QST

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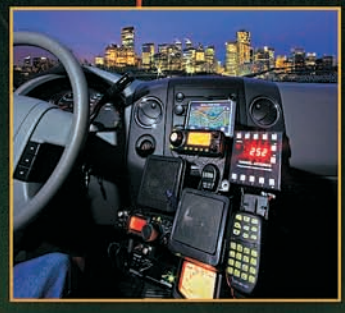
August 2009 WWW.ARRL.ORG

QST reviews:

Inside:



The 2009 ARRL Photo Contest

Page 152

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- Weather Alert

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- 1000 Memory Channels
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- AM, FM and WFM (Sub)
- 1000 Memory Channels
- Optional D-STAR (UT-118)
- Optional P25 (UT-122)
- Optional DSP (UT-106)

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

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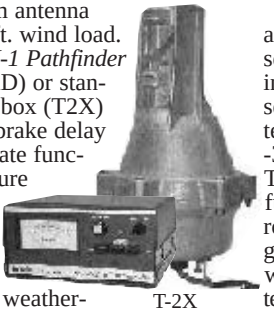
HAM-IV

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!*

ROTATOR OPTIONS

MSHD, $99.95. Heavy duty mast support for T2X, HAM-IV and HAM-V.
MSLD, $39.95. Light duty mast support for CD-45II and AR-40.
TSP-1, $34.95. Lower spacer plate for HAM-IV and HAM-V.

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.**

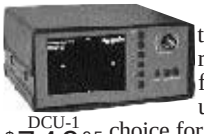
HDR-300A

HDR-300A
$1499.95

For ***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.**

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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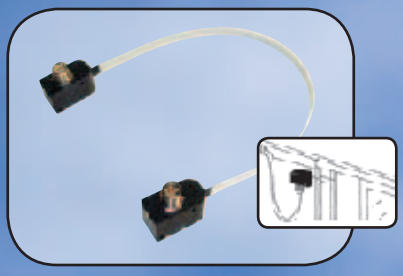


NEW! COMET CTC-50M
Window Gap Adapter!

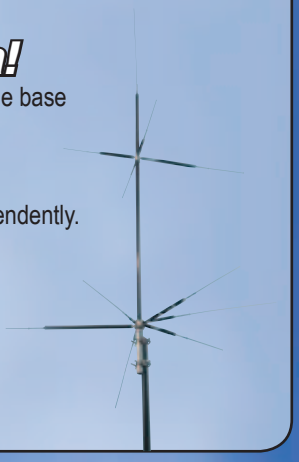
Max Power: HF 100W PEP
VHF: 60W FM
UHF: 40W FM
900MHz - 1.3GHz: 10W
VSWR: <500MHz 1.3:1
>500MHz 1.5:1
Impedance: 50Ohm
Length: 15.75"
Conn: 24k Gold Plated SO-239s

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



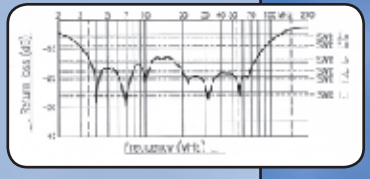
COMET CHA-250B
Broadband HF Vertical!

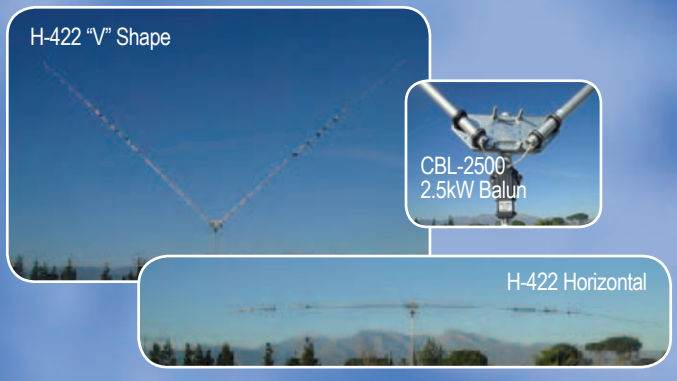
3.5 - 57MHz with SWR of 1.6:1 or less!

- ***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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Contents

This Month in QST

August 2009 ♦ Volume 93 Number 8

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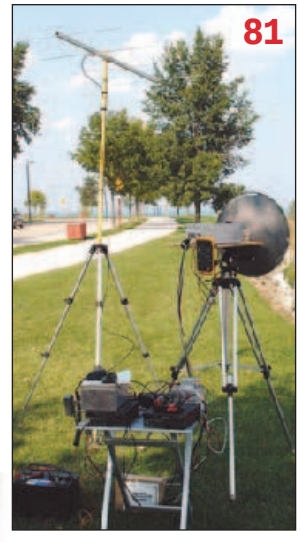
Technical



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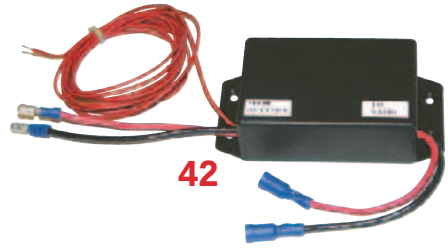

Our Cover
Taken in Norway with the Northern Lights dancing behind the antennas, the large photo captures the mysteries of propagation and the instruments that capture the RF for our enjoyment. Photo by Victoria Panagiotou, SV2KSB/LA7VPA. The photo highlighting the Calgary, Alberta skyline — the first place winner in this year's contest — was taken by Jerry Clement, VE6AB. Sandy Martin of Chiloquin, Oregon took the winter photo. For a look at some of the winning photos from the 2009 ARRL Photo Contest, please turn to page 152.

Departments

US & Possessions: Membership in the ARRL, including a one year subscription to *QST*, is available to individuals at $39. Licensed radio amateurs age 21 and under and the eldest licensee in the household may qualify for the rate of $20. Life Membership, including a subscription to *QST* is available at $975.* Membership and *QST* cannot be separated. Libraries and institutions, $39 per year. Single copies $5.

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*Payment arrangements available. Please write for details.

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- Massive Heatsink guarantees 75 Watts of Solid RF Power with No Cooling Fan Needed
- 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

NEW

2 m MONO BAND

55 WATTS

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

2 m MONO BAND

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

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Commercial Grade Field Radio
Submersible Construction

- Large Backlit LCD Display for easy operation
- 5 Watts of Stable RF Power with Minimum Components for Reliability
- 800 mW of Loud Audio for noisy field operations
- 200 Memory Channels for Serious users
- Commercial Grade Receivers Performance
- Submersible Construction (3 ft. for 30 min)
- Yaesu Exclusive Power Saving Circuit Design Guarantees Longer Operating time
- Hands Free Operation with Optional VC-24 VOX Headset

Wide Range of available Options includes:
- CD-26 Charger Cradle
- VAC-370B 1.5 Hour Desktop Rapid Charger
- External DC Jack for Cigarette-Lighter adapter E-DC-5B or DC Cable E-DC-6
- FBA-25A Alkaline Battery Case (for 6 X AA cells)
- FTD-7 DTMF Paging Unit

Actual Size

VHF FM 5 W COMPACT HANDHELD TRANSCEIVER

FT-270R

Size: 2.4" (W) x 4.7" (H) x 1.3" (D) Weight: 13.8 oz.

NEW 2m MONO BAND

Compact Field Radio with Top Mounted LCD and Loud Audio

- Compact Design with Top mounted LCD Display
- 5 Watts of Stable RF Power with Minimum Components for Reliability
- 700 mW of Loud Audio for outside field environments
- 200 Memory Channels for serious users
- Yaesu Exclusive Power Saving Circuit Design Guarantees Longer Operating time
- Hands Free Operation with Optional VC-25 VOX Headset

Wide Range of available Options includes:
- External DC jack for Cigarette-Lighter adapter E-DC-5B or DC cable E-DC-6
- 6 X AA size Alkaline Battery Case FBA-25A

ULTRA-COMPACT 5 W 2 m FM HANDHELD TRANSCEIVER

FT-250R

Size: 2.3" (W) x 4.3" (H) x 1.0" (D) / Weight: 12.4 oz.

NEW 2m MONO BAND

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

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Heavy-Duty FM Dual Band Mobile with Exceptionally Wide Receiver Coverage*

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

- Large Backlit LCD Display for easy operation
- Stable RF Power (50 Watts VHF / 45 Watts UHF)
- Reliable performance in harsh environments
- 5 ppm Frequency Stability (-4° F to +140° F)
- 1000 Memory Channels for serious users
- Yaesu Unique Power Saving Circuit Design Minimizes Vehicle Battery Drain

Actual Size

NEW 2 m/70 cm DUAL BAND FM TRANSCEIVER

FT-7900R

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

2 m/70 cm DUAL BAND

• 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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"It Seems to Us"

Now We Know

"Now we know what the FCC didn't want us to know, back in 2004, about its staff studies of interference to radio services from Broadband over Power Line (BPL) systems."

When it was writing the BPL rules, the FCC under then-Chairman Michael Powell did not disclose these staff studies. It was only in response to an ARRL Freedom of Information Act (FOIA) request, and then only after the rules had been rushed to adoption, that the Commission deigned to draw back the curtain to provide selective glimpses of its staff's work. The documents were redacted, or selectively edited to withhold certain material from public view (the time for public comment having already passed). From their placement within the remaining material, there was reason to suspect that the basis for the deletions was simply that they contradicted the Commission's conclusions that BPL posed but a "small and manageable degree of interference risk" to licensed radio users.

When the ARRL finally had the opportunity to address the redacted studies in our 2005 petition for reconsideration, the Commission's response was self-contradictory. The FCC conceded that it had "relied…on its own internally conducted studies as described in the FOIA response to ARRL" yet it claimed that "the redacted portions of the FOIA's content referred to internal communications that were not relied upon in the decision making process."

Under Kevin Martin, Powell's successor as Chairman, the FCC managed to make matters worse when it took up the reconsideration petitions the following year. The Commission adopted a new rule exempting BPL operators from having to do anything more to address interference to HF mobile stations than to implement a 20 dB notch on the mobile frequency.

Having exhausted our administrative remedies, the ARRL went to court. Our efforts finally were rewarded on April 25, 2008 when the US Court of Appeals for the District of Columbia Circuit found that FCC prejudice had tainted the rulemaking process. Observing that there is no precedent allowing an agency to "cherry-pick" a study on which it has chosen to rely in part, the Court ordered the Commission, on remand, to release the unredacted studies and provide a reasonable opportunity for public comment.

The Court of Appeals also found that the FCC had mishandled the choice of an extrapolation factor. The factor the Commission chose, 40 dB per decade, is contradicted by several published studies that support a lower figure. In other words, as one moves away from a power line the FCC rules assume that BPL interference drops off more quickly than it does in reality. The Court ordered the FCC either to "provide a reasoned justification for retaining an extrapolation factor of 40 dB per decade…or adopt another factor and provide a reasoned explanation for it."

Incredibly, 11 months later the FCC had failed to take any action whatsoever. Armed with the new Administration's policy of openness on FOIA requests, the ARRL submitted another one — and this time it was granted. While we are still trying to determine whether all of the previously redacted material has been released, we have seen enough to confirm our suspicions.

One part of an FCC staff report that the Commission chose not to rely upon turns out to be a summary of findings of its sister agency, the National Telecommunications and Information Administration (NTIA). According to the summary, the NTIA predicted approximately 60% probability that a mobile station 15 meters from a BPL-carrying power line would experience a 30 dB increase in noise floor at 15 and 25 MHz. The probability of a 20 dB increase was well over 90% in both cases. The summary also noted that the NTIA's predictions were based on a higher environmental noise level than is experienced in practice; in other words, the interference in reality would be greater than predicted.

Repeated references to the FCC staff's finding that BPL is not a point source emitter were redacted. It is significant that the Commission chose to withhold these references because Part 15 emission limits originally were developed for point-source emitters. They are inherently insufficient to safeguard licensed services against interference that radiates from a line rather than from a point source.

We were especially curious about the redacted contents of a page titled "HF Issues and Options." From the unredacted version we have learned that FCC staff offered two options, either one of which would have constructively addressed the interference issue. The first was to ban BPL from using frequencies below 30 MHz on overhead power lines. The second was to impose a 5 dB height correction factor and an extrapolation factor of 20 dB per decade.

The most outrageous redaction we have found so far is a single parenthetical statement, the deletion of which completely reversed the meaning of the sentence. The FCC let stand a suggestion by the Chief Technology Officer of a BPL company, but redacted its own staff's observation that his suggestion was invalid!

Want to compare redacted and unredacted pages for yourself? We've put up a link accessible via the "BPL" button on the ARRL home page.

To summarize, before adopting its flawed BPL rules the FCC *knew* that a 20 dB notch is insufficient to protect mobiles from interference. The FCC *knew* that BPL is not a point source emitter. The FCC *knew* that 40 dB per decade is not the right extrapolation factor, and that banning HF BPL on overhead power lines is the best option to protect the viability of HF communications. The Commission knew this because its own technical staff said so.

And now we know that they knew. Here's what we don't know: Now that Powell and Martin are gone, will the new leadership at the FCC fix this?

David Sumner, K1ZZ
ARRL Chief Executive Officer

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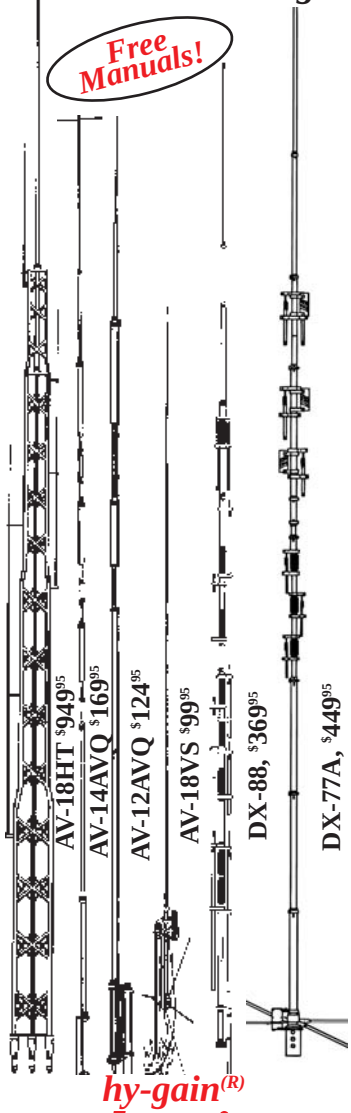

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All hy-gain multi-band vertical antennas are entirely self supporting -- no guys required.

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.

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

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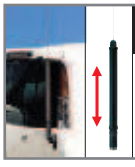

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This Just In

Joel P. Kleinman, N1BKE
jkleinman@arrl.org

In Brief

- After the resignation of Pacific Division Vice Director Andy Oppel, N6AJO, President Joel Harrison, W5ZD, appointed Jim Tiemstra, K6JAT, to fill out the term ending at the end of 2010. President Harrison has also appointed Jeff Beals, WA4AW, as Vice Director of the Southeastern Division.
- The Senate Commerce, Science and Transportation Committee has approved Julius Genachowski as chairman of the FCC.
- Thousands of participants once again filled the ether with RF June 27-28 during ARRL Field Day.
- HR 2160, The Amateur Radio Emergency Communications Enhancement Act of 2009, has gained two new House cosponsors.
- The first three 2009 sessions of the ARRL Teachers Institute on Wireless Technology have brought the promise of wireless technology to 36 teachers and their classrooms.
- The ARRL has announced changes that will "dramatically reduce the time frame for producing results that are available to all ARRL Sweepstakes participants." Two changes were also implemented for the June VHF QSO Party and a change is being implemented to the ARRL UHF Contest.
- ARRL DXCC Manager Bill Moore, NC1L, reports that the HZ1EA operation in Saudi Arabia has been approved for DXCC credit.
- The winner of the *QST* Cover Plaque Award for May is Mal Eiselman, NC4L, for his article "Troubleshooting Radios."
- These online course sessions began July 10: 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.

DIY Ham Radio at 2009 Maker Faire

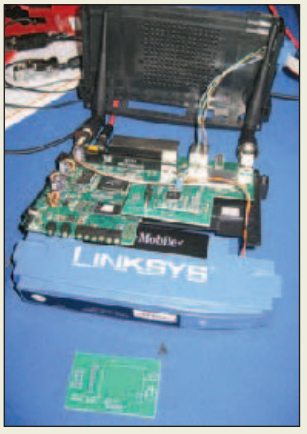
The spotlight was on ham radio at Maker Faire, dubbed the world's largest do-it-yourself (DIY) festival. Nearly 80,000 people attended the fair, held May 29-31 in San Mateo, California. Maker Faire is part science fair and part crafts fair, with a whole lot of innovation, ingenuity and whimsy scattered throughout. Robots, homebuilt steam engines and a hair-raising Van de Graaff generator were all part of the fun. The theme of this year's Maker Faire — *ReMake America: Building a Sustainable Future* — is based on President Obama's call to action to participate in a new era of DIY. Started in California in 2006, Maker Faire is held annually in San Mateo and in Austin, Texas. Maker Faire is supported by O'Reilly Media, the publisher of *Make Magazine*.

"The Amateur Radio community fits this mold perfectly," said Bob Inderbitzen, NQ1R, ARRL Marketing Manager. Inderbitzen attended the event to help support local radio clubs and related groups who organized Amateur Radio exhibits and demonstrations. "Hams represent the very best of service to country and community. We're both doers and makers of things."

Kids love code: **Before the gates opened to the public, Maker Faire offered a one day preview to area schools and teachers. Here, Nick Garner, N3WG, demonstrates Morse code to a group of 7th and 8th grade students from Creative Arts Charter School in San Francisco.**

More "Ham Radio at Maker Faire" photos and videos are posted at **www.arrl.org/blog** and on ARRL's YouTube channel, **www.youtube.com/arrlhq**. — *Photos by Bob Inderbitzen, NQ1R*

Spark gap: **Jack Sparx, aka John Dyer, KJ6JD, builds Tesla coils, electric "art" and other science displays that have been exhibited around the country. A regular flow of willing visitors enjoyed a "shock" from Jack's Van de Graaff generator.**



Chris Kantarjiev, K6DBG, demonstrated APRS (Automatic Position Reporting System) gear that he has collected and built. He modified this Linksys router (WRT54 series) to support a small internal TNC that exchanges data with the router using an unpopulated internal serial port. The reconfigured device connects easily to a radio to operate as an iGate digipeater. For this project, Kantarjiev selected the small "OpenTracker" kit produced by Argent Data Systems to configure the device to support APRS.

Media Hits

Allen Pitts, W1AGP

- The fallout from the release of the FCC's full, uncensored BPL studies continued in the media this month. Author Matthew Lasar asked, "Did the FCC cook the books on broadband over power lines?" in his May *Ars Technica* (Arstechnica.com) article and reported on the "weird" deletions, whiteouts and other redactions now obvious in the FCC's documents about BPL interference issues. DSLReports.com also picked up on the BPL issue in their story "New Docs Show FCC Glossed Over BPL Flaws." According to Karl Blonde, "In Martin's FCC, objective science and real data were an afterthought to political agendas or fealty to industry lobbyists."
- The affinity for do it yourself-ing between hams and others became obvious when *Make Magazine* (**Makezine.com**) did a nice color layout of events at the Dayton Hamvention®. ARRL also had a display at this year's Maker Faire.
- The Lawrence Livermore National Laboratory in California is no stranger to new technologies and gee-whiz electronics. So it was interesting to read in their *Lab News* about their installation of an onsite Amateur Radio repeater at 1800 feet elevation to aid them, and the rest of San Joaquin County, in on-site security and emergency responses.
- Another national level technological hit came from Jon Titus in DesignNews.com with his article "Mechatronics Resources I Can't Live Without." In his pick of the top four references he wouldn't give up "under any circumstances" is *The ARRL Handbook for Radio Communications* because "…it stresses the practical application and use of electronics."
- If you haven't noticed, Alaskans are quickly developing a larger Amateur Radio emergency response capability. KTVA-TV in Anchorage reported on this in May, but also added observations from the Anchorage Police Department. Referring to the Morgan Hill, California incident when fiber optic cables were cut, they said, "Only one system didn't go down, the ham radio network…. Fortunately local hams are ready to do the same here in Anchorage."
- Thanks to the work of the PIOs, dozens of good local and regional stories were published about Amateur Radio and its people in May. Among these were *The Plain Dealer* (Cleveland, OH) story on W8COD, Amateur Radio on a real WWII submarine in Ohio. The *Record Courier* (Gardnerville, NV) had a nice spread about the Sierra Intermountain Emergency Radio Association aiding Pony Express reenactors. The *TriValley Herald* (Pleasanton, CA) did a highly complimentary piece on David, N5FDL, and Elionora Coursey, while the *Daily Herald* in Palatine, IL did a major piece on the Elmering work of Denny Barfuss, W9HI.

Team Maker Faire: **The Foothills Amateur Radio Society was the primary sponsor of the Amateur Radio exhibit, but volunteers from many participating ham radio clubs and other related entities staffed the exhibits. These included the Silicon Valley Amateur Television Group, the Palo Alto ARA, the Mad Scientist ARC, the Kings Mountain ARC, the Burlingame Red Cross, BAERS Ham Cram and Ham Radio Outlet. The coordinating effort was lead by ARRL Santa Clara Valley Assistant SM Michael Pechner, KI6QNZ, of Palo Alto, wearing a hat in the front row. Just behind him is Santa Clara Valley SM Bill Dale, N2RHV. Also exhibiting at the event, and representing ham radio and public service, was Blackberry REACT (Radio Emergency Associated Communications Teams) Team C-57 of California.**

Inside HQ

How Are We Doing?

"How are we doing?" That's the question that many of you have asked me during the last few months while I was staffing the ARRL booth at hamfests throughout the country. While we are all concerned about the effects of the economy, the short answer is that the ARRL and Amateur Radio are doing fine.

I am writing this column in mid-June and, since the beginning of the year, our membership has grown to over 155,000 members, the highest that it has been in recent years. Thanks to those members who have renewed their membership and welcome to our new members. We attribute this membership increase to a heightened interest in emergency and public service communications, the February 2007 elimination of the Morse code requirement for licensing, a renewed national interest in do-it-yourself projects, and a heightened interest in technical and geeky topics in general. We also believe that many of us baby boomers are now becoming active in Amateur Radio again since we now have the time and resources to do so. Plus, Amateur Radio is a cheap date! If you already have a station, it is not difficult or expensive to get back on the air.

ARRL publication sales are healthy. Our top sellers are License Manuals at all three licensing levels, but particularly for General class licensing materials. The increased number of General class upgrades that are coming through our VEC licensing process confirms this fact. We continue to experience a strong interest in books about antennas, particularly basic antennas, and books about new communications technology.

Sales of HF and VHF entry and mid-level transceivers are up according to our advertisers. Antennas, particularly dipoles, mobile and portable antennas and HF verticals are selling well. Many of us have been improving our current stations. Isn't that what we do as radio amateurs? Our advertisers report increases in the purchase of station accessories, such as CW keys (still alive and well), microphones, headphones, coax, connectors and test equipment.

Operating award applications, such as WAS and DXCC, are about even with our record year in 2008. The number of QSL cards passing through the Outgoing QSL Bureau is about the same as last year. Interest is still high for our new Triple Play Award. Logbook of the World activity is up with more than 27,000 users. ARRL Contest log submissions have increased about 20 percent over 2008. Surprisingly, the largest increases have been in the CW and RTTY categories.

We project that there will be over 29,000 new US amateurs licensed this year. That is a slight increase from last year's total of 28,066. The number of upgrades to General and Extra class licenses continues to grow.

Like every other endeavor in 2009, Amateur Radio has its challenges. But my view from here Inside HQ is cautiously optimistic.

This is my 50th Inside HQ column. I appreciate all the feedback that I have received. Please keep those e-mails coming!

73,

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

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

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

Membership inquiries and general correspondence should be addressed to the administrative headquarters:
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COURTESY REG HARDMAN, VK4XH

Paul Mason, WWII hero.

Admiral Bill "Bull" Halsey, US Navy, stated in 1942: "The Coastwatchers (ham radio operators) saved Guadalcanal and Guadalcanal saved the South Pacific." To a number of older hams, the battles of Guadalcanal may be well known; they might have even fought in them. To a slightly younger generation it may be nothing more than a dim memory. But to others it may be totally unfamiliar territory. In 1942, the battles of Guadalcanal were a major life and death struggle on air, land and sea between United States and Japanese forces. During this crucial time, Amateur Radio operator Paul Mason played a major role in tipping the scales to an American victory.

Paul Mason, a native of Sydney, Australia, was a private citizen, Amateur Radio operator and plantation manager near Guadalcanal in the Solomon Islands when WWII erupted in the South Pacific. He had spent the previous 20 years as manager of the Inus plantation, an experience that greatly educated him about the islands and the culture of its inhabitants.

Mason was a short, unassuming man with glasses in his early 40s. He was one who really loved his radio. His diary tells us that he built and repaired his own receivers and that he built his first transmitter in 1936. His looks would suggest that he would be very much at home in a bank or insurance office or some other type of routine daily work. The quickly unfolding events in the South Pacific would soon tell us otherwise. Using sheer guts and nerve, he faced death almost every day for 8 months behind enemy lines, dodging patrols, being constantly on the move through the jungle, all the while sending radio messages to Allied forces regarding enemy movements.

As a radio amateur and coastwatcher, Paul Mason arguably sent the most important message ever transmitted on ham radio:

FROM STO, TWENTY-FOUR TORPEDO BOMBERS HEADED YOURS

Forewarning the American forces, this transmission saved the lives of hundreds of American troops, as well as many ships.

If you would like to learn more about this incredible story and how radio amateur Paul Mason was granted the Distinguished Service Cross by General Douglas MacArthur, head to **www.arrl.org** and search for VK4XH.

RON YOUNG, W8RJL

Big yellow call sign: **While in the PIMA Air & Space Museum in Tucson, Arizona (www.pimaair.org/collections.php) I spotted a big yellow K4OK painted on the nose of a B29 Superfortress, a legendary WWII-era bomber. It has the markings 330th Bomb Group, K-40, "Quaker City," "Sentimental Journey." —** ***Ron Young, W8RJL***

STEVE DOWDY, WJ0I

"We talk so they can walk" **is the motto of the Ararat Shrine Amateur Radio Club. The club has been helping Kansas City's Ararat Shrine Temple with their mission to help kids for many years. Their big event each year is the Hambash (www.hambash.com), where the focus is to smile and make sure everyone of our guests enjoy themselves. The photo, from this year's event, shows Neal Johnson, NØBIQ, who has smiled for years operating the talk-in station. —** ***Dave Hinkley, KAØSOG***

BRIAN JUSTIN, WA1ZMS/4

From the antenna's point of view: **The WA1ZMS 2 meter transatlantic remote transmitter, pointing toward Europe, is located atop the Appalachian Mountains in grid FM07fm. The operating frequency is 144.285 MHz. No official confirmed reports of reception have been made, although one unconfirmed event took place in 2007 from the UK. —** ***Brian Justin, WA1ZMS***

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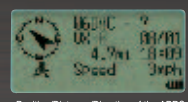

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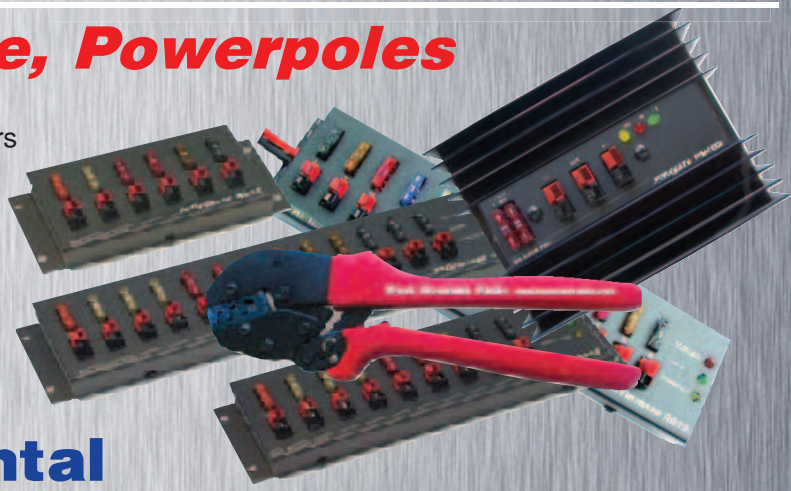

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CORRESPONDENCE

PAY TO PLAY?

♦ Rick Paquette, W7RAP ["Correspondence," June 2009, page 24], would have us believe that closed repeaters are more sophisticated than open repeaters, requiring "considerable expertise to operate." Just how difficult is it to press a microphone button and a few tone access pads to access special features of a repeater? Hams do it every day on open repeaters that are linked to the Internet (VoIP) and other repeaters.

Paquette further argues that "all operators (of closed repeaters) are trained as control operators," ensuring that the repeater is being used as required by regulation. I see nothing unique here, except perhaps volume, since the FCC requires all repeaters to have control operators. In this case it is not quantity, but quality of control operators, that makes for a well-run repeater.

Paquette states that "anyone is free to use that [closed repeater] frequency for simplex operation (on a not-to-interfere basis)." Try operating simplex on a repeater frequency and you will receive the full wrath of the repeater owners or control operators. Not a good idea and besides, VHF/UHF band plans designate specific simplex frequencies that do not infringe upon repeaters. He further states that because of the extreme cost of operating closed repeaters, some method of financial support is necessary. He fails to explain that all repeaters have operating and maintenance costs, but by maintaining a "pay for use" policy in a manner that tends to intimidate, it has the reverse affect of discouraging use and its accompanying revenue. It is my experience that most hams who consistently use a repeater will voluntarily support it; but if payment is required to operate, they will not.

Existing FCC rules support closed repeaters because the equipment cannot be regulated. In my opinion it is wrong that regulated frequencies are held hostage by closed repeater owners who require users to pay prior to use.

MURRAY GREEN, K3BEQ
Cheverly, Maryland

RECOGNIZING GOOD OPERATION

♦ I recently received an e-mail from a ham thanking me for a notice I mailed him in my capacity as an ARRL Official Observer (OO). The notice I sent wasn't a complaint about his operation; in fact, it was just the opposite — he was an excellent operator. I don't know the ham and he does not know me. He simply knows he was monitored and his "outstanding radio control and operation" caught my ear, just as an operator using foul language would have done. I feel I'm duty-bound to give notice to his outstanding operation, just as I would be bound to give notice to the operator using foul language. I feel it is very important to recognize a good operator. All OOs should send out "good operator cards" equal to the number of OO Advisory Notices they send out each month.

JOESEPH VEGA, NE6V
Alhambra, California

CHASING WORKED ALL STATES

♦ I received my first Amateur Radio license in April 1979, but I was serving in the US Air Force and it was two years before I would return to the States from my duty assignment in Grafenwoehr, Germany. Once back, I hit the airwaves hard! But when Uncle Sam says move, you move. In most cases, Uncle Sam's moves involve more than a 50 mile jaunt, and so with every move, my efforts for the ARRL Worked All States Award (WAS) began all over again.

I finally retired from the Air Force and managed to relocate within 50 miles of my last duty station, Langley, Virginia. Things began looking up: On January 25, 2009, I made a contact with Alaska, the final piece in my elusive chase for WAS. My local card checker took the cards and submitted my WAS application to ARRL. Some time later, I contacted the ARRL to check on the status of the award. They told me it had been sent out, but I never received it, so the ARRL immediately sent out a duplicate certificate. Two days later I received #53,746 Worked All States — it only took 30 years. I was so proud. Ironically, I had already received Worked All Continents (WAC) due to my many Uncle Sam moves. The wallpaper proves it all, but the chase made it worthwhile!

RANDY MELTON, KA4AQM
Chesapeake, Virginia

A LETTER ABOUT LETTERS

♦ Many recent correspondents, and some authors, have recommended use of the International Radiotelephony Spelling Alphabet, or IRSA — alfa, bravo and so on. Each of these writers has referred to it as IPA, which is International Phonetic Alphabet. This usage is incorrect. Indeed, the IRSA and the IPA are conceptually exact opposites. The IPA is a set of written symbols (well over 100 of them) used by linguists to represent the sounds of various spoken languages. The IRSA, on the other hand, is a set of sounds used to represent the written symbols (letters) of various written languages.

The IRSA is useful in representing the letters of the Roman alphabet as used in English. For other languages that use variations of the Roman alphabet and include additional letters — Spanish, Portuguese, Turkish, Icelandic, Czech, Polish, German, French, Swedish, Norwegian and many others — the IRSA is of limited usefulness. For languages that use other alphabets entirely, such as Russian, Bulgarian, Arabic, Hebrew, Greek and Bengali, the IRSA is utterly useless. An overwhelming majority of the world's people, even most Europeans, cannot possibly use IRSA.

IRSA's full name is *ICAO the International Radiotelephony Spelling Alphabet*. ICAO is the International Civil Aviation Organization, and has adopted IRSA, as well as English, as the internal patois of aviation. NATO has also adopted IRSA; it is sometimes known as the NATO spelling alphabet, but it is never correct to refer to it as IPA, or International Phonetic Alphabet.

CARL HAYES, NN5I, ARRL Life Member
Tallahassee, Florida

A TECHNICALITY?

♦ I have never thought of *QST* as being a humorous publication, except for the old Gil cartoons, but after 54 years of reading the magazine, I have a new perspective. Alan Sherman, W2NIR ["Correspondence," July 2009, page 24], wrote that he has noticed "that most of the articles in *QST* have been quite technical, almost requiring a strong electronics understanding." Isn't this what used to separate hams from CBers?

When I first started reading *QST*, I could understand almost nothing, but therein lies the point: The idea is to *learn* what they're talking about. Pick up a book or ask someone. Roll with the hobby as those in my age group have. I chat with 90 year olds on 40 meters that blow me away!

I guess in perspective of Alan's letter — in this age of mostly store-bought gear and professional ham gear installers — there really isn't that great a need for deeply technical articles. And I feel *QST* is the least of the technical publications.

MIKE KITSKO, K6VGQ
Grove, Oklahoma

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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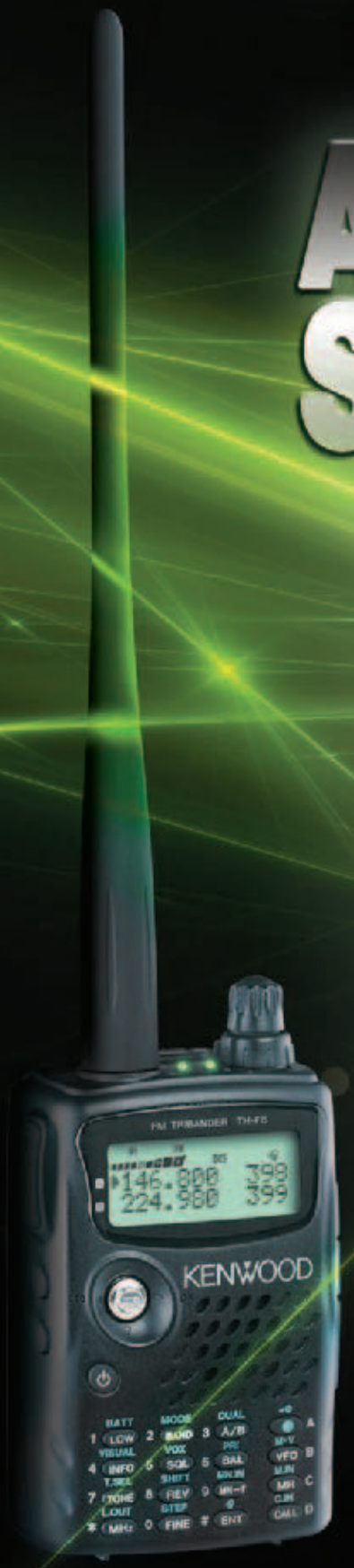
[1]Note that certain frequencies are unavailable. [2]5W output



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Diamonds in the Sky

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Skip Teller, KH6TY

Down here in the "low country" (meaning flat as a pancake!) of South Carolina we've been encouraging digital ragchewing on 2 meter FM using the DominoEx 8 mode. We do it by running an informal net that covers almost the entire state on simplex using horizontally polarized antennas. (See WB8IMY's "Eclectic Technology" column in the March 2009 *QST*.)

As the Net Control Station (NCS) I needed a relatively high-gain, omnidirectional antenna that could cover a wide area. In our DominoEX net, all stations point their beams at the NCS and the NCS relays every transmission so that no one is left out of the conversation. The farther away a station is, the more antenna gain he will need to hear (and be heard) by the NCS. This means that while the net participants can use directional antennas, the NCS must always use an omnidirectional antenna in order to hear from any direction.

Thanks to the fellows at Google, several solutions finally turned up on the Internet and among those were the *Big Wheel*, various *turnstiles* and *stretched rectangle* antennas, and an old design called the *skeleton-slot*.

After extensive testing I ultimately settled on a stretched-rectangle derivative that was inexpensive, simple to build, had moderately high gain with horizontal polarization and a wide beamwidth. I call this design the *DDT*, or *Double Diamond Turnstile*.

The DDT antenna has a noble pedigree. It is based on designs variously described and published by Peter Dodd, G3LDO; B. Sykes, G2HCG; David Jefferies, G6GPR; Dan Handelsman, N2DT; Paul Carr, N4PC, and Brian Beezley, K6STI. They found that by stretching a square quad loop in height they could increase the gain by as much as 2 dB, while at the same time lowering the input impedance from 125 Ω for a square down to 50 Ω for an individual loop — a perfect transceiver match.

The square quad loop, fed at the bottom, may be thought of as a pair of ¼ wavelength horizontal dipoles connected by vertical ¼ wavelength phasing lines. G3LDO found that stretched quad loops could be stacked and fed in parallel without using separate phasing lines and L.B. Cebik noted in his *QST* article on the 6 meter turnstile antenna that a diamond shaped loop, fed at the bottom, is equivalent to the square quad loop (also fed at the bottom) and results in horizontal polarization. In contrast, feeding a quad loop on the side results in vertical polarization.

It was a simple matter to experiment with stacked diamond-shaped loops for 2 meters and the result is a horizontally polarized, bi-directional, antenna with good gain over a wide beamwidth (the azimuth pattern is the same as a dipole, since the diamonds are equivalent to stacked dipoles). Using *EZNEC* antenna modeling software, I sized the two diamonds to produce as much gain as possible with a 75 Ω feed impedance at their junctions. This would let me "turnstile" two 75 Ω double-diamonds, faced 90° from each other, and achieve 360° coverage. Because the antennas are at 90° to each other they can (and should) share the same mast. The two double-diamond antennas are effectively in parallel, connected by a phasing line to combine their individual bidirectional patterns into a single omnidirectional pattern as shown in Figure 1.

The DDT can be constructed from materials commonly available at any hardware or home improvement store. The materials needed are a 6 foot length of 1¼ inch Schedule 40 PVC pipe, 32 feet of #14 insulated, stranded, copper house wiring, four fiberglass 5⁄16 inch diameter rods (sold as driveway markers) for spreaders, one or two 1¼ inch PVC caps, four 6-32 × 2 inch machine screws with star washers and nuts, and two SO-239 connectors from your local RadioShack store or junk box. Fiberglass tubing of ¾ inches in diameter or greater can also be used for the mast and would withstand wind forces better when mounted to a mast or tower instead of being hung in a tree.

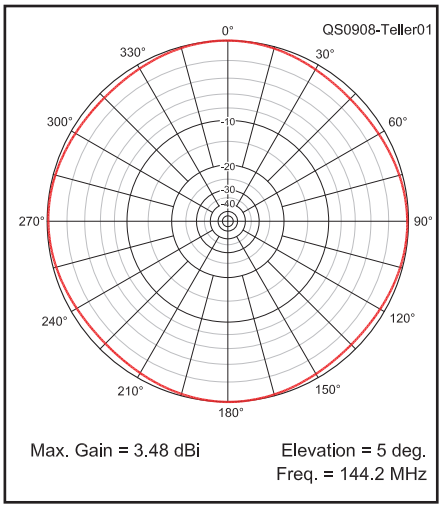


Figure 1 — The azimuth radiation pattern of the DDT antenna.

Building the DDT

Begin construction by drawing a reference line along the full length of the pipe, making sure the line is as much along the center of the pipe as possible. This is *very* important in order to keep the spreaders at right angles to each other. To do this, I placed the pipe, which is used as the mast for the antenna, on a flat tabletop and clamped it down at both ends so it would not move. I then cut a small block of wood, about 1 inch high, held a pencil tightly on top of the wood and, holding the center of the pipe down so it did not bow, scribed a line the length of the pipe to use as a reference for drilling the necessary holes (see Figures 2 and 3).

In order to help insure that the spreaders pass through the mast at right angles, I found it most successful *not* to drill a spreader hole

all the way through the mast to the other side. Instead, I made a paper template to mark the entrance and exit holes for all the spreaders, wire, and connector mounting holes exactly 180° apart and perpendicular to the pipe. You can do the same by cutting a strip of paper 1½ inches in width. Wrap it around the mast and trim the strip until the ends *just* meet. Now fold the paper in half, and in half again, to form creases in the paper at 90°, 180° and 270° with reference to the scribed line at 0°. Use this template to mark the holes in the mast for the wires, spreaders, connectors and mounting screws.

- Starting at one end of the mast, draw short lines across the scribed line at 2, 3½, 16¼, 17¾, 30½, 32, 44¾, 46¼, 59 and 60½ inches.
- Place the template at the 2 inch mark on the line, making sure it lines up perfectly at the edges and the edge bisecting the 2 inch mark. Mark holes at 90° and 270°and label these A.
- Move the template to the 3½ inch mark, mark for holes at 0° and 180° and label these B.
- Move the template to the 16¼ inch mark, mark for holes at 90° and 270° and label these C.
- Move the template to the 17¾ inch mark, mark holes at 0° and 180° and label these D.
- Move the template to the 30½ inch mark, mark holes at 0° and 180° and label these E.
- Move the template to the 32 inch mark, mark holes at 90° and 270° and label these F.
- Move the template to the 44¾ inch mark, mark holes at 90° and 270° and label these G.
- Move the template to the 46¼ inch mark, mark holes at 90° and 270° and label these H.
- Move the template to the 59 inch mark, mark holes at 90° and 270° and label these I.
- Move the template to the 60½ inch mark, mark holes at 0° and 180° and label these J.

Before drilling the holes, re-check the locations carefully. When you're satisfied that every mark is correct, drill all the marked holes with a 5⁄32 inch bit. These will serve as wire holes and also as pilot holes for later enlargement.

Expand the holes at C, D, G and H to 5⁄16 inch diameter. If necessary, move the drill around a little to slightly enlarge the hole for the 5⁄16 inch diameter fiberglass spreaders.

Look at holes E and F. Choose two of these holes to mount your SO-239 connectors. Make sure to select holes that will position the connectors at right angles to each other on the mast. Widen your chosen holes to ⅝ inches in diameter, insert the connectors and use them as templates to drill four mounting holes (two for each connector) parallel to the scribed line. When drilling the holes the bit must go through the mast and out the other side. Each hole must be large enough to accommodate 6-32 machine screws.

For each of the four spreader rods, cut to a length of 32 inches and drill *parallel*

Figure 2 — Clamping the mast to a table keeps it stable as you are marking hole locations.

5⁄32 inch wire holes ¼ inch from the end of each spreader.

Wiring the Antenna Frame

The two antennas will be wired separately. Follow the diagram in Figure 4.

Begin wiring the first antenna by cutting off a 16 foot length of wire, stripping 2 inches of insulation off the end, tinning the end ¼ inch. Feed the tinned end through hole F opposite the hole for the SO-239 connector. Solder to the center pin of the SO-239 connector. Place the connector in the ⅝ inch hole and mount it to the PVC with two 6-32 machine screws, securing them in place on the other side of the mast with star washers and nuts.

Push a spreader through the C holes and center the spreader on the mast. Do the same for the lower spreader using the G holes. You can use epoxy glue or other strong adhesive to keep the spreaders in place, although the wire tension itself may be adequate to hold them in position.

Looking at the wire coming out the back side of the mast (from the center pin of the SO-239 connector), lead it *up and to the left*, feeding the free end of the wire through the hole in the spreader, through the A holes and out the other side of the mast. Continue feeding the wire through the right side of the top spreader and back down to top set of nuts and washers opposite the SO-239 connector. Strip off about ½ inch of insulation, loosen the top mounting screw, (wrap the wire *around* the screw between the mast, star washer and nut and tighten the nut).

Continue feeding the same wire *down and*

Figure 3 — Scribing a straight reference line along the mast is critical.

to the right, going through the lower spreader's hole. Continue downward and through the I holes, out the other side of the mast, *up* through the left-hand spreader hole and over to the connector. Pull the wire taut, cut it 2 inches longer than needed to reach the connector and strip 3 inches. Tin the end ¼ inch to keep the wire from unraveling. Then, wrap the wire a few times around the wire coming out of hole F behind the SO-239 connector center pin and solder. This completes the wiring of the "upper" antenna.

Rotate the mast 90° about its axis and repeat the procedure, using the remaining holes for the "lower" antenna group. Be sure to lead the wire to the *left and up* to the first spreader. *Both wires attached to the connector center pins must lead to the left and up in order for the phasing to be correct.* As you thread the wire it will not cross at the connector, but instead continue down the same side for the lower diamond.

The Phasing Line

The two antennas are connected by a length of RG-59 coaxial cable that will combine the patterns of the antennas and produce an omnidirectional, horizontally polarized pattern. It is critical to use RG-59 and not some other type of coax as the impedance of the phasing line must be as close to 75 Ω as possible. I assembled a phasing line from RG-59 coax with PL-259 connectors on each end, measuring 16½ inches from the tip of one PL-259 to the tip of the other PL-259.

Viewing the antenna with the connectors toward the floor, mount a PL-259 T adapter (RadioShack 278-198) to the lower SO-239 connector. Screw one end of the phasing line into the upper SO-239 connector and the other end into one end of the coax T adapter. The coax feed line is then screwed into the other end of the T adapter as shown in Figure 5.

It is a good idea to create a choke balun to keep currents on the outside of the coax feed line from disturbing the omnidirectional pattern of the antenna. This can be done by winding five turns of the RG-58 feed line

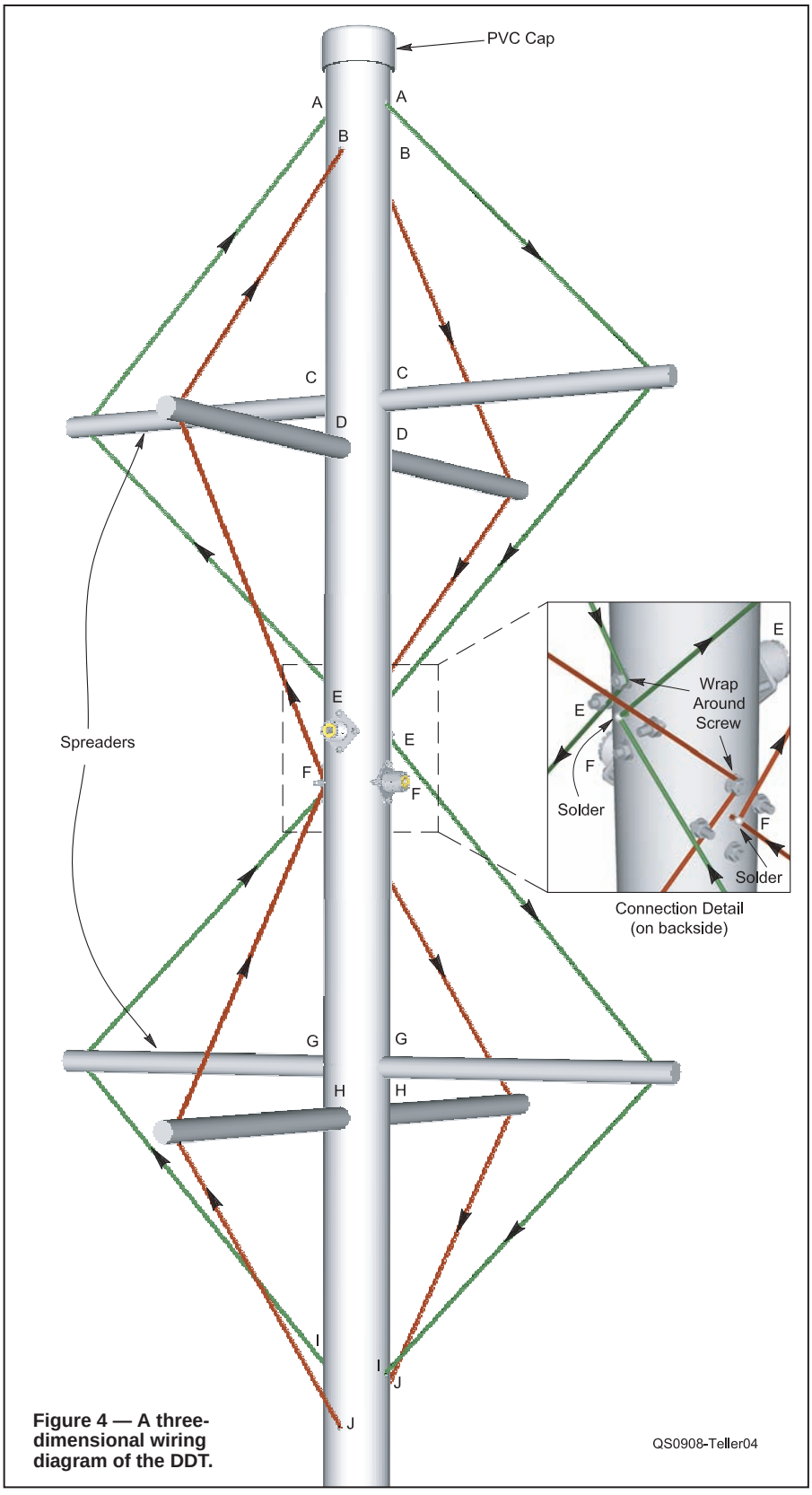


Figure 4 — A three-dimensional wiring diagram of the DDT.

Figure 5 — A close-up view of the phasing line and wire terminations with the T adapter visible.

coax around the mast. Tape the choke in place with electrical tape and weatherproof all connectors and connections.

When completed, the antenna should have an SWR of about 1.3:1 from 144 to 145 MHz since it is designed to be used in the "weak signal" portion of the 2 meter band where horizontal polarization is the convention.

The antenna can be hung from a tree or used as a "topper" for a mast or tower. No rotator is needed, of course, as the antenna is omnidirectional. If you choose to hang the DDT from a tree, drill a hole in the top cap before gluing it on and mount an "eye" bolt to hold the rope. Glue another cap to the bottom and tape the feed line in place on the lower part of the mast for a strain relief. If it is used as a "topper" for a mast or tower, use the thicker 1¼ inch PVC pipe, insert a wood dowel into the PVC as far as it can go to strengthen it against bending and breaking, glue on the top cap and spray with paint for UV protection.

References

B. Beezley, K6STI, "A Gain Antenna for 28 MHz," *QST*, Jul 1994, p 70.

P. Carr, N4PC, "The H-Double Bay Antenna," *CQ*, Sept 1995, p 28. This is an SDR for 30 meters that is horizontally polarized and fed at the lower end-wire.

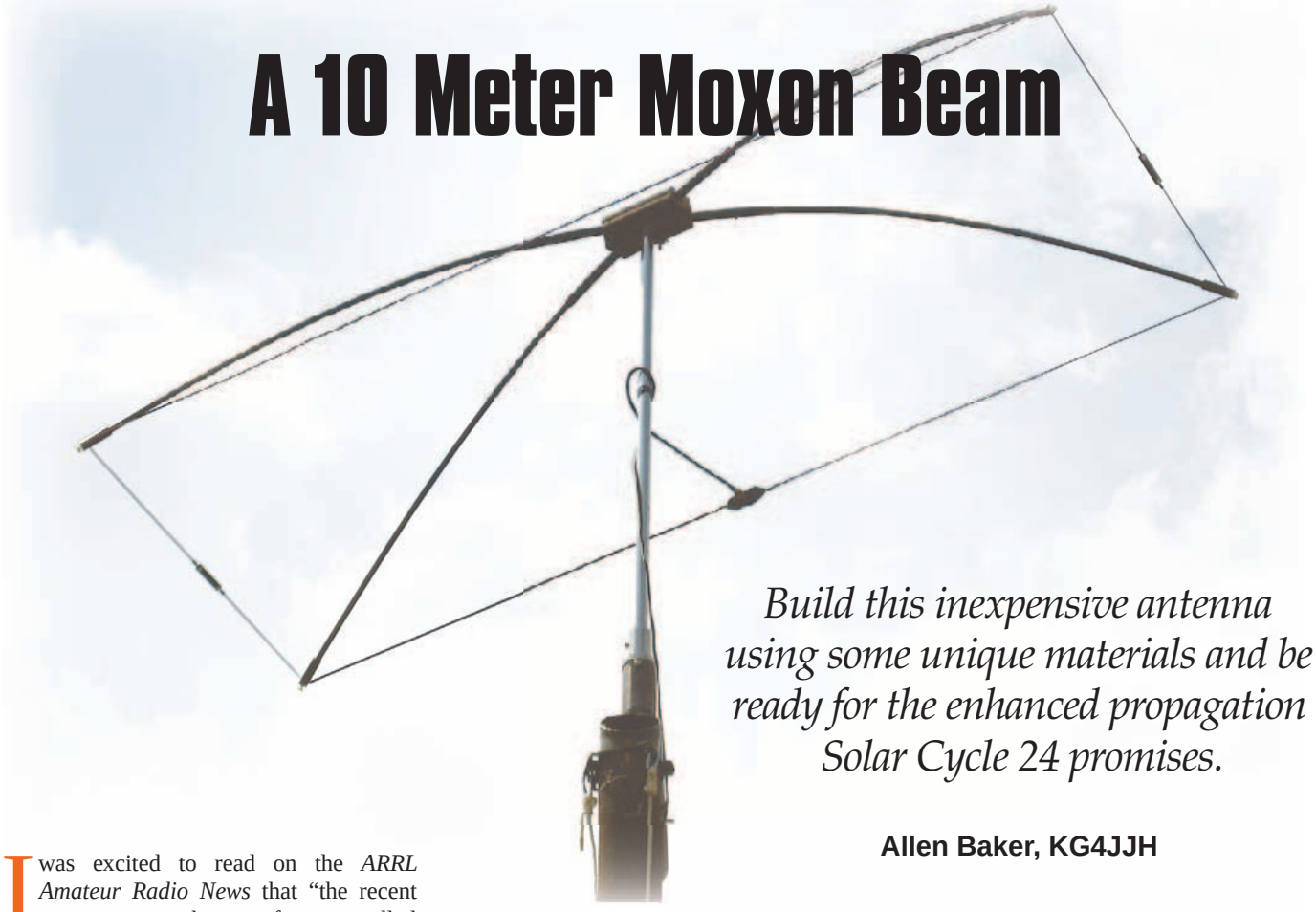
L.B. Cebik, W4RNL, "A 6-meter Quad Turnstile," *QST*, May 2002, p 42.

D. Handelsman, N2DT, "The Double Rectangle," Three variations on a rectangular theme, *Communications Quarterly*, Spring 1999, p 67.

Photos by the author.

Howard ("Skip") Teller, KH6TY, is an ARRL member and was first licensed in 1954. He received his commercial First Class Radiotelephone license in 1959 and worked his way through college as chief engineer of several radio stations. He holds a BS degree in electrical engineering from the University of South Carolina and is retired from running a factory in Taiwan, where he manufactured the weather alert radio that he originated in 1974 and is still sold by RadioShack and many other companies. Skip enjoys developing digital software, such as DigiPan *and* NBEMS, *designing 2 meter transceivers and antennas. He is currently studying the potential of working 2 meter DX on FM using digital modes. You can contact Skip at 335 Plantation View Ln, Mt Pleasant, SC 29464;* **kh6ty@comcast.net**.

A 10 Meter Moxon Beam



Build this inexpensive antenna using some unique materials and be ready for the enhanced propagation Solar Cycle 24 promises.

Allen Baker, KG4JJH

I was excited to read on the *ARRL Amateur Radio News* that "the recent appearance on the sun of two so-called 'backward sunspots' may mean solar cycle 23 is drawing to a close and Cycle 24 now is under way or soon will be."[1] During the peak years of solar cycle 23, some years back, I consistently made worldwide contacts on 10 meter PSK31 using 5 W to an attic mounted Moxon rectangle.

The Moxon rectangle was developed by Les Moxon, G6XN, as a derivative of the VK2ABQ square, with further refinements to natural beam dimensions by L. B. Cebik, W4RNL (SK).[2] The antenna is essentially a two element Yagi with the element ends folded toward each other. It has about the same gain, a higher front to back (F/B) ratio, direct 50 Ω feed and is approximately 30% smaller than the usual two element Yagi.

For this Moxon Beam or *MoxBeam* project, I describe a portable version of my attic antenna that is built from composite lumber, fiberglass tubing, and Home Depot wire for about $75. Your efforts will be rewarded with a 7 pound antenna that, if mounted 25 feet above typical ground, delivers up to 11.3 dBi gain, and has a 40 dB F/B ratio (see Figure 1), a 19° take-off angle and a turning radius of 6.5 feet. For amateurs interested in other bands, I have prepared a table of construction dimensions and performance details for the 6 through 20 meter amateur bands using the same technique. This information, along with additional drawings and photos is available at the *QST* binaries Web site.[3]

[1]Notes appear on page 36.

Table 1

10 Meter MoxBeam Materials List

Qty	*Description*	*Source*	*URL*
1	Hub, Trex composite lumber	Home Depot	**homedepot.com**
2	½" OD × 8' fiberglass tubing*	Max-Gain	**mgs4u.com/fiberglass-tube-rod.htm**
4	¾" OD × 8' fiberglass tubing*	Max-Gain	**mgs4u.com/fiberglass-tube-rod.htm**
33'	#14 PVC insulated stranded wire	Home Depot	**homedepot.com**
4	Nylon screw 5/16-18 × ½"	Ace Hardware	**acehardware.com**
1	Budwig HQ-1	RF Connection	**therfc.com/anttacc.htm**
1	Thumb screw, stainless, ¼-20 × 1½", #91745A546	McMaster-Carr	**mcmaster.com**
1 box	Ring terminal #34540, 16-14 gauge	Ace Hardware	**acehardware.com**
4	Nylon screw and nut, 6-32 × ½"	Ace Hardware	**acehardware.com**
1 pk	Quick release button, stainless, #92988A510.	McMaster-Carr	**mcmaster.com**

*Max-Gain Systems will cut tubing to specification, which can significantly reduce shipping charges

Construction

Hub

You may have seen the new composite lumber that is used to build outdoor decks. At least one company offers this material in dimensional sizes such as nominal 2 × 4 inch. It is an ideal material for building the antenna hub.[4] It saws and drills as easily as wood but is impervious to weather extremes. It has low thermal expansion and contraction and is ultraviolet protected. The smallest piece available is 12 feet long and, according to my local lumber yard, it is expensive at $26 each. You only need an 8 inch piece for this design and the same hub dimensions can be used for all bands, or you can make 18 hubs. You may be as lucky as I was and find a free scrap at a construction site. All required materials are listed in Table 1.

Print a full size template of the hub (see Figure 2) and temporarily fasten it to the composite material using a glue stick. Mark a centerline down the length of the material and use it to line up the template. Using a table or miter saw, cut two 20° angles on each end to form a "V" along the centerline (see Figure 3). The total length should

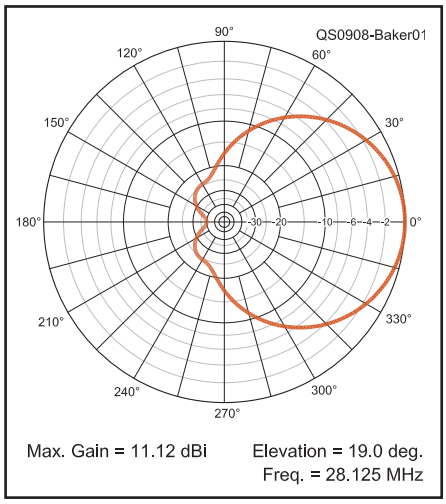


Figure 1 — 10 meter MoxBeam azimuth plot at a height of 25 feet over typical ground.

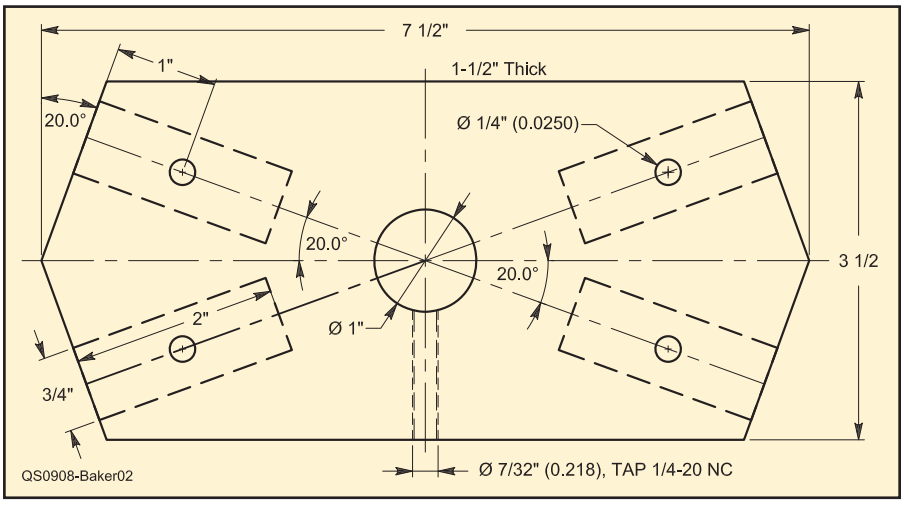


Figure 2 — Template of MoxBeam hub. If printed full size (see Note 3), this can be used as a cutting template.

be 7½ inches from end to end. Extend the spreader hole centerlines down the ends and mark the centers. The angles on the ends make drilling the spreader holes easy. By clamping the piece on its end you automatically get the required 20° spreader angle. I find it helpful to drill an ⅛ inch pilot hole first and then enlarge it to the final diameter.

Using a drill press with a ¾ inch Forstner bit, drill a 2 inch deep hole at each location. Trial fit a piece of ¾ inch OD tubing to ensure that the insertion depth is 2 inches. Next, drill a 1 inch diameter hole in the hub center for the mast. A tapped hole on the side allows the hub to be secured to the mast with a ¼-20 × 1½ inch thumb screw. And last, drill four ¼ inch holes on the top of the hub for the spreader quick release buttons. If desired, remove sharp corners using a file or router with a round over bit. The hub material can be painted, but the manufacturer recommends that you let it weather for 8 to 12 weeks, and then use any paint or stain that adheres well to wood.

Spreaders

The 83 inch long spreaders (see Figure 4) are made from ¾ inch and ½ inch outside diameter (OD) fiberglass tubing (⅛ inch wall). Cut four 61 inch long pieces of ¾ inch OD tubing (Figure 4, dimension S2), and four 28 inch long pieces of ½ inch OD tubing (Figure 4, dimension S3). On one end of the ¾ inch OD tubing, drill a 17⁄64 inch hole through one wall, 1 inch from the end. Deburr the inside of the hole with a round file and insert a quick release button. Insert the ½ inch tubing into the other end of the ¾ inch tubing with a 6 inch overlap. Fasten the tubes with a 6 × ½ inch thread-cutting screw in the center of the overlap.

Corner Clamps

The four corner clamps (see Figure 5)

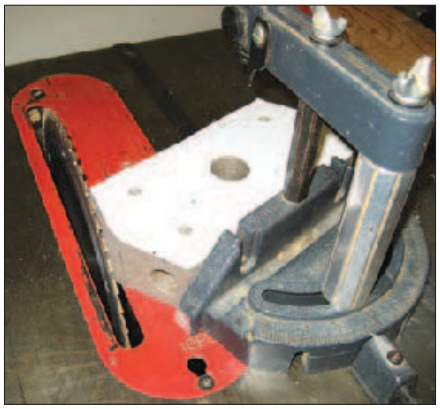


Figure 3 — Preparing a hub on a table saw using a printed template.

are made from ¾ inch OD (⅛ inch wall) fiberglass tubing. Cut four pieces, 2½ inches long. Using scraps from the spreaders, cut four 1 inch long pieces of ½ inch OD fiberglass tubing. Roughen the inside of the ¾ inch tubing with a tubing brush. Then, glue the ½ inch OD tubing inside the ¾ inch OD tubing, flush with one end, using fiberglass epoxy. Allow 24 hours for the glue to set and then remove any excess dried glue inside the ¾ inch tubing with a ½ inch Forstner bit. Next, tap the inside of the ½ inch tubing using a 5⁄16 NC-18 tap. The last step is to drill an ⅛ inch diameter hole all the way through both tubes, ½ inch from the flush end. Use a countersinking bit to smooth the edges and prevent chafing the wire insulation. A 5⁄16 NC-18 × ½ inch long nylon hex head screw is then screwed into the threads. When a wire element is threaded through the ⅛ inch hole the nylon screw is tightened enough to hold the wire, and the corner clamps become part of the element assembly.

Elements

The elements are cut from regular Home Depot 14 gauge THHN insulated wire that was left over from dipole construction. This *machine tool wire* (MTW) has 0.015 inches of PVC insulation plus a 0.005 inch outer nylon jacket. I initially suspected that the nylon jacket affected the insulation's dielectric constant because the first set of elements I made had a resonance that was considerably lower than the model indicated (*EZNEC4 4.0* includes the effects of wire insulation).[5] Closer inspection, however, revealed that the ½ inch metal screws used to attach the elements to the insulators were to blame. The metal screws were replaced with nylon and the element resonance was on target.

The insulator ends are terminated with ring terminals by crimping and soldering. The feed point ends are soldered to a Budwig HQ-1 center insulator as shown in Figure 6. Mark the wire corners with a permanent marking pen and place marks ⅜ inch on either side of the corner mark. This will allow you to center the corner clamps on the corners. Trim the wire to length leaving ¼ inch of wire insulation stripped off for connecting the ring terminals. This gives 7⁄16 inch of additional length from the end of the wire to the tip of an Ace Hardware 16 to 14 gauge ring terminal. Check the ring terminals that you intend to use and adjust the wire lengths as needed to meet the dimensions.

First, trim ¾ inch off both sides of the Budwig wires for a total end-to-end length of 5 inches. For the driven element, solder a ring terminal on the end of the wire. Place the ring terminal on a metal measuring tape (cloth tapes can stretch) with the terminal tip on zero and clamp the measuring tape and terminal in a vise. While keeping constant tension on the wire and tape, measure out 1 foot 10 3⁄16 inches (see dimension details on the binaries Web site) and mark the wire. Continue measuring to 7 feet 10 5⁄16 inches and mark the wire, recheck the measurement

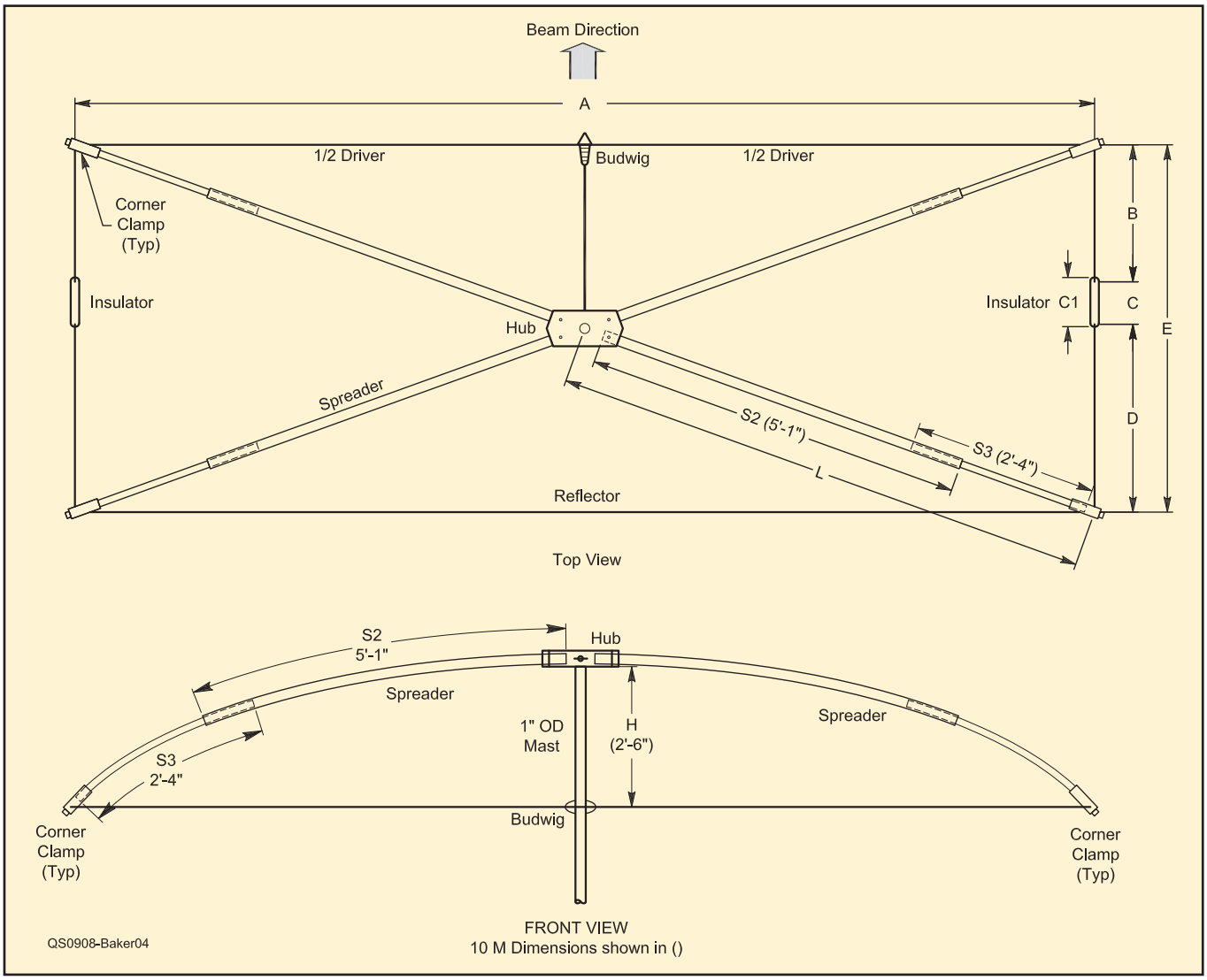


Figure 4 — Dimensioned drawing of the 10 meter MoxBeam.

and cut. Slip on a corner clamp and then a 2 inch length of ¼ inch OD heat shrink. Trim 1 inch of insulation from the wire and wrap the stripped wire around the Budwig wire. Adjust until the element wire insulation just touches the Budwig wire and solder. Slide the heat shrink tubing over the solder joint and shrink. Center the corner clamp between the marks and tighten the nylon screw finger tight, then tighten ½ turn with a wrench. Don't over tighten as it doesn't take much torque to secure the wire. Repeat this procedure for the other half of the driven element.

The reflector is longer than the driver and has no Budwig connector. Solder a ring terminal on the end of the wire. Using the clamping method mentioned above, measure out 2 feet 3$^{7}/_{16}$ inches and mark the wire. Continue measuring to 16 feet 9$^{11}/_{16}$ inches and mark the wire, recheck the measurement and cut. Slip on two corner clamps, strip ¼ inch of insulation and solder a ring terminal on the end. Measure 2 feet 3$^{7}/_{16}$ inches from the tip of the second ring terminal and mark the location of the second clamp. Center the corner clamps between the marks and snug the nylon screws.

Insulators

The insulators provide the required spacing between the driver and reflector elements. Cut two strips, ½ inch wide × 4¾ inch long, from plastic screen base material (used for screened-in porches). This material is stable, flexible and light weight. The element ring terminals are fastened to the insulators using 6-32 NC × ½ inch nylon screws and nuts. It is important not to use metal screws here as it extends the element lengths and detunes the antenna. Mount the element terminal rings so that the tip-to-tip measurement is 4$^{1}/_{16}$ inches.

Assembly

Assembly of the MoxBeam requires no tools and can be completed in less than 5 minutes. Place the hub on the ground and plug each spreader into the hub. Rotate the spreaders until the quick release buttons snap into the hub holes. Lay the wire elements out and slip the corner clamps over the spreaders, flexing the spreaders up as you progress.

There is sufficient tension created by the elements to hold the corner clamps on the spreaders and keep the feed point taut. Flip the antenna over, place it on the mast and tighten the thumbscrew to lock it in place. The 6 and 10 meter versions can also be installed with the spreaders flexed upward.

Due to higher lateral forces on the spreaders, the 12 through 20 meter versions must be installed with the elements flexed downward. Connect the coax feed line to the Budwig center connector and secure the coax to the mast. Adjust the coax for minimum pull or sag on the driven element. I often include a 1:1 choke balun, to prevent common mode current on the coax shield, by strapping it to the mast. Disassembly requires a small diameter rod to depress the spreader quick release buttons in order to remove the spreaders from the hub.

For portable use, the antenna can be hung from a convenient tree limb. A 1 inch OD

wooden dowel inserted in the hub with an eye hook screwed into the top serves as a convenient tie point. The bottom of the dowel is used to suspend the weight of the coax before it is connected to the feed point. Strings tied to opposite ends of two spreaders allow the beam to be rotated from the ground.

Another method I find useful is to mount the smaller antennas with the spreaders flexed upward on a painter's extendable pole. With the acme threads extending past the top of the hub, a short length of wooden extension pole is screwed into the threads using a plastic coupling. The feed line is then secured to the pole, providing support for the antenna feed point. This setup works well while camping by securing the painter pole mast to the camper using plastic conduit clamps.

Modeling, Measuring, and Testing

A modeled azimuth plot for a 25 foot elevation over average ground is shown in Figure 1. Maximum in-band gain is 11.28 dBi at 28.0 Hz dropping to 10.05 dBi at 29.0 MHz. The peak F/B of 39.66 dB is achieved at 28.125 MHz, and the 50 Ω SWR minimum occurs at 28.25 MHz. The antenna's response favors the lower end of the band to cover the CW, digital, and SSB modes up to 28.7 MHz with a 1.5:1 SWR bandwidth. If you wish to alter the response or use different wire I suggest validating any changes with an antenna modeling program.

Builders who want to check the outline dimensions of their finished antenna should understand that the corner clamps alter these dimensions slightly. By securing a ¾ inch section of the elements at an angle, the clamps shorten the antenna length by approximately ¾ inch and increase the width by 11⁄16 inch on the 10 meter version. *EZNEC* modeling shows that this dimensional change does not significantly affect overall performance.

With the 10 meter MoxBeam installed at an elevation of 25 feet, an MFJ-259B antenna analyzer was used to compare the actual and modeled 50 Ω SWR. The antenna SWR curve compared very favorably with the modeled data. I tuned across the band and heard several stations on CW and a few PSK signals.

Jim Innis, K5SP, of Gainesville, Texas was coming in loud and clear at S-8 and we had a nice chat on PSK. Afterwards, I rotated the antenna 180° and his signal dropped to S2. Using the traditional 6 dB per S-unit approximation, this works out to 36 dB, which is very close to the modeled F/B of 39 dB at this height and frequency. Subsequent testing a few weeks later yielded several solid PSK contacts during the New England QSO Party.

All MoxBeams use a dielectric constant of 6 for the wire insulation in the *EZNEC* models with the exception of the 6 meter version. This version repeatedly came up with a 1 MHz lower measured resonant frequency than the models indicated. A quick search on the Internet revealed that the dielectric constant can even change with wire insulation color. An e-mail to (since deceased) L. B. Cebik, W4RNL, provided some much needed assistance with this mystery, for which I am grateful: "The most likely answer is that the insulation of the Home Depot wire is changing its dielectric properties in the upper HF range. PVC and other insulating plastics in the same general range often have additives to improve their durability or some other property such as fire retardation, and these materials can alter the dielectric properties, especially in frequency regions that go untested, since they fall outside the wire's intended use."

Although increasing the dielectric constant helped somewhat, I still couldn't get enough change to match the actual antenna. I ended up by leaving the dielectric constant at 6 and increasing the insulation thickness from 0.020 to 0.031 inches. The antenna (made with red insulation wire) was trimmed to the new dimensions and the resulting SWR curve was finally on target.

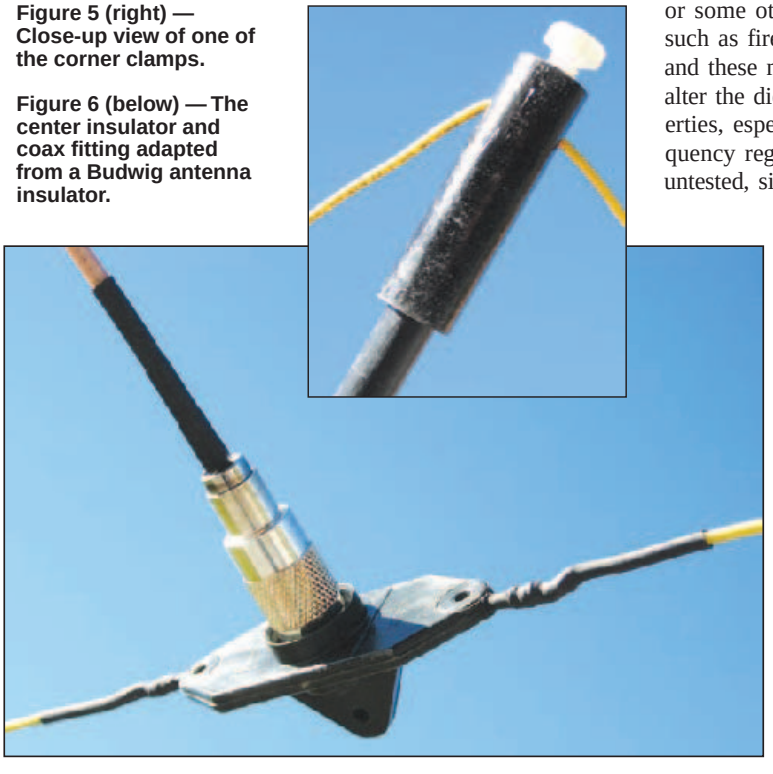
Final Notes

The Moxon rectangle is a proven performer with decent gain and a great F/B ratio, and the 10 meter MoxBeam makes a terrific directional beam. If you are anxious and don't want to wait for the next solar cycle peak, you can get on the air now on any band from 6 through 20 meters using the techniques and information supplied in this article.

Ten meters is a fascinating band to work. At solar cycle peaks the band comes alive with extremely long distance signals that refract from the F2 layer. Even in times of solar minimum when F2 is rarely available, 10 meters still has some long-distance capabilities due to sporadic E propagation.[6] This small antenna will provide hours of fun, and, because it's portable, you can use it just about anywhere. If you make use of the latest rugged and weatherproof materials, the 10 meter MoxBeam will soon become one of your favorite antennas.

Figure 5 (right) — Close-up view of one of the corner clamps.

Figure 6 (below) — The center insulator and coax fitting adapted from a Budwig antenna insulator.



Notes

[1]*ARRL Amateur Radio News*, "Backward sunspots may herald start of Solar Cycle 24," Aug 30, 2006; **www.arrl.org/?artid=6730**.
[2]L.B. Cebik, W4RNL (SK), "Moxon Rectangles"; **www.cebik.com/moxon/moxpage.html**.
[3]**www.arrl.org/files/qst-binaries**.
[4]"Trex Traditional Railing," Trex Company (available at Home Depot); **www.trex.com**.
[5]Several versions of *EZNEC* antenna modeling software are available from developer Roy Lewallen, W7EL, at **www.eznec.com**.
[6]**en.wikipedia.org/wiki/10_meters**

Photos by the author.

ARRL member and General class licensee Allen Baker, KG4JJH, received his license in 2000, fulfilling a lifelong dream of becoming a ham. He holds a BS in Industrial Engineering from Tennessee Tech and works as an Instrumentation and Controls Engineer for the company that operates the US Department of Energy weapons plant in Oak Ridge, Tennessee. Allen is active on SSB and in digital modes, enjoys the challenge of working low power (QRP) and loves to experiment with antennas and radio gear. He can be reached at 211 Brochardt Blvd, Knoxville, TN 37934 or at **kg4jjh@arrl.net**.

Four Output Bench Supply

Every workbench needs a power supply — this one provides four different outputs.

Larry Cicchinelli, K3PTO

This project is a four output bench power supply. Three outputs (positive voltage) use identical switching regulator circuits that can be set to be any voltage between 3.3 and 20 V. Each output is independent of the others and is capable of up to 1 A. The fourth output is via a negative regulator capable of about 250 mA. The unit I built has two fixed outputs and two variable outputs. You can also make any combination of them variable within the above range.

The only dependency among the outputs is that they are all driven by a single transformer. One of the features of a switching regulator is that you can essentially trade off between voltage and current. The transformer I used is rated at 25 V and 2 A. As such it is good for 50 W. Assuming that the regulator IC being used has an efficiency of 75%, you will have a total of about 37 W available from all power supply outputs. In practical terms this means you can get more current from the outputs than what the transformer is supplying — as long as you stay within the 37 W and the maximum current per regulator.

The regulator I used for the positive supplies is the 3.3 V version of the LM2575. If you examine its data sheet you will see that the only difference among the models is the internal voltage divider. This allows you to design a power supply with a higher output voltage by simply inserting a resistance between the output and the FEEDBACK pin. I selected the 3.3 V version mainly due to its cost relative to the others. With it I can get any voltage from 3.3 V to 20 V from the circuit. You could also use the "adjustable" version, which will then allow you to select any voltage between 1.23 and 20 V.

The regulator is specified for up to 37 V output. Since I have specified 50 V capacitors, I believe you should be able to get up to about 30 V output. If you want to output a higher voltage than 30 V, I recommend that you use higher voltage capacitors. The transformer I am using is rated at 25 V; however, I have measured the loaded output at closer to 30 V ac, so I could probably get up to 25 V from the regulators. You will also need to use the 200 V range of the digital panel meter (DPM).

There is also a high voltage version of the LM2575 that can provide outputs of up to 57 V. I recommend that you use capacitors rated to at least 100 V if you decide to use that version.

A Little Theory

Switching regulators come in essentially three varieties: buck, boost and buck-boost. The positive regulator in this article is of the buck type — the output voltage is less than the input voltage. The main feature of a switching regulator that differentiates it from a linear regulator is that the switcher oscillates. They generally use a form of pulse width modulation (PWM) in order to regulate the output voltage. The rise and fall times of the oscillator are quite fast and the harmonics can cause interference to communications receivers. This is the reason a spectrum analyzer is one of the pieces of test equipment used to characterize a switching regulator. This is certainly not the case with a linear regulator!

Two of the best tutorials I have found on switching regulators are *Application Note 2031* on the Maxim-IC Web site at **www.maxim-ic.com/appnotes.cfm/an_pk/2031** and at **www.national.com/appinfo/power/**

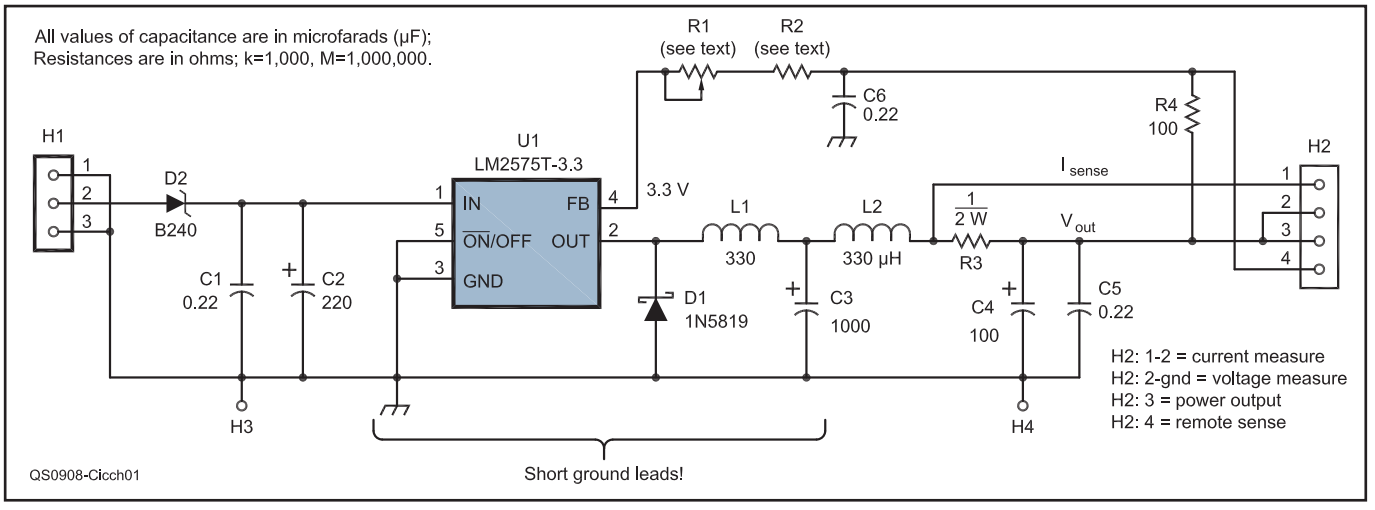


Figure 1 — Schematic diagram of a single positive regulator module.

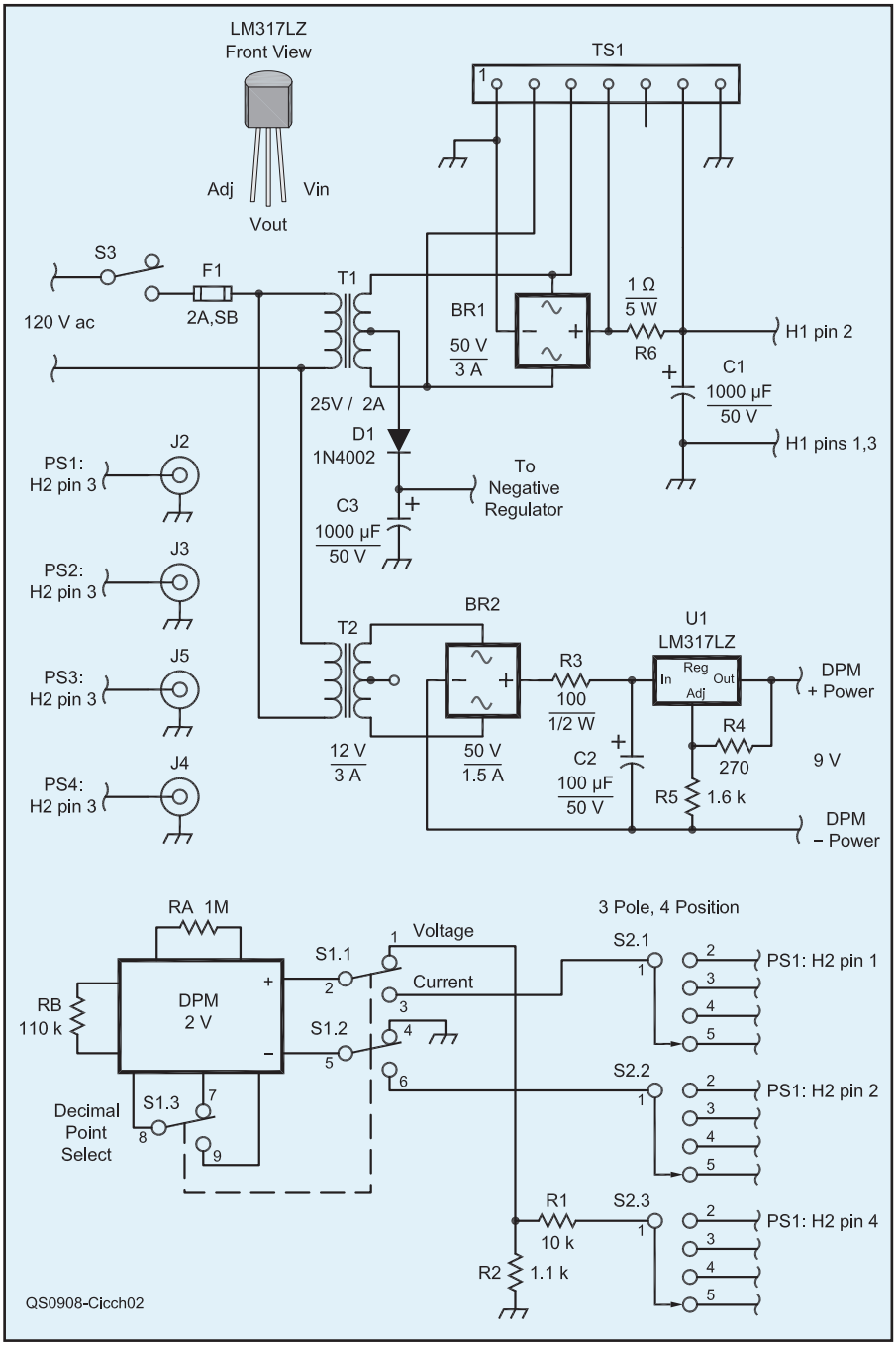


Figure 2 — Chassis schematic showing the interconnection of the modules as well as control and metering details.

files/f5.pdf from National Semiconductor. Rather than try to repeat much of the material in that note, I suggest that you get a copy and read them for yourself.

A switching regulator will have some amount of high frequency noise on its output at the switching frequency, about 52 kHz for the LM2575. In the circuits described here there is a low pass filter on each output that reduces, but does not completely eliminate, this noise. If your requirement is for fixed voltages, you can add a low drop out series regulator (LDO). A good LDO typically requires only about 100 mV between the input and output voltages, so you can design the switcher to be a little higher than the desired voltage and get the benefits of both types of regulators.

Some Circuit Details

Figure 1 is a schematic of a single positive regulator. There are several variations of the circuit which could be implemented. L2 and C4 are optional. These two components provide a low pass filter that will decrease the high frequency noise that might otherwise appear at the output. The pads for R1 will accommodate a small, multi-turn potentiometer. You can insert one here or you can use the pads to connect a panel mounted potentiometer. If you want a fixed output you can simply short out R1 and use R2 by itself. You can also insert a fixed resistor in the R1 position if the calculated value is nonstandard and you want to use two fixed resistors.

The formula for the output voltage (with the 3.3 V version) can be calculated as follows. The current (in mA) through the internal voltage divider is

$$I = 3.3\ V/2.7\ k\Omega = 1.22\ mA$$
$$R1 + R2 = (V_{OUT} - 3.3) / 1.22\ k\Omega$$

transposing terms yields:

$$V_{OUT} = [1.22 \times (R1+R2)] + 3.3$$

Note that if you make R1=R2=0, the calculation results in an output of 3.3 V. The leakage current of the error amplifier in the regulator is somewhat less than –25 nA, so it can be ignored. Also, since the current for the feedback circuit flows through the current sense resistor, it will be included in the value displayed by the DPM when current is selected.

If you want to have an accurate, fixed output voltage, I recommend selecting a value for R2 that is lower than the calculated value. Then select a potentiometer for R1 that yields a reasonable adjustment range.

If you decide to use the extra LC filter, you will have to install L1 and L2 such that their phasing dots line up with the dot symbols on the circuit board. I found out the hard way that if the dots are at the same end of the board, the output will have an additional low frequency ripple. When I built my board I just happened to have three circuits assembled correctly. The fourth one had a serious low frequency ripple that I could not get rid of. I eventually replaced every component, one at a time, to find the bad one. When I replaced L2 the output was okay. It was then I noticed the phasing dots. I reversed L2 just to see what would happen and the ripple came back. There can be inductive coupling, even though there is a ground plane on both sides of the board under the inductors.

Remote Sensing

A feature of many power supplies is that of remote sensing. This is used to electronically adjust for the voltage drop in the wires carrying current to the load. I found that, even with relatively short wires, there can be significant voltage drop between the regulator and its load. There is provision for remote sensing in this circuit. If you are not going to use remote sensing then you should insert a jumper in place of R4. R4 (100 Ω) is there for protection just in case the remote sense connection is missing.

The schematic shows the connections necessary for remote sensing. It will only work, however, if you run a separate wire from H2-4 to the load. The added accuracy

is the result of the load current flowing to the load via H2-3 and essentially no current flowing via H2-4. The connection to H2-2 is still needed in order to measure the voltage drop across the current sense resistor accurately.

If you do not want to use remote sensing you can simplify the switch wiring to use a two pole switch instead of the three pole listed. In this case you would essentially not use S2.2 and connect S1.2 to the common of S2.3 instead of S2.2.

Strictly speaking even this does not fully implement remote sensing. This circuit does not have a mechanism to adjust for the voltage drop in the ground leg. Most high-end commercial supplies will have both power and ground sense inputs. For this power supply make sure that the ground leads have minimal voltage drop. Measurements inside the chassis have indicated this. I have measured about 100 mV drop at 1 A between the positive output of the regulator board and the chassis connector. There was no measurable voltage drop in the ground circuit. You just have to be sure to use relatively heavy wires for the ground connections.

Efficiency

Table 1 on the binaries Web version shows the efficiency of the positive regulator with various input voltages. Notice that the efficiency is really good at 14 V; however, the circuit is no longer regulating! Optimum efficiency seems to occur at 20 V but there is not a whole lot of variation between 16 and 28 V.

Rectifier Circuit

Figure 2 shows the connections among the parts of the system — regulator boards, DPM and rectifier circuit. The components used for the main rectifier circuit are mounted on a terminal strip (Mouser 158-1008). You can see the terminal strip and R6 at the top left of Figure 3. You can hardly see it, but C1 is mounted underneath the terminal strip. The leads of the bridge rectifier are soldered into the holes that are used to rivet the terminals to the Bakelite. One of the four leads, the negative output, is soldered to a grounded terminal. Since I have had quite a few of these terminal strips for several years I used fine Emory paper to clean their surfaces as well as a small file to clean the holes. This was done in order to insure good solder connections.

Negative Regulator

The negative regulator is generally similar to the positive regulator. Its description and schematic are on the binaries Web site.

The Digital Panel Meter

Another feature of the unit is the digital panel meter (DPM). It can be switched to measure the output voltage (H2 pin 1 to ground) as well as the current drawn (voltage between H2 pins 1 and 2) for each of the supplies. Figure 2 shows the circuit I implemented. A three pole, four position rotary switch selects which power supply is being monitored and a three pole, double throw toggle switch selects between voltage and current measurements.

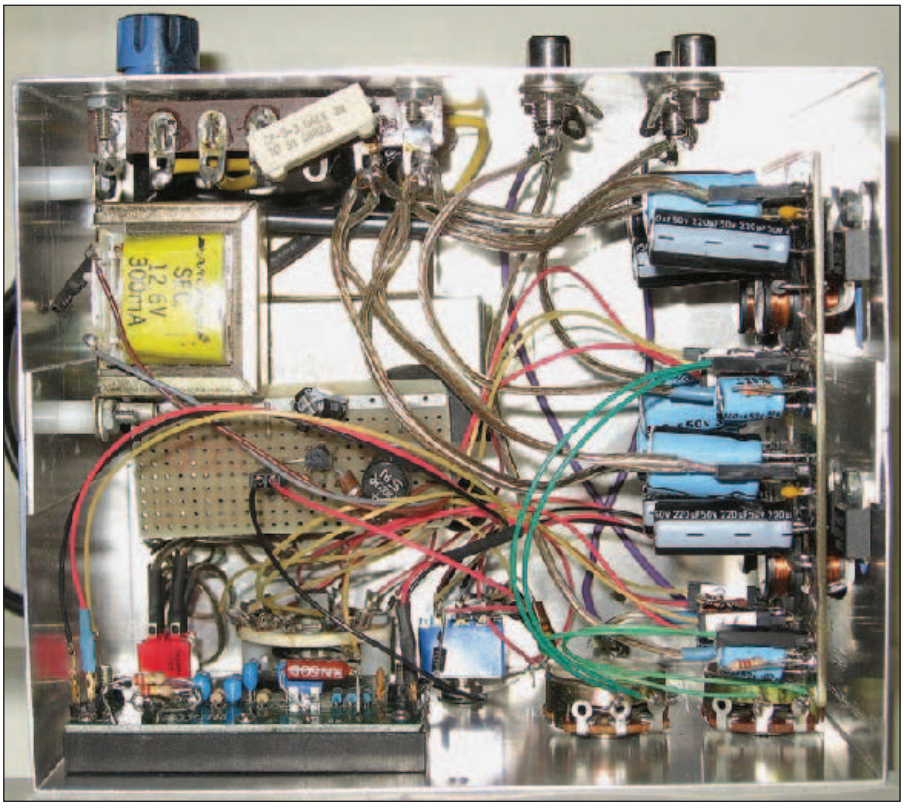


Figure 3 — Underchassis view of the completed power supply. The components used for the main rectifier circuit are mounted on a terminal strip shown at the top left.

The DPM is a 2000 count unit with a basic range of 200 mV. It does not have a 2 V range. I inserted my own resistors on the DPM board for RA (1 MΩ) and RB (111 kΩ). In order to get a 10:1 voltage ratio the resistor ratio needs to be 9:1. If you have to do this for your DPM, you will want to insure that you maintain the accuracy of the meter. I strongly suggest that you maintain at least a 1 MΩ input resistance so that it does not affect the external voltage divider used for measuring the voltage. I used the calibration potentiometer on the DPM for the final accuracy adjustment. I borrowed a four digit DVM of known accuracy to insure good calibration.

It may be hard to get two resistors with exactly a 9:1 ratio from your "junk box." On the DPM I used two 220 kΩ resistors in parallel to get the required 111 kΩ resistance. By measuring several 220 kΩ resistors I was able to find a combination that was quite close to 111 kΩ. For the voltage measuring divider you can do the same thing using a 10 kΩ input resistor and then a 1 kΩ and 110 Ω in series for the "low" side of the divider. The parts list specifies 1% resistors, in case you don't want to combine resistors as I did.

In order to measure the voltage drop across the 1 Ω current sense resistors, the DPM needs either an isolated power supply or some more circuitry (which could require another power supply anyway). For this system I selected the isolated power supply implementation. I used a series regulator because they are somewhat easier to implement and because the DPM has a very low current requirement. Rather than build another printed circuit board I decided to mount all the components, except the transformer, on a breadboard.

The DPM also has a set of jumpers that allow selection of the decimal point location. As can be seen on Figure 2, I use one pole of the toggle switch to select those inputs.

Some Construction Hints

On the DPM and the regulator boards, I used pin headers for all of the connections that come off the boards. (see the parts list for details). This allowed me to assemble the subsystems without having to consider any attached wires. I would then determine the appropriate wire lengths and install the mating connectors on the wires and simply push them onto the pins. This connection method costs about 20 cents per connection.

I have used this method for quite a few

projects and have found it to be very useful. It allows me to disconnect all or part of a circuit for debugging as well as for repair. I typically assemble the connectors under a three power magnifying lens and use a pair of 4 inch needle nose pliers for crimping. A crimping tool would make the job easier but they can be expensive.

I have a supply of eight conductor telephone cable that I use for many of my projects. I cut the cable to an appropriate length and then pull the wires out of the sheath. This gives me wires of eight different colors, making them much easier to trace.

The printed circuit board for the regulators contains four identical circuits. At first I thought I might separate the boards for mounting in the enclosure. I decided to keep them as a single board, however. This made it easier to mount the board and it also gave me an idea as to how to heat sink the regulator ICs. I mounted them on the bottom side instead of on the top as I had originally planned. I then folded over the ICs so that the flat side was parallel to the PCB and farthest from the board. I managed to fold the ICs identically so that I was able to use their mounting holes to fasten them to the side of my enclosure. This not only is a convenient method of mounting the board it also gives the ICs a good heatsink and ground. Figure 3 shows the completed assembly bolted to the side of my enclosure.

One problem I encountered with the above method was that of mounting the nuts and bolts required by the ICs. I solved this problem by using a small amount of epoxy to attach the nuts to the "front" side of the regulators. I used a short bolt to hold the nut in place while the epoxy hardened being careful to avoid getting any epoxy on the threads. Figure 5 on the binaries version shows the back side of the PCB assembly with the ICs folded over and the bolts holding the nuts in place while the epoxy hardens.

Another issue I had to solve was the length of the bolts. I had to insure that they were short enough so that they would not touch the PCB once they were used to bolt the ICs to the chassis. Since I did not have bolts of the proper length I had to cut them to length. I used a pair of bolt cutters with threaded holes for the 10-32 bolts. A word of caution here — to ensure that I could still thread a nut onto the bolt after cutting it, I threaded a nut onto each bolt beforehand, so that after I cut it I would have to remove the nut. This method helps to insure that the bolt will still allow a nut to be threaded onto it.

I then measured the distance between the mounting holes of the four regulator ICs and drilled holes in the side of my enclosure accordingly. This method proved relatively easy to implement and made for a very simple mounting procedure. I suggest making a drilling template out of card stock (an index card, for example) to ensure correct spacing, before you drill any holes.

Since the negative regulator was an addition to the "completed" system its installation was different from that of the positive regulators. The circuit was built on a prototyping breadboard and bolted to the bottom of the enclosure. I removed the connections to my regulator #3 and rerouted them to the negative regulator. I have since designed a printed circuit board, but have not replaced the one in my system.

For those who may already have a positive voltage power supply, the negative regulator can be constructed as a separate project and simply connected to your existing supply.

A caution regarding the circuit boards. My source is FAR Circuits, which makes a lot of boards for ham related projects. Their boards do not have plated-through holes so you will have to be sure that you solder the through-hole components on both sides of the board.

The QST Binaries Web site has the artwork for the board as well as the Gerbers and a drill file.[1] These can be used to make your own boards if you want. The schematic capture software I use is *DipTrace*. The schematic and PCB files are also on the binaries site.

RFI

I have access to a really good spectrum analyzer at my employers, as well as someone who knows how to use it (thank you, Matt!). The power supply, in its aluminum enclosure, was put into a completely shielded box with an 18 inch antenna within a few inches of it. I put an 8 Ω, 20 W resistor on the #2 regulator output and adjusted the voltage to +8 V. We then made a series of measurements. The spectrum analyzer has a mode in which it does FCC Part 15 (RFI) tests automatically — very convenient! Even with the antenna so close, the only interference that would have failed the test occurs around 88 MHz). The horizontal green line shows the FCC limit of about –62 dBm. Figure 4 shows conducted noise — the analyzer probe was connected directly to the output through a 0.22 µF capacitor. Figure 4 shows the noise throughout the range of 1 to 30 MHz. This shows a very quiet output.

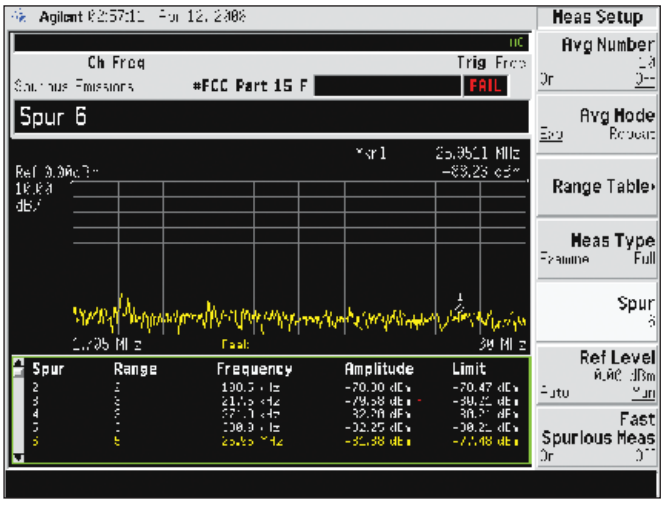


Figure 4 — Measured conducted noise spectrum amplitude throughout the range of 1 to 30 MHz. These show a very quiet output.

Parts

The only critical parts are the resistors that form the two voltage dividers. Even their values can be changed, within reason, as long as the ratios are maintained. Although the value of C3 is not very critical, it should be a low ESR type.

The parts list (also on the binaries site) provides the sources from which I obtained my parts. Since I have built quite a few projects over the years I have developed a fairly good supply of components. I have a spreadsheet I keep updated with everything I purchase so that I can use the same parts in new projects. Many of the parts can be obtained from several sources so you may want to do a little shopping around. I try to minimize costs by getting parts from as few sources as possible in order to keep shipping costs down.

Photos by the author.

Larry Cicchinelli, K3PTO, is an ARRL member who has been licensed as K3PTO since 1961. He holds an Advanced class license. Larry earned a BSEE from the Drexel Institute of Technology in 1969 and an MSES from The Pennsylvania State University in 1981. He was employed at Ford Motor Company for 33 years until 2000, responsible for the design and fabrication of test equipment first for ICs and then for automotive electronics. He is now Technical Support Manager for Rabbit Brand at Digi International. He has had articles published in QEX, Circuit Cellar *and* Nuts & Volts *magazines. You can reach Larry at 119 River Run Cir, Sacramento, CA 95833 or at* **k3pto@arrl.net**.

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

A No-Special-Tools SMD Desoldering Technique

You don't need a fancy fabrication shop to get surface-mount devices off the board.

Wayne Yoshida, KH6WZ

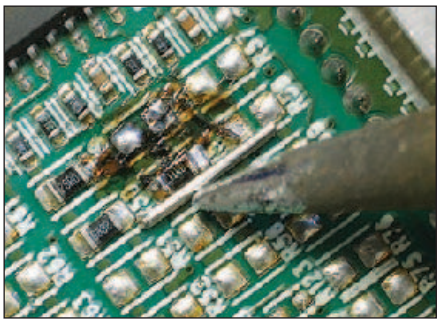


Figure 1 — A small piece of bus wire is used to transfer heat to both sides of the component at the same time.

While modifying a commercial 23 GHz assembly for ham radio use on the 24 GHz band, I had to remove and replace several small surface-mount devices (SMDs). Although several techniques have been described to remove an SMD from circuit boards, I have developed a way to remove these tiny parts without any special tools or a need for a second soldering iron. In addition, this technique does not destroy the component or the circuit board.

Flood, Float and Flick

I call this the *flood, float and flick* (*F3* for short) technique: The component and board are heated, and as the solder begins to melt, more solder is added to the area, flooding the component area. Then, a flick of the iron tip moves the part so that it can be picked up with a pair of tweezers. I use a standard Weller WTCPT soldering iron, with an 800° screwdriver tip for all work.

The main idea is to heat all sides of the component at the same time, so that the device can be picked up and removed from the circuit board. Since surface-mount components are so small, it may be possible to use a large chisel-point soldering iron tip to heat both sides of the component.

The general concept is based on the old trick of wrapping a piece of solid copper wire around a soldering iron tip, to solder small components. In this technique, a small piece of 20 gauge tinned bus wire is used to transfer heat to both sides of an SMD resistor, as shown in Figure 1. In this photo you can see that a component has already been removed, using this technique.

Although I have not tried this, it should be possible to shape the wire into a small circle, rectangle or square to remove other components, such as SOT-223 packaged transistors or SMT DIP packaged devices.

Making it Happen

Refer to Figure 2. As the leads heat and the solder re-flows, quickly add more solder to flood the area. I use Kester rosin-core solder, in a 63/37 (tin/lead) alloy. The component will float, and you can use a wiping action to flick the component away from its mounting pads.

Next, a length of solder wicking is used to remove excess solder from the board, as shown in Figures 3 and 4. The flux can also be removed with some alcohol and a little scrubbing.

The removed chip resistors ended up stuck to the 20 gauge bus wire. Although a bit discolored, these little bits can also be cleaned up with solder wick and alcohol, and be reused in another project. Of course, the little chip resistors are cheap enough to go into the trash bin (the hazardous waste bin). If the component were more valuable, such as a PIN diode or a transistor, however, it would be worth saving.

SMT is Here to Stay

This is another chapter in the *don't be afraid to use surface-mount components* story. As electronic products get more complex and component densities increase, SMT is the only way to go. Experimenters must practice using (and repairing) this construction method, and become comfortable with using these types of components.

By the way, the 24 GHz project I am referring to is discussed on a Yahoo! interest group site started by Frank Kelly, WB6CWN, of the San Bernardino Microwave Society (SBMS).[1]

[1]**groups.yahoo.com/group/24GHzHam/**.

ARRL Life Member and Amateur Extra class licensee Wayne Yoshida, KH6WZ, is employed by M/A-COM Technology Solutions in Torrance, California, and has been a ham since 1976. His most memorable ham radio experience was working in the press room at the NASA Johnson Space Center (Mission Control, Houston) during the 1983 Owen Garriott, W5LFL, operation aboard STS-9/SpaceLab-1. You can reach Wayne at 16428 Camino Canada Ln, Huntington Beach, CA 92649 or at **kh6kine@earthlink.net**.

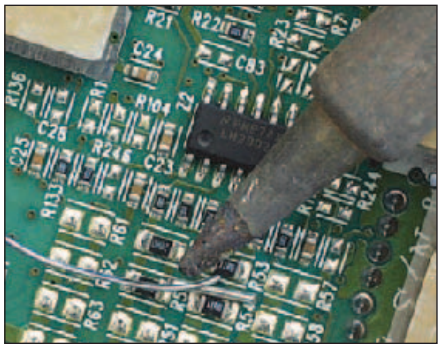


Figure 2 — As the component heats and solder begins to reflow, quickly add more solder to flood the component area. The component will float and you can flick the iron tip to push the component off of its pads.

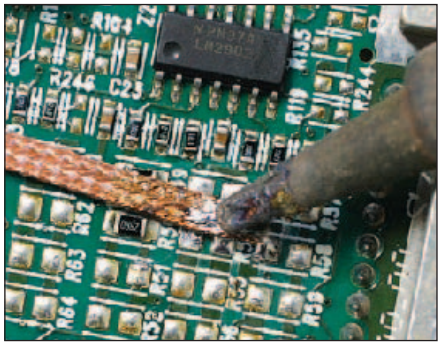


Figure 3 — Remove the excess solder and flux from the board with solder wick. Additional scrubbing with a swab and alcohol will remove the flux residue.

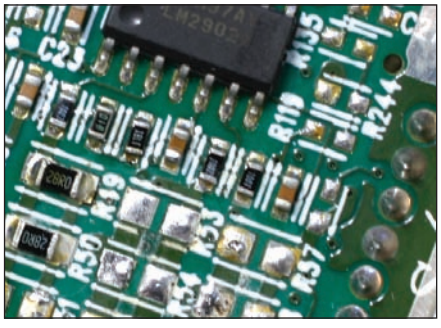
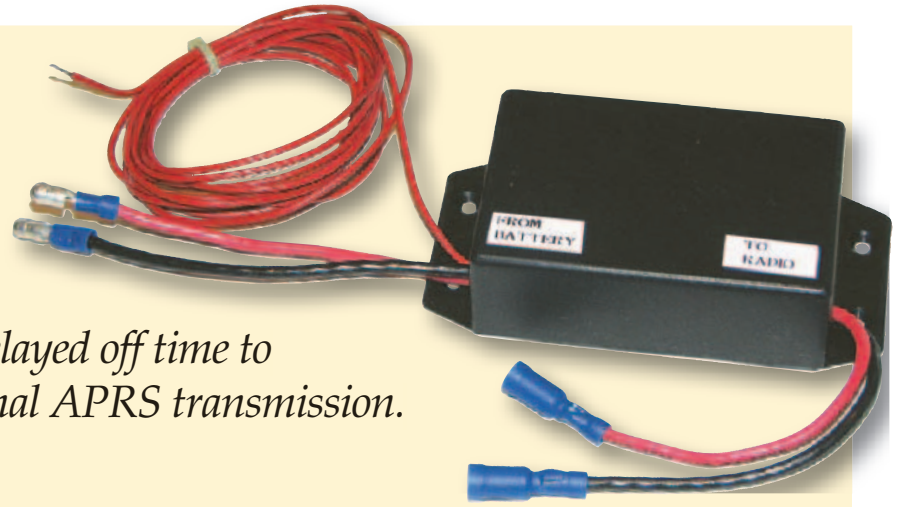


Figure 4 — The board should look like this. Two 0603 size resistors have been removed, and the cleaned board is ready to receive two new resistors.

The Ignition Switch



This handy device provides transient protection and a delayed off time to finish a contact or for that final APRS transmission.

Wayne Mahnker, WA5LUY

When I first became involved in amateur mobile operation, I wired the radio to the vehicle ignition switch. This was very convenient. When the ignition was ON, or in the ACCESSORY position, the radio could be turned on. When you got out of the car with the key in your hand, you didn't have to worry about a dead battery.

That convenience started going away with newer microprocessor radios. Manufacturers today suggest direct connection to the battery with good reason. Unfortunately, I can tell you from personal experience, transients on the electrical system of modern vehicles can play havoc on the newer radios, especially while starting. Some radios do have an automatic power off feature but this is a little cumbersome to set when driving times change and it does not address the problem at start-up.

A Simple Answer

This article describes a weekend project costing under $20 that will connect between the battery and the radio. It provides a 10 second delay after the ignition is turned on to allow power in the vehicle to stabilize and a 5 minute power off delay after the ignition is turned off to finish a contact or get that final location out from your APRS system. It will carry 20 A, which will cover most radios up to the 100 W level.

The Circuit

My goal was to come up with the smallest and least expensive circuit consisting of readily obtainable parts. The heart of the circuit is a 12 V relay rated at 25 A. The circuit (see Figure 1) also consists of two 7555 ICs, CMOS versions of the famous 555 timer IC developed in the early 1970s. Total current draw is about 100 mA while on and 0 mA if off. The first timer, U1, turns on by bat-

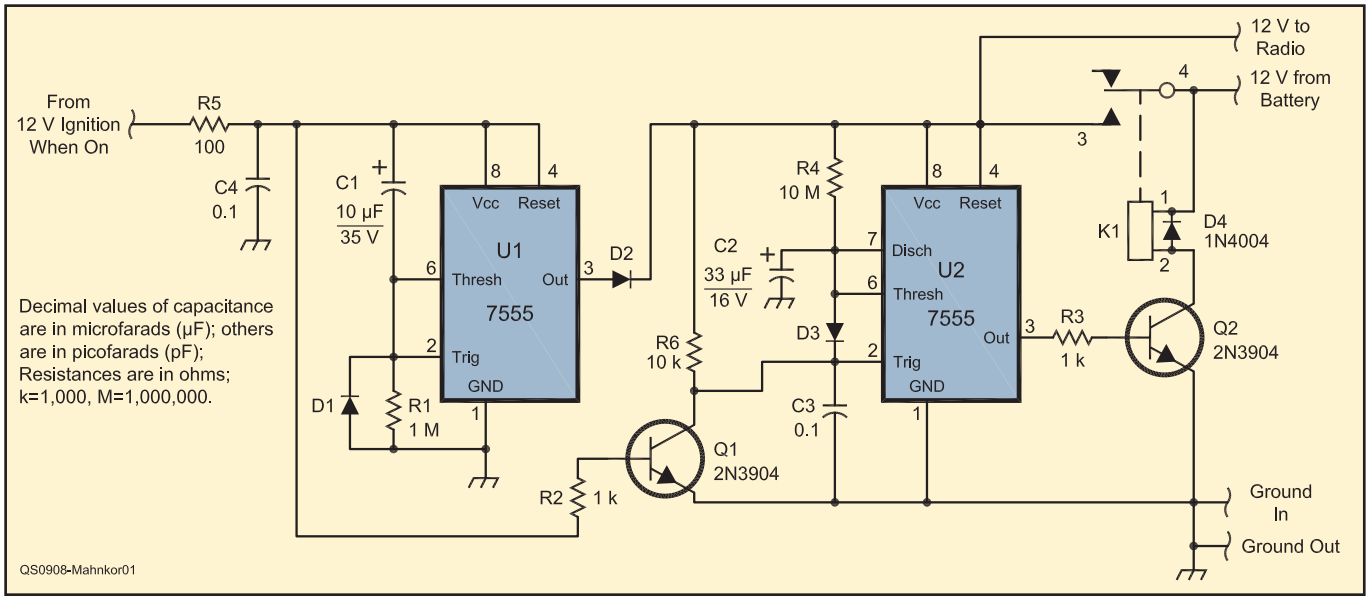


Figure 1 — Schematic diagram and parts list for the Ignition Switch. All resistors are ¼ W. Mouser parts are available at www.mouser.com.

C1 — 10 µF, 35 V capacitor (Mouser 140-LLRL35V10-RC).
C2 — 33 µF, 16 V tantalum capacitor (Mouser 74-199d16v33).
C3, C4 — 0.1 µF, ceramic capacitor (Mouser 581-52h104MACJI).
D1-D3 — 1N914 diode (Mouser 512-1N914B).
D4 — 1N4004 diode (Mouser 512-1N4004GP).
K1 — SPST relay, 12 V at 25 A contacts (Mouser 677-PCF-112D2M).
Q1, Q2 — 2N3904 transistor (Mouser 512-2N3904J052).
R1 — 1 MΩ resistor (Mouser 291-1M-RC).
R2, R3 — 1 kΩ resistor (Mouser 291-1K-RC).
R4 — 10 MΩ resistor (Mouser 660-CF1/4C106J).
R5 — 100 Ω resistor (Mouser 291- 100-RC).
U1, U2 — 7555 integrated circuit (Mouser 511-TS555IN).
Connectors — Male bullet type, four required (Mouser 159-1616).
Connectors — Female bullet type, four required (Mouser 159-1613).
PC Board — 1⅞ × 2⅞ inch (RadioShack 276-150).
Utility box — Bud CU-1941 (Mouser 563-CU-1941).

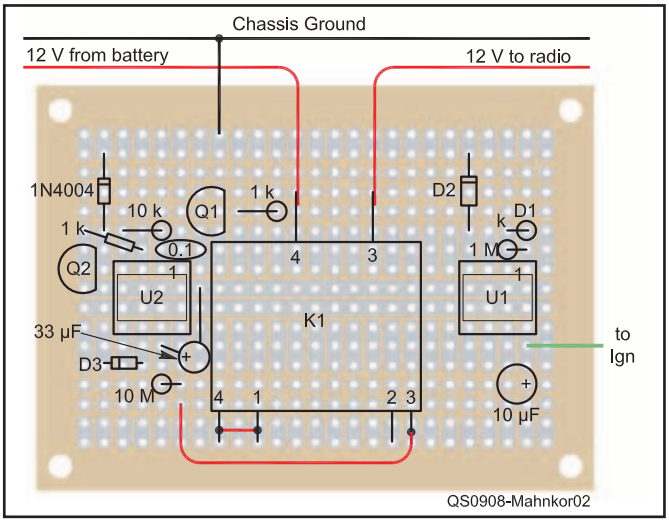


Figure 2 — Perforated board parts layout details.

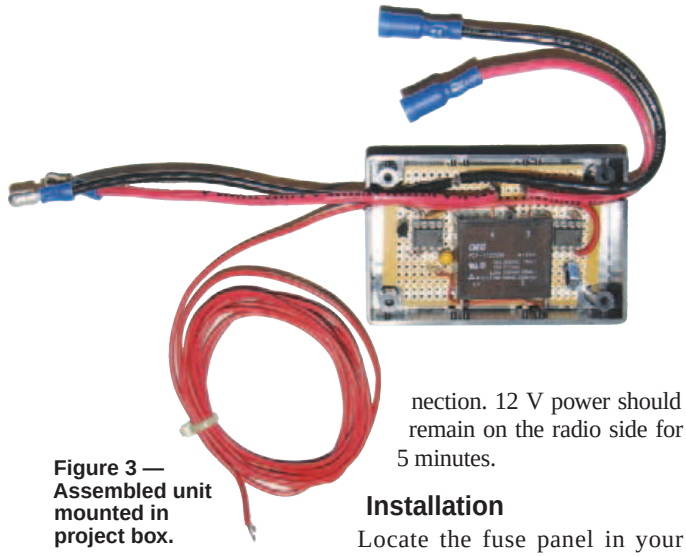


Figure 3 — Assembled unit mounted in project box.

tery voltage from the vehicle ignition switch and turns on timer U2 via D2 after a 10 second delay. When U2 is turned on, it energizes relay K1 via Q2. K1 keeps power on U2 until its time cycle is completed and K1 released. Timer U2 is kept from timing and releasing K1 by Q1 until battery voltage is removed from the vehicle ignition.

A word of caution on substituting components: IC U1 could be substituted with a 555 with a little more consumption of power. IC U2 must be the CMOS version 7555 in order to make the long timing interval accurate. Also the 33 µF capacitor must be a good quality Tantalum type.

Construction

Before mounting any components on the PC board, trim the corners so the board will easily slip into the box case. Also remove some of the flange on either side of the box case so the board will go to the bottom. When the project is completed the board will float in the case.

Glue the relay to the board on its side with coil pins 1 and 2 down. Hot glue works well for this application. Connect pins 1 and 2 to the board. Mount the remainder of the components and jumpers on the board as shown in Figure 2. Nothing is critical here as long as the schematic is followed. Use 12 gauge wire for the high current connections to the relay and ground. The relay terminals are made for solderless connections. I found it was much easier to solder the heavier wire directly to the terminals. Finally, place the completed board in the box (see Figure 3). Mark and notch each end of the box for the wires to the battery, ignition, and the radio. Use high current male and female connectors of your choice. I used inexpensive bullet connectors.

Testing

Inspect the board for any solder or jumper errors. Resistance from pin 4 or 8 to ground of both ICs should be greater than 200 kΩ. Apply 12 V power to the battery side of the circuit. Connect the ignition lead to +12 V. After 10 to 12 seconds you should hear the relay close. Check for 12 V power on the radio side. Remove the ignition lead connection. 12 V power should remain on the radio side for 5 minutes.

Installation

Locate the fuse panel in your vehicle. Find a connection point that is turned on and off with the ignition key. The ignition switch wire can be connected to that fuse position. Newer vehicle fuses have small terminals on top that can be accessed to determine if voltage is present when the ignition key is on. Some fuses are marked IGN or IGN1. Another place to look is the lighter type accessory plugs that are on only with the ignition key. If you are not sure, it might be good to consult your dealer for a proper connection point. Finally, hook the board between the battery and radio and you are ready to go.

Photos by the author.

Wayne Mahnker was first licensed in 1965 with his current call sign WA5LUY. He holds Amateur Extra class and General Radio telephone licenses and is an ARRL member. Wayne retired from Lucent Technologies in 2000 as a Senior Service Manager following a career in the telecommunications industry. Wayne's interests include building and maintaining repeater systems, APRS, VOIP, HF digital and voice. Wayne can be reached at 207 Halteria Pt, Hot Springs, AR 71913-5341 or **wa5luy@arrl.net.**

Feedback

◊ In "An Audio Interface Unit for Field Day and Contesting" [Jun 2008, pp 39-41], C19 is shown in the parts list twice, once as 10 µF, once as 1 µF. The 1 µF value (as in the schematic) is correct. The author notes that adding a 10 µF, 16 V electrolytic in the line between the top of R6 and K1A will keep radio mic bias from reaching the mic. He also notes that FAR Circuits (**www.farcircuits.net**) offers PC boards for this project.

◊ In "Homebrew Coaxial Dipole for VHF or UHF" [Jul 2009, pp 33-35], the stainless steel whip dimension in Figure 1 should read 440-6.5", not 440-65".

◊ In the 2008 ARRL November Sweepstakes CW Contest results [May 2009, pp 81-83] the Northwestern Division Multioperator plaque winner was incorrectly listed as NN7SS. The correct winner is KL2R.

◊ In the 2009 November Sweepstakes Phone Contest results [Jun 2009, pp 81-84], the Northwestern Division Single Operator QRP plaque winner was incorrectly listed as W7YAQ; the correct winner is NN7SS (N6UFO).

◊ In the 2009 ARRL RTTY Roundup Results [Jul 2009, pp 84-85], the Dominion DX Group was incorrectly placed in the Medium Club category. They qualify for the Local Club category, making them the winner of the Local Club competition.

◊ In the W1AW Schedule [Jul 2009, p 101], the 160 meter Morse code transmit frequency should have read 1.8025 MHz.

◊ In "A High Gain Single Wire Beam" [Jul 2009, pp 38-39], the author notes that the inductor should be in series with the center conductor of the coax, not across the coax. The resonant frequency, that at which the SWR is lowest, may need to be adjusted by adding or subtracting turns from the coil. In his case, on 20 meters, the coil only needed about 8 turns rather than 26 turns. If the inductor is in parallel, the antenna will work, but the SWR will likely be about 3 to 1.

◊ In the 2009 ARRL January VHF Sweepstakes Results [Jul 2009, pp 80-83], the winner of the Limited Multioperator category was incorrectly listed as K1JT. The correct winner is KB1DFB.

Bluetooth and Ham Radio or "Look Ma, No Hands!"

Use cell phone technology to simplify ham radio.

Johnny L. Knight, WB4U

The question has been asked, and I've asked it: "Why have the major ham radio manufacturers not added Bluetooth to their product lines?" Well, Yaesu has begun to offer Bluetooth on one if its newest radios, the FTM-10 dual-band V/UHF mobile transceiver.

So far there's nothing for the HF crowd. I for one would love to have a wireless headset to use with my HF station. Wireless capability really cuts the cord from the microphone and gives you the freedom to move around the shack and do other things you just can't do while corded to the rig. Since Bluetooth hasn't come to all of ham radio, perhaps there was a way to let ham radio come to Bluetooth.

The Answer at Hand

I found, after a bit of research, that it was possible and it wasn't that expensive to deploy Bluetooth at my ham station. Generally speaking, for less than $100 I could have a wireless headset to use with my HF transceiver. I found that there had been adapters made for cellular telephones that did not have Bluetooth built in. The question was, could such an adapter be shoehorned onto a ham rig? These small, battery operated, adapters are designed to plug into the cell phone's 2.5 mm speaker/microphone jack. The adapter can either be worn on your belt or be attached to the phone with double sided sticky tape or fastened with hook and loop fasteners. They provide many hours of talk time and even more hours of standby time using small internal lithium polymer (LiPo) batteries.

Adapters for the Radio End

The adapters (see Figure 1) are only about 1 inch square and ¼ inch thick. They have a short pigtail ending in the 2.5 mm stereo plug. The tip provides audio to the cell phone, the ring sends audio from the phone out to the headset and the sleeve is used as a common ground. For radio use, your transceiver is used in place of the cell phone.

And for Your Head

You might balk at the thought of using one of those stick-to-the-side-of-your-head type headsets (see Figure 2), but they do work well and sound pretty good. The main drawback is the fact that the microphone element is far from your lips and, if used in a noisy environment, may tend to pick up sounds around you as well as your voice.

The author using a Blue Parrott B250 headset. This solves the noise pickup problem in a way that's familiar to most amateurs.

Figure 1 — Cardo Wireless BTAII wireless adapter, one choice for the radio end of the link.

Figure 2 — Cardo Scala 500 headset. This style is popular with many wireless phone users.

The answer is an over the head headband earphone with a boom mic as shown in the lead photo. This type is popular with truckers (remember what I said about noisy environments) and I found at least two different companies making them. Cobra makes the CBTH1 headset and Blue Parrott makes the B250 Headset.

Both headsets have internal LiPo batteries, offer many hours of talk time and hours more of standby time. Both would be comfortable to wear for extended periods and even though they may look bulky and side heavy, they are not. The headband is adjustable for fit and comfort and the headset is light weight enough to forget you have it on. By not having a cord attached, you gain much more freedom of movement and that gives the unit a much lighter feel compared to a corded headset.

Search eBay for both items and you'll save. I found the Jabra A210 for $12.99 and the Blue Parrott B250 for $74.95 including shipping. Other brands are available for competitive prices So for less than $100 I was ready to explore the world of Bluetooth and ham radio.

Making it Happen

The first order of business is to charge both units completely before use. Follow the instructions included with the headset and adapter. While those are charging, you'll have time to get your radio wired and ready to go. How you wire things is entirely up to you and depends greatly on what kind of radio you are hooking to. Many of the latest models include some type of data port on the rear to allow connection to either a sound card interface or TNC type unit. These data ports normally provide transmit audio (TX AUDIO), receive audio (RX AUDIO), PTT (you will not need this) and GROUND connections. Since you

only have the three connections coming from the adapter they will match up nicely with any radio. A word of caution is in order here also: Many rigs may provide 5 to 12 V on one of the pins of the data port. Make sure you know what you are connecting to and isolate with a coupling capacitor if needed.

Some modern rigs also provide what you need at the mic connector on the front of the radio. This was the case with my ICOM IC-746PRO. Pin 8 of the MIC connector has receive audio, pin 7 is the mic ground and pin 1 is where I feed transmit audio. If you can find a 2.5 mm female stereo jack and an 8 pin mic connector you can wire everything up, secure the 2.5 mm jack and heat shrink it all for a nice neat appearance. I chose to run a wire from the MIC connector to the 2.5 mm plug to allow me to position the adapter in more advantageous positions. I also plan to make up a cable for the data port on my IC-746PRO. This will allow me the use of the same cable with my Yaesu FT-857D and ICOM IC-703plus, both of which use the same data ports and are wired exactly the same as my IC-746PRO.

How's it Play?

I would guess at this point there might be some comments along the line of "I'll bet the audio is horrible!" Well, the truth is I was worried about exactly that myself. I had been accustomed to hearing my friend and I using Heil Goldline Pro microphones and there simply was no way this little headset could come close to that. I was wrong. My local ham buddy I've been talking to for about 15 years beat me getting his system playing before I could. The first time I heard his Bluetooth headset I was really surprised. If I had not known he was switching to it I might not have noticed the change. The audio was very good, not quite up to a Heil Goldline, but way above a hand microphone. Put a little equalization (EQ) to it from the radio or an outboard equalizer and you'll think you have high fidelity audio. The voice operated transmit (VOX) settings and the mic gain will need to be adjusted, just as you would with any new mic.

RFI? — Not Here

Worried about RFI from the headset or adapter to your radio? So far I've had none. What about RF feedback into the headset or adapter? Again I have not had any problems to this point and that's with my amplifier running. I will not say you won't run into something. As it's been said elsewhere, your mileage may vary. To allow you to relax a bit, the Bluetooth technology uses frequencies in the 2.4 GHz range as well as digital encoding, both contributing to reducing RFI suceptibility.

A Few Things to Get Used To

Once you have units paired, all you do from that point on is turn them on and off to use them and keep the battery charged. Both the Jabra A210 and Blue Parrott headset can be paired with multiple devices, so you could use the same headset with your cell phone if it supports Bluetooth. You could even use one of those small glued to your head type headsets if you wanted to with the Jabra A210 and your radio.

The bottom line: Hook it up and be happy! You'll now be able to surf the Internet if your computer happens to be far from your radio *while* you talk on the radio. One more nice thing about all this headset business: The adapter is sensitive enough that you can turn the volume down low enough that it can't be heard in the room with the radio, and you'll still hear it just fine in the headset. Family members will appreciate that. Alternatively if you wire it into the data port on the back, you get a fixed volume level and again you can turn the radio down to keep things quiet in the radio room.

One note: The adapters all have the 2.5 mm (3⁄32 inch) jack, which is the subminiature size. The standard size stereo jack these days is 3.5 mm or 1⁄8 inch. But with the coming of Bluetooth headsets, cellular phones, iPods and the like, there are more and more devices hitting the market with the 2.5 mm jack. So if you need this size, check the accessories peg boards at Wal-Mart and Target or your electronics or local cell phone dealer for cables, jacks and adapters — you never know!

I have used both the Jabra A210 and the Cardo BTAII. Both work well and are wired the same but there are differences between the two adapters. The adapters can only be paired with one device at a time, so if you want to use multiple headsets you might want to consider getting more than one adapter. Since they are the least expensive item in the system, that isn't a major problem. As a matter of fact, I have three adapters. The main difference you need to be aware of is that the BTAII has a lower audio drive level going to your radio so it might be a good choice for a radio with a fairly hot mic gain circuit.

The Jabra A210, on the other hand, has pretty hot audio to drive most any radio and you can always crank the mic gain down to keep things under control. The other difference you might be interested in is the fact that you can use the Jabra while it is plugged in and charging.

Operation with the system is fairly straightforward but it helps to know a little about the headset and adapters since they were designed to work with a cellular phone and not a ham radio. First, the adapters will go into standby mode. This can really have you scratching your head the first time it happens and you have no idea why, as it did with me. The reason is simple. They go into standby to save battery power.

The why was a mystery until that little light in my head went off. Standby mode is triggered after a period of time that the adapter senses no audio coming from the cell phone, or in this case the radio. This happened to me about a dozen times in a row within a couple of hours while rag chewing with locals one evening. It finally dawned on me that I had turned the radio volume down so low that the adapter was not detecting it. You can turn the volume down to the point it can't be heard from the radio speaker, yet you can run the volume up on the headset and still hear clearly.

That was what was happening in this case. I could re-activate the link by simply tapping the call activate button on the side of the headset, but it was really annoying with it going off while I was talking! So, keep the radio volume up enough (normal listening level would be fine or just below). Another trick I learned was to use the monitor feature on my IC-746PRO. This does two things: First, it sends audio back through the adapter if you get long-winded so it will "sense" some audio and second, it lets you hear what your transmitted audio sounds like so you'll not have the mic gain up too high. The standby feature is handy if you are in the radio room waiting on a call. All you have to do is tap the call button on the headset and that will bring the system back on.

No PTT Means You Need VOX

Most HF radios have VOX and there are many VHF/UHF radios and handheld radios available now with VOX. Also I'm sure many hams have the ability to put together a Junk Box Special VOX circuit to use that would sense the transmit audio and key a radio that is missing VOX.

The bottom line is if you have a radio with VOX or can build a VOX for your radio, you can enjoy the benefits and pleasure of operating hands-free with a wireless Bluetooth system. As always, your milage may vary, but the system has worked well for me.

Photos courtesy of the author.

Johnny L. Knight, WB4U, an ARRL member, has been licensed since 1983 and currently holds an Amateur Extra class license. He is a certified teacher of electronics based on studies at North Carolina A and T University. In addition to working at public schools, his careers have spanned broadcasting and commercial communications, and he now works for Union County Transportation in North Carolina.You can reach Johnny at 2104 Irby Rd, Monroe, NC 28112 or at **wb4u@wrknradio.com**. *His Web page can be found at* **www.wrknradio.com**.

Alinco DJ-175T 2 Meter FM Handheld Transceiver

Reviewed by Steve Ford, WB8IMY
QST Editor

With handheld transceivers, as with anything else, you get what you pay for. So what would $99 buy you these days? Perhaps a stripped down rig with an RF output measured in milliwatts?

In the case of the Alinco DJ-175T, which retails for around $99, you get a radio with a full 5 W RF output, not to mention 39-tone CTCSS (Continuous Tone Coded Squelch System), digitally coded squelch (DCS), tone bursts, DTMF encoding and extended receive coverage from 136-173.995 MHz. That's pretty remarkable for a two-digit price.

Standard Features, and More

I've already mentioned the 5 W output, but the DJ-175T can ratchet down to 2 W and even ½ W when you want to *really* prolong the battery life. As with many FM transceivers, the DJ-175T offers an automatic power off function as well.

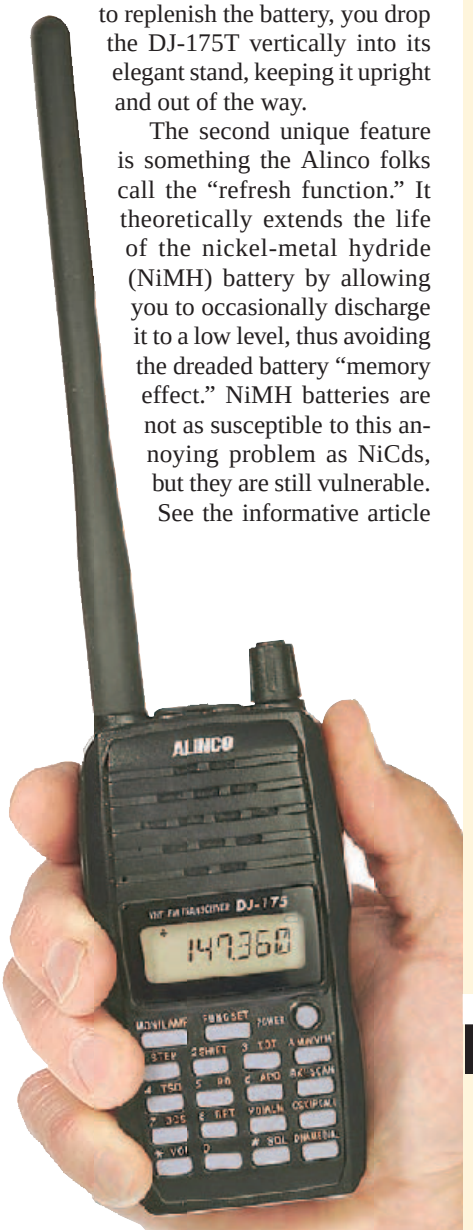
The DJ-175T's tone functions make it downright musical. It has the ability to transmit CTCSS tones for repeater access, and it can decode and display those tones, too. There is also a DCS function for those systems that use it. And while we're on the subject of tones, the DJ-175T offers the ability to transmit four separate burst tones: 1750, 2100, 1000 and 1450 Hz. Tone-burst access isn't commonly used in the United States, but it is in Europe and is handy to have just in case.

When it comes to memory channels, the DJ-175T has a whopping 200, plus one call channel slot. You can tag the DJ-175T memory channels with alphanumeric labels that will appear on the LCD to jog your own memory. Coupled with the convenience of memory is the DJ-175T's ability to rapidly scan the memory channels, stopping briefly when a signal is detected, then moving on, or coming to a full stop until the signal disappears.

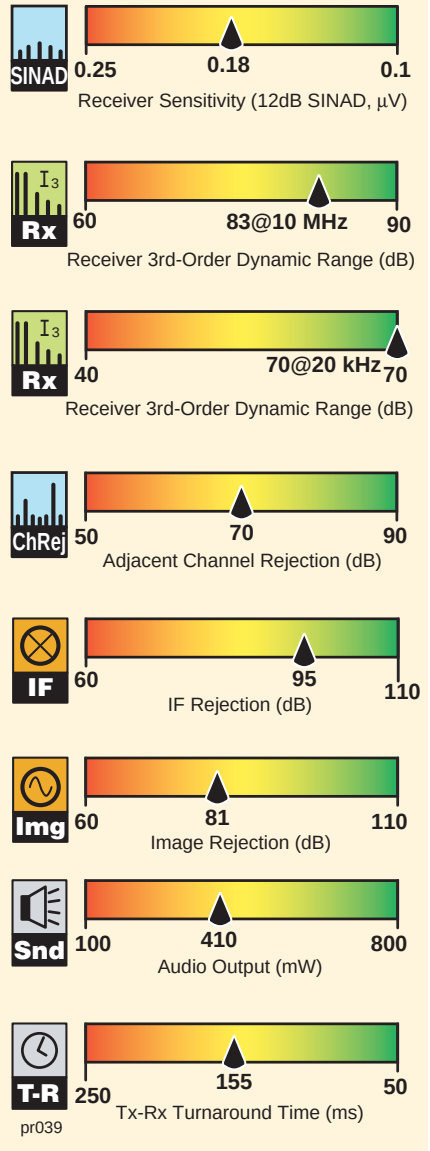
Most of the DJ-175T's features are standard fare in the handheld transceiver universe, but there are at least two that are not as common, especially in low cost transceivers.

The first is the DJ-175T's charger stand. Most handhelds come with a standard wall wart battery charger. You plug the wall wart into the nearest ac outlet and insert its plug into the radio. That's fine as far as it goes, but it means that you have to leave the radio lying on a countertop or wherever. Thanks to the DJ-175T's charger stand, you can charge this rig like a pro. When it is time to replenish the battery, you drop the DJ-175T vertically into its elegant stand, keeping it upright and out of the way.

The second unique feature is something the Alinco folks call the "refresh function." It theoretically extends the life of the nickel-metal hydride (NiMH) battery by allowing you to occasionally discharge it to a low level, thus avoiding the dreaded battery "memory effect." NiMH batteries are not as susceptible to this annoying problem as NiCds, but they are still vulnerable. See the informative article



Key Measurements Summary



Bottom Line

The Alinco DJ-175T is a compact handheld with more than enough power (and features) to satisfy the needs of most hams. At around $99, it's a standout among low-cost handhelds.

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

by Isidor Buchmann at **www.buchmann.ca/Article10-Page1.asp**.

If you need more battery capacity, you can get the optional EBP-71 1200 mAh lithium-ion pack. That requires a different charger, though.

Programming Software

Alinco offers a free *Windows* programming application for use with the DJ-175T. You can download it from the Alinco Web site at **www.alinco.com/main07-05.html**.

To use the software you'll need Alinco's ERW-7 USB cable, which retails for about $50. The ERW-7 configures as a "virtual serial (COM) port" when you plug it into your PC. However, you have no way of knowing which COM port number has been assigned to the ERW-7 unless you take the added step of opening *Windows Device Manager*, which you'll find under the SYSTEM icon in *Windows Control Panel*. In my station computer, the ERW-7 was assigned as COM 9; your computer will be different. A serial port cable is also available if USB won't work for you.

With this vital information in hand, you start the application and select the correct COM port under the TOOLS menu. You then connect the DJ-175T to the cable and switch it on. From there it is a simple step to read the information that's already in the rig, modify it and then write it back to the radio (Figure 1). Of course, you don't need software to manage the DJ-175T, but the program makes the task much easier. You can sit down at your computer and fill the DJ-175T's memories in a single session. You can even set the volume and squelch levels, among other things. If you are part of a group, or have multiple radios, you can easily set them all up to have the same settings.

In the ARRL Lab

The results of ARRL Laboratory testing are shown in Table 1. Test Engineer Bob Allison, WB1GCM, noted that receive audio began to distort at high levels. Lab tests confirmed that the 10% THD threshold is crossed at volume level 16. About 35% THD was measured at maximum volume. During typical use in the field, however, I rarely exceeded volume level 10.

Overall, the RF output was cleanest at high power. At lower output levels, harmonics crept upward, but were still within limits. It was interesting to note that Alinco designed the DJ-175T with the first IF at 21.7 MHz. This resulted in very good IF rejection.

Baptism of Fire

Not long after I received the DJ-175T, I subjected it to one of the most difficult environments available — the 2009 Dayton Hamvention®! When you pack 15,000+ people into a relatively small area — with most of them operating on 2 meters — communication can be a challenge to put it mildly.

Alinco offers the EME-12 VOX (voice-operated switch) headset for the DJ-175T, which is a great accessory to have when you need to keep your hands free. The lightweight headset, shown in Figure 2, covers one ear and extends a thin microphone to

Table 1
Alinco DJ-175T, serial number M000995

Manufacturer's Specifications	Measured in ARRL Lab
Frequency Coverage: Receive, 136-173.995 MHz; transmit, 144-147.995 MHz.	Receive and transmit, as specified.
Modes of operation: FM.	As specified.
Power requirements: 7.2/7.4 V dc (battery only); receive, 250 mA (max volume), 70 mA (standby) 30 mA (battery save on), transmit, 1.6 A (high power).†	Receive, (max volume, no signal) 190 mA; 76 mA (standby); 36 mA (battery save). Transmit, 1.2, 0.73, 0.40 A (hi, med, lo).
Receiver	**Receiver Dynamic Testing**
FM sensitivity: 12 dB SINAD, 0.2 µV.	For 12 dB SINAD, 0.18 µV.
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz offset: 70 dB; 10 MHz offset: 83 dB.
FM two-tone, second-order IMD dynamic range: Not specified.	146 MHz, 81 dB.
Adjacent-channel rejection: Not specified.	20 kHz offset: 70 dB.
Spurious response: Not specified.	IF rejection, 95 dB; image rejection, 81 dB.
Squelch sensitivity: Not specified.	At threshold, 0.11 µV.
Audio output: 400 mW at 10% THD into 8 Ω.	410 mW at 10% THD into 8 Ω.
Transmitter	**Transmitter Dynamic Testing**
Power output: 5.0 W high, 2.0 W med, 0.5 low.	5.3, 2.3, 0.6 W (hi, med, lo)
Spurious signal and harmonic suppression: 60 dB or less.	60 dBc; meets FCC requirements.
Transmit-receive turnaround time (PTT release to 50% of full audio output): Not specified.	Squelch on, S9 signal, 155 ms.
Receive-transmit turnaround time ("tx delay"): Not specified.	120 ms.
Size (height, width, depth): 4.2 × 2.3 × 1.4 inches; weight, 8.7 ounces.	
Price: DJ-175T, $100; EME-12 headset with VOX, $90; ERW-7 USB cable, $50.	

†EBP-72 battery pack (7.2 V, 700 mAh NiMH) and EDC-165T drop-in trickle charger supplied. Available options: Replacement EBP-72, $46. EBP-71 battery pack (7.2 V, 1200 mAh Li-ion), $49; EDC-164T drop-in charger for Li-Ion battery, $60.

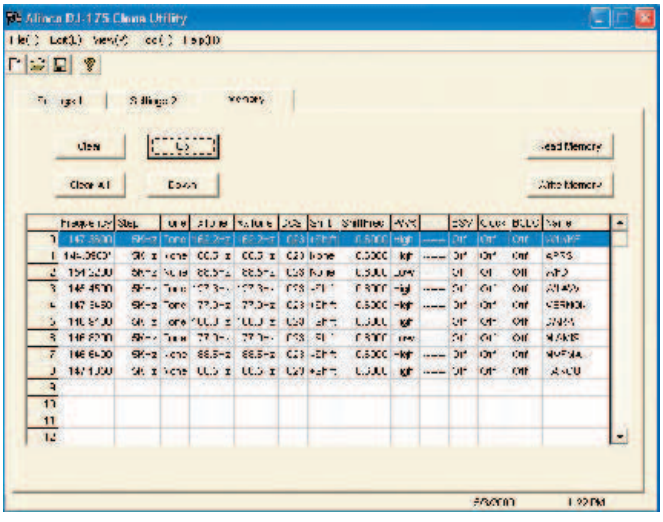


Figure 1 — Using the free Alinco software, you can program the DJ-175T memories and other settings from any *Windows* PC. An optional cable is required.

the front. With the DJ-175T clipped to your belt, you can activate the VOX function to key the rig at the sound of your voice. Alternatively, you can manually key the radio with a pushbutton switch.

With the EME-12 attached to the handheld, I roamed the Hamvention with ease. The microphone has a fairly "close" pattern, so the VOX wasn't tripped by extraneous noise. Of course, I had to be a little careful to disable the headset when I was involved in a face-to-face conversation.

The DJ-175T held up against the Hamvention RF onslaught remarkably well. Yes, there was a certain amount of receiver desensitization at times, but it wasn't objectionable. The headset audio was clear and at the 5 W RF output level I had no difficulty making myself heard.

Using the programming software, I was able to set up the DJ-175T memories before I even left Connecticut. I programmed all the popular Dayton repeaters and configured the display to indicate their call signs as I stepped through the memory channels.

A "Valuable" Transceiver

The Alinco DJ-175T is a compact handheld with more than enough power (and features) to satisfy the needs of most hams. It isn't an extremely rugged radio, but I found it to be more than durable for normal use.

Figure 2 — The EME-12 headset includes a VOX function for hands-free operation.

Some will find that the audio volume and squelch adjustments are a bit cumbersome. You have to press a special key and then rotate the knob at the top. But considering the low price, this seems to be a minor nuisance at best.

The standard-issue battery provides plenty of operating time and, as mentioned previously, the charger stand is extremely convenient. The display is large enough to be easily readable and all controls were useable without too much difficulty, the VOLUME and SQUELCH functions notwithstanding.

In other words, the Alinco DJ-175T is a good "value" in the traditional sense. That is to say, you get much more than you might expect for the price. Among the low-cost handheld transceivers, the DJ-175T is a definite stand-out.

Manufacturer: Alinco Inc**,** Yodoyabashi Dai-Bldg 13F, 4-4-9 Koraibashi, Chuo-ku, Osaka 541-0043, Japan; **www.alinco.com**. *US distributor*: Ham Distributors, 1775 North Loop, 336 East, Suite 8, Conroe, TX 77301; tel 936-649-1497; e-mail **USrep@hamdistributors.com**.

Four Switching Power Supplies

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

This month we look at four switching power supplies that are good candidates for running a variety of 13.8 V equipment as found in most modern amateur stations. The units are the Daiwa SS-505, Jetstream JTPS45, MFJ-4245MV and Samlex SEC-1235M. All of them are equipped with analog meters, and their continuous current ratings range from 30 to 50 A. That's more than enough power for a typical HF or VHF transceiver and station accessories.

Bottom Line

All of these supplies effortlessly deliver high current for your transceiver and accessories and include voltage and current metering and protection circuits. Although all of them have low conducted emissions (which can cause interference to your receiver) in the amateur bands, there are some significant differences at low frequencies.

Past reviews have covered other switching power supply models, many of which are still available.[1-4]

Switching power supplies are smaller and lighter than linear supplies with comparable ratings. The heaviest in this group is less than 9 pounds. They are more efficient and generate less heat, typically requiring small internal heat sinks and using small fans to circulate air inside the cabinets.

Lab Testing

The ARRL Lab ran each of the supplies through a series of tests, with the results reported in the accompanying tables and graphs. The tests measure the supplies under different operating conditions:

- The output voltage was measured with no load, 21 A and 35 A loads (for the three supplies rated at more than 30 A).
- AC line voltage was adjusted to measure the minimum line voltage required to maintain proper regulation of the dc output. In the tables this is shown as *Low line drop out voltage*.
- A dynamic load was connected to the supply, similar to what you would expect during SSB or CW operation, as you switch between receive and transmit. In this case, a test fixture rapidly alternates the load between 1.1 and 21 A. The test result appears as *dc variation during dynamic testing* in the tables.
- An oscilloscope plot shows ripple on the dc output, as well as high frequency switching spikes while under load.
- A spectrum analyzer ac-coupled to the power supply output shows noise generated from 1.5 to 100 MHz.
- Each supply was tested for conducted emissions (noise that a device introduces

[1]J. Bottiglieri, AA1GW, "*QST* Compares: Switching Power Supplies," Product Review, *QST*, Jan 2000, pp 70-73. Includes Astron SS-30M, ICOM PS-85, Kenwood PS-40, MFJ-4225MV, Samlex SEC-1223 and Yaesu FP-1023 *QST* Product reviews are available on the Web at **www.arrl.org/members-only/prodrev/**.

[2]J. Bottiglieri, AA1GW, "Switching Power Supplies Revisited," Product Review, *QST*, Sep 2000, pp 76-79. Includes Alinco DM-330MV and Diamond GZV4000.

[3]S. Ford, WB8IMY, "ICOM PS-125 Power Supply," Product Review, *QST*, Sep 2002, p 62.

[4]M. Wilson, K1RO, "More Switching Power Supplies," Product Review, *QST*, Jul 2006, pp 58-61. Includes Daiwa SS-330W, Kenwood KPS-15, MFJ-4125 and Ten-Tec 963.

Table 2
Daiwa SS-505, serial no. 1708

Manufacturer's Specifications

Power requirement:	90-123 V ac.
Output voltage:	5-15 V dc.
Output current (continuous):	50 A.

Size (HWD): 4.4×8.5×11.1 inches; weight, 8.4 pounds.
Price: $370

ARRL Lab Measurements

Output voltage, no load:	13.71 V dc (set by Test Engineer).
Output voltage, 21 A load:	13.53 V dc.
Output voltage, 35 A load:	13.51 V dc.
Voltage range:	4.48-14.42 V dc.
Low line drop out voltage:	69 V ac.
Dc variation during dynamic testing:	≈200 mV.

into the ac house wiring). This is a new test, one that the ARRL Lab was not equipped to perform for past reviews. See the sidebar "Conducted Emissions Testing" for details.

DAIWA SS-505

The Daiwa SS-505 is housed in a sturdy metal case with a carrying handle on top, and there are removable soft rubber bumpers around the front and back edges. Rated for 50 A continuous output, it offers the highest current rating in this group. Output voltage is adjustable from about 4.5 to 14.4 V via the front-panel VADJ knob. The wide voltage adjustment range and carrying handle make it a good candidate for a workbench supply.

The non illuminated front panel meter is switchable between output voltage (0-30 V) and current (0-60 A). The front panel also offers two low-current dc connections — a cigarette lighter socket rated for 10 A maximum and two sets of spring-loaded terminals rated for 6 A each. These would be very convenient for connecting station accessories. A red POWER switch and LEDs for AC LINE and PROTECTOR complete the front panel. The protection circuitry limits output current if internal temperatures rise too high and disables the supply if output current exceeds 56 A.

The rear panel has binding posts for the high current output, a ground post and a detachable ac line cord. The exceptionally quiet cooling fan is mounted inside the cabinet, on the rear panel. It speeds up under higher loads and gets just a bit louder. Both side panels are ventilated over much of their area, providing good airflow. The case remains cool to the touch, even after extended transmitting periods with a 100 W transceiver drawing about 20 A.

Documentation is a color A4 size sheet that includes specifications, drawings of the front and rear panels, and some cautions. No warranty information or schematic is included, but information about a 1 year warranty and return/repair details are included on the US distributor's Web site.

Manufacturer: NCG Company (US distributor), 15036 Sierra Bonita Ln, Chino, CA 91710; tel 909-393-6133; **www.cometantenna.com**.

JETSTREAM JTPS45

At 8.8 pounds, the JTPS45 the heaviest supply in this group and is packaged in a solid metal case. It's rated for 40 A continuous output current, and output voltage is adjustable from about 7.5 to 14.5 V with the front-panel DC ADJUST control.

The front panel includes two illuminated meters — 0-16 V and 0-60 A. As does the Daiwa, the JTPS45 includes a cigarette lighter socket (7 A) and two sets of spring loaded terminals (also 7 A) for connecting accessories. Two binding posts, also on the front panel, handle the high current output. The rear-panel power cord is removable. An adjacent switch selects between 120 V and 240 V ac line voltage. Overcurrent protection kicks in at 50 A.

The internal cooling fan, which always runs, is quiet. As temperature builds, the fan kicks up to a higher speed, and there's a front panel LED for FAN LOW/HIGH. Vents on the side and rear panel offer good airflow. The case remains cool touch after extended transmitting periods with a 100 W transceiver drawing about 20 A.

Documentation is an A4 size sheet folded in half. It covers installation, operation and specifications and includes front and rear panel diagrams. A 1 year warranty is provided.

Manufacturer: Jetstream, 100 Hancock Ave, Hamilton, OH 45001; tel 513-868-1353; **www.jetstream-usa.com**.

MFJ-4245MV

MFJ offers a variety of switching power

Table 3
Jetstream JTPS45, serial no. 0803706

Manufacturer's Specifications

Power requirement:	85-135 V ac 47-62 Hz or 170-260 V ac 47-63 Hz.
Output voltage:	9-15 V dc.
Output current (continuous):	40 A.

Size (HWD): 4.5×8.9×8.5 inches; weight, 8.8 pounds.
Price: $150

ARRL Lab Measurements

Output voltage, no load:	13.61 V dc (detent).
Output voltage, 21 A load:	13.53 V dc.
Output voltage, 35 A load:	13.43 V dc.
Voltage range:	7.45-14.50 V dc.
Low line drop out voltage:	81 V ac.
Dc variation during dynamic testing:	≈165 mV.

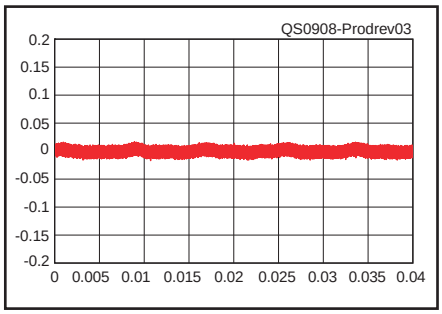


Figure 3 — An oscilloscope trace of the dc output of the Daiwa SS-505 under load. The vertical scale is 50 mV/div and the horizontal scale is 5 ms/div. The level of the dc ripple is approximately 35 mV p-p. There are no discernible spikes due to switching.

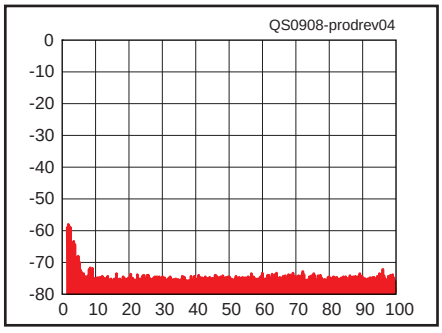


Figure 4 — Spectral plot (0-100 MHz) of the output of the Daiwa SS-505 under load. Reference level is 0 dBm.

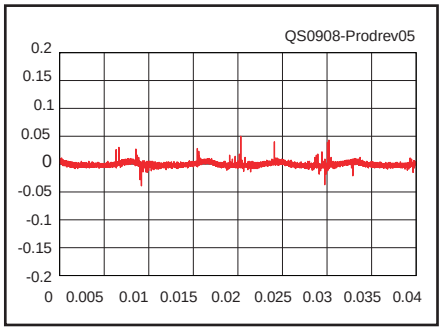


Figure 5 — Oscilloscope trace of the dc output of the Jetstream JTPS45 under load. The vertical scale is 50 mV/div and the horizontal scale is 5 ms/div. The level of the dc ripple is approximately 10 mV p-p, with spikes due to switching of about 80 mV p-p.

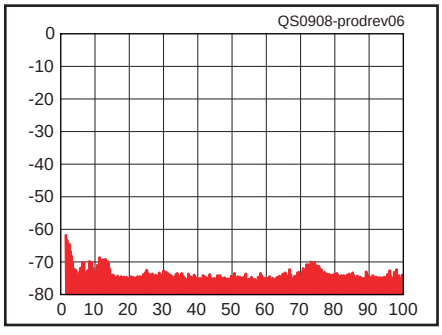


Figure 6 — Spectral plot (0-100 MHz) of the output of the Jetstream JTPS45 under load. Reference level is 0 dBm.

Conducted Emissions Testing

As described in a recent review of dc to ac power inverters, the ARRL Lab now has the ability to perform conducted emissions testing.[5] We'll briefly recap that information here.

Some electronic devices, including switching power supplies, intentionally generate RF as part of their normal operation. This RF is not intended to be radiated as it would be by a transmitter. Under Part 15 of the FCC rules, such devices are defined as *unintentional emitters*.

For Amateur Radio applications, a concern is RF noise generated by the switching regulators. These power supplies are designed and built with shielding and other EMI reduction techniques to suppress noise that could be heard in a station receiver — some with greater success than others.

As with all Part 15 devices, unintentional emitters must not cause harmful interference to a licensed radio service such as Amateur Radio. In addition, Part 15 rules further establish absolute limits for two types of emissions from unintentional emitters.

Conducted Emissions

These emissions are conducted onto the house wiring and power lines via the device power cord. Part 15 provides absolute limits for conducted emissions from 150 kHz to 30 MHz. Conducted emissions are the primary problem below 30 MHz because ac power wiring provides a physically large "antenna" at HF and lower frequencies.

Radiated Emissions

These are emissions radiated by the device itself. The absolute limits in this case are specified at 30 MHz and higher. Power lines are relatively inefficient transmission lines at VHF and higher frequencies, so radiated emissions are the primary problem at those frequencies.

Table 6
Part 15 Conducted Emission Limits

Quasi-peak detection measurements

Frequency (MHz)	*Limit (dBµV)*
0.15 - 0.5	66 to 56*
0.5 - 5.0	56
5.0 - 30.0	60
>30.0	None

*Decreases with the logarithm of the frequency.

Power Supply Tests

FCC Part 15, Section 15.107, sets the limits for conducted emissions. See Table 6. Limits are expressed in dBµV, or dB relative to a microvolt. In this case, 1000 µV of signal equals +60 dBµV.

The ARRL Lab uses a line impedance stabilization network (LISN) and a calibrated Rohde & Schwarz ESH-3 EMC receiver to measure conducted emissions. The device under test is plugged into the LISN, which separates the unwanted RF from the desired 60 Hz ac power. The conducted emissions are then measured by the special Rohde & Schwarz receiver using CISPR quasi-peak detection as specified in FCC Part 15. (This technique uses AM and a 9 kHz bandwidth and is designed to assess the effect of interference of a received signal to the human ear.)

Table 7 shows the levels measured in the ARRL Lab at 137 and 505 kHz; the four highest levels outside the amateur bands; and the six highest levels inside the amateur bands. Tests were performed with 1 A and 20 A loads, typical of current levels required in receive and transmit.

All of the supplies tested were

[5]H. Robins, W1HSR, "DC to AC Power Inverters," Product Review, *QST*, Apr 2009, pp 44-49.

supplies. At 40 A continuous output, the 4245MV is near the top of the line. Output voltage is adjustable from the front panel over a range of about 7.6 to 14.6 V.

The two illuminated front panel meters display current (0-60 A) and voltage (0-16 V). Low current outputs include a cigarette lighter socket on the front panel (7 A) and two sets of spring terminals on the rear panel (5 A). The high current output is from binding posts on the front panel. The rear panel ac power cord is removable, and a rear panel switch selects 120 or 240 V ac operation. Protection circuits for overvoltage and overcurrent are included.

The cooling fan, which is mounted to the inside rear panel, draws air through holes in the cabinet sides. Fan speed varies with output voltage setting. It runs all the time and is noticeably loud at 13.8 V

well below the Part 15 levels on the amateur bands. The Daiwa and MFJ supplies were above the limits at several frequencies below 1 MHz. The Jetstream and Samlex supplies were under the limits at all frequencies, and overall the Samlex was the quietest of the units tested. The Samlex and MFJ supplies had the required FCC Part 15 compliance notices on the cabinet. The other two units did not, nor did they mention Part 15 testing in the accompanying literature.

It is important to note that Part 15 limits are not low enough to *eliminate* the possibility of interference. Interference from a supply that is near the limits may show up as a buzzing noise or as discrete signals, particularly at the lower end of the spectrum. For example, at my station signals from the Daiwa SS-505 were very strong at LF and several were weak but clearly audible in the 160 meter band.

The severity of the interference can also depend upon other factors such as the placement of power cords and distance from the antenna. I observed that lifting the ground on the ac cord (using an adapter for an older ungrounded outlet) caused a noticeable increase in noise while listening in the 150 to 500 kHz range. Using a properly grounded outlet helped in this case. See the *ARRL RFI Book* for information on techniques to help with interference problems. — *Bob Allison, WB1GCM, ARRL Test Engineer*

Table 7

Conducted Emission Levels of Switching Power Supplies

Conducted emissions in dBµV measured in the ARRL Lab. See text.

Daiwa SS-505

Frequency	*Load*	
MHz	*1 A*	*20 A*
0.137	58.9	82.6
0.180	90.4	95.6
0.290	81.0	62.2
0.505	51.3	61.5
0.595	60.8	62.7
0.650	53.9	67.9
1.840	34.3	45.1
1.901	30.9	36.3
1.959	34.1	37.8
3.509	17.1	23.1
3.619	20.1	24.1
3.922	20.4	24.8

MFJ-4245MV

Frequency	*Load*	
MHz	*1 A*	*20 A*
0.137	51.0	51.0
0.174	78.1	83.0
0.245	77.2	74.2
0.505	15.5	20.4
0.525	62.0	58.6
0.595	59.7	65.0
1.820	23.9	36.2
1.857	26.0	39.1
1.928	25.8	38.9
3.504	22.9	38.9
3.539	27.4	41.1
3.820	28.4	42.9

Jetstream JTPS45

Frequency	*Load*	
MHz	*1 A*	*20 A*
0.137	10.5	12.1
0.161	49.4	62.8
0.227	46.4	49.8
0.505	10.5	17.1
0.518	38.8	50.6
0.595	36.4	44.1
1.815	29.0	46.1
1.882	26.4	46.9
1.914	22.2	40.7
3.502	26.5	36.0
3.535	23.4	37.5
3.895	25.5	35.0

Samlex SEC-1235M

Frequency	*Load*	
MHz	*1 A*	*20 A*
0.137	22.7	22.7
0.169	47.1	49.0
0.237	28.5	28.5
0.505	17.0	13.0
0.540	25.9	32.6
0.572	36.7	31.7
1.814	24.0	42.2
1.847	27.7	38.0
1.913	29.7	39.3
3.553	20.5	35.5
3.622	20.7	36.1
3.885	20.5	38.0

output. The supply does remain cool after extended transmitting periods with a 100 W transceiver drawing about 20 A.

The first MFJ-4245MV we tested failed during extended testing with the 21 A load. MFJ promptly replaced it under warranty (1 year).

Documentation is an 8.5 × 11 inch sheet folded in half. It covers installation, operation and specifications and includes front panel and schematic diagrams.

Manufacturer: MFJ Enterprises, 300 Industrial Park Rd, Starkville, MS 39759; tel 662-323-5869; **www.mfjenterprises.com**.

SAMLEX SEC-1235M

Samlex offers a variety of linear and switching power supplies with the Samlex name as well as some manufactured for

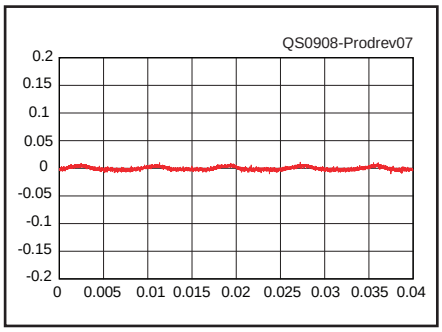


Figure 7 — Oscilloscope trace of the dc output of the MFJ-4245MV under load. The vertical scale is 50 mV/div and the horizontal scale is 5 ms/div. The level of the dc ripple is <10 mV p-p. There are no discernible spikes due to switching.

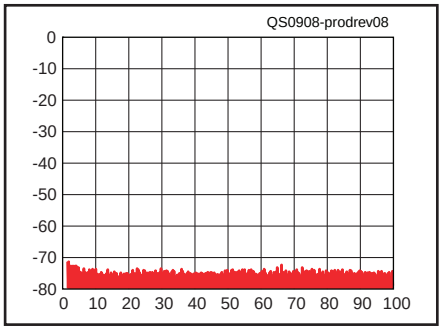


Figure 8 — Spectral plot (0-100 MHz) of the output of the MFJ-4245MV under load. Reference level is 0 dBm.

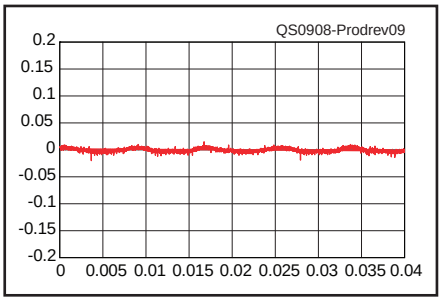


Figure 9 — Oscilloscope trace of the dc output of the Samlex SEC-1235M under load. The vertical scale is 50 mV/div and the horizontal scale is 5 ms/div. The level of the dc ripple is approximately 15 mV p-p with small spikes due to switching.

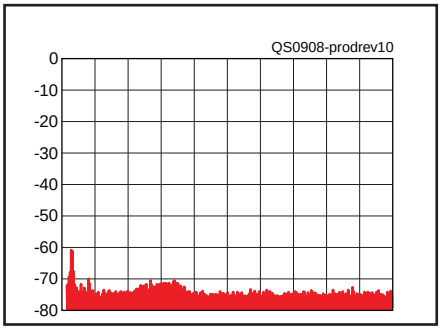


Figure 10 — Spectral plot (0-100 MHz) of the output of the SEC-1235M under load. Reference level is 0 dBm.

Table 4
MFJ 4245MV, serial no. L4000006845

Manufacturer's Specifications

Power requirement:	85 to 135 V ac 47-62 Hz or 170 to 260 V ac 47-63 Hz
Output voltage:	9-16 V dc.
Output current (continuous):	40 A.

Size (HWD): 4.7×7.5×9.0 inches; weight, 5.5 pounds.
Price: $185.

ARRL Lab Measurements

Output voltage, no load:	13.63 V dc (detent).
Output voltage, 21 A load:	13.54 V dc.
Output voltage, 35 A load:	13.47 V dc
Voltage range:	7.63 to 14.60 V dc
Low line drop out voltage:	79 V ac.
Dc variation during dynamic testing:	≈150 mV.

Table 5
Samlex SEC 1235M, serial no. 03435-7E01-00653

Manufacturer's Specifications

Power requirement:	100-130 V ac 60 Hz or 200-260 V ac 50 Hz.
Output voltage:	13.8 V dc, internally adjustable 11.5-15.5 V dc.
Output current (continuous):	30 A.

Size (HWD): 2.5×7.3×8.4 inches; weight, 3.4 pounds.
Price: $140.

ARRL Lab Measurements

Output voltage, no load:	13.85 V dc.
Output voltage, 21 A load:	13.71 V dc.
Voltage range:	11.2 to 16.2 V dc.
Low line drop out voltage:	86 V ac.
Dc variation during dynamic testing:	≈140 mV.

others. The SEC-1235M is a compact supply that weighs only 3.4 pounds. It's rated for 30 A continuous output. Output voltage is set to 13.8 at the factory but internally adjustable from 11.2 to 16.2 V. Current rating is reduced to 25 A at 16 V output. Line voltage is factory set to 120 V but can be changed to 240 V through internal settings.

The front panel includes just two meters (0-15 V and 0-40 A) and a lighted power switch. The meters are not illuminated. The rear panel has a detachable power cord and the dc output connections. Unlike the other supplies in this group, the SEC-1235M does not offer multiple low current outputs. Screw-down terminals on the rear panel provide the only dc output connections. The set screws require a small flat blade screwdriver and are accessible from the top of the cabinet. The manual cautions against inserting stranded wire into these terminals, as the set screws will spread the strands and may not make a good connection. A pair of terminals that can be crimped or soldered to your transceiver power cord are included

A thermostatically controlled cooling fan is mounted inside the cabinet, on the bottom panel. The side panels are vented. The fan is controlled by a sensor on the power transformer and runs only when the temperature exceeds 60° C. During normal operation the fan rarely comes on. The case remains cool to the touch, even after extended transmitting periods with a 100 W transceiver drawing about 20 A.

The instruction manual is a 12 page booklet that includes setup, operation and safety information as well as specifications and troubleshooting tips. The warranty is 3 years.

Manufacturer: Samlex America, 110-17 Fawcett Rd, Coquitlam, BC V3K 6V2, Canada; tel 604-525-3836; **www.samlex.com**.

Some Impressions

In the Lab, all of the supplies could be set to 13.8 V output with no load. All of the supplies kept good regulation during the dynamic load test — all were in the 140-200 mV range, typical of other switching supplies we've tested.

All of the supplies reviewed here will maintain regulation over a wide range of ac line inputs. The Daiwa SS-505 maintained regulation all the way down to 69 V. This is not an issue for normal home station use, but may be a useful feature for emergencies, ARRL Field Day and other situations subject to line voltage fluctuation.

In past reviews, we observed significant switching spikes and ripple on the output of several supplies. All of the supplies in this review exhibit good performance in this area (Figures 3, 5, 7 and 9).

The spectrum analyzer plots (Figures 4, 6, 8 and 10) show the output spectrum under load, up to 100 MHz. The plots show the noise levels under a typical 100 W transmitter load, and the noise levels are lower with the 1 A load typical during receive. All of the supplies were relatively quiet in this test. We did notice some differences among them during conducted emissions testing. See the accompanying sidebar for details.

Any of these supplies would make a good power source for your station. The Daiwa SS-505 has the highest current rating, but also costs twice as much as any other supply in this group and exhibited more conducted noise than the others. A lightweight, cool running switching supply can provide good performance in a compact package. Over the years, noise performance has improved and is no longer a concern for most amateur operation. QST

TECHNICAL CORRESPONDENCE

BUILDING A FERRITE CORE ANTENNA CURRENT PROBE

◊ I found the article in the February 2009 issue of *QST* by Eric Nichols, KL7AJ, about antenna currents, interesting. The discussion in the last paragraph, concerning the use of ferrites to monitor relative RF currents, was especially informative.

That thought led me to put 12 turns of no. 26 AWG wire on one side of a snap on ferrite choke core I had in my junk box. See Figure 1. Hooking the wires to a short piece of coax and snapping the core to one leg of my window line (perfect fit in the window) gave a nice display on my scope when on 40 meters. Figure 2 shows the core snapped into one of the "windows" in my feed line.

My next thought was to build a detector with a meter, but why build one since I already had an old CB style SWR meter. Most of these meters had a threaded stud on the top for an antenna, which would display relative RF when placed near an antenna. I added a BNC connector next to the stud, added a resistive pad between the BNC connector and the antenna stud, and moved the detector diode from the meter to the sensitivity/set potentiometer.

The resistive pad was necessary because the voltage was too high. I found the resistor value by trial and error using 100 W and 600 W output through a tuner to the window line. Figure 3 Part A shows part of the original meter circuit and Part B shows the modified circuit. Figures 4 and 5 show the modifications inside the meter case.

I now have a very inexpensive relative current meter, and yet the meter remains a fully functional SWR bridge when not connected to the ferrite pickup. The only difference from the original bridge is that when used as a field strength meter it has a variable sensitivity control. The next project is to put a ferrite in a small box to use the meter to monitor the current on a coax line. — *73, Allen Wolff, KC7O, 57 W Grand View Ave, Sierra Madre, CA 91024*; **kc7o@arrl.net**

CLEANING UP AGC-INDUCED AUDIO DISTORTION IN THE YAESU FT-1000

◊ Ever since the FT-1000 was introduced, there have been various complaints about the audio quality of the main receiver due to AGC-induced audio distortion. For an example, see the March 1991 *QST* Product Review of the FT-1000. The main receiver

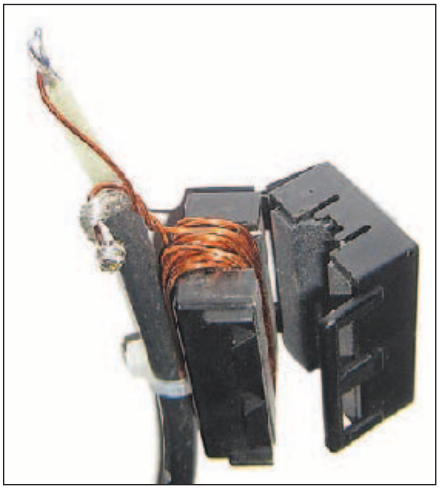


Figure 1 — This photo shows 12 turns of no. 26 AWG enameled wire wound on one side of a snap-on ferrite choke, with a length of coaxial cable attached to the wire ends to form an RF current probe.

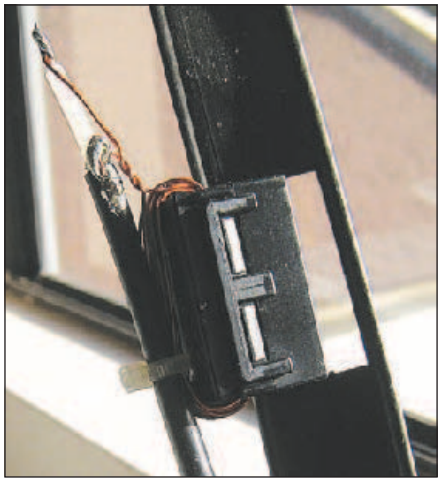


Figure 2 — Here, the snap-on ferrite choke is snapped in place over one of the wires in a piece of window line parallel feed line.

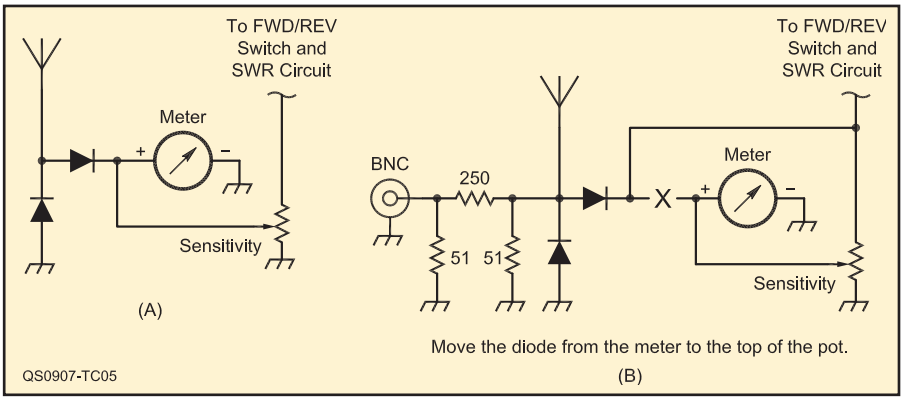


Figure 3 — Part A shows the portion of the SWR meter schematic diagram where the circuit will be modified. Part B shows the diode removed from the meter terminal and connected through the sensitivity adjustment potentiometer.

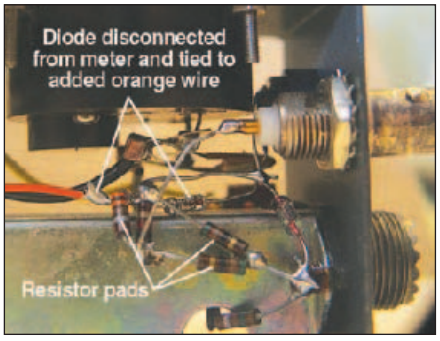


Figure 4 — This photo shows the diode that was disconnected from the meter movement, with that end tied to a new (orange) wire. You can also see the resistors that make up the resistive pad between the RF current probe input and the diodes.

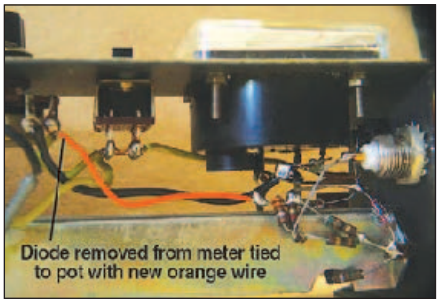


Figure 5 — This wide view inside the SWR meter case shows the new (orange) wire connecting the end of the diode removed from the positive meter terminal with the sensitivity potentiometer.

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

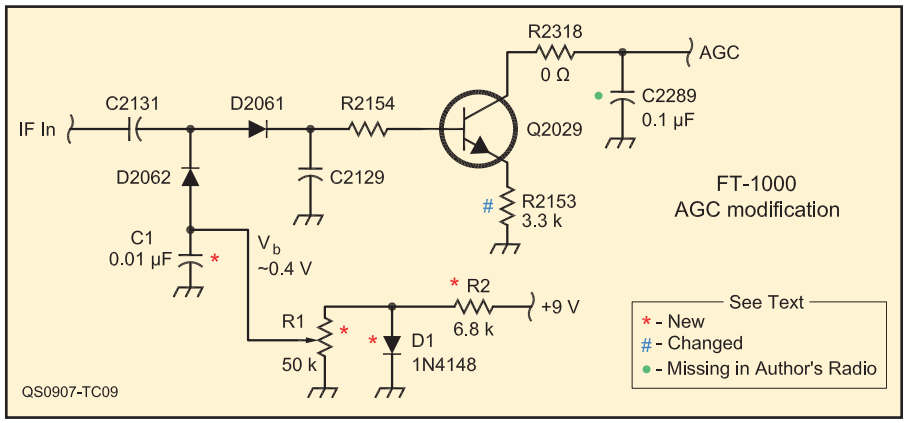


Figure 6 — This schematic diagram shows the changes made to the Yaesu FT-1000 AGC circuit to clean up the AGC induced audio distortion.

distortion has been described on some message boards as having "grit" or "grunge" added to the audio signal when the AGC is enabled. The distortion can be made more noticeable by adjusting the passband tuning to make the audio sound shrill. The AGC setting (fast, medium, slow) seemed to make no difference in the amount or severity of the distortion. Disabling the AGC and manually controlling the receiver gain is the only way to avoid the distortion.

The audio distortion occurs during AGC attack, when a sudden change in the AGC control voltage audibly modulates the amplitude of the signal being received. Thus, it occurred to me that the AGC attack time is too fast, and slowing it would remove most of the distortion. Slowing the AGC attack time too much, however, will result in audio "popping" when a strong signal is initially received, because the AGC does not react quickly enough to reduce receiver gain before the signal is demodulated. Various references recommend using AGC attack time from 1 to 20 ms and, in one reference, as long as 50 ms. My various attempts to slow the AGC attack, while avoiding an objectionable level of popping did not satisfactorily remove this distortion.

I read with interest Wes Howard's IF design article in the December 2007 *QST*. His AGC design is somewhat conventional but in his explanation he described the impact of delayed AGC detector circuits on the quality of the received audio. This seemed to explain why the FT-1000 AGC generated significant distortion even though the AGC attack time was slowed down. I found the AGC-induced distortion was considerably improved by simply applying a dc bias to the AGC detector until AGC amplifier Q2029 was nearly turned on as Wes did in his AGC circuit.

My change to the FT-1000 AGC circuit is shown in Figure 6. The anode end of D2062 was extracted from the IF circuit board and a bypass capacitor , C1, was added between the ground plane of the circuit board and the anode of D2062 to provide an ac ground for the detector. (I reused the hole vacated by the extracted D2062 anode wire for the ground connection.) A bias voltage, V_b, is applied to the anode of D2062, and made high enough to bias Q2029 just short of conduction with no signal applied. This gave about 0.4 V on the base of Q2029 at room temperature. Because the threshold voltage of Q2029 varies inversely with temperature and Q2029 is nearly biased into conduction, V_b should be temperature-compensated to track the change of the Q2029 threshold voltage with temperature. Partial temperature compensation for V_b is provided by D1. Potentiometer R1 is adjusted with V_b starting from 0 V until the S-meter just begins to react. R1 is then backed off until the S-meter is again at rest and R1 turned in the same direction another small amount to give some margin in the Q2029 bias voltage. Because detector diodes D2061 and D2062 are Schottky diodes, V_b is approximately 0.4 V when R1 is set properly.

An alternative approach to providing bias to Q2029 without extracting the anode of D2062 from the IF circuit board is to add a Schottky diode with the cathode soldered to the exposed wire loop (cathode) of the vertically mounted D2062 and bypassing the anode of the added diode by scraping away some of the solder mask material on the ground plane of the circuit board and tack-soldering capacitor C1 to the exposed ground plane. The added diode is then biased as shown in the schematic for D2062. This leaves D2062 reverse-biased and effectively non-functional. While I have not tried it, a conventional silicon diode may be used as the added diode, but V_b will be slightly higher than required when using a Schottky diode.

In the course of my experiments in eliminating the AGC distortion, one AGC memory capacitor, C2289 (0.1 µF), was missing in my FT-1000, although the capacitor is shown on the schematic and listed on the parts list. I added the missing capacitor C2289 before experimenting with the AGC attack time.

The FT-1000 originally came with Q2029 emitter degeneration resistor R2153 as a 10 Ω chip resistor. To increase the AGC attack time, I increased the value of R2153 until the distortion reached a satisfactory level without AGC popping. After listening to the receiver for a while, I found that changing R2153 to 3.3 kΩ worked well enough for my ears. Some distortion remains which, someone with better ears than I have may still find objectionable. To further reduce the distortion and increase the AGC attack time, R2153 may be increased further until the listener is satisfied. I found that increasing R2153 as much as 15 kΩ worked, but that there was objectionable AGC popping on very strong signals.

All of the added components (R1, R2, D1) are mounted on the IF circuit board by tack-soldering D1 and R1 to the circuit board ground plane. By using short leads, there was sufficient rigidity to the components that a separate mounting arrangement was not needed (such as on a perf-board mounted elsewhere) although it is possible to do so. The regulated +9 V power source was readily available on the IF circuit board but regardless of the source and voltage used, the supply voltage must be regulated.

This modification took a while in coming and a lot of listening went into evaluating the different circuit designs and component values I tried in my attempts to suppress the AGC-induced distortion. Lacking sophisticated test equipment, I experimented with various techniques, such as a pulsed RF source (sometimes referred to as a "ditter") and direct pulsing of the AGC voltage, in an attempt to find a way to reproducibly generate the distortion and quantify the result. None of my attempts worked. There is no substitute for using your ears and spending the time needed to listen to different kinds of live signals (SSB, CW, digital, and so on) to see which technique works the best. — *73, Scott McLellan, W3WT, 40 White Oak Ct, Kempton, PA 19529*; **scott@ip-legal-svcs.com**

W1ZR

THE DOCTOR IS IN

Q Glenn, NØPNQ, asks: Do you know of a clock program that will put a clock with UTC on my computer display in the manner of the *Windows* clock?

A *Alpha Clock* (**www.irnis.net/soft/aclock**) is a freeware clock utility for *Windows* based computers. *Alpha Clock* can display your local time or UTC (Coordinated Universal Time). It provides a miniature, but very nice, LCD style watch display that can be moved to an unused corner of your screen. You can choose from a number of color schemes for the display.

Q Steve, KF6OBT, asks: I've always used a straight key for CW, but for Christmas I received iambic keyer paddles (see Figure 1) and am anxious to try them out. Looking at my radio manuals, they all cover how to connect the key and how to adjust the speed and other parameters, but not how to *use* the key with the built-in electronic keyer.

My CW is on the slow side, in the 10 to 15 WPM range, so I've set the keyer speed within that range. I get unexpected results if I slow down or try to go faster. Is that normal? I'm not even sure which side of the paddle is a *dit* or *dah*. Anyway, it might be helpful for me, and other iambic newbies, if you did a piece on how to setup and use an iambic key.

A Congratulations on your new key and I hope you enjoy it! The normal electronic key connections for a right handed person are with the dots on the left side (thumb) and the dashes on the right (forefinger). This is the same arrangement as on an electromechanical semi-automatic key, such as the popular Vibroplex *Bug*. Some southpaws, or folks who like to keep the right hand free for radio adjustments, reverse the connections to key with their left hand.

I have used an electronic keyer for about 40 years and the only downside is that I can no longer send with a bug! I can still use a straight key, however, since the motion is very different and my hand doesn't get confused.

You mention "iambic" and I wonder if your transceiver has an iambic or standard keyer? A standard electronic keyer makes dots on one side and dashes on the other. It also completes dots and dashes if you let go too quickly (called self-completing) and does not allow spaces to be shorter than a proper space interval. This is the way I learned, and even though my radio provides an iambic keyer, and I use dual paddles, I almost never send iambic. Figure 1 shows examples of single and dual lever paddles.

Iambic keyers also send dots on one side and dashes on the other, but it gets more complicated! If you hold both sides closed, you get alternating dots and dashes. If you are sending a string of dots, for example, and tap the dash paddle while keeping the dot paddle closed, it will insert a single dash. It also works the other way. There are multiple iambic modes that get into details about what happens after you release the paddles. Iambic *mode A* mode just stops, while *mode B* inserts an additional opposite code element.

You can find out if your keyer is iambic by putting the transceiver on a dummy load and checking to see what happens if you hold both sides closed. While I'm sure iambic saves some motion, I may be too old a dog to learn that trick!

I think you will become proficient with your keyer if you practice a lot. Take it easy at first and relax and enjoy it. Start slow and don't speed up until you are comfortable receiving at that speed and you have mastered sending at the lower speed. I think the self-completing and self-spacing aspects (which make for better code) can make you think that the keyer isn't doing what you tell it to do.

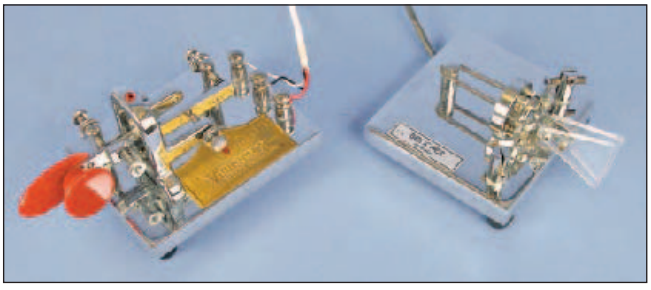


Figure 1 — Two electronic keyer paddle arrangements. On the left is an example of a single lever paddle while on the right is a dual level paddle arrangement. While either type can be used to send with an electronic keyer — it takes the dual lever type to be able to close both dot and dash contacts at the same time to take advantage of the iambic feature.

Q Steve, KF6OBT, also asks: Back in the day, I remember that the conventional wisdom for receivers was to set the AF GAIN at one point and adjust only the RF GAIN to achieve the desired audio level. Have today's radios with DSP made RF gain manipulation obsolete? Is it still good practice to reduce gain in the presence of strong noise in hopes of better copy? I've played around with this and so far the results are inconclusive. Any good guidelines?

A Yes, in the old days, most receivers were really optimized for AM voice. The AGC (automatic gain control) was set up with time constants that favored following a slowly changing AM carrier. For CW operation, a BFO (beat frequency oscillator) signal was injected at the detector and also got into the AGC, reducing the receiver gain. In addition, the BFO injection level was not high enough to allow good SSB reception. By turning the AGC off, turning the RF GAIN down and turning up the AF GAIN, the input signal was lower thus providing a higher relative BFO signal level. This made SSB and CW reception better. Typically the AF GAIN would be set to as high as it could be without hearing any audio hum, and the RF GAIN was used as a VOLUME control.

Modern receivers have a product detector, which does a better job with CW and SSB, along with a higher level BFO signal. The modern AGC level is measured in the audio system where the BFO won't interfere with it. In a properly designed receiver with appropriate AGC parameters, having the AGC on and the RF GAIN up will provide the most sensitivity, as well as the most internal noise. With some radios, reducing the RF GAIN just a bit seems to make weak signals easier to copy, so give it a try on yours. Keep the AGC on, though, since it will keep your ears together if that guy down the street tunes up on the weak signal's frequency!

Q George, N2XM, asks: The schematics of mobile radios installed in vehicles sometimes show both sides of the power line fused. Is this an

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acceptable practice? If, as is usual, the power line runs directly to the vehicle's battery terminals, it seems to me that if the fuse on the ground side of the line blows, the radio will still operate but will pick up a lot of additional vehicle electrical noise. What am I missing?

A A fuse in the battery positive lead — as close to the battery terminal as possible — is the most important fuse to have, since it will protect against a car fire if the radio power cable chafes against sheetmetal, or gets pinched as it runs through the car.

The ground side fuse is really there to protect the radio if the heavy wire from the battery ground to the engine block corrodes or loses its lug. The next time you try to start the vehicle, if the ground side fuse weren't there, the starting current will try to flow through the radio to ground. Since that will be very high current, limited only by the wire resistance, it could cause havoc in the radio.

This year, your "Doctor" had the opportunity to conduct a live clinic at the 2009 Hamvention in Dayton. The following questions are a sampling of those received at the well-attended forum. Thanks to QST Editor Steve Ford, WB8IMY, for serving as recording secretary.

Q Steve, AE5CS, asks: I have started to gather the pieces of a home lab to allow development and repair of radio equipment and systems. I have a volt-ohm-milliameter (VOM), a signal generator and an oscilloscope; what should I consider next? Should I consider a power meter?

A There are a number of directions to go from there. Power meters, especially the inline type, are important for transmitter testing. The newest models provide load impedance data that is useful for antenna system evaluation. For me, though, the next item would be one of the advanced antenna analyzers that includes a frequency counter and measures impedance as well as SWR. It can serve as a component measuring device, a calibrated (frequency, not level) signal source, a transmission line measurement set and other functions as well as measuring antenna characteristics. We have had a number of product reviews of these units over the past few years in *QST*; check them out on our ARRL members' Web site.

Q Richard, W9ZD, asks: Are the operational differences between 100 W and 200 W radios worth the difference in price?

A This is a question with multiple implications. The basic answer is that the difference is 3 dB, amounting to ½ an S-unit on the far end receiver. If signals are strong, the chances are that you will sound the same to a station at the other end. If the other operator is trying to pick a calling station out of a pileup, it *might* put your signal over the top.

The first question I would ask is whether you have, or are considering, a linear amplifier. Many 1 kW or higher output linear amplifiers cost less than the difference between many 100 W and 200 W transceivers. If you have or are considering one that can be fully driven by 100 W, then that will give you a considerably greater edge than the 200 W, so the higher power transceiver is probably not the best choice.

The other aspect of this question is that many 200 W transceivers are in the higher performance category with many additional features than the 100 W radios in the manufacturers' lineup (the Kenwood TS-480 series is an exception here). The price difference has, in my opinion, more to do with the additional features than with the power amplifier output. The question then becomes one of whether or not you feel the features are important to your operating style. If so, the 200 W output is sort of "free" in the package.

The other case is for the CW operator who has a real affinity for 30 meter operation. This is a very interesting band with nice propagation during many times when the bands from 20 meters up are dead. Since 200 W is the maximum power allowed on this band, a 200 W transceiver is a nice fit.

Q Bob, W8RSJ, asked: What is the best way to ground a tower mounted on the roof of an outbuilding for lightning protection?

A As with any lightning protection, the key is to provide low impedance paths to ground for any lightning currents that hit or are coupled to your antenna or tower. If you look at a barn with lightning arrestors, you will see that they tend to have multiple heavy ground leads, typically at least at the building corners. I would do that with heavy leads to the tower base in as many corners as you can afford. At ground level, in addition to a ground rod at each corner, I would install multiple bare radials going out some distance and terminated to additional ground rods. The barn ground system should be bonded to the ground system at the main building.

The coax and rotator cables should come all the way to ground before running to the main building. If they leave from a higher point, the common mode voltage on the wires can easily be in the 100,000 V range during a strike, resulting in a major fraction of the current heading towards your station. Bond the shield to the ground system at ground level on one corner and make that the one with the best ground. An arrestor on coax and control cables at this point would be good, as well as a set at the house entrance panel.

Q Paul, W5ZK, asks: Does wrapping the coax in a coil outside the house entrance panel help in lightning protection?

A In the case with an antenna or tower with proper grounding, this should increase the impedance of the line to the station so that more current will flow towards the ground system and less towards the station. Because it affects higher more than lower frequencies, it should help reduce the slope of the leading edge of the current pulse allowing the arrestors following to fire at a lower voltage. Of course this assumes another ground and an arrestor following the coil, per good practice. I think a ferrite common mode choke should be even better, although, as Dennis, K2TEA, noted it would saturate. In my opinion, even if the ferrite blows up, that is energy that didn't get to the station!

Q Dennis, K2TEA, also asked if coax cable is buried, is it less susceptible to lightning?

A Buried coax is much less likely to be struck or coupled to than an aerial run. If the coax is carrying the results of a strike to an antenna, I don't believe being buried can be counted on to help significantly in reducing the current reaching the station.

Q Steve, N9SZ, asks: How can I keep RFI out of amplified computer speakers?

A These can be tough customers. I suspect many in this competitive market use the least expensive components they can, without giving much attention to filtering. This often means circuitry based on wideband op-amps that happily try to amplify any signals that show up.

If you have multiple brands at different locations, you might try swapping them. If you're lucky, you may find one that is less susceptible that can go near the radio gear. Even if it doesn't go away completely, the less susceptible units may be easier to filter.

It is worth trying to filter on the outside using multiple snap-on ferrite beads on all power and signal leads as close to the amplified speaker as possible. Coil up excess wire before the beads to reduce pickup. If beads don't work, try multiple turns on a ferrite (43 mix) core. If there are still problems, you may need to bypass the signal and power leads as they enter the internal PC board.

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

NØAX

HANDS-ON RADIO

Experiment #79 — Pi and T Networks

We've experimented with the L network in a previous Hands-On Radio experiment, #21. For any combination of source and load impedance, there is at least one version of the four L networks that will transform one into the other using one L and one C. If that's so, why do we need more complex networks to do the same job?[1]

The first reason is that any single version of the L network can only create an impedance match between half of the possible source and load impedance combinations. If the combination is "wrong," then a different version of the L network is required.

Another reason is that the Q of the L network — which determines the frequency range over which the network creates the match — is equal to the ratio of the two impedances to be matched. The more different the two impedance values, the higher the value of Q and the "sharper" the tuning of the network becomes. We need some flexibility to make the adjustment less sensitive to changes in frequency.

Pi Networks

The Pi network can be thought of as two L networks "back to back" as shown in Figure 1. (We'll treat the impedances as pure resistances to simplify the discussion.) Start with the Pi network at A, divide the inductor in half, and create the two L networks in B. The two circuits at A and B act exactly the same. Splitting the inductor, however, creates an intermediate point in the circuit at which we can imagine the input L network transforming R_{IN} to an image resistance, R_{IMAGE}, and the output L network transforming R_{IMAGE} into R_{OUT}. (R_{IMAGE} is not an actual load, of course; it is just a new ratio of voltage and current.)

Different configurations of inductance and capacitance can form a Pi network. The version shown is by far the most common in Amateur Radio because it acts as a low-pass network. This makes it popular as an output circuit for power amplifiers because it reduces the harmonics that are generated in the amplifier.

This "two-step" transformation allows the designer to choose Q for the Pi network because the value of R_{IMAGE} is variable. If R_{IMAGE} is variable, than the Q of the input and output L networks are variable, too.

The value of R_{IMAGE} has to be smaller than either R_{IN} or R_{OUT}. Why? Take a look at the two L networks. The input L network configuration with the parallel or shunt element at the input requires $R_{IN} > R_{IMAGE}$. Similarly, the configuration of the output L network requires $R_{IMAGE} < R_{OUT}$.

While the particular application will affect your choice of Q, one method is to specify the bandwidth (BW) over which the network is to efficiently transfer input power to the output. Similar to a tuned circuit's frequency response, $Q = f_C / BW$, where f_C is the geometric center frequency = $\sqrt{(f_H \times f_L)}$, where f_H and f_L are the upper and lower limits of the frequency range being matched. The wider the frequency range, the lower Q will be.

However the value is determined, Q must also be high enough that $(Q^2 + 1) > (R_{IN} / R_{OUT})$. If these two quantities are equal, the value of X_{C2} becomes infinite (C2 = 0) and the Pi network becomes an L network. Once you've selected a value for Q, follow these steps to calculate the component values (it is assumed that $R_{IN} > R_{OUT}$):

Calculate the value of the parallel reactance, $X_{C1} = R_{IN} / Q$

Calculate the value of the parallel reactance X_{C2}

$$X_{C2} = R_{OUT}\sqrt{\frac{R_{IN}/R_{OUT}}{Q^2+1-R_{IN}/R_{OUT}}}$$

Calculate the value of the series reactance X_L

$$X_L = \frac{Q R_{IN} + R_{IN} R_{OUT}/X_{C2}}{Q^2+1}$$

Convert the reactances to component values:

$$C = \frac{1}{2\pi f X_C} \quad \text{and} \quad L = \frac{X_L}{2\pi f}$$

If the value of Q you select results in components that are impractical, you can change Q and try again. (Large values of L or small values of C are problematic in some applications and frequencies.)

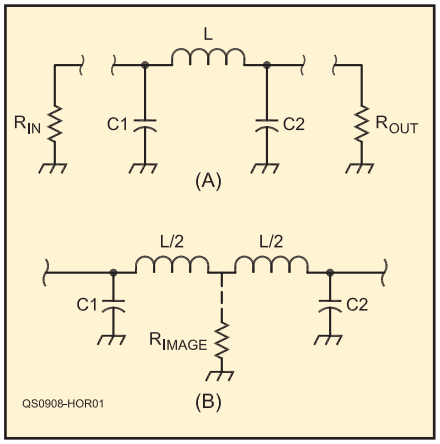

Figure 1 — The Pi network (A) is electrically identical to a pair of back-to-back L networks (B). Using a two-step transformation allows the designer to control network Q and component value. Its low pass characteristics make it popular as an amplifier output circuit.

Building a Pi Network

Let's build a real Pi network that will match a 300 Ω input (such as might be present at the feed point of a folded dipole) to 50 Ω for coaxial cable on the 40 meter band. For good efficiency, we'll set f_H and f_L well outside our operating range at 7.7 and 6.6 MHz, respectively. Thus, we have

R_{IN} = 300 Ω, R_{OUT} = 50 Ω,

$fC = \sqrt{(7.7 \times 6.6)}$ = 7.13 MHz, and

BW = 7.7 – 6.6 = 1.1 MHz.

Use f_C for calculating component values.

[1]Previous Hands-On Radio columns and a complete parts list for all experiments are available to ARRL members at **www.arrl.org/tis/info/HTML/Hands-On-Radio**.

[2]*The ARRL Handbook for Radio Communications*, 2009 Edition. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 1018. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop; pubsales@arrl.org**.

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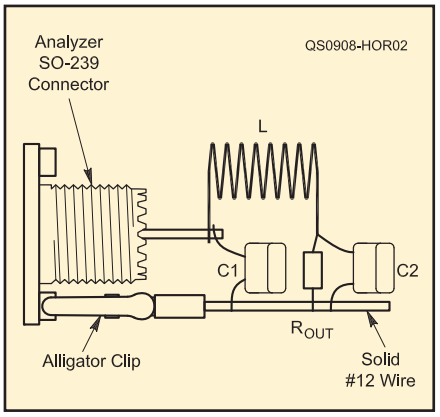

Figure 2 — The example Pi network can be built directly at the output of an SWR analyzer to minimize excess lead length.

Start by calculating Q = 7.13 / 1.1 = 6.48. Check to be sure $Q^2 + 1 = 43 > R_{IN} / R_{OUT} = 300 / 50 = 6$, and proceed. $X_{C1} = 46.3\ \Omega$, so C1 = 482 pF. $X_{C2} = 20.1\ \Omega$, so C2 = 1109 pF. $X_L = 62.5\ \Omega$, so L = 1.40 µH. (A simple spreadsheet is provided on the Hands-On Radio Web site to make the calculations and allow you to experiment with the circuit design values.)

Wind your own inductor using the formulas in the Electrical Fundamentals chapter or tables in the Component Data and References chapter of *The ARRL Handbook*.[2] Eight turns of 20 gauge wire on a ½ inch diameter form over a length of ½ inch will be close to 1.4 µH. To increase inductance, squeeze the turns together. The standard values of 470 pF and 1100 pF will be fine for C1 and C2. Use a noninductive carbon composition or metal-oxide resistor for the 300 Ω load.

Figure 2 shows a suggested method of construction that allows you to build the matching network right at the output of an SWR analyzer. Many other methods of construction will work, since the frequency is relatively low and values of the components relatively large in comparison to stray inductance and capacitance.

Sweep the analyzer frequency back and forth across the band and record the variation in SWR with frequency. Vary the component values to see how they affect the match. (If you have some variable capacitors, you can attach them in parallel with C1 or C2 and adjust them to make a tunable matching network.) Try raising the value of Q by reducing the difference between f_H and f_L, say to 7.3 and 7.0 MHz. Rebuild the circuit and compare the variation in SWR with that of the lower Q circuit.

T Networks

The T network shown in Figure 3 creates a two-step impedance transformation, just as does the Pi network. Also, as for the Pi network, Q must be high enough that $(Q^2+1) > R_{IN}/R_{OUT}$. Unlike the Pi network, the intermediate resistance value, R_{IMAGE} is higher than either R_{IN} or R_{OUT}. This is because the L networks are "turned around" so that the parallel elements are connected across R_{IMAGE}.

With $R_{IN} > R_{OUT}$, Q, and f_C specified as before, calculating the component values for the T network requires the calculation of a pair of intermediate values, A and B, to make the equations more manageable.

Calculate the intermediate variables A and B

$$A = R_{IN}(Q^2+1) \text{ and } B = \sqrt{\left[\frac{A}{R_{OUT}} - 1\right]}$$

Calculate the value of the input series reactance $X_{L1} = R_{IN} \times Q$.

Calculate the value of the output series reactance $X_{L2} = R_{OUT} \times B$.

Calculate the value of the parallel reactance $X_C = A / (Q + B)$

The version of the T network with two series capacitors and a parallel inductor is popular in impedance-matching units because of the reasonable values of components required to match 50 Ω input impedances to a wide range of impedances encountered at the input to feed lines on the HF amateur bands. Using a tapped inductor with a switch and two variable capacitors also works well mechanically and at lower expense than two variable inductors. Unlike the series-inductor Pi and T networks discussed earlier, this circuit is a high-pass network and so doesn't provide any additional harmonic reduction.

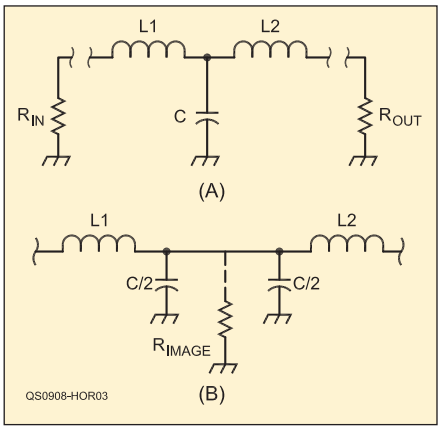

Figure 3 — The T network (A) can also be analyzed as a pair of L networks (B). The version with series capacitors and a single parallel inductor is a popular impedance-matching unit or "antenna tuner" design, although as a high-pass network, it does not offer any harmonic reduction.

Parts List

- 470 pF and 1100 pF silvered mica or ceramic capacitors.
- 300 Ω, ¼ W carbon composition or metal-oxide resistor.
- 10 inches of 20 gauge solid hookup or magnet wire.

Recommended Reading

The three-part series "Impedance Matching" by W1DF in the March, April and May 1957 issues of *QST* remains a classic tutorial. With the online *QST* archives open to ARRL members, there's no reason not to log on to the ARRL Web site and read them!

Next Month

Battery powered accessories and gadgets abound, but which of the many battery types perform well and how can you compare one to another? Let's look at battery capacity next time. QST

Strays

I would like to get in touch with…

◊anyone who has used Isotron antennas, especially on 80 meters. — *Richard Perkins, WA7SNY,* **perkywa7sny@bendbroadband.com**

Grateful ham bestows Elmer Award: **My Elmer, W1NA, sparked my curiosity by telling me about DX contesting and the contacts and friends he made on HF. A great inspiration and source of information, he also gave me my first HF rig. It's great to be in a hobby that harbors such individuals as W1NA and I hope to aspire to promote the hobby as he has to me. The photo shows me presenting Piero L. Iovino, W1NA, an ARRL Life Member, with a well deserved ARRL Elmer Award. — *Nicholas Finocchio, KA1BQ***

COURTESY NICHOLAS FINOCCHIO, KA1BQ

SHORT TAKES

The PIEXX SO2Rxlat USB to LPT Translator

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For more than 20 years, the standard for automating an Amateur Radio station has been to use standard serial (COM) and parallel printer (LPT) ports. By manipulating the states of various lines on these ports, loggers and other software could activate PTT (Push To Talk), send CW, control two-radio controllers such as the TopTen DX Doubler, and automatically switch antennas.

Alas, even as more and more radio amateurs were incorporating such devices in their stations, the computer manufacturers were moving away from hardware COM and LPT ports and settling on USB as their standard for connecting printers, scanners and other peripherals. Already, almost all new laptops and desktops only incorporate USB ports. This doesn't pose many problems for those whose only interest is connecting a transceiver to a logging program because USB-to-serial converters can do everything that's needed, and can even be set up to do PTT and CW chores. But what about the LPT port, much used for SO2R (Single Operator Two Radio) contest operating and automatic antenna switching?

Why a Translator?

Hams quickly discovered that USB-to-parallel adapters, while they existed, didn't support the standard ways of using the LPT port to control antenna switches and SO2R controllers. Something different was needed. From stage right, enter Chris Sieg, WA3LDI, of PIEXX Company, already well-known in the ham community for a variety of handy gadgets using microcontrollers, particularly the TS-930 Microprocessor Board that gives new life to that excellent older transceiver by adding computer control and a lot of other features.

From stage left, enter MicroHAM, which was working on the same problem from a different angle. This Slovak company and its US subsidiary, MicroHAM USA, have gained quite a reputation for their broad line of computer-to-radio interfaces, antenna switchboxes and other products. To support the company's MK2R+ multi-mode SO2R controller, using only a single USB cable to the computer, MicroHAM developed and began encouraging software developers to support the MicroHAM SO2R Protocol.

This ingenious protocol uses simple serial commands to control peripheral devices and has quickly been adopted by most *Windows*-based contest and general purpose logging software.

How the SO2Rxlat Works

With the SO2R Protocol standard already in place, it only made sense for PIEXX to develop its hardware to interpret part of the MicroHAM command set, and translate it to the resulting parallel port signals. The SO2Rxlat does what its name implies — it receives the MicroHAM commands and translates them into their standard LPT port equivalent. For example, most SO2R controllers use LPT port pin 5 to switch between "mono" (both ears on one radio) and "stereo" (one radio in each ear). The MicroHAM protocol uses "FRS" to toggle between the two — the SO2Rxlat turns that into control voltage on Pin 5 of its built-in parallel port plug. Similarly, "AS1xx," where xx is 0-9, applies power to the appropriate pins of the LPT port to match a standard band decoder, enabling automatic switching of up to 10 antennas.

The SO2Rxlat board incorporates two *virtual* serial ports connected to your computer through a single USB port. The first port controls the LPT port. The second port can be used to control CW and PTT by utilizing the standard COM port RTS and DTR lines and is also available to perform general rig-control functions. It can be ordered either as a standard RS-232 port or as a CI-V ICOM-style communications port.

Trying It Out

All this is really a lot harder to describe than it is to get going. I tested the SO2Rxlat with *N1MM Logger* and a TopTen DX Doubler SO2R controller. PIEXX has provided detailed, step-by-step instructions for installing the drivers and testing the unit and it all went very smoothly. The unit is powered by the computer's USB port, which simplifies cabling — essentially, I just connected it to the LPT port on the back of the DX Doubler with a standard 25-pin serial cable, plugged in the provided USB cable, started the logging program and I was in business. Antenna and radio switching all went smoothly, as did the routing of CW and PTT control to the appropriate radio. Models of the SO2Rxlat are available with or without a display (showing the state of the LPT port) and with or without a case. The display is useful for debugging, but in most cases will be unnecessary — the SO2Rxlat truly is plug-and-play.

Clean and Flawless

To sum up, the SO2Rxlat can help you extend the life of your existing station automation hardware. It doesn't add any bells and whistles, but it operates flawlessly. So until that hot new SO2R controller can fit in the budget, the SO2Rxlat makes good sense.

Manufacturer: PIEXX Company, 13 Main St, PO Box 123, Hillsboro, NH 03244; tel 603-464-5625; **www.piexx.com**. *SO2Rxlat with case and display, $131 plus shipping; with case but without display, $85 plus shipping.*

AG1YK

HINTS & KINKS

ANCHORING COAXIAL FEED LINE

◊ Here's the way I anchored the coaxial feedline from my windom antenna to my house. It is free to swing in the wind with the antenna, without becoming crimped or kinked (see Figure 1). I use ⅛ inch nylon rope and a variation of the knot used to lace telephone cables. For RG-8X coax, I start with a 5 foot piece of rope in which I tie simple overhand knots on each end.[1]

Next, I melt the end with a lighted match. When the melting nylon forms a ball, I put the fire out and press the melted ball against the flat side of a screwdriver blade or something similar, to blunt the end of the rope with the now hardening ball. If you do this just right you will have a hard glob on the end that is larger than the diameter of the rope and it will not pull through a simple overhand knot tied at that end of the rope.

Then measure 40 inches from one end of the rope and fold the rope back on itself. Place this loop on and parallel to the coax at the point where you want to secure it. Starting 5 inches from the end of the loop (see Figure 2), wind the longest loose end of the rope around this loop and the coax in close tight turns, toward the loop (see Figure 3). When you run out of rope, you should have about 3.5 inches of wrapping, ending about 1 inch away from the loop end (see Figure 4).

Now pull the knot at the end of the wrap through the 1 inch loop and while holding the wrapped coax in one hand, pull the other end of the rope with your other hand, so that it slips under the wrapped turns and closes the loop around the knot on the other end (see Figure 5). A little practice may be necessary here to get everything tight and neat.

After tying the rope to the screw eye with a couple of half hitches, the remaining rope is wrapped around the screw eye to make it neat and keep it from dangling in the wind. *All photos by the author. — 73, Lyle H. Nelson, ABØDZ, 1450 201st Ave NW, New London, MN 56273,* **lylenel@tds.net**

[1]R. Collins, WX3A, "The Knots of Ham Radio," *QST*, Jun 2006, pp 57-58.

Figure 1 — RG-8X coax anchored to the author's house.

Figure 2 —First, form a 5 inch loop.

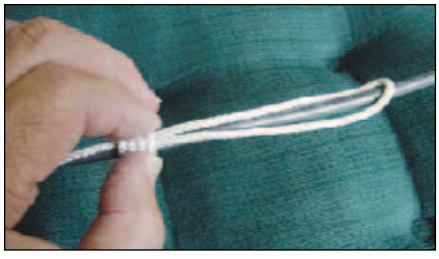


Figure 3 — Wind the end of the rope around the 5 inch loop in tight turns.

Figure 4 — When done, you will have about 3.5 inches of rope wrapped around the coax.

Figure 5 — Finally, pass the knot through the remaining loop and pull the end of the rope to close the loop below the knot.

AUDIO FILTER IMPROVED CW PERFORMANCE

◊ I use an SCAF-1 audio filter from Idiom Press (**www.idiompress.com**) with my ICOM IC-706 MKII transceiver for CW. This filter is an enhanced version of the one designed by Denton Bramwell, K7OWJ, which appeared in the *1999 ARRL Handbook*.[2] It consists of an adjustable switched capacitor low-pass filter followed by a two stage active high-pass filter. Overlap in the two filter responses creates a band-pass filter. As supplied, the low-pass filter cutoff frequency is adjustable from about 740 Hz to 3600 Hz and the high-pass cutoff frequency is fixed at about 300 Hz. This is great for phone operation, but is far from optimum for a CW signal at 750 Hz as there is no way to filter out unwanted signals and noise between 300 Hz and 750 Hz.

A simple solution is to replace six 0.1 µF capacitors (C9, C10, C11, C14, C16, C25) in the high-pass filter with 0.047 µF capacitors. This raises the low frequency cutoff of the unit to about 600 Hz and provides a much better band-pass characteristic for CW (and digital) signals. The filter is still usable with voice, but some of the low frequency voice components are attenuated. *— 73, Frank Getz Jr, N3FG, 685 Farnum Rd, Media, PA 19063-1611,* **n3fg@arrl.net**

WIRELESS RFI DETECTION

◊ Most of us have gone through the hassle of trying to track down RFI sources around the house, including turning off the house circuit breakers and unplugging electronic devices one at a time to isolate the noise source. This usually involves tuning the rig to the offending noise and then going back and forth from the rig to remote parts of the house or yard de-energizing all possible noise sources one at a time. This back and forth process can be a hassle especially if you are dealing with an intermittent noise or one that is radiating or conducting from outside of your house.

This RFI noise detection process can be made a lot easier and more accurate by using an inexpensive pair of wireless headphones that plug into your rig's phone jack. Just tune in the offending RFI, put on the headphones and go anywhere within a 100 foot radius turning circuit breakers off and on, turning household electronics off and on, etc. You'll know immediately if you've isolated the culprit. You can also track noise sources with a sniffer such as a portable broadcast radio and simultaneously listen to see if the sniffer's noise is synchronized with what you are hearing remotely from your rig. If your neighbors are within 100 feet it can also help you track down RFI coming from their house.

I use a $20 wireless headphone set, model HO-900 made by Sentry Industries, Tarrytown, New York(**www.SentryIndustries.com**). I bought mine at a local department store. It comes complete, ready to plug into your transceiver (less batteries), has an approximate 100 foot range, operates on 49 MHz and has a signal/noise ratio of >50 dB. The fidelity is surprisingly good as is the construction quality. *— 73, Dick Goodwin, K4JJW, 2217 Caracara Dr, New Bern, NC 28560,* **rgoodwin41@embarqmail.com**

REUSE YOUR CRT STAND

◊ Hams are known for being resourceful and in the true spirit of the three Rs (reduce, reuse, recycle), I came up with the following useful project. My old CRT computer monitor was due to be replaced by a modern LCD screen. After I had removed it, I began thinking about the rotating stand that the screen sits on. It could be put to good use as a shelf for my HF rig.

After separating the screen and stand, I used a hacksaw to cut off the plastic guides that the screen fits into, thereby making a nice flat surface (see Figure 6). There was a small lip at the rear that I left to stop the rig from sliding backward. My Kenwood mobile rig sits nicely on the stand and can now be rotated left to right and up and down for easier viewing (see Figure 7). Many of these stands are being sent to the disposal centers as they are replaced with newer LCD screens. Consider saving yours and making this handy stand. *All photos by the author. — 73, Jeff Richardson, VA3QSL, 36 Crawley Dr, Bramalea, ON L6T 2S1, Canada,* **va3qsl@arrl.net**

MOBILE CONVERSION OF THE MFJ-1762 6 METER YAGI

◊ The MFJ-1762 3 element, 6 meter Yagi (**www.mfjenterprises.com**) is a simple lightweight antenna easily converted to a travel Yagi. When the antenna was first received, I put it together exactly per the instructions and the SWR was 1.2:1 at 50.200 MHz. A couple of the holes needed to be deburred, but otherwise, all went well. The elements all lined up and it looked good. On-the-air tests for gain and front to back ratio were exactly as expected for a short 3 element Yagi.

I then proceeded to make it into a "travel" Yagi. I cut the boom at about 38 inches, just past the matching stub, halfway between the mast U-bolt mounting holes. I then fitted a 4 inch (2 inch either side) piece of tubing inside the boom splice, using the mast U-bolt to hold all tightly in place. Through the boom

Figure 6 — The modified CRT stand ready for mounting a rig.

Figure 7 — The completed stand with the rig in place.

[2]D. Bramwell, K7OWJ, "A Continuously Variable Bandwidth Audio Filter," *The ARRL Handbook for Radio Amateurs* (Newington: 1998), pp 16.33-16.35.

screws could be added for additional strength if you wish. I then cut all the elements at 36 inches and made 1 inch splices from ¼ inch tubing, for their reassembly on-site. I added a 5 foot RG-8X pigtail, with three snap-on ferrite split beads right below the matching stub.

Now it all fits in a 4 inch × 40 inch fishing rod carrying case. Reassembly on-site is fast. It is exactly what I need for my travels around the Caribbean with my ICOM IC-7000 transceiver and Alpha Delta HF dipoles. — *73, John Abbruscato, W5JON, 22107 Pine Tree Ln, Hockley, TX 77447*, **w5jon@sbcglobal.net**

ALTERNATIVE GROUNDING MATERIAL

◊ Ed Sutton's, KD7PEI, informative article has, I'm sure, inspired many of us to take a good look at our ground systems.[3] Whether or not one has the luxury of using 1½ inch or 3 inch wide solid copper strap, a good ground is important. Most amateurs use large-conductor wire or flat braided grounding strap. Both round-conductor wire and flat braided grounding strap can bend, sometimes sharply, and this may introduce an unacceptable amount of inductance.

A readily available alternative is to use plumbers' hanging strap, available at a hardware store. This strap is about ¾ inch wide and is usually made of steel, either plain or copper coated. It has holes at lengthwise intervals of about ¾ inch. Plumbers' strap can bend, but because it is a flat and solid conductor, it is likely to bend only as intended. — *Bob Raffaele, W2XM, 5 Gadsen Ct, Albany, NY 12205-1309*, **w2xm@arrl.net**

MORE BEHIND THE GRAY DOOR

◊ Terry Coffman's, KC5NAC, near miss was really something unusual, but one never knows about the condition of things hidden in out-of-the-way places.[4] I was reminded of the many industrial plants that I have visited over the past 35 years as a fire protection engineer to discuss and aid management in identifying potentially similar scenarios.

For those of us that have lived in the same home for many years, unless some major electrical work has been done in recent years, most of us have probably never had anyone do more than change a fuse or flip the circuit breaker. Fuse boxes (for those of us that still have the screw-in type of fuse) and circuit breaker panels all have connections that may loosen over time and allow corrosion to begin.

The alternative, for most hams and homeowners, would be to have a *licensed* electrician take a gander at the fuse box or circuit breaker panel every once in awhile and tighten the connection screws, etc. During the electrician's visit, the cover over the switches should be removed and the condition of the connections should be checked.

After living in a home for several years, or even when inspecting a home (new or otherwise) for possible purchase, it is a g2ood idea to check the tightness of the electrical connections in the circuit breaker panel. I have only seen a single instance when a home inspector actually took the trouble to check/tighten connectors on a circuit breaker panel. If you should see a fuse box this is a clue to an even greater opportunity for failed/failing electrical connections.

This is especially important for people who live near salt water areas or when increasing the electrical demand of an older house that may have a low amperage electrical entrance panel. Corrosion can occur in the loosened connections, allowing for the potential of increased resistance. Never assume that there are no loose connections inside of a normally untouched electrical panel. — *John F. Marthens, NU6A, 216 SW 192 St, Normandy Park, WA 98166-4157*, **jfmarthens@msn.com**

CRACKING WALL WARTS

◊ I too have done battle with the recalcitrant wall warts unwilling to give up their inner secrets without a fight. I use a Dremel tool with a number 409 cutoff disc to cut along the factory glue line. This provides the precision necessary to cut the case without damaging the transformer and wiring. I close the wart with tie wraps versus tape to avoid the mess of adhesive residue. — *73, Mark Snowdon, KG4UDL, 409 Mills Ave, Pensacola, FL 32507*, **msnow20989@aol.com**

AUTO CLEARCOAT DISCOLORATION

◊ One of the great things about this hobby is how people pass along great ideas, and warnings of possible problems. A great idea is putting cotton balls loosely in your remote speaker. That cheap little 3 inch speaker in your car will sound incredible with the air space loosely filled. This hint is about an expensive lesson I learned, which can become a problem for a lot of hams with newer vehicles.

I own a 2007 Camry Hybrid. The special light green color is available only on the hybrid, but I've seen a close match on new VW Beetles. The color itself really has nothing to do with the problem, but made it very visible.

Not wanting to drill any holes, I selected a dual band mag-mount antenna from a well-known supplier. The base is about 3 inches in diameter and has a thin rubber boot that fits around the rim and covers the bottom. The combination of newer model paint and rubber on the bottom of the antenna created a major problem.

I happened to be washing the car, lifted the mag-mount base from the trunk and found a discolored patch where the antenna had been. Against the green paint, the patch was brown. This was not simple fading from being covered and not exposed to the sun. It would not clean off with Windex, or any other household cleaner I tried.

I took it to a body shop near where I work and showed it to my "guy" there. He tried lacquer thinner on it and the stain was unaffected. The next day I made arrangements to leave the car with him overnight. He ended up wet-sanding it and had to sand down well into the paint, almost to the metal, to eliminate the stain. It took $200 worth of his labor and paint to redo the entire top of the trunk to make it right.

He explained to me that many of the clearcoats used on newer cars are water based and that rubber and many other things will bleed into and through it, which is what happened to me. So rubber boots on mag-mount antennas and even the rubber top part of a trunk lip mount can and will stain the car right into the paint.

Both the auto manufacturer and the antenna manufacturer have never heard of this problem before. The auto manufacturer says, of course, that they don't make mag-mount antennas and so have no experience with them. The antenna manufacturer says that the usual complaint they get is that the rubber boot is missing. So neither of them has any information to help avoid this problem.

I'm now hoping the thin felt stick-on dots I put on the base of the antenna will prevent this from happening again. If you have a newer car, take a moment to look under any rubber making contact with the paint. It might also be worthwhile finding out if your clearcoat is water based, and what, if anything, they can recommend to keep your antenna boot from bleeding through. It'll be a nasty surprise if you're at your dealer trading in the car and remove the antenna to find a 3 inch round stain that won't go away. — *73, Bill Stewart, 1131 SE 18th St, Cape Coral, FL 33990*, **n4cro@hotmail.com**

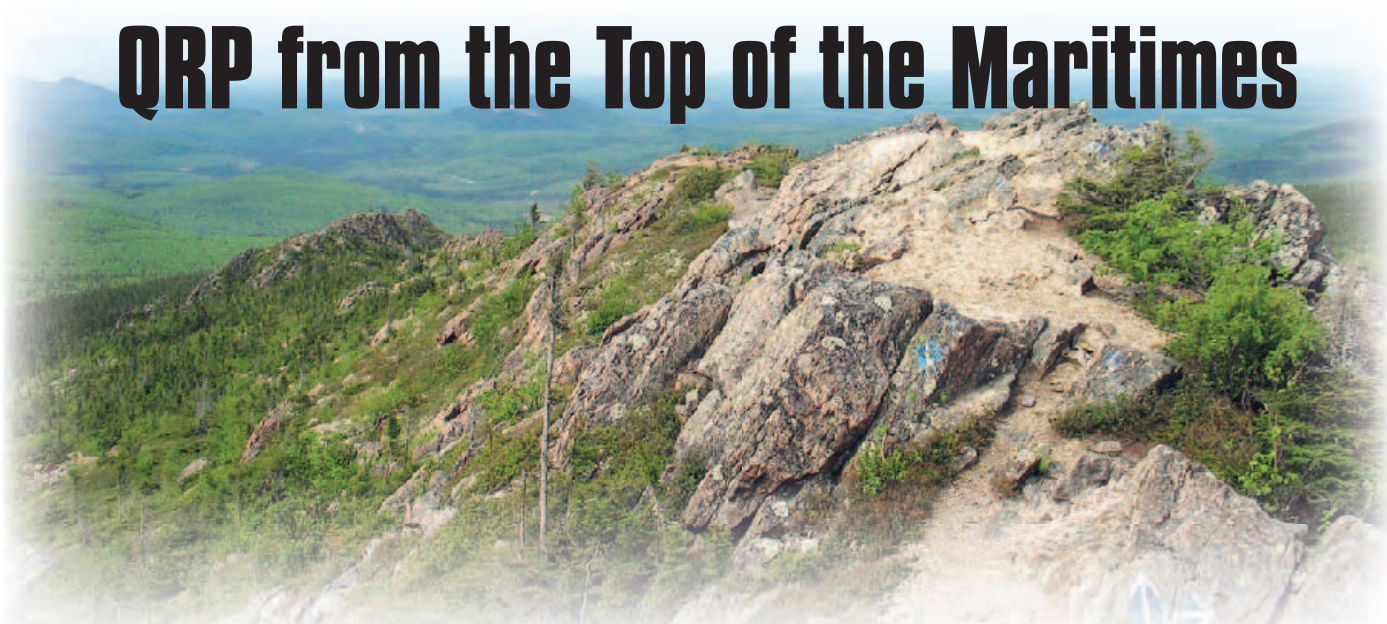
Hints and Kinks items have not been tested by *QST* or the ARRL unless otherwise stated. Although we can't guarantee that a given hint will work for your situation, we make every effort to screen out harmful information. Send technical questions directly to the hint's author.

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

[3]E. Sutton Jr, KD7PEI, "Obtaining Good Ground," *QST*, Aug, 2008, pp 37-40.

[4]T. Coffman, KC5NAC, "Lurking Behind the Gray Door," Hints and Kinks, *QST*, Mar 2008, p 71.

QRP from the Top of the Maritimes



A Kentucky ham snags a 1000 mile QRP contact from a Canadian mountaintop.

Mark Volstad, AI4BJ

Above: Looking out from the summit of Mt Carlton.

They say you're never too old to acquire a new hobby, and in my 45th year I acquired two great ones — Amateur Radio and backpacking. I quickly learned that by operating low power (QRP) I could combine the two. I then discovered and joined the Adventure Radio Society, a "group of men and women who combine Amateur Radio with their love of the outdoors."[1] One of the activities the society sponsors is the Top of the World (TOW), in which members are challenged to complete at least one HF contact from the highest points of each state and province in the US and Canada.

Since first learning of this challenge, I had hoped to one day see my name added to the TOW Honor Roll.[2] Trouble was, the high points in the states closest to my home in northern Kentucky had already been bagged. Although you don't have to be the first on top to have your name added, I didn't want to go to all the effort required and then have to share the glory with someone else. When I began planning a vacation to visit family in the province of New Brunswick in June of 2006, I checked the TOW list and found that Mt Carleton was still waiting to be claimed. It immediately became a key waypoint on my itinerary.

As luck would have it, Mt Carleton is located within a provincial park bearing its name, so access would not be a problem. I decided to fly into Bangor, Maine, rent a car and drive the 250 or so miles to the park. Mt Carleton is a part of the Appalachian Mountain range. At 2680 feet, it is barely half the height of the much better known Mt Katahdin to the south, but it is the highest peak in the Canadian Maritime provinces. (Interesting fact for fellow hikers: It is common knowledge that the Appalachian Trail's northern terminus is Mt Katahdin in Maine, but few are aware that the trail now continues north into Canada as the International Appalachian Trail and passes through Mt Carleton Provincial Park.)[3]

The abandoned fire observation hut on the summit. Note the steel guy cables to prevent the hut from being blown off the mountain and my antenna mast flexing in the wind.

My equipment selection was pretty basic: my trail-friendly Elecraft (**www.elecraft.com**) KX1 CW transceiver powered by 6 AA batteries, headphones, a couple of lightweight wire antennas, an Elecraft BL1 balun and, since I did not expect to find any trees at my destination, a Kanga (**www.kangaus.com**) DK9SQ 33 foot telescoping fiberglass mast. Rounding out the list was a Palm CW mini-paddle (**www.mtechnologies.com/palm**). Total equipment weight came in at well under 10 pounds.

I arrived in Bangor on a cool and wet Saturday afternoon and began my drive north. Mt Carleton Provincial Park is situated in a remote area of north-central New Brunswick, and during the last 50 miles I saw little else but boreal forest carpeting gently rolling hills.[4] I arrived at the near-empty park at dusk, and located a drive-up tent site. A choking cloud of mosquitoes motivated me to erect my tent in record time and I fell asleep to the calling of loons on nearby Big Nictau Lake.

Above the Tree Line

The 8 mile drive from the campsite to

[1]Notes appear on page 64.

Looking down on the Nepisiguit Lakes in the distance.

the trailhead the next morning was via a rather potholed dirt road and I was glad that I was driving a rental car rather than my own. Since I was planning to make a quick trip up and back down the mountain (6 miles round trip), my pack was lighter than normal, burdened only by my radio gear and a few standard survival items. The trail was easy to follow but quite rocky. Fresh moose tracks were evident, and at one point a ruffed grouse watched my passage from just a few feet away in the trees, unaware that his cover had been broken.

The trail steepened noticeably above the tree line and the last few hundred feet had me scrambling over boulders. A stiff wind was blowing by now and I estimated the wind chill to be about 40 degrees. A boarded-up fire observation hut on the summit has been abandoned since 1968, but blown-out windows made entry possible and a picnic table inside seemed like an ideal operating position.

Mark sitting at his operating position, doing his best to stay warm and make a contact.

Plan A

I lashed my mast to the porch railing with bungee cords and raised a 33 foot (40 meter ¼ wave) vertical antenna into the wind. I have found 24 AWG Teflon-insulated, stranded wire to be ideal for portable antennas and my vertical uses this for both the main element and the sixteen 8 foot ground radials. I tossed the 300 Ω twin-lead feed line through one of the hut's windows and then clambered in after it.

With all four windows missing, it seemed almost as windy inside the hut as outside and I had to crank the KX1 audio gain to maximum to hear over the howling. The KX1's built-in automatic antenna unit found a 1.5:1 or better SWR match on all bands (40, 30 and 20 meters). I began on 40 meters and was relieved to hear plenty of signals. I threw out my CQ near 7.040 MHz for several minutes, but failed to snag any takers. I then switched tactics and tried to answer a few CQs myself, but my signal seemed to fall on deaf ears. I did the same on 30 and 20 meters, with no better results. I realized that this was not going to be the slam dunk that I had allowed myself to believe it would be.

Plan B

Realizing that a 3000 foot pile of granite might not be the best ground for a vertical, I decided to switch to my trusty bread-and-butter antenna, a 66 foot doublet with open-wire feeder. While raising it on the mast a gust of wind blew the wires onto the roof of the shack, whereupon the wood shingles availed themselves of a nice, tasty brunch. I managed to free three wires, but I was obliged to apply breaking force to the fourth to free it. I might have attempted a temporary repair, but with increasing winds and rain clouds menacing, I instead opted for...

Plan C

Using pieces of my vertical and a salvaged section of my now defunct doublet, I fashioned a new doublet, this one with the KX1 connected directly to the feed point. I ran one wire out of the north window and the other through the south window, and laid both wires out across the boulders, stretching the term "compromise antenna" to its limit. The KX1's autotuner still found a decent match on all three bands.

I had no better luck on 40 and 30 meters, though, and with a sinking realization that my Top of the World attempt would probably end in failure, decided to spend my final few minutes on 20 meters. I tuned up directly on 14.060, the QRP calling frequency, and threw out a desperation CQ. After my second call, I thought I heard WØIZ, so I quickly tapped out WØIZ DE AI4BJ/VE9 and AI4BJ/VE9 DE WØIZ GM... came the reply. If anybody had happened to peek through one of the windows of the hut at that particular instant, they would have seen a funny fellow in headphones dancing a jig on the picnic table and shouting, "YES. YES."

Igor "Iz" gave me a surprisingly solid 579 signal report. I copied his location as Ohio and later learned that he was less than 40 miles from my home. That made for a contact distance of 1000 miles — not bad for 1 W and a rock-pile antenna. I explained where I was and apologized for my sloppy code, which was due partly to fingers stiff from the cold and partly to the excitement of having achieved my objective. I had been on the summit for almost 3 hours.

My descent from cloud nine was uneventful and shortly after leaving the trailhead in my car a steady rain began to fall.

So where will my next Top of the World adventure take me? Hmm — I see that Mt Katahdin is still waiting to be claimed.

Notes

[1]Adventure Radio Society, **www.adventure-radio.org/**.

[2]TOW Honor Roll, **www.adventure-radio.org/ars/pages/top_of_the_world/tow_honor.html**.

[3]International Appalachian Trail, **www.internationalat.org**.

[4]Mt Carleton Provincial Park, **www.nbparks.ca/MountCarleton/ParkInformation.aspx**.

All photos by the author.

Mark Volstad, AI4BJ, an ARRL member, obtained his Amateur Radio license in 2003. A native of Canada, he now calls the Bluegrass State home and earns a living as a Web application developer. He can be reached at 6098 Tosha Dr, Burlington, KY 41005, or at **ai4bj@arrl.net**.

Putting Ham Radio in the Cable Spotlight

Promoting ham radio on your favorite cable channel.

Harold Kramer, WJ1B

"We'll be right back after this commercial announcement." But wait; don't push that remote control button yet! Right there, on the screen, you see hams having fun on Field Day, helping out during an emergency and doing other exciting things with Amateur Radio.

How can this be? Is the ARRL paying for national commercials? No — you have probably just watched an announcement inserted by your local cable company at the request of a local Amateur Radio operator like you.

How can you get Amateur Radio announcements on your local cable television system? Here's the way it is done. Local cable companies carry many satellite delivered channels on their channel lineup. These include channels like TNT, Lifetime, CNN and ESPN. As commercial channels, they carry (duh…) commercials. These channels run their own commercials most of the time, but they permit the local cable operator to retain a few minutes each hour for their own announcements.

Because they are made "available" to the cable operator, these openings are called "avails." Cable operators sell these avails to local advertisers. Because there are so many avails, however, they are rarely all filled with purchased announcements. If an avail is not sold, a cable operator can insert a *public service announcement* (PSA) into the open slot. A PSA is an announcement provided by a non-profit or community organization. The cable operator donates the air time for the PSA. Most PSAs are 30 seconds in length.

Here is where we have an opportunity to promote Amateur Radio at virtually no charge. The key is to have a technically correct and compelling PSA for the cable system to insert into a national satellite channel when they have an opening. The ARRL can supply you with high quality PSAs in several different formats. You can preview them on **www.arrl.org/pio**. First, check what video format(s) the cable system needs and then contact Allen Pitts, W1AGP, Media & PR Manager at ARRL HQ, **w1agp@arrl.org**. Allen will mail you a CD or DVD of the PSA — they cannot be easily downloaded because the high quality video makes them into very large files.

Here are some tips for getting your PSAs on your local cable system:

- Explain why the public service announcement is applicable to the cable operator's subscribers. For example: There is a need for additional licensed amateurs to help with emergency communications in the cable operator's coverage area.
- Have a visual connection to a local organization. You can customize some ARRL PSAs to your local needs by adding the name of your club, ARES® unit or other Amateur Radio endeavor to the PSA. A friend in the production department at a cable company or broadcaster can help to customize or "tag" the avail.
- You can customize or produce a PSA yourself. The availability of high quality video editing software, such as *iMovie* or *Windows Movie Maker*, along with the downward spiral in prices for "pro-sumer" video gear, make it easy to create your own content. Take special care with lighting and audio. The more professional the product looks, the more likely it will be to get aired.
- Contacting a radio amateur who works for the cable company is a good way to find out the specifics about running a PSA on a particular cable company.
- Do not just mail the cable operator the PSAs. They will probably end up in the trash bin. Mail them after you have spoken with someone directly at the cable system and have a specific contact name and at least a commitment to look at them.
- Whenever possible, have the PSAs prepared in a video format that the cable system requires. Most cable systems today recommend that PSAs be on a DVD. Don't expect to have the cable operator translate them to their local format.
- Don't expect to have the PSAs returned to you. Keep the master yourself and supply the cable operator with a copy. Make sure that the copy is of good quality.
- Have the PSAs clearly labeled and tightly affix labels to the media and its case. At the minimum, the label should include: PSA title, run time, producing organization, local contact name, phone number and/or e-mail, and start and end dates when the PSAs should be run. You don't want a Field Day PSA still running in July!
- Make sure that the PSA timing is accurate. PSAs are inserted with automated equipment. A 30 second announcement should be 30 seconds on the dot. The run time should be accurate within half a second or less. The cable operator may not run the PSA if the timing is too far off.
- Make sure that you have the rights to run the material that you are using whether you produced the PSA yourself or if it is supplied by an outside entity like the ARRL.
- Follow up with a thank you in writing to the cable company management for running the PSA and donating the broadcast time. They will appreciate it.

Good luck, and thanks for helping to promote Amateur Radio and the ARRL. Thanks to Scott Westerman, W9WSW, of Comcast Cable for his assistance with this article.

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

Catch a Net on Your Radio Set

Hams can telecommute too.

Steve Sant Andrea, AG1YK

"Calling the Newington Net. Calling the Newington Net."

The voice comes bursting out of your rig as the repeater snaps to life.

"This is a directed net. All net business is to be conducted through net control. Your net control this evening is Steve, AG1YK."

You've heard these net start-ups before as your rig scans the local repeaters but what exactly are nets and what are they for?

Nets are the ham radio equivalent of telecommuting. Most often related to a club, the net gets the members together at a particular time and frequency to discuss whatever they want to discuss — without having to turn off the soldering iron.

Even when you are working from home you still have a boss and in a net that boss is the "net control station" (NCS). The only good part about our form of telecommuting is that the NCS usually rotates among the members; so everyone gets to be the "boss."

What you heard coming over your rig is referred to as a "call-up." AG1YK, acting as NCS, is "calling up" the net, alerting all those monitoring so they can warm up their microphones.

Casting About

Nets are everywhere. There are HF nets that have hams checking in (*check-ins*) from all over the world and local VHF/UHF nets held on repeaters.

AG1YK continues: "This net is open to radio amateurs; you do not need to be a member of the Newington Radio Association to check in. I will now take check-ins for the net. Any stations with traffic, please call now."

"Hey, I thought telecommuters didn't have to deal with traffic? What gives?" you ask.

Well, there's traffic and then there's "traffic." In hamdon, traffic refers to messages that are sent between stations, usually for a nonham. Many nets are part of the National Traffic System (NTS), an organization of hams who move traffic by voice, Morse code or digital modes throughout the US. Every day of the year many traffic nets operate throughout the country. Even nontraffic nets will have NTS members and will pass traffic if some is available. Find out more about the NTS at **www.arrl.org/FandES/field/pscm/sec2-ch1.html**. If any stations have traffic the NCS will log them in to the net, noting the destination for their traffic, and then continue the check-in procedure:

"Now can I have regular check-ins for the net?"

This is when the RF starts flying. The other hams on frequency will begin to call. For a small local net this is your time to jump in. As each station checks in, the NCS will leave a long pause for others. During one of these pauses just key up and call:

ALAN BARROW, KM4BA

Robin Kemp, KD5QEL, one of the network of hams who supplied emergency communications in the aftermath of the Katrina disaster.

"This is AG1YK, Steve in Newington."

That is all it takes. After a pause with no check-ins, the NCS will announce the list of stations that he or she has logged into the net. If you are not on the list, don't worry, the next time the NCS calls for check-ins just give it another try.

If the net is a large one, the NCS will usually give some directions to control how stations checkin. One method is to divide stations checking-in into small groups according to the last letter of their call sign.

"Stations with calls ending in A through G, please call now."

On the HF bands, the NCS is often using a beam and he or she will conduct check-in using the "round-the-clock" method. In this method the NCS will begin the net with the beam pointed north. After 10 or 15 minutes or when call-ups from the north are complete, NCS will move the beam to the east and repeat the call up. Slowly moving around the compass rose in time with the clock.

Once all the checking-in is complete, the NCS will begin the net. If the net holds traffic, the NCS will arrange for the traffic to be passed. If not, then the NCS will start the discussion of that night's topic.

So Many Interests — So Many Nets

Message handling is not the only thing nets are convened for. You can find nets for just about any purpose. There are nets that cover particular regions and countries, nets for women hams, low power (QRP), emergency communications, ragchewing, equipment swapping, maritime mobile, vintage radios, portable hamming, youth and Scouting, satellite operations, and on and on.

"Okay, so there are lots of nets covering lots of subjects, but how do I know where and when to find one I might be interested in?"

The best place to start is near your own antenna. Somewhere nearby is a club and most clubs hold on-the-air nets. Use the ARRL club search engine (**www.arrl.org/FandES/field/club/clubsearch.phtml**) to locate clubs nearby. Go to the club Web site or contact them to find out the frequency, day and time of their net.

"I'm already a member of my local club; what about all those other nets you mentioned?"

The ARRL has a net directory at **www.arrl.org/FandES/field/nets/client/netsearch.html**. Rod Dinkins, AC6V, maintains an extensive list of nets on his Web site: **http://ac6v.com/nets.htm**.

"All net business having been concluded, this is AG1YK closing the Newington net. The frequency is now returned to regular amateur use."

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

Ham Radio *in* the Air

Two jets, one QSO.

Eskil van Loosdrecht, AB6BC/SM5SRR

Eskil's QSL card photo. In 2003, I was copilot on an SAS McDonnell Douglas MD-82 with registration SE-DIN named, believe it or not, *ESKIL VIKING.*

I fly for an airline in Scandinavia and obtained my radio amateur license in 1979 with the call ON7EV. The experience as a ham has come in quite handy in my job as an airline pilot, especially the ability to copy a weak or distorted signal on the radio.

Some of the aircraft I fly have HF transceivers that are used for position reporting on intercontinental flights. These stations are quite powerful but can only transmit in AM and USB. The frequency coverage goes from 2 MHz to 30 MHz in 1 kHz steps. The loop antenna is embedded in the aircraft's vertical stabilizer and is tuned with an autotuner. The antenna is not very effective but then again, at 41,000 feet, even a hairpin would probably work great.

Packet radio is also included on board. The Aircraft Communications Addressing and Reporting System (ACARS) is used for everything from obtaining a clearance or load sheet to crew and passenger messages. The only differences are that the signal is transmitted as AM in the VHF aviation band at 4800 bauds.

Quiet Flight Leads to Lucky QSO

Flying big aircraft is a lot of fun and you never get tired of the view from high above. Some of these flights can get really long and monotonous since not much tends to happen between takeoff and landing. Mind you, neither the passengers nor us pilots want anything to happen!

Now give a ham any type of shortwave radio and it won't be long before he has figured out a way to have some fun with it.[1] Calling CQ at Flight Level 410 (41,000 feet) is quite interesting. Imagine half the world calling you while you admire the French Alps or the Egyptian pyramids and this from above, traveling at 600 mi/h. Everyone wants to talk to the ham in the sky and, having had the chance to do so myself from my own home station, I can understand the kick you get from that contact (QSO).

Now, a little while back, I had the one in a million chance QSO. We were flying the return flight to Stockholm from Copenhagen with a Boeing 737-800. We were climbing to Flight Level 340 when I switched on the HF station.

Two hours earlier, on the way down to Denmark, I had been talking to Seymour, W6CCP, in Anza, California who was coming in like he was next door. The radio was still on the same frequency and now I heard W7COH talking to a G4 station. I don't know why but something caught my attention. It couldn't be. Sure enough, the call sign was W7COH/AM. Now what are the chances of two airliners both with ham pilots at the controls being on the same amateur frequency at the same time without knowing of each other beforehand?

As soon as we had leveled off, I gave him a quick call: "W7COH/AM this is SKØSAS/AM calling." Paul came back. He was as surprised as I, and I guess that all the other hams must have been as well because the frequency became real quiet. Paul was on board a McDonnell Douglas MD-11 going from Chicago to Frankfurt and he still had 3 hours to go before landing. We had a nice short talk after which I had to attend to my flight duties. The pilot to pilot QSO was a first for him as well as for me.

As soon as we were done, the frequency exploded with calls directed to both Paul and myself. I had to switch the radio off but I am sure Paul saw his 3 hours go by fast. By the time he touched down in Frankfurt, I was back at home thinking about that one in a million QSO. (Thanks, Paul.)

Photos by the author.

[1]All amateur radio aeronautical mobile (/AM) operations are done only as flight duties permit. Flight safety always comes first. Operation is by pilots who are licensed ham radio operators and only aboard aircraft registered in countries where such operation is permitted. Pilot crew always consists of at least two pilots aboard the aircraft we fly.

The HF station used aboard the Boeing 737-800 is a Collins HFS900D with 400 W PEP coupled to an automatic antenna tuner (bottom right).

Eskil van Loosdrecht, AB6BC/SM5SRR, an ARRL member, is a Dutch citizen. He has lived in Belgium, Sweden and the US and has held licenses in all three. He currently resides in Sweden and has been a pilot with Scandinavian Airline Systems (SAS) since 1998.

Eskil is chairman of AMSAT-SM and in 2006 he was instrumental in the first Scandinavian ARISS contact with Christer Fuglesang, the first Swedish astronaut. Aside from ham radio Eskil enjoys restoring Model A Fords. He currently lives in Knivsta, about 40 miles north of Stockholm, with his spouse Helena. He has two boys, Jonathan, SA5AMD, and Alexander. Eskil can be reached at Kolonivagen 6A, SE-741 44 Knivsta, Sweden, **evl@post.utfors.se**. QST

In the July/August 2009 Issue:

■ Gary Steinbaugh, AF8L, presents Part 3 of "A Cybernetic Sinusoidal Synthesizer." In this installment, Gary describes some limitations of proportional control systems and explains the advantages of adding integration and differentiation steps to proportional controllers. Gary also describes the construction of the RF power meter circuit used in the project.

■ John Magliacane, KD2BD, and Bill Walker, W5GFE, describe "*SPLAT!*: An RF Signal Propagation and Terrain Analysis Tool." In addition to VHF/UHF line-of-sight paths, this program includes the Longley-Rice propagation model to predict path loss across irregular terrain. A Web interface provides a convenient way to use the extensive geographic terrain database in the calculations.

■ Rudy Severns, N6LF, presents more of his research in "Experimental Determination of Ground System Performance for HF Verticals." Part 5 focuses on the effects of different numbers of radials on received signal strength for 160 m vertical antennas.

■ Tom Warnagiris, K3GSY, introduces us to the Tapered Area Small Helix (TASH) antenna in "The Chicken Wire Wonder." Chances are, this unique broadband vertical antenna does not look like any antenna you have ever seen! An 80 m version is 14 feet high and covers an area of about 4 feet by 5 feet on the ground.

■ Maynard Wright, W6PAP, provides information on several "Alternatives to Octave" for various electronics calculations.

■ ARRL Technical Advisor Robert J. Zavrel, Jr, W7SX, presents the case for "Maximizing Radiation Resistance in Vertical Antennas" to increase the efficiency of our antennas.

■ John S. (Jack) Belrose, VE2CV, another ARRL Technical Advisor, presents a brief discussion "On Elevated Radials" after reading earlier installments of Rudy Severns' series about his experiments with HF vertical antenna radial systems.

■ Ray Mack, W5IFS, continues his software defined radio column. In this installment of "SDR: Simplified," Ray builds an SDR that will tune a single AM broadcast band station.

QEX is edited by Larry Wolfgang, WR1B, (**lwolfgang@arrl.org**) and is published bimonthly. The subscription rate (6 issues) for ARRL members in the US is $24. For First Class US delivery, it's $37; in Canada and internationally by airmail it's $31. Nonmembers add $12 to these rates. Subscribe to *QEX* today at **www.arrl.org/qex**.

Would you like to write for *QEX*? It pays $50/printed page. Get more information and an Author's Guide at: **www.arrl.org/qex/#aguide**. If you prefer postal mail, send a business-size self-addressed, stamped envelope to *QEX* Author's Guide, c/o Maty Weinberg, ARRL, 225 Main St, Newington, CT 06111-1494.

New Products

MACINTOSH LOGGING PROGRAM FROM DOG PARK SOFTWARE

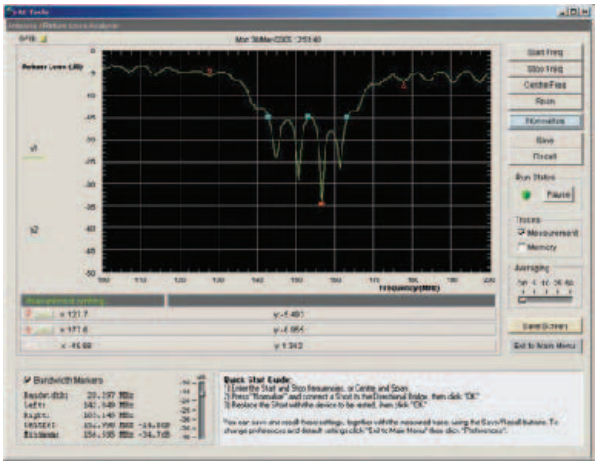
◊ *MacLoggerDX 5.0* is a radio control and logging program for the Macintosh (Mac OS X 10.5 and later). This version includes an *SQLite* data base with unlimited log size and fast operation. It supports shared access to microHAM keyer ports. All internal databases can be updated over the Internet, and there's a contest mode data entry function. *MacLoggerDX 5.0* exports ADIF format files and imports ADIF and *MacLoggerDX 3.5* and later logs. Price: $50 to upgrade for registered *MacLoggerDX 3.5* and later users. To order or to download a limited-time evaluation version, visit **www.dogparksoftware.com**.

COMPACT CROSS-NEEDLE SWR/WATTMETERS FROM MFJ

◊ MFJ-88x series SWR/power meters feature a 3-inch illuminated cross-needle meter that displays SWR, forward and reflected power simultaneously. The backlit meter scales use three colors for improved readability. SO-239 connectors handle RF input and output, and a 13.8 V dc or 120 V ac power source is required. The series includes four models: MFJ-880 — 1.6 to 60 MHz, 0-2000 W in three ranges (20/200/2000 W), price: $129.95. MFJ-882 — 1.8 to 200 MHz, 0-200 W in three ranges (2/20/200 W), price: $129.95. MFJ-883 — 125 to 525 MHz, 0-200 W in three ranges (2/20/200 W), price: $129.95. MFJ-884 — 1.8 to 525 MHz, 0-200 W in three ranges (2/20/200 W) and separate HF and VHF/UHF power sensors. Price: $169.95. To order, or for your nearest dealer, call 800-647-1800 or see **www.mfjenterprises.com**.

SOLAR POWER CONTROLLER FROM ECC

◊ Electronic Control Concepts introduces the Model 510 solar controller designed to integrate photovoltaic (PV) panels, a battery and a dc load into an operational system by connecting appropriate wires. The controller will keep a battery safely charged and ready for use at any time and offers protection by shutting down when the battery becomes fully discharged. Four tricolor LEDs keep the user informed about battery status, PV status, charge current and load current. An optional LCD readout can give additional status information. The controller has several user-selected operating modes including duty cycle, deep cycle and night mode. There are four configurations available (12, 24, 36 and 48 V). For more information and pricing, visit **www.eccxray.com**.



RF TOOLS SOFTWARE FOR COMMUNICATIONS TEST SETS

◊ *RF Tools* from Measurement Innovation is a *Windows* software application that extends the capabilities of HP/Agilent 892x series RF Communications Test Sets. Used in commercial communications for cable fault location, tuning diplexers and antennas, interference monitoring and signal strength logging for site surveys, *RF Tools* is now available at a specially discounted price for licensed Amateur Radio operators by ordering part number RFT-1000-HAM. For further information, pricing and ordering online, visit **www.measurement.net.au**.

ARRL Board Welcomes Two New Vice Directors

President Joel Harrison, W5ZN, has appointed two new Vice Directors to the ARRL Board of Directors. In the Delta Division, Harrison appointed Jeff Beals, WA4AW, to replace Sandy Donahue, W4RU, who passed away in May. Harrison appointed Jim Tiemstra, K6JAT, to replace Andy Oppel, N6AJO, who resigned in June, citing family and business reasons.

Oppel had served as Vice Director since being appointed in 2003 to complete the term of Bob Vallio, W6RGG, who became Director upon the death of Jim Maxwell, W6CF. In a message posted to the East Bay Section Web page, he commented: "I regret to inform you that family and work issues have forced me to resign as your ARRL Pacific Division Vice Director. I have enjoyed being able to serve you in that capacity for the past 6+ years and as East Bay Section Manager for 3 years prior to that. I very much appreciate the support and friendship offered by many of you and I hope I still get a chance to see many of you from time to time."

Southeastern Division Vice Director Jeff Beals, WA4AW

Jeff Beals, WA4AW

On June 1, President Harrison appointed Southern Florida Assistant Section Manager Jeff Beals, WA4AW, as the new Southeastern Division Vice Director. An Extra class licensee and ARRL Life Member, Beals was first licensed in the early 1960s as WN2OUK. Beals — who splits his time between Royal Palm Beach, Florida and Dothan, Alabama — has been an ARRL member for more than 30 years; he has served as Southern Florida Assistant Section Manager since 2002. Beals has also held appointments as Section Emergency Coordinator, Affiliated Club Coordinator, Technical Coordinator, Technical Specialist and District Emergency Coordinator.

"I am deeply honored to be chosen by President Harrison to serve as Vice Director of the Southeastern Division," Beals told the ARRL. "I am looking forward to working with Division Director Greg Sarratt, W4OZK, to provide quality service and representation to the members of the Southeastern Division. I feel that my years of service in the ARRL Field Organization provide me with a unique outlook on what our members expect of our League. My ability to listen and learn from them will assist Greg and myself to provide the representation they have come to expect from the Southeastern Division."

Beals counts emergency communications support, liaison with served agencies, radio club liaison and support, classic Amateur Radio operation and restoration, and training of Section volunteers as just some of his Amateur Radio activities. "I am always promoting Amateur Radio and the ARRL at community events, and I attend many club meetings, functions and hamfests throughout the Division," he said.

Beals is a Life Member of the ARRL, Quarter Century Wireless Association and the Antique Wireless Association; he is a Senior Grade member of the Radio Club of America and the ARRL A-1 Operator Club. He is Past President of the Fort Myers and West Palm Beach Amateur Radio Clubs and is a current member of the Palms West ARC, North Florida ARS, Wiregrass ARC, OOTC, the Florida and Alabama Contest Groups, and the Florida East Coast DX Club.

Jim Tiemstra, K6JAT

President Harrison appointed East Bay Section Emergency Coordinator Jim Tiemstra, K6JAT, to fill the Pacific Division Vice Director position that was vacated upon the resignation of Andy Oppel, N6AJO. Oppel resigned in June, citing family and work issues.

Pacific Division Vice Director Jim Tiemstra, K6JAT

First licensed in 1970 as WN9ELU, Tiemstra, an attorney, is an Amateur Extra class licensee. "I'm thrilled at the opportunity to serve an organization that I have been a member of for my entire Amateur Radio career," Tiemstra said. "I have known of and supported Pacific Division Director Bob Vallio's efforts at the League for many years, and look forward to the opportunity of working with him in those endeavors. I am deeply honored to be chosen to fill the vacancy left by Andy's resignation. Because Amateur Radio certainly has enriched and added value to many aspects of my life, I am elated to have the opportunity to contribute something back to the hobby. The future of Amateur Radio is at a critical crossroads that will involve our appeal to youth."

Tiemstra told the ARRL that his favorite Amateur Radio activities are "contesting — I seem to have more wallpaper than wall — DXing with 300 confirmed entities and DXpeditions, a poor but adequate excuse for a vacation. I have operated as 3D2TJ, PJ2/K6JAT and KH6/K6JAT and from V26DX, but I have long been involved in the public service aspects of Amateur Radio."

As a member of the Oakland ARES® group, Tiemstra responded to the 1989 Loma Prieta earthquake and the 1991 Oakland Hills firestorm. He worked with Oakland area hams and city officials to gain RACES recognition and was instrumental in forging a formal *Letter of Understanding*. In addition, he assisted Oakland ARES®/RACES in successfully championing a proposal to use post-firestorm, bond Measure I funds to acquire and install Amateur Radio equipment in the Oakland's Emergency Operations Center and each of its 30 fire stations; this has been dubbed the Emergency Communication Ham Operation (ECHO) system. Tiemstra also served as Oakland's RACES Radio Officer for more than 14 years.

In 1998, Tiemstra acted as the incorporator of the Oakland Radio Communication Association (ORCA), an ARRL affiliated club; he was a founding director and became its first president. He is a member of ORCA's board of directors and trustee of the club's call sign WW6OR. Tiemstra is a member of the Northern California Contest Club, the Quarter Century Wireless Association and 10-10 International.

CHANGES COMING FOR SWEEPSTAKES, VHF+ CONTESTS

ARRL Contest Branch Manager Sean Kutzko, KX9X, has announced some upcoming changes for the ARRL November Sweepstakes and ARRL VHF/UHF Contests. Changes for Sweepstakes will take effect this year, while the changes for the VHF+ contests took effect in June.

ARRL November Sweepstakes

The changes for Sweepstakes center on the deadline for log submissions. According to ARRL Sweepstakes Contest Manager Ken Adams, K5KA, the contest community has requested for some time to have Sweepstakes

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

FCC News

♦**FCC Chairman Nominee Genachowski, Current Commissioner McDowell Face Confirmation Hearings**: On June 16, Julius Genachowski — the man President Barack Obama picked to head the Federal Communications Commission — and current FCC Commissioner Robert McDowell appeared before the Senate's Commerce, Science and Transportation Committee for their confirmation hearing. President Obama nominated Genachowski to lead the Commission on March 3, 2009; the president renominated McDowell to his post on June 2. Genachowski is a Democratic nominee, while McDowell is a Republican. Only three Commissioners may be members of the same political party.

FCC Chairman Nominee Julius Genachowski

FCC Commissioner Robert McDowell

At his confirmation hearing, the Chairman of the Commerce, Science and Transportation Committee Senator John D. Rockefeller IV (D-WV) told Genachowski that he wants "an FCC that is transparent, that inspires confidence and that makes our digital infrastructure a model for the world. Tragically, this has not been the case for some time. Let me be very clear about the challenge before you. Fix this agency or we will fix it for you." Senator Byron Dorgan (D-ND) praised Genachowski for having the "perfect background" to run the FCC. He then added, "It seems to me that you will lead a rather unhealthy agency. We've been through a period of substantial secrecy."

Senator Rockefeller noted that during former Chairman Kevin J. Martin's tenure, the FCC was under congressional investigation for mismanagement and the focus of criticism by the Government Accountability Office (GAO) for its lack of transparency and potential misuse of data. Late last year, the House Committee on Energy and Commerce — the congressional committee that oversees the FCC — released its majority staff report "on the bipartisan investigation of the FCC's regulatory processes and management practices." The report — *Deception and Distrust: The Federal Communications Commission under Chairman Kevin J. Martin* — stated that the investigation was prompted "by allegations to the effect that [FCC] Chairman Kevin J. Martin has abused FCC procedures by manipulating or suppressing reports, data and information."

Genachowski assured the Committee that his career "inside and outside government has convinced [him] that the FCC can be a model for excellence in government, fighting for consumers and families, fostering investment and innovation, through open, fair, and data-driven processes — a 21st century agency for the information age. The FCC should consult closely with Congress, and work effectively and efficiently for the American people."

In his testimony, McDowell said the Commission should focus on attracting capital investment to the communications sector, saying that the wireless sector is becoming increasingly important. "I will work to support policies that will promote vigorous growth in the broadband markets to ensure that all Americans have access to the promise of high-speed Internet services and that the Internet remains robust, open and safe," he told the Committee.

♦**FCC Looks to Raise Vanity Call Sign Fees for Second Consecutive Year**: The FCC released a *Notice of Proposed Rulemaking and Order* (*NPRM*) on May 14 seeking to raise fees for Amateur Radio vanity call signs. Currently, a vanity call sign costs $12.30 and is good for 10 years; the new fee, if the FCC plan goes through, will go up to $13.40 for 10 years, an increase of $1.10. The FCC is authorized by the *Communications Act of 1934, as amended* to collect vanity call sign fees to recover the costs associated with that program. The vanity call sign regulatory fee is payable not only when applying for a new vanity call sign, but also upon renewing a vanity call sign for a new term. The vanity call sign fee has fluctuated over the 12 years of the current program — from a low of $11.70 in 2007 to a high of $70 (as first proposed in the FCC's 1994 *Report and Order*). In 2007, the Commission lowered the fee from $20.80 to $11.70. The FCC said it anticipates some 15,000 Amateur Radio vanity call sign "payment units" or applications during the next fiscal year, collecting $201,000 in fees from the program.

results posted faster. Currently, results are posted approximately six months after each running.

"To facilitate this request, we would like to make the 2009 ARRL Sweepstakes final results available on the Web in 60 days in the form of a PDF file," Adams said. "If this effort proves successful, we plan to shorten this window to 30 days in 2010. This PDF would simply be the scores in each category — full write-ups and detailed analysis of the Sweepstakes contest would still appear in *QST* and on the Web at a later time."

To meet this aggressive schedule, Adams said that the log submission deadline will be reduced from 30 days to 15 days. For the 2009 Sweepstakes, the deadline for CW Sweepstakes logs will be 0300 UTC on Monday, November 23, 2009. The deadline for the Phone Sweepstakes will be 0300 UTC on Monday, December 7, 2009. "The number of non-Cabrillo logs received at ARRL HQ must be reduced," Adams explained. "By receiving logs 15 days earlier, we can begin the log checking process that much faster."

ARRL VHF+ Contests

There are two major changes to the ARRL's VHF+ contests. The first change concerns the Limited Rover category. Limited Rovers may now compete on only the four lowest frequency bands available for any given contest. For the January, June and September VHF Contests, this means 6 and 2 meters, as well as 222 and 432 MHz. For the August UHF Contest, this means 222, 432 and 902 MHz and 1.2 GHz. QSOs on other bands can be made by Limited Rovers, but they will not count toward the Limited Rover's score and will be considered a checklog. "We have already applied changes to the log-checking software that will adjust the Limited Rover's QSOs above the lowest four bands to zero-point QSOs," Kutzko said.

The second change concerns the ARRL UHF Contest. For the first time, Kutzko said, the ARRL Awards Committee voted to add Club Competition to the UHF Contest, beginning in 2009. "The VHF/UHF community has been asking for this for quite some time," he explained. "We hope to see VHF/UHF clubs across the country help increase participation and get involved with this fun contest."

ARRL TEACHERS INSTITUTES OFF TO FAST START

The second and third sessions of the ARRL's Teachers Institute on Wireless Technology of 2009 wrapped up in June in Rocklin, California and Tucson, Arizona. These two TIs mark the first time that the ARRL has offered simultaneous sessions of the popular summer program for teachers. According to Education and Technology Program Coordinator Mark Spencer, WA8SME, the addition of two new TI instructors made it possible to hold two ses-

sions at the same time. "With Miguel Enriquez, KD7RPP, and Nathan McCray, K9CPO, on board," Spencer said, "we are able to hold more sessions, and in turn, involve more teachers into learning how to bring wireless technology into their classrooms."

In Tucson, Enriquez led a group of local teachers through the four day curriculum that includes basic electronics, the science of radio, space in the classroom, microcontroller programming and basic robotics. "The Tucson Teachers Institute progressed wonderfully," he told the ARRL. "I saw lots of smiles, heads nodding in understanding and teachers espousing intended commitment to provide a return on investment."

Spencer led the other session group at the Parallax facility in Northern California. "This group was more geographically diverse," he said, "with teachers from nine states from coast to coast." McCray was scheduled to lead a session in Michigan that began on June 29.

Each Teachers Institute session includes 12 teachers. According to Spencer, the curriculum is information packed and intensive. "This year," Spencer said, "we tried to connect the teachers in the Tucson session with the teachers in the California session via an AO-27 contact; satellites are part of the space in the classroom unit. Unfortunately, this was not successful due to unforeseen complications with accessing the satellite; however, a later attempt to demonstrate ham radio space technology was successful."

The final day of the Teachers Institute is dedicated to basic robotics; this unit ties together all of the other content areas taught during the Teachers Institute. The ARRL offered seven Teachers Institutes this year. Spencer said that "the aggressive schedule and increased number of teachers participating this year — 84 — is testament to the success of this ARRL Educational and Technology program that is supported by the generous League donors who share a passion for education."

MARK SPENCER, WA8SME

Each Teachers Institute session culminates with a lesson in robotics, with each participant building their own robot. The basic robotics lesson ties together all of the other content areas taught during the four day Institute.

In Brief

• **Two New Co-sponsors Pledge Support for HR 2160**: In June, HR 2160 — *The Amateur Radio Emergency Communications Enhancement Act of 2009* — gained two new Congressional co-sponsors: Republican Roscoe Bartlett (MD-6) and Democrat Bart Gordon (TN-6). Originally sponsored by Representative Sheila Jackson-Lee, a Democrat representing Texas' 18th District, HR 2160 is also sponsored by Madeleine Bordallo (Guam), Brett Guthrie (KY-2), Mary Jo Kilroy (OH-15), Zoe Lofgren (CA-16), Blaine Luetkemeyer, (MO-9) and Bennie Thompson (MS-2). For information on how to encourage your Congressional representative to sponsor HR 2160, please visit the ARRL Web site (**www.arrl.org/news/stories/2009/05/12/10818**).

• **Ohio Section Manager Joe Phillips, K8QOE (SK)**: Joe Phillips, K8QOE, who served as ARRL Ohio Section Manager since 1998, passed away suddenly at his home on Saturday, June 20. He was 68. Licensed in 1959 as KN9SYL, Phillips first joined the ARRL Field Organization as an Official Emergency Station in 1986. He became a Public Information Officer in 1989 and has served as an Official Observer since 1997. He was elected Ohio Section Manager in 1998. A graduate of Youngstown University, Phillips had a career as a journalist and a teacher. He edited six separate ham radio newsletters in Cincinnati before becoming Newsletter Editor for the Ohio Area Repeater Council in 1984, a position he held for five years. In 1986, Phillips organized the first *Ohio Repeater Directory* and in 1992, organized the Ohio Section Ham Radio Newsletter Contest. He authored a weekly ham radio newspaper column in the Sunday edition of the *Cincinnati Enquirer* called "Ham Call" and hosted a similarly named program for cable television in the Cincinnati area. "Throughout a 40-year friendship, Joe and I worked closely together on many occasions," said ARRL Great Lakes Division Director Jim Weaver, K8JE. "From his early days of supporting the county ARES/RACES unit and the Ohio Repeater Council, Joe has always provided energetic and effective leadership with a friendly, personal touch. The magnetism of his style of leadership drew the best from others who soon became solid friends, not mere associates."

SECTION MANAGER NOMINATION NOTICE

To all ARRL members in the Alabama, Alaska, Delaware, East Bay, Kansas, Michigan, New Mexico, Santa Barbara, Tennessee and Western Massachusetts 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. (See **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 September 4, 2009. If more than one member is nominated in a single section, ballots will be mailed from Headquarters on or before October 1, 2009, to full members of record as of September 4, 2009, which is the closing date for nominations. Returns will be counted November 24, 2009. Section Managers elected as a result of the above procedure will take office January 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 January 1, 2010. If no petitions are received from a section by the specified closing date, such section will be resolicited in the January 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

Nominees Sought for ARRL Board of Directors

If you're a full ARRL member in one of the following five divisions and are interested in playing a part in the League's democratic organization, here's the opportunity. Nominations are open for the offices of director and vice director for the 2010-2012 term in the Central, Hudson, New England, Northwestern and Roanoke divisions.

ARRL Divisions

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 (see page 15 of any recent *QST* for a list of the divisions, directors and vice directors). These 15 directors serve for three-year terms, with five standing for election each year.

Just as in national or state politics, ARRL voters/members have the privilege and responsibility to decide that they like the actions of their incumbent representatives and support them actively for reelection or to decide that other representatives could do a better job, and to work for the election of those persons. Vice directors, who succeed to director in the event of a midterm vacancy and serve as director at any Board meeting the director is unable to attend, are elected at the same time.

How to Nominate

1. *Obtain official nominating petition forms*. This package consists of a cover letter; a reprint of this election announcement; blank Official Nominating Petition forms and Candidate's Questionnaires for the offices of director and vice director; a copy of the ARRL Articles of Association and Bylaws; and an informational pamphlet for candidates.

Any full member residing in a division where there is an election may request an official nominating petition package. You don't need to be a candidate to request the forms. Your request for forms must be received by the Secretary *no later than noon Eastern Time on Friday, August 14, 2009*. There are separate forms for director and vice director nominations.

2. *Submit petition with statement of eligibility and willingness to serve*. Official forms bearing the *signatures of 10 full members of the division* and naming a full member of the division as a candidate for director or vice director, must be submitted, with a statement *signed by the candidate* attesting to his or her eligibility, willingness to run and willingness to assume the office if elected. These documents must be filed with the secretary *no later than noon Eastern Time on Friday, August 21, 2009*. Only original documents can be accepted; *no facsimiles of any kind are acceptable*. On Monday, August 24, 2009, the secretary will notify each candidate of the names and call signs of each other candidate for the same office. Candidates will then have until Friday, September 4, 2009, to submit 300-word statements and photographs, if they desire these to accompany the ballot, in accordance with instructions that will be supplied.

3. *Ethics and Elections Committee to certify eligibility*. In accordance with the Bylaws, an Ethics and Elections Committee, composed of three directors not subject to election this year, is responsible for the conduct of the election. This year, the Ethics and Elections Committee consists of Greg Sarratt, W4OZK, chair; Brian Mileshosky, N5ZGT, and Jay Bellows, KØQB.

Call for Nominations

Nominations are open for director and vice director in the five divisions mentioned above for the three-year term beginning at noon January 1, 2010.

The nominee must be at least 21 years of age and have been licensed and a full member of the League for a continuous term of at least four years immediately preceding nomination. No person is eligible whose business connections are of such nature that his or her influence in the affairs of the League could be used for his or her private benefit or would materially conflict with the activities or affairs of the League. The primary test of eligibility under this portion of the Article shall be full compliance with the Articles, Bylaws and Rules and Regulations of the League relating to ethics, elections and conflicts of interest.

Balloting Will Follow

If there is only one eligible candidate for an office, he or she will be declared elected by the Ethics and Elections Committee. Otherwise, ballots will be sent to all full members of the League in that division who are in good standing as of September 10, 2009. (You must be a licensed radio amateur to be a full member.) The ballots will be mailed not later than October 1, 2009 and, to be valid, must be received at HQ by noon Eastern Time on Friday, November 20, 2009. A group of nominators can name a candidate for director or vice director, or both, but there are no "slates," as such. Each candidate appears on the ballot in alphabetical order. If a person is nominated for both director and vice director, the nomination for director will stand and that for vice director will be void. A person nominated for both offices does have the option, however, of declining the higher nomination and running for vice director if he or she wishes. Because all the powers of the director are transferred to the vice director in the event of the director's death, resignation, recall, removal outside the division or inability to serve, careful selection of candidates for vice director is just as important as for director.

Absentee Ballots

All ARRL members licensed by the FCC, but temporarily residing outside the US, are eligible for full membership. Members overseas who arrange to be listed as full members in an appropriate division prior to September 10, 2009, will be able to vote this year where elections are being held. Members with overseas military addresses should take special note of this provision; in the absence of information received to the contrary, ballots will be sent to them based on their postal addresses. Even within the US, full members temporarily living outside the ARRL division they consider home may have voting privileges by notifying the Secretary prior to September 10, 2009, giving their current *QST* address and the reason that another division is considered home. If your home is in the Central, Hudson, New England, Northwestern and Roanoke divisions but your *QST* goes elsewhere, let the ARRL Secretary know as soon as possible, but no later than September 10, 2009, so you can receive a ballot from your home division.

The Incumbents

These people presently hold the offices of director and vice director, respectively, in the divisions conducting elections this year:

Central — Dick Isely, W9GIG and Howard Huntington, K9KM

Hudson — Frank Fallon, N2FF and Joyce Birmingham, KA2ANF

New England — Tom Frenaye, K1KI and Mike Raisbeck, K1TWF

Northwestern — Jim Fenstermaker, K9JF and Bill Sawders, K7ZM

Roanoke — Dennis Bodson, W4PWF and Patricia Hensley, N4ROS

For the Board of Directors:

May 19, 2009

David Sumner, K1ZZ
Secretary

NBEMS — a Digital Emcomm Tool

Dave Kleber, KB3FXI, O'Hara Twp, PA Emergency Management Agency, **kb3fxi@arrl.net** *and Harry Bloomberg, W3YJ, Assistant SEC, Western Pennsylvania Section,* **w3yj@arrl.net**

COURTESY HARRY BLOOMBERG, W3YJ

The Narrow Band Emergency Messaging System (NBEMS) in operation on 80 meters.

Hurricane Ivan

The remnants of Hurricane Ivan had nearly finished dumping 7 inches of rain on Pittsburgh when Dave Kleber, KB3FXI, received a message. He could expect a couple of busloads of evacuees from flooding in Sharpsburg to begin arriving soon at his position at Parkview Fire Hall. Dave and his crew rapidly began assembling bunk beds and preparing the shelter. Soon, 80 evacuees had arrived.

Not too long afterwards Dave received another message. What were the names, phone numbers and addresses of the people? Landline phones were a mess, the cell phone network was overloaded and the public service radio frequencies were crowded with emergency calls. Amateur Radio was about the only reliable means of communications left.

"Don't they know how long it will take to read all that over the air?" thought Dave.

That was the moment when Dave realized that the traditional Amateur Radio emergency communications model of a ham with a radio at a shelter was no longer good enough.

Why Digital Emcomm?

The needs of those we serve during disasters and emergencies have changed. We now need to be able to send lists of evacuees in a format compatible with a spreadsheet, inventories of required medical supplies, phone numbers of officials, weather information, directions to an emergency operations center, bulletins of critical situation updates. In other words, we now need to be able to send data not suited to message forms.

The problem is that data is not suited to being relayed by voice. Imagine how long it would take to read a list of evacuees or how hard it would be to spell out phonetically a long list of pharmaceuticals.

So we set out to find a good way to send data. Unfortunately, many of the methods that hams use are either impractical or too expensive for western Pennsylvania, which is very hilly with deep valleys that are difficult for VHF and UHF radio waves. The area does not have much of a digital Amateur Radio infrastructure, so any solution would have to work well with weak signals in valleys and not require an extensive build-out.

The Solution: MT63 and NBEMS

After several years of experimentation, we hit upon a mode that would work well on VHF and UHF, MT63.

MT63, developed by Pawel Jalocha, SP9VRC, is a very robust mode that transmits data on 64 tones simultaneously in bandwidths of 500 Hz, 1000 Hz or 2000 Hz. It can also be configured to transmit so much redundant data that a 1-2 second gap in a transmission would not lead to a loss of data at the receiving end. MT63 is very forgiving of audio levels, so careful tweaking of volume is not necessary during an emergency. Finally, MT63 works very well in a weak signal environment, so a 2000 Hz wide MT63 signal (abbreviated MT63-2000) could be received deep in our rugged terrain. MT63 also works very well through FM repeaters. Although western Pennsylvania is lacking in digital infrastructure, it has an abundance of repeaters, as there are dozens in the Pittsburgh area.

There was one other property of MT63 that makes it very useful as an emcomm mode. We learned that one can just hold a radio's microphone up to a computer's speakers and be able to transmit MT63. Likewise, at the other end, another ham can hold his radio's speaker up to a computer's microphone and the data will be received by the computer's sound card. In other words, although a radio-to-computer interface like a RIGblaster or SignaLink is great, you really don't need one when you use this method we call "acoustical coupling." This means that you don't have to waste valuable time fumbling around with an octopus of cables or be sidelined by forgetting a cable or an interface.

We now started looking for software that could do MT63. We found one called Narrow Band Emergency Messaging System (NBEMS). NBEMS (**www.w1hkj.com**) consists of two parts: *fldigi*, which acts as a sound card modem and generates audio signals in many different modes in addition to MT63 like MFSK, PSK31 and Olivia; and *flarq*, which allows one to send binary files and place an Automatic Repeat Request (ARQ) layer of handshaking on top of NBEMS. With NBEMS, one can use a repeater channel for either voice or data as needed. There's no need for a channel to be dedicated to just one mode.

There were other features of NBEMS that appealed to us. It ran not only on *Windows XP* and *Vista*, but also *Linux* and Mac. It was easy to install and support. It would transmit PSK31 and RTTY signals so it could be used for recreational nonemcomm hamming. And it was *free*. NBEMS is released under the GNU Public License (GPL), which means that it is unencumbered by patent or restrictive licenses. It also means that you receive the original source code for the program and you're free to

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

modify the code as you see fit, so you're protected against a vendor going out of business or changing the terms of software use.

NBEMS also allowed us to easily send bulletins to large numbers of stations at one time. With connected networks like packet radio, a bulletin station can send messages to only one station at a time, or to put it another way, there is a one-to-one relationship between the station originating the bulletin and receiving stations. But any station monitoring a channel containing NBEMS data would receive the bulletin. There is a one-to-many relationship between sender and receiver. One can therefore use NBEMS to transmit situation updates, weather information, road closures and other critical information to many stations at the same time. Stations receiving the data can be unattended. All digital NBEMS data transmitted will be captured by *fldigi* and can be examined at the convenience of the operator in the field.

The combination of NBEMS, MT63 and acoustical coupling gave us a powerful, flexible, relatively simple means of sending and receiving data. We now had a digital emcomm package that required only a ham, any VHF/UHF FM radio and nearly any computer. No need for external modems, TNCs nor dedicated digital mode radios; no modified radios; interfacing between radio and computer was no longer a headache; the software was "free"; we did not need to procure, set up, configure and maintain a dedicated digital infrastructure, and we did not need to worry about an incident occurring outside the range of any specialized digital network.

Was the Message Received?

There was still one obstacle for us to hurdle before NBEMS could be adopted. How do you know that a particular message had been received 100%? MT63 is very robust, but for some critical emergency traffic, one needs to know for certain that a message was received. With many shorter text messages, a ham can just "eyeball" the message and see that something's amiss. But how can one determine that data exported from a spreadsheet, was received intact? The *flarq* program can do this, but only at a cost of significant overhead.

We proposed a solution to the problem to the NBEMS developers. How about embedding a checksum in the data sent by *fldigi* that could be used by the receiving station to determine if the message had been received intact? A checksum is the result of a calculation involving all of the data in the message. If the receiving station computed the same checksum in the message as the sending station, the message had been received 100%. This is not as elegant a solution as *flarq*, but it was more efficient and simpler to implement.

After some discussion, the developers went to work and in a very short period of time came up with a solution, a program called *Wrap*. *Wrap* would envelop a message with special strings to indicate the start and end of "wrapped" data. Within this wrapped message would be stored a checksum and the name of a file.

This wrapped message would then be sent using *fldigi*. At the receiving end, *fldigi* would look for the start and end of the wrapped data. Once a wrapped message had been identified, *fldigi* would extract it and store it in a folder. The operator would then run *Wrap* against this file to compute a checksum on the received data and to compare it to the checksum that the sending station had embedded in the message. If the two checksums were equal, the receiving operator would see a message indicating success and the original message would be extracted.

Training

We then started an effort to recruit and train operators in using NBEMS. Dave organized an informal group named wpaNBEMS (**www.wpanbems.org**). This group holds training nets on repeaters using Olivia and MT63.

Harry volunteered as an Assistant Section Emergency Coordinator and wrote a western Pennsylvania digital emcomm standards document and helped train ARES® groups.

One recent training net illustrated the portability of the NBEMS software and the fact that it does not require very powerful or expensive hardware. We were able to successfully send and receive MT63 data between machines running Windows Vista, Windows XP, Macintosh OS X and Ubuntu Linux. Several of our net members use Dell Mini 9s for NBEMS, running both Linux and Windows XP, and find that they work very well as a cheap digital emcomm workstation.

Applying Lessons Learned

Dave and Harry participated in the 2008 Simulated Emergency Test. Harry was assigned to a parking lot of UPMC St Margaret Hospital in Pittsburgh. Dave was located at a simulated EOC at Skyview Radio Society's clubhouse approximately 10 miles away.

Harry was asked to use NBEMS to send a text file exported from a spreadsheet. This spreadsheet contained the names of 25 patients sent to the hospital, and for each patient, a nine digit ID number, a phone number and a postal address.

Just as Harry was about to begin transmitting the data, the repeater that had been chosen for the data transmission failed. No big deal. Harry and Dave met on a backup repeater and the data file was successfully transmitted in just under 2 minutes. The harsh lesson that Ivan taught us had been learned.

The authors would like to thank KB3JXG, W1HKJ, KH6TH, NAØB, W3HRK, N3MSE, N3SPW and N3LLR.

EMCOMMENTARY

Many Tools, One Tool Box

This month's column discusses just one tool Amateur Radio operators can use to move information across the bands. It is an example of a tool that was found that addresses the needs encountered locally. We get many questions about which mode, frequency band or equipment should be used for emergency communications. The simple answer is always use what works for you. That usually brings on the follow-up of "I don't know what works."

The Emergency Preparedness & Response Program of the ARRL is not the entity to be inventing and implementing communications systems to address specific needs that are encountered in the field. We do not have the knowledge of who you need to communicate with, over what distances, passing what kind of data, under what conditions. Those variables must be investigated, discussed, examined and finally implemented in your local area — be that the county your ARES® program operates in, or in the larger area of a region or state.

One of the key items that does dictate what must be used is based upon who you need to communicate with and what systems others are using to provide collaborative communications to the served agencies and organizations. Once you determine that, you can design your system. For a comparison in the computer world, we wouldn't want you to think about purchasing "netbooks" if the responsibility you had was to determine the DNA structures of all life on earth. There are other computing tools better designed to do that job. The same is true for our world. You wouldn't just install 6 meter transceivers if the entire Amateur Radio response capabilities in your area were based upon repeaters in the 222 and 902 MHz bands.

A question that is the most prevalent is, "How come you don't designate 'X' system or mode for emergency communications? If you did, we could all plan on using that system everywhere." The answer is simple. Designating a single system or mode to use creates a potential single point of failure. As emergency communications planners, our role is to determine all the possible scenarios in which Amateur Radio resources can be applied. Just as important are the Amateur Radio applications (modes, frequencies, etc) that are applied and what the backup systems are when failure occurs. So you'll never hear of a single equipment or mode standard — it's not good preparedness. The NBEMS is one solution to an application need — and one of the tools in the toolbox of Amateur Radio resources. We need to continue to always keep that toolbox full.

Dennis Dura, K2DCD
Manager, Emergency Preparedness and Response

This Month in Contesting

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

CLUB PARTICIPATION IN CONTESTS

There are several reasons to join a contesting club: making new friends, meeting people to operate contests with and maybe even finding a little extra muscle when it's time to put up your tower. Contest clubs also combine their members' individual scores and enter many events in Club Competition, hoping to win a commemorative gavel for their club's efforts.

A (Very) Brief History and How-To

Club competition in ARRL contests has a very rich tradition going back to 1936. That year saw the first club competition in the ARRL Sweepstakes, with one of the great Amateur Radio clubs, the Frankford Radio Club, claiming the first awarded gavel. Today, club competition exists in several ARRL events: the November Sweepstakes, the ARRL DX contests (SSB and CW), the RTTY Roundup, the January, June and September VHF contests, the 10 Meter Contest and the 160 Meter Contest. This past May, club competition was also added to the August UHF Contest. The pride of a club's members can spark generally good-natured rivalries but, in the heat of competition, these can become very intense.

Clubs compete in ARRL events based on their club's size: Local, Medium and Unlimited. Local clubs are defined as those that submit no more than 10 logs for any given event, Medium clubs can submit up to 50 entries for an event and Unlimited clubs can submit 51 or more entries for any one contest. In addition to the number of entries, a club's category is also defined by the size of their geographic "footprint." Local clubs must have all members residing within a 35 mile radius from the club's declared center. Both Medium and Unlimited club's geography is defined as either a 175 mile radius or an entire ARRL section, at the club's discretion. This is known as the "Club Circle."

"Kid, Have You Affiliated Yourself?"

The other major requirement to be eligible for club participation is ARRL affiliation. What does that mean? It means that your club has to be registered with ARRL, serve the amateur community in some capacity, have a constitution and have an annual club report on file with ARRL's Field Services branch within the last two years. This is required of all clubs in the US.

Who Can Submit a Club Score?

Members of clubs have to meet certain requirements before their score is able to count for a club's score. The biggest requirement is one of residence. A club member must maintain their primary residence and operate within the club's circle in order for their scores to count. A club member must be considered "in good standing" with their club for their scores to count. In addition, all scores for a club must come from a station operated within the club's circle. These rules are to ensure that a club's score is made up of only current members who live in the area and doesn't include any "hired guns" to boost their score. There is one exception: If a club member is on a DXpedition outside the country during the ARRL DX Contest, Medium and Unlimited clubs may count that DXpedition in their score.

Club's Responsibilities

So how does the Contest Branch know who is eligible to submit scores for a club? Clubs need to tell the Contest Branch who meets the eligibility requirements. The Club Competition rules state: "The Club Secretary or designated Club Scorekeeper for an affiliated club must submit a list of all club members eligible to compete for the club (not a club roster) and which level (unlimited, medium, local) they wish to enter ***for each competition*** within 30 days after the contest." This means it's not sufficient for a club to simply submit a roster of all its members. For each contest, it is the club's responsibility to identify the category the club will enter and submit a list of eligible club members. A club's secretary, contest manager or other appointed official can simply send me an e-mail with their eligibility list for each event the club wishes to enter.

Multiops and Guest Ops

Many contesters operate as part of a team from one location, as a guest at a fellow contester's house or from another country during a contest. Club competition rules allow these operations to count for a club's score, under certain conditions. Generally speaking, the station and the operators must both be within the club circle to qualify. For multi-operator efforts, at least half of the multi-operator team 2must belong to the club for the contest score to count for that club.

Club Competition is an excellent way to unite members of your club and get them on the air to compete for some serious bragging rights. If you're looking for a fun activity for your club, this just might do the trick. For more information, look for the complete Club Competition rules in the General Rules for All ARRL Contests, found at **www.arrl.org/contests/forms**. I hope to see some new clubs on the Club Competition list for the upcoming ARRL events.

Do you have a contest-related question or comment? Drop me a line and I'll consider it for publication in my column.

In the July/August "Contesting 101"

This Month in the *NCJ*'s Contesting 101: Staying QRV: Station and Operator Maintenance. Kirk Pickering, K4RO, discusses tips and tricks for keeping your station and yourself in top form when not competing. 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

Get Paddling. *If you're in a CW contest and using your logging program to send CW, put a CW paddle in line as well. A paddle comes in very handy when you want to send specific fills, request specific information or say a quick hello to a friend who gives you a point. Put a mouse pad underneath the paddle to keep it from sliding around the desk, too.*

CONTEST CORRAL

in association with the *National Contest Journal*

AUGUST 2009

Start and Finish	HF	VHF+	Contest Title	SSB	CW	Dig	Exchange	Sponsor's Web Site
Aug 1, 0000Z - Aug 1, 2359Z	1.8-28	50	TARA Grid Dip Contest			✘	Name and grid square	www.n2ty.org/seasons/tara_grid_rules.html
Aug 1, 0001Z - Aug 9, 2359Z	1.8-28	50,144	Lighthouse-Lightship Week	✘	✘	✘	Serial or ARLHS mbr/light nr, name, S/P/C	ialhp.org
Aug 1, 0001Z - Aug 2, 2359Z	28		10-10 Summer Phone QSO Party	✘			Call, name, 10-10 number, S/P/C	www.ten-ten.org
Aug 1, 1200Z - Aug 1, 2359Z	1.8-28		European HF Championship	✘	✘		RS(T), last two digits of 1st year licensed	lea.hamradio.si/~scc/euhfc.html
Aug 1, 1800Z - Aug 2, 1800Z		222+	ARRL UHF Contest	✘	✘	✘	Grid square	arrl.org/contest
Aug 1, 1800Z - Aug 2, 0600Z	1.8-28		North American QSO Party		✘		Name and state	ncjweb.com
Aug 2, 1300Z - Aug 3, 1630Z	3.5-14		South Africa HF DX Contest	✘			RS and serial	www.sarl.org.za
Aug 8, 0000Z - Aug 9, 2359Z	3.5-28		Worked All Europe		✘		RST and serial (see Web for QTC rules)	www.waedc.de
Aug 8, 1600Z - Aug 9 2359Z	1.8-28	50-440	Maryland-DC QSO Party	✘	✘	✘	Maryland County/City or S/P/C	www.w3cwc.org
Aug 15, 6 AM - Aug 16, 12 AM		10G+	ARRL 10 GHz and Up Contest	✘	✘	✘	6-character grid locator	arrl.org/contest
Aug 15, 0000Z - Aug 16 1600Z	3.5-28		SARTG WW RTTY Contest			✘	RST and serial	www.sartg.com
Aug 15, 0800Z - Aug 16, 0800Z	1.8-28		Russian District Award Contest	✘	✘		RS(T), serial or Russian district	rdaward.org/rdac1.htm
Aug 15, 1200Z - Aug 16, 1200Z	1.8-28	50	Keymen's Club of Japan Contest		✘		RST and JA pref/dist or continent	www.jarl.com/kcj
Aug 15, 1500Z - Aug 15, 1800Z	1.8-28		Silent Key Memorial Sprint		✘		RST, S/P/C, QRP ARCI mbr nr or pwr	qrparci.org
Aug 15, 1800Z - Aug 16, 0600Z	1.8-28		North American QSO Party	✘			Name and state	ncjweb.com
Aug 15, 2000Z - Aug 17 0200Z	1.8-28	50,144	New Jersey QSO Party	✘	✘		Serial and NJ county or S/P/C	www.qsl.net/w2rj
Aug 22, 0700Z - Aug 23, 2200Z	1.8-28		Hawaii QSO Party	✘	✘	✘	RS(T), S/P/C or maritime regn or HI county	www.karc.net
Aug 22, 1600Z - Aug 23, 0400Z	3.5-28		Ohio QSO Party	✘	✘		Serial and S/P or "DX"	www.ohqp.us
Aug 29, 0600Z - Aug 30, 1159Z	3.5-28		ALARA Contest	✘	✘		RS(T), serial, ALARA nr, name	alara.org.au
Aug 29, 1200Z - Aug 30, 1159Z	3.5-28		YO DX Contest	✘	✘		RS(T), serial or YO district	www.hamradio.ro
Aug 29, 1200Z - Aug 30, 1159Z	3.5-28		SCC RTTY Championship			✘	RST, 4-digit year first licensed	lea.hamradio.si/~scc/rtty.html
Aug 30, 1400Z - Aug 30, 1600Z	3.5-14		South Africa HF DX Contest		✘		RS and serial	www.sarl.org.za

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, additional contests and a downloadable PDF version online at www.arrl.org/contests

Sean's Picks

■ **State QSO Parties this month: Hawaii, Maryland-DC, New Jersey, Ohio**
2009 is the Year of the State QSO Party! Visit **www.arrl.org/ysqso** for details!

■ **10-10 Summer Phone QSO Party (August 1-2):** Sponsored by Ten-Ten International, this a great contest to take advantage of the summer Sporadic-E season and get on 10 meters! A great activity for Technician class licensees. How many 10-10 membership numbers can you collect?

■ **ARRL UHF Contest (August 1-2):** Get on 222 MHz, 432 MHz and even higher! SSB and CW activity will be high, but there will be plenty of FM folks to work as well. This is also the first year Club Competition is allowed for this contest, so get your club active and your club just might win a gavel!

■ **North American QSO Party, CW (August 1-2):** 12 hours of great CW fun. The exchange is simple: your name and your state. Dust off that paddle or straight key and make some CW QSOs!

■ **Worked All Europe CW Contest (August 8-9):** There is no other contest like WAE; be on the lookout for stations asking you for QTC, or a repeat of your contest log…they get extra points that way. Just be sure to give them a little extra time to copy your info. This one is unique and lots of fun!

■ **SARTG Worldwide RTTY Contest (August 15-16):** The Scandinavians know how to sponsor a RTTY contest — they've been doing it for a long time! Everybody works everybody in this one.

■ **North American QSO Party, SSB (August 15-16):** If CW isn't your bag, try the SSB version! Same rules, different mode.

Contest results — Contest Calendar — Stories from the participants — Tips and tricks — all-time record scores — On-air strategies — Award winners — *and more!* All available at www.arrl.org/contests.

AUGUST 2009 QUALIFYING RUNS

♦ W1AW Qualifying Runs are 10 PM EDT Wednesday, August 5 (0200Z August 6) and 4 PM EDT (2000Z) Thursday, August 20. The West Coast Qualifying Run will be transmitted on 3590 and 7047.5 kHz by station K9JM at 9 PM PDT Wednesday, August 12 (0400Z August 13)(10-40 WPM). Unless otherwise indicated, code speeds are from 10-35 WPM.

The 2009 ARRL DX CW Contest Results

February 21-22, 2009 — record scores despite a record solar slump

Scott Robbins, W4PA
w4pa@yahoo.com

The observation that the sunspot cycle is not cooperating with the desires of the contesting community has become a tad tired, so let's accept that as the default condition and go right into talking about the scoring in the 2009 ARRL DX CW contest, shall we?

While ol' Sol remains in slumber mode, the good news is that scores were on the rise from the horrid band conditions seen in the 2008 running. All-band Single-op and Multi-op scores for the top spots were higher from the DX side for six of the seven major Single operator and Multioperator categories. Superb band conditions on the low bands led to a number of record scores in various call areas on 20 through 160 meters and four continental category records from the DX side. New overall scoring records were set in the W/VE 20 meter Single Band, DX 80 meter Single Band and DX 160 meter Single Band categories.

Recognition is traditionally afforded in the preamble of the contest summary article to those operators and stations who have won their categories multiple years in a row. In 2009, Ed, N1UR, has made it a four-peat with his fourth consecutive win in the W/VE Low Power category. Chas, K3WW, has taken the top spot in W/VE Single Operator, Assisted for the second consecutive year. Contest Hall of Famer Frank Donovan's, W3LPL, Maryland station has scored a hat trick in the W/VE Multi-Multi category with a third consecutive ARRL DX CW win.

Setting new overall records in the DX 80 meter Single Band and DX 160 meter Single Band categories operating from the Bahamas were Kevin, K4PG, as C6APG on 80 meters and Bob, N4BP, who operated C6AKQ on 160. Congratulations to both of these fine operators on a job well done.

New overall record holder for the W/VE 20 meter Single Band category is Bob, KQ2M (CT) who broke one of the oldest single band overall records dating all the way back to 1992.

Call area records were set from the W/VE side in numerous Single Band categories. On 160 meters, new call area records are in place for W1 (K8PO, ME); W3 (W3GH, EPA); W4 (W4ZV, NC); W5 (K5RX, NTX), and W7 (N6TR, OR). On 80 meters, new call area records were notched for W1 (KT1V, NH); W4 (N4PN, GA), and W5 (K5NA, STX). On 20 meters, new call area records were set for W1 (KQ2M, CT); W2 (N2MF, WNY) and W4 (VE7ZO, GA).

Continental records for the DX side were set in the Single Op Assisted category for Africa by D4C (YL2KL, op), Single Band 20 meters for Oceania by KH7XS (K4XS, op), Multioperator Single Transmitter for Africa by EF8M and Multioperator, Multitransmitter for Africa by CT9L.

W/VE Single Operator and Regional Coverage

West Coast top spots in the High Power category were led by Dan, N6MJ, who operated W6YI (SDG) to a score of just over 2.2 million points and a number 15 national finish. Second and third place went to 2007 West Coast High Power winner Denis, K7GK (OR) and Bob, K6XX (SCV). Low Power was won by Mike, KM6Z (LAX) by a 27k point margin over second place finisher Dan, N7AN (WWA). West Coast QRP was a reversal of the 2008 number 1 and number 2 spots with Frank, W6JTI (SF) edging out Gary, N7IR (AZ) by less than 2k points.

In the High Power category, Steve, N2IC (NM) finished as top scorer in the Midwest Region, while second and third place went to Roy, AD5Q at WXØB (NTX) and Steve, KØSR (MN). Low Power for the Midwest was topped for a third consecutive year by Marv, N5AW (STX) who also finished number 4 nationally. In second place with a number 12 national finish was Jim, WØUO (NTX). QRP was won by Phil, NØKE (CO) with a substantial lead over second place Jim, NØUR (MN).

Central Region High Power was led by Ron, VE3AT, operating as CG3AT (ON) with 2.363 million vs second place Greg, K8GL (MI) at 2.086 million. Third was John, N8AA (OH). Low Power was topped by Yuri, VE3DZ (ON) and Terry, N4TZ (IN) who also finished number 4 and number 6 nationally. QRP was led by Michigan's Tim, KT8K, followed by Anthony, K8ZT (OH).

The Southeastern Region High Power category was led by Paul, K1PT (SFL) with a comfortable lead over second and third place finishers Larry, N6AR (NFL) and Terry, N4TB (WCF). Low Power was led by number 8 national finisher Nate, N4YDU (NC) with a fine 1.1 million point effort, followed by Ron, WD4AHZ (WCF) at 702k. The 2009

GABRIEL CORNEJO, LU3DAT

From left: Fernando, LW2DX; Alberto LU1DZ, along with contest rookies Gabriel, LU3DAT, and Marcelino,LU7DSU, operated as LU1DZ. Their Multi-Single effort was good for fourth place in South America.

US

Single Operator, High Power

Call	Score
VY2ZM (KØDQ, op)	4,892,940
NN3W (@ N3HBX)	4,066,260
K3CR (LZ4AX, op)	3,868,128
K5ZD (W1UE, op)	3,717,186
AA1K	3,637,740
K1ZZ	3,634,962
WC1M	3,192,783
VY2TT (K6LA, op)	3,092,202
N2LT	2,933,856
W1WEF	2,684,079

Single Operator, Low Power

N1UR	2,175,624
WA1Z	1,793,880
W3EF	1,768,530
N5AW	1,409,262
VE3DZ	1,365,471
N4TZ	1,283,040
N3DG	1,228,110
N4YDU	1,105,272
K2PS	1,083,396
W1JQ	899,946

Single Operator, QRP

K3ZM	648,774
K2DM	534,060
K3PH	512,460
KR2Q	507,771
N1TM	371,862
W9WI	303,276
N4CW	291,798
AA1CA	284,769
W6JTI	247,800
N7IR	245,853

Single Operator, Unlimited

K3WW	4,317,522
K2Z (K2NG, op)	3,962,280
AA3B	3,433,560
K9NW	2,324,508
N2MM	2,304,606
N1IW	2,071,539
K2SG	1,795,248
W8MJ	1,773,648
W9IU	1,679,400
W1CSM	1,624,476

Single Operator, 10 Meters

K4WI	900
K5DU	828

Single Operator, 15 Meters

K4EA	104,922
NY3A	69,441
WB4TDH	20,625
W2RR	15,180
K8IR	7,455
K1SE	6,216
WØHBH	5,124
K7BG	2,961
NK6A	2,880
NE6M	2,793

Single Operator, 20 Meters

KQ2M	766,479
NQ4I (VE7ZO, op)	731,880
N2MF	620,031
W1MU	562,275
K2XA	535,080
K9BGL	389,958
WO4O	364,509
K4FJ	357,513
N4ZZ	320,910
W9XT	285,762

Single Operator, 40 Meters

K9OM	425,376
KD2RD	329,376
N4UA	187,254
VE1DT	175,770
N6MA	147,924
KD2I	142,020
W6PU	138,039
AC8Y	107,793
W3BP	103,074
VE3YAA	77,112

Single Operator, 80 Meters

KT1V	328,383
N4PN	325,422
W3UA	245,700
K5NA	155,376
W5ZN	137,592
KU2M	119,244
K5GO (KØRO, op)	108,240
VE3XB	90,000
K1GU	87,480
AI2N	66,456

Single Operator, 160 Meters

W4ZV	101,199
K8PO	91,464
W3GH	37,026
K4PI	34,371
K5RX	28,416
K6ND	27,258
K2YR	25,986
N2WN	25,740
WD5R	22,101
K1VW	21,060

Multioperator, Single Transmitter

K1LZ	4,864,200
W3BGN	4,525,245
KT3Y	4,425,498
K9RS	4,230,810
K8AZ	3,713,868
K2QMF	3,399,708
WW2DX	3,256,980
K9SD	1,932,510
W2XL	1,632,000
K5WA	1,514,880

Multioperator, Two Transmitter

WE3C	7,901,712
N3RS	6,556,320
K1AR	5,500,731
W4RM	5,037,522
NØNI	4,793,886
NR5M	4,580,082
K1KI	4,490,343
KB1H	4,211,592
KØTV	4,145,025
N2RM	3,360,006

Multioperator, Unlimited Transmitter

W3LPL	9,389,328
K3LR	9,139,320
NR4M	7,778,490
K1XM	7,569,276
K1TTT	6,792,870
W2FU	6,647,562
K1RX	6,546,972
NY4A	6,318,000
W3PP	5,479,560
K1IR	3,075,045

Southeastern and national number 1 QRP finisher was Peter, K3ZM (VA), followed by Doug, W9WI (TN), second place.

The Northeast Region High Power categories duplicate the national top finishes with Scott, KØDQ, operating as VY2ZM (MAR), Rich, NN3W (MD) operating from N3HBX and Alex, LZ4AX operating as K3CR (WPA) in the number 1, number 2 and number 3 slots. Low Power top finishers are Ed, N1UR (VT) and Bob, WA1Z (NH). QRP top spots George, K2DM (NNJ) and Bob, K3PH (EPA).

W/VE Unlimited and Single Band Categories

An overall seventh win and his second consecutive win in the unlimited category has been notched by Chas, K3WW (EPA). Multipliers are not the only way to win this category; despite being well behind in multiplier count to eventual second place finisher Noah, K2NG, operating as K2Z (NNJ), Chas' 475 QSO lead was definitely more than enough to take the top spot overall. Top unlimited score from outside the East Coast was Mike, K9NW (IN) who operated at the K9UWA station for a fourth place finish.

In the single-band categories on the low bands, W4ZV (NC) made it a two-fer with his second consecutive win on 160 meters over K8PO (ME). 80 meters featured a very close race with Ted, KT1V (NH) narrowly edging out Paul, N4PN (GA). N4PN racked up 101 multipliers for a DXCC weekend on 80 but Ted's 90 extra QSOs brought him the victory. Dick, K9OM (NFL) was our 40 meter champion for 2009 with a comfortable margin over second place John, KD2RD (NLI).

On the high bands, 20 meters featured Bob, KQ2M (CT) setting a new overall scoring record and taking the win over Jim, VE7ZO who operated NQ4I (GA). 15 meters had Neal, K4EA (GA) making 410 QSOs to take the top spot over Steve, NY3A (EPA). Slim pickings on 10 meters led Cort, K4WI (AL) to a second consecutive win on the band with 30 total QSOs completed.

Overall W/VE Multioperator Categories

The four man team of K1VR, E78WW, N8BO and K3JO took top honors in the Multioperator, Single Transmitter category from K1LZ (EMA) with a winning score of 4,864,200 over second place finishers K2TW, NO2R, W2GD, and W3BGN at W3BGN (EPA). Top Multi-Single score from outside the northeast USA went to the K8AZ crew in metro Cleveland, Ohio, pulling in at number 5.

Multi-Two featured a runaway win from the crew of W3FV, NN3Q, KQ3F, KF3B and W2GD (yes, you read that right — W2GD at two QTHs for ARRL DX CW 2009) operating as WE3C (EPA) over N3RS, N3RD,

DX

Single Operator, High Power

Call	Score
FM5KC (UT5UGR, op)	4,520,064
ZF2AM (K6AM, op)	4,204,257
KP2M (K3CT, op)	3,816,960
KH7X (KH6ND, op)	3,540,108
NP3U (N6TJ, op)	3,431,586
CS2C (OK1RF, op)	3,212,820
V26G (N2ED, op)	2,922,084
TM6X (F5VHY, op)	2,248,194
G4BUO	2,238,354
PV8AA (PV8DX, op)	2,095,548

Single Operator, Low Power

P4ØLE (K2LE, op)	3,077,325
VP5DF (WJ2O, op)	2,923,032
P4ØR (N4RR, op)	2,851,686
VP9/W6PH	2,532,720
J88DR (G3TBK, op)	2,246,199
YS4M (K9GY, op)	2,036,496
V49A (KØEJ, op)	2,007,048
J38A (K4LTA, op)	1,158,912
PY2SEX	883,428
EA8CN	589,680

Single Operator, QRP

TI5N (W8QZA, op)	1,444,422
HB9BMY	180,642
LZ2RS	86,775
AO7AAW	67,260
HA6IAM	61,008
JR4DAH	57,720
G3LHJ	47,499
G4DBW	41,961
DK1YY	41,814
ON4BHP	40,800

Single Operator, Unlimited

D4C (YL2KH, op)	3,858,426
J7N (K3TEJ, op)	3,294,612
S5ØR	1,551,120
S57DX	1,518,192
DK8ZB	1,488,015
MDØCCE	1,283,772
DK3GI	1,211,910
OQ5M (ON5ZO, op)	1,062,318
F5VIH	1,061,769
HB9CVQ	785,631

Single Operator, 10 Meters

PU2MTS	5,478
PU5ATX	12

Single Operator, 15 Meters

ZW5B (LU5DX, op)	269,748
LS1D (LW9EOC, op)	257,040
CE1/K7CA	253,287
PY1NX	179,655
KH6ZM	167,409
KH7Y	144,153
LW5EE	93,885
E73W	38,406
PU3LYB	38,340
PP5BZ	34,809

Single Operator, 20 Meters

VP2VVA (K6VVA, op @ VP2VQ)	380,700
KH7XS (K4XS, op)	310,140
S5ØK	262,668
YT5W (YU8A, op)	252,225
E74EBL	251,625
E74A	248,760
E7ØT	235,338
P49V	231,339
OM3NA	230,031
XE1CT	224,259

Single Operator, 40 Meters

PY5CA (PY2ZXU, op)	252,402
OK5R (OK1RI, op)	246,384
S52AW	237,180
DL6FBL	234,879
HQ9R	229,923
IR1Y (IK1YDB, op)	227,700
PY1NB	197,001
S53M	196,821
OM2VL	194,358
ZM3A	191,226

Single Operator, 80 Meters

C6APG (K4PG, op)	277,890
M6T (G4TSH, op)	180,345
GØIVZ	174,888
F6ARC	169,614
SN3A	140,778
CO8ZZ	139,608
EA2EA	125,664
EF8R (EA8CAC, op)	116,547
9A5Y (9A3LG, op)	113,550
S53MM	107,712

Single Operator, 160 Meters

C6AKQ (N4BP, op)	161,448
CM6RCR	109,065
KV4FZ	99,990
ON4UN	61,548
ISØ/K7QB	48,465
SN3R (SP3RBR, op)	48,216
HG3M	44,772
E77DX	41,697
OL1A	38,178
9A4W	35,280

Multioperator, Single Transmitter

EF8M	4,518,408
YN2DD	4,229,784
V31TP	4,014,144
KH6LC	3,411,408
KL7RA	2,651,964
CW5W	2,492,880
IR4M	2,435,760
IR2C	2,264,400
OL3Z	1,986,678
KH6MB	1,939,740

Multioperator, Two Transmitter

PJ2T	7,045,038
6Y1LZ	5,940,000
ZY7C	4,303,788
TM6M	4,139,796
OM7M	2,700,378
DQ4W	1,952,010
ZM1A	1,529,280
DL1A	1,175,958
JA1YPA	761,475
OZ5E	743,337

Multioperator, Unlimited Transmitter

CT9L	4,924,872
9A1A	3,328,632
HG1S	2,109,357
RW2F	2,010,276
JA3YBK	1,719,576
OH4A	1,196,685
RK3SWS	45,000

N3ED, N3NA, N2SR, W7CT and W8FJ at N3RS (EPA) and K1AR and K1EA operating as K1AR (WMA).

W3LPL (MDC) has racked up a third consecutive win in the ever-competitive Multi-Multi category. Frank's team of himself, K1DQV, K1HTV, NI1N, WX3B, N3KS, K3KU, K3MM, N3OC, K3RA, K3RV, WR3Z, KD4D, K4ZA and AC6WI took top honors over second place ops K3LR, K3UA, K8CX, N2NC, N2NT, N9RV, K1DG, N3SD, W2RQ, NØAX and N3GJ at K3LR (WPA); and third place NR4M, N2YO, K1SE, K2WK, K4EC, K4EU, K4GM, K4GMH, K4IA, K4ZW, K7SV, KC4D, W4AU, WA4JUK and WK3W at NR4M (VA).

DX Single Op Categories

2008's summary article for the DX QRP category led off with "Not Even Close" as an opening thought. We'll continue that theme with Mr Not Even Close himself, Bill, W8QZA, cruising to yet another DX QRP win at TI5N with a score of 1.4 million points for the second consecutive year. Also as in 2008, second place and the top European score went to Peter, HB9BMY. Asia was led by number 6 finisher Izuno, JR4DAH.

DX Low Power featured a close race among three Caribbean entrants for the top spot, with only a few percent score difference among them. It was Andy, K2LE, operating P4ØLE from Aruba taking the number 1 position ahead of Dave, WJ2O, at VP5DF in Turks and Caicos and Roger, N4RR, also in Aruba at P4ØR coming in third. Top Africa score was Andy, EA8CN, at number 10 overall. High European score was Adrian, YO3APJ. High Oceania score was Steve, KH6/AA4V. High Asia score for the second year in a row was Masa, JI1RXQ.

As almost always, the Caribbean is the place to be for a serious shot at winning the DX High Power category and 2009 was no exception. Dmitry, UT5UGR, operated from Martinique as FM5KC to take the number 1 spot in the High Power category by a comfortable margin over second place finisher John, K6AM, at ZF2AM in the Cayman Islands. Third place went to John, K3CT, operating from the US Virgin Islands as KP2M. High Oceania score was number 4 overall finisher Mike, KH6ND, at KH7X. European leader and sixth place was Jiri, OK1RF, at CS2C in the Azores. Top South America and 10th overall was Paulo, PV8DX, at PV8AA in Brazil. Africa was led by Miguel, EA8MQ, and Asia by Masa, JH4UYB.

The Cape Verde Islands off the coast of West Africa was where Girts, YL2KL, operated D4C to the top finish and a new continental record in the Assisted category with a score of just over 3.8 million points. John, K3TEJ, operated J7N from Dominica to second place in the category with 3.29 million. High European scorer and number 3 overall was Leo, S5ØR. High South America score was Tom, CX7TT. Adhi Bimbo, YB3MM, led for Oceania and Hiro, JS3CTQ, in Asia.

On the low bands in the Single Band categories, two US operators in the Bahamas took the top spots on both 160 and 80 meters and set new overall scoring records on both bands. It was a second consecutive win for Bob, N4BP at C6AKQ on Top Band, coming in with 961 QSOs to take number 1. 80 meters was won by Kevin, K4PG, as C6APG with more than 1500 QSOs for the win. 40 meters featured a very close race with Thomas, PY2ZXU, operating PY5CA from Brazil over Jiri, OK1RI, at OK5R second and Karl, S52AW third. All three had the maximum 59 multipliers with less than 100 QSOs separating them.

On the high bands in the Single Band categories, Rick, K6VVA, operated VP2VVA at the VP2VQ QTH to a number 1 finish on 20 meters over Bill, K4XS in Hawaii at KH7XS. 15 meters has a close finish with three South American stations all battling it out with Martin, LU5DX, at the big ZW5B contest station taking the top spot by a narrow margin over Tim, LW9EOC, at LS1D and Al, CE1/K7CA. 10 meters, being predictably fairly dead due to the sunspot cycle, was won by Mat, PU2MTS.

JEFF LACKEY, K8CQ

Don't see any antennas? Jeff, K8CQ, doesn't let antenna restrictions keep him out of the contest. He loaded up his flagpole and rain gutter to get 90 multipliers in the log. Not bad for no sunspots!

DX Multioperator Categories

The DX Multioperator, Single Transmitter category was won by two Russians in the Canary Islands off the west coast of Africa, setting a continental record in the process. Val, RD3AF, and Alex, RZ3AZ, operated EF8M to a score of 4.51 million points and the top spot in a category that is almost always won in ARRL DX CW by a team immediately offshore in the Caribbean or Central America. Second place went to YN2DD in Nicaragua, operated by AC8W, K8DD and N8LJ. AC8W and K8DD were also involved in a second place 2008 effort in the M/S

W/VE Regional Leaders

Tables list call sign, score and power (A = QRP, B = Low Power, C = High Power

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

VY2ZM (KØDQ, op)	4,892,940	C
NN3W (@ N3HBX)	4,066,260	C
K3CR (LZ4AX, op)	3,868,128	C
K5ZD (W1UE, op)	3,717,186	C
AA1K	3,637,740	C
N1UR	2,175,624	B
WA1Z	1,793,880	B
W3EF	1,768,530	B
N3DG	1,228,110	B
K2PS	1,083,396	B
K2DM	534,060	A
K3PH	512,460	A
KR2Q	507,771	A
N1TM	371,862	A
AA1CA	284,769	A

Southeast Region
(Delta, Roanoke and Southeastern Divisions)

K1PT	1,665,405	C
N6AR	1,389,720	C
N4TB	1,353,132	C
WJ9B	1,282,932	C
W5WMU	1,245,594	C
N4YDU	1,105,272	B
WD4AHZ	702,576	B
K5KLA	691,260	B
N4ZI	622,503	B
WA4DOU	598,752	B
K3ZM	648,774	A
W9WI	303,276	A
N4CW	291,798	A
WA8WV	117,390	A
NU4B	92,637	A

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

CG3AT (VE3AT, op)	2,363,070	C
K8GL	2,086,671	C
N8AA	1,860,663	C
VE3TA	1,383,264	C
N9CK	1,252,998	C
VE3DZ	1,365,471	B
N4TZ	1,283,040	B
K9QVB	784,404	B
VE3NE	759,624	B
KV8Q	461,700	B
KT8K	207,624	A
K8ZT	70,278	A
VA3RKM	20,448	A
KØCD	18,228	A
N8WS	7,872	A

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

N2IC	2,589,156	C
WXØB (AD5Q, op)	1,981,854	C
KØSR	1,449,522	C
N5XZ	785,664	C
NN7ZZ (N5LZ, op)	770,127	C
N5AW	1,409,262	B
WØUO	887,112	B
WD5K	434,385	B
WØETT	354,006	B
WØVX	342,108	B
NØKE	221,850	A
NØUR	62,088	A
KIØG	58,128	A
WF4U	56,964	A
NDØC	49,896	A

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

W6YI (N6MJ, op)	2,241,120	C
K7GK	1,647,780	C
K6XX	1,508,925	C
KO7AA	1,326,456	C
N6AA	1,047,960	C
KM6Z	256,296	B
N7AN	229,749	B
W7RV	173,328	B
W7QDM	133,062	B
WA6FGV	119,784	B
W6JTI	247,800	A
N7IR	245,853	A
NN7SS (K6UFO, op)	154,212	A
N6WG	51,903	A
K6MI	6,831	A

Continental Leaders

Continents/Category Name	Call	Score
Africa		
Single Operator High Power	EA8MQ	472,230
Single Operator Low Power	EA8CN	589,680
Single Operator 20 Meters	EA8BVP	2,850
Single Operator 40 Meters	EA8DA	11,520
Single Operator 80 Meters	EF8R (EA8CAC, op)	116,547
Single Operator Assisted	D4C (YL2KL, op)	3,858,426
Multioperator Single Transmitter	EF8M	4,518,408
Multioperator Multi Transmitter	CT9L	4,924,872
Antarctica		
Single Operator Low Power	R1ANB	6,615
Single Operator 20 Meters	R1ANC	7,290
Asia		
Single Operator High Power	JH4UYB	1,128,171
Single Operator Low Power	JI1RXQ	279,090
Single Operator QRP	JR4DAH	57,720
Single Operator Assisted	JS3CTQ	206,910
Single Operator 15 Meters	JA6WFM	4,590
Single Operator 20 Meters	JA7FTR	174,420
Single Operator 40 Meters	7J1AAI	102,150
Single Operator 80 Meters	JJ5GMJ	21,168
Single Operator 160 Meters	JH2FXK	6,075
Multioperator Single Transmitter	JAØQNJ	928,626
Multioperator Two Transmitters	JA1YPA	761,475
Multioperator Multi Transmitter	JA3YBK	1,719,576
Europe		
Single Operator High Power	CS2C (OK1RF, op)	3,212,820
Single Operator Low Power	YO3APJ	464,772
Single Operator QRP	HB9BMY	180,642
Single Operator Assisted	S5ØR	1,551,120
Single Operator 15 Meters	E73W	38,406
Single Operator 20 Meters	S5ØK	262,668
Single Operator 40 Meters	OK5R (OK1RI, op)	246,384
Single Operator 80 Meters	M6T (G4TSH, op)	180,345
Single Operator 160 Meters	ON4UN	61,548
Multioperator Single Transmitter	IR4M	2,435,760
Multioperator Two Transmitters	TM6M	4,139,796
Multioperator Multi Transmitter	9A1A	3,328,632

Continents/Category Name	Call	Score
North America		
Single Operator High Power	FM5KC (UT5UGR, op)	4,520,064
Single Operator Low Power	VP5DF (WJ2O, op)	2,923,032
Single Operator QRP	TI5N (W8QZA, op)	1,444,422
Single Operator Assisted	J7N (K3TEJ, op)	3,294,612
Single Operator 20 Meters	VP2VVA (K6VVA, op @ VP2VQ)	380,700
Single Operator 40 Meters	HQ9R	229,923
Single Operator 80 Meters	C6APG (K4PG, op)	277,890
Single Operator 160 Meters	C6AKQ (N4BP, op)	161,448
Multioperator Single Transmitter	YN2DD	4,229,784
Multioperator Two Transmitters	6Y1LZ	5,940,000
Oceania		
Single Operator High Power	KH7X (KH6ND, op)	3,540,108
Single Operator Low Power	KH6/AA4V	369,180
Single Operator Assisted	YB3MM	6,375
Single Operator 15 Meters	KH6ZM	167,409
Single Operator 20 Meters	KH7XS (K4XS, op)	310,140
Single Operator 40 Meters	VK2IA	99,456
Single Operator 80 Meters	VK2CCC (LY1F, op)	312
Multioperator Single Transmitter	KH6LC	3,411,408
South America		
Single Operator High Power	PV8AA (PV8DX, op)	2,095,548
Single Operator Low Power	P4ØLE (K2LE, op)	3,077,325
Single Operator QRP	PP5VX	2,016
Single Operator Assisted	CX7TT	339,297
Single Operator 10 Meters	PU2MTS	5,478
Single Operator 15 Meters	ZW5B (LU5DX, op)	269,748
Single Operator 20 Meters	P49V	231,339
Single Operator 40 Meters	PY5CA (PY2ZXU, op)	252,402
Single Operator 80 Meters	HC2AD	76,638
Multioperator Single Transmitter	CW5W	2,492,880
Multioperator Two Transmitters	PJ2T	7,045,038

Sponsored Plaque Winners

Thanks to the generous sponsorship of numerous clubs and individuals, we are pleased to announce the winners of a sponsored ARRL DX CW plaque. The ARRL wishes to thank the plaque sponsors for their continued commitment to the ARRL Plaque Program. Without their support and dedication, the Plaque Program would not be possible.

Plaque Category	Plaque Sponsor	Winner
World Single Operator High Power CW	North Jersey DX Association	FM5KC (UT5UGR, op)
World Single Operator Low Power CW	Jim Stevens, K4MA	P4ØLE (K2LE, op)
World Single Operator QRP CW	Jerry Griffin, K6MD/YI9MD	TI5N (W8QZA, op)
World 1.8 MHz CW	Fred Race, W8FR, In Memory of DL1FF	C6AKQ (N4BP, op)
World 21 MHz CW	Caribbean Contesting Consortium PJ2T	ZW5B (LU5DX, op)
World Multioperator Single Transmitter CW	DX Publishing — QRZ DX-DX Magazine	EF8M
World Multioperator Two Transmitters CW	Tom De Meiss K2TD Memorial	PJ2T
World Multioperator Unlimited CW	H. Stephen Miller, NØSM	CT9L
W/VE Single Operator High Power CW	Frankford Radio Club	VY2ZM (KØDQ, op)
W/VE Single Operator Assisted CW	Harold Ritchey, W3WPG Memorial	K3WW
W/VE 14 MHz CW	The QSL MAN — W4MPY	KQ2M
Europe Single Operator High Power CW	Jim George, N3BB	CS2C (OK1RF, op)
Europe Single Operator QRP CW	William Parker, MD — W8QZA	HB9BMY
North America Single Operator High Power CW	Potomac Valley Radio Club	FM5KC (UT5UGR, op)
North America Single Operator Low Power CW	John Patterson WCØW/V31TP	VP5DF (WJ2O, op)
North America Single Operator QRP CW	St Louis QRP Society — WØNVM Memorial	TI5N (W8QZA, op)
Great Lakes Division Single Operator CW	North Coast Contesters	K8GL
Pacific Division Single Operator High Power CW	Jim Davis, NN6EE	K6XX
Pacific Division Single Operator Low Power CW	Central California DX Club, Inc	W6MEL

Unsponsored plaques may be purchased by the plaque winner. If you wish to purchase an unsponsored plaque or order a duplicate plaque, contact ARRL Contest Branch Manager Sean Kutzko, KX9X, at 860-594-0232 or by e-mail at **kx9x@arrl.org**. The cost for plaques is $75 (includes shipping).

category from PZ5WW. Third were 2008 number 1 finishers K5PI and WCØW from Belize as V31TP.

DX Multi-Two was again won by the Caribbean Contest Consortium PJ2T team on Curacao. This year's operating crew consisted of WØCG, NP2L, K6ZH, N5OT, N4QQ, WI9WI and N1ZZ. This is the fourth M/2 title for PJ2T; they also won the category in 2003, 2004 and 2007. Add in Multi-Multi wins in 2005, 2006 and 2008 and you have 7 years in a row with CCC's club station at the top of a DX multioperator category. Second place went to the 6Y1LZ crew at the 6Y1LZ/6Y1V station with operators K1LZ, JT1CO, N2OW, RA1AIP and 6Y5RV. Third was the ZY7C team in Brazil of OH2MM, PT7AA, PT7CG and PY8AZT.

The Madeiras station of CT9L operated by Germans DJ6QT, DK7YY, DK9VZ, DL5AXX, DL5LYM and DL8WAA was the top entrant in the DX Multioperator, Multi-Transmitter category. Their score of just over 4.9 million points was enough to set a new Africa record and to top Croatia's 9A1A with operators 9A5W, 9A5E, 9A8W, 9A6A, 9A4WW, 9A7R, 9A9A and 9A2DQ and third place HG1S operated by HA1TJ, HA1DAC, HA1DAI and HA1DAE.

Coda

I once likened doing well in contests to scoring good seats at rock concerts. Pretty soon, if you do it enough you know the process involved and you're in the right location, rewards will be had. Not "can" be had, will be had. Look at a year like 2009; even with a subpar sunspot count, notice the number of call area and continental records that were set — even a couple of overall Single Band category record scores were posted.

K4WI will be the first to tell you that you're not going to set a scoring record on 10 meters at the pits of the cycle, but with tenacity and skill you can still put a new piece of wood on the wall in the ham shack. You just have to be in the right place at the right time and know how to do it. Enjoy those plaques, think of the effort that went into earning them and the memories you've created to last a lifetime. Enjoy life, and radio contesting, as it comes. We will only pass this way once; life is simply too short to be wasted.

The 2010 running of the ARRL DX CW contest will be held the weekend of February 20 and 21. Until next year — see you on the bands. QST

2009 ARRL 10 GHz and Up Contest

COURTESY ZACK WIDUP, W9SZ

COURTESY ZACK WIDUP, W9SZ

6 AM local time Saturday through 12 Midnight local time Sunday

One of the most challenging events on the contest calendar, the 10 GHz and Up Contest tests your ability to communicate on the microwave bands. Portable operation is not only allowed, it's encouraged! If you're an experimenter, this event is definitely for you!

E-mail logs to **10ghz@arrl.org**, or send paper logs to 10 GHz Contest, ARRL, 225 Main St, Newington, CT 06111. All logs must be received by 2359 UTC on Tuesday, October 20, 2009.

Complete rules may be found at
www.arrl.org/contests

2009 ARRL September VHF QSO Party

1800 UTC Saturday, September 12 through 0300 UTC Monday, September 14

If you think the VHF+ bands are only for local FM use, think again! Operators from across North America will take to their shacks, cars and favorite hilltops to work stations hundreds or thousands of miles away!

It doesn't take much to get involved; many modern radios come equipped with 6 meters, 2 meters and 432 MHz SSB/CW. A horizontally polarized dipole, loop or small beam will put you in the game. Listen for activity around 50.125, 144.200, 222.100 and 432.100 MHz USB/CW.

If you've never tried long-distance communication on the VHF+ bands, you're missing out on a lot of fun. Technician class licensees can participate, too!

Send Cabrillo-formatted logs to **septemberVHF@arrl.org**. Paper logs go to September VHF, c/o ARRL, 225 Main St, Newington, CT 06111. All logs must be received by 0300 UTC on Wednesday, October 14, 2009.

Complete rules may be found at
www.arrl.org/contests

COURTESY RAY HUTT, AA4SI

2009 ARRL International EME Competition

Becoming active in EME has never been easier! Many stations are working DX on 2 meters and up with only 100 W and a single long-boom Yagi. Using CW or digital modes, you too can bounce your signal off the lunar surface and work DX! Certificates awarded to all stations that submit a log with at least one QSO!

Want to try moonbounce? Visit www.vhfdx.net/jt65bintro.html for a beginner's guide.

COURTESY HUGH DUFF, VA3TO

★Logs must be received no later than 2359 UTC Tuesday, January 5, 2010.

★Send electronic logs to **emecontest@arrl.org**; paper logs to EME Contest, ARRL, 225 Main St, Newington, CT 06111 USA.

"From the northwest corner
Of a brand new crescent moon
Signals bounce and headphones ring
A rare and different tune..."

Three weekends of activity and fun!

★October 10-11: 50 through 1296 MHz

★November 7-8: 2.3 GHz and Up

★December 5-6: 50 through 1296 MHz

0000 UTC Saturday – 2359 UTC Sunday each weekend

New rules are in effect for 2009. Read the rules at www.arrl.org/contests

SPECIAL EVENTS

Contact these stations and help commemorate history. Many provide a special QSL card or certificate!

Jul 17-Jul 19, 0300Z-0300Z, Eldorado, KS. VFW, WØVFW. All Veterans Reunion. 14.283 3.683. QSL. Marc Hammann, 2241 S Ellis, Wichita, KS 67211. **www.vfw3115.org**

Jul 25, 1300Z-2200Z, Owosso, MI. Shiawassee Amateur Radio Association, W8QQQ. Train Festival 2009 Special Event. 14.245 7.245. Certificate. Shiawassee Amateur Radio Association, 702 W Corunna Ave, Corunna, MI 48817. **www.w8shi.net/Home/community/trainfestival2009**

Jul 25-Jul 26, 0800Z-2200Z, Dover, KE, United Kingdom. Dover Amateur Radio Club, GB100LB. 25th July 1909 Louis Bleriot flies from Calais to Dover. 21.250 21.025 18.150 18.072 14.250 14.025 10.115. QSL. Via bureau or GØKOK direct, 2 Meadway, River, Dover CT17 0PS, United Kingdom. **g0kok@dsl.pipex.com**

Jul 29-Aug 2, 1300Z-2100Z, Oshkosh, WI. Fox Cities Amateur Radio Club, W9ZL. Airventure 2009 Experiment Aircraft Association Air Show. 14.270 7.250 52.550. Certificate. FCARC EAA Airventure 2009, PO Box 5233, Appleton, WI 54912-5233. **www.fcarc.us**

Jul 30-Aug 3, 1600Z-0400Z, Litchfield, MN. Meeker County Amateur Radio Club, KØMCR. Meeker County Fair. 21.250 14.250 7.250 7.050. QSL. Jim Westrup, 524 S Holcombe Ave, Litchfield, MN 55355. **ka0csw@yahoo.com**

Aug 1, 1300Z-2100Z, Red Wing, MN. Hiawatha Valley Amateur Radio Club, WØR. Red Wing River City Days Celebration from Bay Point Park. 147.300 21.300 14.250 7.200. QSL. Bill Eichenlaub, 1966 Launa Ave, Red Wing, MN 55066. **w0ike@q.com**

Aug 1, 1400Z-1900Z, Stony Point, NY. 10-70 Repeater Association, N2S. Lighthouses on the Air. 14.270 14.070 14.030 7.270. QSL. Herbert VanDenHouten, N2OPJ, 1 Cozy Glen, Saddle Brook, NJ 07663. **kc2gik@arrl.net** *or* **www.bergenscanner.com/stonypoint.shtml**

Aug 1, 1400Z-1800Z, Townshend, VT. West River Radio Club, W1RRC. Grace Cottage Hospital Fair Day. 14.250 14.070. QSL. John Borichevsky, N1TOX, PO Box 8087, North Brattleboro, VT 05304. **www.westriverradio.org**

Aug 1, 1400Z-1900Z, Wendell, MA. Central Mass Amateur Radio Club, W1BIM. Smokey Bear's 65th birthday. 50.250 28.430 14.260. QSL. Ray Doucette, 2 Dawes Rd, Stow, MA 01775. **www.qrz.com/kb1ouw**

Aug 1, 1400Z-2359Z, West Bloomfield, MI. Prince of Peace Amateur Radio Society, K8M. Feast Day of St Maximilian Kolbe, SP3RN. 14.275 7.275 CW digital EchoLink. Certificate. Joseph Miller, 69289 Forest Park Ct, Troy, MI 48098. *Other operating times and modes through Aug 15, see* **www.qrz.com/ka8o**

Aug 1, 1600Z-2100Z, White Oak, PA. Two Rivers Amateur Radio Club, W3O. White Oak Borough PA Community Day. 14.252 14.045 7.240 7.045. Certificate. Two Rivers Amateur Radio Club QSL Request, PO Box 225, Greenock, PA 15047. **w3oc@arrl.net** *or* **tworiversarc.com**

Aug 1-Aug 2, 1400Z-2200Z, Alexandria, VA. Mount Vernon Amateur Radio Club, K4CG. 219th Birthday of the United States Coast Guard. 14.250 10.110 7.270. QSL. US Coast Guard TISCOM, 7323 Telegraph Rd, Alexandria, VA 22315. **k4us@mvarc.com**

Maty Weinberg, KB1EIB ♦ Special Events ♦ events@arrl.org

Aug 1-Aug 2, 2359Z-2359Z, Boscobel, WI. Pine Valley Repeater Amateur Radio Club, W9PVR. Muskets and Memories Civil War Reenactment. 14.320 7.055 14.070 3.850. QSL. Ralph Gray, W9RIG, 906 Justin Cir, Reedsburg, WI 53959. **www.musketsandmemories.net/** *or* **www.w9pvr.com**

Aug 1-Aug 15, 1400Z-2359Z, San Jose, CA. Saratoga Amateur Radio Association, K6M. Feast Day of St Maximilian Kolbe, SP3RN. 14.275 7.275 3.825 146.535. Certificate. Christina Capurro Sand, PO Box 18142, San Jose, CA 95158. *Other operating times and modes, see* **k6sa.net/k6m.php**

Aug 2, 1600Z-2000Z, Wingdale, NY. Steve Jacobson Memorial Amateur Radio Association, N2SJ. Ham Radio at Camp Ramah; Steve Jacobson (SK), Norm Wesler (SK). 14.287 7.240. QSL. Steve Jacobson Memorial Amateur Radio Association, c/o Gerard Petitte, KC2FBY, 572 Grand St, Apt G1203, New York, NY 10002. **www.sjmara.org**

Aug 7-Aug 8, 1500Z-2359Z, Cove Fort, UT. Cove Fort Amateur Radio Club, K7K. Cove Fort Days. 14.333 7.272 3.987 146.46. Certificate. Cove Fort ARC, Cove Fort Historic Site, HC-74 Box 6710, Beaver, UT 84713. **nu7x@arrl.net**

Aug 7-Aug 9, 1400Z-2200Z, Twinsburg, OH. Triangle Amateur Radio Club, K8T. Twins Days Festival. 14.255 7.180. QSL. Rich Feldman, PO Box 30, East Liverpool, OH 43920. **www.twinsday.org** *or* **www.k8blp.org**

Aug 7-Aug 9, 1700Z-0100Z, Pt Reyes National Seashore, CA. Valley of the Moon Amateur Radio Club, N6P. Pt Reyes Lighthouse Activation. 14.270 7.270 PSK 14.070 7.070. QSL. W6AJF c/o K. McTaggart, 402 Fourth St E, Sonoma, CA 95476. **www.vomarc.org**

Aug 7-Aug 9, 1900Z-1900Z, Leland, MI. Michigan DX Association, W8DXI. North Manitou Island Activation. 18.150 14.250 14.230 7.250. QSL. David M. Smith, KC8PCL, 1652 Rossman SE, Grand Rapids, MI 49507. **mdxa1.org**

Aug 7-Aug 10, 1200Z-2359Z, Canton, OH. Canton Amateur Radio Club, W8AL. Annual Pro Football Hall of Fame Festival. 28.365 21.365 14.265 7.265. Certificate. Donald E. Perry, WQ8J, 968 Culverne Ave NW, Massillon, OH 44647. **www.w8al.org**

Aug 8, 1300Z-2300Z, Van Wert, OH. Van Wert Amateur Radio Club, W8FY. US 127/US 30 Garage Sale Crossover Point. 14.244 7.244 7.044 146.700 EchoLink 315705. Certificate. Van Wert Amateur Radio Club, PO Box 602, Van Wert, OH 45891. **www.w8fy.org**

Aug 8, 1600Z-2359Z, San Diego, CA. USS *Midway* (CV 41) Museum Radio Operations Room, NI6IW. US Coast Guard Birthday 1790 and National Navajo Code Talkers Day. SSB 14.320 7.250 PSK-31 7.070 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**

Aug 8-Aug 9, 1600Z-2000Z, Glenville, NY. Glenville Park Planning Commission, N2Y. CanalFest 2009 Celebrate Erie Canal Heritage-Ham Radio Demo. 14.245 7.245 PSK 14.070 CW 14.060. QSL. Larry Eaton, KC2BLC, 7 Wagon Wheel Ln, Scotia, NY 12302-3708. **kc2blc@arrl.net**

Aug 8-Aug 9, 1800Z-2100Z, Plano, TX. Plano Amateur Radio Klub, K5PRK. Celebrating the upcoming Plano Balloon Fest. 28.400 21.300 14.245. QSL. K5PRK SE Station, PO Box 860435, Plano, TX 75086. **www.k5prk.org**

Aug 9, 1300Z-2200Z, Sudbury Fire Tower, MA. Central Mass Amateur Radio Club, W1BIM. Celebration of Smokey Bear's 65th birthday. 50.250 28.430 14.260. QSL. Ray Doucette, 2 Dawes Rd, Stow, MA 01775. **www.QRZ.com/kb1ouw**

Aug 12-Aug 16, 1300Z-2100Z, Sycamore, IL. Kishwaukee Amateur Radio Club, W9S. Northern Illinois Steam Power Show and Threshing Bee. 14.268 7.268 7.042 3.988. Certificate. Bob Yurs, W9ICU, 1107 Commercial St, Sycamore, IL 60178. **w9icu@arrl.net** *or* **www.kish-club.org**

Aug 13-Aug 15, 1600Z-0100Z, Punta Gorda, FL. Peace River Radio Association, Inc, W4C. 5th Anniversary of Hurricane Charley. 14.250 7.235. QSL. PRRA, PO Box 510943, Punta Gorda, FL 33951-0943. **k7cxw@arrl.net** *or* **www.w4dux.org**

Aug 13-Aug 17, 0000Z-0000Z, Denver, NY. Sponsored by KC8SKK, N2Y. 40th Anniversary of 1969 Woodstock Music Festival. 1.865 MHz through 70 cm. QSL. Brian S. Floutz, 6140 S Huron River Dr, South Rockwood, MI 48179-9509. **floutz@sbcglobal.net**

Aug 13-Aug 23, 1200Z-0300Z, Des Moines, IA. Madison County DX Club, WØISF. The Great Iowa State Fair. 146.535 14.230 7.230 3.830. QSL. Mark Mease, 2989 Truro Rd, Truro, IA 50257. *Operating at various times and frequencies, contact* **mmease@netins.net**

Aug 14-Aug 23, 1200Z-2359Z, Arecibo, PR. Caribbean Amateur Radio Group, W4L. International Lighthouse Weekend from the Arecibo Lighthouse. 28.350 18.122 14.225 7.150 SSTV on 20 m. QSL. CARG, PO Box 140031, Arecibo, PR 00614. **wp4crg@yahoo.com**

Aug 15, 1400Z-2200Z, Alliance, OH. Alliance Amateur Radio Club, W8LKY. Home of the Scarlet Carnation, Ohio's state flower. 7.245; 40 20 15 6 SSB CW as propagation permits. Certificate. Alliance ARC, PO Box 3344, Alliance, OH 44601. **www.w8lky.org**

Aug 15-Aug 16, 0100Z-2359Z, Fire Island, NY. Great South Bay Amateur Radio Club, W2GSB/LH. International Lighthouse/Lightship Weekend. PSK CW SSB 14.255 14.070 7.225 3.800. QSL. W2GSB/LH, PO Box 1356, West Babylon, NY 11704. **www.gsbarc.org**

Aug 15-Aug 16, 1500Z-2300Z, Forest City, MN. Meeker County Amateur Radio Club, KØMCR. Forest City Thresher Days, commemorating farming of the past in Meeker County. 21.250 14.250 7.250 7.050. QSL. Jim Westrup, 524 S Holcombe Ave, Litchfield, MN 55355. **ka0csw@yahoo.com**

Aug 15-Aug 16, 1800Z-1800Z, Morgantown, WV. Monongalia Wireless Association and WVU Amateur Radio Club, W8V. Mason-Dixon Line, western most marker #248 celebration. 14.260 14.060 7.260 7.060 3.860 3.560. Certificate. Monongalia Wireless Association, PO Box 4263, Morgantown, WV 26504. **w8mwa@arrl.net** *or* **www.w8mwa.org/mdspecialevent.html**

Aug 16-Aug 19, 1700Z-2300Z, Las Vegas, NV. APCO International, K4AI. 75th Annual APCO Conference and Exposition. 146.580 14.310 7.280 3.860. Certificate. K4AI Special Event Station, c/o Conference & Meeting Services APCO HQ, 351 N Williamson Blvd, Daytona Beach, FL 32114-1112. **tinyurl.com/apco-k4ai**

Aug 18-Aug 21, 1900Z-0200Z, McKeesport, PA. Two Rivers Amateur Radio Club, W5O. 50th International Village Celebration of Ethnic Traditions. 14.252 14.045 7.240 7.045. Certificate. Two Rivers Amateur Radio Club QSL Request, PO Box 225, Greenock, PA 15047. **w3oc@arrl.net** *or* **tworiversarc.com**

Aug 21-Aug 30, 1400Z-2359Z daily, Marshfield, MA. Whitman Amateur Radio Club, NN1MF. 142nd Annual Marshfield Fair. 18.160 14.260 7.260 3.860. Certificate. Whitman ARC, PO Box 48, Whitman, MA 02382. **www.wa1npo.org**

Aug 22, 1400Z-2100Z, Miamisburg, OH. R.L. Drake Amateur Radio Club, W8CYE. Celebrating 66 years of R.L. Drake communications excellence. 28.360 18.100 14.260 7.260. Certificate. Drake ARC, c/o Gary Hardwick, 498 Lake Front Dr, Lebanon, OH 45036.

Aug 22-Aug 23, 1400Z-2200Z, Chesterton, IN. All States Radio Club, W9SAL. Celebrating the history of All States Radio Club. 21.350 14.250 7.250 3.950. Certificate. Joseph F. Krajacic II, N9TAX, 648S 300W, Hebron, IN 46341. **w9sal_event@pcarc.net**

Aug 22-Aug 23, 1500Z-2000Z daily, Harrison Township, MI. Metro Detroit SATERN, N8SE. Selfridge Air National Guard Base Annual Air Show. 147.200 146.565 14.265 7.265. Certificate. Ann-Marie Ruder, K8AMR, 15708 Bringard Dr, Detroit, MI 48205.

Aug 28-Aug 30, 0000Z-2359Z, Goodells, MI. American Red Cross Amateur Radio Service, K8ARC. 25th Annual St Clair County Farm Museum's Fall Harvest Days, Steam, Tractor & Engine show. 28.410 21.300 14.250 7.250 3.920 Talk-in 146.800 PL100. Certificate. American Red Cross Amateur Radio Service, 615 Pine St, Port Huron, MI 48060. **kc8spd@comcast.net** *or* **www.qsl.net/arcars**

Aug 28-Aug 30, 0559Z-1800Z, Eureka, MT. Tobacco Valley Amateur Radio Club, K7EUR. Lincoln County Montana 100 Year Centennial. 14.240 7.200 3.900 IRLP 3363 EchoLink KC7CUE-R. Certificate. TVARC, PO Box 1, Eureka, MT 59917. **www.tvarc.org**

Aug 28-Aug 29 1600Z-0400 and Aug 29-Aug 30 1200Z- 0400Z, Titusville, PA. Fort Venango Mike and Key Club, W3ZIC. Sesquicentennial of Oil Production. 160 80 40 20 m CW and SSB. QSL. Fort Venango Mike and Key Club, PO Box 99, Cranberry, PA 16319. **www.w3zic.com**

Aug 28-Aug 30, 1500Z-0300Z, Indianapolis, IN. Indianapolis Motor Speedway Amateur Radio Club, W9IMS. 2nd running of the Indianapolis MotoGP. 21.340 14.240 7.240 3.840. QSL and certificate. Indianapolis Motor Speedway ARC, PO Box 18495, Indianapolis, IN 46218-0495. **www.w9ims.com**

Aug 29, 1200Z-2000Z, Manassas, VA. Ole Virginia Hams, W4OVH. Second Battle of Manassas (Bull Run). 146.970 14.225 7.225 3.825. QSL. Ole Virginia Hams, PO Box 1255, Manassas, VA 20108-1255. **aldugas@juno.com** *or* **www.w4ovh.net**

Aug 29, 1400Z-2000Z, Ponchatoula, LA. Southeast Louisiana Amateur Radio Club, K5R. 4th anniversary of Hurricanes Katrina and Rita. 14.250 7.250. QSL. K5R, PO Box 1324, Hammond, LA 70404. **www.selarc.org**

Aug 29-Aug 30, 1500Z-2300Z, Port Townsend, WA. Jefferson County and Port Ludlow Amateur Radio Clubs, W7R. Fort Worden Radio Station 100 Year Anniversary. 14.265 7.255 3.920 SSB CW PSK RTTY. QSL. W7R Special Event, PO Box 88, Chimacum, WA 98325. **www.olympus.net/community/jcarc** *or* **www.n7pl.org**

Aug 30, 1400Z-2100Z, Hanover, KS. Crown Amateur Radio Association, KØASA. Hollenberg Pony Express Station Festival. 14.240 14.040 7.040 3.540. Certificate. Crown Amateur Radio Association, 11551 W 176th Terr, Olathe, KS 66062. **www.arrlmidwest.org/ponyexpress.html**

QST

W3UR

HOW'S DX?

ZL7T — Chatham Island DXpedition 2009

Lee Jennings, ZL2AL

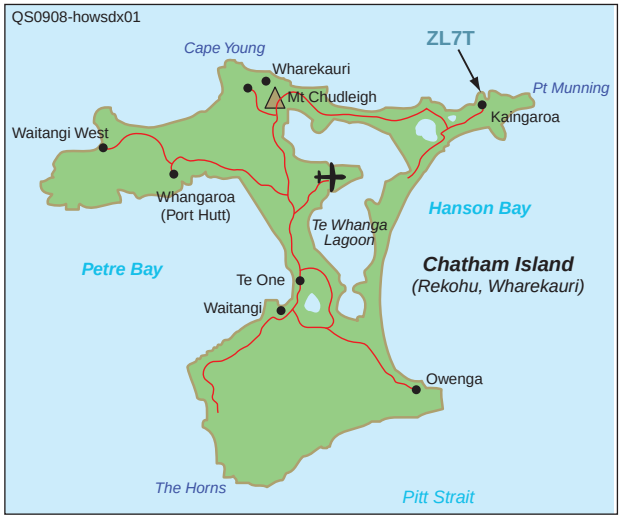
New Zealand is lucky to have five DXCC entities, which include mainland New Zealand (ZL1 to ZL4), Antarctica — ZL5, Raoul Island in the Kermadec chain of islands — ZL8 and Auckland/Campbell Islands — ZL9. With the exclusion of the mainland, these DXCC entities are extremely difficult to activate except for Chatham Island (see map). Chatham is easy to get to and has no restrictions. Although not rare, the island is keenly sought after by the DX community. At the outset this was a "Kiwi" operation, which grew out of a few interested DXers from the Kiwi DX Group (**www.radioamateurs.org.nz**).

Eventually the team grew to nine with Mike, ZL2CC; Phil, ZL2RVW; Wayne, ZL2WG; Mark, ZL3AB; John, ZL1BYZ; John, ZL1ALZ; Leonie, ZL2LE, and the two team leaders Morrie, ZL2AAA, and Lee, ZL2AL. Accommodations are scarce on Chatham Island and we were not able to activate the planned DXpedition in 2008 so the decision was made to go in March 2009. Morrie, ZL2AAA, arranged lodgings at the farm run by Ken Worthington known as the "Chathams Fishing Experience" located at Kaiangaroa on the northeast tip of the island.

We originally planned to activate two stations but as the team grew in size we doubled the number to four. The Chatham Air Convair 580 only flies to Chatham from Napier on Thursday so it had to be a 7 day operation with 1 day at each end for travel, which left us with only five operating days.

The Chatham Islands are a group of 10 islands about 800 kilometers east of New Zealand. Accommodations are less primitive and tourism is becoming a major source of income for the residents. They are the first inhabited islands in the world to see the dawn of the new day. The international dateline lies to the east of the Chathams, which are 45 minutes ahead of New Zealand time.

The team met at the Napier airport on March 5 and boarded for the short flight to Chatham. An hour and half later saw us loading the same gear onto a truck at the Chatham airport ready for the drive to the farm and fishing camp. The trip is pleasant with the Chatham tundra-like scenery to look at. We followed the equipment truck and the ensuing 100 meter trailing cloud of dust. The gravelled road runs up the middle of the island, past the ancient lagoon to the farm near Kaiangaroa where we were confronted by several hectares strewn with old and new farm equipment.



The next day it became immediately obvious that the very tall surrounding pine trees would double as excellent LF wire antenna supports. Several diesel generators power all the buildings and the house. A quick walk around the farm and we made the decision to use the farm implement shed as the main operating shack and another old storage shed as the 160 meter shack.

The equipment was unpacked from the plastic fish boxes, operating tables set in place and everything was made ready to connect the antennas the next morning. In addition to the high wire loops, we had to assemble and erect the Hy-Gain TH-3 triband Yagi and the 17 meter monobander by noon the next day. By 10 AM the next day one station was working and we decided to put ZL7T on 17 meters immediately and follow with more stations as the Yagi antennas were put in place. The afternoon was devoted to installing the 80 meter and 40 meter loops plus the 30 meter vertical and finally the inverted L for 160 meters.

On the Air

From the moment we hit the air the pileups started in earnest. Even though ZL7 is not in the top 100 most wanted there are thousands who need it for a new one or a band filler. A few opening contacts on any band and then the DX clusters unleashed the snarling pileups. It became apparent that 17 meters was going to be a very worthwhile band. As we progressed into Friday evening, the big 40 meter and 80 meter loops started paying dividends. The noise level was generally very low and 80 meters sounded like 40 meters and 20 meters at times with so many Europeans calling us. As with most DXpeditions, CW is a far more effective mode to work pileups and our CW to SSB ratio showed how effective CW was.

ZL1BYZ and ZL1ALZ worked long shifts during the 5 day operation to give many hams around the world a new one on CW. From the beginning the Solar Flux Index of 69 plagued us with poor propagation. We were able to catch a few band openings on 15 meters while 12 meter and 10 meter propagation was nonexistent in our part of the world. At times 20 meters was quite dead with no signals being heard from anywhere.

The ARRL DX Contest was scheduled for Saturday. We were aware of the contest before we left and felt that it would help our totals. In fact the heavy demand for space in the 40 meter and 80 meter phone DX windows meant that our signals from the bottom of the planet were swamped by the rest of

Bernie McClenny, W3UR ♦ 3025 Hobbs Rd, Glenwood, MD 21738-9728 ♦ w3ur@arrl.org

the world. Meanwhile 17 and 30 meters continued to provide some impressive long runs.

Our makeshift inverted L on 160 meters provided a few EU and USA contacts on Saturday night and good signals around the Pacific. Sunday night was better and our window openings to JA, EU and the USA became quite exciting. On Monday night 160 meters came alive and our inverted L worked very well.

160 meters was never intended as a major activity but once the team experienced the fun of working other countries on top band they were into it, making adjustments and changing hardware to reduce noise and interference. Their efforts were rewarded on Monday night when we worked into the USA and Europe along with a wall of JAs calling us. The pileups soon disappeared because the gray line and sunrise doesn't hang around waiting for us hams. We were astounded at the signal strengths of AAØRS and N8GZ when the opening occurred. It was interesting to listen to the grey line propagation hit the West Coast USA and roll across the continent to the East Coast with 10 minute windows.

COURTESY KEN MCCLINTOCK

The ZL7T team included (from left) Mike, ZL2CC; Wayne, ZL2WG; John, ZL1ALZ (letter Z); Mark, ZL3AB; Morrie, ZL2AAA (holding L); Lee, ZL2AL (holding 7); Phil, ZL2RVW; Leonie, ZL2LE (holding T), and John, ZL1BYZ.

My experience 10 years ago with 30 meters on ZL9 showed that a simple resonant quarter wave vertical with above ground radials would produce good results. That proved correct with our homebrew vertical working extremely well. Mark, ZL3AB, wanted to work CW and RTTY on that band. Using the ICOM IC-7000 transceiver, *WriteLog* software and no amplifier we were working everywhere in the world. 17 meters opened nicely most mornings an hour or so after sunrise. Our decision to take Morrie's homebrew 3 element 17 meter Yagi paid off because 17 meters was our most useful and productive band. The pileups were always there.

We seemed to have a pipeline into the JAs and USA. The EUs found it very hard to break through the walls at times. During the initial planning we wanted to give the VKs and ZLs the experience of working a new country. To that end we took short windows out from running pileups and called for VKs and ZLs to work us. The plan was amazingly successful as so many of them took their hand keys out of the cupboard and made the effort. On the other hand, the joy of some east coast USA stations after working us on 160 meters was pretty hard to beat. At times the 160 meter and 80 meter bands sounded like 20 meters with the pileups that resulted.

Tear Down

The weather was generally quite good during our stay with temperatures ranging from 6°C to 15°C but the overcast windy days often dominated the sunshine. Chatham Island, at 44° south of the equator, is well-known for its strong prevailing westerly winds shaping the tall one-sided pine trees. Huge trees that began growing vertically from the trunk base ended up with the tops 90° over horizontal years later. The good news is that the bent-over top branches make great supports for antennas.

As we had to be at the airport loaded and ready to go early Thursday morning, the plan was to shut down Wednesday afternoon. The weather looked ominous and ready to change and a change of plan resulted in getting all the antennas down and the gear packed by noon before the weather turned nasty. We decided to leave the 6 mm nylon ropes up over the high trees in the hopes that some DXpedition in the future will be able to use them.

The last night of most DXpeditions to Chatham usually results in a debriefing and winddown dinner at the local eatery in Waitangi about an hour away. An enjoyable time was had by all the team. Our objective was to concentrate on the lower bands and the 17 and 30 meter bands, and have fun while doing it. Only one of the team had ever been on a DXpedition previously. It was a revelation to many team members that instead of being the hunter while working DX we were the hunted. It was a new experience for many of them to have to adopt strategies to cope with unruly pileups.

The team members were very experienced DXers and rose to the challenge. The statistics of our operation are on the ZL7T Web site **www.zl7t.com**. CW dominated our operation while 17 meters and 30 meters were the most productive bands. We made 10,580 contacts during the 5 days and made a lot of low band enthusiasts very happy. The abysmal Solar Flux Index was not kind to us with many times of the day just noise and few signals.

We would like to express our sincere gratitude to those people and organizations that helped us with generous donations and logistics support. Our sponsors: The German DX Foundation, Nippon DX Association, Chiltern DX Club, Noticebored — a Napier based Internet security company, ICOM New Zealand and the Kiwi DX Group — an informal group of ZL hams.

Thanks to our pilot Duncan, ZL3JT, for keeping us informed daily and Gary, ZL2IFB, our Webmaster, who designed the **ZL7T.com** site and kept it up-to-date with online log search facilities. Quite a few team members have expressed an interest in returning next year. The door is open. QST

W3ZZ

THE WORLD ABOVE 50 MHz

Long Distance E_s Propagation on 50 MHz at Solar Cycle Minimum — *Part 2*

This month Joe Kraft, CT1HZE/DL8HCZ, presents his results and conclusions about long distance 6 meter E_s contacts based on the data he presented in the July column. So pick up the July column and read along.

Results

The various hop target areas have been simulated by DF5AI's *Beamfinder* software (**www.df5ai.net/Software/bfintro.html#Top**) in Figure 6. Circles 1, 3, 5, 7 and 8 from IM57nh are equivalent to the "beginning" of the areas of hops 1-5. Circles 2, 4, 6, 9 and 11 from IM57nh are equivalent to the "end" of the areas of hops 1-5. Note the correspondingly widening areas as the number of hops increases. Limiting target areas to 1500-2300 km, target areas beyond hop 2 overlap and enable us to work any distance beyond the beginning of the third hop. The target areas of the second hop (GN/GO fields) and the third hop (EL, EO, FL-FO fields) are depicted by dark blue squares. Previous reflection from the Earth's surface took place from water areas for all of these hops. The light blue squares in the EN/EO fields can be reached only by reflection of the second hop on land areas.

Areas west of the marked squares in the US (ie, beyond 6900 km) mostly require only a land reflection for the fourth hop. The exceptions are southwest Texas and certain parts of W6/7 that can be reached by a touchdown on water. This agrees well with the findings from EA7KW's NA contacts shown last month in Figure 3.

The First Hop. The target area of the first hop from CT is the Azores Islands (CU). Stations in HM68 are mostly active during their local evening. But the CU3URA beacon was recorded on more than 80% (40/46 days) of NA propagation. At 1600 km the distance from CT1HZE to CU3URA/B may be lower than optimal. The new CU8 beacon was operational for a few days from HM49kl (1950 km distant) and was observed several times during NA openings when CU3URA/B was not audible. It is thus possible that the CU8 beacon will be audible during well above 90% of all NA openings.

Since current activity and beacons are all located in HM68 or HM77, no Gaussian-like curve is obtainable as most of the relevant distances are located in the Atlantic Ocean. This is not a problem as the geometry and distance distributions of single hop 6 meter E_s QSOs are not disputed.

The Second Hop. The target area of the proposed second hop is Newfoundland (VO1). Although 6 meter activity exists, there are no retired, full-time operators similar to those in the US. Since the closest distance between CT1HZE and VO1 is about 3750 km, there is likewise no possibility of finding a nice Gaussian-like distribution here, since distances closer than 3000-3700 km are all in the Atlantic Ocean. On

This Month

August 1-2	ARRL UHF Contest
*August 9	Moderate EME conditions
August 12-13	Perseids meteor shower. For peaks see text.
August 15-16	ARRL 10 GHz and Up Contest

*Moon data from W5LUU

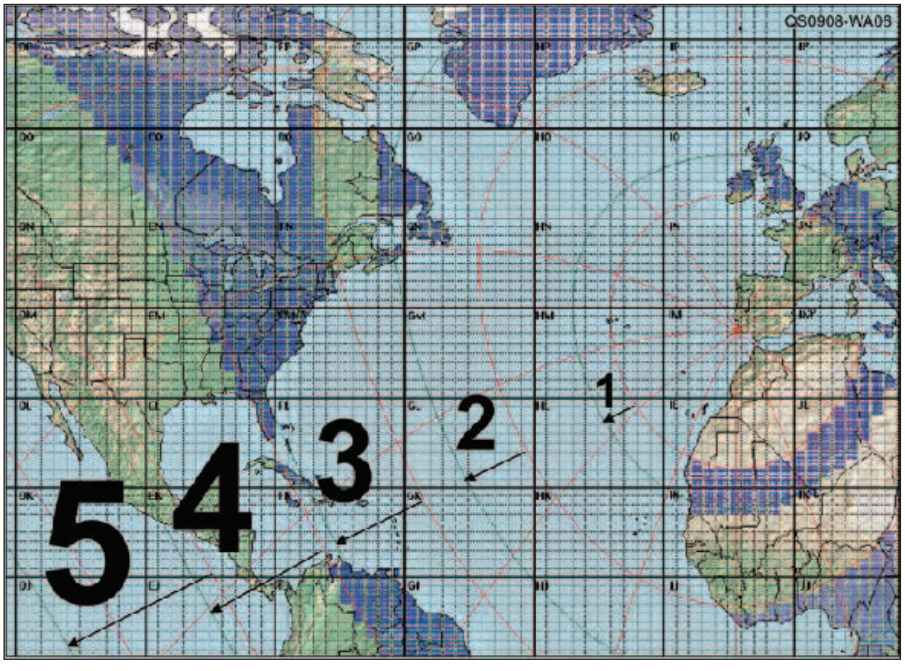


Figure 6 — Simulation of the hop target ranges and areas with the *Beamfinder* software (by DF5AI) assuming a constant height of 105 km for the E layer. See the text for an explanation. To improve the illustration, hop distances were set to 1700 km (minimum) and 2200 km (maximum).

VOLKER GRASSMANN, DF5AI

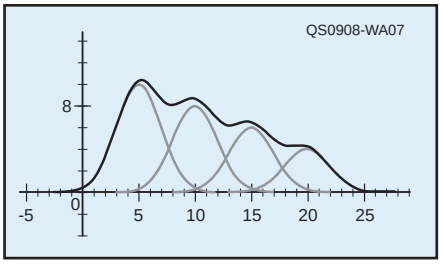


Figure 7 — Illustration of the theoretical result (bold black line) of overlapping perfect Gaussian distributions. (Axes are included to provide scale.)

Gene Zimmerman, W3ZZ ♦ 33 Brighton Dr, Gaithersburg, MD 20877 ♦ w3zz@arrl.org; (301-948-2594)

at least 18 of 46 NA days (~40%) CT1HZE heard VO1ZA/B (GN37js), noted as the peak for the second hop in Figure 5 in the July column. VO1 stations were worked on fewer than 50% of the days when VO1ZA/B was heard. Thus the lack of active VO1 stations keeps the counts for the second hop between 3800-4600 km quite low.

Since VO1ZA/B runs only 10 W to a quarter λ vertical antenna, many openings between CT and VO1 were very likely not detected. We can assume that a 100 W VO1 beacon would double the number of days from 18 to ~36. Furthermore, VO1ZA/B is geographically not perfectly in line with all NA areas, eg, Florida, where several "exclusive" days were counted. On the other hand, VO1ZA/B was spotted by NA stations on the OH2BUA cluster on 15 different days in summer 2008 and on 14 of these days NA also worked into CT on 6 meter. For the NA stations VO1ZA/B represents the first hop.

The Third Hop. Initially one can see a dominant Gaussian-like distribution centered around the 6000 km distance (possibly caused by 3 × 2000 km hops) that rises smoothly from about 4500 km (3 × 1500 km hop) and falls quite sharply at ~6900 km (3 × 2300 km hop). This shape can be easily ascribed to the E_s skip geometry as the known maximum single hop distance is ~2300 km. On the left side of the curve one would expect a smooth rise as many different shorter multiple hop distances are possible, eg, from 1450-1600 km. The downside limit of this curve is the low probability for a relatively high MUF on the actual path over a long distance as we know from extensive transatlantic tests on 70 MHz made in 2007 and 2008. Thus, it is quite plausible to see the curve start in the 4500 km range.

The Fourth Hop. As expected from the first three hops, the next hop should be at ~8000 km. Since path loss rises significantly with the number of hops, four-hop contacts should be "much" less than three-hop. Importantly, 95% of all target areas worked by three-hop E_s (as well as one-hop and two-hop contacts) originate from a water reflection in the Atlantic Ocean. See Figure 6 for target areas of the second and third hop.

The target areas of a possible fourth hop may be worked only via land reflection or by reflection from lakes and rivers. The first would imply that higher power levels may be necessary and the second that certain target areas may be preferred. Given a single maximum hop distance of ~2300 km, the maximum workable distance is ~9000 km. This distance was indeed worked on a few days in 2008 (and also in previous years). The starting distances of the fourth hop of about 6000 km (4 × 1500 km) to about 6900 km is masked by the third hop. QSOs that certainly count for the fourth hop range start at ~7100 km. Although there is only one distinct peak at ~7700 km, the fourth hop was observed on a good number of days and reached most distances of the target range.

In assessing the data we must realize that there are essentially no 6 meter operators in huge regions of the fourth hop target area, eg, DL99, DM90-97, DM80-89 and DM70-77 or at least there are few or no dedicated 6 meter ops trying to work Europe. In 2005-2007 no stations were worked from these squares. This is exactly the 8000-8300 km range that is underrepresented in the curve in Figure 5 from the July column. This lack of activity is one reason that the Gaussian shape of the curve of the fourth hop is unclear. In past summers on several occasions stations from Montana (DN26) were heard on 6 meters in US contests, but it was not possible to get their attention. At a distance of 8000-8100 km we also expect propagation there, although the northern paths to the CN and DN fields are certainly rarer.

In order to show that the 2008 season is quite representative, the 21 squares additionally worked in the years 2005-2007 are colored magenta in Figure 4 from the July column. Thus, the areas that were worked in over 2000 6 meter QSOs from 2005 to 2007 are more or less the same as in the 2008 season.

The Fifth Hop? The target range for a possible fifth hop would be 7500 to 11,500 km. Much of this range overlaps with the fourth hop. Since there is no more land for CT1HZE past California at a distance of ~9300 km, no QSOs are possible at these distances to get the data necessary for a potential peak at about 10,000 km. Although there is a slight indication of a rise at 8900 and 9200 km in the curve of Figure 5 of the July column, the counts are too low to be significant.

A distance distribution for the fifth (and fourth) hop could be derived from the data of 6 meter QSOs between Japan and the US in the summer of 2008. JE1BMJ worked more than 400 QSOs in 2008 to the US and since 100 of these were from 10,000-11,000 km, and 20 from 11,000 to 12,000 km, it definitely appears that the expected distribution is also apparent here. Hopefully JE1BMJ will publish his detailed results soon in another article.

COURTESY JOE KRAFT, CT1HZE/DL8HCZ

Figure 8 — CT1HZE in his shack after 1500 hours of monitoring 6 meters in the summer of 2008.

COURTESY JOE KRAFT, CT1HZE/DL8HCZ

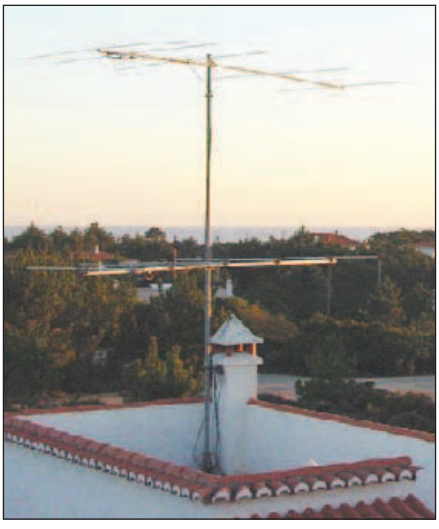


Figure 9 — The view toward North America from the roof of CT1HZE's station.

Conclusions

The distribution of the transatlantic distances worked on 6 meters in summer 2008 clearly shows the existence of a first and second hop, which are well correlated with a Gaussian-like distributed third hop and also a slightly weaker peak for the fourth hop. This result can readily be explained by common simple hop theory. Due to the overlap between the target ranges, in general all distances should be workable up to maybe 15,000 km. This was verified by the EU-NA QSOs up to 9250 km and probably by the JA-NA QSOs up to 11,500 km.

If a chordal propagation model such as SSSP proposed by JE1BMJ plays a significant role in the longer paths one would expect a more equal distribution of the worked distances and no distinct maxima and minima. The almost perfect shape of the distance distribution of the third hop with the borderlines to the second and fourth hop significantly confirms the presence

of certain returning hops between 1500 and 2300 km. Hops of between 1800 and 2200 km apparently lead to the most worked distances in the target areas of the second, third and fourth hop.

Figure 7 shows an illustration of the theoretical result (bold black line) of overlapping perfect Gaussian distributions. In reality E_s distances cannot be really Gaussian distributed at the end of the right side of the curves because of the geometrical limit due to the height of the E layer. Thus the minima of the bold black line in Figure 7 should be deeper in reality. This is in good agreement with the results from the 2008 season shown in Figure 5 from the July column.

Since QSOs from CT to the Caribbean are all in the range of the third hop, it is no surprise that KP4 (FK68), at 6000 km the exact peak of the third hop, was worked on at least 16 days. In addition, four-hop QSOs to the Caribbean and South America were worked in the past over a range from 7500 to 7900 km (eg, FJ09, FJ26, EK57). Due to the lack of resident stations and the geographical shape of Central America and the Caribbean it is impossible to get significant data from this latter region.

The results from the QSOs between NA and Japan and also between Europe and Japan most probably confirm a similar scenario for the fifth hop. The best JA to Europe distance worked so far is between JE1BMJ and CT1HZE over 11,287 km or 5 × 2257 km. During this QSO CT1HZE also observed signals from the target area of the first hop (PA/DL) and second hop (northern Scandinavia).

In summary, the data presented is strongly consistent with a model of E_s propagation over long distances encompassing multiple hops up to 2300 km. While some form of propagation such as the SSSP described by JE1BMJ for long JA/NA and JA/Europe contacts at the summer solstice cannot be ruled out, the kinetics of the observations presented here infer that each of these hops actually occur and that such contacts are possible without invoking any form of ductal propagation.

In the 2008 summer E_s season CT1HZE worked about 230 different grid squares from North America and the Caribbean. Joe looks forward to see each of you in the next 6 meter opening.

Finally, to visualize how the data was collected, CT1HZE and his station are shown in Figure 8 and his excellent view of the Atlantic Ocean appears in Figure 9. Indeed he is optimally sited to carry out this study. A version of CT1HZE's articles in the July and August 2008 columns will also appear in *DUBUS* 2009 Issue 2 (in press).

ON THE BANDS

6 Meters. The summer E_s season is progressing well everywhere except in the east. On May 2 Dave, N3DB (FM18) recounts an interesting opening including K1TOL and K1AC to the south fairly deep into PY, which appears to be straight E_s and not TEP. Stations in the Caribbean one or two hops shorter (KP4, HI, P4) were worked as indicated by Julio, NP3CW. Todd, N4QWZ (EM66) also worked into PY and the Caribbean. Newcomer Mark, WD4ELG (FM06) found the band open to the Midwest. On May3-4 Jack, OA4TT (FH16) immediately under the geomagnetic equator worked ~100 US stations. N3DB reports double hop from FL to WA on the third. On May 4 Mike, KB7ME (CN85) found the band open to the east the entire day. On the fifth the first of several JA openings to the western US saw KB7ME; Johnny, KE7V (CN88); Bob, K6QXY (CM87), and Phil, NØKE (DM69) into Japan. The JA opening continued on May 6-7 for Chip, K7JA (DM03); KE7V, and Mark, W7MEM (DN17) Idaho. Ken, KE2N (FM18) and Jon, NØJK (EM17) report KP4 on the 14th and 17th. The Caribbean/South America opened to Europe on the 18th. OA4TT worked FM, PJ7 and CU the latter his first European on 6 from Canete. Willem, WP3UX (FK68) worked CT [first European this season] and NP3CW worked CN8. Dan, K3ZXL (EL87) and other FL stations worked into Western Europe on the 20th. OA4TT worked 68 stations in the US and Caribbean. On the 21st K7JA and Dave, N7DB (CN85) worked VE8NSD (CP20). A more widespread JA opening on the 22nd reached KS, OK, CO, MT and TX. Jay, KØGU (DN70) worked 6 JAs that day. Fred, KH7Y (BK29) worked 19 JAs on the 21st and 3 US stations including FL on the 22nd. OA4TT worked 31 stations in western and central Europe on the 25th and 5 DLs and Gs on the 28th. KØGU heard HB9 and 9A5 on the 26th. Al, K7ICW (DM62) worked double hop to the Midatlantic. The East Coast had its first decent opening to Europe on the 28th but only to southern Europe. Russ, K4QI (FM06) worked into CT. Emil, W3EP, relays a note from Graham, G3TCT, indicating an 11,500 km contact between EA6 and 9M6. Contacts from TN5SN (JI75) to Europe also indicate multihop that is probably not TEP. Vic, WB4SLM (EM82) worked into the Caribbean and later EA8 with one watt on the 28th.

Tropospheric Ducting. On May 7 Jim, K5YC (DM82) worked into TX, OK, AR, KS and TN on 144 and 432. ODX was N4LI at 787 miles. The morning of May 9 John, W5UWB (EL17) worked trans-Gulf into Florida on 144, 432 and 1296. Al, K7ICW (DM62oh) reports finally completing with John, W7BBM (DM42lg) over a highly mountainous 250 mi path. Of course John's 10.2 m dish helps but the obscured paths are very difficult to work.

EME. How small a station can work 6 meter EME? Pat, WA3RGA (FN10pv) worked W7GJ's elevatable 4 Yagi array May 31 with 375 W to a 3-element Yagi at 20 feet.

HERE AND THERE

August UHF Contest. This contest covers all bands from 222 MHz up. It begins at 1800Z August 1 and ends at 1800Z August 2. This contest now includes a club competition. Rules are listed at **www.arrl.org/contests/rules/2009/uhf.html**.

Perseids Meteor Shower. The Perseids, the granddaddy of all meteor showers, has a peak (ZHR) of up to 100 60 km/s meteors/hr. This year the peak is unclear. The traditional peak is at 1800Z August 12; Lyytinen predicts an earlier peak at 0900Z and if last year's unexpected peak recurs, the peak will be at 0800Z August 13. So keep alert.

ARRL 10 GHz and Up Contest. The initial weekend of this popular microwave contest begins 0600 local time August 15 and runs through midnight local time August 16. Operate any 24 hours. Liaison frequency is 144.260 MHz. Rules may be found at **www.arrl.org/contests/rules/2009/10-GHz.html**.

VHF/UHF Century Club Awards

Compiled by Sharon Taratula
Administrative Manager

The ARRL VUCC numbered certificate is earned by amateurs who submit written confirmation for contacts with the minimum number of Maidenhead grid locators (indicated in italics) for each band listing. The numbers preceding call signs indicate total grid locators claimed. The numbers following the call signs indicate claimed endorsement levels. The totals shown are for credits given from April 1, 2009 to May 31, 2009.

The VUCC application form, field sheets and complete list of VHF Awards Managers can be found on the VUCC Web site at **www.arrl.org/awards/vucc**. An SASE to ARRL is required if you cannot download these forms. Send questions relating to VUCC to **vucc@arrl.org**.

50 MHz
100

1679	N3ZBK
1680	SM7AED
1681	VA2LGQ
WA3BZT	125
K3MSB	150
N9ISN	150
W4FRA	300
W4AVY	325
K6LMN	400
WA5KBH	400
K6GXO	500
W5WVO	500
WX7M	525
AK3E	700

144 MHz
100

694	CT1DIZ
695	N6VMO
K8TL	200
WA3BZT	200

1296 MHz
25

155	K8ZES/2
156	W3UUM

10 GHz
5

188	KBØPE
189	W1JHR

3.4 GHz
5

AA5C	20

Satellite
100

173	XE2YBG
174	N9AMW
175	ZS6WB
176	K4DLG
177	WA2S
178	KBØRZD
179	YV1DIG
180	W8KHP
181	WB2OQQ

DXCC Honor Roll

Bill Moore, NC1L
Awards Branch Manager

The DXCC Honor Roll is earned by DX Century Club members who submit confirmation for contacts reached within the numerical top 10 of the overall number of entities on The ARRL DXCC List for Mixed, Phone, CW and RTTY modes. There were 338 entities on the DXCC list for this period with 329 being required for the Honor Roll. The period for this list is from January 1, 2008 through December 31, 2008. The **boldface** number indicates the total current DXCC credits. The number next to the call sign represents an individual's overall total.

MIXED
338

Top of the Honor Roll

4X1FQ/378
4X4DK/389
4X6KA/345
4X6UO/344
9A2AA/367
9A2EU/344
9A4A/371
9A7V/344
9A7W/338
9A8A/344
AA1V/351
AA4H/349
AA4V/358
AA4Z/361
AA5AT/344
AA7A/351
AA8EY/361
AB0X/351
AB8K/355
AB9V/347
AC8G/349
AD1C/348
AD5A/343
AF2C/348
AI0O/346
AI9Y/343
AJ3K/347
AJ6V/349
AK0A/348
AK1N/347
AL7R/344
CT1BH/366
CT1BOH/344
CT1EEB/342
CT1ZW/357
CT3BM/347
DF2NS/346
DF2UH/343
DF3CB/345
DF3GY/346
DF3UB/344
DF4PL/345
DF9ZP/345
DF9ZW/344
DJ2BW/387
DJ2RB/351
DJ2TI/356
DJ2YA/376
DJ3IW/346
DJ4AX/369
DJ4GJ/346
DJ4PI/364
DJ4SO/352
DJ4TZ/377
DJ5AV/347
DJ5JH/365
DJ5JK/357
DJ6NI/362
DJ6OV/351
DJ6TK/364
DJ6VM/362
DJ7ZG/372
DJ8CG/345
DJ8NK/360
DJ9HX/346
DJ9ON/352
DJ9RR/347
DJ9WH/339
DJ9ZB/360
DK1FW/361
DK1RV/347
DK2GZ/343
DK3HL/355
DK3KD/352
DK5AD/353
DK8DB/346
DK8UH/343
DL0BMW/342
DL0WW/355
DL1BO/386
DL2FAG/344
DL3IE/366
DL3MGK/342
DL3OH/368
DL4MCF/344
DL6JGN/350
DL6QW/366
DL7HU/379
DL7VEE/349
DU9RG/345
EA1AUS/344
EA1RT/346
EA3BT/343
EA3NA/363
EA4DO/367
EA4DX/344
EA4KD/344
EA5BM/343
EA5BY/343
EA5KY/339
EA6BH/357
EA6NB/344
EA8AKN/344
EA8BYR/342
EA8ZS/344
EI6FR/341
ES1AR/381
ES1RA/351
EY8MM/342
F2VX/360
F3AT/383
F3SG/349
F5II/366
F5IL/345
F5JQI/343
F5NBU/344
F5NBX/343
F5NTV/344
F5OZF/344
F5QF/348
F6BEE/352
F6BFH/357
F6DLM/349
F6EXV/349
F6FHO/346
F6FWW/344
F6FXU/343
F9CZ/347
F9GU/377
F9RM/380
F9XL/357
GØCGL/344
GØDQS/344
GØJHC/344
G3GIQ/371
G3KHZ/362
G3KMA/373
G3LQP/363
G3NDC/353
G3NLY/370
G3OAG/346
G3PJT/342
G3PLP/347
G3RTE/350
G3SJX/347
G3SNN/349
G3UML/369
G3VKW/353
G3VXJ/345
G3XTT/347
G4BWP/347
G4IUF/346
G4OBK/344
G4PTJ/344
G4SOZ/338
G4ZCG/344
GJ3LFJ/344
GMØAXY/345
GM3ITN/379
GM3WIL/347
GM3YTS/345
M4YMM/343
GW4BLE/351
HAØDU/355
HA5KG/342
HA5WA/344
HA8IE/344
HBØLL/362
HB9AAA/365
HB9AFI/356
HB9ANK/353
HB9AQW/358
HB9BGV/345
HB9BZA/345
HB9DDZ/344
HB9MX/380
HB9PL/379
HB9QR/376
IØDJV/352
IØEKY/345
IØKRP/353
IØMWI/352
IØTCA/348
IØWDX/356
I1AGC/358
I1WXY/348
I1ZL/382
I2KMG/371
I2MQP/351
I2PEI/351
I2PNB/355
I2YBC/355
I4ACO/347
I4AVG/347
I4DZ/349
I4EAT/351
I4EWH/344
I4FTU/365
I4IZZ/343
I4LCK/363
I4MKN/364
I5ARS/375
I5CRL/352
I5FLN/362
I5JHW/348
I5KKW/349
I5RFD/349
I5SDG/356
I5ZGQ/349
I6FLD/376
I6FYR/347
I6NO/363
I8ACB/352
I8DVJ/344
I8IHG/347
I8MTQ/348
IKØAZG/344
IKØDWN/344
IKØFVC/343
IK1GPG/344
IK2ABJ/344
IK2ANI/344
IK2BLA/344
IK2GNW/344
IK4BHO/344
IK4CIE/344
IK4FNF/341
IK4HLO/344
IK4NQL/343
IK5BAF/344
IK5CBE/343
IK5HHA/345
IK6DLK/344
IK7FPV/344
IK8BQE/345
IK8CNT/344
IK8HJC/340
IT9GCQ/352
IT9HLR/344
IT9UCS/349
JAØCRG/345
JAØDAI/349
JAØDWY/352
JAØEKI/338
JAØHXV/346
JAØUH/351
JAØUUA/344
JA1BK/377
JA1BLC/368
JA1BRK/375
JA1CNM/349
JA1CZI/354
JA1DFK/343
JA1DIO/352
JA1EOD/365
JA1FNA/358
JA1FQI/339
JA1GRM/343
JA1GV/368
JA1HGY/364
JA1IFP/366
JA1IOA/349
JA1KQX/351
JA1LSP/354
JA1MLV/354
JA1MRM/351
JA1OND/355
JA1PEJ/349
JA1SGU/352
JA1SYY/351
JA1TRL/355
JA1UQP/363
JA1VLK/351
JA1WSK/356
JA1WSX/357
JA1XQC/342
JA2AH/363
JA2AXB/351
JA2BAY/354
JA2CXH/352
JA2DSY/360
JA2FJP/347
JA2IVK/354
JA2JNA/347
JA2JW/380
JA2KVD/354
JA2MNB/344
JA2QPY/345
JA2TBS/345
JA2VPO/350
JA2WYN/345
JA3EMU/358
JA3FYC/356
JA3LDH/344
JA3MHA/342
JA3PIS/347
JA4AFT/363
JA4DLP/358
JA4DND/355
JA4IYL/347
JA4LKB/347
JA4LXY/355
JA4ZA/371
JA5AUC/351
JA5IU/355
JA5XAE/340
JA6BZI/363
JA6GXP/355
JA6LCJ/352
JA7AQR/356
JA7EMH/347
JA7IC/346
JA7MA/365
JA7MFL/344
JA7MSQ/344
JA7ZF/358
JA7ZP/350
JA8ADQ/369
JA8BAR/357
JA8CDT/358
JA8DNV/355
JA8FKO/352
JA8MS/362
JA8NFV/349
JA8RJE/345
JA9BEK/346
JA9BFN/344
JA9CGW/349
JD1AMA/344
JE1PNX/343
JE2LPC/345
JE2LUN/347
JF1KKV/349
JF2MBF/344
JF7XKY/350
JG3QZN/345
JH1AFD/346
JH1AGU/352
JH1GZE/357
JH1HGC/354
JH1SJN/345
JH2FXK/343
JH2RMU/344
JH2SON/344
JH2UVL/351
JH3VNC/349
JH4IFF/349
JH4JNG/344
JH4UYB/345
JH5FTY/344
JH8JPK/349
JH8SLS/344
JI1DHY/343
JI1FXS/342
JI1MNT/344
JI1NJC/344
JJ2RCJ/345
JJ3PRT/353
JK1OPL/359
JO1WKO/343
JR1AIB/352
JR1BLX/353
JR1DUP/348
JR1MLU/353
JR1TNE/356
JR1XIS/346
JR2KDN/344
JR3HZW/350
JR7TEQ/353
JR9LKE/339
JS2LHI/342
KØBS/362
KØBX/351
KØCA/344
KØCS/352
KØCX/347
KØEOU/349
KØEPE/367
KØEU/349
KØFF/352
KØGSV/359
KØGX/339
KØIEA/359
KØJGH/351
KØJUH/345
KØMN/353
KØQC/346
KØQQ/359
KØSR/352
K1AC/346
K1BD/350
K1BW/360
K1DG/346
K1IK/354
K1JU/344
K1KI/358
K1KO/344
K1LD/346
K1MO/351
K1NOK/351
K1NY/353
K1RM/366
K1WER/342
K1ZZ/358
K2CL/366
K2CO/348
K2EP/343
K2EWB/353
K2HK/369
K2MUB/369
K2PLF/349
K2PS/350
K2QMF/350
K2SGH/350
K2TE/346
K2TQC/377
K2TWI/346
K2XF/346
K3BEQ/350
K3DI/350
K3JGJ/354
K3PH/350
K3PL/357
K3UA/353
K3VN/345
K3WC/365
K3WW/357
K4AU/344
K4AVC/355
K4BVQ/378
K4CIA/370
K4CN/347
K4DX/349
K4DXA/346
K4DY/367
K4FJ/372
K4ID/372
K4IQJ/347
K4ISV/370
K4JAF/346
K4JLD/352
K4JRB/373
K4MQG/374
K4MS/357
K4MZU/373
K4PI/357
K4SBH/355
K4SO/345
K4TAG/354
K4TEA/369
K4TQ/344
K4UTE/363
K4WS/355
K4XG/366
K4XI/359
K4XO/364
K4XP/352
K4YR/386
K4YYL/371
K4ZYU/362
K5AC/349
K5AQ/365
K5AT/344
K5BG/344
K5CON/346
K5DU/344
K5EJ/356
K5GH/359
K5GZ/351
K5JP/344
K5JUC/349
K5KLA/355
K5NA/368
K5OVC/363
K5PC/346
K5PP/349
K5QY/346
K5RC/367
K5RK/355
K5TT/345
K5UR/365
K5VRX/349
K5XX/359
K5YY/370
K6AM/346
K6DT/373
K6EGW/347
K6FG/351
K6FM/355
K6GAK/364
K6GXO/350
K6KII/382
K6KLY/344
K6RIM/362
K6RN/378
K6SQL/349
K6TA/372
K6XJ/358
K6YRA/372
K6ZG/347
K7AA/365
K7ABV/368
K7AR/346
K7EG/351
K7GEX/354
K7JS/344
K7LAY/352
K7LJ/348
K7LZJ/343
K7NN/362
K7OM/348
K7PI/348
K7SO/350
K7XB/358
K7ZBV/348
K7ZD/344
K8AJR/343
K8AV/343
K8CW/361
K8CX/351
K8DR/381
K8EJ/370
K8FL/373
K8GG/350
K8LN/345
K8MC/348
K8MFO/368
K8NA/353
K8NW/350
K8PT/353
K8PYD/362
K8RA/358
K8RR/363
K8VFV/346
K8WWA/344
K8YSE/344
K8ZZU/347
K9AJ/356
K9BWQ/357
K9CW/357
K9DX/346
K9EU/351
K9HMB/353
K9KK/347
K9MM/365
K9NU/344
K9OW/354
K9QVB/352
K9RA/364
K9RR/348
K9UWA/354
K9VAL/349
K9XJ/358
KA6A/344
KA7T/344
KA9CFD/344
KB5GL/348
KB7YX/346
KB8NW/344
KC2NB/346
KC3X/346
KC5P/344
KC8CY/349
KD4OS/344
KD5M/350
KE3A/348
KE4YD/344
KE5TF/345
KE9ET/343
KE9I/346
KE9U/350
KF2O/356
KG9N/347
KH6HH/359
KI6WF/343
KJ9I/345
KKØM/344
KKØU/348
KL7J/345
KM1R/346
KM3V/344
KN4F/346
KN9T/346
KP4BJD/355
KP4L/357
KP4P/350
KR5C/350
KT9T/356
KUØA/343
KWØA/361
KW4MM/343
KY7M/347
KZ2I/357
KZ2P/347
KZ4V/344
LA2QM/344
LA5XGA/344
LA7QI/352
LA7SI/345
LA8XM/344
LA9DAA/343
LA9SN/344
LA9XG/344
LU1BR/358
LU1JDL/345
LU2NI/344
LU3CQ/352
LU3MCJ/346
NØTB/357
NØXA/349
N1API/345
N1DG/353
N1RJ/343
N1XX/370
N2BJ/348
N2LT/361
N2TK/348
N2TN/343
N2TU/344
N2WB/344
N3II/356
N3ME/345
N3SL/346
N3US/353
N3XX/345
N4AA/356
N4AH/358
N4AVV/348
N4CC/360
N4CH/345
N4JA/355
N4JR/344
N4KG/365
N4MM/367
N4NX/352
N4OL/346
N4SZ/347
N4TJ/356
N4TL/345
N4VB/349
N4WW/369
N4XM/352
N4XO/377
N4XP/360
N4XR/380
N4ZC/367
N5AR/373
N5ET/348
N5FG/354
N5JR/348
N5LZ/345
N5MT/345
N5NR/348
N5OK/355
N5TY/351
N5UR/358
N5ZM/346
N6AR/374
N6ET/364
N6FX/377
N6JV/355
N6JZ/357
N6OC/350
N6OJ/355
N7BK/344
N7EF/349
N7HN/348
N7KA/357
N7NG/367
N7RO/363
N7RT/362
N7US/355
N7UT/351
N8AA/367
N8BJQ/346
N8DJX/347
N8DX/364
N8GZ/388
N8JV/344
N8JX/349
N8PR/344
N8RF/348
N8TR/346
N9AB/363
N9AF/367
N9AU/353
N9LR/351
N9MW/350
NAØY/381
NA2X/351
NA4D/348
NA4M/359
NA9Q/350
NE8Z/359
NM4O/348
NN2Q/344
NN5O/345
NN6K/338
NO2R/348
NQ1K/347
NR1R/354
NS6C/355
NW7O/347
NYØV/350
NZØO/343
OE1ZL/354
OE2EGL/368
OE2GEN/344
OE2VEL/350
OE3EVA/354
OE3OLW/348
E3WWB/361
OE5KE/353
OE6DK/352
OE7SEL/346
OE8RT/368
OH1EB/344
OH2BH/372
OH2BN/352
OH2BR/366
OH2BU/359
OH2DW/349
OH2EA/360
OH2FT/344
OH2KI/361
OH2LU/362
OH2RI/358
OH2VZ/371
OH2XF/375
H3NXW/339
OH3RF/344
OH4NS/371
OH5KW/345
OH5NZ/369
OH5PA/361
OH5VT/360
OH8KN/353
OH9OM/355
OK1MP/376
OK1PD/360
OK1RD/346
OK2SK/345
OM3MM/384
ON4AOI/343
ON4DM/386
ON4IQ/342
ON4ON/343
ON4TX/375
ON4UN/367
ON5FP/344
ON7DR/343
ON8AW/362
OZ1BTE/344
OZ1CTK/349
OZ1FAO/346
OZ1LO/368
OZ3PZ/359
OZ3SK/377
OZ7DN/343
OZ7YY/358
OZ8BZ/363
OZ8XW/344
OZ9PP/357
PAØCLN/348
PAØGMM/358
PAØLOU/382
PAØTAU/372
PAØWRS/348
PA1CW/343
PA3FQA/343
PP5SZ/348
PT2BW/361
PT2TF/350
PT7WA/355
PY2RO/344
PY2XB/345
PY2YP/348
PY5EG/350
PY7XC/344
PY7ZZ/357
S5ØA/364
S57AC/366
SLØZG/344
SLØZZI/345
SMØAGD/379
SMØAJU/382
MØCCM/355
SM1CXE/374
SM2EJE/349
SM3BIZ/387
SM3CXS/366
SM3DMP/349
SM3DXC/352
SM3GSK/346
SM3RL/361
SM4CTT/353
SM4DHF/359
SM4EMO/352
SM5ARL/364
SM5AYY/346
SM5BFJ/362
SM5CZQ/363
SM5DJZ/352
SM5FUG/345
M5FWW/342
SM5KNV/344
SM5VS/363
SM6CCO/350
SM6CKS/367
SM6DHU/366
M7CRW/358
SP2JKC/346
SP3E/347
SP3FAR/343
SP3IBS/347
SP4KM/344
SP5CJQ/344
SP5EAQ/348
SP5EWY/356
SP6A/345
SP6AEG/351
SP6IXF/344
SP6RT/367
SP7CVW/346
SP7GAQ/344
SP7GXK/344
SP7HT/369
SP8AJK/364
SP9AI/361
SP9FKQ/344
SP9PT/363
SV1IW/351
SV1JG/350
SV1LK/344
T77C/349
T99T/348
TG9NX/350
UA1CT/348
UA3AB/345
UA3AGW/344
UA3AKO/343
UA3BS/348
UA4CC/347
UA6LV/342
UN6T/346
UR7GG/338
US7MM/339
UT5MD/349
UT7WZA/351
UYØMM/345
UY5XE/347
VA3DX/349
VE1AST/353
VE1DX/343
VE1YX/352
VE2GHZ/343
VE3EJ/350
VE3FF/344
VE3LDT/351
VE3MV/348
VE3XN/365
VE3XO/347
VE6WQ/353
VE7AGC/351
VE7BD/360
VE7JO/341
VE7ON/342
VE7SZ/344
VE7VF/343
VK3QI/352
VK4LC/378
VK5WO/374
VK6HD/364
VK9NL/344
VK9NS/344
VO1FB/368
WØAWL/346
WØBKR/344
WØBV/352
WØCM/387
WØCP/349
WØDJC/342
WØFK/350
WØJM/345
WØNS/352
WØRI/374
WØWOI/351
WØXV/345
WØYVA/348
WØZR/358
W1AO/348
W1CKA/381
W1CYB/353
W1DGJ/375
W1DIG/343
W1GD/352
W1GG/369
W1GL/358
W1HEO/353
W1JR/386
W1JZ/365
W1KSZ/348
W1MAG/349
W1MI/354
W1NH/358
W1NU/384
W1PNR/358
W1TRC/354
W1TYQ/373
W1WEF/348
W1WLW/369
W1YM/344
W1YRC/365
W1ZK/359
W2AY/348
W2FLA/365
W2FP/364
W2HTI/386
W2KKZ/346
W2MPK/364
W2OKM/389
W2QM/385
W2RD/343
W2RS/359
W2SM/358
W2SY/364
W2UP/348
W3AP/363
W3BTX/358
W3GG/362
W3GH/385
W3KB/346
W3LPL/365
W3MF/348
W3NO/355
W3NV/361
W3OOU/346
W3OZ/344
W3UM/350
W3UR/345
W3YX/348
W3YY/349
W4ABW/364
W4AO/364
W4AVY/381
W4AXL/358
W4BUW/351
W4CK/346
W4CZU/353
W4DK/352
W4DKS/362
W4DR/386
W4DXX/359
W4ETN/346
W4FQT/346
W4GD/348
W4GF/371
W4JR/343
W4LK/349
W4MBD/352
W4NL/366
W4PZV/364
W4TD/347
W4UM/349
W4VHF/351
W4VQ/374
W4WG/364
W4WM/353
W4WX/339
W4YCH/354
W4ZV/379
W5AV/376
W5BC/348
W5BOS/367
W5BPT/350
W5EC/356
W5EU/361
W5FI/350
W5FKX/352
W5GO/345
W5HD/353
W5IZ/369
W5JE/352
W5MQ/364
W5NUT/383
W5OU/357
W5PJR/346
W5RQ/351
W5TCX/345
W5XX/359
W5ZE/352
W5ZPA/350
W6AN/358
W6BCQ/360
W6BJH/359
W6BSY/386
W6DPD/348
W6EL/376
W6EUF/370
W6FW/376
W6GR/368
W6IJ/347
W6IS/343
W6JRY/360
W6KH/383
W6KPC/370
W6OAT/368
W6SR/353
W6TC/360
W6VX/343
W6XA/347
W6XI/361
W6YA/375
W6YI/355
W7ACD/377
W7AM/358
W7CA/343
W7CB/365
W7CL/344
W7DQ/356
W7GN/386
W7ID/352
W7KH/393
W7KNT/347
W7KQ/354
W7LFA/364
W7LR/355
W7MO/352
W7ND/348
W7OM/367
W7PEB/344
W7SDR/348
W7UT/354
W7XA/359
W8AXI/346
W8CZN/349
W8DCH/367
W8DX/347
W8GF/369
W8GG/347
W8GMH/348
W8HB/344
W8HC/344
W8ILC/368
W8LKG/350
W8LU/352
W8QBG/362
W8QHG/348
W8UV/348
W8UVZ/357
W8WEJ/346
W8WOJ/358
W8XD/347
W9BF/346
W9CH/377
W9DC/369
W9DMH/351
W9IL/347
W9IXX/344
W9JA/356
W9KNI/376
W9LA/364
W9LKJ/364
W9MU/349
W9NGA/357
W9OP/348
W9PJ/357
W9RN/359
W9SN/343
W9SS/359
W9VA/355
W9YSX/383
W9ZR/364
WA1JMP/355
WA1S/344
WA2NPD/351
WA2UXC/351
WA3DVO/366
WA4FFW/364
WA5HOD/345
WA6F/348
WA6TLA/354
WA6WZO/352
WA8VPN/348
WA8WV/349
WA9CVK/348
WB1J/354
WB2AQC/355
WB2YQH/363
WB4OSS/364
WB5XX/344
WB6RSE/350
WB7B/344
WB8K/350
WB8ZRL/347
WB9EEE/346
WB9Z/352
WC4B/348
WC6DX/343
WD5DBV/349
WD5GJB/348
WF5E/376
WF5T/349
WI8R/344
WJ4T/344
WK3N/344
WK7E/346
WO2N/344
WQ3X/348
WT8C/347
WX5L/347
WZ8P/346
XE1AE/379
XE1CI/355
XE1J/359
XE1L/349
XE1ZLW/343
XE1ZW/345
YL2MU/352
YO3APJ/355
ZL1AMO/366
ZS4TX/343

337

7L1WII/341
9A1CAL/349
9A1R/343
9A2OM/344
9A2YM/355
9A3SM/343
AA1K/348
AA4S/360
AA5AU/344
AA5BT/343
AA5C/346
AA6G/351
AA6YQ/342
AB5C/348
AD8RL/343
AFØF/344
CT1EKY/339
CX4CR/357
DF2RG/346
DF4TD/345
DF7NM/345
DJØMCH/341
DJ3AS/346
DJ4LK/364
DJ4PT/362
DJ4XA/366
DJ6DU/345
DJ6RX/365
DJ9RQ/354
DKØEE/343
DK1BX/343
DK2JX/345
DK3SF/354
DK5PR/357
DK5QK/354
DK6WA/346
DK9IP/344
DK9KX/352
DL1AMQ/344
DL1EY/359
DL1RWN/341
DL4FW/345
DL4MDO/343
DL5ZB/337
DL5ZBB/343
DL6ATM/347
DL7MAE/343
DL8NU/366
DL9TJ/368
DL9YX/363
DL9ZAL/343
EA1JO/346
EA3BHK/339
EA3LX/342
EA4MY/354
EA8LS/340
EA9IE/346
F2GL/356
F2WU/351
F3TH/343
F3TK/352
F5XL/343
F5XX/340
F6AJA/359
F6ANA/343
F6AOI/361
F6BKI/352
F6BLP/347
F6BWJ/350
F6CKH/357
F6COW/341
F6CUK/349
F6CXJ/345
F6DHB/348
F6DZO/344
F6HIZ/343
F9LX/354
G3HTA/365
G3JAG/365
G3RUV/359
G3TXF/356
G3VMW/347
G4EDG/344
G4GED/343
GM4FDM/340
GM4UZY/338
W3CDP/349
GW3JXN/338
HA3NU/345
HA5AGS/342
HA5BSW/340
HB9ARC/344
HB9BGN/348
HB9BIN/341
HB9BOI/346
HB9CIP/344
HB9CZR/343
HB9DDM/343
HB9DHK/341
HB9DLE/342
HB9KT/346
HB9RE/350
HB9RG/352
HB9TL/385
HB9US/360
HL3IUA/342
HS1NGR/337
IØAMU/387
IØOLK/363
IØSSW/356
I1APQ/359
I1BUP/355
I1EEW/345
I1FNX/349
I2JSB/347
I2PJA/354
I2YDX/357
I2ZFD/367
I2ZGC/351
I3EVK/367
I4IKW/343
I4MFA/346
I5HOR/345
I5KG/343
I5ZJK/343
I7RIZ/351
I8KNT/350
IKØIOL/343
IK1WGX/338
IK2ILH/341
IK4DCT/342
IK4PLW/340
IK4WMA/337
IK5CQV/343
IK6CGO/343
IK8BIZ/337
IK8JVG/341
IK8VRH/337
IN3RZY/347
IN3TJV/349
IN3XAI/347
IT9AF/358
IT9AUA/361
IT9GAI/366
IT9YHR/344
IV3JVJ/342
IV3VER/352
JAØGCI/348
JAØLXP/351
JAØNPQ/350
JAØSC/353
JA1AAT/365
JA1ADN/376
JA1BFF/353
JA1BNL/346
JA1BWA/370
JA1CLW/346
JA1DOF/345
JA1FGB/351
JA1HEE/344
JA1HRQ/353
JA1JAN/362
JA1MCU/364
JA1MOH/354
JA1PCY/353
JA1QWT/341
JA1QXY/357
JA1RJU/358
JA1RWI/351
JA1SHE/342
JA1SVP/352
JA1VDJ/355
JA1VN/354
JA1WPX/349
JA1WTI/358
JA2ADY/346
JA2AHH/346
JA2BL/368
JA2BY/371
JA2CYL/347
JA2DLM/348
JA2EWE/345
JA2FGL/346
JA2JRG/343
JA2LMA/345
JA2XYO/355
JA3APU/343
JA3ART/362
JA3AZD/364
JA3CSZ/350
JA3DY/377
JA3GM/358
JA3GN/348
JA3MF/355
JA3NTE/354
JA3THL/357
JA4DEN/346
JA4FHE/357
JA4JBZ/347
JA4UQY/346
JA4XZR/343
JA5BEN/345
JA5FDJ/350
JA6AV/365
JA6BDB/346
JA6BEE/364
JA6BZA/342
JA6CBG/345
JA6CDA/352
JA6MWW/342
JA6VQA/344
JA6VU/346
JA6YG/364
JA7BJS/351
JA7BSD/351
JA7BWT/344
JA7FWR/346
JA7GDU/354
JA7JH/361
JA7JM/357
JA7LMZ/344
JA7PL/353
JA7XBG/344
JA8AWH/355
JA8DSO/346
JA8EKU/337
JA8GMZ/343
JA8HH/351
JA8JO/357
JA8OW/354
JA9AA/374
JA9CWJ/344
JA9LJS/346
JA9LSZ/337
JE1GMM/352
JE1SYN/342
JE2HCJ/344
JE2OVG/346
JE2URF/343
JE8BKW/343
JE8TGI/342
JF1PUW/347
JF1SEK/348
JF2OWA/343
JG1TCB/339
JH0BBE/344
JH1IED/344
JH1JNR/342
JH1LMG/348
JH1XYR/344
JH2MYN/354
JH5BHP/343
JH6CDI/350
JH6JMN/343
JH7BDS/347
JH7FMJ/349
JH8DEH/340
H8GWW/346
JH8MXH/345
JH8NBJ/343
JH8UQJ/342
JI1UHZ/342
JI1VVB/345
JI2KXK/343
JI5TRJ/343
JJ1TEA/343
JJ2LPV/342
JL1BLW/346
JL1UXH/339
JL1XMN/343
JM1TWR/346
JM1VRW/343
JP1NWZ/344
JR2UJT/342
JR4LNG/342
JR4VMS/342
JR5VHU/342
JR6EXN/343
JR7BDQ/348
JR7VHZ/341
JS3CTQ/343
KØBJ/351
KØDEQ/352
KØHQW/344
KØJN/360
KØJW/355
KØJY/349
KØKG/345
KØRW/344
KØSW/345
K1AR/352
K1EU/343
K1HTV/357
K1KM/347
K1NTR/343
K1OA/342
K1ST/352
K1YR/353
K2AJY/342
K2AZ/344
K2BA/342
K2GBH/345
K2JG/337
K2RW/350
K2SHZ/380
K2TK/348
K2UFM/358
K2UO/350
K2ZD/345
K2ZZ/347
K3FN/351
K3GT/347
K3HP/346
K3II/382
K3KO/345
K3OTY/359
K3SWZ/349
K3ZO/353
K4CEB/365
K4DJ/367
K4ESE/350
K4JEZ/348
K4MD/347
K4MPE/368
K4RBZ/347
K4UEE/359
K4WI/349
K4XH/360
K4XR/350
K4XU/351
K4ZW/347
K5ESW/357
K5IH/346
K5JW/363
K5KC/351
K5KT/348
K5LP/355
K5RH/346
K5RJ/359
K5VV/343
K6AAW/356
K6ANP/358
K6DXX/349
K6EXO/370
K6JAD/355
K6LGF/381
K6LM/350
K6RQ/380
K6SMF/355
K6TS/344
K6XT/358
K6YUI/359
K7BG/341
K7OH/343
K7VS/345
K7VV/352
K7WE/347
K7WJB/342
K7ZA/355
K8DYZ/370
K8FC/344
K8FF/372
K8IFF/363
K8KS/341
K8KWT/346

K8LJG/356
K8RD/350
K8RWL/361
K8SIX/347
K8SL/342
K8VJG/341
K8ZTT/344
K8ZZO/347
K9ADJ/345
K9EMG/350
K9GA/349
K9HQM/353
K9IO/345
K9IR/343
K9IUF/366
K9JF/362
K9KA/363
K9LA/344
K9MUF/345
K9PPY/362
K9RJ/367
K9SM/374
K9ZO/352
KA1ERL/343
KA4S/352
KA5V/348
KA8ZPE/343
A9WON/343
KB4ET/345
KB4XK/343
KC6AWX/342
KC7V/344
KE5K/341
KE9L/342
KE9XN/342
KFØLA/344
KFØQR/340
KF8N/343
KH6CD/391
KL7RA/351
KM1D/352
KO4DI/340
KP2A/347
KR9U/343
KS1J/346
KS4Q/343
KW9K/348
KX6C/343
LA4CM/352
LA4OGA/342
LA5HE/382
LA6LHA/340
LU2DSL/347
NØAV/353
NØJR/345
N1DCM/343
N2MF/349
N2QT/343
N2RR/350
N2UN/350
N2WK/343
N3AM/348
N3VA/344
N4CID/344
N4DB/346
N4GN/343
N4JJ/354
N4JQQ/342
N4KW/361
N4NO/362
N4PN/377
N4RJ/350
N4VN/345
N4ZY/346
N5AN/355
N5AW/355
N5HB/347
N5ORT/342
N5PR/345
N6CR/351
N6EE/337
N6FF/343
N6HR/362
N6RA/362
N6UC/362
N6VR/356
N7KH/347
N8ZX/339
N9BX/345
N9EN/343
N9JV/339
N9OY/341
N9RD/344
N9RS/347
NA2M/353
NA5C/347
NB8B/345
ND6G/343
NE1B/342
NE9Z/343
NF9V/342
NIØG/346
NI4H/345
NI6T/346
NK4L/344
NN1N/345
NN4T/349
NU8Z/342
NX4D/344
NZ9Z/343
OE2LCM/343
OE2SCM/343
OH2BCK/337
OH2BCV/358
OH2BNY/344
OH3BU/341
OH3YI/366
OH4OJ/343
OH5WW/341
OK1ADM/374
ON4AAC/343
ON4ADN/343
ON4IZ/374
ON5FU/351
ON6HE/348
ON7EM/347
OZ1ACB/343
OZ5EV/353

OZ5MJ/352
PY4OY/343
PY5PS/349
RA3DX/343
RA6AR/348
RU3FM/342
RX9FM/342
S51GI/348
S57J/343
S59AA/368
SK7AX/349
SMØBSB/343
SMØDTK/337
MØKRN/343
SMØKV/384
SM2DMU/351
SM3AFR/344
SM3EVR/351
SM3NRY/342
SM3PZG/342
SM4BZH/360
SM4CTI/348
SM4EAC/363
SM4OLL/344
SM4OTI/343
SM5API/366
SM5BCO/376
M5BRW/358
SM5CAK/367
SM5CEU/351
SM5CZY/373
SM5DQC/360
SM6AOU/373
SM6CTQ/355
SM6CVX/363
M6CWK/363
SM7BIP/360
SM7CMY/349
SM7FIG/341
M7HCW/348
SM7TE/356
SP1JRF/343
SP2GOW/344
SP5DRH/344
SP6CZ/344
SP7ASZ/350
SP9WZJ/341
SV1AOZ/342
SV1RK/338
UAØCW/345
UA1MU/359
UA6AF/345
UA9CBO/353
UT3UY/343
UU2JQ/341
UXØUN/360
UX7UN/343
VA5DX/352
VE1ACU/340
VE1AI/353
VE1AL/353
VE1JS/345
VE3JV/342
VE7AHA/351
VE7CT/364
VE7IU/342
VE7SV/370
VE7VV/342
VE7YL/343
VK3DYL/343
VY2OX/347
WØBW/391
WØCD/362
WØFLS/343
WØGAX/352
WØJLC/348
WØKW/343
WØNB/352
WØRT/350
WØSR/355
WØUO/352
WØYG/358
WØZT/347
W1AIM/343
W1CU/352
W1FJ/372
W1GDQ/360
W1HH/380
W1JA/347
W1LW/354
W1MK/345
W1OG/365
W1OO/369
W1UC/354
W1UN/362
W1URV/347
W1WW/362
W1YIF/343
W1YY/358
W1ZA/368
W2BIE/344
W2IJ/349
W2OIB/369
W2OW/339
W2TA/354
W2YC/342
W3DX/344
W3JJ/351
W3MR/347
W3NF/350
W3TEF/346
W4CZ/342
W4DUP/355
W4DZZ/350
W4EP/343
W4FC/356
W4GIW/357
W4HHN/363
W4MPY/346
W4MV/348
W4NKI/367
W4NU/348
W4NZ/360
W4OEL/367
W4OV/356
W4PKU/339
W4RFZ/350
W4SK/340

W4TO/347
W4UNP/348
W4UW/349
W4YO/377
W4ZCB/351
W5DV/356
W5ODD/346
W5OZI/342
W5TO/367
W5UA/344
W5UN/383
W5WP/342
W5ZN/344
W6CN/349
W6CUA/351
W6DCK/343
W6HT/357
W6IEG/350
W6ISQ/378
W6KR/340
W6OM/347
W6OTC/343
W6PBI/372
W6RFF/356
W6RGG/370
W6RJ/374
W6SCC/343
W6VM/343
W6YOO/343
W6YWH/343
W7AJ/352
W7CT/349
W7DQM/366
W7EKM/359
W7EYE/342
W7GA/344
W7IR/389
W7KCN/343
W7KSK/344
W7KW/342
W7QMU/345
W7SLB/342
W7UPF/366
W7ZK/346
W8AAX/352
W8CY/348
W8DO/350
W8EB/337
W8ERD/348
W8LIQ/343
W8LWU/351
W8QID/351
W8QY/382
W8TE/352
W8TN/350
W8VI/341
W8WM/341
W8WRP/359
W9BB/347
W9DS/346
W9DX/348
W9FR/356
W9HA/371
W9JUV/388
W9KQD/367
W9NB/360
W9OL/359
W9RC/343
W9VNE/364
W9WU/352
W9XX/348
W9XY/348
WA2F/344
WA2HZO/350
A2WSX/349
WA3DCG/340
WA6GFE/369
WA6SZE/344
WA8JOC/344
WA9IVU/343
WA9MAG/347
WB4TDH/352
WB4UBD/347
WB8FIW/347
WB9CIF/343
WC5Q/344
WD5K/362
WD6GFF/343
WO9S/349
WQ7B/342
WS7I/344
WT8S/343
WU4G/344
XE1EK/356
XE1VIC/344
YS1RR/357
YU1AB/353
YU1AM/359
YU1FW/352
YU1GTU/350
YU3AA/343
ZL1ARY/369
ZL3JT/339
ZS6P/342

336
4X6ZK/341
7N2KRX/343
9A2F/339
9A2TN/341
9A4SS/336
9A5CY/336
AA1AC/345
AA4MM/364
AA8LL/336
AA9RN/336
AB2N/347
ACØM/347
AD5Q/346
AI3Q/347
AJ9C/344
AK4N/346
CT1APE/338
CX3AN/345
DF7NX/342
DJØIF/340
DJ1OJ/360
DJ9UM/350

DK2OY/346
DK5WL/356
DK8FS/345
DL1DA/361
DL3NM/336
DL3SZ/365
DL3ZA/367
DL6XK/342
DL8FL/360
DL9RCF/336
EA1QF/348
EA3WL/337
EA5RM/340
EA7OH/350
EU7SA/340
F2JD/341
F5HNQ/341
F5OKK/336
F6CLH/343
GØOIL/337
G3KWK/351
G3LZQ/348
G3RZP/343
G3SJH/354
G4BUE/352
G4OWT/338
HA5FA/343
HA9PP/338
HB9AJL/344
HB9ALO/348
HB9AQA/350
HB9BHY/340
HB9CEX/340
HB9DKV/341
HB9KC/365
HK3JJH/342
I1LGR/356
I4ENO/336
I8NHJ/342
IKØHFO/341
IK1RLI/340
IK2WAN/337
IK4HPU/337
IK5EKB/341
IK5MEN/341
IK5ORP/337
IK7UFL/336
IK8FUN/343
IV3JWR/342
IV3TQE/346
JAØAZE/356
JAØBKX/347
JAØDBQ/345
JA1ADT/345
JA1ANR/336
JA1BN/374
JA1BNW/357
JA1CPZ/339
JA1EMK/342
JA1GCA/342
JA1HSF/343
JA1MZM/345
JA1NAQ/345
JA1NWD/342
JA1QOQ/346
JA1SJV/351
JA1TAA/359
JA2BHG/364
JA2JPA/347
JA2XCR/339
JA3AYU/350
JA3BSL/341
JA3DLE/346
JA3HZT/355
JA4GXS/347
JA6BJV/342
JA6CNL/357
JA6TMU/347
JA7EPO/346
JA7MYQ/344
JA7OWD/347
JA7QFU/342
JA8EJO/345
JA9RRH/336
JE1HPM/343
JE4WOK/341
JE7CJL/342
JF1UVJ/343
JF7DZA/342
JH1BSJ/347
JH1NYM/342
JH1OCC/341
JH3AEF/344
JH3IMR/342
JH4GNE/341
JI4POR/340
JJ3HGJ/336
JL1WQO/336
JQ3DUE/337
JR1KAG/346
JR1WCT/347
JR3OEH/340
KØALL/354
KØAXU/355
KØBLT/367
KØGT/345
KØHUU/337
KØIUC/352
KØJPL/359
KØNN/349
KØTJ/342
KØWK/347
K1AJ/351
K1BV/361
K1DC/356
K1EFI/357
K1KNJ/340
K1KZ/340
K2AM/347
K2ARO/346
K2AU/343
K2FF/340
K2FU/345
K2GPL/357
K2LE/369
K2MFY/355
K2MP/342
K2NV/357

K2QE/347
K2SX/351
K2XB/341
K3DPT/341
K3GY/355
K3HT/352
K4ADK/348
K4CL/347
K4HGX/342
K4LRX/356
K4OCE/356
K4QL/345
K4SI/342
K4TXJ/350
K4UY/343
K4VX/359
K4WSB/349
K4WW/337
K4XF/349
K4ZA/342
K5AB/336
K5CSK/351
K5DV/339
K5GKC/346
K5GS/346
K5JB/360
K5LA/348
K5MC/343
K5RE/348
K5UO/348
K5ZK/345
K6EL/343
K6ESL/339
K6MD/344
K6UFO/340
K6ZH/345
K6ZZ/343
K7SP/351
K8BCK/357
K8BL/344
K8RYU/339
K8TMK/348
K8UE/346
K8WK/340
K9ALP/360
K9CC/349
K9DT/352
K9EL/347
K9FN/356
K9IL/354
K9IW/346
K9LCR/344
K9MIE/347
KA1CRP/341
KA5TQF/342
KB2XP/342
KB3KV/343
KE9S/336
KF8UN/341
KG7H/343
KI6T/382
KM4H/342
KM6K/346
KQ3F/345
KR4OJ/348
KS9W/341
LA1FH/350
LA2PGA/341
LA7FD/352
LA9HC/358
LY2IJ/339
NØABE/343
NØAT/352
N1NK/346
N2BAT/342
N2ERN/341
N2JD/350
N2KA/352
N2OO/352
N2VW/348
N4AL/342
N4DW/361
N4LT/345
N4MHQ/344
N4PQX/339
N4RA/359
N5KM/345
N5WI/344
N5XZ/349
N6AWD/343
N6MZ/341
N6ZM/351
N7GR/336
N7KO/342
N7MQ/339
N9AOL/344
N9IW/344
N9NS/352
NDØJ/342
NK5K/344
NO8D/341
NRØX/359
OE1UZ/364
E1WHC/340
OE5NNN/342
OH1HM/338
OH2TA/342
ON4FU/378
OZ4RT/376
PAØINA/357
PA3APW/342
PY2BW/359
PY2SP/341
RA3AUU/340
RL3BM/343
RZ3AM/340
RZ4FA/340
S5ØO/346
S5ØR/353
MØCCE/382
SM5AQD/347
SM5FQQ/347
SM5SWA/341
SM6AHS/349
SM6CUK/361
SM6DYK/349
SM6TEU/341
SM6VR/370

SP3EPK/342
SP6CIK/339
SP7TF/336
T94B/342
UA3AP/338
UA9FAR/344
VE3HO/350
VE3UW/342
VE4SN/349
VE6PY/341
VE7IG/364
WØANZ/347
WØMHK/345
WØTRF/353
WØUD/366
WØVX/352
W1BL/350
W1OX/348
W1UE/345
W1ZT/345
W2CC/356
W2CG/343
W2FGD/368
W2GW/343
W2LO/351
W2PSU/358
W2QL/348
W2RMM/343
W2RQ/347
W2TO/350
W3CC/354
W3DF/347
W3IOP/361
W3KHZ/342
W3OA/342
W3OP/342
W3TN/352
W3XX/360
W4AG/361
W4AXO/344
W4BP/336
W4DC/345
W4IR/348
W4JAM/342
W4KS/350
W4SVO/355
W4UWC/370
W4ZRZ/364
W4ZYT/345
W5AQ/379
W5GAI/356
W5HTY/366
W5UC/358
W6FF/351
W6FI/353
W6JD/356
W6KK/341
W6OUL/348
W6RLL/341
W6RT/385
W6UA/340
W6UY/358
W6ZO/347
W7BG/350
W7BJN/342
W7FP/353
W7JEN/351
W7JNC/364
W7WM/349
W8AEF/347
W8AV/342
W8CRM/342
W8FDN/351
W8GC/356
W8JV/337
W8PHZ/383
W8RV/351
W8SAX/341
W8TWA/350
W9AAZ/341
W9KTP/343
W9LNQ/367
W9MDP/346
W9QQ/356
W9TX/349
W9WJ/343
AØGOZ/339
WA2HZR/349
WA2IKL/346
WA3AFS/344
WA4BIM/346
A4MME/343
WA4VA/341
WA5IPS/342
WA5VGI/340
WA6EZV/342
WA7FKV/350
WB6AXD/336
WB8YJF/342
WD5FVQ/345
WD8E/341
WE9A/340
WP4G/342
WP4U/341
WS6X/345
XQ2CC/370
YO3CD/343
ZS6EZ/342

335
4O3A/337
4X4JU/383
9A1HDE/353
9A9A/344
AA1M/347
AA4HP/335
AA5XE/352
AA7AV/340
AB0CT/339
AB4IQ/340
AB6QM/336
AB9E/346
AC0X/340
AC4S/341
AG9S/344
AL7O/342
CP5NU/339
CT1RM/353

DF2IS/341
DF3IS/337
DJ1ND/345
DJ5DA/369
DJ6KH/355
DJ8FW/353
DJ9KG/347
DK2LO/335
DK6ED/344
DK6IP/347
DK6NP/349
DK6WL/348
DK8NG/349
DK9NA/341
DL1DUL/335
DL3NBL/341
DL5KAT/341
DL5MBY/341
DL6MI/341
DL6NW/346
DL7AFV/341
DL7OD/356
DL7SY/348
DL7WL/346
DL8QS/347
DL8UP/353
DL8YR/351
DL9NC/359
EA3GHZ/335
EA3NC/362
EA4GT/344
EI2GS/340
EI7CC/347
ES1QD/342
EU6MM/341
F2BS/369
F5BDT/335
F5KOK/346
F5VU/357
F6DYY/343
F6DZU/346
F6ELE/341
F6EWK/346
F6GCP/342
F6HMJ/341
GØDBE/340
G3BJ/342
G3HCT/379
G3LAS/342
G3MIR/345
G3MXJ/360
G3OCA/340
G4AZN/345
G4ELZ/342
HA1RB/338
HA1RW/339
HA3HP/338
HA5LV/342
HA6NF/341
HA8UT/343
HB9AZO/345
HB9BLQ/342
HB9BXE/340
HB9CGA/341
HB9CMZ/341
HB9CRV/341
HC1HC/344
HL1XP/341
HL3DE/343
IØKDF/343
I2IAU/342
I2LPA/357
I2MOV/347
I2RFJ/346
I2TZK/342
I2VGW/335
I3ADI/356
I4MNY/335
I4WZT/341
I5ENL/343
I5ICY/342
I5IGQ/342
I8LEL/353
I8QJU/340
I8XTX/345
I8XVP/341
IKØLNN/340
IK1JJB/339
IK2DFZ/340
IK2FIQ/341
IK2IQD/341
IK4DCS/340
IK4DRR/339
IK4EWN/341
IK4WMH/335
IK6BOB/341
IK6GPZ/340
IK6QOP/335
IK7NXM/339
IK8TWV/344
IT9JOF/341
IT9SVJ/341
IT9TQH/343
IT9VDQ/342
IT9ZGY/382
IV3VCS/349
JAØBYS/345
JAØGRF/353
JAØGZZ/352
JA1AFF/349
JA1CHN/346
JA1DM/382
JA1FHK/364
JA1GHR/345
JA1JMF/340
JA1JYZ/342
JA1KAW/343
JA1KJK/338
JA1PMN/347
JA1PUK/347
JA1QOP/346
JA1UXC/343
JA2ACI/343
JA2AO/346
JA2DDN/349
JA2DPC/336
JA2DXD/347
JA2FCZ/344

JA2FMW/343
JA2JSF/353
JA2LHG/352
JA2NDQ/350
JA2ODB/345
JA2QCX/344
JA2VMU/340
JA2XW/367
JA3AAW/364
JA3APL/362
JA3AUQ/351
JA3BQE/358
JA3KWZ/347
JA3MNP/354
JA4MRL/341
JA4RED/344
JA4XH/349
JA5ALE/346
JA5BLB/348
JA5CEX/336
JA5NLN/338
JA6HUG/347
JA6IVR/339
JA6VA/359
JA7ARD/353
JA7FS/359
JA7JWF/350
JA7RPC/349
JA8ALB/346
JA8DRK/350
JA8EOT/336
JA8GTA/347
JA8HYB/340
JA8XJF/352
JA9JFO/349
JE1DXC/341
JE1LFX/339
JE2VLQ/342
JE8LWZ/335
JF2KWD/340
JF2PZH/340
JF2WXS/340
JF3LGC/342
JG1WSC/341
JHØMXV/340
JH1BAM/340
JH1EIZ/342
JH1FDP/348
JH1HLQ/352
JH1IFS/356
JH1LPZ/340
JH2AYB/340
JH2KXN/341
JH3AWX/342
JH3HTD/340
JH3PAS/341
JH4CBM/337
JH4FEB/348
JH4RLY/343
JH6QFJ/335
JH6WMJ/340
JH7CFX/341
JI1PGO/343
JI2EMF/341
JI8DGO/335
JJ1SKG/342
JJ3AFV/341
JK1DVX/340
JL3JTD/340
JL3VWI/342
JM1GAW/341
JM1GYQ/340
JN1MKU/341
JO1MOS/340
JP1IOF/341
JQ1ALQ/340
JQ1BNA/341
JR1CBC/344
JR1IZM/338
JR1MVA/341
JR1PIZ/335
JR2UBS/342
JR3IIR/349
JR6LDE/342
JR6SVM/338
KØDEW/341
KØGM/338
KØKES/347
KØOR/338
KØXN/350
KØYW/344
K1DII/345
K1JO/358
K1KOB/342
K1MY/345
K1RO/344
K1SA/348
K1YT/340
K2DP/351
K2FB/375
K2FL/383
K2JMY/369
K2MYR/345
K2NJ/348
K2OWE/346
K2TV/347
K2VV/356
K2WE/343
K3AB/358
K3GGN/338
K3IE/344
K3KY/346
K3ND/354
K4DLI/344
K4MQL/353
K4PB/342
K4SE/348
K5ACQ/342
K5AS/345
K5DF/345
K5EYT/336
K5FA/358
K5JZ/346
K5KR/350
K5LC/342
K5RT/341
K5UZ/340
K5WE/348

K5YG/341
K5ZQ/350
K6BTT/356
K6CF/341
K6IR/357
K6LRN/343
K6MA/371
K6PT/358
K6RK/356
K7DRN/365
K7GQ/345
K7OSE/354
K8ME/343
K8PV/341
K8QM/336
K8TL/363
K8ZR/353
K9ECE/376
K9FD/348
K9LJN/342
K9RHY/346
K9RT/338
K9YY/341
KA2CYN/343
KA2ELW/342
KC2Q/342
KC9G/340
KD2UF/341
KE2U/339
KG6B/351
KG6I/341
KH6FKG/343
KH6WU/367
KK2I/346
KK9DX/335
KM3J/337
KNØV/344
KN5G/350
KQ9W/341
KR4W/342
KR6C/337
KR8V/344
KSØM/341
UA9YE/346
UN2O/342
UR5LCV/343
US5WE/356
UT2UB/336
UT3UA/340
UT5UGR/339
UU1JA/341
UX5UO/341
UYØIM/340
UY5EG/336
UY5ZZ/338
VA7DJ/338
VE1BLX/345
VE1ZZ/356
VE3BHZ/355
VE3BW/345
VE3LYC/335
VE6AX/338
VE7WO/378
VK3EGN/335
VK3OT/346
WØEKS/351
WØFF/355
WØGG/338
WØGJ/346
WØLSD/349
WØSD/361
WØZU/341
W1BIH/390
W1DOH/343
W1ECH/365
W1ECT/342
W1FYI/340
W1GCC/344
W1GF/349
W1MLG/354
W1NG/362
W1TSP/348
W2CF/347
W2FB/337
W2FKF/345
W2FXA/379
W2GEZ/349
W2JB/353
W2NRA/344
W2TX/344
W2VO/357
W2XI/345
W2XT/343
W2YE/337
W3ETT/367
W3GE/338
W3KHQ/349
W3SI/352
W3VT/387
W4AX/351
W4FDA/363
W4ITD/365
W4JTL/348
W4OWY/345
W4OX/348
W4PRO/361
W4PV/345
W4QCU/352
W4SW/344
W4UBC/340
W5GML/344
W5KK/340
W5NF/346
W5SL/343
W5TUD/339
W5UP/358
W5VX/358
W5XY/353
W5YM/344
W6AUG/342
W6DN/357
W6EJ/346
W6EJJ/364
W6FAH/341
W6GVM/388
W6KFV/368
W6KTE/370
W6KUT/386
W6LQC/358

W6MI/367
W6MUS/346
W6NP/341
W6PGK/342
W6TK/342
W6WI/335
W6XK/335
W6ZZ/363
W7CG/383
W7DT/335
W7IL/356
W7IUV/347
W7RXO/344
W7TSQ/341
W7ZMD/355
W7ZR/350
W8GE/349
W8KA/342
W8KS/345
W8LR/341
W8WFN/339
W9ARV/363
W9DY/379
W9EMF/341
W9RPM/335
W9XT/343
W9YYG/359
WA1FCN/345
WA2NHA/341
WA2UUK/343
WA2VUY/346
WA3HUP/362
WA4AFE/342
WA4CBF/341
WA4IUM/346
WA5BBR/343
A6OGW/351
A8LOW/340
WB3AVN/345
B4MAR/350
WB6MBF/343
WC5E/341
D8MGQ/346
WG6P/341
WR2G/348
WW5L/340
WW7Q/349
YT7DX/344
YV5IVB/341
ZL1HY/346
ZL3GS/361
ZL3JU/335
ZL3NS/367
ZL4BO/375
ZP5YW/343
ZS5NK/346

334
4X1AD/340
7N1GMK/336
7N4OBV/336
9A2JK/337
AA4NC/344
AA4R/350
AA6PI/373
AA8CH/339
AD5W/334
AE1T/342
AE3T/355
AF5M/352
BX5AA/334
DF1DB/348
DJ5IH/354
DK3QJ/346
DK6NJ/346
DL1LH/337
DL3ZI/374
DL6CNG/334
DL6DK/340
EA3EQT/340
EA4LH/360
EA5BD/340
EI6S/348
F2YS/W2/347
F6BVY/339
F6CPO/341
F6GUG/339
F6HWM/340
F8BBL/334
F8GB/349
G3IFB/366
G3KMQ/357
G3NSY/356
G3OHN/338
G4DDS/344
G4SQA/340
G5LP/358
MØVRP/334
M3AWW/359
HB9AAL/341
HB9AIJ/358
HB9DDO/335
HB9HT/359
HB9LCW/335
HC2RG/341
K7XM/343
K7XU/369
K8CH/360
K8DJC/345
K8KAE/359
K8MW/342
K9HUY/341
K9KVA/341
K9RB/346
K9US/343
KA4IWG/339
KA5CQJ/344
KB2RA/339
KB4GYT/338
KCØSB/339
KC5LK/337
KC6X/341
KD6EU/340
KD6WW/342
KE3Q/349
KE5PO/340
KI4SR/339
KJØM/343
KM2P/359

KN2L/339
KN4T/349
KP4AZ/356
KQ4I/335
IZ4BEZ/334
KW4V/341
KW5USA/354
LA6MP/335
LA8PF/351
LU8ADX/335
NØACH/343
NØRN/343
N1AC/345
N2FF/344
N2GBO/347
N2SS/359
N3ED/358
N4AXR/345
N4CFL/342
N4CW/346
N4HH/351
N4RU/349
N4TD/334
N4TN/354
N4TO/367
N4UH/363
N5BV/342
N5GGO/341
N5PHT/339
N5PPT/339
N5TW/334
N5WA/364
N6DUR/338
N6IG/340
N6KZ/339
N6MM/354
N6NG/347
N6ST/348
N7HK/341
N9ALC/342
N9CHN/341
N9ER/344
ND5S/335
NK2H/340
NK8V/338
NM7G/351
NY7T/339
OE1HGW/367
OE1TKW/340
OE2DYL/340
E2KGM/340
OH2BAD/358
OH2BGD/358
OH3MKH/336
OK1AVI/334
OK1DH/352
OK2SW/344
OZ1ING/339
PA3ABH/340
PA3EVY/340
PJ2MI/340
PT7BZ/340
PY5ATL/356
PY5GA/360
RA6AU/334
S55ZZ/341
SMØNJO/338
SM5CZK/344
SM5KI/351
SM6CTC/342
SM7ASN/362
SM7CQY/338
SM7DMN/351
SM7EXE/358
SM7WT/360
SP5DIR/340
SP5PB/342
SV1JA/342
SV8JE/341
UA4PNL/341
UR5EDU/335
UT5UT/347
VE3EXY/334
VE7WJ/352
WØHZ/370
WØJCB/348
WØJW/367
WØTT/336
WØYDB/358
W1BR/360
W1CWU/349
W1DNZ/356
W1GQ/342
W1QJR/375
W1RY/340
W1SKU/339
W2AX/381
W2BXA/390
W2CNS/342
W2HAZ/357
W2VJN/368
W2VUF/364
W2WD/370
W2WG/334
W3IG/343
W3KT/346
W3SB/346
W4EB/339
W4HG/350
W4II/348
W4LIA/336
W4NYN/369
W4YA/359
W4YV/360
W4ZX/345
W5FK/340
W5KN/335
W5NX/340
W5QZ/344
W5WLA/340
W5XC/339
W6AE/359
W6ENZ/340
W6NO/339
W6TJI/347
W6UB/338
W6ZQ/349
W7AV/342
W7LGG/355
W7WT/343

W7YW/334
W7ZI/348
W8BW/360
W8EMI/343
W8FF/354
W8KTH/339
W8NW/343
W8QWI/363
W8XM/352
W8ZET/372
W9GXR/345
W9HB/341
W9IT/361
W9MP/340
W9UM/343
A4MWX/342
A4WTG/355
WA5POK/343
WA6BXV/340
WA6KBL/336
WA7NB/335
WA7UTM/339
A8NMN/350
WA9AQN/339
WB1BVQ/342
WB2GOK/345
WB3CQN/344
WB4W/344
WB9NOV/344
WF2S/339
WMØX/349
WO2T/339
WR6O/339
WT8E/340
WY5H/339
WZ6Z/344
YO7LCB/334
YT1AD/341
YT1AT/342
YU7BB/358
YU7FW/340
YV1TO/344
YV5AMH/344
YV5NWG/334
Z24S/365

333

5B4AFB/333
9A1CCB/345
9A2NO/337
9A5V/339
AAØFT/337
AA1QD/333
AA4ZK/339
AA9DX/339
AB4KO/338
AB5RM/333
AD3Z/351
AD7L/337
AE5V/338
CT3FT/338
DF4RD/340
DF5WA/339
DJ2SL/351
DJ3GG/356
DJ6BN/350
DK2OC/348
DK2PS/343
DL7AV/367
DL7NS/354
DL8VN/345
EA3ELM/339
EA4CP/339
EA5AD/340
EW2AA/333
F5RUQ/336
F5TNI/337
F6CQU/339
F6IFJ/339
F6LQJ/339
G3COJ/359
G3GAF/345
G3KYF/356
G3NKC/338
G3SBP/333
G3ZBA/356
G4DXW/339
G4LVQ/339
GM3PPE/340
GW3ARS/345
HB9IIY/333
HL5FBT/338
HP2AT/336
I1HLI/339
I1TBE/351
I2QMU/340
I2VDX/349
I2WTY/342
I2XIP/343
I4JUB/339
I6NNJ/337
I8JJB/348
IK1HSR/339
IK6FWJ/335
IK7VJO/333
IV3YYK/339
IZ5BAM/333
JAØBJR/340
JAØBMS/340
JA1BJS/342
JA1BRL/340
JA1CJO/340
JA1DDH/342
JA1GO/351
JA1HOM/350
JA1OHD/346
JA1RWE/354
JA1SFL/340
JA1XJA/341
JA1XLU/338
JA2FWS/339
JA2OZI/339
JA2THS/344
JA4BXL/338
JA4ESR/341
JA4ITW/333
JA5AB/354
JA5LI/340
JA6COW/343
JA6GIJ/346
JA6UDI/333
JA7AO/350
JA7DYJ/340
JA7JI/353
JA7KY/344
JA8AQ/373
JF2ICB/334
JG1HND/343
JHØEQN/333
JH1ADY/336
JH1CHU/340
H1OWW/339
JH1QYT/342
JH1SWD/335
JH4CPC/334
JH4UVU/340
JH7LBE/340
JH7NRE/341
JH7SOF/335
JI1CYX/337
JK1EXO/338
JL1EEE/343
JM1JZN/334
JR3MTO/339
JR3RRY/340
JR6LLN/339
KØGUG/341
KØGY/333
KØIIR/343
KØKT/350
KØOB/336
KØWV/339
K1ACL/343
K1KD/339
K1NU/338
K1SF/344
K2BS/368
K2CDJ/339
K2HVN/362
K2IUK/343
K2OGD/336
K2PK/344
K2QIL/357
K2SB/361
K4AIM/375
K4DSE/351
K4EM/338
K4IKM/339
K4PYT/342
K4TT/352
K5GO/354
K5ZR/350
K6BAG/358
K6CTA/337
K6GJ/366
K6IPV/352
K6SE/345
K6TQ/340
K7EFB/341
K8AC/338
K8AJK/363
K8MG/343
K9KU/352
K9MDK/342
K9QFR/350
K9SG/335
K9ZG/341
KA1EJ/341
KA2BZS/341
KB1MY/338
KDØJL/338
KD2SY/339
KD4U/340
KEØMO/336
KF2TI/336
KM4A/338
KU4EC/333
KX2A/339
KX4R/346
LA1K/373
LA4DM/348
NØIJ/343
N1KC/335
N2US/343
N2ZZ/338
N3HBX/336
N3KK/339
N3TO/344
N4EX/338
N4GG/348
N4HID/337
N4RFN/339
N4TB/357
N4TX/345
N5PC/338
N5RR/358
N5YY/349
N6GM/343
N6HK/339
N6ZS/351
N7TK/336
N7TO/340
N7UN/333
N7WO/333
N8CP/338
N8MC/344
N8MZ/342
N8TT/347
N9AG/338
N9AX/338
N9SF/339
NA9A/335
NI3P/339
NK7L/339
NN2C/338
NN6R/348
NR3Y/339
NX7K/353
NY3C/337
OE1ZJ/357
OE3RSB/343
OH3JF/334
OH5NG/347
OK1ABP/352
OK1TD/345
ON5TW/348
PA3FWV/333
PA7F/339
PA7MM/338
PY2PC/364
PY3JZ/338
PY5IP/333
RA9AB/338
S57AT/333
SLØAS/342
SM3BCS/368
SM5CLE/341
SM6BGG/346
SM7BHH/342
SP3BGD/340
SP3DOI/357
SP7ITB/339
SQ6SZ/333
SV1VS/339
UAØAZ/339
UA3LAR/340
UA3TCJ/337
UA9SG/336
UT5UY/334
VE2WY/368
VE3VHB/357
VE6HG/347
VE6KC/337
VE6LB/343
VO1XC/337
VY2RU/335
WØJMZ/352
WØJS/354
WØPR/337
WØUVC/337
W1AX/387
W1GA/373
W1QJ/344
W2CQ/341
W2FCR/351
W2GFF/344
W2LE/339
W2LK/341
W2MF/334
W2OB/352
W2PK/342
W2SON/340
W2ZR/339
W3BL/342
W3MC/340
W4AI/368
W4DCY/338
W4EEU/367
W4GKR/347
W4GKT/343
W4IS/336
W4JAN/347
W4JKC/345
W4KJ/343
W4NK/340
W4RBO/336
W4RJ/346
W5AP/341
W5CWQ/349
W5GVP/342
W6HIB/338
W6KM/341
W6ORD/344
W6RKC/346
W6SHY/343
W6TMD/343
W6US/352
W7/DL1UF/340
W7GB/347
W7IAN/333
W7LY/340
W7NGR/333
W7OIH/339
W8CNL/360
W8IQ/369
W8OI/338
W8ZCQ/378
W9FID/379
W9IIX/342
W9ITB/343
W9RF/359
W9RXJ/354
W9TA/345
WA1YTW/342
WA3IIA/340
A4QMQ/344
WA5JDU/343
WA5YON/339
WA6JA/333
WA8ZDL/344
WB2ABD/342
WB3D/339
WB3JFS/340
WB5MTV/340
WB9UQE/339
DØBNC/344
WD4CBA/337
WI8A/340
WK2H/339
WK6E/362
WN6R/339
WZ4S/339
XE1ILI/338
YB5QZ/338
YL2LQ/340
YO5BRZ/339
YS1GMV/349
YU1EA/342
YU1HA/367
YU1NA/344
YU7BCD/369
YV1AJ/342
YV1KZ/359
YV5AJK/372
YV5ANT/341
ZL2ST/342
ZS1FJ/337

332

7L2OHM/332
9A2X/332
9A2YC/337
9A3NM/332
9A7AA/340
AA4NG/337
AA6IR/335
AA6LY/333
AA8BN/336
AB4H/354
AE5B/352
AF9H/337
AI3Y/340
AI9L/336
AJ6T/337
AJ8J/340
CT4NH/341
DF2UU/338
DL2SCQ/338
DL6YK/360
DL9JH/351
EA3ALD/344
EA4BT/337
EA7BLU/341
F6GKA/338
F6JOB/332
G3TMA/343
G3UAS/340
G4SOF/338
GM3CIX/366
HA8FW/338
HB9AGH/344
HB9BOS/338
IØER/350
IØJBL/342
IØZUT/338
I2BVG/348
I4FAF/343
I5EFO/342
I5PAC/360
I5YDO/339
I7CSB/334
IK1SOW/332
IK2ILK/337
IK2QPR/335
IK8DDN/337
IT9POD/337
IV3BSU/332
JA1IRH/344
JA1NLX/355
JA1STF/337
JA2MOG/339
JA3BXF/352
JA3EOP/349
JA3MLJ/334
JA3TJA/340
JA4BTD/344
JA5BSQ/345
JA5CKD/344
JA5EYW/349
JA6AD/374
JA6OXA/338
JA7BAL/343
JA7BMR/341
JA7WKG/338
JA8DJY/339
JA8EAT/351
JA8GSN/339
JA9IFF/341
JE2PCY/334
JE2PMC/334
JFØCSK/332
JF1MBA/337
JF3KON/338
JF6WTY/332
JH1BAY/345
JH1PEZ/344
JH3GRO/337
JH4GJR/340
JH6GKH/336
JJ2KDZ/336
JK1HGI/332
JL1ARF/338
JL1CHV/338
JL7BRH/332
JM2RUV/332
JN1NDY/334
JQ1IBI/334
JR1IOS/339
JR3PZW/332
JR3QHQ/332
JR6BU/347
JS1DLC/332
KØKO/332
K1HZ/347
K1IE/345
K1RY/343
K2AT/335
K2UR/362
K3AV/370
K3FMQ/337
K3SGE/357
K4CNW/343
K4GN/332
K4IE/344
K4LQ/340
K4MF/341
K4OM/338
K4PVZ/352
K4QD/336
K4SB/355
K5HAA/339
K5KA/340
K5MK/340
K5NX/342
K5NZ/337
K6DW/337
K6EID/350
K6GFJ/346
K6KM/349
K6NS/338
K6QS/338
K6TAR/340
K6UNR/333
K7CVL/354
K8ND/337
K8VP/341
K9CT/350
KAØCPY/338
KA4RRU/336
KBØNL/339
KCØDA/338
KD3RR/332
KF9D/340
KH6ACD/344
KI6Y/336
KO4PY/333
KQØB/334
KQ4C/351
KQ8M/341
KS7C/355
KV1J/337
NØGWR/337
NØVD/337
N4BYU/341
N4IA/351
N4SR/352
N4TV/333
N4VA/345
N4VG/333
N4MX/337
N4XX/357
N4YIC/337
N5IN/334
N5UW/332
N5XU/337
N6HC/337
N6KD/338
N6RFM/336
N7RU/343
N7XD/341
N8EL/353
N8PCN/332
N8TN/354
N9FN/335
NC8V/338
ND8L/336
NI5M/343
NP2N/340
NXØI/339
NY8I/337
OE1FT/374
E1WEU/336
OH1HD/333
OK1ZL/366
ON4GG/336
ON6AA/332
PA3FFJ/338
PA5A/338
PY2KP/337
RN3OA/332
RN6BY/332
S53AW/347
S53R/339
SM3BIU/357
SM3VAC/332
SM4BNZ/351
SM4SET/337
SM5APS/343
SM7MS/380
SV1AER/332
SV1FJA/332
TA1AZ/338
UX4UM/333
VE2DO/350
VE3BZ/355
VE3FRR/338
VE3MDQ/338
VE4ACY/337
VK2AVZ/343
VK2DTH/336
VK3EW/338
WØEJ/344
WØGKE/354
WØHT/341
WØNV/338
WØPSH/338
WØTM/351
WØWC/352
WØZX/336
W1TC/347
W2FT/338
W2IOT/334
W2NO/337
W2TS/345
W2UDT/339
W3BZN/345
W3SOH/361
W3UJ/342
W4CEB/346
W4JFK/344
W4QN/367
W4RDX/337
W4SO/340
W4TGT/337
W5PF/343
W5QNF/340
W5SJ/361
W5TIZ/377
W5WT/339
W6HTC/340
W6MZQ/337
W6RS/340
W6WBY/338
W8DN/339
W8EVZ/366
W8JQ/365
W8KEN/332
W8KL/340
W8SYR/360
W9AA/338
W9KIA/336
W9MMZ/361
W9RB/332
W9RY/352
WA1EHK/335
WA2IZN/343
WA2UKA/341
WA4FHQ/342
WA5ZIJ/343
WA6GIN/336
WA9WJE/355
WA9YYY/339
WB1ASC/334
B2OSM/332
WB2RAJ/338
WB4CSW/341
WB6L/353
WB6ZUC/350
WJ7R/344
WSØE/345
WS1F/335
WZ1Q/341
XE2MX/347
YU7GMN/345
YV1DIG/334
ZL2AL/335

331

A35RK/331
AA4SC/344
AA4XR/341
AB5EB/335
AD6W/339
AI5B/340
AI6Z/340
CT1YH/337
CT3BX/337
DJ5AI/356
DJ8WD/340
DK5JI/341
DK7YY/337
DL1KS/359
DL4CF/336
DL5MHQ/331
DL6GV/332
DL6RAI/337
DL8FM/342
DL9OH/374
DS2BGV/331
E73Y/331
F6CDJ/343
F6FFR/334
F8CIQ/331
F8KA/345
G3UHU/337
G4DYO/345
G4YRR/337
GM3UCH/334
HA5CW/334
HB9BCK/336
HB9BPP/338
HB9CSA/337
HB9ZS/338
HK3YH/344
HK5LEX/335
I1UW/352
I2JQ/338
I3TGW/337
I4JBJ/342
IK1ADH/335
IK4AUY/335
IK4IDF/335
IK5CRH/337
IK7JTF/337
IV3TDM/333
JAØJDV/338
JAØLFV/336
JAØRWF/337
JAØRYN/339
JA1CLZ/336
JA1GHH/337
JA1ITX/351
JA1MJ/361
JA1MZL/343
JA1OVF/341
JA1OYY/348
JA1XGI/344
JA2CGH/337
JA2HJB/331
JA3PG/336
JA3RQ/356
JA6CM/345
JA8BZL/344
JA8XDM/331
JA9GPG/342
JE1CCD/339
JE2TRG/331
JF1EQA/336
JG3SKK/334
JH1MQC/336
JH2AQI/331
JH3SIF/331
JH4PMV/337
JJ3FRB/331
JO1CRA/337
JR6CWC/342
JR6PGB/337
JS6PXB/341
K1DW/333
K1KS/337
K2BXG/344
K2EZK/342
K2HWE/342
K2PWG/339
K2RSK/337
K2UFT/345
K2WJ/336
K2WT/349
K3PA/341
K3SC/345
K4BM/347
K4RO/337
K4SV/332
K4TNN/340
K4WY/338
K5ALQ/335
K5CWR/331
K5FNQ/343
K5LJ/331
K5SM/341
K5TN/338
K6RO/336
K7NTW/340
K8ER/356
K8IA/346
K8JP/352
K8KR/340
K8MID/341
K8OZ/341
K9FZ/333
K9TI/341
KB1CQ/336
KB6KTV/336
KB8GWL/335
KC2KU/338
KC4B/343
KC4EW/336
KD1F/337
KD9EC/336
KD9Q/340
KE1F/342
KE7PB/336
KF4MH/334
KG6AM/336
KG8P/341
KG9Z/339
KI6CG/334
KM9G/338
KN6KI/332
KR9A/339
KS3F/338
KS4YT/331
KX2S/339
KX4DX/342
LA7JO/347
LX2PA/337
N1PM/336
N2FY/343
N3RX/337
N4BQD/337
N4EKD/336
N4IG/359
N4PY/341
N4RF/337
N5EPA/337
N5HSF/336
N5PG/337
N5XG/340
N6ED/334
N6TV/337
N6XJ/347
N7ACB/337
N7DC/335
N7OJ/334
N8KF/340
N8SHZ/333
N9MR/339
N9XX/343
NA7AA/337
NA8D/334
NC6A/336
NH7A/341
NI5DX/336
NMØF/336
NO3N/340
NW4M/345
NZ2L/336
OE3HGB/337
OH1AA/350
ON5JV/334
ON8XA/359
PR7FB/334
RN3DK/331
RU1AO/331
RX4HW/336
RX9TX/331
S55SL/331
SM4AWC/345
SM5CSS/343
SM7BZV/342
SM7CNA/357
SM7DXQ/337
SP1S/335
SP3XR/337
SP5GRM/340
SV1DPI/331
VE2NW/336
VE3KP/343
VE3PNT/337
VE3RIG/332
VE3SWA/331
VE5KX/WØ/333
VK2FH/343
WØCK/331
WØGKL/374
W1AM/354
W1ECS/336
W1EQ/333
W1VJ/334
W2GC/376
W2MJ/373
W2RA/334
W2ZI/340
W3GO/343
W3IRE/349
W3MPN/340
W4DKB/345
W4DMV/342
W4GBU/335
W4JVN/346
W4OGG/342
W4QH/333
W4QM/370
W4RNZ/341
W4VV/338
W4YOK/349
W5FL/339
W5IF/332
W5SG/341
W5XG/341
W6BS/380
W6GM/342
W6PHF/368
W6SIJ/349
W6SZN/338
W6WF/336
W7AO/361
W7IIT/342
W7MH/331
W7PMV/336
W7QN/340
W7RDX/336
W8ZD/369
W9AJ/338
W9BEA/332
W9EDA/337
W9GW/363
W9HJ/372
W9WAQ/340
WAØI/333
WA2USA/336
WA2VYA/345
WA3WIX/342
WA4TLI/350
WA8CDU/337
WB2GAI/334
WB2TPS/338
B2WPM/336
WB3LHD/337
WB4RUA/345
WB5ZAM/337
WC7N/331
WD4NGB/335
WE7K/336
WF1N/336
WF2Y/336
WF4G/344
WG3U/344
WI9H/337
WOØY/336
WQ5W/333
WR5Y/334
WV1R/335
WW1N/358
WY4Q/337
XE1D/337
YB3OSE/336
YL2JN/337
YU1EQ/331
ZL2VS/341

330

4X4NJ/356
7M4GTU/334
AAØAV/340
AA4NJ/337
AA8R/338
AB2RF/330
AD1E/338
AHØW/W7/334
AI7W/336
AK1L/337
BA4DW/330
CE3GN/345
CX2CB/336
DJ3TF/339
DJ5GG/357
DJ5LE/342
DK3PO/356
DK4MX/330
DL7UKA/331
DS5RNM/330
EA1DFP/332
EA3OD/342
EA4JL/357
EA9AM/336
F5JJM/336
F6HUJ/336
G3AAE/381
G3BBR/336
G3TJW/353
MØGAV/332
GM4KLO/336
HB9EAA/330
HB9G/337
HK4SAN/331
I1PME/335
I1YRL/339
I8WY/339
IKØPRP/332
IK1NLZ/334
IK2UKW/333
IK4SDY/333
IK6GZM/336
IK7WPC/330
IK8AUC/336
IT9QDS/338
IZØCKJ/330
JAØCWZ/344
JAØDIN/334
JAØNUB/330
JA1BDF/343
JA1CB/352
JA1DDZ/340
JA1GTF/355
JA1XCZ/338
JA3AFR/353
JA4FM/343
JA5AQC/342
JA5BGA/339
JA5THU/340
JA6JPS/342
JA7GY/339
JA8BB/351
JA9FPI/343
JE1WZB/340
JF1CZQ/337
JF1RYU/331
JF1SQC/336
JF2ION/333
JHØNBN/336
JH1EIG/355
JH1XFR/330
JH2AJY/330
JH2CYU/340
JH2IEE/336
JH7DIS/331
JI8PDC/330
JN1BMX/331
JRØAMD/333
JR1FYS/345
JR8OGB/333
KØKM/333
KØLUZ/349
KØRY/336
KØTVD/336
KØVRW/340
K1EM/341
K1GG/337
K1JN/332
K1VKO/341
K2BX/333
K2CD/333
K2CS/331
K2NT/338
K3NL/357
K3SUE/330
K4BOE/339
K4CSB/335
K4UU/336
K4YT/351
K5ABW/356
K5KV/340
K5PI/331
K6KA/335
K6ND/334
K7BHM/342
K7ER/330
K7JY/345
K7NK/332
K7NPN/331
K7SFN/345
K7SKW/331
K8CI/334
K8IU/336
KAØBKR/336
KA1X/336
KB1HY/336
KB6CLL/335
KCØQ/338
KC5UO/339
KE5AX/347
KF8HR/336
KJ5X/332
KJ6NZ/336
KJ9N/334
KK6T/330
KLØS/335
KNØL/336
KQ8O/337
KR4F/340
KT8X/333
KU2A/336
KV4T/332
KX5V/338
LA2IJ/337
LA5YJ/346
NØFX/335
NØZA/343
N1AE/351
N1CPC/336
N1FOJ/334
N1GS/340
N1RR/338
N3VS/333
N4GE/343
N4OT/342
N4QQ/343
N4RR/346
N4ZX/336
N5FW/345
N6JN/339
N6MA/340
N6SJ/338
N7WS/338
NN9K/333
NT5V/335
NW7E/330
NX1Q/338
NY2E/336
OE6CLD/335
OH1MLZ/334
OH3WS/344
PA3CSR/335
PY3BXW/357
S51MA/341
SM3QJ/341
SP9UPK/330
SQ8J/330
UAØFDX/330
UA4LY/330
UN7JX/333
UT7QF/331
UX4UA/336
VE3CFK/334
VE3QAA/337
VE6FR/333
WØBL/358
WØHH/336
WØSBE/356
W1GX/360
W1IKB/356
W1IQW/330
W1RQ/349
W1YN/343
W2APU/359
W2QXA/346
W2RIJ/336
W3DRY/334
W3HNK/352
W3HRF/335
W3QO/356
W4EO/339
W4EQV/333
W4ITA/340
W4NS/355
W4PLL/374
W5AJ/340
W5ASP/336
W5KV/344
W5LE/338
W5REA/356
W5RJV/335
W6GYM/335
W6KX/337
W6OSP/342
W6XP/353
W7KS/362
W7XN/341
W8BT/340
W8ELL/355
W8GS/345
W8PJY/331
W9AEB/338
W9DE/352
W9EQP/348
W9GD/345
W9NIP/334
W9OF/343
WAØROI/333
WA1PMA/333
WA2VKS/336
WA3V/335
WA4OEJ/343
WA6TJM/338
WA9VGY/353
B4KZW/336
WB5LBJ/
DU/341
WD1X/333
WD5COV/334
WD8LTM/335
WE2K/336
WN9Q/335
WR4K/350
WT4Q/330
WW3S/332
YS1AG/356
YU1TR/337
YV1CLM/335
ZL1ALE/349
ZL1AMN/350
ZL1AV/364

329

4X6UU/335
7K1WLE/335
9A1CCY/329
9A8W/337
AA6Z/337
AA9AA/334
AA9LC/330
ABØGA/329
AG4M/336
ALØE/329
D44BS/352
DJ2AJ/351
DJ3GW/341
DJ6GK/337
DK2UA/342
DK2WH/338
DK9KD/344
DL1BFZ/335
DL2KL/339
DL3MF/332
DL9DRA/329
DL9YC/348
EA3CUU/335
EA4CQT/335
EA7ABW/338
F6HWU/335
GØWRE/329
G3KLL/353
G3MPB/344
G3PJK/335
G3ZSS/336
G4YVV/332
HA5UK/329
HB9CND/335
HK3W/330
HL3ERJ/330
I1SBU/343
I2UPG/337
I3BLF/354
IKØPEA/331
IK4CWP/335
IK8CVZ/332
IK8EPC/335
IK8YTA/329
IZ3BJK/329
JAØUMV/333
JA1DLX/332
JA1JAT/336
JA1KPH/329
JA2CXF/341
JA2HO/354
JA2KVB/337
JA3KNN/329
JA7ASD/336
JA7BVH/344
JA8AWR/336
JA9FAI/337
JE2DZC/335
JF2SKV/330
JH1ECF/329
JH1UBK/333
JH1UUT/334
JH2BFY/338
JH2DMO/334
JH8DBJ/333
JH8JBX/336
JH8RZJ/330
JI1FDF/332
JI1JMK/329
JI1WLL/334
JJ3GPJ/329
JL6HKJ/336
JM1HXU/329
JM1SMY/335
JQ6RUP/331
JR1ITT/334
JR1NHD/331
JR5KQF/330
JT1BV/331
K1IN/333
K1MS/332
K1ZG/336
K1ZZI/335
K2LP/359
K3CV/334
K3QIA/339
K4AVU/340
K4CM/335
K4DN/335
K4HB/329
K5OT/334
K5QX/334
K5RPC/337
K5YA/341
K7HRW/337
K7OX/345
K8UT/335
K9JJR/352
K9MF/345
K9WA/341
K9WZB/337
KA2NDX/333
KB2HK/337
KB5MDD/333
KB6NAN/331
KB9AIT/334
KB9JM/333
KC6H/336
KEØET/334
KF2X/335
KG2KJ/329
KT1J/338
LZ1MS/330
NØAMI/339
N1GC/331
N1LN/329
N2EDF/334
N2NS/329
N2UM/342
N2UR/335
N4DV/378
N5JB/336
N5ML/329
N6OU/334
N6TNX/329
N7TC/331
N8HB/337
N9OP/330
NA2U/335
NU4D/335
OE1NY/354
OE3GCU/330
OH2QV/367
OK1FM/329
OZ5KU/344
OZ8AE/338
PA5EA/331
PP7HS/346
PT7BI/334
PY2DSC/354
RA1AG/329
RA6AF/329
RN3OG/329
RN3OK/329
RU6FZ/329
SM3CBR/336
SM5FNU/337
SM5LI/338
SM6CNN/350
SV8RX/333
UA9SC/329
UN5J/331
UT7EC/329
UT9FJ/329
VE3UZ/331
VE3YV/335
VE3ZZ/333
VE7DP/342
VE9RJ/345
VK3EUZ/330
WØIYH/361
WØNAR/349
WØOE/349
WØSHL/331
W1DF/339
W2EJG/335
W2GDJ/331
W2WC/337
W2YR/336
W3FM/353
W3GQ/333
W3NB/367
W3YT/348
W4JO/331
W4LI/340
W4SD/332
W4TNX/335
W4UFO/333
W5TZN/339
W5VHN/336
W6AXH/348
W6ND/329
W6OES/344
W6TNW/335
W6ZH/341
W7EQ/335
W7NN/337
W7SFF/345
W7VJ/336
W7YS/341
W8AF/335
W8KST/359
W8RI/339
W8UZ/336
W8WT/330
W9XF/329
W9ZX/339
WA1PTZ/336
WA3OFR/338
WA4FLZ/334
WA4JQS/340
WA7ZDU/333
WCØY/335
WD8PKF/340
WI7N/335
WO6G/369
WS7W/338
WW1V/331
WY3A/338
XE1MD/338
ZS6BBP/358
ZS6WB/335

PHONE

338

Top of the Honor Roll

4X4DK/389
4X6KA/344
4X6UO/344
9A2AA/339
9A4A/370
AA1V/351
AA4V/357
AA7A/350
AC8G/349
AF2C/347
AL7R/344
CT1BH/366
CT1EEB/342
CT1XK/353
CT1ZW/357
CT3BM/347
CT3DL/344
CX3CE/343
DF2NS/346
DF2UH/343
DF3CB/344
DF3GY/346
DF4PL/345
DJ2BW/380
DJ2RB/351
DJ2YA/371
DJ4GJ/345
DJ5AV/346
DJ5JH/352
DJ6NI/362
DJ6VM/362
DJ7ZG/372
DJ8CG/345
DJ8NK/360
DJ9ZB/360
DK1FW/361
DK1RV/346
DK3HL/355
DK6XR/352
DK8DB/346
DK8UH/343
DL2GAG/344
DL4MCF/344
DL7AFS/344
DL7HU/377
DL7VEE/348
DL8DSL/338
DL8FAJ/339
DU9RG/345
EA1RT/346
EA3BT/343
EA4DO/367
EA4DX/344
EA4KD/344
EA5AT/344
EA5BY/343
EA5OX/339
EA6NB/344
EA8AKN/344
EA8BYR/342
F2VX/359
F3SG/349
F5II/366
F5IL/344
F5JQI/343
F5NBU/344
F5NTV/343
F6BFH/357
F6DLM/349
F6EXV/349
F6FHO/346
F6FWW/344
F6FXU/343
F9GL/374
F9RM/379
GØCGL/344
GØDQS/344
G3KMA/363
G3LQP/363
G3NDC/351
G3NLY/370
G3UML/369
G3VKW/353
G4IUF/345
G4SOZ/338
GM3WIL/347
HAØDU/353
HA8IE/344
HB9AAA/365
HB9BGV/344
IØDJV/352
IØEKY/345
IØKRP/352
IØMPF/351
IØMWI/352
IØTCA/348
IØWDX/356
I1AGC/358
I1WXY/348
I2AT/368
I2EOW/345
I2KMG/369
I2MQP/351
I2PEI/351
I2YBC/355
I4ACO/347
I4AVG/347
I4EAT/351
I4LCK/363
I4MKN/364
I5FLN/362
I5JHW/348
I5KKW/349
I5ZGQ/349
I6FLD/376
I6NO/363
I6ONE/345
I8ACB/352
I8DVJ/344
I8IHG/347
IKØAZG/344
IKØDWN/344
IKØFVC/343
IK1GPG/344
IK2ANI/344
IK2BLA/344
IK4BHO/344
IK4NQL/343
IK5BAF/344
IK5HHA/344
IK7FPV/344
IK8BQE/345
IK8CNT/344
IK8HJC/340
IK8HJM/343
IK8OZZ/343
IV3YIB/344
JAØCRG/344
JAØDWY/352
JAØHXV/339
JA1BK/376
JA1BRK/373
JA1CNM/349
JA1EOD/365
JA1FNA/357
JA1FQI/339
JA1GV/359
JA1IFP/357
JA1KQX/346
JA1LSP/351
JA1TRL/354
JA1UQP/363
JA2BAY/354
JA2CXH/349
JA2DSY/359
JA2IVK/351
JA2JW/371
JA2KVD/353
JA2QPY/345
JA2VPO/349
JA2WYN/345
JA3EMU/354
JA3FYC/346
JA3LDH/344
JA4AFT/362
JA4DLP/358
JA4DND/355
JA4ZA/370
JA5AUC/350
JA5IU/355
JA7AQR/355
JA7MSQ/344
JA7ZF/357
JA7ZP/349
JA8ADQ/365
JA8NFV/349
JA9BEK/346
JA9BFN/344
JA9CGW/349
JE2LUN/346
JF2MBF/343
JG3QZN/345
JH1AFD/346
JH1GZE/357
JH1HGC/354
JH2FXK/341
JH2SON/344
JH2UVL/346
JH3VNC/347
JH4IFF/348
JH4UYB/344
JH5FTY/344
JJ2RCJ/344
JJ3PRT/353
JO1WKO/343
JR1AIB/352
JR1BLX/352
JR2KDN/344
JR7TEQ/353
JS2LHI/341
KØBS/362
KØCA/342
KØEPE/367
KØEU/349
KØGSV/354
KØIEA/351
KØMN/353
KØQC/344
KØQQ/359
KØSR/348
K1NY/352
K2CL/358
K2EWB/353
K2SGH/350
K2TQC/359
K3BEQ/350
K3JGJ/346
K3PL/357
K3UA/352
K3WC/365
K4CIA/359
K4CN/347
K4DX/349
K4DXA/346
K4DY/362
K4FJ/366
K4JLD/348
K4JRB/373
K4MK/343
K4MQG/370
K4MS/357
K4MZU/360
K4PI/354
K4SBH/355
K4UTE/361
K4WS/354
K4XG/362
K4XO/362
K4YYL/369
K5AT/344
K5CON/344
K5GH/359
K5GZ/351
K5KLA/353
K5NA/363
K5OVC/363
K5TT/345
K5UR/362
K5XX/346
K5YY/367
K6AM/344
K6DT/358
K6FG/348
K6GXO/349
K6KLY/343
K6TA/363
K6YRA/371
K7ABV/353
K7EG/350
K7GEX/354
K7JS/344
K7LAY/352
K7LZJ/343
K7NN/361
K7OM/348
K7XB/356
K7ZBV/348
K8AV/343
K8CX/351
K8DR/369
K8LN/345
K8MFO/358
K8NA/353
K8NW/350
K8PT/353
K8PYD/360
K8RR/363
K8WWA/344
K8YSE/344
K9AJ/348

K9BWQ/357
K9EU/348
K9HMB/351
K9MM/364
K9NU/342
K9OW/354
K9QVB/350
K9RR/348
K9VAL/349
KB5GL/348
KB7YX/346
KB8NW/344
KC2NB/343
KC8CY/349
KD3CQ/343
KD4OS/343
KE4MM/343
KE4YD/344
KE9ET/343
KF2O/355
KG9N/346
KH6HH/359
KI6WF/343
KU0A/343
KW4MM/343
KY7M/343
KZ2I/355
KZ2P/347
KZ4V/344
LA5XGA/344
LA5ZN/338
LU1BR/358
LU1JDL/345
LU2NI/343
LU3MCJ/346
NØTB/357
N1API/345
N1DG/353
N2LT/348
N2TK/348
N2TN/343
N2TU/344
N2WB/344
N3SL/341
N3US/350
N3XX/344
N4AVV/348
N4CC/357
N4CH/345
N4JA/355
N4KG/355
N4MM/364
N4NX/352
N4VB/349
N4WW/363
N4XM/351
N4XP/358
N5FG/353
N5JR/348
N5TY/351
N5UR/355
N5ZM/346
N6AR/369
N6ET/362
N6OC/348
N6PYN/343
N7BK/344
N7EF/349
N7HN/348
N7RO/361
N7RT/349
N7US/355
N8DJX/347
N8GZ/377
N8JV/344
N8PR/343
N8TR/346
NAØY/375
NN2Q/344
NR1R/354
NS6C/355
NT5C/344
OE2EGL/367
OE2VEL/350
E3WWB/361
OE7SEL/345
OE8HIK/342
OE8RT/366
OH2LU/350
OK1MP/370
ON4AOI/343
ON4ON/341
ON4UN/367
ON5FP/344
ON7DR/343
ON8AW/362
OZ1BTE/344
OZ1CTK/338
OZ1LO/363
OZ3PZ/359
OZ3SK/377
OZ7DN/343
OZ8BZ/363
PAØCLN/347
PAØLOU/362
PA3FQA/343
PA8A/346
PP5SZ/348
PT2BW/359
PT2TF/350
PT7WA/352
PY2YP/348
PY5EG/350
PY7ZZ/353
SLØZG/344
SMØAJU/374
MØCCM/346
SM3BIZ/386
SM4CTT/351
SM4DHF/356
SM5DJZ/351
SM5KNV/344
SM5VS/363
SM6CKS/367
SM6DHU/361
SM6GZ/355
SM7CRW/357
SP3E/344
SP5EAQ/348
SP5EWY/347
SP6IXF/344
SP7GAQ/343
SP8AJK/358
SV1LK/344
TG9NX/350
UA3AKO/343
UA6LV/341
UT7WZA/344
VA3DX/349
VE1YX/352
VE2EBK/344
VE2GHZ/343
VE3EJ/349
VE3FF/343
VE3LDT/344
VE3MR/372
VE3MRS/349
VE3XN/365
VE3XO/344
VE7JO/341
VE7VF/341
VK3QJ/351
VK4LC/378
VK9NL/344
VK9NS/344
WØAWL/346
WØBV/351
WØCM/387
WØJM/343
W1CKA/374
W1CYB/351
W1DGJ/375
W1DIG/343
W1GG/348
W1HEO/352
W1JR/375
W1JZ/361
W1MAG/349
W1MI/354
W1PNR/358
W1TRC/354
W1TYQ/358
W1WN/347
W2AY/347
W2GBC/369
W2MPK/364
W2OKM/387
W2SY/362
W3AP/356
W3GH/379
W3LPL/358
W3NO/355
W3NV/361
W3OZ/344
W3UM/350
W3UR/344
W3YX/348
W4ABW/364
W4AVY/367
W4AXL/358
W4DK/352
W4DR/382
W4DXX/357
W4ETN/346
W4FQT/341
W4JR/343
W4MBD/352
W4PZV/363
W4VHF/349
W4WM/353
W4WX/339
W4YCH/350
W5BPT/350
W5EU/361
W5GO/345
W5MQ/364
W5PJR/346
W5ZE/352
W5ZPA/349
W6AN/347
W6BCQ/360
W6BSY/380
W6DPD/348
W6EKR/343
W6EL/374
W6EUF/369
W6GR/366
W6IS/343
W6KPC/369
W6XA/344
W7ACD/377
W7CL/344
W7DQ/356
W7GN/376
W7KNT/347
W7KQ/353
W7LFA/364
W7MO/348
W7OM/364
W7PEB/344
W7UT/348
W8AXI/346
W8DCH/355
W8DX/347
W8LU/350
W8QBG/362
W8UV/348
W8UVZ/351
W9BF/345
W9DC/365
W9DMH/351
W9JA/356
W9LA/364
W9NGA/357
W9OP/342
W9SS/359
W9ZR/361
WA1S/343
WA2UXC/350
WA4FFW/358
WA6F/348
WA6TLA/346
A6WZO/352
WA8VPN/348
WA9CVK/348
WB4OSS/363
WB6RSE/348
WB8ZRL/347
WC4B/344
WD5DBV/349
WF5T/344
WK3N/342
WK7E/346
WT8C/347
XE1AE/379
XE1CI/355
XE1J/359
XE1L/349
XE1ZLW/343
YV5JBI/343
ZL1AMO/359

337

9A7V/342
AA4S/357
AA5AT/343
AA6YQ/342
AD8RL/343
CT1BOH/343
CT1BWW/341
CT1EKY/339
CT1FJK/337
DF2RG/346
DF7NM/345
DJ2TI/353
DJ4PT/362
DJ9RQ/354
DKØEE/343
DK9KX/352
DL1EY/358
DL2FAG/343
DL4FW/345
DL4MDO/343
DL5ZBB/343
DL6QW/356
DL7MAE/343
DL9BM/343
DL9ZAL/343
EA4GZ/358
EA5BM/338
EA7DUD/343
EA9IE/346
ES1AR/371
F2LZ/364
F2WU/351
F5XL/343
F6AJA/359
F6ANA/343
F6AOI/361
F6CKH/356
F6CTL/342
F6HIZ/343
G3SNN/346
G3XTT/346
G4BWP/346
G4GED/343
G4OBK/342
G4PTJ/343
HB9AQW/357
HB9BZA/344
HB9DLE/342
HB9RG/352
HB9TL/384
HS1NGR/337
IØAMU/387
IØOLK/363
IØSSW/356
IØZYA/342
I1APQ/359
I1EEW/345
I1FNX/349
I2JSB/347
I2PJA/353
I2YDX/357
I2ZGC/351
I4IKW/343
I4MFA/346
I5CRL/351
I5HOR/345
I5ZJK/343
I7RIZ/351
I8KNT/350
IK2CHZ/339
IK4GRO/343
IK4HLU/341
IK6GRT/341
IK8HCG/342
IK8JVG/341
IN3TJV/349
IT9GAI/366
IT9GNG/343
IT9YHR/344
IV3JVJ/342
IV3VER/352
JAØLXP/351
JAØNPQ/349
JAØUUA/342
JA1AAT/364
JA1ADN/369
JA1BNL/346
JA1BWA/363
JA1CLW/344
JA1DOF/343
JA1HEE/344
JA1HGY/354
JA1JAN/360
JA1PCY/351
JA1RWI/347
JA1SHE/342
JA1VLK/347
JA1WSX/354
JA2AH/361
JA2DLM/348
JA2EWE/344
JA3AZD/364
JA3CSZ/349
JA3DY/357
JA3MF/355
JA3MHA/341
JA3NTE/352
JA4LKB/342
JA4UQY/346
JA5BEN/344
JA5FDJ/350
JA6AV/365
JA6BEE/359
JA6CBG/343
JA7BSD/351
JA7FWR/344
JA7GDU/354
JA7IC/338
JA7JH/360
JA7JM/354
JA7LMZ/343
JA7MA/364
JA8BAR/356
JA8DSO/345
JA8EKU/337
JA8RJE/343
JA9LSZ/337
JE1PNX/342
JE2URF/343
JE8BKW/342
JF1SEK/346
JH1AGU/351
JH1SJN/343
JH1XYR/344
JH5BHP/342
JH7FMJ/346

H8GWW/346
JH8MXH/345
JI1FXS/339
JI2KXK/342
JK1LPV/341
JK1UVP/342
JL1UXH/339
JR1DUP/347
JR1MLU/349
JR4LNG/342
JR4VMS/342
JR5VHU/342
JR9LKE/338
KØDEQ/347
KØJGH/338
KØJN/359
KØKG/345
K1BD/349
K1HTV/349
K1IK/352
K1QS/348
K2PLF/347
K2RW/349
K2UFM/358
K2UO/350
K2XF/345
K3FN/346
K3HP/346
K3OTY/359
K3SWZ/349
K4IQJ/344
K4TAG/353
K4TQ/343
K4UEE/350
K4XI/354
K4ZYU/356
K5AQ/362
K5IH/346
K5JW/363
K5PC/345
K6JAD/355
K6LGF/378
K6LM/350
K6RN/366
K6VMN/343
K6XJ/357
K6YUI/358
K7OH/343
K7VV/350
K8DFC/343
K8DYZ/370
K8LJG/356
K8SIX/347
K8VFV/345
K8VJG/341
K8ZTT/343
K8ZZO/347
K8ZZU/346
K9GA/348
K9HQM/352
K9JF/358
K9SM/368
KA1ERL/343
KA5V/348
A9WON/343
KC5P/343
KC7V/343
KE3A/347
KE5K/341
KE9L/342
KE9XN/342
KFØLA/344
KN4F/345
KP4P/349
LA4CM/352
LU3CQ/351
NØAV/349
N1DCM/343
N2BJ/347
N2QT/343
N2RR/348
N2WK/342
N4GN/343
N4JJ/349
N4TL/344
N4ZC/361
N5ORT/342
N6CR/351
N6FF/342
N6JV/349
N8JX/348
N8RF/347
N9AF/365
N9RS/346
NA4M/357
NI4H/345
NI6T/343
NN1N/345
NQ1K/344
NU8Z/342
NW7O/346
NYØV/348
OE2SCM/343
OE3EVA/351
OE6DK/349
OH2DW/343
OH3YI/361
OK1ADM/370
ON4AAC/343
ON4ADN/343
ON4DM/385
ON5FU/351
ON5PO/341
ON7EM/346
OZ1ACB/343
OZ1HPS/343
OZ5EV/353
OZ5KG/367
OZ5MJ/342
PAØGMM/357
PAØTAU/348
PAØZH/344
PT7AZ/343
PY2XB/342
PY4OY/343
PY5PS/349
SK7AX/341
SM4EAC/363
SM4EMO/351
SM5ARL/358
SM5BCO/376
SM5BMD/347
SM5CZY/373
SM5DQC/359
SM6CTQ/354
SM6CVX/361
SM7HCW/347
SM7TE/352
SP9AI/354
SV1BRL/341
SV1JG/346
SV1RK/338
SV8AQY/342
UAØCW/345
UA3AB/338
UA3AGW/343
UA9CBO/353
UXØUN/347
VE7AHA/347
VE7IU/342
VK3DYL/343
VK5WO/370
VK6HD/363
VK6LK/360
WØBW/384
WØDJC/339
WØSR/354
WØYG/354
W1AO/343
W1FJ/363
W1KSZ/347
W1URV/347
W1WLW/344
W1YY/356
W2FP/361
W2HTI/384
W2KKZ/345
W3AZD/373
W3GG/359
W3JJ/351
W4BUW/348
W4GIW/357
W4NKI/367
W4RFZ/350
W4TO/345
W4UNP/348
W4UW/349
W4VQ/357
W4ZCB/351
W5BC/347
W5FI/348
W5FKX/341
W5NUT/365
W5TCX/339
W6CN/349
W6CUA/347
W6DCK/343
W6IEG/350
W6RGG/367
W6YWH/343
W7EKM/359
W7FA/349
W7KH/378
W7SLB/342
W7UPF/366
W7ZK/346
W8GMH/346
W8HC/343
W8ILC/364
W8LIQ/343
W8QHG/347
W8VI/341
W8WQJ/355
W8WRP/359
W9DS/345
W9DX/348
W9KQD/354
W9MU/346
W9VA/345
W9WU/349
W9XX/348
W9YSX/382
WA2F/344
WA3DCG/340
WA6SZE/344
WA9IVU/343
WB4UBD/347
WB5XX/343
WB8FIW/347
WD6GFF/343
WJ4T/343
WQ7B/342
WT8S/343
WZ8P/345
XE1VIC/343
XE1ZW/344
YS1RR/357
YU1FW/350
YU3AA/342
ZL1ARY/364
ZS6P/341

336

5B4MF/341
7L1WII/340
AA4MM/364
AB5C/344
AC0M/347
AC6HY/336
AD1C/345
AD5A/340
AI3Q/346
AJ3K/343
CT1APE/338
CU3AD/338
DJ4XA/351
DJ9HX/344
DJ9UM/350
DK3SF/352
DL7CN/340
DL8NU/362
EA1QF/348
EA5RM/340
F5BEG/338
F5HNQ/341
F5OZF/342
GØKXL/341
G3SJH/354
W3CDP/348
HB9ANK/348
HB9CIP/341
HB9DDM/342
HB9DHK/340
HK3JJH/342
HL3IUA/341
IØYR/355
I4EWH/341
I4GAS/350
I6CXD/342
IKØHFO/341
IK1RLI/340
IK1YDA/336
IK4HPU/337
IK4THK/338
IK6DLK/342
IK6SNR/337
IK7UFL/336
IK8WEJ/337
IT9FXY/341
IT9HLR/342
IV3TQE/345
JA1ADT/345
JA1DIO/350
JA1GRM/340
JA1MOH/347
JA1OND/351
JA1WTI/355
JA2BL/349
JA2FGL/341
JA6CDA/346
JA6GXP/352
JA7BJS/350
JA7EPO/346
JA7PL/350
JA9LJS/344
JE1HPM/342
JE1SYN/339
JE2OVG/345
JE4WOK/341
JE8TGI/339
JF1KKV/336
JF1PUW/344
JH2MYN/352
JH4GNE/341
JI4POR/340
JM1VRW/341
JR7VHZ/340
JS3CTQ/341
KØALL/353
KØFF/350
KØGT/345
KØIUC/352
KØTJ/342
KØWK/347
K1CBK/342
K1ST/349
K1YR/347
K2AJY/341
K2FF/339
K2GPL/357
K2MFY/352
K2TK/346
K5DV/339
K5GKC/345
K5RE/348
K6ESL/339
K6SMF/354
K8CW/357
K8TMK/348
K8WK/340
K9ALP/352
K9EL/342
K9IR/340
K9IW/346
K9KA/361
K9RJ/363
K9ZO/350
KA5TQF/342
KB2XP/342
KB3KV/343
KC6AWX/341
KI6T/375
KM1D/349
KN9C/342
KO4DI/339
KR4OJ/348
LA2PGA/341
LA9SN/342
LU2DSL/346
NØXA/347
N2ERN/341
N2VW/348
N4CID/342
N4NO/351
N4PQX/339
N5LZ/343
N6AWD/343
N9EN/342
N9RD/340
NIØG/343
NK5K/344
NM4O/346
NN4T/347
OH2RI/349
OH2VZ/348
ON4ANN/336
SM2EJE/347
SM3NRY/341
SM4CTI/345
SM5AQD/347
SM5CAK/358
SM5CZQ/358
SM5FQQ/347
SM5HPB/346
SM6DYK/347
SM6VR/363
UA4CC/343
VE3IQ/346
VE6WQ/347
VE7ON/340
WØANZ/346
WØCD/359
W1CU/346
W1ZA/367
W2BIE/343
W2CC/356
W2FGD/368
W3CC/354
W3IIQ/342
W3OA/342
W3OOU/341
W4CK/344
W4DKS/358
W4DUP/354
W4FC/354
W4JAM/342
W4UWC/370
W4YO/369
W5HTY/366
W6BJH/338
W6FF/351
W6FW/373
W6ISQ/371
W6SR/351
W6UA/340
W6YI/353
W6YOO/342
W7BJN/342
W7FP/353
W7HUY/336
W7JNC/364
W8CRM/342
W8CY/347
W8GC/356
W8TE/350
W9MDP/346
W9QQ/356
W9TX/346
WA2NPD/349
WA2WSX/344
WA4BIM/346
WA4VA/341
WA6EZV/342
WB6AXD/336
WB7B/341
WD8E/341
XQ2CC/370
ZL3JT/338

335

4X4JU/378
9A2OM/342
9A4SS/335
AAØBS/340
AA4HP/335
AA5XE/352
AA9CN/340
ABØCT/339
AB4IQ/340
AB6QM/336
AD6P/356
AE1Q/340
AFØF/342
CP5NU/339
CT1FMX/335
CT1RM/353
DF2IS/341
DF3UB/341
DJ4ZB/350
DJ9KG/344
DK6IP/347
DK6NP/349
DK6WA/344
DK6WL/348
DL7AFV/341
DL7OD/356
DL9RCF/335
DU1KT/341
EA3GHQ/338
EA3GHZ/335
EA3GJW/337
EA4GT/344
EA8PP/345
F5KOK/346
F5OKK/335
F5PAC/336
F5VU/357
F6DZU/345
F6ELE/341
F6EWK/346
GØDBE/339
GM4UZY/336
HA5AAS/340
HB9AZO/344
HB9CZR/340
HK6DOS/341
IØKDF/343
I1JQJ/341
I2IAU/342
I2LPA/357
I2WNO/343
I3ADI/356
I3EVK/364
I4ENO/335
I4WZT/341
I5ENL/343
I5ICY/342
I5IGQ/342
I8LEL/353
I8XTX/345
I8XVP/341
IKØIOL/341
IKØLNN/340
IK1JJB/339
IK2IQD/341
IK4EWN/341
IK5EKB/340
IK6BOB/341
IK6GPZ/340
IK8PGC/339
IK8TWV/344
IN3XAI/343
IT9GCQ/349
IT9SVJ/341
IT9TQH/343
JAØGZZ/350
JA1CHN/345
JA1DM/370
JA1GHR/344
JA1HSF/342
JA1MLV/350
JA1NAQ/344
JA1NWD/341
JA1PUK/347
JA1SGU/345
JA1WPX/346
JA2DDN/349
JA2JRG/341
JA2JSF/351
JA2LHG/352
JA2NDQ/349
JA2QCX/344
JA2VMU/340
JA2XW/361
JA3APL/361
JA3BQE/356
JA3GM/352
JA3MNP/354
JA5BLB/348
JA6BZA/338
JA6LCJ/344
JA7ARD/353
JA7FS/348
JA8ALB/346
JA8DRK/349
JA8GTA/346
JA8XJF/352
JA9AA/357
JA9RRH/335
JD1AMA/338
JE1LFX/338
JE2HCJ/342
JF1UVJ/342
JH1IED/341
JH2AYB/340
JH3AEF/342
JH3IMR/341
JH4FEB/345
JH4RLY/343
JI1PGO/343
JI2EMF/340
JI8DGO/335
JL1WQO/335
JL1XMN/340
JM1TWR/344
JQ1ALQ/340
JQ3DUE/336
JR1CBC/343
JR1KAG/345
JR2UBS/342
JR3IIR/349
KØHQW/342
K1WER/339
K2FL/374
K2JMY/369
K2ZZ/343
K3AB/358
K3KO/336
K4BVQ/369
K4DJ/358
K4QL/343
K4SE/347
K4SSU/340
K5DU/341
K5GS/344
K5JB/359
K5JZ/346
K5KC/344
K5KT/344
K5RJ/357
K5UO/346
K5ZK/344
K6BTT/356
K6FM/348
K6IR/356
K6MA/360
K7DRN/365
K7LJ/343
K8BCK/346
K8IFF/361
K8SL/340
K8ZR/351
K9EMG/348
K9MUF/343
K9PPY/356
KA1PM/345
KA2CYN/341
KA2ELW/342
KA8DZT/341
KD5M/341
KF8UN/340
KG6B/346
KH6FKG/343
KH6WU/354
KM3J/337
KQ8D/340
KR4W/342
LA5HE/377
LU2AH/349
NØAT/348
N1RK/339
N2DXJ/338
N4AH/350
N4RA/358
N4TJ/349
N5ET/342
N6JZ/354
N6UC/360
N7TP/355
N8BEE/340
N8BJQ/342
N9JV/337
N9US/343
NA2X/339
NE1B/340
NJ3H/341
NOØC/340
NQ6X/341
NRØX/347
OE1AZS/335
OE7XMH/341
OH1TX/354
OM3JW/348
ON4ATW/340
ON5WQ/342
ON6MY/346
PT7BR/341
PT7NK/341
PY2BW/353
RA3AJ/335
RA4CC/340
SM2EKM/357
SM4BOI/344
SM4PUR/339
SM5CEU/342
SM7BYP/347
SP5AUB/335
UA3CT/359
UA4RZ/346
US5WE/356
VE1DX/340
VE3BW/345
VE3HO/349
VE3MV/345
VE6AX/338
VE7WO/364
VK3SX/341
WØGAX/342
WØGLG/340
WØZU/341
W1DOH/343
W1NG/354
W1YM/340
W2FKF/345
W2RMM/341
W2VO/356
W2XT/342
W3KHZ/341
W3TN/351
W4DC/344
W4EP/341
W4UBC/340
W4UM/345
W5RQ/338
W5TUD/339
W5WP/340
W6DN/345
W6FAH/340
W6GVM/388
W6HXW/354
W6KTE/369
W6KUT/371
W6LQC/358
W6OD/336
W6PGK/342
W6RLL/335
W6WI/335
W7DQM/363
W7EYE/340
W7KSK/340
W7RXO/344
W8LRO/340
W8WFN/339
W9LNQ/354
W9NB/354
W9VG/341
WA2NHA/341
WA2VUY/345
WA5BBR/343
A8LOW/340
WC5Q/342
WD5K/351
WG6P/341
WP4U/340
XE1EK/351
YV5IVB/341
ZL1HY/346
ZL2AFT/351
ZL2RR/345
ZL3GS/361
ZL3NS/367
ZS5NK/346

334

9A8A/338
AA6PI/349
AB9E/344
AG9S/343
AH6HY/339
CT1CJJ/334
DK5QK/349
DK8NG/348
DL3NBL/340
DL6XK/340
DL8FL/357
EA3EQT/340
EA4LH/360
EA5BD/340
F2BS/367
F2YS/W2/347
F6CPO/341
F6GUG/339
G3PLP/342
G4NXG/340
G4SQA/340
HB9BGN/344
HB9BIN/337
HB9DDZ/337
HC1HC/343
HC2RG/341
I2PKF/344
I2VGW/334
I4NJM/339
I5FCK/350
I7IVL/347
I7SCA/364
IKØOEM/340
IKØYQJ/334
IK1AOD/340
IK6QOP/334
IK6SNS/334
IT9ZGY/370
IV3DSH/335
JAØGCI/343
JA1BN/363
JA1BWT/355
JA1DJO/337
JA1FHK/351
JA1SVP/348
JA2DPC/334
JA2FCZ/342
JA2ZL/337
JA3ART/354
JA3CMD/349
JA3KWZ/342
JA5JUG/345
JA6IVR/338
JA6VA/351
JA6WW/348
JA7MYQ/340
JA7QFU/339
JA8HH/348
JF3LGC/341
JF7DZA/339
JH1BAM/337
JH1HLQ/350
JH1IFS/355
JH1JNR/339
JH1QAX/344
JH6WMJ/339
JH8NBJ/339
JJ1SKG/341
JJ3AFV/340
JJ3HGJ/334
JP1NWZ/341
JR2WCX/337
JR6SVM/337
KØHRF/344
KØXN/349
K1AJ/348
K1EFI/345
K1KM/336
K1MY/344
K1UO/348
K2SY/342
K2WE/340
K3LC/336
K3PT/337
K3RV/341
K4CMS/342
K4HJE/362
K4JP/354
K4KC/367
K4KJZ/345
K4MEZ/354
K4XH/356
K5KR/349
K5RT/340
K6KO/334
K6SLO/340
K6WRF/337
K7DS/346
K7NO/345
K7OSE/353
K7SP/349
K8DJC/344
K8UE/337
K9ECE/374
K9FD/343
K9FN/353
K9IL/351
K9LCR/342
K9MIE/345
K9PP/340
K9RB/345
K9YY/340
KA4IWG/339
KB2RA/339
KD2UF/340
KD6WW/340
KE5PO/339
KE9S/334
KE9U/344
KF4M/340
KI4SR/339
KJ9I/340
KK2I/345
KL7D/348
KM2P/358
KQ3F/343
KR5C/346
KW5USA/354
LZ2CC/345
NØACH/343
N1AC/344
N2SS/359
N3UN/346
N3VA/341
N3ZOM/334
N4CFL/342
N4DW/348
N5AW/342
N5OK/336
N5PHT/339
N5PPT/339
N6BEP/338
N6DUR/338
N7GR/334
N7HK/341
N8KOL/338
N9CHN/340
N9OY/338
NEØDX/334
NE9Z/340
NK2H/340
NN7X/339
OE2LCM/340
OE6IMD/338
OK1ABB/344
PAØWRS/340
PT7BZ/340
PY5GA/360
RU3FM/338
RX9FM/339
M7MPM/339
SP6CDK/341
SV1IW/345
UR5EDU/335
VE3JV/339
VE3LYC/334
VE7WG/334
VE7WJ/352
WØJCB/347
WØYDB/358
W1BIH/369
W1DNZ/356
W1JK/339
W1RY/340
W1YIF/337
W2BXA/388
W2FXA/364
W2GW/341
W2PSU/354
W2RD/339
W2RQ/340
W2YC/336
W3IG/343
W3IOP/346
W3SI/351
W4DZZ/347
W4EB/339
W4NYN/369
W4OWY/344
W4OX/341
W4SVO/349
W4WG/354
W5CIA/340
W6KR/337
W6NP/340
W6OM/340
W7BG/348
W7JEN/342
W7WT/343
W8HB/339
W8KS/344
W8KTH/339
W8QWI/344
W8SAX/336
W8SET/351
W8TWA/347
W9RPM/334
WAØJH/337
WA2IKL/341
WA2UUK/342
WA4IUM/342
A4WTG/355
A6OGW/350
WB1BVQ/342
WB2GOK/345
WB9CIF/335
WB9EEE/336
WF5E/366
WW5L/339
YV5NWG/334
ZL4BO/365
ZP5YW/342
ZS6EZ/339

333

4X6ZK/338
AA8EY/356
AA9RN/333
BX5AA/333
DF1DB/346
DJ5DA/356
DK2OC/347
DL1RWN/337
DL5SBA/338
DL6DK/339
DL7SY/346
DL9TJ/341
EA3ELM/339
EA3KB/338
EA4CP/339
EA5AD/340
EA6LP/333
EI2GS/338
EI7CC/345
F2JD/336
F6CQU/339
GØOIL/334
G3TXF/350
GM4FDM/335
HBØCC/334
HL1XP/338
HL5FBT/338
HL5NBM/334
I1CAW/352
I1POR/347
I1TBE/351
I2TZK/340
I2WTY/342
I4JUB/339
I5AFC/351
I5GKS/345
I6NNJ/337
IK4EWM/333
IK4SWX/333
IK5GUJ/338
IK7VJO/333
IK8BIZ/333
IN3ASW/339
IT9JOF/339
JA1ASO/339
JA1BOQ/339
JA1DFK/338
JA1HRQ/349
JA1OCA/357
JA1RWE/354
JA2THS/343
JA3AYU/345
JA4XH/346
JA6BZI/351
JA7XBG/340
JA9JFO/345
JA9NLE/341
JE8LWZ/333
JH3HTD/338
JH4JNG/334
JH8UQJ/337
JI1DHY/335
JJ1DWT/344
JL2JVX/334
JL3VWI/339
JR2UJT/338
JR3RRY/340
KØJS/353
K1HDO/344
K2BA/336
K2BS/367
K2IUK/343
K3GT/339
K3KY/343
K4AU/339
K4CKS/343
K4EM/338
K4SO/340
K4UAS/355
K5AS/343
K5CR/333
K5EJ/349
K5HW/338
K6GJ/361
K8BL/340
K8MG/343
K8QM/334
K8TL/354
K9KVA/340
K9LJN/339
K9RHY/341
KA8ZPE/338
KB4XK/339
KC2Q/340
KC9G/338
KD2SY/339
KE0MO/336
KF2TI/336
KG7H/339
KK@M/338
KP2A/342
KQ9W/339
KS1J/337
KT9T/350
LA2PA/333
LZ1HA/339
NØABE/340
NØJR/338
N3BNA/338
N4AL/338
N4AXR/344
N4DB/339
N4RFN/339
N5GGO/340
N5PR/341
N6DX/362
N6KK/341
N7TO/340
NN2C/338
NX7K/352
OE2DYL/339
OE3RSB/343
ON4IQ/337
ON5TW/348
PY2PC/364
PY3JZ/338
PY4OD/355
MØSMK/338
M2GCQ/339
M5BRW/348
M5FWW/336
UA1MU/355
UA3BS/342
UA6JD/353
UA6JW/355
UY5XE/342
VE2WY/368
VE3EFX/349
VE3VHB/344
WØJMZ/352
WØMGI/358
W1AX/372
W1DO/358
W1GA/359
W1TSP/345
W2FCR/351
W2HAZ/343
W2LO/340
W2XI/341
W2ZR/339
W3NC/339
W4GKT/343
W4ZX/344
W5GVP/342
W6ORD/344
W6RFL/337
W6SHY/340
W6UY/355
W6VX/337
W7KW/338
W7NGR/333
W7WK/333
W8EMI/342
W8ZET/371
W9IL/340
WA4AFE/336
A4MME/340
A4QMQ/344
WA5IPS/338
WA6JA/333
A8NMN/349
WA8ZDL/344
WB9NOV/343
WC5E/339
D8MGQ/344
WN6R/338
WY5H/338
XE1ILI/338
YV1AJ/342
YV1KZ/359
YV5AJK/372

332

AA1AC/340
AA7AV/337
AA8BN/336
AA9DX/337
AD4AM/337
AI9U/341
AJ8J/338
CT4NH/341
CX2AAL/337
DF2UU/338
DJ2MM/354
DL2SCQ/338
DL6NW/337
DL9JH/351
EA1YO/335
EA3ALD/344
EA4BT/337
EA7BLU/341
EA7CD/337

331

F6FYD/336
F6GKA/338
G3LAS/333
G3UAS/340
G3VOF/342
G3ZBA/355
G4LVQ/338
MØAXY/339
GW3ARS/344
HA5WA/338
I2BVG/348
I2MOV/344
I2PQW/340
I2YWR/337
I4CSP/352
I4FAF/343
I5PAC/360
I8JJB/347
IK6CGO/337
IK7MXB/338
IK8DDN/337
IV3ODE/332
IZ6CST/332
JAØEKI/332
JAØGRF/347
JA1BFF/340
JA2AHH/333
JA2GBO/342
JA2LMA/340
JA3MLJ/334
JA6AD/358
JA6CNL/346
JH1IAQ/337
JH1OCC/336
JH4CBM/332
JH8CFZ/335
JL1ARF/338
JL7BRH/332
JO1MOS/337
JP1IOF/337
KØGY/332
K1HT/332
K1IE/345
K2CIB/338
K2HK/358
K3SGE/356
K4AIM/374
K4KU/347
K4QVK/348
K5AC/332
K6CF/338
K6LD/335
K9KU/348
KAØCPY/338
KB1MY/336
KD8KX/337
KH6ACD/339
KI8I/337
KN2L/337
KS4Q/336
KV1J/337
KW4V/339
LU4DXU/336
LU8ADX/333
NØGWR/337
NØOB/332
N2KA/347
N3ED/350
N3HBX/335
N3TO/342
N4BYU/341
N5YY/348
N6GM/342
N7TT/350
N8PCN/332
NA2R/337
NA5C/339
NI5M/343
NW6S/340
OH2BCK/332
OH5NG/345
OK2SW/341
ON4AWZ/337
OZ2NZ/342
PA3EWP/336
PJ2MI/335
PY4BL/337
SM4SET/337
VE2DO/344
VE3FRR/336
VK2AVZ/343
VK2DTH/336
VY2RU/334
WØGJ/343
WØGKE/354
WØPSH/338
WØZX/336
W1SKU/337
W2AYM/339
W2IOT/334
W2SM/347
W4JFK/344
W4NK/339
W5AQ/364
W5GML/341
W5QNF/338
W6EJJ/352
W6TC/345
W6WBY/338
W6ZI/340
W7AG/337
W8FF/349
W8TN/345
W8VKW/340
W9ITB/341
W9KIA/336
W9MMZ/361
W9RXJ/353
WA1YTW/341
WA4FHQ/342
WA5VGI/335
WA5ZIJ/343
WSØE/345
WW4KW/333
WZ1Q/341
YB5QZ/337
YS1GMV/347
YV5AMH/342

331

9A5CY/331
AA4R/347
AA4ZK/337
AA8LL/331
AE5B/351
CT1AHU/337
DK4KL/351
DK5WL/350
DL1NAI/337
DL5IC/331

DL9OH/374
EA1DDU/336
EA3BKI/338
EA3WL/332
EA5GPQ/331
EA5XV/331
F6BVY/336
F6HMJ/332
G4VXT/333
HK5LEX/335
HL5BDD/335
HP2AT/334
I0JBL/341
I0MOM/339
I1CMA/347
I2JQ/338
I4JBJ/342
IK4IYC/336
IK7JTF/337
IT9DAA/331
JA1SJV/345
JA2ANA/339
JA2FWS/336
JA2KSP/342
JA3MZB/331
JA4ECC/336
JA4FHE/349
JA4RED/340
JA5WIZ/331
JA6COW/339
JA7WKG/336
JA8AWH/347
JA8EAT/349
JA9GPG/342
JF2WXS/336
JH1MQC/336
JH1QYT/339
JH2AQI/331
JH4PMV/337
JJ2KDZ/334
JR1PIZ/331
K1OA/332
K2HWE/342
K2PWG/339
K2TV/340
K2VV/352
K4HL/337
K6EID/349
K6EXO/363
K6RK/351
K6RO/336
K7XM/337
K8AJK/355
K8MID/341
K8PV/337
K8ZLP/335
KB1CQ/336
KB8GWL/335
KC2KU/338
KC8KE/337
KD9EC/336
KD9Q/340
KF4MH/334
KG5FX/336
KX4R/343
N1PM/336
N3KK/336
N4BQD/337
N4RF/337
N5HSF/336
N7ACB/337
N7WR/339
NA7AA/337
NI5DX/336
NZ2L/336
OE2KGM/337
OH2BAD/354
ON8XA/359
OZ1FAO/338
PA3ABH/337
PY2OB/343
PY5CC/337
RA0FU/331
RK9CWA/332
SM6AOU/350
SM7DXQ/337
SP3EPK/337
SP3IBS/340
SV1CQR/331
SV1VS/337
UA3AP/333
UA4SKW/334
VE3EXY/331
VE3PNT/337
VK3EW/336
W0FK/343
W0GKL/373
W0MHK/335
W1AIM/337
W1GD/344
W2OW/333
W2QL/343
W3SB/341
W4EEU/362
W4KS/344
W4PV/340
W4QH/333
W4WDR/336
W5AP/339
W5KN/332
W5WT/334
W6IGK/336
W6UB/334
W6XK/331
W7IAN/331
W7RDX/336
W7TSQ/337
W7YW/331
W8EVZ/364
W9TA/343
WA2IZN/342
WA4TLI/350
WA5YON/333
WA6GIN/334
WB2AQC/345
WB3D/337
WF1N/336
WF2S/336
XE1D/337
YL2JN/337
ZL1BOQ/341
ZL1WG/337

330
AA1QD/330
AA5O/340
AK1L/336
AK1N/339
CT1EGW/330
CT3DZ/332
CX2CB/336
DJ6BN/342
DL6ATM/339
DL8FBC/330
DL8QS/342
DS5RNM/330
EA3OD/342
EA4JL/357
EA7BXL/336
EA9AM/336
EA9PY/334
EI6S/343
F5JJM/336
G3KYF/349
G3SBP/330
G4DXW/336
G4DYO/344
GM3CIX/355
M4YMM/335
HB9DKV/335
HL3DE/335
I0CUT/337
I0ER/348
I0KHY/334
I1GEA/351
I3DSE/350
I4LX/352
I8SAT/347
IK4AUY/334
IK4MSV/331
IK7OKB/333
IK8AUC/336
IV3RQC/332
IV3TDM/332
IZ5BAM/330
JA0BOV/330
JA1CJO/337
JA1JMF/333
JA1KAW/337
JA1OYY/346
JA2TBS/337
JA3AFR/353
JA5AQC/341
JA5CKD/338
JA7GY/338
JA8EJO/334
JA8GSN/333
JF2PZH/334
JH1ANZ/333
JH1CML/337
JR1FYS/342
K1EY/336
K1GG/337
K1SF/340
K2OGD/333
K3SUE/330
K4HGX/331
K4JDJ/333
K4MZ/348
K4ZO/340
KA1CRP/335
KA3SHN/333
KB6CLL/335
KB6KTV/335
KC5UO/339
KC6X/337
KM4A/335
KP3AH/335
KQ8O/337
LA2IJ/337
LA4DM/345
LX2PA/335
N1FOJ/334
N1KC/332
N4RU/341
N4XX/353
N6HK/336
N8MZ/336
N9ER/339
NA2M/346
NK7L/336
NX9T/334
NY2E/336
OD5NH/330
OH5LP/332
OZ5GF/347
OZ5YL/335
PA3CSR/335
PY3BXW/357
S58T/330
SM6AHS/343
SM6TEU/332
VO1XC/334
W1BR/354
W1ECS/335
W1LW/339
W1MGP/342
W2APU/359
W2MF/331
W3HRF/335
W3MPN/339
W3YE/336
W4CZ/334
W4NS/350
W4RBO/333
W4RNZ/340
W4VV/337
W6XP/353
W8BT/340
W8CNL/354
W9HRQ/337
W9RY/350
WD8LTM/335
WD8MQJ/335
WE9A/333
WO2T/335
WV1R/333
YV1CLM/335
ZL1ALE/349
ZL1AMN/350

ZL1AV/353
ZL3JU/330
ZS1FJ/334

329
AG4M/336
AI3CD/345
CE3GN/344
CP2DL/330
D44BS/352
DK2WH/338
DK5AD/343
DK9KD/344
DL6GV/330
DS2BGV/329
EA1DFP/331
EA4CQT/335
EA7ABW/338
EI8EM/334
GØWRE/329
G3PJK/335
G3TJW/352
G4OWT/331
G4YRR/335
HL3ERJ/330
IKØPEA/331
IKØPRP/331
IK2QPR/332
IK4CWP/335
IK4SDY/332
IK7MCJ/335
IK8CVZ/332
IK8YTA/329
IT9YRE/338
IV3ARJ/331
IV3YYK/335
IZØCKJ/329
JAØCWZ/342
JA1GO/343
JA1KJK/332
JA1KPH/329
JA1WSK/346
JA2XYO/344
JA8RY/334
JA9FPI/342
JA9IFF/337
JH1PEZ/335
JH1UUT/334
JH8RZJ/329
JI1NJC/334
JR1ITT/334
JR3MTO/334
JR6PGB/335
K1JO/351
K1NJH/335
K4PR/337
K4SB/351
K5ALQ/333
K5RPC/337
K5TN/336
K7HG/331
K7MC/336
K9QFR/346
K9TI/339
KA2BZS/336
KB4GYT/331
KB6NAN/331
KB9JM/333
KEØET/334
KNØL/334
KQ8M/336
KT1J/338
KW6U/351
LA1K/358
LA7AFA/334
LA7JO/345
LA7SI/335
LU4DR/331
N1NK/330
N2BAT/335
N2UR/335
N3CDA/333
N5FW/340
N6DKZ/332
N6JN/338
N8SHZ/331
NA9A/331
NU4D/335
NW4M/341
OE2YMO/335
OE6CLD/334
ON4CD/330
ON6AA/329
OZ9SN/334
PP7HS/346
PT7BI/334
PY2DSC/354
SP1JRF/335
SQ6SZ/329
SV1DPI/329
VK3EUZ/330
VK3OT/340
WØNB/341
WØUVC/332
W1ZD/337
W3HNK/350
W3SOH/338
W4LI/340
W4UFO/333
W5FL/336
W5VHN/336
W5ZN/336
W6AXH/348
W6GYM/334
W6ZZ/356
W8KST/359
W8RHM/335
W9FOE/337
W9ZX/339
WA4OEJ/342
WB5LBJ/DU/340
WB6JXJ/333
D4NGB/333
WD8PKF/340
WE2K/335
WF2Y/334
WI9H/335
YB3OSE/333
YV2NY/336

ZS6BBP/358

CW

338

Top of the Honor Roll

JA1BK/348
JA1UQP/350
JA2VPO/345
OH2BN/346
OH2EA/346

337
4X4DK/344
AA1V/343
AA4V/346
AA7A/347
CT1BOH/343
DF3CB/344
DJ2BW/351
DJ2TI/347
DJ2YA/343
DJ4GJ/343
DJ5JH/347
DJ8NK/343
DK1RV/343
DK5PR/346
DL4MCF/343
DL6KVA/343
DL6QW/343
DL9TJ/347
EA6NB/343
F3AT/349
F3TH/343
F5NTV/342
F6BLP/343
F6EXV/345
G3GIQ/346
G3KMA/348
G3RTE/343
G3VMW/344
G3XTT/344
G4BWP/345
G4EDG/344
GM3YTS/344
HAØDU/348
HB9AQW/345
I2KMG/345
I4EAT/343
IK2BLA/341
IK4CIE/343
IK4HLO/343
JAØDWY/343
JA1EOD/348
JA1FNA/346
JA1HGY/345
JA2JW/347
JA3FYC/350
JA3PIS/345
JA4LXY/348
JA5AUC/348
JA9CWJ/344
JE2LUN/341
JH1GZE/337
JH1SJN/341
JR1MLU/345
JR1TNE/347
KØQC/343
K1LD/345
K1NTR/343
K2CL/345
K2TQC/349
K2TWI/343
K3FN/349
K3UA/348
K4CN/343
K4DX/346
K4DY/345
K4FJ/346
K4IQJ/343
K4PI/350
K4TEA/343
K4XG/347
K4XO/350
K5AC/347
K5AQ/347
K5BG/343
K5KLA/348
K5NA/345
K5UR/349
K5YY/347
K6DTI/348
K7PI/343
K8CW/346
K8CX/347
K8EJ/347
K8IFF/344
K8MFO/348
K8NA/346
K8NW/346
K8PYD/347
K8RR/348
K9AJ/348
K9BWQ/345
K9CW/345
K9MM/349
K9OW/341
K9QVB/348
K9VAL/343
KA6A/343
LA7SI/344
N1DG/342
N2LT/346
N2TK/344
N2TU/343
N3XX/344
N4KG/346
N4MM/348
N4RJ/350
N4WW/352
N4XM/344
N4XR/343
N5AW/347
N5ET/345
N5FG/344
N5JR/345
N6AR/347
N6JV/347
N7EF/346

N8GZ/343
N8JV/343
N8JX/343
NR1R/347
NYØV/342
OE1ZL/343
OH2BU/349
OH2LU/344
OK1MP/346
ON7PQ/343
OZ1BTE/343
OZ1CTK/347
OZ1LO/350
OZ9PP/345
PAØLOU/346
PAØWRS/345
PY2YP/344
PY7ZZ/346
SLØZG/343
SMØAJU/350
SM3GSK/344
SM4CTT/345
M4EMO/343
SM4OTI/343
SM5BFJ/346
SM5DJZ/346
SM6CCO/343
SM6DHU/345
SP5EWY/349
SP8AJK/345
TG9NX/346
UT7WZA/346
VA3DX/347
VE3EJ/343
VE3XN/344
VK3QI/345
VK6HD/347
VK9NL/342
VK9NS/343
WØGAX/346
WØJM/343
W1GG/347
W1GL/347
W1JR/347
W1JZ/347
W1WLW/347
W2FP/348
W3AP/348
W3GG/346
W3NO/343
W3UR/344
W3YX/343
W4CK/344
W4CZU/346
W4DR/348
W4VQ/348
W5BQS/343
W5BPT/341
W5ZPA/346
W7LR/349
W7OM/344
W7UT/348
W8LU/347
W8UVZ/347
W8XD/343
W9IXX/343
W9KNI/353
W9YSX/343
W9ZR/347
WA6TLA/348
WB4TDH/347
WB6RSE/348
WB8ZRL/346
WB9EEE/344
WB9Z/343
WC4B/343
WD5DBV/343
WJ4T/343
WT8C/343

336
AA1K/347
AA5AT/341
AA5BT/342
AA5C/344
AB0X/346
AD5Q/343
AI0O/344
DJ3IW/343
DJ4XA/344
DK2GZ/341
DK5AD/347
DK9KX/342
DL3IE/339
DL7HU/336
DL7MAE/342
DL9YX/345
EA4MY/347
EA5BM/341
EA7OH/345
F5QF/343
F6AJA/342
G3SNN/344
G3TXF/346
G3VXJ/342
HA3NU/342
HB9ALO/348
HB9BZA/342
I2EOW/341
I4IKW/342
I4LCK/341
IK1GPG/341
IK2ILH/340
IK4BHO/340
IK4DCT/341
IN3RZY/344
JAØCRG/342
JAØDAI/342
JAØUUA/342
JA1BFF/340
JA1BWA/349
JA1IFP/346
JA1IOA/345
JA1KQX/346
JA1MRM/344
JA1VN/347
JA3CSZ/345
JA3DY/348
JA3EMU/346
JA3NTE/346

JA5IU/343
JA6VU/343
JA7IC/344
JA7LMZ/342
JA8DNV/349
JA8RJE/342
JE2URF/342
JF1KKV/347
JF1PUW/344
JF1SEK/345
JF2MBF/341
JF7XKY/346
JH1TWT/342
JH3VNC/344
JH4IFF/344
JI1FXS/340
JM1VRW/342
JO1WKO/340
JR1BLX/343
JR7TEQ/347
KØCA/342
KØDEQ/345
KØEU/341
KØJGH/338
KØJUH/342
KØRW/341
KØSR/344
K1AJ/343
K1EFI/342
K1ST/344
K1TL/342
K2RW/344
K2TE/342
K2TK/342
K2UFM/346
K2UO/346
K2XF/342
K4CEB/345
K4CIA/344
K4MQG/346
K4UTE/344
K4WS/345
K4XI/345
K5DU/341
K5PC/342
K5UO/346
K6AM/342
K6FG/341
K6GXO/342
K6KII/345
K6TA/346
K7ABV/344
K7EG/345
K7LJ/342
K7NN/345
K7SO/341
K7XB/340
K7ZA/345
K7ZBV/344
K8LJG/346
K8YSE/341
K9EU/342
K9IW/345
K9NU/339
K9ZO/346
KF2O/345
KJ9I/342
KM3V/342
KP4P/346
KY7M/342
KZ4V/342
LA9XG/342
NØTB/342
NØXA/346
N1DCM/342
N2QT/339
N2TN/339
N3SL/344
N4CC/345
N4CH/340
N4DW/346
N4GN/342
N4JJ/346
N4MHQ/343
N4NX/346
N5PO/342
N5UR/346
N6ET/345
N6OC/342
N7RO/343
N7RT/346
N7US/344
N9AU/342
NN4T/342
NS6C/345
OE2VEL/344
OE3EVA/344
OH2DW/342
OH3YI/348
OH4OJ/342
ON4UN/345
ON7EM/343
OZ1FAO/344
PAØCLN/344
PAØTAU/342
PT7WA/342
PY2RO/342
MØCCM/347
MØKRN/342
SM3DXC/345
SM3EVR/348
SM4BZH/346
SM4DHF/345
SM4OLL/342
SM5AQD/346
SM5DQC/342
SM5FUG/342
SM6AOU/346
SM6CTQ/345
SM6CVX/348
M7HCW/343
SP2JKC/344
SP3E/343
VE3HO/345
VE3LDT/343
VE3XO/341
VK5WO/341
WØBV/341
WØJLC/346
WØYG/342

W1CU/346
W1KSZ/346
W1TYQ/340
W1YY/347
W2SM/346
W3UM/344
W4DKS/347
W4FC/345
W4GD/344
W4MPY/345
W4TO/340
W4UM/346
W5FI/345
W5FKX/339
W5TCX/339
W6BJH/346
W6ISQ/346
W6SR/341
W6TC/348
W6XA/342
W7MO/342
W8AV/342
W8CY/344
W8DCH/346
W8TE/345
W9BF/341
W9DC/346
W9KQD/345
W9TX/342
W9XX/346
WA2HZO/342
WA2HZR/345
WA4FFW/343
WF5T/345
WK3N/338
WO2N/342

335
4K9W/337
AA5AU/342
AA6YQ/339
AB9V/343
AD1C/344
AD5A/338
AF2C/343
AI3Q/345
DF2NS/343
DF2UH/335
DJ5AV/340
DJ9RR/340
DKØEE/341
DL3ZA/342
DL7VEE/344
F6BEE/342
F6DLM/340
F6DZO/342
G4BUE/345
HA8IE/341
HB9BIN/337
I4FTU/343
IK4NQL/335
IK4WMA/335
IT9AF/346
JA1GRM/340
JA1GV/345
JA1RWI/343
JA1WSX/339
JA2JRG/341
JA2KVD/346
JA3GM/346
JA4LKB/343
JA4MRL/341
JA6BJV/341
JA7FWR/342
JA7PL/345
JF2OWA/341
JH7BDS/345
JI2KXK/339
JR9LKE/335
KØQQ/342
K1HTV/342
K1JO/344
K1KO/341
K2FL/347
K2MFY/345
K2VV/346
K3KO/339
K4CL/345
K4JLD/343
K4UEE/345
K4ZW/345
K4ZYU/345
K5CON/337
K5ESW/337
K5MC/340
K5ZK/343
K6LM/343
K7LAY/340
K7ZD/339
K8AV/338
K8BCK/344
K8DYZ/344
K9EL/341
K9GA/343
K9IL/344
K9RJ/342
KC7V/341
KF8N/341
KN4F/341
KP2A/343
KS1J/341
KUØA/339
LA5XGA/340
LA7AFA/341
N2MF/344
N2UN/344
N4AH/340
N4IR/345
N4NO/346
N5ZM/336
N8AA/345
N8PR/340
N9RD/339
NAØY/340
NA2M/343
ND6G/340
NIØG/341
NI4H/343
NI6T/340
NRØX/336

OE5NNN/341
OE6IMD/341
ON4ON/339
ON6CW/340
OZ5MJ/343
PY2BW/342
PY2SP/340
PY2XB/341
RA3DX/340
SK7AX/340
SMØBSB/341
SM5CAK/344
SM5CZQ/345
SM6DYK/344
SP5CJQ/341
UA6LV/339
UXØUN/337
VE3UW/337
VE7AHA/341
WØBW/346
WØMHK/340
WØSR/346
W1CKA/340
W1MK/341
W1MU/341
W1OX/341
W2KKZ/340
W2RQ/342
W2TO/344
W2YC/339
W3LPL/344
W4OEL/341
W4OX/341
W5EC/338
W6CUA/343
W6JI/345
W6JTI/340
W7EKM/343
W8RV/337
W9LNQ/343
W9NGA/341
W9WU/346
WA2IKL/339
A2WSX/343
WB7B/340
WT8S/339

334
AB9E/345
AL7R/339
DF2PI/342
DF9ZW/338
DJ9HX/340
DJ9KG/340
DJ9ZB/338
DK2JX/338
DK6NP/341
DK6WL/341
DK8NG/345
DL4MDO/338
DL5KAT/340
DL7AFV/340
DL7WL/345
DL9ZAL/338
F6GCP/340
F9XL/343
G3MIR/340
G3MXJ/342
G4OBK/339
HA3HP/337
HA5AGS/338
HA5WA/340
HB9BGV/339
HB9CMZ/340
HB9DDZ/340
HB9HT/345
I1JQJ/340
I2MOV/340
I4NGZ/341
I5KKW/335
I5RFD/341
IK4DCS/339
IK4PLW/337
IK6DLK/340
IT9AXZ/340
IT9VDQ/341
IT9ZGY/344
JAØHXV/336
JA1ADN/343
JA1FGB/342
JA1OND/341
JA1PCY/341
JA1SHE/338
JA2ADY/342
JA2BL/345
JA2EPW/334
JA2XW/347
JA3BQE/346
JA3KWZ/340
JA3MNP/344
JA4IYL/340
JA6VA/344
JA7FS/342
JA7MSQ/339
JA7MYQ/340
JA8EJO/340
JA9AA/341
JA9LSZ/334
JE2OVG/342
JE8BKW/340
JH1IFS/343
JH4UYB/339
JH6CDI/336
JJ2LPV/339
JJ3AFV/340
JR1XIS/340
JR3IIR/341
KØWK/341
K1HJC/337
K1IK/344
K2JF/340
K2OWE/342
K2PLF/343
K2SHZ/345
K3IE/343
K3JGJ/341
K3KY/340
K4HGX/338
K4NA/340
K4SE/345

K4XU/343
K6JAD/338
K6MA/343
K8MW/340
K8PT/344
K8PV/340
K8TL/342
K9ALP/340
K9FD/343
K9IR/339
K9LJN/340
KA5TQF/340
KA7T/339
KI6T/339
KK2I/341
KQ9W/340
KR8V/340
KW4V/341
LZ2CC/343
N3BNA/340
N4CW/345
N4DB/336
N6FF/339
N6VR/343
N7FU/343
N9EN/340
N9US/344
NK4L/340
NM7G/339
NQ1K/340
OH1HM/336
OH1XX/343
OH3RF/340
OK1ABB/344
OM3JW/346
ON4IQ/337
ON5WQ/341
OZ3PZ/334
PA1CW/339
PA5TT/334
PT2BW/342
PT7AA/340
PY2OW/342
SM3NRY/339
SM5BRW/344
SM6AHS/340
SM7BYP/341
SV1JG/345
UA3AGW/340
VE3BW/342
VE3FF/340
VY2OX/340
W1AO/339
W1FJ/341
W1MLG/344
W1NG/344
W2FXA/340
W2HAZ/345
W2TX/340
W3IOP/339
W4AVY/334
W4ZX/343
W4ZYT/338
W5FK/340
W5ODD/343
W6DN/339
W6ENZ/340
W6KUT/339
W6NP/339
W6VX/338
W8DX/340
W8GMH/341
W9HB/341
W9MU/338
W9VA/339
WA2NPD/338
WA4IUM/340
WB4UBD/340
WB8FIW/334
WB9CIF/339
WG6P/339
ZL1AMO/340

333
DK2OC/343
DK6ED/341
DL2FAG/338
F3SG/337
G3VKW/336
G4ELZ/340
HB9CGA/339
I1HLI/339
IKØHBN/337
IK2FIQ/339
IK6CGO/339
IK8BIZ/333
IT9TQH/341
JAØBKX/341
JA1BNW/337
JA1CLW/336
JA1CPZ/336
JA1DOF/338
JA1MOH/343
JA1QXY/344
JA1SVP/342
JA2THS/339
JA3CMD/341
JA6BEE/342
JA6CBG/339
JA7QFU/339
JA8JL/345
JE1DXC/339
JE1PNX/338
JG1WSC/339
JH2AYB/337
JH2FXK/338
JH2RMU/339
JH2UVL/343
JH7FMJ/342
JH8JYV/341
JI1PGO/341
JI4POR/336
JL1UXH/333
JR1DUP/336
JS2LHI/336
KØGUG/341
KØKES/342
KØMN/336
K2PK/343
K3NW/339

K4KU/340
K4QL/339
K4SI/339
K5AS/343
K5KR/342
K6TQ/340
K6YUI/334
K7BG/337
K7NO/341
K7SP/341
K8ZTT/335
K9BWI/333
K9RB/342
K9RR/338
KA8ZPE/339
KD5M/339
KE9U/341
KN4T/340
KQ3F/338
KSØM/339
KS4Q/339
LA2QM/339
LZ1XL/333
N3UN/342
N7UT/344
N8BJQ/340
N8DJX/335
NA2X/339
NE9Z/337
NF9V/338
NU8Z/335
OH2FT/338
OH3JF/334
PA3FQA/336
RU3FM/338
SLØAS/342
SLØZZI/339
MØCCE/343
SM4CTI/340
SM7TE/337
SP8FNA/335
US5WE/343
VE7VF/335
VE7WO/343
W1TSP/343
W1UC/339
W3MC/339
W4AXO/339
W4JTL/342
W4RFZ/333
W5RQ/342
W6AN/338
W6HIB/338
W6JD/344
W7IUV/343
W7JEN/338
W8QWI/342
W8XM/340
WB4W/340
WD5K/339
ZS6EZ/339

332
9A3SM/338
9A7V/338
AA4NG/337
ACØM/340
AJ8J/340
DF1DB/338
DF2IS/335
DF3GY/332
DJ5DA/344
DK5QK/340
DL9MEN/335
EU7SA/336
G3NOH/335
HB9DDM/337
I1WXY/338
I2XIP/341
I4MKN/333
JA1CHN/339
JA1CZI/341
JA1LSP/339
JA2EWE/337
JA2FGL/338
JA3AAW/340
JA8EAT/344
JA8EOT/333
JA8FKO/342
JE1SYN/334
JE2LPC/337
JH4JNG/337
JH7CFX/338
JI1DHY/337
JJ1SKG/332
JJ1TEA/336
JJ2RCJ/338
JP1NWZ/338
JR1IOS/338
JR2KDN/333
KØXN/338
K2CO/341
K2SX/342
K4PB/338
K5JZ/334
K5RT/337
K5XX/335
K5ZR/336
K6GJ/335
K6RK/340
K6TS/338
K7JS/336
K8LN/337
K8SW/341
K8WK/334
K9RHY/340
KA3S/335
KG6B/338
KG9N/338
KM1D/340
KZ2I/340
NØAT/338
N3AF/342
N4TJ/338
N9CK/336
NN1N/338
NN7X/338
NW6S/338
OE5BWN/337
OH2BCK/332

OK1DH/339
PY4OY/336
M2GCQ/338
SM5APS/339
SM5ARL/337
SM6CUK/338
SM6VR/340
SP3FAR/335
SP5PB/340
SP7GAQ/337
UA3AB/333
UA6AF/339
VE1BLX/342
VE3LYC/332
W1GA/346
W2NRA/341
W4IR/342
W6RLL/335
W6TMD/339
W7GA/336
W7KCN/334
W9IT/341
W9RY/342
WA2UUK/336
WB2GOK/342
WB4ZBI/338
WB6ZUC/342
WB9UQE/338
WK6E/338
WS1F/335
YO3CD/337
ZL3JT/332

331
AA1AC/337
AG9S/337
DL1DA/344
DL1EY/334
DL1RWN/333
DL3NM/331
DL3SZ/338
DL6ATM/339
DL7SY/341
EA1JO/338
G3LZQ/333
G4SOZ/331
I2VDX/337
I2YDX/332
JA1ADT/332
JA1DM/338
JA1SFL/336
JA1SGU/340
JA1VLK/337
JA2AHH/335
JA2DPC/331
JA2XYO/339
JA4DEN/338
JA4DLP/331
JA5BEN/337
JA6TMU/336
JE1LFX/333
JF1UVJ/336
JI1WIB/341
JI8DGO/331
JQ3DUE/331
JR7VHZ/331
KØHRF/337
KØMF/336
K1HDO/338
K2AU/337
K4PR/337
K5KC/334
K7ET/337
K7OSE/337
K8BL/337
K8RYU/332
K8SIX/338
K9TI/340
KF9D/339
KG6I/334
KG7H/337
KKØM/336
N1AC/340
N1NK/336
N2WK/335
N3ED/342
N5OK/334
N6KK/336
N6XJ/339
N7GR/331
N8MZ/340
N9RS/337
N9SF/335
NO3N/340
NX7K/336
OE2KGM/337
ON5YR/334
PY2KP/336
SMØNJO/335
SM4BNZ/342
SM5CEU/333
UAØZC/333
VE3EXY/331
WØTT/333
W1AH/337
W1TC/342
W1YIF/334
W3SB/341
W4FQT/332
W4SK/333
W4UW/336
W6OUL/339
W6PBI/334
W7LY/337
W8KS/341
W9OP/335
W9RPM/331
W9WAQ/337
WA1YTW/336
WA2UKA/337
WA5VGI/335
WB4OSS/337

330
9A5CY/330
DJ5DT/330
DJ5LE/340
DK6NJ/336
DL1AMQ/333
I1YRL/339

I2QMU/336
I4YCE/334
JAØCWZ/338
JAØDBQ/336
JA1DFK/335
JA1GTF/344
JA1NWD/336
JA1WPX/337
JA2ANA/339
JA2DXD/332
JA2NDQ/338
JA2QCX/336
JA5NLN/333
JA6BZA/335
JA6CNL/340
JA6LCJ/339
JA7JI/337
JA7XBG/335
JA8BAR/336
JG3QZN/334
JH1BAM/335
JH1OCC/334
JH3IMR/330
JH4FEB/335
JH5BHP/336
JI7NUF/330
JL1ARF/336
JR1FYS/340
JR3MTO/336
JS3CTQ/333
KØGSV/336
K1OA/334
K2QIL/338
K3GGN/333
K4MF/338
K6CTA/334
K6EGW/334
K6EID/336
K7XM/338
K8IU/336
K9CC/332
KA1ERL/336
KC5P/336
KE3A/335
KQ8M/338
NØJR/336
N2WB/334
N3KK/336
N5FW/340
N5KD/330
N5LZ/337
N6MZ/334
N8MC/340
NQ6N/336
NT9L/336
NW8F/336
NY2E/336
OE2DYL/335
OH5LP/334
ON4AGX/335
PP2FN/332
S58T/330
SM5HV/
HK7/336
SM5JE/335
UR5BO/335
VE1ACU/333
VE6WQ/339
WØCD/338
WØDJC/333
W1AX/336
W2LO/333
W2XI/338
W4AX/340
W4DZZ/338
W4NS/336
W5SL/334
W7CA/334
W7IIT/335
W7KW/332
W9EDA/336
W9GW/340
WA5POK/335
WA9CVK/333
WB2GAI/333
WC7N/330
WG3U/336
YO3APJ/340

329
9A8A/333
DJ1OJ/333
DL4CF/334
DL7NS/338
DL9GOA/334
EA3CUU/335
F6HWU/334
G3MPB/334
G3SWH/334
GMØGAV/331
GM3PPE/336
HA1RW/332
HB9CZR/332
I8WY/337
JA1ANR/329
JA1BN/339
JA1BOQ/332
JA1DIO/333
JA1SJV/336
JA1WTI/336
JA2AH/332
JA2GBO/339
JA5JUG/332
JA8AQ/333
JH1JNR/333
JH2SON/333
JR1BAS/332
KØOR/331
K1HT/333
K1VKO/337
K2BA/332
K2SB/330
K2ZZ/337
K5DF/336
K5TN/333
KB4GYT/333
KD6WW/336
KE4YD/333
LA4WJ/334
N4XP/329
N5HB/330

N5XG/336
OH3BU/333
OH3WS/335
ON4CD/329
OZ8AE/338
PA3AXU/335
PY4OD/336
RA3AJ/329
RK9CWA/332
SM5KNV/329
SM5SWA/333
SM6TEU/334
SM7CNA/335
SP5GH/337
SP9AI/340
UA4RZ/336
UA9FAR/333
UT5UGR/332
WØANZ/335
W1ECT/335
W1GJ/330
W2GW/335
W3ODJ/336
W5KN/330
W5WT/332
W9ITB/338
W9RC/335
WA1FCN/338
WB2ABD/336
YV5ANT/333

RTTY

336
DJ2BW/343
I4MKN/343
I5FLN/346
K4FJ/342
SMØAJU/342
SP4KM/342
W2UP/342
WX5L/340

335
AA5AU/340
KB5GL/339
N2TU/341
N3SL/339
NAØY/339
OH2LU/341
W5ZPA/341

334
I5KG/340
JA2VPO/340
JH4IFF/335
K3WC/344
N4CC/338
N4WW/336
N5FG/336
N8JX/340
W5PJR/340
WB4UBD/340

333
DK1BX/339
DK3CU/345
JE1GMM/338
K5KR/339
KA5CQJ/339
KP4BJD/341
N2LT/339
N2QT/335
SLØZG/335
W5FKX/333
WD5DBV/339

332
I5KKW/336
JA1BWA/338
JA1KQX/336
JA3AUQ/338
JA3DLE/337
JA8ADQ/342
K3UA/338
SM6CVX/339
W4PK/338
W8DCH/334

331
DF3CB/336
DL5KAT/335
JA3MNP/337
JF2MBF/333
K8MFO/334
LA7AJ/335
N3UN/337
VA3DX/331
W3YX/332
W5BPT/331

330
DJ5JK/332
DL4MCF/334
I4FTU/335
JR2KDN/332
SM5FUG/335
VE3XO/334
W2FXA/336

329
G4BWP/334
I5ICY/335
I5IGQ/335
IK8CNT/334
JA8RJE/331
KØEU/331
K7XB/334
LA5XGA/331
N5ZM/329
OH2BU/331
OH2DW/333
WØBV/331
W4EP/335
WA9CVK/332
WB8YJF/332
WT8S/330

On the International Stage: 4U1ITU and High Speed Telegraphy

Located at the headquarters of the International Telecommunication Union (ITU) in Geneva, Switzerland, 4U1ITU opened in 1962 as the club station for the International Amateur Radio Club (IARC). The IARC was formed May 5, 1962 under the auspices of the Secretary-General of the United Nations and the Secretary-General of the ITU. The club maintains 4U1ITU for the use and benefit of club members, as well as those licensed radio amateurs who are duly authorized to operate from the station. According to IARC President Attila Matas, OM1AM, 4U1ITU is intended to serve as a model of Amateur Radio operation at its highest standard.

On May 21, 2009, the IARC held their 2009 Annual General Meeting at the ITU. More than 35 amateurs attended, including ITU Secretary-General Dr Hamadoun Touré, HB9EHT; IARU Region 1 President Hans Blondeel Timmerman, PB2T, and former IARU President Larry Price, W4RA. There was truly an international flavor at the meeting: Chief Technology Officer Paul Rinaldo, W4RI, and Technical Relations Manager Brennan Price, N4QX, represented the ARRL. Jay Oka, JA1TRC/KH2J, represented the Japan Amateur Radio League (JARL) and Gerald Lander, HB9AJU, represented Union Schweizerischer Kurzwellen Amateure (USKA), the Swiss IARU Member-Society.

"Also present were many licensed and other delegates to the ITU-R WP 5A, whose working party meeting was being held in Geneva at the same time," Matas said. Working Party 5A, which is preparing for the 2012 World Radiocommunication Conference (WRC-12), considers issues in the Amateur Radio and Land Mobile services for the ITU.

Following the annual meeting, guests were treated to dinner, held in the restaurant on the 15th floor of the ITU Tower building, overlooking the city of Geneva and the lake below. During the dinner Dr Touré presented former IARU President Larry Price, W4RA, with an ITU certificate honoring "his long-term cooperation with ITU and his outstanding contribution to the ITU-D and ITU-R Sectors on matters relating to the amateur service and emergency communications."

COURTESY ATTILA MATAS, OM1AM

ITU Secretary-General Dr Hamadoun I. Touré, HB9EHT, presents former IARU President Larry Price, W4RA, with a certificate honoring his years of participation in ITU activities on behalf of the amateur service. ARRL Chief Technology Officer Paul Rinaldo, W4RI, is seated next to Dr Price.

US High Speed Telegraphy Team Gears Up for IARU World Championships

Next month, high speed Morse enthusiasts will gather in Bulgaria for the Eighth IARU High Speed Telegraphy World Championship. Barry Kutner, W2UP, is leading a team of seven US amateurs to the event. Some participants are able to copy more than 500 characters per minute, or 100 words per minute!

According to Kutner, high speed telegraphy, or HST, has long been considered a sport in Europe, especially Eastern Europe, similar to chess or an Olympic sport. Most of the participating IARU Member-Societies hold a national competition in their country, seeking members to field and sponsor a team to the World Championship. "In some of the Eastern European countries, where they take this very seriously, there are team and individual coaches, too," Kutner said. Competitors must be licensed Amateur Radio operators, except that entrants in the younger categories may be SWLs. In the US, Kutner said those who wish to participate in the World Championship do so at their own expense. "In past years, there has either been one — myself in 2005 and Ilya Kleyman in 2007 — or no US participants," he said. "This year, we have a team!"

There are three main competitive events at HST meets: Transmitting, receiving and receiving Amateur Radio call signs via *RUFZxp*; the sending and receiving portions of the competition are referred to as the Radio-amateur Practicing Tests. There is also a pileup competition using *Morserunner*. Kutner said that each US team member practices on an individual basis, using both on-the-air and computer-generated CW. As the US team gears up for Bulgaria, "we are in frequent contact via e-mail, exchanging tips and ideas," he said.

While it's too late to join the 2009 US team, it's not too early to think about upcoming events. If you are able to copy or send CW at dizzying speeds, why not think about attending the next IARU HST World Championship? Kutner said they are always looking for younger hams, especially young ladies. For more information on the US HST Team or high speed telegraphy in general, send Kutner an e-mail at **w2up@arrl net**.

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

WB8IMY

ECLECTIC TECHNOLOGY

Your Hard Drive is Going to Fail

I hope the headline grabbed your attention because it is time for my annual warning: *back up your data!*

Most hams have computers in their stations these days. If you're like me, your "station computer" may also do extra duty as your household computer. Not only do I have my station logs on my PC, the computer is also home to all my digital images, digital music, videos and family financial records. I'd sure hate to lose all that critical information simply because my hard drive decided to give up the ghost.

Of course, it *will* croak one of these days — that's a certainty. My primary hard drive has been perking along for about three years and the mean-time-to-failure statistics tell me that it is now entering the twilight of its lifespan. One of these days I will fire up my PC and the operating system will refuse to boot. Instead, I'll be presented with messages from my motherboard telling me that the drive can no longer be found, or something equally grim.

At ARRL Headquarters we back up our computers daily. We even take the additional step of storing the backed-up data off site in case some destructive calamity were to visit the building itself.

My home backup solution is not so dramatic. I've installed a second hard drive in my PC and use a backup application to automatically copy data to it every day. If my primary drive fails, it is unlikely that my secondary drive would crash at the same time. But to hedge my bets, I use a 500 GB external hard drive to perform a once-a-month backup of the entire system. Finally, anything that is truly precious and irreplaceable gets copied to a data DVD for permanent storage.

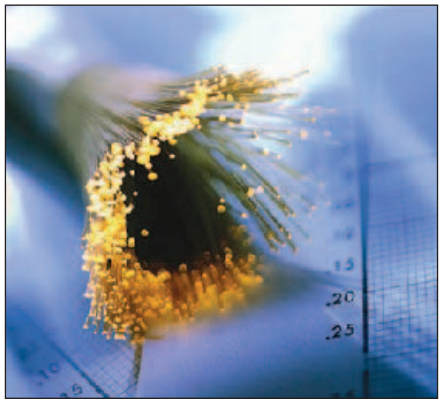
There is plenty of inexpensive software to automate backups and make these tasks no-excuses easy. In fact, if you're running *Windows XP*, there is a backup utility on the *Microsoft XP* CD. You'll find details here: **www.microsoft.com/windowsxp/using/setup/learnmore/bott_03july14.mspx**. If you happen to be using *Windows Vista Home Premium*, *Business* or *Ultimate*, there is a backup feature already included.

There are also a number of online backup services that allow you to store your information on distant systems via the Internet.

IOSAFE

The ioSafe Solo external hard drive can be submerged in water and withstand heat up to 1500° F.

NEXTGEN



Will rural broadband arrive on a fiber optic cable?

If you're not too squeamish about privacy issues, they might be attractive if the subscription price is right.

If you're considering the external hard drive solution for your backup storage, ioSafe has announced what may be the most bulletproof unit to date. Called the ioSafe Solo, this drive is rated to endure a blistering 1550° Fahrenheit. The Solo can also be submerged in fresh or salt water for 3 days at a depth of 10 feet. At the January Consumer Electronics Show ioSafe made a powerful point by pouring gasoline on a Solo, igniting the fuel and allowing it to burn for several minutes before putting out the flames by blasting the drive with a high-pressure fire hose. After opening the drive's protective case, they plugged it into a computer and were able to read the data normally.

The 1.5 terabyte model sells for $400. You can learn more at **https://iosafe.com/solo**.

We all tend to procrastinate, but backing up your computer is a task you shouldn't postpone. It is a wise investment of your time that will pay huge dividends when the day of reckoning finally arrives.

A Fiber Alternative to BPL?

BPL — Broadband over Power Lines — promised high-speed Internet nirvana to the rural hinterlands by sending RF data carriers through leaky ac power mains. Not only did this technology create heartburn for hams, it fell far short of its original goal.

The next attempt at rural broadband may arrive on a fiber optic cable, specifically Gigabit Passive Optical Networks, or GPONs. These networks carry data long distances over optical fibers to passive optical splitters, which split the signal to individual households. Currently, the reach of this technology into rural areas is limited by the loss in signal strength along the optical fiber. Each line can only run approximately 19 miles from a central office.

Researchers in Australia have managed to extend the reach of GPONs by substantially boosting the output of devices known as *Raman amplifiers*. Installed in the central office of network providers, these specially designed Raman amplifiers use high-powered lasers to amplify the optical signal tremendously, increasing the reach by a factor of 10. In one test they pumped 2.5 GB per second over a fiber line nearly 100 miles long.

The biggest drawback of the system in its current form is the question of safety. The supercharged signal will require additional safety measures, and a more careful inspection for breaks in fibers. Even so, the technology has the potential to bring high speed Internet to many rural areas in a way that is more cost effective than BPL, but without the RF pollution.

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

K2TQN

VINTAGE RADIO

Vintage Ham Scopes

Prior to 1935 hams relied on station monitors or used their receivers to check the quality of their phone signals.[1] Unfortunately, not every station sounded good and a better method was needed. ARRL encouraged hams to clean up their signals and from the mid 1930s *The ARRL Handbooks* provided schematics, so hams could build a basic oscilloscope for phone station use. At about the same time the National Radio Company offered the CRO, a 3 inch model of similar design. At $29.50 plus the cost of the 3 inch 906 cathode ray tube (CRT) and one #80 tube, this was considerably more than the weekly wages of the average ham.

1937 — From the National Radio CRM manual:

> In the past the Cathode-Ray Oscilloscope has generally been considered beyond the financial reach of the average amateur. Without such a device, however, it is most difficult to properly adjust a phone transmitter, as is evidenced by the present day performance of many amateur transmitters, even in the more exclusive 20 and 75 meter bands. Perhaps some amateurs may question the accuracy of this statement. If so, it is because they have not examined the performance of their own transmitter with an oscilloscope. Should they do so, they would find the results rather startling.
>
> With the advent of the RCA No. 913 tube and the National CRM Oscilloscope, there is no longer any prohibitive financial barrier to keep every amateur station owner from having one of these modern indicating devices for his own station. The Cathode-Ray Oscilloscope is just as essential as is the monitor to the amateur phone station.

Figure 2 — A *QST* advertisement from 1937 announcing the new CRT and its bargain pricing.

But before the CRM could be developed, it was RCA that designed and built the new 913 tube that made it all possible and then they reduced the cost to $5 each (see Figures 1 and 2). National quickly designed a new scope around that tube. The CRM (see Figures 3 and 4) would sell for $11.10 plus tubes. It was much more affordable than their larger 3 inch CRO. Thus, with the CRM, National made it possible for most amateurs to improve their AM phone signal.

Searching for a CRM

If you want one for your collection it will take some time and money, as they are highly coveted by collectors. They seem to bring in excess of $100 most of the time on eBay. I missed a $5 CRM at a hamfest about 10 years ago. My friend John Kelly, N3GVF (SK), reached right over my head and plucked it out of the seller's trunk as

[1]J. Dilks, K2TQN, "Old Radio," *QST*, Feb 2007, pp 93-94.

JOHN DILKS, K2TQN

Figure 1 — RCA 913 tube, about the size of a metal 6L6 tube.

RICHARD POST, KB8TAD

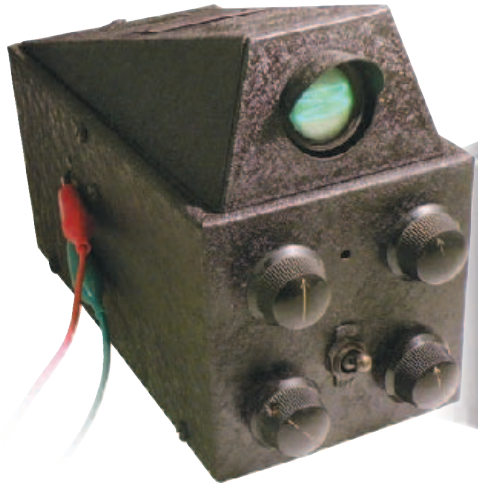


Figure 3 — The original National CRM oscilloscope.

NEIL LAWTON, WK9Q

Figure 4 — Later version of the National CRM oscilloscope.

John Dilks, K2TQN ♦ 125 Wharf Rd, Egg Harbor Township, NJ 08234-8501 ♦ k2tqn@arrl.org

I was going through a box of tubes on the ground. My lesson was that once I am standing in front of the items for sale, look from top down, not the other way. Once you bend over, the person behind you can see what you missed.

It took several more years before I found one I could afford. Mine came all the way from Great Britain via eBay. With shipping to the US it was still cheaper than one found around here. It also came with a spare 913 tube.

I think the CRO is the best looking ham scope ever made. It's not too big, 9 × 4 × 6½ inches high, and it looks good sitting on the shelf or on top of another boat anchor. I was happy to finally have one in my collection.

Richard Post, KB8TAD, has restored his and it is shown in Figure 3. It displays a vertical 2 to 1 image indicating 30 Hz on the vertical input from his audio oscillator.

Neil Lawton, WK9Q, of Radio Recyclers in Wisconsin, sold an interesting later version of the CRO on eBay. Even though he said it was not working, it went for $82 plus shipping. Richard Post and I discussed the differences between the two versions. Of the fancy front panel he said, "National had an escutcheon plate made for later scopes. The designs for our originals were based on the early RME-69 principle; if you don't know what the knobs are for, you don't deserve this piece."

Beyond the CRM

The next oscilloscope in my collection is a beauty, built by Robert Gold, WA2IIB (SK). I reported on him in my January 2003 column.[2] It has a 2 inch tube, but uses the same basic circuit. Robert's cabinet is different, as it has the tube protruding at a 45° angle sticking out the front. I think Robert designed his first, used a 913 and then switched it with a larger 902 (see Figure 5).

I asked tube expert Ludwell Sibley, KB2EVN, of the Tube Collectors Association about the 913 and 902, and he said:

> RCA announced the 151 Oscillograph, and the 913 that used it, with a big splash in the January 1937 issue of the "RCA Radio Service News." RCA had a fairly strong position in test gear at the time. The price was $47.50, not all that cheap. Ownership of a cathode-ray oscillograph had come to be the mark of the progressive service engineer but until then the price of high-grade oscillographs had prevented many service engineers from owning one.
>
> The actual announcement of the tube was via "New Small Cathode-Ray Tube" in "Radio World," December 1936. The advertised price was $5. Contemporary scopes using the tube, besides National, were the Triumph 77 and Clough-Brengle 105; later, the Simpson 555 and Signal Corps I-240 came out.
>
> The metal shell was self-shielding against magnetic fields. RCA's 902 2 inch CRT had the same base and pinout and would interchange with the 913 electrically.

[2]J. Dilks, K2TQN, "Old Radio," *QST*, Jan 2003, pp 86-87.

JOHN DILKS, K2TQN

Figure 5 — Homebrew scope built by Robert Gold, WA2IIB.

JOHN DILKS, K2TQN

Figure 6 — The ugly scope I picked up at a hamfest.

JOHN DILKS, K2TQN

Figure 7 — Central Electronics Multiphase MM2 RF Analyzer.

JOHN DILKS, K2TQN

Figure 8 — Heathkit HO-10 scope.

Winning the award for ugly is the scope I picked up at a hamfest that came from an unknown estate cleanout (see Figure 6). It too has the same basic circuit and uses a 3 inch tube. It was built from WW II surplus parts. And almost no time was spent on cabinet aesthetics, but it worked and did the job for the ham.

The next scope is a big leap forward in design and functions. Still in use today in many ham shacks where a clean AM signal is important to the operator is the Central Electronics Multiphase MM2 RF Analyzer/ Monitor scope (see Figure 7). This scope can be used to monitor both AM or SSB.

Rounding out the collection is the Heathkit HO-10 (see Figure 8). This is also a good basic scope for monitoring your AM signal. Later versions of this scope from Heath have cabinets that match their popular SB series of radios and have a few more functions. This cabinet matches the last AM transmitter series they sold, such as the 150 W TX-1 "Apache" ham transmitter.

There were many other scopes made for hams over the years and many more that were homemade. Even today a working scope in your ham shack can show you what your signal looks like on the air — AM, SSB, CW or whatever mode you like to run. For more on scopes, check out my Web page: **www.k2tqn.com**. E-mail me a photo of your old ham scope if it is different than these shown here and I'll put it on my Web page. QST

Strays

QST congratulates…

◊ Richard M. Shappee, W5HQJ, of Concord, California, who has been named an Honorary Life Member of Sons in Retirement for "his exceptional and outstanding service."

◊ Jeff Murray, K1NSS, whose book, *Lid, Kid, Space Cadet*, a full color graphic coming of age story, is available at **www.lulu.com**.

CONVENTION AND HAMFEST CALENDAR

Abbreviations
Spr = Sponsor
Tl = Talk-in frequency
Adm = Admission

Alabama Section Convention

August 15-16, Huntsville
D F Q S V

The Alabama Section Convention, sponsored by the Huntsville ARC and the Huntsville Hamfest Assn, will be held at the Von Braun Center (South Hall), 700 Monroe St. Doors are open Saturday 9 AM-5 PM, Sunday 9 AM-3 PM. Features include all indoor, air-conditioned event with giant new dealer/manufacturer show (Charlie Emerson, N4OKL, 256-882-9137; **charlieemerson@hamfest.org**); huge flea market (Dave Givens, K5RSI, 256-883-2760; **k5rsi@davidgivens.net**); exhibitors; vendors; wide selection of forums (Johnny Winter, KR4F, 256-534-6785; or Chuck Lewis, N4NM, 256-539-8950); DX banquet (Saturday eve); VE sessions (10 AM sharp, both days; $10 test fee); Hospitality Rooms (Friday and Saturday eves at the Holiday Inn, located next to the VBC); DXCC card checking; convenient parking ($4); limited RV parking. Talk-in on 146.94, 147.3. Admission is $7 (under 12 free). Tables are $30 (8-ft table and 1 chair). Contact Charlie Emerson, N4OKL, 8003 Craigmont Rd, Huntsville, AL 35802; 256-882-9137; **n4okl@arrl.net**; **www.hamfest.org**.

Southwestern Division Convention

August 15, Santa Barbara, California
R S

The Southwestern Division Convention, sponsored by the Santa Barbara ARC, will be held at the Earl Warren Showgrounds, 3400 Calle Real. Doors are open 9 AM-5 PM. Features include extensive exhibits, outdoor static emergency communications displays, special guest speakers and discussion groups, Tri-tip barbeque lunch, unlimited free parking. Talk-in on 146.79 (131.8 Hz). Contact Michael Ditmore, W7HUT, 805-569-5700; **hamfest@sbarc.org**; **www.sbarc.org/**.

Colorado (Golden) — Aug 16 S V

8:30 AM-2 PM. *Spr:* Denver Radio Club. Jefferson County Fairgrounds, 15200 W 6th Ave. *Tl:* 145.49, 448.625 (100 Hz). *Adm:* $5. Tables: $15. Bryan Steinberg, KBØA, 1011 S Foothill Dr, Lakewood, CO 80228; 303-987-9596; **drcfest@w0tx.org**; **www.w0tx.org**.

Colorado (Lake George) — Aug 28-30 D

Friday 6 PM-Sunday 6 PM. *Spr:* Mountain ARC. Lake George Mobile Home Park, Main and County Rd 90. CampFest 2009, Saturday eve potluck dinner. *Tl:* 147.015 (107.2 Hz). *Adm:* Free. Tables: Free. David Koerner, NØHIO, Box 308, Larkspur, CO 80118; 314-856-8537; **n0hio@arrl.net**; **www.nx0g.org**.

Connecticut (Gales Ferry/Ledyard) — Aug 8 H R V

Set up 7 AM; public 9 AM-1 PM. *Spr:* Radio Amateur Society of Norwich. Gales Ferry Firehouse, 1772 Rte 12. *Tl:* 146.73, 449.725 (both 156.7 Hz). *Adm:* $4. Tables: $15 (6-ft; multi-table discounts). Chuck Wehner, W1FJW, 220 Benham Rd, Groton, CT 06340; **w1fjw@arrl.net**; **www.rason.org**.

Illinois (Danville/Oakwood) — Aug 23 F S V

8 AM-1 PM. *Spr:* Vermilion County ARA. Vermilion County Fairgrounds, 17520 N 1180 E. *Tl:* 146.82 (88.5 Hz). *Adm:* $5. Tables: $10. Josh Kittle, N9WEW, 2403 N Jackson St, Danville, IL 61832; 217-442-0578; fax 217-477-7134; **josh@kittle.com**; **www.vcara-hamfest.info**.

Illinois (Peotone) — Aug 9 D F H V

6 AM-3 PM. *Spr:* Hamfesters RC. Will County Fairgrounds, Wilmington/Peotone Rd. 75th Anniversary Hamfest. *Tl:* 146.52. *Adm:* advance $6, door $8. Tables: $15. Mr Kerry Nelson, AA9SB, 3404 Hazel Ln, Hazel Crest, IL 60429; 708-335-4574 (phone and fax); **kw_nelson@earthlink.net**; **www.hamfesters.org**.

Indiana (Lafayette) — Aug 16 F V

8 AM-2 PM. *Spr:* Tippecanoe ARA. Tippecanoe Fairgrounds, Home Ec Bldg, 1401 Teal Rd. 39th Annual Hamfest. *Tl:* 147.135 (88.5 Hz). *Adm:* $5. John Parker, AB9LE, 30 Guinevere Ct, Lafayette, IN 47905; 765-446-7747; fax 509-694-0973; **ab9le@arrl.net**; **w9reg.org/hamfest/index.htm**.

Indiana (LaPorte) — Aug 21-23 F R V

Friday 3 PM-Sunday 6 PM. *Spr:* Porter County ARC. All States ARC Complex, Rte 35 and Schultz Rd. Campout and Swapmeet. *Tl:* 146.775 (131.8 Hz). *Adm:* Free. Carl Konefsky, W9TAD, 1392 N 600 E, Michigan City, IN 46360; 219-929-4500; **boatguy@hughes.net**; **www.pcarc.net/**.

Indiana (Osgood) — Aug 22 F R T

Set up 7 AM; public 8 AM-4 PM. *Spr:* Ripley County ARC. Ripley County 4-H Fairgrounds, 525 Beech St. 2nd Annual Tailgaters Hamfest. *Tl:* 441.775. *Adm:* $3. Tables: $3. Delbert Felix, WY9L, 114 Harlan St, Osgood, IN 47037; 812-689-3161; **wy9l.thebigdog@gmail.com**; **www.441775.com**.

Indiana (Spencer) — Aug 22 D F R S T V

7 AM to 2 PM. *Sprs:* Owen County ARA and Bloomington ARC. Owen County Fairgrounds, 300 S East St. Foxhunt. *Tl:* 146.985 (136.5 Hz). *Adm:* $5. Tables: $5. Katie Smith, K9INU, 2961 Magnus Rd, Poland, IN 47868; 812-829-2140; **k9inu@arrl.net**; or Bob Poortinga, K9SQL, 812-876-6174; fax 812-323-4060; **hamfest.10.bobp@xoxy.net**; **www.owencountyara.org/images/OwenMonroe2009.pdf**.

Kansas State Convention

August 16, Salina
D F Q R S V

The Kansas State Convention, sponsored by the Central Kansas ARC, will be held at the Salina Bicentennial Center, 800 The Midway. Doors are open 8 AM-4 PM. Features include large indoor air-conditioned flea market; major vendors; High Voltage Hazards seminar by Westar Energy; forums; meetings; VE sessions (8:30-10 AM); DXCC, WAS, and VUCC card checking; refreshments. Talk-in on 147.03, 443.9. Admission is $5. Tables are $15 (commercial or flea market; includes electricity if requested, and 1 admission ticket per table). Contact Ron Tremblay, WAØPSF, 112 N Douglas Dr, Salina, KS 67401; 785-827-8149; **rtremblay@cox.net**; **www.centralksarc.com**.

Maryland (Westminster) — Aug 16 F T

8 AM-1 PM. *Spr:* Carroll County ARC. Carroll County Agricultural Center, 700 Agriculture Center Dr. 10th Annual Tailgate Fest (outdoor tailgating only — spaces included in admission donation). *Tl:* 145.41. *Adm:* $5. Steve Beckman, N3SB, 2145 Bethel Rd, Finksburg, MD 21048; 410-876-1482; fax 410-583-4149; **n3sb@qis.net**; **www.qis.net/~k3pzn**.

Massachusetts (Cambridge) — Aug 16.

Nick Altenbernd, KA1MQX, 617-253-3776 (9 AM-5 PM); **w1gsl@mit.edu**; **www.swapfest.us**.

Michigan (Lapeer) — Aug 16 F H R V

8 AM-1 PM. *Spr:* Lapeer County ARA. Lapeer

Coming ARRL Conventions

July 17-18
Arizona State, Williams*

July 17-19
Montana State, Essex*

July 18
WØ DXCC and Contest Central, Rochester, MN*

July 23-25
Central States VHF, Elk Grove Village, IL*

July 24-25
Oklahoma Section, Oklahoma City*

August 7-8
Texas State, Austin*

August 7-9
Pacific Northwest DX, Spokane Valley, WA*

September 11-12
Delta Division, Mena, AR

September 12
Great Lakes Division Symposium, Findlay, OH

September 12-13
Virginia Section, Virginia Beach

September 18-19
W9DXCC, Elk Grove Village, IL

September 19
Ohio Section, Reynoldsburg

September 26
Mid-Atlantic States VHF, Plymouth Meeting, PA
Washington State, Spokane Valley

October 3
EMCOMM East, Rochester, NY

October 9-11
Pacific Northwest VHF, Seaside, OR

*See July *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

County Center Building, 425 County Center Dr. Inside sales only. *TI:* 146.62. *Adm:* $5. Tables: $10. Bill Miller, KD8VP, Box 12, Hadley, MI 48440-0012; 810-797-5329; **kd8vp@arrl.net**; **www.w8lap.com**.

Michigan (Owosso) — Aug 22 F T V
8 AM-noon. *Spr:* Shiawassee ARA. Baker College Welcome Center, 1309 South M-52. *TI:* 147.02 (100 Hz). *Adm:* $1. Tables: $5. Don Warner, WB8GUS, 10008 Lehring Rd, Byron, MI 48418; 810-266-4897; **wb8gus@arrl.net**; **www.w8qqq.org**.

Michigan (Port Huron) — Aug 9 T
9 AM-noon. *Spr:* Eastern Michigan ARC. Vantage Point Maritime Center, 51 Water St. 1st Annual Seaway Trunk Swap. *TI:* 146.72. *Adm:* Free. Bob Herbert, K8WMW, 819 Tunnel St, Port Huron, MI 48060; 810-982-1561; **k8wmw@arrl.net**.

Missouri (Joplin) — Aug 28-29 F S V
Friday 4-9 PM; Saturday 8 AM-2 PM. *Spr:* Joplin ARC. Holiday Inn Convention Center, 3615 Hammons Blvd. Friday eve cookout. *TI:* 147.21. *Adm:* advance $5, door $6. Tables: $10. Jim Johannes, NØZSQ, c/o JARC, Box 2983, Joplin, MO 64803-2983; 417-781-2211; fax 417-781-2234; **jimjohannes@sbcglobal.net**; **www.joplin-arc.org**.

Missouri (O'Fallon) — Aug 16 D F H R S V
8 AM-1 PM. *Spr:* St Charles ARC. O'Fallon Elks Club, 1163 Tom Ginnever Ave. *TI:* 146.67. *Adm:* $3. Tables: $12. Chuck Zelsman, NØCAZ, 4 Briar Patch Ct, O'Fallon, MO 63366; 636-240-2544; **n0caz123@gmail.com**; **www.wb0hsi.org**.

Nebraska (North Bend) — Jul 18 F H R
9 AM-12:30 PM. *Spr:* Pioneer ARC. St Charles Parish Center, 8th and Locust Sts. 12th Annual Flea Market. *TI:* 146.67. *Adm:* $2. Tables: $5-$7. Rich Mehaffey, KBØARZ, 1525 County Rd 5, North Bend, NE 68649; 402-652-3410; **4randjme@futuretk.com**; **www.k0jfn.com**.

New Jersey (Oakland) — Aug 15 D F R T
Set up 6 AM; public 8 AM. *Spr:* Ramapo Mountain ARC. American Legion Hall, 65 Oak St. 33rd Annual Ham Radio and Computer Flea Market. *TI:* 146.49, 446.175 (both 107.2 Hz). *Adm:* $5. Tables: $12 (inside; tailgate space $10). Robert Kogan, KB2KQO, c/o RMARC, Box 364, Oakland, NJ 07436; 973-896-3909; **kb2kqo@gmail.com**; **www.qsl.net/rmarc**.

New Jersey (Toms River) — Aug 16 D F T V
Set up 6 AM; public 8 AM. *Spr:* Jersey Shore ARS. Riverwood Recreation Center, Riverwood Dr and Whitesville Rd. "Hamfest by the Shore." *TI:* 146.91 (127.3 Hz). *Adm:* $5. Tables: $15. Darleen McGlaughlin, KC2HCW, c/o JSARS, Box 295, Toms River, NJ 08754; 732-237-9448; **jsars910@gmail.com**; **www.jsars.org**.

New Mexico (Alamogordo) — Sep 5 F H R T V
7 AM-2 PM. *Spr:* Alamogordo ARC. Otero County Fairgrounds, 401 Fairgrounds Rd. 25th Annual Hamfest. *TI:* 146.8 (-67 Hz). *Adm:* advance $5, door $6. Larry Moore, WA5UNO, 1830 Corte Del Ranchero, Alamogordo, NM 88310; 575-437-0145; **www.alamohams.org**.

New Mexico State Convention
August 14-15, Albuquerque
D F S T V
The New Mexico State Convention ("Duke City Hamfest"), sponsored by the New Mexico Hamvention Committee, will be held at the Del Norte Baptist Church and Conference Center, 5800 Montgomery Blvd NE. Doors are open Friday 5-9 PM, Saturday 9 AM-3 PM. Features include the buying, selling, and trading of Ham Radio gear; commercial vendors; free tailgating (Saturday only; reserve space); many excellent technical and non-technical forums and demonstrations; special guest from ARRL HQ Allen Pitts, W1AGP, Media and Public Relations Manager; New Mexico Ham Club displays; Special Event Station N5M; VE sessions; banquet (Saturday, 7 PM). Talk-in on 145.33, 444.0 (both 100 Hz). Admission is free. Tables are $20 (without power), $30 (with power); register in advance. Contact Mike Langner, K5MGR, 929 Alameda Rd NW, Albuquerque, NM 87114; 505-898-3212 or 505-238-8810 (cell); **mlangner@swcp.com**; **www.dukecityhamfest.org**.

New York (Deerfield) — Aug 22 D F T V
7:30 AM-3 PM. *Spr:* Central New York ARA. Deerfield Volunteer Fire Department, 5476 Trenton Rd. Ham-Jam (Radio/Electronics/Computer Expo). *TI:* 146.58. *Adm:* advance $5, door $6 (includes tailgate space). Tony Mancuso, KG2BV, 3665 Knight Rd, Sauquoit, NY 13456; 315-507-1240; fax 315-737-8729; **kg2bv@arrl.net**; **www.cnyara.com**.

New York (Westmoreland) — Aug 15 F R
8 AM-2 PM. *Spr:* Rome RC. Westmoreland VFD, Station Rd. 56th Annual Hamfest, "Junk Box" area. *TI:* 146.88 (151.4 Hz). *Adm:* $5. Tables: $5 (indoor only). Tony LoVaglio, WA2GBE, 134 Glen Rd S, Rome, NY 13440; 315-337-2293; **wa2gbe@verizon.net**; **pages.prodigy.net/romeradioclub**.

North Carolina (Dallas) — Sep 5-6 D F H R S T V
7 AM both days. *Spr:* Shelby ARC. Gaston County Park, 1301 Dallas-Cherryville Hwy. 53rd Shelby Hamfest, limited overnight camping. *TI:* 146.88, 147.12. *Adm:* advance $6, door $8. Robby Hamrick, WA4RH, Box 1408, Ellenboro, NC 28040; 828-453-9121; **chairman@shelbyhamfest.org**; **www.shelbyhamfest.org**.

Ohio (Cambridge) — Aug 23 F H V
8 AM-1 PM. *Spr:* Cambridge ARA. Pritchard Laughlin Civic Center, 7033 Glenn Hwy. Hamfest and Computer Show. *TI:* 146.85 (91.5 Hz). *Adm:* $5. Tables: $10. Mary Jane Rhodes-Ellis, KD8EIR, 5855 Sherrard Rd, Cambridge, OH 43725; 740-439-6610; **radicalrhodes@yahoo.com**; **www.w8vp.org**.

Ohio (Cortland) — Aug 16 D F H V
Set up 6 AM; public 8 AM-4 PM. *Spr:* Warren ARA. Trumbull County Fairgrounds, 899 Everett Hull Rd. Hamfest and Electronics Show. *TI:* 146.97. *Adm:* advance $4, door $5. Tables: $6. Chris Brister, KD8BHR, 5714 Ensign Rd, W Farmington, OH 44491; 440-548-5616; **kd8bhr1@yahoo.com**; **www.w8vtd.org**.

Ohio (Friendship) — Aug 22 F
8 AM-3 PM. *Spr:* Portsmouth ARC. Nile Township Community Building, 12215 Rte 52. *TI:* 145.39 (136.5 Hz). *Adm:* $5. Tables: inside, free; outside, bring your own. John Pick, KC8JRE, 443 Diana St, Minford, OH 45653; 740-820-3366; **kc8jre@falcon1.net**; **www.portsmouthamateurradioclub.com/**.

Western Pennsylvania Section Convention
August 23, New Kensington
F Q R T
The Western Pennsylvania Section Convention, sponsored by the Skyview Radio Society, will be held at the Skyview Radio Society Clubhouse, 2335 Turkey Ridge Rd. Doors are open 8 AM-1 PM. Features include 49th Annual Swap 'n Shop, tailgating ($5 per space), DXCC card checking, breakfast and lunch served, "Skyview Jam" (musicians bring your instruments), food bank donation center. Talk-in on 146.64 (131.8 Hz). Admission is $3. Contact Bob Boehmer, KG3F, c/o Skyview Radio Society, 2335 Turkey Ridge Rd, New Kensington, PA 15068; 412-860-0046; fax 412-826-3738; **SkyviewHamfest2009@verizon.net**; **www.skyviewradio.net**.

Pennsylvania (Sinking Spring) — Aug 8 F V
Set up 7 AM; public 8 AM. *Spr:* Reading RC. Heritage Park, Clematis St. Mini-Hamfest, auction (noon). *TI:* 146.91 (131.8 Hz). *Adm:* $1. Tables: $2. Harry Hoffman Jr, W3VBY, 104 Evans Ave, Sinking Spring, PA 19608; 610-678-8976; **harryhoffmanjr@juno.com**; **www.readingradioclub.com**.

South Carolina (Moncks Corner) — Aug 15 F T
9 AM-3PM. *Spr:* Trident ARC. Moncks Corner Fraternal Order of Police, Lodge 19, 1310 S Live Oak Dr. 3rd Annual Tailgate Party, equipment test station with power and antennas. *TI:* 147.15. *Adm:* $1. Tables: $3. Dennis Zabawa, KG4RUL, 307 Pine Cone Ct,

To All Event Sponsors
Before making a final decision on a date for your event, you are encouraged to check the Hamfest and Convention Database (**www.arrl.org/hamfests.html**) for events that may already be scheduled in your area on that date. You are also encouraged to register your event with HQ as far in advance as your planning permits. See **www.arrl.org/FandES/field/hamfests/regform.html** for an online registration form. Dates may be recorded up to two years in advance.

Events that are sanctioned by the ARRL receive special benefits, including an announcement in these listings and online, donated ARRL publications and handouts.

For hamfests: Once the form has been submitted, your ARRL director will decide whether to approve the date and provide ARRL sanction. *For conventions:* Approval must come from your director and the ARRL executive committee.

The deadline for receipt of items for this column is the **1st of the second month preceding publication date**. For example, your information must arrive at HQ by **August 1** to be listed in the **October** issue. Information in this column is accurate as of our deadline; contact the sponsor or check the sponsor's Web site for possible late changes, for driving directions and for other event details. Please note that postal regulations prohibit mention in *QST* of prizes or any kind of games of chance such as raffles or bingo.

Promoting your event is guaranteed to increase attendance. As an approved event sponsor, you are entitled to special discounted rates on *QST* display advertising and *ARRLWeb* banner advertising. Call the ARRL Advertising Desk at 860-594-0207, or e-mail **ads@arrl.org**.

Ladson, SC 29456; 843-572-4053 (after 10 AM); **kg4rul@comcast.net**; **www.tridenthams.org**.

Tennessee (Gladeville) — Aug 22
D F R T V
Set up 6 AM; public 8 AM. *Spr:* Short Mountain Repeater Club. Gladeville Community Center, 95 McCreary Rd. Foxhunting. *TI:* 146.91. *Adm:* $5. Tables: $10. Tony Singleton, KI4HMC, 107 Lealand Ln, Lebanon, TN 37087; 615-444-6547 (phone and fax); **ki4hmc@arrl.net**; **www.shortmountain.org**.

Texas (Gainesville) — Aug 22 D F R T V
7 AM-3 PM. *Spr:* Cooke County ARC. Gainesville Civic Center, 311 S Weaver St. 17th Annual Hamfest, programs, eyeball QSOs, RV parking with full hookup adjacent to Civic Center ($15; 940-668-4530). *TI:* 147.34, 442.775 (both 100 Hz). *Adm:* advance $6 (by Aug 15), $8 (after Aug 15). Tables: advance $8 (by Aug 15), $10 (after Aug 15); electrical hookup $5 extra. James Floyd, N5ZPU, 1704 E California St, Gainesville, TX 76240; 940-668-7511; **jfloyd54@swbell.net**; **www.gainesvillehamfest.org**.

Vermont (Swanton) — Aug 15 D F T V
6 AM-3 PM. *Spr:* St Albans ARC. Raven Extruder Die Service, Rte 78. *TI:* 145.23 (100 Hz). *Adm:* $5. Tables: $5. Arnold Benjamin, N1ARN, 1420 Rice Hill Rd, Franklin, VT 05457; 802-309-0666; **n1arn@yahoo.com**; **www.starc.org**.

West Virginia State Convention

August 22, Weston
D F S V
The West Virginia State Convention (51st Annual Event), sponsored by the West Virginia State Amateur Radio Council, will be held at the WVU Convention Center – Jackson's Mill 4-H Conference Center, 160 WVU Jackson Mill. Doors are open 8 AM. Features include President's Reception (Friday, Aug 21, 6 PM; Jackson Lodge Basement); flea market; vendors; auction; forums; educational programs and demonstrations; guest speakers; Special Event Station; MARS, QCWA, Net, and Council Meetings; VE sessions. Talk-in on 145.39, 147.88. Admission is $8. Contact Patrick Shea, N8MIN, 27 Jackson St, Weston, WV 26452; 304-269-3468; fax 304-427-2187; **pshea@citynet.net**; **www.qsl.net/wvsarc/**.

Wisconsin (Baraboo) — Aug 22 F V
8 AM-1 PM. *Spr:* Yellow Thunder ARC. Elks Club Lodge, 623 Broadway St. 13th Annual Circus City Swapfest, VE sessions. *TI:* 147.315 (123 Hz). *Adm:* $5. Tables: $5. Steve Schulze, N9UDO, 1120 City View Rd, Baraboo, WI 53913; 608-356-2313; **n9udo@yellowthunder.org**; **www.yellowthunder.org**.

Wisconsin (Chippewa Falls) — Aug 8 F T
8 AM-noon. *Spr:* Chippewa Valley ARC. Lake Hallie Eagle's Club, 2588 Hwy 53. *TI:* 147.375 (110.9 Hz). *Adm:* $5. Tables: $5. Ronald Anderson, W9RMA, 8121 163rd St, Chippewa Falls, WI 54729; 715-723-1729; **w9rma@charter.net**; **www.w9cva.org**.

Wisconsin (Sturtevant) — Aug 15 D F R
7 AM-1 PM. *Spr:* Racine Megacycle Club. Fireman's Park, 9600 Charles St. 2nd Annual Freefest. *TI:* 147.27. *Adm:* Free. Bob Frederiksen, KB9ZAF, 4455 Spring St, Racine, WI 53405; 262-637-6588; **kb9zaf@arrl.net**; **www.w9udu.org**.

Strays

GETTING AN EARFUL OF *QST*

♢While *QST* has written articles on the technology that has long made Amateur Radio accessible as a hobby for the visually impaired, have you ever wondered how *QST* itself reaches the ears of blind hams? Meet Jake Williams. Jake has been putting *QST* on tape for over 28 years. He began his career in voice work in 1967 when he worked as a radio DJ. In the mid 1980s he began working for a recording studio in Denver, Colorado putting books and magazines on tape for the persons who are blind and physically handicapped.

Jake reads the magazine, but he also has some behind-the-scenes help to make sure that what blind hams hear is what the authors intended. Although not a ham himself, he has certainly been reading the magazine for long enough to recognize and define the terms, symbols, name brands and abbreviations often used in Amateur Radio. Even then, if he is unsure, he consults a comprehensive guide written by hams in the late 1970s.

Without the help of long-time hams Rex Bailey, KØFQM, and Bill Thomas, WAØBND, the most challenging thing about reading *QST* aloud would be relaying the visual information presented in schematics and charts. These two gentlemen have been writing out *QST*'s schematics for Jake to read in a sort of "narrative" form for 10 and 20 years, respectively. This leaves as his most difficult task correctly pronouncing DXCC entities.

QST on tape is produced by Talking Book Publishers and distributed through the Library of Congress. If you would like more information about the Library of Congress, National Library Service for the Blind and Physically Handicapped, please call 1-800-424-8567. — *Anna Till,* **anna@talkingbookpublishers.net**

Jake Williams at work reciting an issue of *QST*.

LAWRENCE CAMPI, WA5TRX

An Island on the Air? **ARRL Life Member Lawrence Campi, WA5TRX, of Kenner, Louisiana, came across this street in nearby Metairie. He asks: "As the area is totally surrounded by the Mississippi River, Lake Pontchartrain and various drainage canals, does it qualify as an island?**

STEVE GINGO, KB2RMS

Hunting the fox: **Joe Stack, N2JOE, a member of the Delaware Valley Radio Association of Trenton, New Jersey, participated in a club-sponsored electronic foxhunt with his boys, ages six and nine. They had built a cubical quad 2 meter antenna out of #10 copper wire and 1×2s, but the antenna was too cumbersome. So Joe and his sons designed and put together a quad out of Tinker Toys, lightweight cables and dowel rods. The design worked and the trio placed second in the April foxhunt. More than that, the boys and their dad had a great time building and then using the home-brew antenna.**

75, 50 AND 25 YEARS AGO

August 1934

■ The cover photo shows "New Equipment for the Five-Meter Band."
■ The editorial announces that, through the League's efforts, hams may now operate mobile on 5 meters and above 110 Mc. without filing special notifications.
■ Ross Hull and George Grammer provide complete details on building "New Equipment for the 56-Mc. Station" — transmitter, receiver, and power supply.
■ A Strays item on the facing page notes that W2AOE was the first ham to use the 5 meter band for emergency traffic. When he ran out of gas late one foggy night, W2DX heard his call for help and delivered some gas!
■ L. W. Hatry provides "Pointers on Noise-Reducing Receiving Antenna Systems."
■ C. A. Harvey, W1RF, and R. M. Purinton, W1HTM, describe how to build "A Medium-Powered 'Phone-C.W. Transmitter with Pentode Power Tubes."
■ Frank Davis, W9FVM, tells how he built "A Four-Band Transportable 'Phone and C.W. Transmitter" that weighs only 25 pounds.
■ J. H. Dellenger tells about his "Observations on Long-Delay Radio Echoes," which he describes as "…a most surprising and baffling phenomenon."
■ The "Amateur Radio Stations" column this month pictures and describes the FB stations of W2GOX, W6HOG, and VE3EU.

August 1959

■ The cover shows KH6UK's antenna, with a bold banner exclaiming, "California to Hawaii on 220 Mc.!"
■ The editorial discusses the "Geneva Proposals" that will be the basis for negotiations in the Geneva radio conference later this year.
■ Frank Jones, W6AJF, describes his "Experimental Parametric Amplifiers" that provide exceptionally good noise figures on 144, 220, and 420 Mc.
■ Fred Reed, K2RHG, presents his nice-looking all-band H.F. amplifier that uses "6146s in Parallel."
■ Merell Hess, W3QEF, tells how he uses a "Single-Line Feed for Tri-Band Quads."
■ John Fill, K2GC/4, adds a third ham band to the W2EWL Special (originally designed for 75 and 20 meter S.S.B.), in "'Cheap and Easy S.S.B.' Goes on 15."
■ "Amateur Communication at 36,500 Mc." is a belated report of the 1957 work by W6NSV and K6YYF — the first known two-way ham communication on the territory above 30,000 Mc.
■ Frank Gue, VE3DPC, tells how to get stability and selectivity on 80 and 40 meters at low cost by using a BC-453, a BC-454, and a BC-455 as "An ARC-5 Triple Superhet."
■ Charles Thompson, W4UVY, reports on "Adding a Reflector to the One-Element Rotary."
■ Gil Countryman, W4JA, describes "A 75-Watt V.F.O. for 20-40 C.W."

August 1984

■ The cover photo shows G6BTU, G6APF, and G3YJO working on OSCAR 9, with the caption reporting that the bird is "alive and well."
■ The editorial announces, "Volunteer Examining — At Last," with the FCC expected to act favorably on the agenda item at its July (Friday the) 13 meeting.
■ John Lindholm, W1XX, and Bob Halprin, K1XA, report on the status of "The Amateur Auxiliary for Volunteer Monitoring."
■ Thomas McMullen, W1SL; Jim Worsham, WA4KXY, and Harold Senderson, WB4TTA, tell about W5LFL's 2-meter space shuttle rig, in "Amateur Radio's Hand-Held in Space."
■ Doug DeMaw, W1FB, presents "Some Basics of VHF Design and Layout."
■ Robert Diersing, N5AHD, tells us how to read satellite telemetry in "Microcomputer Processing of UoSat-OSCAR 9 Telemetry."
■ James Rautio, AJ3K, presents Part 4 of "The Effects of Real Ground on Antennas."
■ Doug DeMaw, W1FB, gives us Part 8 of "The Magic of Transistors," those little gizmos that were invented at Bell Labs in 1947.
■ "Amateur Radio at the Louisiana World Exposition," by Wayne Knabb, KO5R, reports on the splendid work done by hams to show the good face of Amateur Radio to Expo visitors.

Al Brogdon, W1AB ♦ Contributing Editor

Field Organization Reports

MAY 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/.**

670
W7TVA
610
AC8AR
504
W2LTB
450
WA2WMJ
427
NC4VA
409
W4CAC
380
W2MTA
345
KB2RTZ
335
WB7WOW
N2LTC
326
KI4KWR
325
KØIBS
320
AK2Z
295
KA2ZNZ
278
KC8NTE
270
W2LC
260
KB2BAA
246
N4HUB
242
KI4GEM
240
K7BFL
232
KT5SR
224
KB2ETO
210
K2HJ
205
K2BRG
204
KØLQB
200
N2YJZ
196
K5SFM
WB2KNS
194
KK1X
192
NY3H
190
N2RDB

189
W2KFV
185
WA2BSS
K7OAH
180
KE4HYW
K2YYD
175
K2ABX
W2DWR
K2RRM
171
W4SOU
170
KI4HGO
N5NVP
169
KA5EXI
166
KI4GWC
165
WC6C
KD1LE
WB8RCR
160
KB5KKT
N1UMJ
N7CM
KK3F
159
W7ELI
W2LIE
154
KA2EJD
152
WB9FHP
150
WD4FLJ
N2VGA
145
K7EAJ
W2SFD
W5DY
K8MFK
K8RDN
144
K4DLF
K2GW
140
W1PLW
K2UPS
K1HEJ
139
K7BC
136
W9AL
135
N2JBA
W5ESE
W3YVQ
KB1NMO

132
KO4OL
131
KE4PAP
130
K6JT
K9LGU
WØLAW
KK7DEB
W4ZJY
W4DNA
W4FAL
KI4JOO
WB9JSR
N8IO
126
K4DND
WD8JAW
125
W7EKB
NN7H
AG9G
KA8ZGY
120
KA4FZI
N4HHP
K2UL
WB2FTX
KW1U
W1GMF
K4BG
K4GK
K4IWW
KI4ZJI
W8UL
118
N2GJ
WB2HPI
116
K1LKJ
115
N7BEC
WA9WNE
W5PY
114
KB3MXM
K8AMR
113
KB5PGY
N3RB
110
W7QM
W7GB
N2VC
N4ABM
KK5GY
N1JX
W6DOB
N1IQI
N7XG
N7YSS
KB3LNM
W2EAG
KB2EV
WB4GHU
KF7GC
K5KV

108
WB8OIF
107
KC2RJX
105
KE4CB
KC5OZT
W4TTO
N8OD
WC5M
103
W3CB
KD1SM
102
W7JSW
101
N7EIE
KJ7NO
100
W7GHT
K4AWB
NA9L
K4SCL
WA2NDA
KK5NU
N5OUJ
N2GS
KM1N
WB6UZX
K2AN
KS3Z
W3TWV
AA3SB
KI4YV
N9MN
NR2F
W1SGC
KB2KLH
K2TV
W2DSX
KB8GT
WB8SIQ
K5MC
NX1Q
W4KLB
98
N2DW
96
K4BEH
N7IE
95
WG8Z
94
WA4UJC
91
WM2C
W7VSE
90
WA2CUW
W2CC
K3IN
N3ZOC
KA8WNO
WD8DHC
KB8NDS
WB4BIK

K1JPG
NU8K
W3GQJ
W8IM
KC2SYM
NN7D
N8DD
WD8Q
KA1RMV
KA1GWE
N4MEH
89
KE5DKV
W8CPG
KBØDTI
K2KYQ
86
AD4BL
WA1JVV
KC2CHA
85
KC2OOY
84
KD7THV
NS7K
83
KB9KEG
N7JCO
82
K9EOH
KB1KRS
80
K7MQF
KE7DVV
N2VQA
AB9SY
K8KV
KE5PWL
79
N8NMA
W2OSR
78
W9ILF
WDØGUF
W4QAT
77
NA7G
75
W5GKH
WB2WAK
N2RSO
W5HUD
72
WA2LKJ
WA2WKV
WB2ZEX
N5MEL
71
W9WXN
70
WN2Y
N3SW
WF2T
NM1K

The following stations qualified for PSHR in previous months but were not recognized in this column: (Apr) WA2WMJ 400, N2YJZ 200, WA2BSS 191, W2SFD 145, N2JBA 135, N2VC 116, WN2Y 75, WM2C 71. (Mar) W9AL 109, NA9L 100, W9ILF 100, K9EOH 97, W9WXN 70.

Section Traffic Manager Reports

The following Section Traffic Managers reported: AK, AL, AR, AZ, CO, CT, EB, EPA, EWA, GA, ID, IN, KS, KY, LA, MI, MN, MS, NC, NFL, NH, NLI, NM, NNJ, NNY, NTX, OH, SD, SFL, SJV, SNJ, STX, UT, VA, WCF, WI, WMA, WNY, WV, WY.

Section Emergency Coordinator Reports

The following ARRL Section Emergency Coordinators reported: AZ, EWA, IN, GA, KS, KY, LA, MDC, ME, MI, MO, MT, NC, NLI, NV, OK, OR, SD, SFL, SNJ, STX, SV, TN, VA, WNY, WPA, WTX, WV.

Brass Pounders League

The BPL is open to all amateurs in the US, Canada and US possessions who report to their SMs a total of 500 or more points or a sum of 100 or more origination and delivery points for any calendar month. Messages must be handled on amateur radio frequencies within 48 hours of receipt in standard ARRL radiogram format. Call signs of qualifiers and their monthly BPL total points follow.

WB5ZED 2011, KK3F 2011, KA8EKG 1282, N1IQI 1237, K7BDU 1131, WB5NKD 1018, W1GMF 1018, WB5NKC 945, KT2D 775, W4ZJY 773, KW1U 751, W8UL 746, N1UMJ 635, W7QM 582, WB9JSR 505, N8IXF 502, K8LJG 106.

The following station qualified for BPL in April, but was not recognized in this column last month: KT2D 515.

SILENT KEYS

It is with deep regret that we record the passing of these amateurs:

K1CFW **Guerrazzi,** Carmine, Loganville, GA
K1DVW **Parlee**, Lawrence C., Clifton, ME
WW1F **DiPietro**, Lawrence C. Sr, Freeport, ME
W1GNA **Relyea**, Mary L., Bethany, CT
K1GPJ **Clement**, Armand "Clem" I., Turner, ME
WB1GSZ **Blackman**, Arthur S., Bethel, CT
N1GXW **Gagner**, Frank A. Sr, Baileyville, ME
WB1HBQ **Hubner**, Raymond, Higganum, CT
KB1IEC **Gahagan**, James K., Auburn, ME
W1KRV **Steventon**, Joseph T., Rochester, VT
W1LSD **True**, William A., Sanford, ME
KC1LW **Friedman**, Thomas R., Manchester, NH
KB1MZE **Bloom**, James, Newton, MA
N1NAB **Campbell**, Thomas M., Cranston, RI
KC1OX **Hunt**, Charles "Chick" F., Lakeland, FL
N1RGP **Kelley**, Gordon E., Hancock, ME
W2DQE **DePalma**, Michael L., Mount Vernon, NY
KC2MDK **Haeger**, Herbert E. Jr, Rye Brook, NY
♦W2NYU **Rand**, Arnold H., Winthrop, ME
W2PH **Anlage**, Joseph J., Southampton, NJ
WA2RQY **Lucchesi**, Richard B., Port Charlotte, FL
♦N2UD **Whelan**, Daniel W., Delanson, NY
KB2VWZ **Soifer**, Samuel, New York, NY
WA2VYS **Rice**, Ruth E., South Salem, NY
W3DPG **Weidle**, Paul A., Wattsburg, PA
N3EGC **Zadera**, Jerome S. Sr, Annapolis, MD
WB3IET **Beard**, Vernon, Waterford, PA
W3ILQ **Goldsmith**, Joseph K., Harrisburg, PA
N3JSS **Kania**, Matthew W., Cape Coral, FL
WN3PIT **McCann**, Kenneth D., Newville, PA
W3YE **Trauterman**, Robert P., Ford City, PA
WA4AFZ **Voyles**, Charles M., Fayetteville, GA
N4AXB **Lee**, Kenneth W., Columbia, SC
AI4BE **Cannon**, Robert "Kenny," Dallas, GA
WB4DHU **Caywood**, Dan R., Wilmington, NC
ex-WB4MHG **Reinlie**, Robert, Fort Walton Beach, FL
N4EEL **Eiden**, Paul E. Jr, Louisville, KY
N4HDW **Phillips**, Lendon M., Cumming, GA
KF4HGV **Bogusz**, Angela K., Sun City Center, FL
K4HH **Royse**, Herbert "Pete" H. Jr, Nicholasville, KY
K4JNO **Black**, John W., Sevierville, TN
ex-K4RES **Speight**, Norman C., Columbia, SC
N4LLZ **Migdol**, Monte S., Leesburg, FL
KA4LME **Brown**, Aura Edwin "Ed," Lakeland, FL
NV4L **Johnson**, Larry D. Sr, Lizella, GA
KA4MKG **Pugh**, Mike, Lexington, KY
K4NL **McClain**, William "Mac" T., Tampa, FL
K4NTY **Walker**, Cal C., Matthews, NC
N4RWL **Lamb**, Robert C. Sr, Roberta, GA
KE4RWN **McGlynn**, Lawrence J., Charlotte Court House, VA
W4SHN **Jones**, William R., Paris, KY
KR4SR **Carrico**, Jim, Lebanon, KY
KC4TWL **Ricker**, Robert, Ocala, FL
KA4WVO **Crable**, Jack B., Dothan, AL
KQ4XN **Gregg**, Earl R., Palm Beach Gardens, FL
N4XS **Burkhard**, Richard J., Niceville, FL
KE4YIX **Wilson**, Ben R., Palmetto, FL
K4ZYK **Nichols**, Carl "Nick" L., Gainesville, GA
W5AHF **Cochran**, Robert G. Sr, College Station, TX
W5CJZ **Moffatt**, Barney C., Dallas, TX
W5FO **Schriner**, Lynn Allen, Bella Vista, AR
W5HUQ **Moore**, John R., Booneville, AR
W5IMR **Miller**, Charles M., San Antonio, TX
KI5KP **Meinhardt**, Raymond P., Mountain Home, AR
K5MBE **Chaffin**, Donald V., Nathrop, CO
W5PTP **Rupe**, Harvey C. Jr, White Settlement, TX
KB5PXE **Marsala**, Petrina M., Monroe, LA
KU5S **Tabor**, James L., Greenwood, AR
N5TVZ **Dorsey**, Bettye V., Hurst, TX
AC5VN **Whitecotton**, Ronald D., Gary, TX
WJ5V **Shaw**, Edward R., Denison, TX
WA5YJK **Wheeler**, Russell T., Paragould, AR
♦W5YQ **Goodwin**, Dr Martin B., Portales, NM
W6AYO **Fike**, Grover P., Bend, OR
K6KMW **Crawford**, James B. Jr, Nuevo, CA
KC6NAH **Stamps**, Hubert D., Santa Barbara, CA
AA6OC **Toombs**, Robert R., Murphys, CA
AC6OO **Mueller**, Kenneth E., Thousand Oaks, CA
W6PZF **Meyers**, Orval L., Gig Harbor, WA
W6QPU **Dowers**, James F., Ventura, CA
N6REV **Manley**, Melvin C., Selma, CA
WA6TEM **Grambsch**, Richard L., Sunnyvale, CA
KC6UFL **Wear**, Jo Ann, Wilseyville, CA
W6WW **Whitehead**, Clay T., McLean, VA
WB6YDO **Pethel**, John A., Fresno, CA
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KD7EM **Johanson**, Lloyd M., Portland, OR
♦W7FEO **Ryan**, Gordon G., Moses Lake, WA
K7GF **Brouwer**, Robert L., Medford, OR
KE7GT **Higgins**, Thayne N., Prescott, AZ
WA7HWD **Mader**, John "Jack" W., Colfax, WA
KD7LJV **Henderson**, Robert J., Scio, OR
KD7POW **Beard**, Aaron A., Mantua, UT
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♦W8DUW **Anderson**, Edward C. Jr, Apollo Beach, FL
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N8XQL **Wert**, Donna S., Midland, MI
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KC9DVQ **Zomchek**, Alexander J. Sr, Gleason, WI
KB9JNL **Hazelwood**, Patricia R., Oshkosh, WI
W9JWM **Clark**, James E., Waukesha, WI
KB9MAS **Jesko**, James J., LaPorte, IN
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KB9TJI **Willoughby**, Timothy S., Washburn, WI
KM9T **DuKate**, Dale A., Jupiter, FL
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WØYF **Hedin**, Douglas G., Dassel, MN
♦KØBM **Moschenross**, Benjamin H., Saint Charles, MO
WØDCO **Slagel**, Garold "Bud" D., Madison, SD
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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

KIDS NET

◊I sit by my 2 meter radio in anticipation…It is almost time for Kids Net. The repeater chirps a reply as it responds to being keyed. A small voice fumbles a call sign and again silence returns. Children are all gathered around their handhelds.

Kelsey, KE7EBI, connects the repeater to IRLP node 9255, a reflector in Nevada. Moments later Lindsay in San Diego can be heard connecting into the reflector.

"Hello, my name is Kelsey, KE7EBI, net controller for the Lake Washington Ham Club Kids Net. Is there any emergency traffic at this time? Hearing none, we will proceed with the roll call of regular members." From that point Kelsey delivers a routine message about Kids Net, its meeting time, its purpose and the procedure for kids calling in. Kelsey starts by calling California and Lindsay usually answers. Then Kelsey moves into the Seattle region going from suburb to suburb calling the names of regular members. Some 30 minutes later Kelsey has completed the roll call of 30 active members, many of whom have answered. These youngsters range in age from 8 to 15 with an occasional 18 year old.

With the routine roll call out of the way, my favorite part of Kids Net is ready to happen. It is the honking of the horn and the name draw. Kelsey, using an old Bombay taxi horn, honks the horn once and then reaches into a jar and draws out the name of one individual who was present at roll call.

On any given net there are usually 18-22 children checking in and anywhere from 14-25 visitors….bigger kids, called adults.

If you are a kid and would like to participate in Kids Net, simply register on the LWHC Web page, **lakewashingtonhamclub.org**.

The LWHC Kids Net meets on Sunday evenings at 8:15 PM Pacific Time on the LWHC Kirkland Repeater 145.490 (–) tone 103.5 or on IRLP reflector 9255. Visitors are always welcome. To find out how to set up a Kids Net in your own community, contact the Lake Washington Ham Club at **k7lwh@lakewashingtonhamclub.org**.
— *Dave Condon, KI7YP*

DAVE CONDON, KI7YP

Kelsey Corley, KE7EBI, is Net Control for the Kids Net, sponsored by the Lake Washington Ham Club.

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**.

Four Output Bench Supply

Digital panel meter — A display device that serves as a replacement for an analog meter as a circuit measuring tool. Instead of a continuous range of values, the digital meter provides a fixed number of digits that are the limit of its precision.

Gerber file— Data file format that takes printed circuit connection information and is used to produce a layout of traces for board manufacture. See **en.wikipedia.org/wiki/Gerber_File**.

IC — Integrated circuit. A single structure containing multiple active devices that perform a function such as an operational amplifier, a number of logic gates or a microprocessor. A "chip."

Printed circuit board (PCB) — Wiring methodology in which a copper clad board is etched to remove undesired copper leaving connection paths for electrical connections between parts.

Switching regulator — A voltage regulator circuit that uses switching to reduce output voltage by switching the output to the filter on and off. The result is less energy los and increased efficiency as compared to the more usual linear regulator.

A 10 Meter Moxon Beam

Budwig insulator — Trade name wire antenna center insulator (model HQ-1) with attached wires and integral SO-239 type coax connector. The 35% glass filled ABS copolymer device is designed for strength and to be light in weight.

dBi — Logarithmic power ratio of the radiated field of an antenna in a particular direction in Decibels compared to that from an antenna that radiates equally in all directions (an *isotropic* antenna).

EZNEC — Proprietary software that performs analysis of antenna systems based on the *Numerical Electromagnetic Code (NEC)* antenna modeling engine. **www.eznec.com**.

F/B ratio — Front to back ratio. The ratio of the power in the main beam of a directional antenna to that to its rear. This is a key figure of merit for many applications of directional antennas, particularly if used to reject signals from undesired directions.

Spreaders — Structural element of wire antenna array that holds end or corners of multiple elements in correct relative position.

THHN insulated wire — Wire designed for ac power distribution in buildings. THHN stands for thermoplastic high heat-resistant nylon coated, describing the composition of the insulating material. The wire itself comes in a number of sizes and can be found either solid or stranded. It is frequently used for antenna construction because of its low cost. The insulation results in an antenna that needs to be a percent shorter than one made with bare wire.

Diamonds in the Sky

Antenna gain — The relative intensity of the radiated field of an antenna in a certain direction compared to the intensity of some reference antenna in the same direction.

Big wheel — A kind of omnidirectional horizontally polarized VHF antenna introduced in a 1961 *QST* article.[2] It consisted of three full wave horizontal loops arranged in a circle and fed from a central hub.

DominoEX 8 — A sound card digital mode that is useful on VHF FM at lower signal to noise ratios than generally needed for SSB operation. Software available as a part of the free *Fidigi* package at **www.w1hjk.com/Fidigi.html**.

Horizontally polarized — Orientation of wave front in which the magnetic field is horizontal.

Net control station (NCS) — The station in control of an on-the-air meeting of hams at a set time, day and radio frequency.

Phasing line — Section of transmission line with length selected to provide a particular time delay or equivalent phase shift between two points in a system. Often used in antennas to define the phase relationship between signals radiated from different antenna elements..

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

Ragchewing — Casual, sometimes longwinded, Amateur Radio on air conversation.

RG-59 coaxial cable — Coaxial cable type with 75 Ω characteristic impedance and 0.242 inch outer diameter. Compatible with a PL-259 with the use of a sizing adapter.

Skeleton slot — Name of antenna consisting of a full wave rectangular loop higher than wide. It is fed via a transmission line split to connect to the center of each vertical side. It acts as two horizontally stacked bent dipoles in phase and was used as the driven element structure of a VHF stacked Yagi array popular in the 1950s.

SO-239 connector — Designation of a flange mount female coaxial cable connector socket of the usual UHF type.

Turnstile antenna — An antenna consisting of two perpendicular horizontal dipoles in the same plane and fed through a 90° phasing line. While originally designed as an omnidirectional horizontal VHF antenna, it also provides circular polarization perpendicular to the plane of the elements.

The Doctor is IN

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

Semi-automatic key — Telegraph key with horizontal motion of a lever arm. Pushing the arm to the right results in a stream of dots generated by a weight and spring. Dashes are made manually by pushing the arm to the left. Left handed versions are sometimes seen.

UTC — Coordinated Universal Time. Abbreviation for worldwide time standard based on the time at the prime meridian (0° longitude) that runs through Greenwich, England.

The Ignition Switch

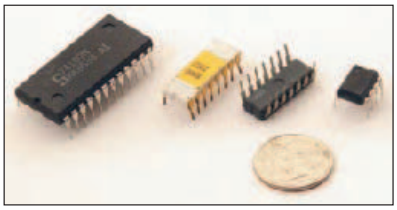
CMOS — Complementary metal oxide semiconductor. An integrated circuit logic family with particularly low power requirements.

Relay — Electromechanical device in which a voltage to a coil produces a magnetic field that pulls electrical contacts together or apart. It serves as a remote-control switch.

A No Special Tools SMD Desoldering Technique

Bus wire — Generally thick, uninsulated wire designed to be used as a common power, signal or ground bus in an electronic assembly.

Dual in-line package (DIP) — Integrated circuit package characterized by two rows of connecting pins.



Solder wick — Braid of thin wires that is heated along with a connection to remove solder from the connection. The capillary action between the wires tends to draw the molten solder into the wick of wires. After the solder on the wick has cooled, the solder filled area is cut off and the solder filled portion is cut off and discarded leaving a fresh region for the next application.

Surface mount devices — Kind of electronic component, passive or complex integrated circuits, that mount to printed circuit boards through adhesive and direct solder connections rather than the earlier technology of wires mounting through holes in the board. Well suited to precision automated assembly and much more compact than earlier technology. See **www.dprg.org/tutorials/1999-07a/**.

[1] *The ARRL Handbook for Radio Communications,* 2009 Edition. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 0261 (Hardcover 0292). Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop/**; **pubsales@arrl.org**.

[2] R. Mellen, W1IJD, and C. Milner, W1FVY, "The Big Wheel on Two," *QST*, Sep 1961, pp 42-45.

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- Mounts easily on wall. Size: 34 1/2" x 22 1/2"

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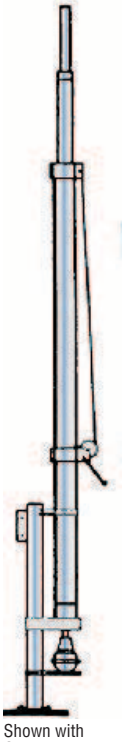

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MA-40

40' Tubular Tower

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MA-550

55' Tubular Tower

Handles 10 sq.ft. at 50mph

Pleases neighbors with tubular streamlined look

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Special Multi-Band UNUN Vertical Matching Network

- Superior to other multi-band vertical UNUNs
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- Full 1.8 to 30 MHz coverage
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- Direct replacement for other multi-band UNUNs—fits existing mounting hole pattern
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Multi-Band Vertical UNUN

DXE-UN-43 .....**$99.95**
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Radials for Top Vertical Performance!

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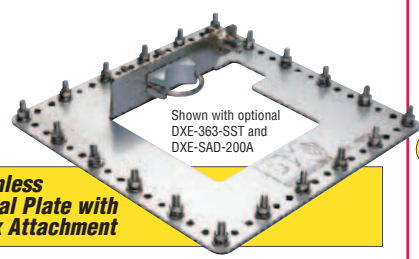

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Makes radial attachment a snap!

- Fits 2" pipe, 4x4 and 6x6 posts
- 0.125" thick 304 stainless steel
- Accommodates up to 120 radials
- Patented high current coax connection to radials

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The Hy-Tower is an omnidirectional, self-supporting vertical radiator that operates on 10 through 80 meters. Add a loading coil and 160 meter operation is possible. The use of stub decoupling systems allows band switching on 10, 15, 20, 40, and 80 meters. The stubs isolate various sections of the vertical antenna so that an electrical 1/4 wavelength (or odd multiple of 1/4 wavelength) exists on all bands. On 20 meters, the 80 meter section acts as a 3/4 wave radiator.

- Tilt base allows easy assembly before raising antenna into position
- Stainless steel hardware
- Maximum Power: 1 kW AM, 2 kW PEP
- Overall Height: 53 feet

The Hy-Tower is drop-shipped directly from Hy-Gain. DX Engineering will e-mail you a shipping quote when you place your order.

HYG-AV-18HT **$899.95**

Check Our Prices Before You Buy!

MULTI-BAND, NO-RADIALS VERTICAL ANTENNAS

Patriot HF 8-Band No-Radials Vertical

- Quarter wave stubs on 6, 10, 12, and 17 meters
- Efficient end loading coil and capacity hats on 15, 20, 30, and 40 meters
- Effective counterpoise system replaces radials and grounding
- No lossy can traps
- End loading of the lower HF bands allows efficient operation
- Maximum Power: 1,500W
- Overall Height: 25.5 feet

HYG-AV-640.....**$379.95**

7-Band, No-Radials Vertical

- Operates on 10, 12, 15, 17, 20, 30, and 40 meters
- No ground radials required
- Off-center feed design
- High efficiency high-power traps
- Heavy-duty tiltable mast clamp for tubing up to 2 1/8" O.D.
- Easily raised and lowered
- Exceptional bandwidth on 40 and 20 meters
- Maximum Power: 750W average, 1,500W PEP
- Overall Height: 29 feet

HYG-DX-77A.....**$439.95**

Low Loss Coax Cable Assemblies

- All connectors are soldered, not crimped
- 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
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REPAIR OR BUILD YOUR OWN ANTENNAS!

6063 Aluminum Tubing

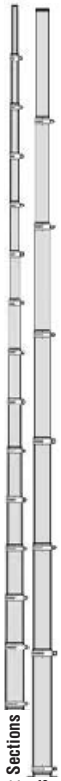
- High strength Type 6063-T832 drawn aluminum tubing
- Sections with 0.058 inch wall thickness are perfect for telescoping antenna elements
- Most sizes are pre-slit on one end for element clamps
- Available in 3 and 6 foot lengths

Aluminum Tubing, 0.058" Wall, 3 Foot Length

Part Number	Diameter/End Type	Price	Cost/Foot
DXE-AT1240	0.375", no slit	$2.70	$0.90
DXE-AT1241	0.500", one end slit	$3.30	$1.10
DXE-AT1242	0.625", one end slit	$3.60	$1.20
DXE-AT1243	0.750", one end slit	$3.90	$1.30
DXE-AT1244	0.875", one end slit	$4.20	$1.40
DXE-AT1245	1.000", one end slit	$4.50	$1.50
DXE-AT1246	1.125", one end slit	$4.95	$1.65
DXE-AT1247	1.250", one end slit	$5.55	$1.85
DXE-AT1248	1.375", one end slit	$6.15	$2.05
DXE-AT1249	1.500", one end slit	$6.75	$2.25
DXE-AT1250	1.625", one end slit	$7.65	$2.55
DXE-AT1251	1.750", one end slit	$8.40	$2.80
DXE-AT1252	1.875", one end slit	$9.15	$3.05
DXE-AT1253	2.000", one end slit	$9.90	$3.30
DXE-AT1254	2.125", one end slit	$11.40	$3.80

Aluminum Tubing, 0.058" Wall, 6 Foot Length

Part Number	Diameter/End Type	Price	Cost/Foot
DXE-AT1189	0.375", no slit	$5.40	$0.90
DXE-AT1205	0.500", one end slit	$6.60	$1.10
DXE-AT1206	0.625", one end slit	$7.20	$1.20
DXE-AT1207	0.750", one end slit	$7.80	$1.30
DXE-AT1208	0.875", one end slit	$8.40	$1.40
DXE-AT1209	1.000", one end slit	$9.00	$1.50
DXE-AT1210	1.125", one end slit	$9.90	$1.65
DXE-AT1211	1.250", one end slit	$11.10	$1.85
DXE-AT1212	1.375", one end slit	$12.30	$2.05
DXE-AT1213	1.500", one end slit	$13.50	$2.25
DXE-AT1214	1.625", one end slit	$15.30	$2.55
DXE-AT1215	1.750", one end slit	$16.80	$2.80
DXE-AT1216	1.875", one end slit	$18.30	$3.05
DXE-AT1217	2.000", one end slit	$19.80	$3.30
DXE-AT1218	2.125", one end slit	$22.80	$3.80



Aluminum Tubing, 2.000" Diameter, 0.125" Heavy Wall

Part Number	Length/End Type	Price	Cost/Foot
DXE-AT1255	3', no slit	$14.85	$4.95
DXE-AT1204	6', no slit	$29.70	$4.95

All Stainless Steel Element Clamps

DXE-ECL-020	1/2" and smaller tubing	$1.90
DXE-ECL-040	5/8" tubing	$1.90
DXE-ECL-060	3/4" and 7/8" tubing	$1.90
DXE-ECL-10SS	1" and 1 1/8" tubing	$1.90
DXE-ECL-12SS	1 1/4" tubing	$1.90
DXE-ECL-16SS	1 3/8" and 1 1/2" tubing	$1.90
DXE-ECL-20SS	1 5/8" and 1 3/4" tubing	$1.90
DXE-ECL-24SS	1 7/8" and 2" tubing	$1.90
DXE-ECL-28SS	2 1/8" and 2 1/4" tubing	$1.90
DXE-ECL-32SS	2 3/8" and 2 1/2" tubing	$1.90
DXE-ECL-36SS	2 5/8" and 2 3/4" tubing	$1.90
DXE-ECL-40SS	2 7/8" and 3" tubing	$1.90
DXE-ECL-44SS	3 1/4" maximum tubing	$1.95

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 DXE 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

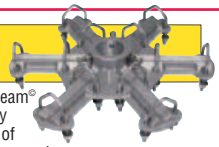
DXE-VE-BASE ..... Only $99.50

DXE-CAVS-1P	V-Saddle Clamp	$8.95
DXE-TB-3P	Tilt Base Assembly	$62.50

Heavy Duty Base
- Tilt Base included
- Two DXE-CAVS-2P mounting clamps required to attach base to mounting post

DXE-VA-BASE		$149.50
DXE-SSVC-2P	V-Saddle Clamp	$11.45

Hexx© 5-Band HF Beam Antenna Kits



The DX Engineering Hexxagonal Beam© kits provide a fast, economical way to build the latest, hottest version of an antenna concept that has been around since the 1980s. Hexxagonal Beam component packages provide an easy, step-by-step approach for designing your own antenna or upgrading an existing installation. The Total Antenna Packages allow you to build a complete one band or five band (20 through 10 meters) system.

New!

- Balanced in the wind—reduces torque load on the rotor
- 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
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- 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 Package	$99.95
DXE-HEXX-1SCP	Spreader and Center Post Package	$199.95
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DXE-HEXX-5CFP	5-Band Coax Feeder Package	$194.95
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Receive Antenna Interface for Transceivers

New!

Now you can 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. The RTR-1 enables operators the improved reception that a low noise receiving antenna system offers. Connection to a Beverage, receive four-square, active receive antenna, 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

See DXEngineering.com for complete information!

New!

Coaxial Cable Prep Tools

- Precision, two-step operation
- No nicks or scratches to conductor
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- 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
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DXE-CNL-911	Coax Cable Cutters	$23.75
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DXE-UT-KIT1	Basic Coax Cable Prep Kit	$99.95
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TIG-SL-CAB4R	4-pin round mic connector	$14.95
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
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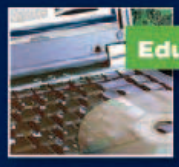

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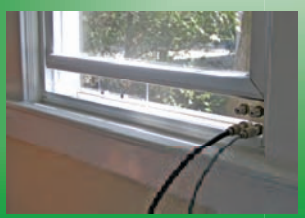

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Power Cables and Connectors for ICOM, Yaesu, Kenwood, Alinco, and others. Most HF, FM Mobile, and Handheld rigs. Red/Black Zip Cord in many sizes. Hard to find plugs and cables for older radios like the Kenwood TS-520/TS-820 and Yaesu FT-747/FT-757.

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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.

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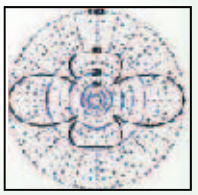
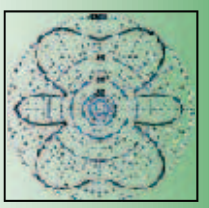
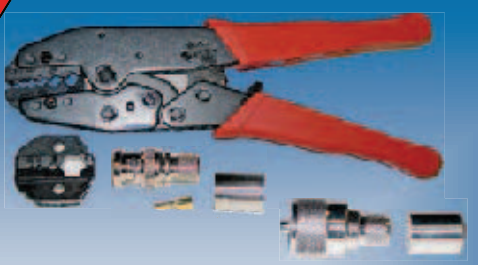


EZNEC Rocket 88™ Antenna plot at 35 feet over typical ground on 20 Meters. 10.43 dBi gain (4.98 dBi free space).



EZNEC G5RV Antenna plot at 35 feet over typical ground on 20 Meters. 7.33 dBi gain. That's more than 3 dB *below* the Rocket 88™!



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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***

Z-11Pro

The Z-11Pro, designed from the ground up for battery operation. Only 5" x 7.7" x 1.5", and weighing only 1.5 pounds, it handles 0.1 to 125 watts, making it ideal for both QRP and standard 100 watt transceivers from 160 - 6 meters. With an optional LDG balun, it will also match longwires or antennas fed with ladder-line. All cables included. ***Suggested Price $179***

NEW! Z-817

The ultimate autotuner for QRP radios including the Yaesu FT-817(D). 2000 memories cover 160 through 6 meters. The Z-817 will also function as a general purpose antenna tuner with other QRP radios. Powered by four AA internal Alkaline batteries (not included), no additional cables required. A coax jumper cable is also induced for fast hook up. ***Suggested Price $129.99***

AT-100Pro

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***

FT Meter NEW! FTL Meter NEW! M-7700

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

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! IT-100

Matched in size to the IC-7000 and IC-706, the IT-100 sports a front panel push-button for either manual or automatic tunes, and status LEDs so you'll know what's going on inside. You can control the IT-100 and its 2000 memories from either its own button or the Tune button on your IC-7000 or other Icom rigs. It's the perfect complement to your Icom radio that is AH3 or AH-4 compatible. ***Suggested Price $179.99***

NEW! KT-100

LDG's first dedicated autotuner for Kenwood Amateur transceivers. Easy to use - just right for an AT-300 compatible Kenwood transceiver. Has 2,000 memories for instant recall. If you have an AT-300 compatible Kenwood radio, you can simply plug the KT-100 into your transceiver with the provided cable; the interface powers the tuner, and the Tune button on the radio begins a tuning cycle. The supplied interface cable makes the KT-100 a dedicated tuner for most modern Kenwood transceivers. ***Suggested Price $199.99***

NEW! Z-100Plus

Small and simple to use, the Z-100Plus sports 2000 memories that store both frequency and tuning parameters. It will run on any voltage source from 7 to 18 volts; six AA batteries will run it for a year of normal use. Current draw while tuning is less than 100ma. The Z-100Plus now includes an internal frequency counter so the operating frequency is stored with tuning parameters to make memory tunes a blazingly fast 0.1 seconds; full tunes take an average of only 6 seconds. ***Suggested Price $159.99***

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***

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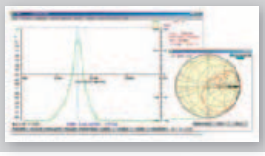
AIM 4170 Laboratory quality impedance analyzer for antennas and networks using our patent pending technology 5 kHz to 180 MHz.

NEW! **2 port VNA-2180** – vector network analyzer



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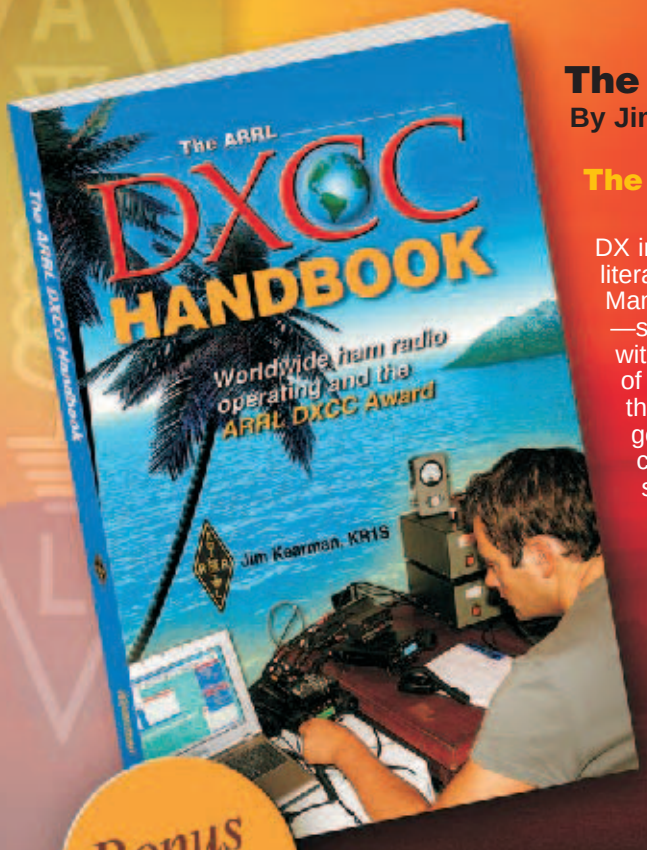

The ARRL DXCC Handbook

By Jim Kearman, KR1S

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DX in ham radio shorthand means distance, literally talking to people in distant lands. Many radio amateurs enjoy the lure of DXing—seeing how far away we can communicate with other Amateur Radio operators. It's a way of determining how well our stations—and we, the operators—perform. DXing is a full-time goal for some hams and a just-for-fun challenge for others. The pinnacle of DXing success is the ARRL DX Century Club, or DXCC award.

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VX-170 2M FM HT
- TX: 144-148 • RX: 136-174
- Power: 5/2/0.5W • Memories: 200

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-1802M 2M FM Mobile
- TX: 144-148 • RX: 136-174
- Power: 50/25/10/5W • Memories: 221

FT-897D 100W HF/VHF/UHF Portable
- 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

FT-7800R 2M/440 FM Mobile
- TX: 144-148, 430-450 MHz
- RX: 108-520, 700-999 MHz (cell blkd)
- Power: 50/20/10/5W (2M), 40/20/10/5W (440 MHz)
- Memories: 1055 • YSK-7800 included!

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

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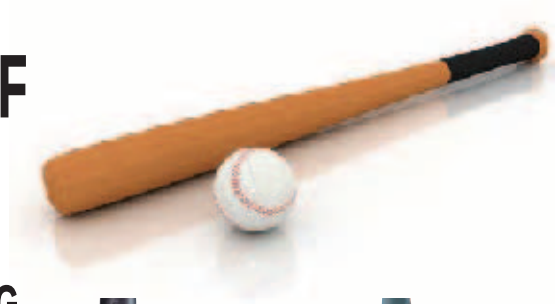

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TM-271A 2M FM Mobile
- TX: 144-148 MHz • RX: 136-174 MHz
- Power: 60/25W • Memories: 200

TM-V71A Dualband FM Mobile
- TX: 144-148, 430-450 MHz
- RX: 118-524, 800-1300 MHz (cell blkd)
- Power: 50/10/5W • Dual receive (V+V) (U+U)
- Cross-band repeat • EchoLink® ready

TM-D710A
Dualband FM Mobile w/TNC
- TX: 144-148, 430-450 MHz
- RX: 118-524, 800-1300 MHz (cell blkd)
- Power: 50/10/5W • Dual receive (V+V) (U+U)
- Built-in TNC for APRS (needs GPS)
- Cross-band repeat • AvMap G5 & EchoLink® ready

TH-K2AT

TH-F6A

TH-K2AT 2M FM HT
- TX: 144-148 • RX: 136-174
- Power: 5/1.5/0.5W • Memories: 100

TH-F6A Triband FM HT
- TX: 144-148, 222-225, 438-450 MHz
- RX: 0.1-1300 MHz (cell blkd) • Power: 5/0.5/0.05W
- Memories: 435 • Dual band RX

TS-480HX
200W HF/6M Mobile/Base
- TX: HF/6M • RX: 0.5-60 MHz
- Power: 10-200W (with two optional 22A PS's)
- Memories: 99 • IF/stage DSP on main band, AF/stage DSP on sub-band

TS-480SAT 100W with auto antenna tuner.

TS-2000 100W HF/VHF/UHF Base
- TX: HF/6M/2M/440 MHz • RX: 0.03-60, 142-152, 420-450 MHz • Power: 10-100W (10-50W on 440 MHz)
- Memories: 99 • HF/6M Auto Antenna Tuner
- IF/stage DSP on main band, AF/stage DSP on sub-band

TS-B2000 Same as the TS-2000 without front panel controls. Includes PC control software.

TS-2000X The TS-2000 with 1.2 GHz @ 10W.

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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 **889.95**
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..... **889.95**
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 **289.95**
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..... **289.95**
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..... **289.95**
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**
FNB72 Ni-Cd Battery Pack **59.95**
MH36E8J DTMF Mic..... **56.95**
YF122S 2.3 kHz SSB Filter..... **164.95**

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**

FT1900

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 mes-

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**
FBA25A AA Battery case **21.95**
MH57A4B Speaker Mic..... **27.95**
VC27 Earpiece Microphone **27.95**

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2m/70cm dual band antenna. 8.5" long

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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!

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MLS100 External Speaker **46.95**
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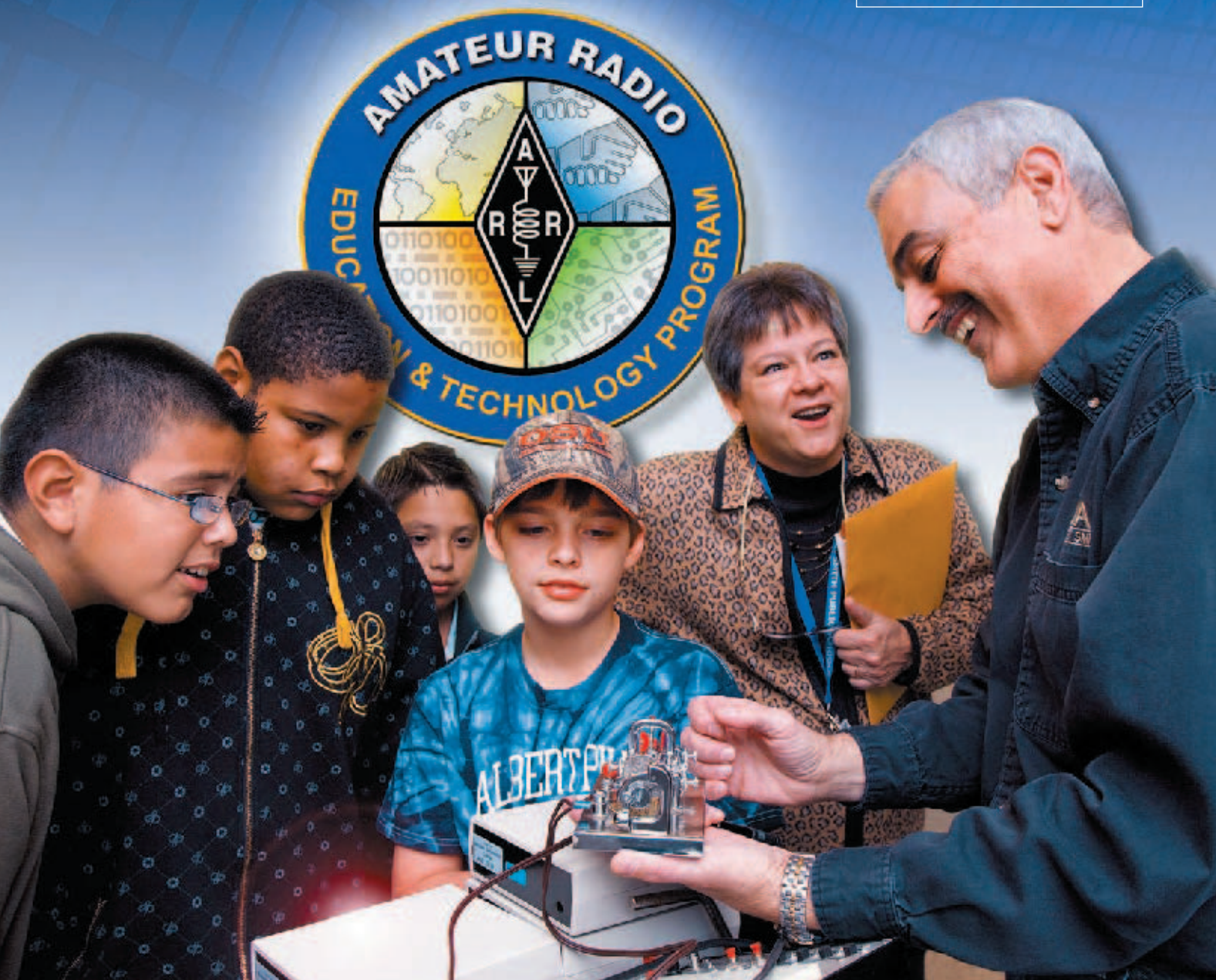

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FT-1900R
144-148 MHz


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FT-7900R
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(200 on HX)

TH-K2AT
2M HT, 5 Watts w/NOAA warning, VOX


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You can tune any *real* antenna 1.8-30 MHz. Custom 48 position switched inductor and 1000 Volt variable capacitors provide arc-free operation. Handles 300 Watts PEP SSB, (150 Watts on 1.8 MHz).

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VC-300M
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The VC-300M *Mobile* Antenna Tuner is compact, lightweight, easy-to-operate and is our most economical tuner.

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Backlit Cross-Needle meter simultaneously monitors Forward/Reflected power and SWR. Covers 1.8 to 30 MHz.

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SWR/Power Meters

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$89.95
PM-30UV
$99.95

PM-30, $89.95, for 1.8 to 60 MHz.
Displays forward/reflected power, SWR simultaneously on Cross-Needle meter. True shielded directional coupler assures accuracy. Backlit meter displays peak or average power in 300/3000 Watt ranges. First-rate construction, scratch-proof case, durable paint, Lexan front panel. Lamp switch. SO-239 connectors. 5.3x5.75x3.5 in.
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PM-30UV, $99.95, SO-239 connectors.
PM-30UVN, $99.95, N connectors.
PM-30UVB, $99.95, BNC connectors.

1.5 kW *dry* Dummy Load

DL-650M, $79.95
100 Watts continuous 1500 W/10 seconds to 650 MHz. *Ceramic* resistor. SWR less than 1.3. SO-239s. **DL-650MN, $84.95** has N connectors.

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Eliminates TVI by attenuating harmonics at the source. Plugs between transmitter and antenna or tuner. 1.5 kW.

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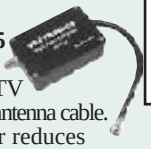

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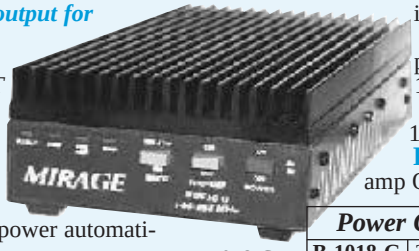
The MIRAGE B-5018-G gives you 160 Watts output for 50 Watts input on all modes -- FM, SSB, or CW!



Ideal for 25-50 Watt 2 Meter mobile or base. Weak signals pop out with its low noise *GaAsFET* preamp and its excellent 0.6 dB noise figure. Selectable 5, 8 or 14 dB preamp gain.

Exclusive MIRAGE *ActiveBias*™ circuit gives *crystal clear SSB* without splatter or distortion.

B-5018-G is legendary for its ruggedness and is fully protected -- high SWR or excessive input power automatically bypasses the B-5018-G to prevent damage.

Heavy-duty heatsink spans entire length of cabinet. Power transistors protected by MIRAGE's *Therm-O-Guard*™. Has adjustable delay *RF sense* Transmit/Receive switch *and* remote external keying. 16-20 Amps at 13.8 VDC.12x3x5½ in.

B-5018-G
$329

B-1018-G, $409. MIRAGE's most popular *dual purpose* HT/mobile/base amp. 160 Watts out/10W in. For 0.25-10W rigs.

B-2518-G, $329. Like B-5018-G but for 10-25 Watt mobile/base. 160W out/25W in.

RC-2, $49. Remote Control. On/Off, preamp On/Off, selects SSB/FM. 25 ft. cable.

Power Curve *-- typical output power in Watts*

B-1018-G	25	50	140	150	160	160	--	--	--	--
B-2518-G	5	7	40	60	80	100	125	160	160	160
B-5018-G	--	2	15	25	40	50	70	100	130	160
Watts In	.25	.5	3	5	8	10	15	25	35	50

FCC Type Accepted

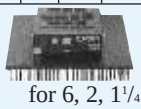
6 Meter Amplifier

A-1015-G, $389, *world's most popular* all mode FM/SSB/CW 6 Meter amplifier. 150 Watts out/10W in. For 1-15 W transceivers. 20 dB GaAsFET preamp.

300 Watts on 2-Meters, $739

3 models: 300 Watts out for 10, 25, or 50 Watts in. FM/SSB/CW. 15/20 dB gain, *GaAsFET* preamp.

Repeater Amps



11 models: *continuous* duty FM/SSB/CW *Repeater* Amps for 6, 2, 1¼ Meters, 70 cm, 450 MHz, ATV.

Commercial Amps, $159 to $429

Commercial Amps for 150-174, 450-470 MHz, VHF marine bands, 70-130 Watts out.

70 cm Amplifiers (420-450 MHz)

D-3010-N, $389 -- 100 W out/30W in. For 5-45 Watt *mobile/base*. **D-1010-N, $419**, 100W out/10W in. *Dual purpose* -- for handhelds or mobile/ base. **D-26-N, $299**, 60W out/2W in, for *handhelds*.

Low Noise GaAsFET preamps

High gain ultra low noise *GaAsFET* preamps for receiving weak signals. Selectable 15-22 dB gain prevents intermod. < 0.8 dB noise figure, auto RF switching to 160W.

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Accurate SWR/Wattmeters

Read SWR directly and Forward/ Reflected, Peak/Average power. Remote coupler. 1.8-30, 50-200, 420-450, 1260-1300 MHz band models.

Amateur TV Amps

Industry standard ATV amps: **D-1010-ATVN, $439**, 82 W PEP out/10W in. **D-100-ATVN, $449**, 82W PEP out/2W in. (without sync compression).

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10 models -- 20-220 Watts out for 2-50W in, $169-$739.

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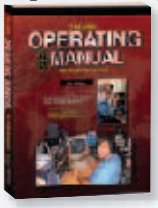

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MFJ-2990
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New!

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
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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.

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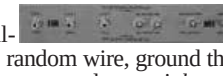

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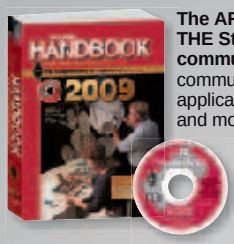

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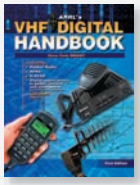

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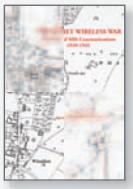

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MFJ All-Band G5RV Antennas

Operate all bands through 10 Meters, even 160 Meters, with a single wire antenna!

MFJ-1778
$44.95

The famous G5RV antenna is the most popular ham radio antenna in the world! You hear strong signals from G5RVs day and night, 24/7.

And it's no wonder . . . it's an efficient, *all band* antenna that's only 102 feet long -- shorter than an 80 Meter dipole. Has 32.5 foot ladder line matching section ending in SO-239 connector for your coax feedline.

Use as Inverted Vee or Sloper, and it's even more compact and needs just one support.

With an antenna tuner, you can operate all bands 80 Meters through 10 Meters and even 160 Meters with an antenna tuner and a ground.

MFJ's fully assembled G5RV handles 1500 Watts. *Hang and Play™* -- add coax, some rope to hang and you're on the air!

MFJ-1778M, $39.95. *Half-size*, 52 foot *G5RV JUNIOR* covers 40-10 Meters with tuner. Handles full 1500 Watts.

MFJ All Band Doublet

MFJ-1777
$59.95

MFJ-1777 is a 102 foot *all band* doublet antenna that covers 160 through 6 Meters with a balanced line tuner. Super strong custom fiberglass center insulator provides stress relief for ladder line (100 ft. included). Authentic *glazed ceramic* end insulators. Handles full 1500 Watts.

MFJ *Dual Band* 80/40 *or* 40/20M Dipoles

MFJ-17758
$89.95
80/40 Meters

MFJ-17758 is a short 85 foot long *dual band* 80/40 Meter dipole antenna. It's *full-size* on 40 Meters and has ultra-efficient end-loading on 80 Meters. Handles full 1500 Watts. Super-strong injection-molded center insulator with built-in SO-239 connector and hang hole. Solderless, crimped construction. 7-strand, #14 gauge hard copper wire. Connect your coax feedline directly, no tuner needed.

MFJ-17754, $59.95. Short coax fed 42 foot long *dual band* 40/20 Meter dipole antenna. *Full-size* on 20 Meters, ultra-efficient end-loading on 40 Meters. Same construction as MFJ-17758.

MFJ *Single Band* Dipole Antennas

Ultra high quality center fed dipoles will give you trouble-free operation for years. Custom injection-molded UV-resistant center insulator has built-in coax connector and hanging hole. Heavy duty 7-strand, 14-gauge hard copper antenna wire. Extremely strong solderless crimped construction. Authentic *glazed ceramic* end insulators. Use as horizontal or sloping dipole or inverted vee. Handles full 1500 Watts. Simply cut to length for your favorite frequency with cutting chart provided.

MFJ-1779A $69.95 160M, 265 ft.
MFJ-1779B $49.95 80-40M, 135 ft.
MFJ-1779C $29.95 20-6M, 35 ft.

True 1:1 Current *Balun & Center Insulator*

MFJ-918
$24.95

True *1:1 Current Balun/ Center Insulator* forces equal antenna currents in dipoles for superior performance. Reduces coax feedline radiation and field pattern distortion -- your signal goes where *you* want it. Reduces TVI, RFI and RF hot spots in your shack. *Don't build a dipole without one!* 50 hi-permeability ferrite beads on high quality RG-303 *Teflon*(R) coax and *Teflon*(R) coax connector. Handles full 1.5kW 1.8-30 MHz. Stainless steel hardware with *direct* 14 gauge stranded copper wire connection to antenna. 5x2 inches. Heavy duty weather housing.

RF Isolator

MFJ-915
$29.95

MFJ-915 *RF Isolator* prevents unwanted RF from traveling on the outside of your coax shield into your transceiver. This unwanted stray RF can cause painful RF "bites" when you touch your microphone or volume control, cause your display or settings to go crazy, lock up your transceiver or turn off your power supply. In mobile installations, stray RF could cause your car to do funny things even blow your car computer. Clear up these problems, plug an MFJ-915 between your antenna and transceiver. 5x2 in. Handles full 1500 Watts. Covers 1.8-30 MHz. **MFJ-919, $59.95.** 4:1 current balun,1.5 kW. **MFJ-913, $29.95.** 4:1 balun, 300 Watts.

Antenna Switches

MFJ-1704
$79.95
4-Positions

MFJ-1704 heavy duty *antenna switch* lets you select 4 antennas or ground them for static and lightning protection. Unused antennas automatically grounded. Replaceable lightning surge protection. Good to 500 MHz. 60 dB isolation at 30 MHz. 2.5 kW PEP. Less than .2 dB insertion loss, SWR below 1.2:1. SO-239 connectors. Handy mounting holes. 6¼Wx4¼Hx1¼D inches.

MFJ-1702C
$39.95
2-Positions

MFJ-1702C Like MFJ-1704, but for 2 antennas. 3Wx2Hx2D"

MFJ-1700C
$99.95

MFJ-1700C *Antenna/ Transceiver Switch* lets you select one of six antennas and one of six transceivers in any combination. Plug in an antenna tuner or SWR wattmeter and it's always in-line for any antenna/transceiver combination. Has lightning surge protection. Handles 2 kW PEP SSB, 1 kW CW, 50-75 Ohm loads. Unused terminals are automatically grounded. 1.8 to 30 MHz. SO-239 connectors. 4¾W6½Hx3D inches.

MFJ-1701
$69.95

MFJ-1701 *Antenna Switch* like MFJ-1700C but lets you select one of six antennas only. 10Wx3Hx1½D inches.

33 ft. Telescoping fiberglass Mast

3.8 feet collapsed, 3.3 lbs.

MFJ-1910
$79.95

Super strong fiberglass mast has huge 1¾ inch bottom section. Flexes to resist breaking. Resists UV. Put up *full size* inverted Vee dipole/vertical antenna in minutes and get *full size performance!*

Make your own antennas

Dipoles, G5RV, Random Wire, Doublets, Beverage Antennas, etc.

MFJ-16C06, $4.56. 6-pack authentic *glazed ceramic* end/center antenna insulators. **MFJ-16B01, $19.95.** Custom injection-molded UV-resistant center insulator has built-in coax connector and hanging hole. **MFJ-18G100, $24.95.** 100 ft. of flexible, 7-strand, 14-gauge solid copper antenna wire. **MFJ-58100X, $49.95.** 100 ft. 50-Ohm RG-8X with PL-259s on each end. **MFJ-18H100, $34.95.** 100 feet, 450 Ohm ladder line, 18 gauge copper covered steel.

Lightning Surge Protectors

Ultra-fast gas discharge tube shunts 5000 amps peak. Less than 0.1 dB loss. Up to 1000 MHz. SO-239s. **MFJ-270, $29.95.** 400W PEP. **MFJ-272, $39.95.** 1500W PEP.

Dealer/Catalog/Manuals

Visit: http://www.mfjenterprises.com or call toll-free 800-647-1800

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MFJ Weather-Proof *Window Feedthrough Panels*

Weather-proof window feedthrough panels bring coax, balanced lines, HF/VHF/UHF antennas, random wire antennas, ground, rotator/antenna switch cables and DC/AC power into your hamshack without drilling through walls!

MFJ Weather-Proof *Window Feedthrough Panels* mount in your window sill. Lets you bring all your antenna connections into your hamshack *without* drilling holes through walls.

Simply place in window sill and close window. One cut customizes it for any window up to 48 inches. Use horizontally or vertically. Connectors are mounted on inside/outside stainless steel plates and attached to a 4 foot long, 3½ inch high, ¾ inch thick *pressure-treated* wood panel. Has excellent insulating properties. Weather-sealed with a heavy coat of long-lasting white outdoor enamel paint. Edges sealed by weather-stripping. Seals and insulates against all weather conditions. Includes window locking rod.

Inside/outside stainless steel plates ground all coax shields. Stainless steel ground post brings ground in.

MFJ-4603 Universal Window Feedthru Panel

MFJ-4603
$89.95

Four 50 Ohm *Teflon*(R) SO-239 coax connectors lets you feed HF/VHF/UHF antennas at full legal power limit.

A 50 Ohm *Teflon*(R) coax *N-connector* lets you use any antenna up to 11 GHz, including 450 MHz, UHF, satellite, moon bounce and 2.4/5.8 GHz Wi-Fi antennas.

A 75 Ohm, 1 GHz *F-connector* makes it easy to bring in television, Satellite, HD, cable TV and FM radio signals.

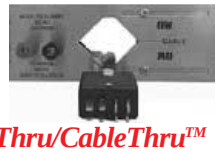
A pair of high-voltage *ceramic feedthru insulators* lets you bring in 450/300 Ohm balanced lines directly to your antenna tuner.

Has random/longwire antenna *ceramic feedthru insulator*.

***5-way** binding posts* lets you supply 50 Volts/15 Amps DC/AC power to your outside antenna tuners/relays/switches.

Stainless ground post brings in ground connection, bonds inside/outside stainless steel panels together and drains away static charges.

MFJ's exclusive *Adaptive Cable Feedthru*™ lets you bring in rotator/antenna switch cable, etc. without removing connectors (up to 1¼X1⅝ in). Adapts to virtually *any* cable size. Seals out rain, snow, adverse weather.



3 Coax, Balanced Line, Random Wire

Best Seller! 3 *Teflon*(R) coax connectors for HF/VHF/UHF antennas. Separate high voltage *ceramic* feed-thru insulators for balanced lines and longwire/random wire, Stainless steel ground post.

MFJ-4602
$69.95

6 Coax

6 high quality *Teflon*(R) coax connectors for HF/VHF/UHF antennas. Stainless steel ground post. Full 1500 Watt legal limit.

MFJ-4601
$59.95
New!

4 Balanced Line, 2 Coax

4 pairs of high-voltage *ceramic* feed-thru insulators for balanced lines and 2 coax connectors.

New!
MFJ-4600
$79.95

5 Cables, any-size

5 *Adaptive Cable Feedthrus*™. Pass any cable with connector: 2 cables with large connectors up to 1¼x1⅝ inches and 3 cables with UHF/N size coax connectors. Seals out weather.

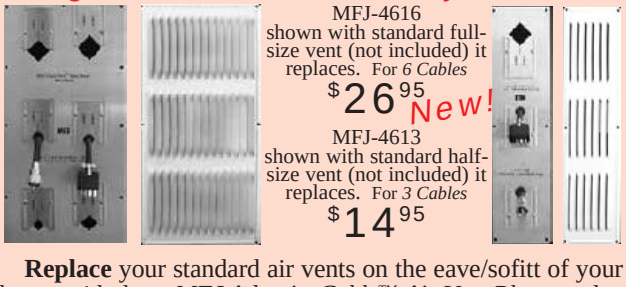
MFJ-4604
$99.95
New!

All-Purpose FeedThru/CableThru™

***Stacks** MFJ-4603 **and** MFJ-4604!* Gives you every possible cable connection you'll ever need through your window without drilling holes in wall -- including UHF, N and F coax connectors, balanced lines, random wire, ground, DC/AC power and cables of any size for rotators, antenna switches, etc.

MFJ-4605
$159.95
New!

Bring cables thru eave of your house



MFJ-4616
shown with standard full-size vent (not included) it replaces. For *6 Cables*
$26.95
New!

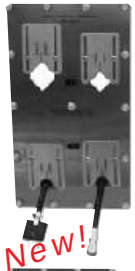
MFJ-4613
shown with standard half-size vent (not included) it replaces. For *3 Cables*
$14.95

Replace your standard air vents on the eave/sofitt of your house with these *MFJ AdaptiveCable*™ *Air Vent Plates* and…

Bring in coax, rotator, antenna switch, power cables, etc. *with connectors* up to 1¼x1⅝ inches!

Sliding plates and rubber grommets adjust for virtually any cable size to seal out adverse weather, insects and varmints. Use existing vent hole, mounting screws and screw holes.

AdaptiveCable™ *Wall Plates*



New!

MFJ-4614
For 4 Cables
$34.95

Bring nearly any cable -- rotator, antenna switch, coax, DC/ AC power, etc. -- through walls *without removing connectors* (up to 1¼x1⅝ inches). Sliding plates and rubber grommets adjust hole size to weather-seal virtually any size cable.

Includes *stainless steel* plates for each side of wall, sliding plates, rubber grommets, weather stripping and screws.

MFJ-4612
For 2 Cables
$24.95

MFJ-4611
For 1 Cable
$14.95

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1.8-170 MHz *plus* 415-470 MHz
MFJ HF/VHF/UHF Antenna Analyzer

All-in-one handheld antenna test lab lets you quickly check and tune HF, VHF, UHF antennas anywhere. Covers 1.8-170 MHz and 415-470 MHz

Measures: SWR…Return Loss…Reflection Coefficient…Antenna Resistance(R), Reactance(X), Impedance(Z) and Phase Angle(degrees) . . . Coax cable loss(dB) . . . Coax cable length . . . Distance to short or open in coax … Inductance . . . Capacitance . . . Resonant Frequency . . . Bandwidth . . . Q . . . Velocity Factor . . . Attenuation . . . Has: LCD readout . . . frequency counter . . . side-by-side meters . . . Ni-MH/Ni-Cad charger circuit . . . battery saver . . . low battery warning . . . smooth reduction drive tuning . . . One year No Matter What™ warranty . . .

You can instantly get a complete picture, check and tune any antenna from 1.8 to 170 MHz and 415 to 470 MHz -- an MFJ-269 exclusive -- with this rugged easy-to-use hand-held antenna test lab! You can measure virtually every antenna parameter.

You won't believe its capability and versatility. This rugged handheld unit literally replaces a workbench full of expensive delicate test equipment.

MFJ-269 $389.95

SWR Analyzer

You can read SWR, return loss, reflection coefficient and match efficiency at any frequency simultaneously at a single glance.

Complex Impedance Analyzer

Read Complex Impedance (1.8 to 170 MHz)as series equivalent resistance and reactance (Rs+jXs) or as magnitude (Z) and phase (degrees). Also reads parallel equivalent resistance and reactance (Rp+jXp) -- *an MFJ-269 exclusive!*

Coax Analyzer

You can determine velocity factor, coax loss in dB, length of coax and *distance to short or open in feet (it's like a built-in TDR).*

CoaxCalculator™ lets you calculate coax line length in feet given electrical degrees and vice versa for any frequency and any velocity factor -- *an MFJ-269 exclusive!*

Use any Characteristic Impedance

You can measure SWR and loss of coax with *any* characteristic impedance (1.8 to 170 MHz) from 10 to over 600 Ohms, including 50, 51, 52, 53, 73, 75, 93, 95, 300, 450 Ohms -- *an MFJ-269 exclusive!*

Inductance/Capacitance Meter

Measures inductance in uH and capacitance in pF at RF frequencies, 1.8-170 MHz.

Frequency Counter/Signal Source

You can also use it as a handy frequency counter up to 170 MHz and as a signal source for testing and alignment.

Digital and Analog displays

A high contrast LCD gives precision readings and two side-by-side analog meters make antenna adjustments smooth and easy.

415 to 470 MHz

Range features

Just plug in your UHF antenna coax, set frequency and read SWR, return loss and reflection coefficient simultaneously. You can read coax cable loss in dB and match efficiency.

You can adjust UHF dipoles, verticals, yagis, quads and others and determine their SWR, resonant frequency and bandwidth.

You can test and tune stubs and coax lines. You can manually determine velocity factor and impedances of transmission lines.

You can adjust/test RF matching networks and RF amplifiers without applying power.

Has easy-to-read LCD *logarithmic* SWR bargraph and SWR meter for quick tuning.

Much Better Accuracy

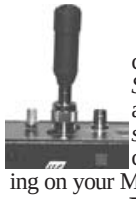
New 12-bit A/D converter gives much better accuracy and resolution than common 8-bit A/D converters -- *an MFJ-269 exclusive!*

Super Easy-to-Use

Select a band and mode. Set frequency. Your measurements are instantly displayed! Smooth reduction drive tuning makes setting

MFJ SWR Analyzer Accessories

MFJ-39C, $24.95.
Tote your MFJ-269 anywhere with this *genuine* MFJ custom carrying case. Has back pocket with security cover for carrying dip coils, adaptors and accessories. Made of special foam-filled fabric, the MFJ-39C cushions blows, deflects scrapes, and protects knobs, meters and displays from harm. Wear it around your waist, over your shoulder, or clip it onto the tower while you work -- the fully-adjustable webbed-fabric carrying strap has snap hooks on both ends. Has clear protective window for frequency display and cutouts for knobs and connectors.



MFJ-66, $24.95.
Plug these MFJ dip meter coupling coils into your MFJ *SWR Analyzer™* and turn it into a sensitive and accurate *band switched* dip meter. Set of two coils cover 1.8-170 MHz depending on your MFJ-269 *SWR Analyzer™*.

MFJ-99C, $40.90.
SWR** Analyzer Power Pack.* 10 Pack MFJ *SuperCell™* Ni-MH batteries, and power supply for SWR analyzers. ***Save $5!

MFJ-98, $60.85.
MFJ-269** Accessory Pack.* MFJ-39C *custom* Carrying Pouch, MFJ-66 dip coils, power supply for MFJ-269. ***Save $5!

MFJ-98B, $88.90.
MFJ-269** Deluxe Accessory Pack.* Complete accessory pack! MFJ-39C Pouch, 10 Ni-MH batteries, dip coils, power supply. ***Save $7!

MFJ-269*PRO™* Analyzer

MFJ-269*PRO* $419.95 ***NEW!***

Like MFJ-269, but has extended coverage in UHF range ***(430 to 520 MHz)*** and ruggedized cabinet that protects LCD display, knobs, meters and connectors from damage.

MFJ-259B HF/VHF Antenna *SWRAnalyzer™*

MFJ-259B $289.95

The world's most popular antenna analyzer gives you a complete picture of your antenna performance 1.8 to 170 MHz.

It's Super easy-to-use -- makes tuning your antenna quick and easy.

Read antenna SWR, complex impedance, return loss, reflection coefficient. Determine velocity factor, coax cable loss in dB, length of coax and distance to a short or open in feet. Read inductance in uH and capacitance in pF at RF frequencies.

Large easy-to-read two line LCD screen and side-by-side meters clearly display your information. Built-in frequency counter, Ni-Cad charger circuit, battery saver, low battery warning and smooth reduction drive tuning.

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http://www.mfjenterprises.com *for instruction manuals, catalog, info*

KENWOOD
Listen to the Future

TM-G707A

TM-V7A

TM-D700A

With the supplied accessories the RC-D710 is a full upgrade to the TM-V71A. The TM-V71A will have full functionality of the TM-D710A by exchanging the TM-V71A panel with the RC-D710.

This is where it gets interesting!

PG-5J connection kit makes the RC-D710 a complete standalone APRS/TNC for your current radio. This option allows connectivity with previous and current Kenwood models* as an external modem.

**Compatible models include: TM-D710A / TM-V71A / TM-D700A / TM-G707A / TM-V7A / TM-733A / TM-255A / TM-455A*
SmartBeaconing™ from HamHUD Nichetronix

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MFJ *IntelliTuner*™ Automatic Tuners

More hams use MFJ tuners than all other tuners in the world!

World's most advanced Automatic Antenna Tuners feature world renowned MFJ AdaptiveSearch™ and AutomaticRecall™ algorithms -- world's fastest ultra-wide range tuning. Nine World Class models! Choose your features: Digital/Analog/Audio SWR-Wattmeter, Antenna Switch, Balun, Radio Interface, Digital frequency readout, Remoteable, Coax/Balanced Lines/Wire Tuning, Field Upgradeable . . .

MFJ-993B 300 Watt *IntelliTuner*™

The World's Best Selling Automatic Antenna Tuner!

The MFJ-993B *IntelliTuner*™ lets you tune any antenna -- balanced or unbalanced -- *automatically* and *ultra fast*.

It's a comprehensive automatic *antenna tuning center* complete with SWR/Wattmeter, antenna switch for two antennas and 4:1 current balun for balanced lines.

MFJ's exclusive *IntelliTuner*™, *Adaptive Search*™ and *Instant Recall*™ algorithms give you *ultra fast* automatic tuning with over 20,000 *VirtualAntenna*™ Memories.

Select 300 Watt SSB/CW power level and match 6-1600 Ohm antennas ***Or . . .*** select **150 Watt** SSB/CW power level and match *extra wide-range* 6-3200 Ohms!

You get a highly efficient L-network, 1.8-30 MHz coverage, Cross-Needle *and* digital meters, audio SWR meter, *backlit* LCD, remote control port, radio interface, heavy-duty 16 amp/1000V relays.

MFJ-993B $259.95

The MFJ-993B automatically tunes for minimum SWR and remembers your frequency and tuner settings. The next time you operate on that frequency and antenna, these tuner settings are instantly restored and *you're ready to operate in milliseconds!* 10W x2¾ Hx9D". Use 12-15 VDC/1 amp or 110 VAC with **MFJ-1316, $21.95**. Radio interface cables, remote control available. See ***www.mfjenterprises.com***

for 600 Watt amps

AL-811/ALS-600/ALS-500

For 600 Watt amps like Ameritron AL-811/ALS-600/ALS-500M. Matches 12-800 Ohms. 10,000 *Virtual Antenna*™ memories. Cross-Needle SWR/Wattmeter. 10Wx2¾Hx9D inches.

MFJ-994B $359.95

No Matter What™ Warranty

Every MFJ tuner is protected by MFJ's famous one year *No Matter What*™ limited warranty. We will repair or replace your MFJ tuner (at our option) for a full year.

1500 Watt *Legal Limit*

for Ameritron AL-1500/1200/82 amps

Roam the entire HF spectrum 1.8-30 MHz *hands-free* with full *1500 Watt* legal limit on SSB/CW and near-perfect SWR! Lighted LCD/Cross-Needle Meter.

MFJ-998 $699.95

300 Watt...Extra Wide Range

SWR/Wattmeter, 10000 VA Memories

Extra *wide matching range at less cost.* Exclusive dual power level: 300 Watts/6-1600 Ohms; 150W/6-3200 Ohms. Cross-Needle SWR/Wattmeter.

MFJ-991B $219.95

200 Watt ...Compact

Digital Meter, Ant Switch, Wide Range

World's fastest compact auto tuner uses MFJ *Adaptive Search*™ and *InstantRecall*™ algorithms. 132,072 tuning solutions instantly match virtually any antenna with near perfect SWR.

MFJ-929 $219.95

200 Watt ...Econo

Small, Ant Switch, 20K VA Memories

High-speed, wide matching range and compactness at low cost! Leave in-line and forget it -- your antenna is *always* automatically tuned! 2-position antenna switch.

MFJ-928 $199.95

200 Watt *MightyMite*™

Matches IC-706, FT-857D, TS-50S

No *extra space needed!* Just set your IC-706/7000, FT-857D, TS-50S on top of this matching low-profile automatic tuner -- it's all you need for a completely automated station using *any* antenna! Just tune and talk!

MFJ-925 $179.95

G5RV Antenna

Covers all bands, 160-10 Meters with antenna tuner. 102 ft. long. Can use as inverted vee or sloper. Use on 160 Meters as Marconi.1500 Watts. Super-strong fiberglass center/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.

MFJ-1778 $44.95

200W...Weather-sealed

for Remote/Outdoor/Marine

Fully *weather-sealed for remote Outdoor/Marine use*! Tough, durable, built-to-last the elements for years.

MFJ-926 $399.95

200 Watt...Remote

Coax/Wire Ant, No pwr cable needed

Weather protected fully automatic *remote* auto tuner for wire ***and*** *coax* antennas -- an MFJ exclusive. Powers through coax -- No separate power cable needed.

MFJ-927 $259.95

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MFJ TUNERS

Ham Radio's *Most Popular* 300 Watt Antenna Tuner

More hams use MFJ-949s than any other antenna tuner in the world!

Why? Because the world's leading tuner has earned a world-wide reputation for being able to match just about anything.

Full 1.8-30 MHz Operation

Tune your antenna for minimum SWR! Works 1.8-30 MHz on dipoles, verticals, inverted vees, random wires, beams, mobile whips, shortwave receiving antennas . . . Use coax, random wire, balanced lines. Has heavy duty 4:1 balun for balanced lines.

Custom inductor switch

Custom designed inductor switch, 1000 volt tuning capacitors, *Teflon*(R) insulating washers and proper L/C ratio gives you *arc-free* no worries operation up to 300 Watts PEP transceiver input power.

MFJ-949E $179.95

The MFJ-949E inductor switch was *custom* designed to withstand the extremely high RF voltages and currents that are developed in your tuner.

8-Position Antenna switch

Antenna switch lets you select two coax fed antennas, random wire/balanced line or dummy load through your MFJ-949E or direct to your transceiver.

Lighted Cross-Needle Meter

Full *size* 3-inch lighted Cross-Needle Meter. Lets you easily read SWR, *peak* or average forward and reflected power simultaneously. Has 300 Watt or 30 Watt ranges.

QRM-Free PreTune™

MFJ's *QRM-Free PreTune™* lets you pre-tune your MFJ-949E *off-the-air* into its built-in dummy load! Makes tuning your actual antenna faster and easier.

Plus Much More!

Full *size* built-in non-inductive 50 Ohm dummy load, scratch-proof Lexan multi-colored front panel, $10^{5}/_{8}$x$3^{1}/_{2}$x7 inches. Superior cabinet construction and more!

MFJ-948, $159.95. Econo version MFJ-949E. Has all features except for dummy load.

***No Matter What™* Warranty**

Every MFJ tuner is protected by MFJ's famous one year *No Matter What™* limited warranty. We will repair or replace your MFJ tuner (at our option) for a full year.

More hams use MFJ tuners than all other tuners in the world!

MFJ-989D ***Legal Limit*** Tuner

MFJ-989D $389.95

New, improved MFJ-989D *legal limit* antenna tuner gives you better efficiency, lower losses and a new *true* peak reading meter. Easily handles *full* 1500 Watts SSB/CW, 1.8-30 MHz, including MARS/WARC bands. Six position antenna switch, dummy load. *New* 500 pF air variable capacitors. *New* improved *AirCore™* Roller Inductor. *New* high voltage current balun. *New* crank knob. $12^{7}/_{8}$Wx6Hx$11^{5}/_{8}$D".

MFJ-986 Two knob ***Differential-T™***

MFJ-986 $349.95

Two knob tuning (differential capacitor and *AirCore™* roller inductor) makes tuning foolproof and easier than ever. Gives minimum SWR at only one setting. Handles 3 KW PEP SSB amplifier input power (1.5 KW output). Gear-driven turns counter, lighted peak/average Cross-Needle SWR/Wattmeter, antenna switch, balun. 1.8 to 30 MHz. $10^{3}/_{4}$Wx$4^{1}/_{2}$Hx15 in.

MFJ-962D ***compact*** kW Tuner

MFJ-962D $299.95

A few more dollars steps you up to a KW tuner for an amp later. Handles 1.5 KW PEP SSB amplifier input power (800W output). Ideal for Ameritron's AL-811H! *AirCore™* roller inductor, gear-driven turns counter, pk/avg lighted Cross-Needle SWR/Wattmeter, antenna switch, balun, Lexan front, 1.8-30MHz. $10^{3}/_{4}$x$4^{1}/_{2}$x$10^{7}/_{8}$ in.

MFJ-969 300W ***Roller Inductor*** Tuner

MFJ-969 $219.95

Superb *AirCore™* Roller Inductor tuning. Covers *6 Meters* thru 160 Meters! 300 Watts PEP SSB. *Active* true peak reading lighted Cross-Needle SWR Wattmeter, *QRM-Free PreTune™*, antenna switch, dummy load, 4:1 balun, Lexan front panel. $10^{1}/_{2}$Wx$3^{1}/_{2}$Hx$9^{1}/_{2}$D inches.

MFJ-941E ***super value*** Tuner

MFJ-941E $139.95

The *most for your money!* Handles 300 Watts PEP, covers 1.8-30 MHz, *lighted* Cross-Needle SWR/Wattmeter, 8 position antenna switch, 4:1 balun, 1000 volt capacitors, Lexan front panel. Sleek $10^{1}/_{2}$Wx$2^{1}/_{2}$Hx7D in.

MFJ-945E HF/6M ***mobile*** Tuner

MFJ-945E $129.95

Extends your mobile antenna bandwidth so you don't have to stop, go outside and adjust your antenna. Tiny 8x2x6 in. *Lighted* Cross-Needle SWR/Wattmeter. Lamp and bypass switches. Covers 1.8-30 MHz *and* 6 Meters. 300 Watts PEP. **MFJ-20, $6.95,** mobile mount.

MFJ-971 ***portable/QRP*** Tuner

MFJ-971 $119.95

Tunes coax, balanced lines, random wire 1.8-30 MHz. Cross-Needle Meter. SWR, 30/300 or 6 Watt QRP ranges. Matches popular MFJ transceivers. Tiny 6x$6^{1}/_{2}$x$2^{1}/_{2}$ in.

MFJ-901B ***smallest*** Versa Tuner

MFJ-901B $99.95

MFJ's smallest (5x2x6 in.) and most affordable wide range 200 Watt PEP Versa tuner. Covers 1.8 to 30 MHz. Great for matching solid state rigs to linear amps.

MFJ-902 ***Tiny Travel*** Tuner

MFJ-902 $99.95

Tiny $4^{1}/_{2}$x$2^{1}/_{4}$x3 inches, full 150 Watts, 80-10 Meters, has tuner bypass switch, for coax/random wire.

MFJ-904H, $149.95. Same but adds Cross-needle SWR/Wattmeter and 4:1 balun for balanced lines. $7^{1}/_{4}$x$2^{1}/_{4}$x$2^{3}/_{4}$ inches.

MFJ-16010 ***random wire*** Tuner

MFJ-16010 $69.95

Operate all bands anywhere with MFJ's reversible L-network. Turns random wire into powerful transmitting antenna. 1.8-30 MHz. 200 Watts PEP. Tiny 2x3x4 in.

MFJ-906/903 ***6 Meter*** Tuners

MFJ-906 $99.95

MFJ-906 has lighted Cross-Needle SWR/Wattmeter, bypass switch. Handles 100 W FM, 200W SSB. **MFJ-903, $69.95**, Like MFJ-906, less SWR/Wattmeter, bypass switch.

MFJ-921/924 ***VHF/UHF*** Tuners

MFJ-921/924 $89.95

MFJ-921 covers 2 Meters/220 MHz. **MFJ-924** covers 440 MHz. SWR/Wattmeter. 8x$2^{1}/_{2}$x3 in.

MFJ-931 ***artificial*** RF Ground

MFJ-931 $109.95

Eliminates RF hot spots, RF feedback, TVI/RFI, weak signals caused by poor RF grounding. Creates artificial RF ground or electrically places far away RF ground directly at rig. **MFJ-934, $209.95**, Artificial ground/300 Watt Tuner/Cross-Needle SWR/Wattmeter.

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MFJ *Balanced Line* Antenna Tuner

Superb balance . . . Very wide matching range . . . Covers 1.8-54 MHz . . . Cross-Needle SWR Wattmeter . . . Handles 300 Watts . . . Compact size . . .

The MFJ-974HB is a* fully balanced true *balanced line antenna tuner. It gives you superb current balance.

Johnson Matchbox

For decades, the Johnson Matchbox has been the standard of comparison for balanced line antenna tuners. But, it had a severely limited matching range and covered only 80, 40, 20, 15 and 10 Meters.

***The** MFJ-974HB is its successor*. It meets today's needs and even surpasses the Johnson Matchbox outstanding performance.

Everything You Need

The MFJ-974HB gives you excellent current balance, very wide matching range(12-2000 Ohms) and covers 1.8 through 54 MHz *continuously* including all WARC bands, 160 Meters, 6 Meters and the new 60 Meter band. Handles 300 Watts SSB PEP and 150 Watts CW.

Tuning is fast and easy - - just three tuning controls. You can adjust for highly efficient broadband low-Q operation or use higher Q when you encounter extreme loads.

A large three-inch lighted Cross-Needle SWR/Wattmeter lets you read SWR, peak or average forward and reflected power *all at a glance* on 300/60 or 30/6 Watt ranges.

A ground post is provided to ground one output terminal so you can also tune random wires and coax fed antennas.

Compact 7½Wx6Hx8D in. fits anywhere.

Tunes any Balanced Line

The MFJ-974HB tunes any balanced lines including 600 Ohm open wire line, 450/300 Ohm ladder lines, 300/72 Ohm twin lead - - shielded or unshielded.

Superb current balance minimizes feedline radiation that can cause troublesome TVI /RFI, painful RF bites, mysterious RF feedback problems and radiation pattern distortion.

Excellent Balance, Excellent Design

The MFJ-974HB is a *fully balanced* wide range T-Network. *Four* 1000 Volt air variable capacitors are gear driven. A high-Q air wound tapped inductor is used for 80-10 Meters with separate inductors for 6 and 160 Meters. The tuning components are mounted symmetrically to insure electrical balance.

MFJ-974HB
$209.95

A 1:1 *current* balun is placed on the low impedance 50 Ohm input side to convert the balanced T-Net-work to un-balanced operation. An efficient balun is made of 50 ferrite beads on RG-303 *Teflon*™ coax to give very high isolation. It stays cool even at max power.

Balanced Line = Extremely Low Loss

Balanced lines give extremely low loss.

Doublet, horizontal loop, vertical loop, quad, double extended Zepp, Lazy H, W8JK antennas all give efficient multi-band operation when fed with balanced lines.

6-80 Meter Balanced Line Tuner

MFJ-974B
$189.95

MFJ-974B, $189.95. Same as MFJ-974H but for 6-80 Meter operation (no 160 Meters).

160-6 Meters All Band Doublet Antenna

MFJ-1777, $59.95. 102 feet doublet antenna covers 160-6 Meters with balanced line tuner. Super strong custom fiberglass center insulator provides stress relief for 450 Ohm ladder line (100 feet included). Authentic *glazed ceramic* end insulators. Handles 1500 Watts.

MFJ 1500 Watt *Fully Balanced* Antenna Tuner

Fully balanced MFJ-976 handles 1500 Watts legal limit . . . Extra-wide 12-2000 Ohms matching range . . . continuous 1.8 to 30 MHz coverage including all WARC bands . . . Four separate 500 pF in two gangs gives you a total of 2000 pF capacitance . . . Heavy duty 1:1 current balun . . . more!

MFJ-976
$499.95

The MFJ-976 is a 1500 Watt Legal Limit *fully balanced* antenna tuner.

You get *superb* current balance, very wide matching range (12-2000 Ohms) and *continuous* 1.8-30 MHz coverage including all WARC bands. Handles *full* 1500 Watts SSB *and* CW.

You can tune *any* balanced lines including 600 Ohm open wire line, 450/ 300 Ohm ladder lines, 300/72 Ohm twin lead -- shielded or unshielded. Also tunes random wires and coax fed antennas.

MFJ's *fully balanced* extremely wide-range T-network gives you simple, fast three knob tuning. No complicated switching between high and low impedance and switching in additional capacitance of L-networks.

Four separate 500 pF in two gangs gives you a total of 2000 pF for highly efficient low loss operation on 160 Meters.

You get superb 10 Meter performance due to MFJ's low minimum capacitance and exclusive *Self-Resonance Killer*™ high-Q *AirCore*™ roller inductor with silver plated contacts.

Heavy duty 1:1 current balun gives you *superb balance* and stays cool even at 1.5kW.

True *active* peak reading lighted Cross-Needle SWR/Wattmeter lets you read SWR, *true peak* or average forward and reflected power all at a glance on 300/ 3000 Watt ranges. 12Wx6Hx15¾D inches.

Ladder line, Twin lead, Insulators, Copper wire . . .

Super-strong fiberglass 450 Ohm ladder line insulators

MFJ-16D01, $8.95. *Center* insulator. Double weave ladder line stress-relief. Strong wire tie points. Hang hole.

MFJ-16E01, $9.95. Feedpoint *End* Insulator. Double weave ladder line stress relief. Built-in SO-239 connector.

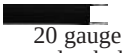
MFJ-16F01, $8.95. *Middle* insulator. High-strength coax connection at mid-point with SO-239, quadruple weave-through ladder line stress relief.

MFJ-16C06, $4.56. Authentic *glazed ceramic* Insulator, 6-pack.

450 Ohm Ladder Line

Extremely low loss, open-frame construction. Heavy duty black polyethylene. Solid 18 gauge wire. MFJ-18H050, **50 Ft.**, $19.95. MFJ-18H100, **100 Ft.**, $34.95. MFJ-18H250, **250 Ft.**, $89.95.

300 Ohm Twin-Lead



20 gauge stranded copper wire. Black polyethylene. MFJ-18T050, **50 Ft.**, $24.95. MFJ-18T100, **100 Ft.**, $44.95. MFJ-18T250, **250 Ft.**, $99.95.

Copper Antenna Wire

Flexible, 7-strand, 14 gauge, hard solid-copper wire. Strong/long-lasting. MFJ-18G100, **100 Ft.**, $24.95. MFJ-18G250, **250 Ft.**, $59.95.

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Huntsville Hamfest and ARRL Alabama Section Convention

August 15-16, 2009
At the Von Braun Center in Huntsville, Alabama

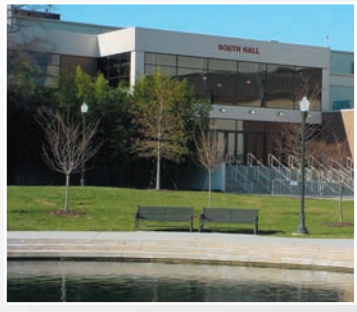
Program Highlights

- **Huntsville Hamfest** – Featuring huge new dealer show, manufacturers, giant flea market, and more!
- **International DX, contest, technical, and public service forums.**
- **DX Banquet** (sponsored by the North Alabama DX Club) featuring Tim Pearson, K5AC, speaking on the K5D Desecheo Island DXpedition.
- **DXCC Card Checking**
- **ARRL Program Representatives**
- **Youth Activities**
- **2009 YHOTY** (Young Ham of the Year) Award Presentation.

Hotels

Holiday Inn
Group/Convention code: HAMFEST.
Reservation: **1-877-465-4329** or **1-256-553-1400.**
www.holidayinn.com/huntsvilleal

Embassy Suites Hotels
Group/Convention code: HAM.
Reservations: **1-800-362-2779** or **1-256-529-7573** or
visit www.embassysuiteshuntsville.com



Nearby Points of Interest

- ✓ U.S. Space & Rocket Center and U.S. Space Camp
- ✓ NASA Marshall Space Flight Center Tour
- ✓ Bridge Street Centre – Upscale Shopping Mall
- ✓ Huntsville Botanical Garden
- ✓ Huntsville Museum of Art
- ✓ Cathedral Caverns State Park
- ✓ Historic Huntsville Depot Museum and Alabama's Constitution Village

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MFJ *Switching* Power Supplies

Power your HF transceiver, 2 meter/440 MHz mobile/base and accessories with these highly reliable 15, 22, 30, 40 or 75 Amp MFJ Switching Power Supplies!

No RF hash . . . Super lightweight . . . Super small . . . Volt/Amp Meters . . .

MFJ's adjustable voltage switching power supplies do it all! Power your HF or 2M/440 MHz radio and accessories.

MFJ's *MightyLites*™ are so light and small you can carry them with one hand! Take them with you anywhere.

No more picking up and hauling around heavy, bulky supplies that can give you a painful backache, pulled muscle or hernia.

These babies are clean . . . Your buddies won't hear *any* RF hash on your signal! *None* in your receiver either! These super clean *MightyLites*™ meet all FCC Class B regulations.

Less than 35 mV peak-to-peak ripple under 25 or 45 amp full load. Load regulation is better than 1.5% under full load.

You won't burn up our power supplies!

MFJ Power supplies are *fully protected* with Over Voltage, Over-temperature and Over Current protection circuits.

MFJ *MightyLites*™ can be used anywhere in the world! They have switchable AC input voltage and work from 85 to 135 VAC or 170 to 260 VAC. Replaceable fuse.

A whisper quiet internal fan efficiently cools your power supply for long life.

22 Amp Continuous

MFJ-4125

$109.95

Ham Radio's smallest and lightest 22 Amp continuous power supply is also its best selling!

22 Amps continuous/25 Amps max at 13.8VDC. 5-way binding posts on front, 5A quick connects on back. 85-135/170-260 VAC input. 2.9 lbs. 5¾Wx3Hx5¾D".

MFJ-4125P, $124.95. Adds 2-pairs *Anderson PowerPoles*™.

22 Amp Continuous

MFJ-4225MV

$149.95

22 Amps continuous, 25 Amps maximum. Like MFJ-4125 but adds Volt/Amp meters, cigarette lighter plug. Adjustable 9-15 VDC Output. 5¼Wx 4½Hx6D in. Weighs 3.7 lbs. Use 85-135 VAC or 170-260 VAC input. Replaceable fuse.

40 Amp Continuous

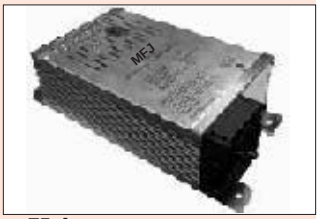
***MightyLite*™**

MFJ-4245MV

$199.95

40 Amps continuous, 45 Amps max. Adjustable 9-15 VDC output. Volt/Amp meters, cigarette lighter plug, front 5-way binding posts, two rear quick connects. 5.5 lbs. 7½Wx 4¾Hx9D inches. Use 85-135 VAC or 170-260 VAC input. Replaceable fuse.

75 Amp Continuous



MFJ-4175

$359.95

75 Amps continuous. Adjustable 13.8-14.2 VDC output. Reverse polarity, over-current/temperature, brown-out input protection, 7.8 lbs. 6½Wx3½Hx10D in. 108-132 VAC. Great for Ameritron's ALS-500M mobile amplifier!

High Current Multiple DC Power Outlets

Power multiple Transceivers/accessories from a* single *DC power supply . . . Keeps you neat, organized and safe . . .Prevents fire hazard . . . Keeps wires from tangling up and shorting . . . Fused and RF bypassed . . . 6 foot, 8 gauge color coded cable . . .

Versatile 5-Way Binding Posts

MFJ-1118

$84.95

MFJ-1118, $84.95. Power two HF and/or VHF rigs and six accessories from your main 12 VDC supply. *Built-in 0-25 VDC voltmeter*. Two pairs 35 amp 5-way binding posts, fused and RF bypassed for transceivers. Six pairs RF bypassed binding posts provide 15 Amps for accessories. Master fuse, ON/OFF switch,"ON" LED. 12½x2¾x2½ in.

MFJ-1116

$59.95

MFJ-1116, $59.95. 8 pairs binding posts, 15A total.Voltmeter, on/off switch.

MFJ-1112

$44.95

MFJ-1112, $44.95. 6 pairs binding posts, 15 Amps total.

MFJ-1117

$64.95

MFJ-1117, $64.95. Powers *four* transceivers simultaneously (two at 35 Amps each and two at 35 Amps combined). 8x2x3 inches.

MFJ-1128

$104.95

***All PowerPoles*™**

MFJ-1128, $104.95. 3 high-current outlets for transceivers. 9 *switched* outlets for accessories. Mix & match included fuses as needed (one-40A, one-25A, four-10A, four-5A, three-1A fuses installed). 0-25 VDC *Voltmeter*. *Extra* contacts, fuses. 12Wx1¼Hx2¾D".

MFJ-1126

$84.95

MFJ-1126, $84.95. 8 outlets, each fused, 40 Amps total. Factory installed fuses: two 1A, three 5A, two 10A, one 25A, one 40A. *0-25 VDC Voltmeter*. Includes *extra PowerPoles®, extra* fuses -- *no extra cost*. 9Wx1¼Hx2¾ inches.

MFJ-1129

$114.95

***PowerPoles*™ *AND* 5-Way Binding Posts**

MFJ-1129, $114.95. 10 outlets each fused, 40 Amp total. 3 high-current outlets for rigs -- 2 *PowerPoles®* and one 5-way binding post. 7 *switched* outlets for accessories (20A max) -- 5 *PowerPoles®* and 2 binding posts. Fuses include (1- 40A, 2-25A, 3-10A, 3-5A, 2-1A installed). *0-25 VDC Voltmeter*. Includes extra *PowerPoles®* and fuses, 12½Wx1¼Hx2¾D inches.

MFJ-1124

$64.95

MFJ-1124, $64.95. 6 outlets each fused, 40 Amps total. 4 *PowerPoles®*, 2 high-current binding posts, Installed fuses: 1-40A, 2-25A, 2-10A, 1-5A, 1-1A. Includes extra *PowerPoles®* & fuses -- *no extra cost.*

15 Amp Continuous

15 Amps continuous, 17 Amps max at 13.8 VDC. Over-voltage, over-current protection. 5-way binding posts. Load fault indicator and automatic shutdown. 90-130 VAC input. 1½ lbs. Tiny 3¾Wx2¼Hx3¾D inches fits easily in an overnight bag.

MFJ-4115

$79.95

30 Amps Continuous

Linear with 19.2 lb.Transformer

This heavy-duty linearly regulated MFJ-4035MV has *abolutely no RF Hash*. It delivers 30 Amps continuous, 35 Amps maximum from its massive 19.2 lb. transformer. Front panel adjustable 1-14 VDC output with convenient detent at 13.8 VDC. Volt/Amp Meters. 1% load regulation, 30 mV ripple. Over-voltage/current/temperature protection, 5-way binding posts, 2 pairs of quick-connects and a covered cigarette lighter socket for mobile accessories. Front panel replaceable fuse. 110 VAC input. 9½Wx6Hx9¾D in.

No RF Hash!

MFJ-4035MV

$149.95

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2009 ARRL Photo Contest: IMPRESSIVE!

This year set a record, as we received almost 60 entries in the ARRL Photo Contest. Our thanks to all who took part. The submitted photos may be used in *QST*, in the *ARRL Amateur Radio Calendar* or in other ARRL publications.

Hearty congratulations to the overall winner, as selected by the *QST* editorial and production staff — Jerry Clement, VE6AB, of Calgary, Alberta. He writes: "I shot this photo from one of my favorite locations for working DX. It shows the downtown area of Calgary, shot through the windshield of my truck. If you look closely at the display of my navigator, you can see my truck in the lower center. What can I say, I love working HF mobile."

The large photo on this month's cover, shot by Victoria Panagiotou, SV2KBS/LA7VPA, was the first runner-up. Not surprisingly, her striking photo was taken at LA3T in Norway, not in Greece!

— Joel P. Kleinman, N1BKE, Managing Editor, QST

Cityscape

Jerry Clement, VE6AB, found it a challenge to get the right exposure. "To add to the challenge," he explains, "rain is coming down, visible just below the wipers."
JERRY CLEMENT, VE6AB

Cool Monochrome

"This picture," writes the photographer, Sandy Martin, "was taken in December 2008 on our property in Chiloquin, Oregon. This antenna was built and is owned and operated by Dave Martin, WA6TYJ."
SANDY MARTIN

Double Rainbow

Chris Huber, N6ICW, of Sacramento, California, points out that the second rainbow is faintly visible at the upper left of the photo.
CINDY HUBER, W6MEZ

Forest Fire

The Cubex 3 element, 5 band quad at KI7MO in Winthrop, Washington, with a disturbing backdrop: Smoke from the 2006 Tripod Fire that devastated forest land in northeastern Washington.
RICHARD HAMEL, KI7MO

California Sunset

Chris Tate, N6WM, sent in this entry. "I took this photo during the final installation steps at the K6LRG contest station of a Force 12 Tri-band Yagi antenna (the station's first one) along with a 5L Cushcraft 6 meter antenna. Jon Schwartz, K6EWN, is the engineer on the tower." K6LRG is the station of the Livermore Amateur Radio Group.
CHRIS TATE, N6WM

Ham Ads

Please contact the **Advertising Department** at **860-594-0231** or **hamads@arrl.org** for further information or to submit your ad.

1. Advertising must pertain to products and services which are related to Amateur Radio.

2. The Ham-Ad rate for commercial firms offering products or services for sale is $2.00 per word. Individuals selling or buying personal equipment: ARRL member .65¢ per word. Non-ARRL member $1.00 per word. **Bolding** is available for $2.25 a word. Prices subject to change without notice. You may pay by check payable to the ARRL and sent to: Ham-Ads, ARRL, 225 Main St., Newington, CT 06111. Or, you may pay by credit card sending the information by fax to 860-594-4285 or via e-mail to hamads@arrl.org. The credit card information we need is: the type of credit card, the exact name that appears on the credit card, the credit card number, the expiration date and the credit card billing address.

3. Remittance in full must accompany copy since Ham-Ads are not carried on our books. Each word, abbreviation, model number and group of numbers counts as one word. Entire telephone numbers count as one word. No charge for postal Zip code. No cash or contract discounts or agency commission will be allowed. Tear sheets or proofs of Ham-Ads cannot be supplied. Ads submitted in writing should be typed or printed clearly on an 8 1/2" X 11" sheet of paper.

4. Closing date for Ham-Ads is the 15th of the second month preceding publication date. No cancellations or changes will be accepted after this closing date. Example: Ads received June16th through July15th will appear in September *QST*. If the 15th falls on a weekend or holiday, the Ham-Ad deadline is the previous working day. Please contact the Advertising Department at 860-594-0255 or hamads@arrl.org for further information or to submit your ad.

5. No Ham-Ad may use more than 100 words. No advertiser may use more than two ads in one issue. A last name or call must appear in each ad. Mention of lotteries, prize drawings, games of chance etc is not permitted in *QST* advertising.

6. New firms or individuals offering products or services for sale must check with us to determine if a production sample (which will be returned) should be submitted for examination. Dealers are exempted, unless the product is unknown to us. Check with us if you are in doubt. You must stand by and support all claims and specifications mentioned in your advertising.

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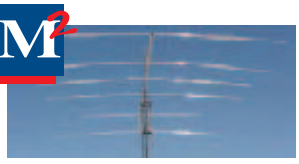

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