
QST
Official Journal of ARRL The national association for AMATEUR RADIO
Devoted entirely to
Amateur Radio
www.arrl.org
December 2007
QST reviews:
Yaesu FT-450
HF and 6 Meter Transceiver
M³ Electronix FPM-1
Frequency Counter/Power Meter Kit
Inside:
Hybrid Cascode IF Amplifier
Marconi Crossed the Pond in 1901...Or Did He?
4-Band Portable Antenna
Clean Up Your HF Digital Signal
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Ham it up with the best this holiday season!

IC-7800

The ultimate amateur radio.

- HF / 6M
- 5 - 200 W output power*
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- Four 32-bit floating point DSP units and 24-bit AD/DA converters
- 3 roofing filters
- 2 identical, independent receivers
- 7 inch wide color TFT display
- Real time spectrum scope
- Dual, digital twin passband tuning
- High speed auto antenna tuner
- Digital IF filter
- 110 dB dynamic range
- +40 dBm 3rd order intercept point
- AGC loop management using DSP
- 50 CTCSS tone encode/decode
- Digital voice recorder
- CF memory card slot

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IC-R9500 Icom's Ultimate Wide Band Receiver

We've raised the bar with our super performance, multiple function wide band "measuring" receiver. The IC-R9500 has normal and wide spectrum scope functions. With five roofing filters before the first amp, two independent 32 bit floating point DSP processors, and 7-inch wide color TFT LCD, this is something to get excited about!

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Optional DSP
1000 Memory Channels
PCR Upgradeable

IC-R2500

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1000 Memory Channels
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P25 (Option UT-122)

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Weather Alert

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Triple Conversion
Twin Passband Tuning
Digital Signal Processing (DSP)

For the love of DC to Daylight.

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

hy-gain® ROTATORS

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

HAM-IV

HAM-IV
$559.95

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

T-2X
$699.95

T-2XD
$1079.95
with DCU-1

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.

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
$389.95

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
$999.95
with DCU-1

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

AR-40

AR-40
$289.95

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
$1379.95

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.**

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.

Digital Automatic Controller

DCU-1
$699.95

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
$79.95

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

RBD-5
$34.95

NEW! Automatic Rotator Brake Delay

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

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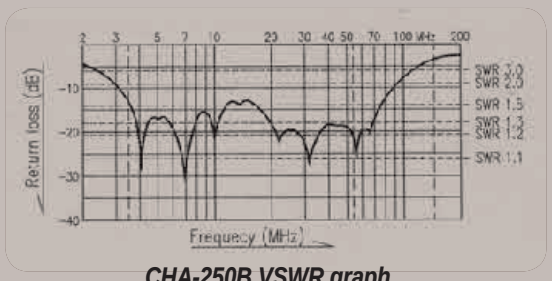
Life is a JOURNEY, Enjoy the ride!

COMET and Maldol

Base Antennas



CHA-250B VSWR graph

"One person can effortlessly raise the antenna at night when no one can spot it, and take it down before daybreak. This antenna is also a great choice for portable operations, such as quick and easy mini-DXpedition to a campground or a nice tropical island! In short, the Comet CHA-250B is simple to assemble, painless to elevate and is easy on the eyes, while at the same time getting you on 6 meters thru 80 meters without the requirement of an antenna tuner and ground radials. You'll even be able to work some DX while you're at it!" – Dan Dankert N6PEQ

COMET NEW CHA-250B BROADBAND HF/6M GROUND-PLANE ANTENNA
A newly designed broadband vertical with NO GROUND RADIALS. EXTREMELY easy to assemble, requires no tuning or adjustments and VSWRis under 1.5:1 from 3.5-57MHz! • TX: 3.5MHz – 57MHz • RX: 2.0 – 90MHz • VSWR is 1.5:1 or less, continuous • Max Power: 250W SSB/125W FM• Impedance: 50 Ohm • Length: 23' 5" • Weight: 7 lbs. 1 oz. • Conn: SO-239 • Mast Reqd: 1" – 2" dia. • Max wind speed: 67MPH

COMET GP-15 TRI-BAND 52/146/446MHZ BASE REPEATER ANTENNA
Wavelength: 52MHz 5/8 wave • 146MHz 5/8 wave x 2 • 446MHz 5/8 wave x 4 • Max Pwr: 150W • Length: 7'11" • Weight: 3lbs. 1oz. • Conn: Gold-plated SO-239• 2MHz band-width after tuning (6M) • Construction: Single-piece fiberglass

COMET CX-333 TRI-BAND 146/220/446MHZ BASE REPEATER ANTENNA
Wavelength: 146MHz 5/8 wave x 2 • 220MHz 5/8 wave x 3• 446MHz 5/8 wave x 5 • Max Pwr: 120W • Length: 10'2" • Weight: 3lbs. 1oz.• Conn: Gold-plated SO-239 • Construction: Fiberglass, 2 Sections

COMET GP-3 DUAL-BAND 146/446MHZ BASE REPEATER ANTENNA
Wavelength: 146MHz 6/8 wave • 446MHz 5/8 wave x 3 • Max Pwr: 200W • Length: 5'11" • Weight: 2lbs. 9ozs. • Conn: Gold-plated SO-239 • Construction: Single-piece fiberglass

COMET GP-6 DUAL-BAND 146/446MHZ BASE REPEATER ANTENNA
Wavelength: 146MHz 5/8 wave x 2 • 446MHz 5/8 wave x 5 • Max Pwr: 200W • Length: 10'2" • Weight: 3lbs. 8ozs. • Conn: Gold-plated SO-239 • Construction: Fiberglass, 2 Sections

Maldol HVU-8 ULTRA-COMPACT 8 BAND HF/VHF/UHF VERTICAL ANTENNA
80/40/20/15/10/6/2M/70cm Only 1/2 the traditional size and weight of vertical HF antennas, and it includes 2M/70cm! Unique radial system rotates for balcony installations, the radials can all be rotated to one side. • Wavelength: HF and 6M: 1/4 wave • 2M: 1/2 wave • 70cm: Two 5/8waves in phase • Impedance: 50 Ohm • Max Power: HF 200W SSB • 6M–70cm: 150W FM• Conn: SO-239 • Height: Only 8'6" • Weight: 5lbs. 7ozs.

COMET GP-9 / GP-9N DUAL-BAND 146/446MHZ BASE REPEATER ANTENNA
BEST SELLER!• Wavelength: 146MHz 5/8 wave x 3 • 446MHz 5/8 wave x 8 • Max Pwr: 200W• Length: 16' 9"" • Weight: 5lbs. 11ozs. • Conn: GP-9 Gold-plated SO-239 • GP-9N Gold-plated N-type female • Construction: Fiberglass, 3 Sections

COMET NEW H-422 QUAD-BAND HF DIPOLE Compact 40/20/15/10M "V" or Horizontal Dipole • Max power: 1kW SSB • Length "V" Dipole: 24' 3" • Horizontal Dipole: 33' 10" • Shipping length: 79" • Weight: 11 lbs 14 ozs • Wind Load: 3.02 sq feet • Required mast size: 1.5" - 2.5" diameter • CBL-2000 2kW Balun included • Simple installation, band tuning and profile change

COMET and Maldol Antennas

For a complete catalog, call or visit your local dealer.
Or contact NCG Company. 15036 Sierra Bonita Lane, Chino, CA 91710
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This Month in QST

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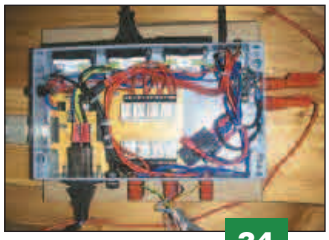
Technical



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News and Features

US & Possessions: Membership in the ARRL, including a one year subscription to *QST*, is available to individuals at $39. Age 65 and over, with proof of age, $36. 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.* Age 65 and over, $900.* 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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QST Workbench

Operating

OUR COVER
This tranquil scene was captured during the 2005 R1MVC/R1MVW operation from Malyj Vysotskij, an island in the Gulf of Finland (IOTA EU-117). May your holidays be seasoned with delightful DX (or whichever radio activities you pursue). Photo courtesy Vlad Gumennikov, UA2FF.

Departments

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Fax: **860-594-0259**

Imagine the Future of the Mobile Radio ...
It's Now All Yours ! ... YAESU FTM-10SR

2 m/70 cm Band
FM Dual Band Transceiver
(2 m 10 W/ 70 cm 7 W)
FTM-10SR

IP57 Submersible 3 feet for 30 min Body/Front panel

Great New Features to Support Outdoor Motor Sports Activities
Mobile Transceiver... Great Appearance ...Easy to Operate

2 m/70 cm Band
FM Dual Band Transceiver
(2 m 50 W/ 70 cm 40 W)
FTM-10R

IP57 Submersible 3 feet for 30 min Front panel

2 m Band

50 W 2 m Ultra Rugged
VHF FM Mobile
FT-1802M

2 m Band

65 W 2 m Rugged FM Mobile
FT-2800M

50 W 10 m/6 m/2 m/70 cm*
Quad Band FM Mobile
FT-8900R
*70 cm 35 W

50 W 2 m/70 cm*
Dual Band FM Mobile
FT-8800R
*70 cm 35 W

50 W 2 m/70 cm*
Dual Band FM Mobile
FT-7800R
*70 cm 35 W

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NEW COMPACT HF TRANSCEIVER WITH IF DSP

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

HF/50 MHz 100 W All Mode Transceiver

FT-450 Automatic Antenna Tuner ATU-450 optional

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

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

■ Large informative Front Panel Display, convenient Control knobs and Switches

■ The IF DSP guarantees quiet and enjoyable highperformance HF/50 MHz operation

Handy Front Panel Control of Important Features including:

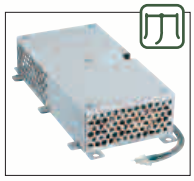
- **CONTOUR Control Operation**
  The Contour filtering system provides a gentle shaping of the filter passband.
- **Manual NOTCH**
  Highly-effective system that can remove an interfering beat tone/signal.
- **Digital Noise Reduction (DNR)**
  Dramatically reduces random noise found on the HF and 50 MHz bands.
- **IF WIDTH**
  The DSP IF WIDTH tuning system provides selectable IF passband width to fight QRM.
  SSB - 1.8/2.4/3.0 kHz , CW - 0.5/1.8/2.4 kHz
- **Digital Microphone Equalizer**
  Custom set your rig to match your voice characteristics for maximum power and punch on the band.
- **Fast IF SHIFT Control**
  Vary the IF SHIFT higher or lower for effective interference reduction / elimination.

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

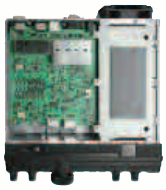
MOS FET RD100HHF1

The rugged aluminum die-cast chassis with cooling fan

■ Operate anywhere using optional internal or external antenna tuning systems



Internal Automatic Antenna Tuner ATU-450
Covering 160 m to 6 m Amateur Bands Dipole or Yagi antennas
(The ATU-450 Antenna Tuner is included in the FT-450AT)



External Automatic Antenna Tuner FC-40
Covering 160 m to 6 m Amateur Bands (with 65+ ft end fed wire)

Active Tuning Antenna System ATAS-120A
Covering 40 m to 6 m Amateur Bands
(For mobile)

More features to support your HF operation

●10 kHz Roofing filter ●20 dB ATT / IPO ●Built-in TCXO for incredible ±1 ppm/hour (@+77 °F, after warmup) stability ●CAT System (D-sub 9 pin): Computer programming and Cloning capability ●Large, Easy-to-See digital S meter with peak hold function ●Speech Processor ●QUICK SPLIT to automatically Offset transmit frequency (+5 kHz default) ●TXW to monitor the transmit frequency when split frequency operation is engaged ●Clarifier ●Built-In Electronic Keyer ●CW Beacon (Up to 118 characters using the CW message keyer's 3 memory banks) ●CW Pitch Adjustment (between 400 to 800 Hz, in 100 Hz steps) ●CW Spotting (Zero-Beating) ●CW Training Feature ●CW Keying using the Up/Down keys on the optional microphone ●Two Voice Memories (SSB/AM/FM), store up to 10 seconds each ●20 seconds Digital Voice Recorder ●Dedicated Data Jack for FSK-RTTY operation ●Versatile Memory System, up to 500 memory channels that may be separated into as many as 13 Memory Groups ●CTCSS Operation (FM) ●My Band / My Mode functions, to recall your favorite operating set-ups ●Lock Function ●Adjustable Main Tuning Dial Torque ●C.S. Switch to recall a favorite Menu Selection directly ●Hand Microphone included ●IMPORTANT FEATURE FOR THE VISUAL IMPAIRED OPERATORS - Digital Voice Announcement of the Frequency, Mode or S-meter reading

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The radio... YAESU
Choice of the World's top DX'ers

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

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

DMU-2000
Data Management Unit

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

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

Options

SP-2000
External Speaker
with Audio filters

RF μ-Tune Kits

160m Band RF μ-Tune Kits A	80/40m Band RF μ-Tune Kits B	30/20m Band RF μ-Tune Kits C
		

- Up to three μ-Tune Kits may be connected.
- μ-Tune Kit is included in purchase price of μ-Tune Unit.

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Public Service

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"It Seems to Us"

Absolute Zero

"Sunspot-wise, we seem to be stuck in a trough between Solar Cycles 23 and 24. Lately the W1AW propagation bulletins have been reporting zero sunspots, day after day. The level of solar activity was low throughout 2006 and 2007 and is not expected to begin to pick up until around March 2008 — months later than earlier predictions."

Many ARRL members are new to HF this year. If you are among them you may be a bit disappointed that the reality you have experienced has not met your expectations. We boast that radio amateurs can communicate anywhere in the world, but it's not an easy game for beginners when Old Sol refuses to lend a helping hand.

The good news is that for ionospheric surfers, things can only get better. While we speak of the "11-year cycle," sunspot numbers go up faster than they come down. Starting next fall, conditions should improve steadily until late 2011 or 2012.

If you're a hardcore DXer with a good antenna farm you've found plenty to hold your interest during the solar minimum. "Top Band" — 160 meters — has come into its own as a DX band, though it's mainly a CW game. Phone DXers spend the hours of darkness on 75 meters, although the 40-meter situation has improved a lot since amateurs in many other countries have been able to move into the 7100-7200 kHz segment. The problem is, competitive antennas for these bands aren't easy to engineer into a typical backyard. The competition eases a bit on 30 meters, but by definition this is CW/digital territory.

It's not that DX isn't possible without sunspots. It just isn't as much fun if you have a marginal antenna, especially if your operating time is limited to evenings and weekends. The workhorse band, year in and year out, regardless of sunspots, is 20 meters. At the solar minimum it's a daytime band; at the maximum it's mainly a nighttime band. And while the 17-meter regulars will hate me for revealing their secret, even now their favorite band offers a great respite when 20 is a bit too busy for comfort.

Among casual DXers the favorite band by far is 10 meters. The band provides enough elbow room that it's possible to enjoy long, interference-free chats with stations in other countries. An amplifier is rarely a necessity, especially if you can manage a Yagi or quad on a modest tower. Sure, the guys with amplifiers and stacked Yagis on tall towers will get through first — but when 10 is wide open, everyone gets a chance.

The problem, of course, is that it takes quite a few sunspots to push the maximum usable frequency (MUF) up to 28 MHz — sunspots that we don't have right now. But they will come, and the higher bands — 15, 12 and 10 meters — will begin to get interesting long before the peak. Solar cycles are measured by what are called "smoothed" sunspot numbers, which obscure the day-to-day variations that make DXing such a fascinating pastime. Every day is different, and potentially better — much better — than the one before.

Will we get enough of a peak to make 6 meters a DX band again? The experts are divided. One group predicts a peak in October 2011 exceeding the level that brought exciting, sustained DX opportunities in late 2001 and early 2002. Another group predicts a much lower peak in August 2012. It doesn't pay to get too excited about such predictions; the Sun has been in business for billions of years, yet the data on which predictions are based only cover the most recent 400 years.

So, what's a frustrated DXer to do until the Sun develops a decent pox?

First, put up the best antennas you can. If you can't manage that at home, head for the wide open spaces and operate portable. There's simply no substitute for a good antenna. Good doesn't have to mean expensive; a piece of "educated wire" can work wonders. If the new, 21st edition of *The ARRL Antenna Book* doesn't give you enough inspiration, there are more than two dozen other antenna books in the ARRL catalog.

Second, if you've limited yourself to SSB get equipped for RTTY and other digital modes. Develop CW operating skills — there's a reason why the major DXpeditions make most of their QSOs on CW.

Third, try to get on the air at different times of day. If you can't break through the pileups in the evening, try getting on early in the morning. Conditions change very quickly at dawn; with good timing and a bit of luck you can get the contact in the log before the "big gun" across town is out of bed.

If none of these ideas appeals to you, just be patient. The ARRL has a "Five-Year Plan" to restore the sunspots, and so far it's right on track!

David Sumner, K1ZZ
ARRL Chief Executive Officer

PS: On this page in October we attributed the first amateur SSB transmission to W6YX in 1947. Several members stepped forward to point out that a group of West Coast amateurs was experimenting with SSB more than a decade earlier. The W6YX/WØTQK work was very important and ultimately led to the popularization of SSB, but it wasn't actually a "first." Our apologies for perpetuating an error.

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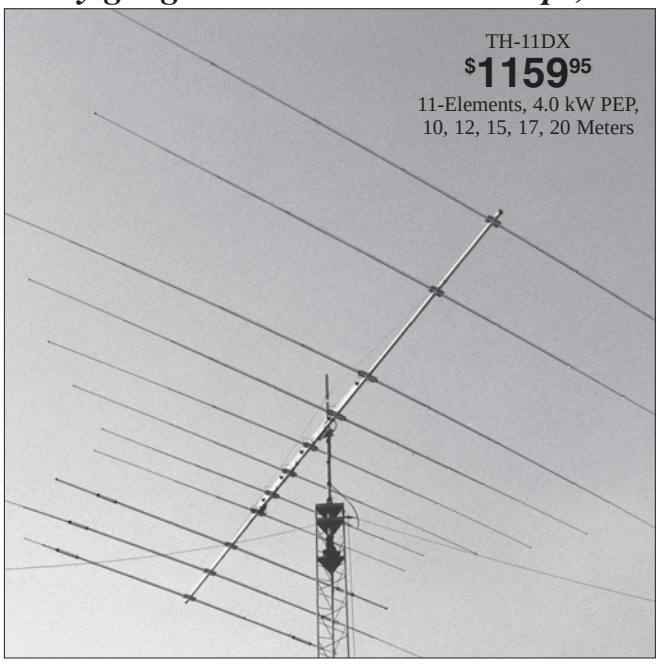

TH-11DX, $1159.95. 11-element, 4.0 kW PEP, 10,12,15,17,20M

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The broadband *five element* TH5-MK2 gives you outstanding gain.

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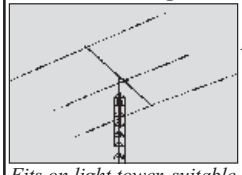

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Model No.	No. of elements	avg gain dBd	avg F/B dB	MaxPwr watts PEP	Bands Covered	Wind sq.ft. area	Wind (mph) Survival	boom feet	Longest Elem. (ft)	Turning radius(ft)	Weight (lbs.)	Mast dia O.D.(in.)	Recom. Rotator	Sugg. Retail
TH-11DX	11	*For Gain and F/B ratio--See...* • www.hy-gain.com • Hy-Gain catalog • Call toll-free 800-973-6572		4000	10,12,15,17,20	12.5	100	24	37	22	88	1.9-2.5	T2X	$1159.95
TH-7DX	7			**1500**	**10, 15, 20**	**9.4**	**100**	**24**	**31**	**20**	**75**	**1.5-2.5**	**HAM-IV**	**$869.95**
TH-5MK2	5			1500	10, 15, 20	7.4	100	19	31.5	18.42	57	1.5-2.5	HAM-IV	$759.95
TH-3MK4	**3**			**1500**	**10, 15, 20**	**4.6**	**95**	**14**	**27.42**	**15.33**	**35**	**1.9-2.5**	**CD-45II**	**$469.95**
TH-3JRS	3			600	10, 15, 20	3.35	80	12	27.25	14.75	21	1.25-2.0	CD-45II	$359.95
TH-2MK3	**2**			**1500**	**10, 15, 20**	**3.25**	**80**	**6**	**27.3**	**14.25**	**20**	**1.9-2.5**	**CD-45II**	**$369.95**
EXP-14	4			1500	10,15,20 opt. 30/40	7.5	100	14	31.5	17.25	45	1.9-2.5	HAM IV	$599.95

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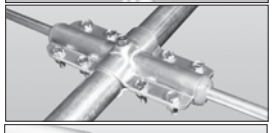
2. *Tooled* *Boom-to-Element Clamp*



3. Thick-wall *swaged* aluminum tubing

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This Just In

Joel P. Kleinman, N1BKE
jkleinman@arrl.org

In Brief

- The Second Annual ARRL On-Line Auction, 9 days of bidding and (sometimes) winning, went live October 24.
- Supercell thunderstorms hit 7 states on October 18, producing more than 30 tornadoes.
- The Marine Corps Marathon has named the Amateur Radio Service its Volunteer Group of the Year in light of the 30 years of service and support hams have provided for the annual event.
- The 2007 World Radiocommunication Conference (WRC-07) of the International Telecommunication Union (ITU) began October 22 and will run through November 16 in Geneva, Switzerland.
- ITU Secretary General Dr Hamadoun Touré is now HB9EHT.
- Long-time ham and ARRL member David Lien, W6OVP, of Battle Ground, Washington, has transferred the Web address **www.QST.org** to the ARRL.
- Registration remained open through November 4 for these online courses beginning November 16: Amateur Radio Emergency Communications Level 2 (EC-002); Amateur Radio Emergency Communications Level 3 (EC-003R2); Antenna Modeling (EC-004); HF Digital Communications (EC-005); VHF/UHF — Life Beyond the Repeater (EC-008), and Radio Frequency Propagation (EC-011).
- ARRL DXCC Manager Bill Moore, NC1L, reports that the 2007 3V8SS DXpedition to Tunisia has been approved for DXCC credit.
- The ARRL and TAPR held their 26th Annual Digital Communications Conference September 28-30 in Hartford, Connecticut.
- Nominations are open for the 2007 ARRL International Humanitarian Award. For more information, see the Public Service column, page 65 of this issue.
- The ARRL Executive Committee met October 6 in Little Rock, Arkansas.
- The winner of the *QST* Cover Plaque Award for September is James Michener, K9JM, for his article "Maximum Gain Portable HF Yagi."
- AMSAT hosted a Special Event Station October 3 commemorating the 50th anniversary of the launch of *Sputnik I*.
- ARRL President Joel Harrison, W5ZN, appointed Greg Widin, KØGW, of Stillwater, Minnesota, as Dakota Division Vice Director effective October 1.
- Sean Kutzko, KX9X, has joined the ARRL HQ staff as Contest Branch Manager.
- October operating events included Jamboree on the Air, the Simulated Emergency Test, the School Club Roundup and the ARRL EME Contest. Coming up in November are November Sweepstakes (CW and Phone), another round of the EME Contest and the 160 Meter Contest.

S. KHRYSTYNE KEANE, K1SFA

Hands-on: **A student at the recent US Telecommunications Training Institute course at ARRL HQ works on his first Amateur Radio project. There's more on the event in this month's "Happenings" column.**

Media Hits

Allen Pitts, W1AGP

With apologies to Clint Eastwood, we present "The Good and the Just Plain Dumb" recent media hits. With the Christmas Season upon us, we can use a little ho-ho-ho and forget "the Bad.

- The Good came in large quantities with everything from an article about Morse code on the front page of *The Wall Street Journal* (New York) on October 8 to The Kim Komando Show's exhortation "Be a ham: communicate via radio instead of cell," on October 6. While *WSJ* wrote of historic technologies, Kim wrote instead about how modern Amateur Radio is needed in a crisis. Just such a crisis happened in early October when a contractor cut a major fiber optic cable in Vashon, WA. The entire island community lost communications. Everything from banks to the Internet to phones including 911 calls were disabled. This was no drill and ARES was activated to cover emergencies while repairs were made. The entire story was published in the Vashon-Maury Island *Beachcomber* on October 10. Well done out there!
- Another area of the country doing well is the upper midwest with the *Macomb Daily* (Mt Clemens, MI) and the *Detroit Free Press* reporting on an ARISS school contact while the *Chicago Daily Southtown* and the *Chicago Tribune* reported on Amateur Radio classes in the region. Topping it all was *The Daily Telegram* (Superior, WI) article about our own Tom Abernethy, W3TOM, and the RV Radio Network on September 17.
- There were several articles about Amateur Radio Awareness Day (September 15), such as the full page, color story in the *Cape Coral Daily-Breeze* (Cape Coral, FL) featuring Don Clifford, K8JZK, and Frank DeVito, W4OZ. But there were many more articles about the 50th anniversary of *Sputnik* and the role of Amateur Radio operators in listening to the birth cries of the space race.
- Hams do indeed listen to many things, not just satellites, as was shown in the *Florida Today* article on October 10. While the article was primarily about the region's hamfest and its continuing Amateur Radio activity, a couple of Florida crooks should have been paying attention. (Here it comes…) They might have learned something at the hamfest. But then again, maybe not. The *Jupiter Courier* of West Palm Beach, FL and other media were delighted to publish their September 24 story of three burglars who thought they were already very smart. They had excellent communications as they plotted their thefts. After all — they were using these really neat walkie-talkie things. The three, who win my personal "dumb crook of the month award," were plotting their heist over Amateur Radio handhelds and were being heard by everyone listening in to the local repeater! Their last transmission was, "Code Red! There are cops everywhere, dude!" — Ho ho ho!

VO1ARES: Special Event at a Special Place

Daniel A. Lamoureux, VE2KA

A demonstration of cooperation in emergency communications preparedness between Canadian and US radio amateurs was held September 29-30, with the installation of a special event station at historic Signal Hill, St John's, Newfoundland. Foreign Affairs and International Trade Canada (DFAIT) through their Atlanta, Georgia office and Radio Amateurs of Canada (RAC) cosponsored the event. Facilities were provided by Parks Canada, and coordinated by the Society of Newfoundland Radio Amateurs (SONRA).

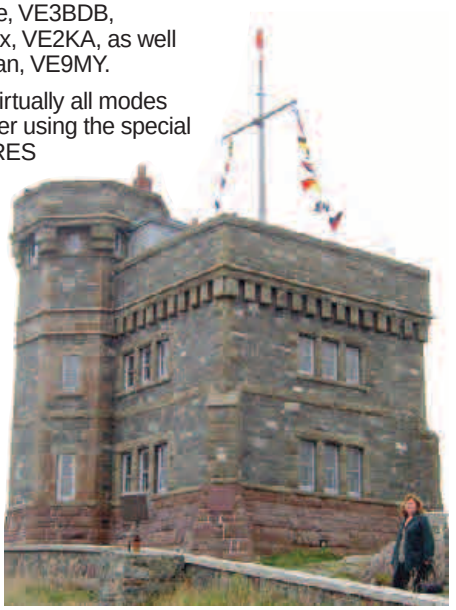
DANIEL LAMOUREUX, VE2KA

Presidential event: **RAC President Earle W. Smith, VE6NM (seated), with ARRL President Joel Harrison, W5ZN, at the VO1ARES special event station at Signal Hill, St John's, Newfoundland.**

The site was the Marconi Memorial Station on Signal Hill where reception of the first transatlantic wireless transmission occurred in 1901. ARRL President Joel Harrison, W5ZN, attended the event, as did members of the RAC Board, including President Earle Smith, VE6NM, Vice Presidents Bob Cooke, VE3BDB, and Daniel Lamoureux, VE2KA, as well as Director Len Morgan, VE9MY.

Operations featured virtually all modes on most HF bands over using the special event call sign VO1ARES authorized by Industry Canada. More than 400 QSOs were made and all will be acknowledged by a special QSL card.

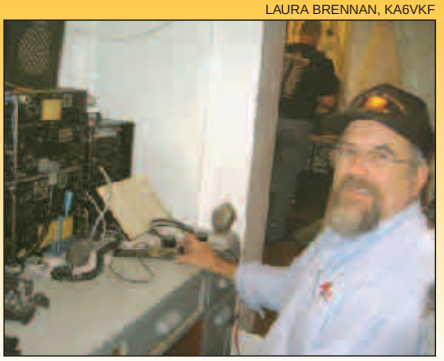
Special thanks to all who helped make a success of this memorable event, especially to Christine Papas and Steve Flamm, WB4GCF, both from the Canadian Department of Foreign Affairs and International Trade.



DANIEL LAMOUREUX, VE2KA

Cabot Tower, site of the special event station, was used as a wireless station until 1960.

LAURA BRENNAN, KA6VKF



Shipboard SpEv: **Jim Falls, KG6FWT, brought along his collection of early radio gear for a special event operation aboard *LCI(L)-1091* (Landing Craft Infantry-Large), moored in Eureka, California. Members of the Humboldt ARC operated KA6PGN from the ship, which saw military action during WWII and the Korean War, October 13-14.**

Inside HQ

Here are some of the new things that are happening inside HQ:

ARRL Publicity Material Now Online

We have made it easier for you to order our ARRL publicity kits and public relations materials since they are now online at **www.arrl.org/brochures/**. These updated materials are a terrific way to promote Amateur Radio at malls, Field Day, presentations, scouting activities and other local events. We have even bundled items together for typical events. These bundled kits include a Scouting Kit, an ARES Kit and a general purpose Exhibit Kit. You can nicely display the fliers and brochures with the included reusable, clear plastic display holders. It sure beats using a rock to hold the papers on the table! There is also an area on the reverse on the brochures where clubs can provide their own contact information. We offer these publicity materials at no charge, although there is a small fee for shipping and handling.

Improved Web Pages for Membership and Renewal

We have just finished updating our Membership Web Pages to make them easier to understand, simpler to use, more secure and able to process your membership application or renewal more quickly. You can check them out at **https://www.arrl.org/forms/membership/**. These changes are just the beginning of a larger effort that we will be starting on during the next year to improve our members' experience with our Web site. Stay tuned for other Web site upgrades and enhancements to **www.arrl.org**.

New Staffers

Some accomplished new staffers have recently joined us here at HQ. In a newly created position, Dennis Dura, K2DCD, has become our Emergency Response and Preparedness Manager. He will create the ARRL's organizational disaster response and continuity plans and implement the recommendations of the National Emergency Response Planning Committee (NERPC). Dennis has more than 26 years of experience in the emergency management field including the American Red Cross, and The New Jersey State Police, Office of Emergency Management. Before joining us, he was the Deputy State Emergency Coordinator for the New Jersey Department of Human Services.

Our new Contest Manager is Sean Kutzko, KX9X. Sean replaces long time staffer Tom Hogerty, KC1J. Sean was first licensed in 1982 as KA9NGH, and he has been active in both HF and VHF contesting. A former Contributing Editor to *The National Contest Journal*, he has won several contest and DX awards, including several Top Ten finishes in the ARRL Sweepstakes SSB contest as a QRP entrant. He has been on two HF contest DXpeditions and he also enjoys activating rare grid squares for the VHF/UHF community. Sean will be initially focusing on improving contest scoring accuracy and processing time. As a strong advocate of mentoring new contesters, Sean will actively engage the contesting community to recruit and tutor newcomers.

We welcome Dennis and Sean to our team and we look forward to them making a positive contribution to the ARRL and to Amateur Radio.

73,

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

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

"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.

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Replace **5** coax with 1! 1.2 SWR at 250 MHz. Useable to 450 MHz. < .1 dB loss, 1kW@ 150MHz.

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Up Front in QST

Another Fabulous Field Day!

The bugs, the food, the camaraderie, the fun…All who took part know the sum of the Field Day experience is far more than its individual parts. If you'd like to see how your group fared, see the article beginning on page 80.

VE3VIG

Field Day satellite operation, complete with launcher: **The Ottawa (ON) Valley Mobile RC operation, VE3RAM, had an added component this year — attempting satellite communications. As usual, we set up on the grounds of the Canada Science and Technology Museum using our Emergency Preparedness Communications trailer and incremented with home-built satellite antennas and a launcher on standby.**
— Maurice-André Vigneault, VE3VIG

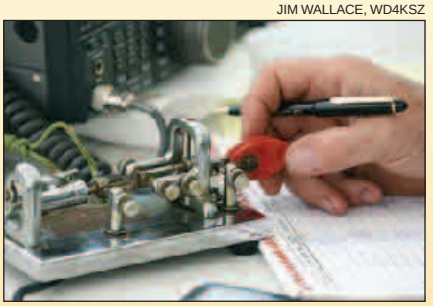
CHARLIE CHAPMAN, KB8SFR

Field Day with political leaders: **Members of the Van Buren County (Michigan) ARES/RACES and Black River ARC pose for posterity during FD weekend. Their guests (the well-dressed ones) included US Congressman Fred Upton (R-6th District) and State Representative Tonya Schuitmaker (R-80th District). Representative Upton is the ranking member of the House Subcommittee on Telecommunications and the Internet.**

PAUL M. WALSH

Teresa Dall, KAØCDO, and John Cavanaugh, KCØAFE, raise a 60 foot tower at the Arrowhead Radio Amateurs Club site just south of Duluth, Minnesota.

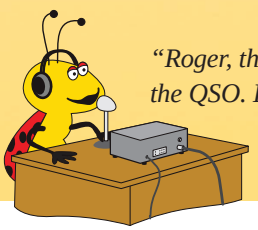
JIM WALLACE, WD4KSZ



CW at this year's Durham (NC) FM Association Field Day.

COURTESY W5GT

The three grandchildren of Dave Routzon, W5GT, each made a contact at the North Richland Hills (TX) ARC FD site. From the left are David, 10; Bekah, 12, and Carlie, 8.



"Roger, that. 73 and thanks for the QSO. KA1BUG QRZed."

Troop Member Demos Her Favorite Pastime

Our Yuma, Arizona Venture Scout troop is lucky enough to have several Amateur Radio operators as members. One, Katelyn Weddle, K7SHF, recently gave an hour-long presentation on Amateur Radio to the troop. Steven Hooper, K7ACS, assisted with a demo of the Automatic Position Reporting System (APRS). A lively question-and-answer session followed. — *Dan Weddle, N7HV*

KATHY WEDDLE, W7HG

Katelyn Weddle, K7SHF, prepares to tell her Venture Scout Troop about ham radio, as Steven Hooper, K7ACS (right), waits his turn.

AD1B

QST **author Tom Hart, AD1B, reports that he has set up a new organization, The Dignified Retirement of Vacuum Tubes Society. Its goal is fulfilled nicely by this 833A.**

H. T. (TOM) ADKINS, WB3EME

Does the FCC know? **This is a sign on Rte 194 heading out of Hanover, Pennsylvania.**

N7BDZ

Last year, I got ambitious and made a gingerbread house for a Christmas decoration...and decided it wouldn't be complete without a tower and beam! — ***Elaine Jones, N7BDZ***

WØVHV

My QTH, Warsaw, Missouri, is a small resort town located on the Lake of the Ozarks in south central Missouri. I frequently use a golf cart to run errands around town. I recently outfitted it with a Kenwood TS-450 transceiver with tuner, Hamstik 20 meter antenna and a metal counterpoise up top. Works well. — ***John Salley, WØVHV***

REDUCE OR ELIMINATE NOISE AND INTERFERENCE

DSP NOISE REDUCTION

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The CLRspkr is an amplified loudspeaker with DSP noise reduction that provides extremely effective noise reduction for both Voice and CW using the latest ClearSpeech® adaptive noise reduction. It is ideal for mobile radio operation with enough acoustic output to overcome ambient noise in the loudest vehicles. The CLRspkr clearly passes voice and CW while attenuating noise, such as hum, hiss, whistles and static. It effectively removes heterodynes, ignition noise, lightning crashes, power line noise, and hum. A CLRspkr makes mobile voice operation fun without all that background noise. Supplied with Powerpole 12 VDC connector, swivel mounting bracket and West Mountain Radio quality.

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A CLRdsp is the same ClearSpeech® adaptive noise reduction amplifier as inside our CLRspkr, provided in a stand alone box. The CLRdsp may be used with any un-amplified radio speaker or amplified computer speakers. Built in a heavy power coat painted aluminum case that is just the right size to be used underneath our COMspkr. A headphone jack allows use with headphones.

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If you, your family or neighbors haven't heard your signal coming out of their computer speakers you are quite a lucky ham. The COMspkr will solve this interference problem. The COMspkr is an RF proof amplified stereo computer speaker system, designed to install at a computer in or near your ham station.

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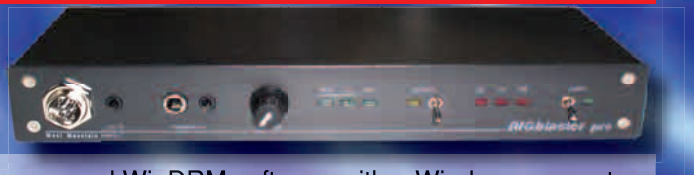
DIGITAL VOICE ON HF

RIGblaster pro



Operate digital voice on HF with SSB bandwidth! A RIGblaster pro and WinDRM software with a Windows computer that has a basic, full duplex, sound card is all you need to operate digital voice. HF signals that take no more spectrum than SSB but are noise free like FM. WinDRM is the HF digital program that works with a RIGblaster pro. The WinDRM program is free, and because you can use a RIGblaster pro there will be no problem in getting QSOs.

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TEN-TEC

CORRESPONDENCE

DOUBLE DOWN

♦ Whether one is operating HF, VHF or UHF, if there are more than two hams in a conversation, it is probable that those two stations will start transmitting at the same time. This unintentional simultaneous transmission is called doubling. This results in either only one station being heard by the third station or unintelligible interference, depending on the relative power levels of the two stations and the operating mode. Doubling is undesirable, as the transmitting stations have to repeat what they have said to ensure that everyone else in the group will hear and understand their message.

Good operating practice dictates that when we have completed our transmission, we are to give the call sign of the next station to transmit and to end with our call sign. For example, if I was in a 3-way conversation with KZ6XXX and KZ6ZZZ, when I had finished my turn talking, I might say: "KZ6XXX and the group, this is W6APZ." That way KZ6XXX would know to transmit next and KZ6ZZZ (and any others) would know to wait for their turn to transmit. By specifying the next station to transmit, we can avoid doubling.

RICH STIEBEL, W6APZ
Palo Alto, California

HYBRID HAZARDS

♦ I must respectfully point out that the editors of *QST* missed one very important fact in the article "Emergency Power from a Hybrid Car?" [October 2007, p 86]. Nowhere in the article was there any mention of the hazards involved in handling the high voltage traction batteries and associated circuits. When I purchased my 2006 Prius and I told the mechanics at the dealership that I intended to install Amateur Radio equipment in my vehicle, they advised me where I could find safe places to route the cables to avoid being in close proximity to the orange colored high voltage dc cables. The dealership said that over the course of the introduction of hybrid automobiles, several technicians were severely injured or killed through mishandling of the high voltage circuits. Consequently, technicians who service these vehicles receive special training and safety certifications. They also wear high voltage safety gloves similar to those worn by a power company lineman. The manufacturers of hybrid automobiles also provide information to emergency first responders with safety information regarding safe extrication of victims in the event that the hybrid automobile is involved in an accident.

With these considerations, I feel that it is worth pointing out that handling the high voltage circuits within these cars is more akin to handling third rail or catenary wire of a railroad and should not be thought of as just like working on the power supply of your vacuum tube radio.

FRANK COLUMBUS, WA2KWR
Laguna Niguel, California

[The author replies: Frank is, of course, correct that improper attention to the dangers of high voltage can injure or kill you. This is true for hybrid vehicles whose traction batteries are typically in the 200-300 V range, not dissimilar to that of vacuum tube radios, although much lower than those in tube kW amplifiers. I endorse Frank's comments fully. I was careful to include a section on electrical safety on my Web site, and I hope it will be read by those interested in "trying this at home." These comments relate specifically to the Prius if you're interested in using the traction battery for power. — Richard Factor, WA2IKL]

FIRST "REAL" QSO, WITH W2HD, AN HONOR

♦ I recently had the honor to make radio contact with Harry Dannals, W2HD, ARRL President from 1972-82. Not knowing his esteemed status, we exchanged the usual radio reports then moved on to topics we shared in common. As a newbie to Amateur Radio I am sometimes apprehensive to engage others in prolonged QSOs. Harry made the transition easy. His radio presence combined with his genuine friendly attitude immediately put me at ease. Harry spoke of his 60 years in Amateur Radio and of learning Morse code at the age of 10; Harry is an octogenarian now and still active on the bands. Code has always been an obstacle for me, and my anxiety with it kept me out of the amateur ranks for years. It was only after I made my log entries for the day did I discover Harry's association with the ARRL and it became readily apparent to me just how he achieved that status. In my short seven months within the amateur ranks, I realized this contact with Harry was my first real QSO. I attribute this achievement to Harry himself.

GARY MULLENS, KI4TEF
Kempner, Texas

D-STAR DEBATE

♦ When I was a teenager, I liked to build RTTY modems in order to listen to RTTY signals. I had tried a number of designs, but one design that did an outstanding job used a phase lock loop as a discriminator. That PLL modem was able to detect and properly decode RTTY signals that were inaudible to the human ear. I was astounded that I was able to copy signals from Europe on a band that should not have been open at that time of day. So 35 years ago, it was possible to have digital communications that were far superior to analog communications.

The issues brought forth by C. Richard Pumphrey, WN9DDV ["Correspondence," October 2007, p 24] are valid and point out shortcomings that current commercial digital voice communications like cell phones and VoIP (Voice over Internet Protocol) have. But given a digital communication design like D-STAR that is optimized for radio traffic, if you are not able to pass traffic with an optimized digital communications system, you would not be able to pass traffic with an analog solution, either. My experience with pulling RTTY signals out of the mud proves this.

To address the problem of dropouts with digital voice, maybe we need to consider generating background white noise (a static sound) when dropouts that would impair the voice traffic are detected. That way the listener knows that part of the communication is missing and can then decide what to do just like we do with garbled analog transmissions. The artificial static feature, if applied to all forms of digital voice communications, may provide exactly what is needed to assure everyone that is listening that the message was heard in its entirety.

DAVID BARKER, ARRL Life Member
Clinton Township, Michigan

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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Mike, KM0T – I had always dreamed about a radio and interface like this; but never thought it would ever happen. I sometimes catch myself staring at the screen showing the microwave band frequencies thinking "Man this is awesome!" Seems every time I turn around, there is something new coming down the pipe to make the whole setup better.

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- PowerSDR™ - The open sourceDSP software that allows continuous evolution of unmatched radio performance and functionality. PowerSDR™ is the brains of the radio where the FLEX-5000™ is the brawn. You get a "new radio" every time you download the latest version.
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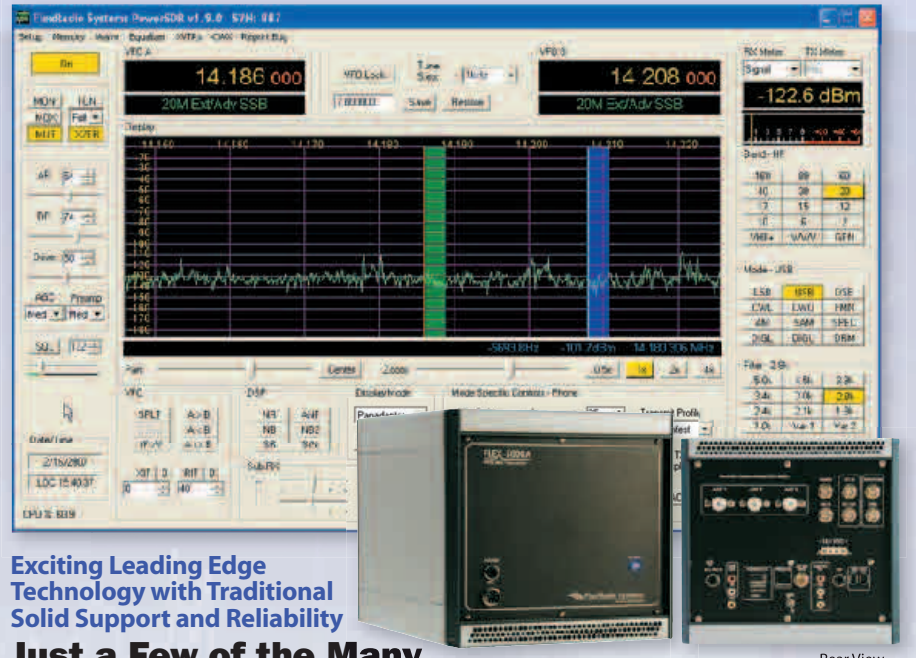

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- Two antenna ports selectable from front panel.
- Great for desktop or DXpedition!

Specifications

Frequency:
1.8 ~ 28MHz all amateur bands including WARC bands and 50MHz

Mode:
SSB, CW, RTTY

RF Drive:
85W typ. (100W max.)

Output Power:
HF 1kW PEP max.
50MHz 650W PEP max.

Matching Transceivers for Auto Band Decoder:
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Drain Voltage:
53V (when no RF drive)

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Input Impedance:
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Output Impedance:
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Final Transistor:
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Circuit:
Class AB parallel push-pull

Cooling Method:
Forced Air Cooling

MPU:
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Drain Voltage – Vd 60V
Drain Current – Id 50A

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AC Power:
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AC Consumption:
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The Hybrid Cascode — A General Purpose AGC IF Amplifier

Include this simple, high performance automatic gain control system in your next receiver project.

Wes Hayward, W7ZOI, and Jeff Damm, WA7MLH

Almost every superheterodyne receiver we build has an intermediate frequency (IF)-amplifier with automatic gain control. AGC keeps the receiver output nearly constant for all received signal levels. It also saves our ears should that strong station in the next block decide to join us on our favorite band.

Receiver intermediate frequencies range from 15 kHz up to 100 MHz or higher. A critical requirement for any amplifier that will be part of an AGC controlled IF system is that it have a gain that can be controlled with a voltage. This allows us to reduce gain until the output from our headphones or speaker is at a level we have chosen, and no more.

There are numerous circuits that provide electronic gain control. Many semiconductor manufacturers build integrated circuits with electronic gain control. An excellent AGC system using ICs from Analog Devices was described by Bill Carver, W7AAZ.[1] Special AGC ICs are often expensive, consume considerable current for portable applications, and often have a high noise figure. One of several circuits using discrete components that we investigated is shown in Figure 1, a cascode connection of two junction field effect transistors (JFETs).[2]

A cascode circuit with two devices of the same type is a common form that can be built with bipolar transistors, JFETs, MOSFETs and even vacuum tubes. The cascode connection has several virtues. The first virtue is stability, resulting from a grounded (bypassed) gate in the upper FET in Figure 1. Large output voltages at the J2 drain do not reach the amplifier input at the J1 gate. Most important, this circuit has gain controlled by a voltage. Decreasing the dc voltage on the J2 gate reduces the dc drain voltage on J1, forcing dc current to decrease, thus reducing RF gain.

Use automatic gain control to avoid ear drum damage

The biasing is set for 10 mA when V_{AGC} is 6 V in this circuit.[3,4]

The Hybrid Cascode Connection

The circuit of Figure 1 works well when the power supply, V_{DD}, is 12 V or higher. We discovered to our dismay, however, that the performance degrades severely when the power supply voltage drops — a common situation in portable equipment. (Both of us frequently carry portable rigs on backpacking treks into the mountains of the Pacific Northwest.) Lower V_{DD} reduces the maximum gain and severely compromises the gain control characteristics. In an effort to eliminate this problem, we observed that all fundamental virtues of the circuit of Figure 1 are retained if the upper JFET, J2, is replaced with a bipolar transistor. We call this circuit, shown in Figure 2, the hybrid cascode. Setting V_{AGC} to 8.5 V establishes the same conditions on J1 that we had in Figure 1 with a V_{AGC} of 6 V, producing identical maximum gain.

The major difference between the two circuits lies in the dc control. The circuit with two FETs in Figure 1 required a large string of diodes to be in series with the circuit so that the J2 gate voltage could drop far enough to

[1]Notes appear on page 33.

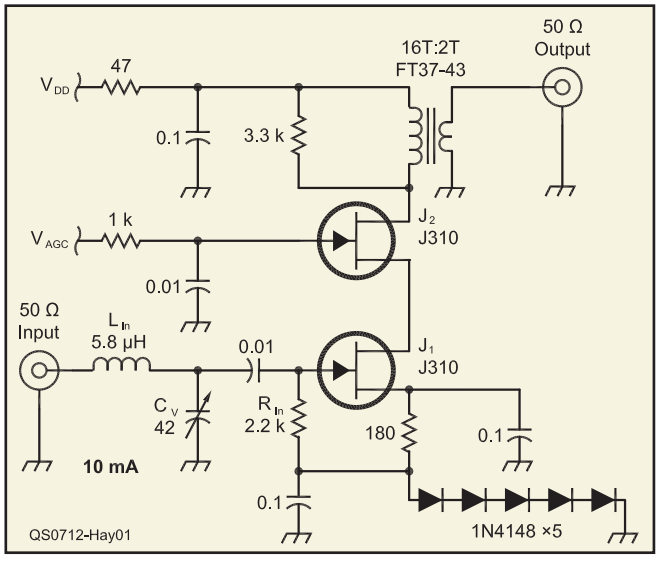


Figure 1 — Traditional JFET cascade IF amplifier. The computer simulated gain of this circuit is 23.5 dB at 9 MHz. Measurements produced similar values.

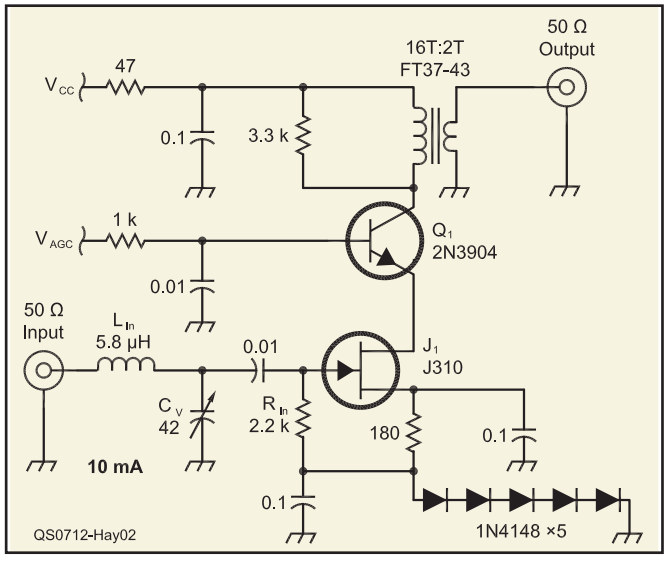


Figure 2 — Hybrid cascode. 9 MHz G_{MAX} of 23.9 dB when V_{AGC} is 8.5 V. Same tuning as Figure 1.

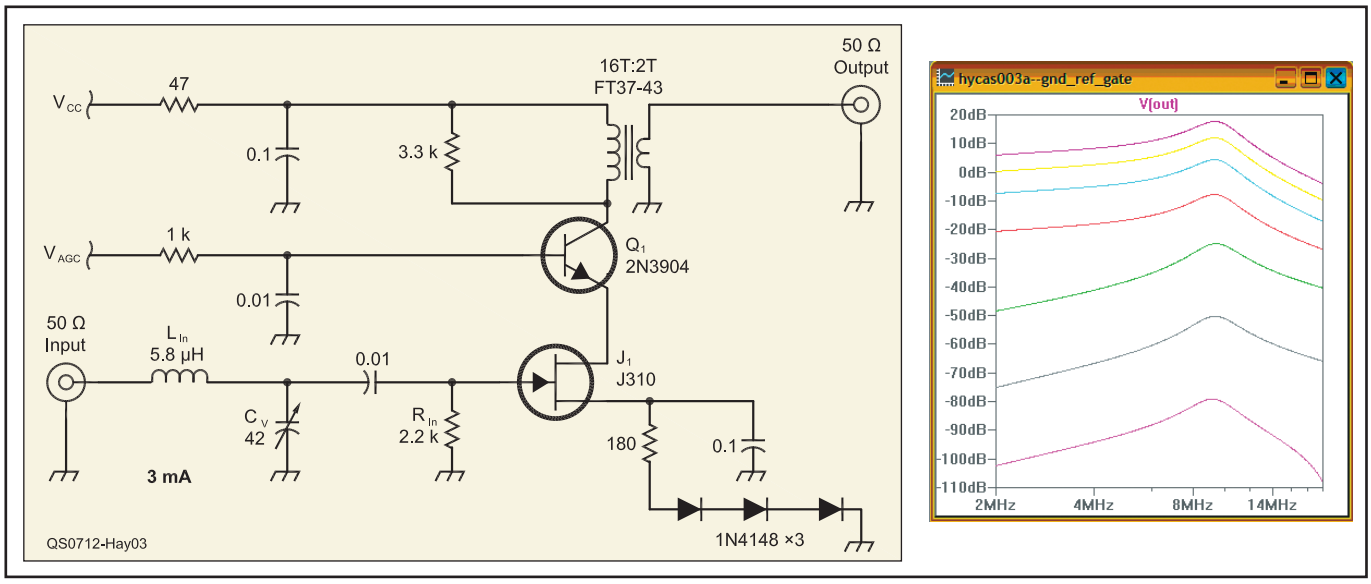


Figure 3 — Ground referenced hybrid cascode amplifier. (Details: V_{AGC} of 4 to 1 in 0.5 V steps, G_{MAX} of 17.7 dB, with virtually no change when V_{CC} drops to 6 V.)

cut off current flow in J1. J1 drain to source voltage and current can be dropped to zero in the hybrid cascode, even without a diode string. This yields a significant power supply margin.

The configuration we ended up using for our later designs is shown in Figure 3. This circuit has lower gain than that of Figure 2, for the maximum current has dropped from 10 to 3 mA. Only three diodes are used with a maximum V_{AGC} of 4 V. The input gate is now ground referenced through R_{IN}. This circuit shows virtually no measured or simulated performance change between V_{CC} of 12 and 6 V. The simulated curves, now in 0.5 V steps in Figure 3, show an extremely wide gain range for a single stage.

The same maximum gain can be achieved with two diodes and a 390 Ω source resistance, or with no diodes and a 750 Ω source resistance. The version of Figure 3 with three diodes and a 180 Ω source resistance provides a greater, and more monotonic, gain control range. Although other FET types can be used, the high I_{DSS} J310 offers a higher maximum gain.

A Receiver IF Amplifier

Figure 4 shows the next step of our design exercise, an amplifier suitable for use in communications receivers. Three hybrid cascode stages are used, offering 100 dB of AGC range. A transformer in the third stage drives a differential pair of PNP transistors, Q7 and Q8. Product detector output is extracted from Q8, while Q7 drives a diode AGC detector. R6 sets the AGC threshold. The value shown yields a dc level of 0.4 V at the detector output with no input signal. Shorting R6 increases the AGC threshold, often producing a more crisp receiver sound. The detected dc drives the base of Q10, which then discharges "memory" capacitor C3. The collector of Q10 also decreases the Q9 base voltage. Q9 is a PNP emitter follower that drives the AGC line which controls the gain of the three cascode amplifiers.

The nominal output level of this amplifier is between –35 and –40 dBm, depending on the value of threshold resistor R6. These levels are optimum to drive a standard diode ring product detector such as a Minicircuits TUF-1 or SBL-1 while keeping distortion low. R3 can be decreased while R4 is increased to drop the level for less robust product detectors.

Three hybrid cascode stages are used, offering 100 dB of AGC range.

The AGC may be turned off with a positive base voltage applied to Q12. A similar positive signal applied to Q11 will mute the amplifier. Diodes from the memory capacitor and the AGC line are routed to a manual gain control.

This amplifier has an overall AGC OFF gain of 55 to 60 dB. This may be altered by using different values for R1 and R2. The gain may also be reduced by using only two cascode stages. The two stage circuit is similar to the IF amplifier used in the popular Progressive Receiver, a design from antiquity that is still being built today.[5] The amplifier input is matched to 50 Ω with an L network (preferred), although a ferrite transformer was used in some of the experimental amplifiers. The values shown in the schematic are for 9 MHz with a match to the 3.3 kΩ gate resistance at Q2. The circuit can be adapted to frequencies throughout the MF and HF spectrum.

We examined the dynamics of this circuit with a pulsed signal generator consisting of a PIN diode modulator following an HP-8640B signal generator.[6] The modulator was driven by a pulse generator. Pulses of 1 mS in length up to –20 dBm in strength occurred once per second. Signals within the IF amplifier were then observed with an oscilloscope. The Q10 saturation resistance confined overshoot to the first 100 µS. These sharp pulses will never reach an IF amplifier that is preceded by a SSB or CW width crystal filter. If necessary, R5 may be increased to slow the attack. AGC recovery time is set by the two 1.5 MΩ resistors charging the memory capacitor and driving the base of Q9.

We included a regulator on the board to provide 9 V to the active circuits. Power supplied to the board down to 11 V is allowed. A low dropout regulator in place of the LM317L would allow an even lower supply voltage.

Construction

The amplifier should be constructed using reasonable RF methods, although we found nothing especially critical in the circuit. The first prototype used "ugly" construction over a ground plane.[7]

A printed circuit board version of the amplifier is shown in Figure 5. This imple-

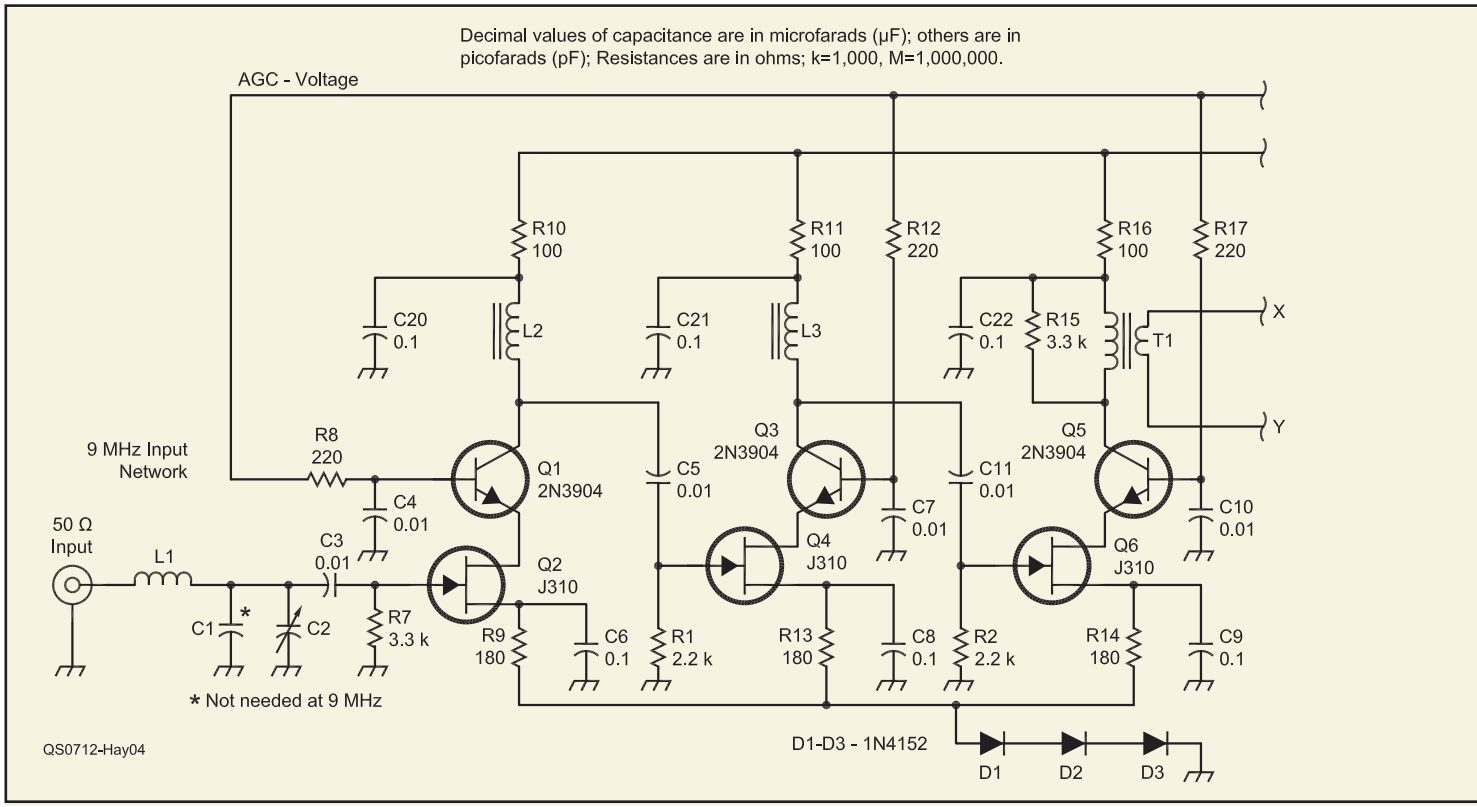


Figure 4 — Schematic diagram and parts list for complete IF amplifier and AGC system for receivers.

C1 — See text. None needed at 9 MHz.
C2 — 65 pF trimmer capacitor.
C3-C5, C7, C10, C11, C15 — 0.01 µF, 50 V ceramic capacitor.
C6, C8, C9, C12-C14, C19-C22 — 0.1 µF, 50 V ceramic capacitor.
C16 — 4.7 µF, 50 V electrolytic capacitor.
C17, C18 — 0.22 µF, 50 V ceramic capacitor.
D1-D5 — 1N4152, 1N4148 or BAV70 small signal diodes.
L1 — For 9 MHz, 7.1 µH inductor. 42 turns 28 gauge enameled wire on a T50-6 toroid core.
L2-L4 — 120 µH SMT inductor, or 16 turns 28 gauge enameled wire on a FB-43-2401 toroid core.
Q1, Q3, Q5, Q10-12 — NPN small signal silicon transistor, 2N3904 or MMBT3904.
Q7-Q9 — PNP small signal silicon transistor 2N3906 or MMBT3906.
R1, R2, R25, R33 — 2.2 kΩ, ¼ W resistor.
R3 — 51 Ω, ¼ W resistor.
R4, R5 — See text.
R6 — 270 Ω, ¼ W resistor.
R7, R15 — 3.3 kΩ, ¼ W resistor.
R8, R12, R17, R34 — 220 Ω, size 1206 for SMT or ¼ W leaded resistor.
R9, R13, R14, R20 — 180 Ω, ¼ W resistor.
R10, R11, R16 — 100 Ω, ¼ W resistor.
R18 — 4.7 kΩ, ¼ W resistor.
R19, R28-R31 — 10 kΩ, ¼ W resistor.
R21, R22 — 680 Ω, ¼ W resistor.
R23 — 47 kΩ, ¼ W resistor.
R24 — 100 kΩ, ¼ W resistor.
R26, R27 — 1.5 MΩ, ¼ W resistor.
R32 — 5 kΩ potentiometer.
R35 — 1 kΩ, ¼ W resistor.
R36 — 330 Ω, ¼ W resistor.
T1 — 16 turns 28 gauge enameled wire on a FB-43-2401 toroid core with output link of 4 turns 22 gauge enameled wire.

mentation used surface mount (SMT) components. The only changes to this circuit from the breadboard were a substitution of SMT inductors at L2, L3 and L4. The inductors used were 120 µH, length 0.3 inches. We measured a Q of 25 for these parts. The diodes were BAV70 in an SOT-23 package. The SMT board layout was generated with the 2.5 × 3.8 inch Miniboard option from Express PCB.[8] The board is double sided with a ground plane covering most of the bottom. Although the printed circuit board is not complete at this writing, we will likely generate a PCB layout for leaded parts as this goes to press.

Further Measurements

The single stage circuit shown in Figure 3 was built and tested for intermodulation distortion and noise figure with a V_{CC} of 12 V and two R_{IN} values. The input network was designed for 2.7 kΩ and was not changed when a higher termination

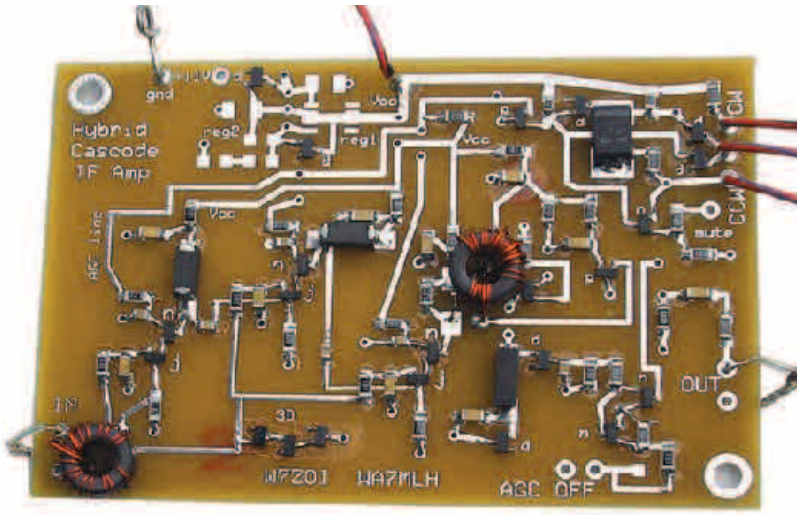
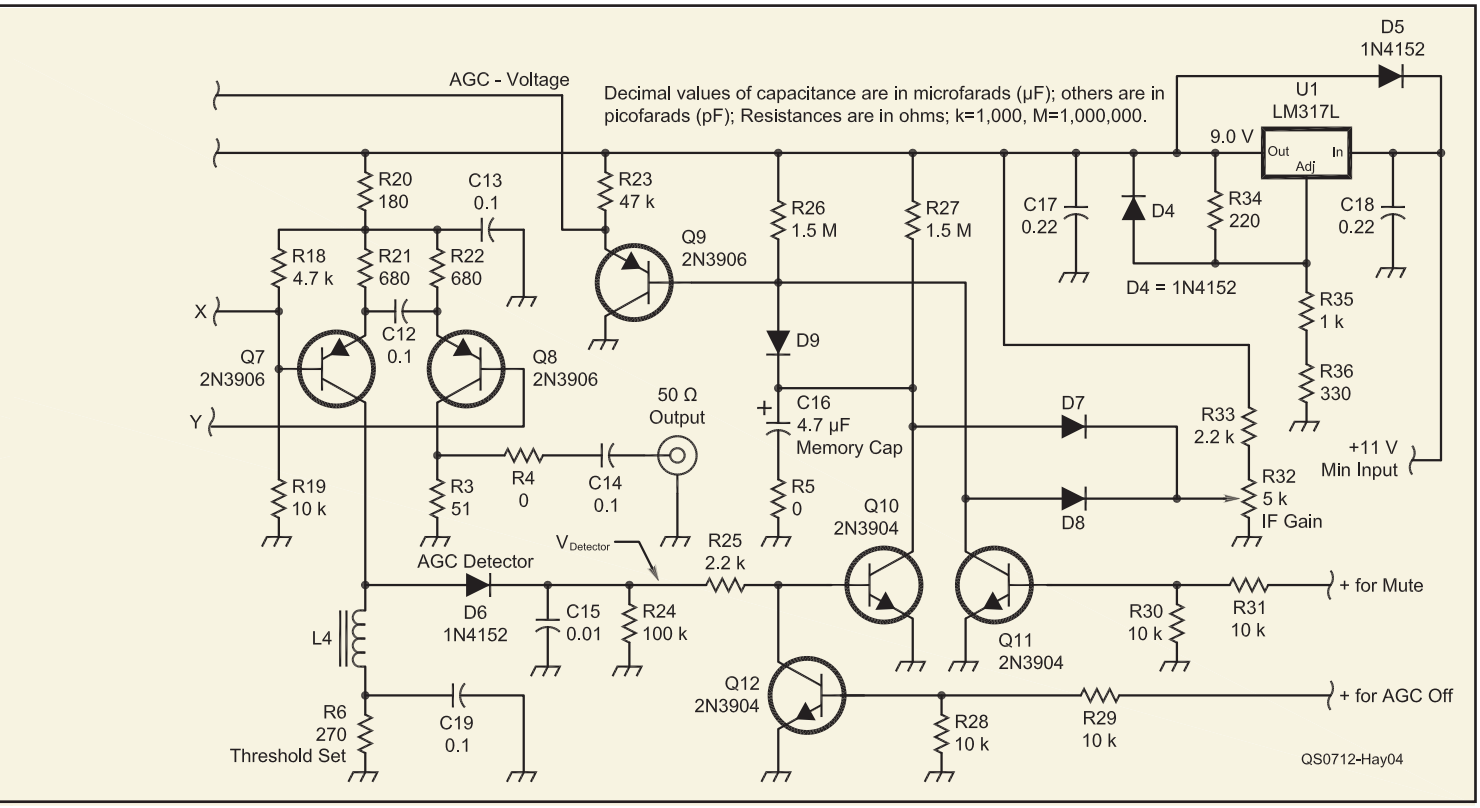


Figure 5 — A printed circuit board version of the IF amplifier using surface mount (SMT) components. The regulator was not installed when the circuit was built and tested with V_{cc} of 9 V.



resistance was applied. We measured a noise figure of 3.9 dB and third order input intercept (IIP3) of +3 dBm when R_{IN} = 2.7 kΩ. This input produced a very good input impedance match. IIP3 increased as gain was reduced while the noise figure remained low until gain became very low. The noise figure dropped to 2 dB when R_{IN} was increased to 22 kΩ, although the input match then became poor. The combination of low noise figure and reasonable IMD make this circuit suitable as an RF amplifier (when really needed) if the bias current is increased to 10 or 15 mA.

Conclusions and Refinements

The hybrid cascode appears to be an excellent general purpose circuit topology for receiver applications. The low noise figure makes it appealing, even compared with high end integrated circuits. The circuit form is easily adapted to other FET and bipolar transistors, making it useful worldwide.

We initially thought that the hybrid cascode circuit with a bipolar and a JFET was new. But we then discovered that it has been in use for a long time, especially in automotive equipment.[9]

The hybrid cascode can be modified by replacing the upper bipolar transistor with a differential NPN pair. This then allows one to apply AGC by current diversion, the scheme used in many popular integrated circuits such as the ubiquitous MC-1350P. Further expansion suggests using this scheme with transformer feedback amplifiers.[10,11] Finally, it appears that the scheme could be expanded to realize low noise, high intercept hybrid mixers.[12,13]

Additional data and information regarding circuit board availability can be found on the W7ZOI Web site.[14]

Acknowledgments

We would like to thank Rick Campbell, KK7B, and Bob Culter, N7FKI, for valuable comments. Thanks also to John Lawson, K5IRK, who built a version of the circuit for one of his receivers.

Notes

[1]W. Carver, "A High-Performance AGC/IF Subsystem", *QST*, May 1996, pp 39-44.
[2]W. Hayward, W7ZOI, R. Campbell, KK7B, and B. Larkin, W7PUA, *Experimental Methods in RF Design*, pp 6.15-6.26. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 8799. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop/**; **pubsales@arrl.org**.
[3]See Note 2, pp 2.5-2.6.
[4]**w7zoi.net/jfet101.pdf**. See JFET tutorial.
[5]W. Hayward and J. Lawson, "A Progressive Communications Receiver," *QST*, Nov 1981, pp 11-16. Also appeared in several editions of *The ARRL Handbook* in the 1980s.
[6]See Note 2, p 7.40.
[7]See Note 2, pp 1.2-1.3.
[8]**www.expresspcb.com/**.
[9]US patent 4,277,757, Richard Kennedy, 1979, assigned to Delco/General Motors.
[10]W. Hayward, *Introduction to RF Design*, ARRL, 1994, pp 215-218. Also see Note 2, p 6.51.
[11]W. Hayward and J. Damm, "The Hybrid Cascode AGC Amplifier," *Proceedings of Four Days in May*, 2007 (QRP ARCI), pp 65-73.
[12]See Note 11.
[13]See Note 11. Also, *Radio Communication Handbook*, RSGB, 8th Edition, 2005, pp 5.4-5.6.
[14]See **w7zoi.net**.

Wes Hayward has been licensed since 1955 as W7ZOI and is now retired from a career in electron-device physics and later, in circuit design. He now devotes his time to some writing, consulting, circuit research and a bit of backpacking and hiking. You can reach Wes at 7700 SW Danielle Ave, Beaverton, OR 97008 or **w7zoi@arrl.net**.

Jeff Damm, WA7MLH, was first licensed in 1968 while in junior high school. He showed up on Wes's doorstep just a few days later. He helped Wes with many breadboarding and construction chores for use in Solid State Design for the Radio Amateur. *His Amateur Radio focus since 1972 has been primarily HF CW/SSB homebrew/design. He has a BSCEE from Oregon State University and has worked the last 26 years in many phases of GaAs digital and RFIC design and product development from VHF through 12 GHz. Jeff is a cofounder of TriQuint Semiconductor. He currently does contract microwave consulting and design of GaAs RFICs. He can be reached at 3384 Winola Ave S, Salem, OR 97302, or* **wa7mlh@neoanderthal.com**. QST

A Remotely Controlled Station for HF Digital Modes

A remote SSB station isn't typically the best for digital modes. Here's why and how to make it all work.

Daniel Crausaz, HB9TPL

I am a city dweller without the ability to have effective HF antennas, particularly for the lower bands. The chalet that I own, located in the Alps, offers a much better opportunity including a few cooperative trees supporting a double L, a half square and two lazy H antennas. They, along with my old Ten-Tec Omni VI HF transceiver, have allowed me some great nights on 40 or 80 meters DXing and chatting in digital modes such as PSK, MFSK or Olivia. Unfortunately, the chalet is a 1½ hour drive from home (plus a 2 mile walk in winter), restricting my activity to a couple of weekends that, unfortunately for me, happen to be correlated with RTTY contests.

A *QST* article by Larry Phipps, N8LP, gave me the idea to have a particularly long cable connecting my home PC to the transceiver — a 100 mile telephone line.[1]

The Remote HF Digital Modes Station

A station designed for HF digital modes consists of a transceiver, antenna, ground and power supply — connected to a PC that will process digital data as encoded audio signals. Operating from a remote location requires the transmission of the computer audio tones to and from the remote location, to switch between transmit and receive as well as being able to tune the transmitter.

Brute Force Isn't Always the Answer

As suggested by the literature, I tried bringing the audio back home via the Internet protocol (VoIP). The results were disappointing. Audio is no longer transported as an analog signal even in our typical phone networks. It's digitalized and processed in order to get the best results for the human ear listening to human speech — not for digital mode processing software. The same happens with VoIP, with more distortion and delays as the signal is fragmented in packets to travel on the Internet. As a result, PSK cannot be demodulated at all, and the most robust mode, Olivia, needs very strong signals to come through.

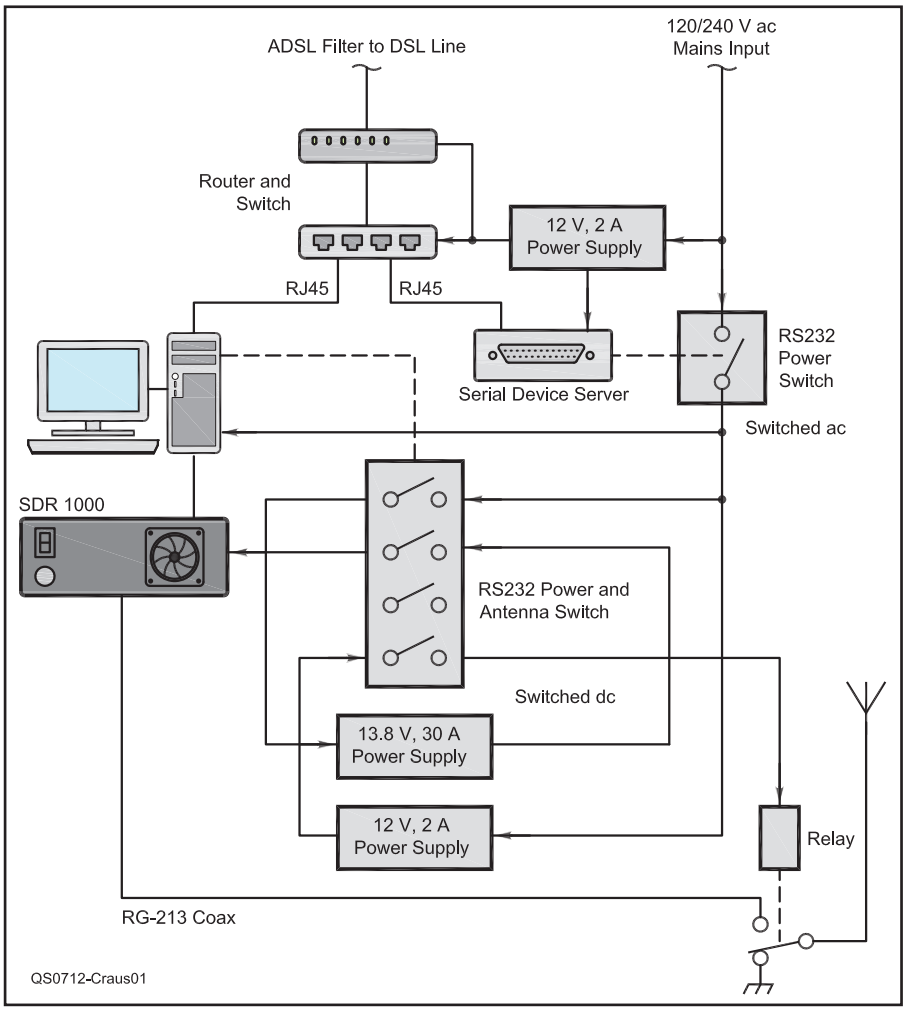


Figure 1 — Remote station interconnections. The components used by the author are as follows:

HF transceiver — FlexRadio SDR-1000.
Router — Linksys WAG200G.
RS 232 and TCP/IP power switch — ePowerswitch and AKNord (in Europe).
Serial device server — Lantronix UDS 10.

As an experiment, try to have a VoIP digital contact with one of your friends — just connect the output of your sound card with the input, launch your preferred digital mode software and call your friend via your usual VoIP provider. Try PSK. You will hear the signal and see it on the waterfall display, but the error rate will be nearly 100%. Perhaps some coder/decoders (codecs) can do a better job. If so, I would be very interested if someone would identify one that results in only a 2 or 3% error rate.

Switch to Plan B

If the audio signals can't be sent to the remote location, let's let the Internet do what it does best and ship the digital signals. Then we must do the audio processing at the remote site. As a matter of fact, transporting keystrokes or pixels on the Internet is much

[1]Notes appear on page 35.

less challenging than respecting the integrity of a complex and delicate audio signal.

Making it Happen

Managing the digital modes software from a remote location can be done with a function that comes for free with *Windows XP* — the *Remote Desktop* software that allows connecting to another PC and working with it as if you were on the remote PC. This function is found in the ACCESSORIES menu under the COMMUNICATIONS tab. The remote PC needs to be configured in order to accept connections. The use of a broadband digital connection such as a cable modem or telephone provider ADSL line is mandatory. In addition, rather powerful computers are needed at both ends to support both the remote desktop and the digital mode processing.

The remote PC does need a fixed IP address that can be called. The scarce number of fixed IP addresses makes them quite expensive. Fortunately, the guys at DynDNS (**www.dyndns.com**) offer a free service that matches the temporary address assigned by the Internet provider on a connection to a permanent alias. This alias address is the only one you will need to remember.

In my setup (see Figure 1), the router is connected permanently to the phone line. It calls the Internet provider's server every 5 minutes to keep the DynDNS alias updated. Most routers offer this possibility. Actually, the address will be that of the router and its KEEP ALIVE function will maintain its validity. Switches that can be operated via RS232 serial connections can be found for reasonable prices and can be used to turn the remote PC on and off. They can be operated directly with *Telnet* (another functionality that comes for free with *Windows*), without the need for special programs.

Nuts and Bolts

The RS232 order must come from the router and not from the PC (which is switched off when you are not operating it). Serial device servers are tiny pieces of hardware that transform the TCP/IP protocol commands into RS232 orders. They can be found on auction sites for prices starting at around $40. They are connected between the router and the PC power switch to allow orders given via the Internet to be passed to the RS232 switch. The router must of course be configured appropriately. Switches that accept TCP/IP data are used by network managers to reboot servers but they seem to be a more expensive solution and I had already bought the serial control device.

The ordinary job of switching and grounding antennas needs to be performed, too. I didn't find something ready-made to perform this function. In addition, you will need to switch on the transceiver's power supply, the transceiver itself as well as other devices, an antenna tuner for example. I bought 12 relay serial cards on the Internet, constructed a connection box for 240 V ac, 12 V and 13.8 V dc using a 40 A automotive relay. The antenna switching box (see Figure 2) is based on the description in a *QST* article by Darrin Walraven, K5DVW, as well as an article found on the Internet.[2,3]

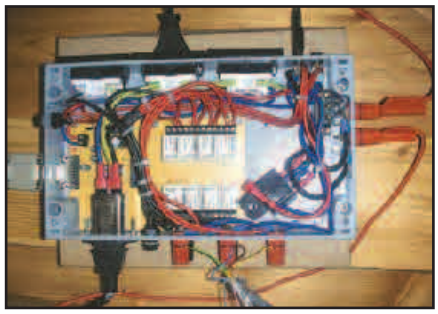


Figure 2 — Author's implementation of the switch box.

The software needed to operate all these relays proved to be the toughest part of the project for me. Programming has evolved a lot since I last practiced it with *FORTRAN*. It's great to download *Visual Basic Express* for free, but finding the correct way to operate serial ports has proven to be a hassle. The documentation is scarce and I found it inconsistent between *Visual Basic's* versions.

The Radio Equipment

With a PC at the chalet, I thought a computer-based radio would be a logical approach, since I would have a dedicated PC at the chalet anyway. I purchased a FlexRadio SDR-1000 — for the task. It required no knobs or other hardware requiring manual intervention. The SDR-1000 provides the possibility to reduce the refresh rate and to shut down spectrum analyzer's screen. These functions represent a lot of pixels and provide no really useful information to the remote operator, so I chose to reduce the processor load.

Digital Mode Software

This system should operate with any of the popular digital mode software. We probably all have our favorites. I chose *Multipsk*. I find *Multipsk* to be exceptionally rich in exotic modes and it's offered free, thanks to Patrick, F6CTE. It also offers the possibility to reduce the number of colors of the PSK31 waterfall display to as few as two, black and gray. This is very helpful to reduce the file size of the screenshots that must be transmitted.

While N8LP needed a single PC, this system requires two PCs. There is no need for an audio hybrid as only screenshots are transmitted. In my opinion, the advantage is that the station can be fully operated from any computer anywhere in the world without the need of specific software that doesn't come with the *Window XP Pro* package.

Ringing it Out

Having the whole system operating correctly required a lot of tests and traveling, not to mention support from my local telecom provider. They got to walk in deep snow to check the ADSL line whenever I was complaining. The first contact occurred between Fred, OH/DK4ZC, and himself on 20 meters using *Olivia*. He was operating my station from his home in Finland and monitoring the received signal on his home station.

Results were excellent, although there is considerable room for improvement and experimentation. Possible enhancements include audio streaming rather than remote desktop, for instance, installation of an oven controlled crystal oscillator (OCXO) to stabilize the transceiver's frequency as the chalet has no heating, improvement of the reliability and clear understanding of the capacity of the Internet connection. I shall be happy to try to help anybody interested in undertaking such a project and underline that this is by far not the only possible configuration.

Special thanks to Charles, HB9VJS, who, as a network expert, was the key to the success and to Fred, OH/DK4ZC, for his encouragement.

Notes

[1]L. Phipps, N8LP, "Networked Equipment for Remote Station Control," *QST*, Oct 2005, pp 40-43.
[2]D. Walraven, K5DVW, "Three Position Remote Coax Switch," *QST*, Jul 2006, pp 41-43.
[3]J. Talt, "Remote antenna switching," **iol.ie/~bravo/remote.htm**

Daniel Crausaz, HB9TPL, has been licensed since 2004. He graduated in physics from the Ecole Polytechnique Federale de Lausanne and subsequently received an MBA. He is now an independent business consultant. He and his wife, Cecilia, have two children and all have been subjected, more or less willingly, as participants in one or more of his ham radio projects.

Daniel enjoys building wire antennas, working early morning digital mode DX on the lower bands as well as ragchewing in digital modes on 80 meters with remote friends, among them two Freds — N9GUE and OH/DK4ZC, Massimo, IZØGKZ, and Bob, WA5KVB. You can reach Daniel at Russel 7, 1025 St Sulpice, Switzerland or at **cecidan@bluewin.ch**.

The Octopus — Four Band HF Antenna for Portable Use

An easy to make, easy to assemble and easy to pack travel antenna.

Geoff Haines, N1GY

My participation in the world of Amateur Radio has led me in many directions. From DX to disaster recovery, I have used my meager skills to do many things. For me, the most enjoyable of these is the building of the simple gadgets and accessories that make my station work better.

One for the Road

I have a frequent need for an HF antenna to support portable operation on multiple bands. I recently thought of a simple way to provide one based on a *multiband fan dipole* in combination with a *helical mobile dipole*. Now those of you with 70 foot towers with multi-band Yagis on top who never leave their linear behind can leave the room. This idea is for those who like to go somewhere such as a beach or park where it's quiet and set up a modest station for an afternoon of radio fun. It also works for those of us who are Amateur Radio Emergency Service (ARES) members and have to set up a working HF station in the middle of a parking lot after a natural disaster such as a hurricane.

The Octopus is Born

Using the concept of a horizontal fan dipole, I drew up a design for a helical type dipole taken to extremes. The basic plan was to find an attachment mechanism that could be mounted on a mast and accept up to four helical dipoles, eight helical type antennas, radially around the mount in the horizontal plane.

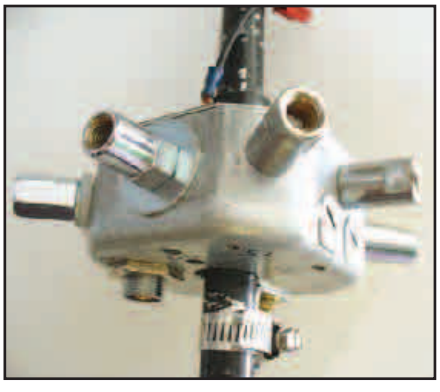


Figure 1 — The hub of the array is a standard octagonal electrical box available at your local home improvement store. Stud mounts available from your local ham radio or CB shop are used to mount the mobile antenna pairs.

Finding the Pieces

Since I have often found the perfect parts for my projects at the local home improvement chain stores, I looked there again. Almost as soon as I got to the electrical department, my search was over. An eight sided electrical box, of the type used to mount overhead lighting, looked ideally suited for the task. See Figure 1. It had eight sides, a top and a bottom and would be relatively easy to modify. The punch-out slugs on the side were larger than I wanted for mounting the helicals, but could be adapted with fender washers. I drilled these out to ½ inch internal clearance.

The punch-out slugs in the top and bottom of the box are the right size "out of the box" to allow the entire mount to be slipped over the top of a ¾ inch diameter top section of telescoping mast. I used an angle bracket bolted to the bottom of the box to allow me to clamp it to the mast.

The next problem was how to mount the antennas. Checking the hardware aisle I found ⅜ × 24 bolts in the fasteners section. The long nuts for the other side of the mount were harder to find, but by going to truck stops (where they usually have a CB parts wall, visiting RadioShack and raiding my parts box, I eventually came up with eight double female stud mounts to attach to the central hub. The assembly details are shown in Figure 2.

Making it Happen

Four of these stud mounts were mounted directly to the hub, and four were mounted with insulating washers. The four insulated mounts were wired to a single SO-239 type connector mounted to the bottom of the hub box. Each insulated mount has a grounded mount 180° away from it. The connections from the insulated mounts to the SO-239 were made with ring terminals of appropriate size soldered to a wire harness that is connected to the SO-239, as shown in Figure 3.

Since this antenna system is intended for short term, temporary deployment, weatherproofing is not particularly significant for me. Should anyone want to use this idea for a more permanent installation, weatherproof-

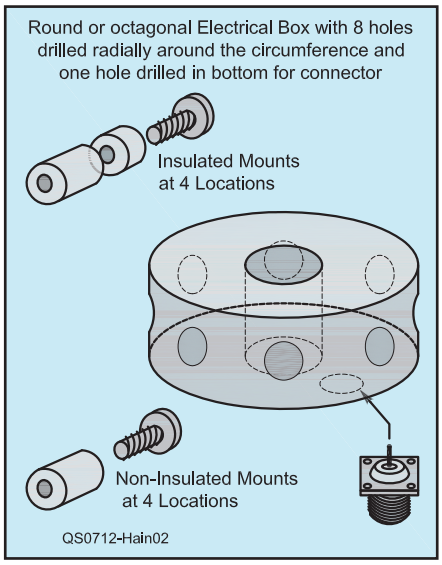


Figure 2 — A drawing of the electrical box showing the holes drilled for the stud mounts, four of which are insulated from the box and four of which are grounded to it.

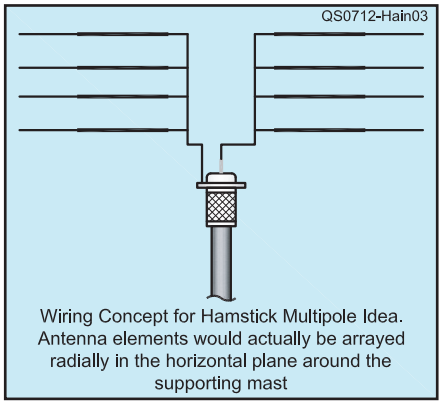


Figure 3 — This shows the schematic diagram of the wiring of the antenna elements.

ing the hub will require at least several coats of rust resistant paint and the sealing of any spots where water could gain entry.

The next step was to install four pairs of helical type mobile antennas cut for four different bands on the mount. With each pair, one is connected to an insulated mount and the other is installed in the grounded mount opposite to the first. I chose to use Valor Pro-Am helical whip antennas because the 3/8 × 24 connection of the whip to the helically wound lower shaft of the antenna makes them easier to store and assemble than the set-screw arrangement of the Lakeside Hamstick antennas. This is not to say one is better than the other. I have purchased both makes before and indeed use the Lakeside antennas on my mobile rig where storage is not an issue. The antenna, all ready to go, is shown in Figure 4.

How it Works

Since we now have four dipoles all connected to the same coax, a little explanation is in order. When the radio transmits RF up the coax to the antenna array, it sees all of the antennas as a high impedance load except the dipole that is resonant on the band being transmitted. Thus, almost all of the RF energy is directed automatically to the proper dipole. This is the way a multiband fan dipole works, and what we have here is such an antenna turned sideways from the usual configuration. See Figure 5.

Figure 4 — Here is a view of the octopus all set up for park-side DX or disaster recovery operations. The SUV, sitting on the mast base, keeps the whole array erect. The guy lines in the picture would be used only if the vehicle was needed elsewhere.

Tuning it Up

There are two ways to make sure that the transceiver sees a 50 Ω load. One is to mount and raise one pair of antennas at a time, and tune each pair to present a 50 Ω load. It's very time-consuming, but it does work. Each pair will have to be retuned to some extent because of slight interactions between the pairs of antennas, but eventually all can be made to work. The second way is to get them approximately on frequency and use a manual or automatic antenna coupler or tuner such as my LDG Z-100.[1] This was my personal choice.

Once the antenna array goes up, I don't want to have to take it down until I am ready to go home. I chose to adjust each dipole to resonance at the middle of each band. To expand the bandwidth to the full scope of the available frequencies I rely on the automatic tuner, which also appears to handle the small mismatches caused by any interaction between sets of dipoles. This interaction is less than with a traditional fan dipole because the 40 and 75 meter antennas are at right angles to each other. The 20 and 15 meter antenna sets are also at right angles to each other and at a 45° angle to the lower band sets.

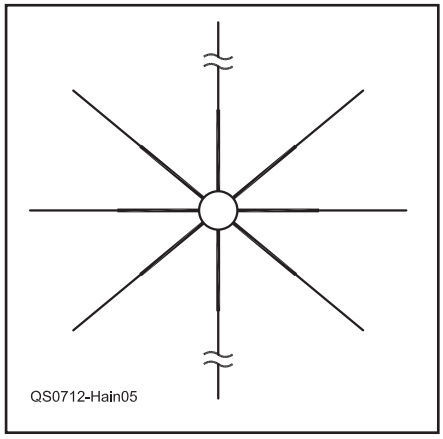


Figure 5 — Top view of the array.

Raising the Beast

The octopus array is mounted on a telescopic mast home-brewed of aluminum tubing available from several sources. The telescopic feature allows the array to be positioned from a low position for near vertical incidence skywave (NVIS) type operations or extended up to 26 feet for lower angle operation on the higher bands.[2] Any height

[1]Notes appear on page 38.

up to λ/4 will support NVIS operation, so the full height works well on 80 and 40 meters; the prime NVIS bands but lower heights can also be effectively used, if conditions warrant. I think that the low position should be above 8 or 9 feet off the ground for safety's sake. No one likes to run into the sharp end of an antenna.

Don't Expect Miracles — but Good Results for its Size

Any short dipole array, including the octopus, is a compromise. If time were no object and funds unlimited, there are antenna systems that work better. However, if your antenna system has to ride around in the trunk of your car waiting for the next ARES callout, or you just have one afternoon to devote to catching some fun DX at the beach, this antenna will do the job well enough. A decent enough antenna is better than no antenna at all.

To store the array, just remove the helicals and put them back into whatever bag they are normally stored in. The mast is telescoped to its minimum length and stored the same way. You can leave the hub on the mast or store it separately — your choice. The initial setup only takes about 15 to 20 minutes and once done, you are finished with antenna work until it's time to go home. There are no radials to lay out and trip over. When disassembled, it all fits in the trunk of your car.

But Wait — There's More!

This antenna array also allows the use of a VHF or UHF antenna mounted above the hub on the very tip of the mast as shown in the lead photo. Therefore, with just one mast you can provide communications over a broad range of amateur bands and ranges with a minimum of effort. Sounds like the Amateur Radio we all know and love.

How's it Play?

I raised the octopus about 11 feet above ground for my initial testing. The radio and autotuner combination had no trouble getting a good match on any of the four bands, 75, 40, 20 and 15 meters. During an all-day display of Amateur Radio at a local American Red Cross center, I set up the mast and antenna to its full height of 26 feet. I had no trouble at all checking into the Maritime Mobile Service Net on 20 meters and similar success in making contacts on all of the bands except 75 meters, which is usually pretty dead here during the daytime. I was able to get a good match on all four bands, so I have no doubt that it will work on 75 meters when the band is open. To take advantage of the directional effects of the dipoles, particularly on the higher bands, the antenna can be manually rotated as shown in Figure 6.

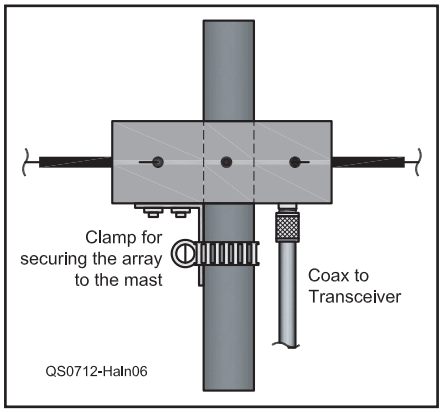


Figure 6 — This diagram shows clearly how the hub is secured to the mast to allow "armstrong" rotation of the array, if needed.

One cautionary note: This antenna mast should never be tilted up with the antenna on board. It should always be extended upward with the mast already vertical. I discovered this when I attempted the tilt-up method, with disastrous results. The mast bent under the weight of the antenna and had to be repaired. As long as it is extended vertically, and then guyed, there should be no problem in any reasonable wind.

If you decide to try this approach, you can substitute your favorite band or bands of choice. You could build a one, two or three band version just as easily. In terms of overall performance, the array appears to work just as well as any single band helical type dipole. Note that any helical dipole will be more efficient at 20 meters and higher than on the lower bands, but will work as well as other antennas their size. The main advantage of the multiband configuration is that when you want to change bands you just switch the radio to the new band and give the TUNE button a jab. Two seconds later you are ready. No going out to the mast, lowering it down to 6 feet and removing one set of antennas to substitute another pair. All of that could easily soak up 15 or 20 minutes, and you still have to raise the mast back up to the proper height.

Time to Hit the Road

The octopus resides in the back of my SUV, along with the telescopic mast and its base, also home-brewed. When deployed, the base sits under one of the tires on the SUV and keeps the mast vertical until the guy ropes are deployed. Then I can drive the car away and set up the rest of the station in a more convenient spot. Total time from the initial setup of the mast and antenna to being on the air ready to catch some DX or assist after a disaster is about 30 minutes. It can be less if I use the radio mounted in the car instead of a separate station set up as in the "Radio in a Box" pictured in *Up Front* in the October 2005 issue of *QST*. On the other hand, using the radio in a box means that the vehicle is available to do other things while the station continues to be operated.

Notes

[1]J. Hallas, W1ZR, "Product Review — Automatic Antenna Tuners — A Sample of the Field," *QST*, May 2004, pp 71-76.
[2]R. Straw, N6BV, "What's the Deal About 'NVIS'?" *QST*, Dec 2005, pp 38-43.

Geoff Haines, N1GY, has been licensed since 1992 and holds an Amateur Extra class license. He retired after a career in respiratory care. He currently holds several ARRL appointments in the West Central Florida Section, including Technical Coordinator, Technical Specialist, Official Bulletin Station, Net Manager, Official Emergency Station and Official Relay Station. He is the President of the Manatee Amateur Radio Club, a member of the Manatee ARES group and member of the Bradenton Amateur Radio Club, the Yale University Amateur Radio Club and the Meriden (CT) Amateur Radio Club. In his spare time, he enjoys homebrewing antennas and accessories for his Amateur Radio operations. Geoff can be reached at 708 52nd Av Ln W, Bradenton, FL 34207; **n1gy@arrl.net**. QST

New Products

CHRISTMAS KEY FROM MORSE EXPRESS

◊ The 2007 Christmas Key from Morse Express is a fully operational miniature Marconi style telegraph key. The key is machined from solid brass, underplated with nickel and finished in 18 carat gold. It is mounted on an ebony base measuring 2 × 1.25 inches and weighs 4.5 ounces. All of the usual tension and spacing adjustments are available. This Marconi key has contacts at the front and rear of the key. When you close the key, the rear contacts open an instant before the front contacts close, a useful feature for muting a separate receiver. The base of each key is engraved with the Morse Express logo, "Christmas 2007" and a serial number. (This is a limited edition of 200 keys.) Price: $79.95. For more information or to order, visit the Morse Express Web site at **www.MorseX.com**.

Get a Youngster on the Air During Kids Day 2008

2008 will bring two opportunities to introduce a kid to the magic of Amateur Radio: January 6 and June 21.

Dave Patton, N1NN
Manager, Membership and Volunteer Programs Department
dpatton@arrl.org

On January 6, 2008, kids everywhere can use the magic of radio to make new friends over the air. After over 10 years of activity, the Kids Day events, created by the Boring Amateur Radio Club, have gained in popularity year after year. Nearly 500 kids were reported to have shouted their favorite color into a microphone during 2007's running of Kids Day!

DAVID HODGE, N6AN

Ten-year-old Alan Hodge, son of David Hodge, N6AN, sitting at the main operating position at W6UE, the Caltech ARC in Pasadena, California, and no doubt getting hooked on the magic of radio. The Hodges used special event call sign W6CIT during Kids Day 2007.

After the successes of the 2007 events once again this year we suggest the use of the same frequencies used by the scouts during Jamboree on the Air (JOTA) — they're shown in the sidebar. With propagation conditions that accompany the bottom of the sunspot cycle, we need to spread out to find bands where everyone can participate.

Also carried over from the June 2007 announcement are some ideas from Ward Silver, NØAX (with a few new ones included), to help you make this event even more enjoyable.

For the parent ham or host:

- Use a CW reader program such as *CWGet* (**www.dxsoft.com/micwget.htm**)
- Have the kids make and exchange their own QSL cards
- Make a special logbook for each kid
- Be sure to request the participation certificate from BARC
- Amateur Radio is all about geography; have a map of North America available and point-out locations (or have the kids find them using an atlas) of the kids on the other sides of the QSO
- If this isn't the first Kids Day for your kids, pull up the old logs and see if previous friendships are renewed during the 2008 events.

For the radio club host:

- Have an open house at the club station
- Promote Kids Day in your newsletter
- Give out your own certificates and blank logbooks
- Sponsor a pizza party after the event
- Make custom stickers about ham radio or QSOs/QSLs for the kids to apply to their scrapbooks commemorating each event in which they participate.

For the kids:

- Mike fright? Make up cue cards and point to each thing to say
- Bored? Share the station with a friend, operate in short stretches
- "What's That Do?" Construct a "pretend radio" with knobs and switches
- Break the ice by arranging a schedule with another local family.
- The Kids Day operating events are the first Sunday in January and the third Saturday in June — January 6 and June 21 this coming year. Make that personal connection that may result in a new ham radio licensee. You just might find yourself re-infected with that enthusiasm you once had with ham radio. Don't forget to further the fun and invite the kids to Field Day the next weekend!

Find out more about Kids Day by visiting **www.arrl.org/FandES/ead/kd-rules.html**. Also, check out the certificate on the Web at **www.arrl.org/FandES/ead/kids-day-survey.html**. Send pictures of the kids operating your station so we can share them with others — **kidsday@arrl.org**. QST

Kids Day Rules

Sunday, January 6, 2008

Purpose: Kids Day is intended to encourage young people (licensed or not) to enjoy Amateur Radio. It can give young people on-the-air experience so they might develop an interest in pursuing a license in the future. It is intended to give hams a chance to share their station with children.

Date: Sunday, January 6, 2008.

Time: 1800-2400 UTC. No limit on operating time.

Suggested exchange: Name, age, location and favorite color. You are encouraged to work the same station again if an operator has changed. Call CQ KIDS DAY.

Suggested frequencies: 3.740 & 3.940 MHz, 7.270 MHz, 14.290 MHz, 18.140 MHz, 21.360 MHz, 24.960 MHz, 28.390 MHz and 2 meter repeater frequencies (with permission from your area repeater sponsor). Observe third party traffic restrictions when making DX contacts.

Awards: All participants are eligible to receive a colorful certificate (it becomes the child's personalized sales brochure on ham radio). Please visit **www.arrl.org/FandES/ead/kids-day-survey.html** to complete a short survey and post your comments. You will then have access to download the certificate page. You can also send a 9×12 self-addressed, stamped envelope to the Boring Amateur Radio Club, PO Box 1357, Boring, OR 97009.

GB3SSS — Marconi's Transatlantic Leap Revisited

Did he do what he said he did in 1901? A group attempts to reach a conclusion.

Steve Nichols, GØKYA

Club Chairman Dave Wall, 2EØGSD (left), and Club Secretary Keith Matthew, GØWYS, at the base of the GB3SSS antenna at GB2GM at The Marconi Centre, Poldhu, Cornwall, UK.

As far as the history books and the general public are concerned, Marconi is the father of radio. But Marconi's main claim to fame all rests on a simple premise — did he actually receive signals from Poldhu, Cornwall, UK at Signal Hill, Newfoundland on December 12, 1901?

Unfortunately, some say the evidence is stacked against him and people have argued about the success or otherwise of his achievement for years.

In 2001, Dr John S. (Jack) Belrose, VE2CV, of the federal Communications Research Centre in Ottawa and a respected authority on radio, is reported to have said that: "As far as I am concerned Marconi heard absolutely nothing. He deceived himself and the world into thinking he heard something."

That is why the Poldhu Amateur Radio Club at the Marconi Centre in Cornwall and the Marconi Radio Club of Newfoundland wanted to set the record straight.

In late 2006 a group of radio amateurs from both sides of the Atlantic decided to re-enact the legendary transmission. The idea came from Bart Lee, KV6LEE, an associate member of Poldhu ARC, who realized that the solar conditions in the winter of 2006/2007 would be similar to when Marconi received the signals in Newfoundland — sunspot minimum in midwinter with its attendant low ionospheric D layer absorption and minimum absorption frequency.

As Bart said: "I determined, in 1998 or so, that the sunspot number in December 1901 was exactly zero, a remarkable coincidence if nothing else.

"The D-layer daylight absorption was then much less than nowadays because the amount of atmospheric nitric oxide was less, too. Carl Luetzelschwab, K9LA, first pointed out to me the role of nitric oxide in the D-layer. What this could mean in 1901 is that a whole lot more of Marconi's 15 kW hit the F-layer to come down in St John's than would happen today. How much more is hard to say. So 1901 perhaps got a bonus in dBm relative to today."

From the start of November, the Poldhu Amateur Radio Club, based at Marconi's original transmitter site on the Lizard peninsula, Cornwall, used a 160 meter beacon — GB3SSS — to make regular one-minute transmissions on 1960 kHz while radio amateurs in Canada and the USA tried to copy and analyze the transmissions.

But why all the fuss? Why should there have been any doubt in the first place?

Keith Matthew, GØWYS, Poldhu ARC's club secretary explained:

> No one really knows for sure what frequency Marconi's transmissions were on. Marconi himself was evasive concerning the actual frequency. But in a lecture in 1903 Ambrose Fleming said that the wavelength was 1000 feet or more — 810-870 kHz is generally the quoted frequency.
>
> But in 1908, Marconi said in a lecture to the Royal Institution that the wavelength was 1,200 feet, and in a recorded lecture in the early 1930s he changed his story to approximately 1,800 meters (166 kHz). At the same lecture he quoted the transmitter power as being 15 kW.
>
> Whatever the frequency was, the tests took place at the worst time of day.

Marconi said he received the signals at 12:30 PM, 1:10 PM and 2:20 PM local time using a 500 foot long antenna suspended by a kite. At the time this corresponded to 1600Z, 1640Z and 1750Z.

Map these times using a modern program like *Geoclock* and you see that the complete path was in daylight at 4 PM and only the UK end of the path was in darkness at 5:50 PM.

Even though we know there were no magnetic storms at the time, or for 10 days before, the daytime skywave would have been heavily attenuated.

In Marconi's favor, it was midwinter with low sun elevation angles, but a 3500 km path in daylight on 880 kHz? Surely not.

Factor in that the receiving equipment consisted of a long-wire antenna and an untuned receiver and the odds get worse. As

Marconi used a spark transmitter he would have heard faint clicks, not the audio tone of a CW signal that we know and love today.

But as Marconi said later: "At 12:30 PM, while I was listening on the telephone receiver there came to my ear, very weakly, but with such clarity that there could be no possible doubt, a rhythmic succession of the three dots corresponding to the letter S of the Morse code..." Some signals were also received on December 13 during the brief time that a kite could be kept flying and there was a possibility that they were also heard on the 11th.

"Davey" Davey-Thomas, G3AGA, of Poldhu ARC is looking at the possibility that Marconi actually heard the signals on three-times the quoted frequency at around 2.5 MHz. The Poldhu spark transmitter emitted a wide range of frequencies and it was only the characteristic length of the transmitting and receiving antennas that favored one frequency over another. This is not to be confused with true "harmonics" of the fundamental. In truth, there was no fundamental.

If the Poldhu antenna was resonant at 860 kHz it would also have exhibited a low impedance at three times this — 2.5 MHz.

Perhaps the secret lies in the story that Marconi was allegedly using an untuned receiver. One theory is that the spectrum of the Poldhu transmitter contained significant power in the higher HF (short wave) bands — 14 MHz would be no problem for making the contact as Poldhu ARC shows every year on the anniversary of Marconi's claims when it contacts Newfoundland in a symbolic exchange of greetings.

But as Bart Lee pointed out: "Under these low sunspot conditions, the maximum usable frequency is at its lowest as well. I doubt that a harmonic or spurious signal got across in 1901. I also doubt that Marconi was listening for signals on anything other than his primary frequency where his transmitter's power was concentrated."

I visited Poldhu on the 105th anniversary of Marconi's achievement on December 12, 1901 to research this story. At 1600Z history was remade when GB2GM made CW contact with VO1MRC in Newfoundland on 20 meters as the club does every year. With Ron, GØMRH, on the key and a shack full of Poldhu ARC members it was a fitting tribute to Marconi's work.

But GB3SSS hoped to show once and for all that it could have been possible for Marconi to hear the signal transmitted on or around 880 kHz, slap bang in the middle of what is now the Medium Wave broadcast band. The closest frequency, with similar characteristics, available to radio amateurs was Top Band (160 meters); hence the selection of 1960 kHz.

Keith added: "The beacon, built by Andy Talbot, G4JNT, used a sequence of transmissions similar to that of the UK 5 MHz beacons. It used a one-minute transmission on the hour and at each subsequent 15 minutes consisting of the call sign in CW followed by a series of bursts of carrier each decreasing by 6 dB — from 100 W to 25 W, 6 W, 1.5 W, 0.4 W, and 0.1 W. There was then a burst of PSK31 at 100 W with the message: GB3SSS IO7ØIA POLDHU, CORNWALL GB3SSS IO7ØIA POLDHU, CORNWALL QSL GB3SSS@YAHOO.CO.UK.

Davey, G3AGA said: "The antenna used was a Marconi 'T' at 50 feet with eight 65-foot radials, which the National Trust would not allow us to bury. The original was a flimsy affair, but was later replaced by 16 SWG hard-drawn copper. The matching unit was a simple LC circuit feeding the 200 foot length of coax, and giving an SWR of 1:1.3, which varied between 1:1.1 to 1:1.4 depending on how much rain there was."

Thanks to John Gould, G3WKL's help, the beacon idea was steered through the RSGB beacon committee, was licensed by Ofcom and transmissions commenced. The results beat all expectations. By mid-December reception reports had been received from across the UK, Italy, Belgium, Germany, Sweden and New Zealand. There was even one possibly dubious report from Beijing, China. The transmissions continued until the end of January 2007.

But it was the transatlantic reception reports that Poldhu were interested in and it didn't take long for them to flow in.

Many US and Canadian stations heard the beacon, but mostly during the hours of darkness.

Jeff Briggs, K1ZM, author of *DXing on the Edge — the Thrill of 160 Meters*, has a holiday home on Prince Edward Island, Canada. Working as VY2ZM and using a 2×2 vertical element Top Band array with about 8 dBd of gain toward 55°, he reported hearing the beacon at 1031, 1615, 1659 and 1745Z on November 3. It was the same story the next day. Signal levels varied from ESP levels to 599+.

The Atlantic had been bridged on Top Band during daylight hours. Jeff said:

> I went back to VY2ZM from 22/11/06 through to 04/12/06 and did some actual

Ron, GØMRH (rear) and Keith Matthew, GØWYS, make the anniversary contact with VO1MRC on December 12, 2006 at GB2GM.

Part of the impressive display of wireless history at The Marconi Centre.

measuring of the GB3SSS signal at 1750Z using an HP signal generator (verified against an HP spectrum analyzer). On several days, I listened and measured the GB3SSS signal at 1750Z repeatedly at about –91 dBm strength. By way of information, I recall the signal at 0330Z was about –60 to –63 dBm in strength.

It was suggested to me by K1ZZ of the ARRL that I try to copy the EU broadcast stations at 9 kHz spacing and note how early and at what signal levels I could hear them.

I did this and copied signals from Norway, Sweden, UK, Spain, Canary Islands and Switzerland — with their carriers heard as early as 1630Z and *copiable* audio from programming content as low as 855 kHz (Radio Nacional de Espana) by 1750Z.

Joe Craig, VO1NA, of the Marconi Radio Club of Newfoundland also received the signal in daylight. He said the MRCN receiving station comprised a one-wave Beverage aerial feeding a stable DDS (direct digital synthesized) receiver with the automatic gain control disabled and whose line output was connected to the sound card of a computer running the GB3RAL software.

Joe said: "We mitigated noise by selecting a quiet location for the aerial, decoupling both ends of the line to the Beverage and running the computer and radio from a linear power supply. The system operated from the start of the experiment with only four days of downtime."

Joe also reenacted history by receiving the beacon at 2130Z and 2330Z on a short active antenna from the top of Signal Hill in Newfoundland. "I think this was the first time that MF signals have been received from Poldhu at this point since 1901," he said.

But the tests have now thrown up a new dilemma. If the signals could have been propagated across the Atlantic at the time and frequency logged by Marconi, was his receiving equipment sensitive enough to have heard them?

Marconi was using a Bose/Solari Mercury Detector (coherer) — sometimes called an Italian Navy coherer.

Coherers use a direct current (dc) voltage across them to work, the so-called bias voltage. Radio frequency (RF) energy from the antenna changes the dc resistance of the coherer from high to low. Once "triggered" the dc current causes a click to be heard in the headphones.

The coherer is believed to have used a carbon and iron electrode with mercury in between, but as Keith Matthew points out there was mention in Marconi's notes about the use of "dirty mercury."

"Could this have given a layer of mercury oxide in the coherer?" said Keith. "Did the voltage 'punch through' the mercury oxide which would then reseal? If it did then a lot more research needs to be done," said Keith.

The GB3SSS Top Band beacon at the Marconi Centre.

Ron, GØMRH, makes the anniversary contact with VO1MRC on December 12, 2006.

Bart Lee added:

The Solari/Bose detector has been shown, recently by Lane Upton, IEEE, to be about as sensitive as a germanium diode in rectifying mode. My suggestion is that it, like a Branly filings coherer, acts as a pulse amplifier when shocked with RF energy — a very small amount of RF energy and power triggers a much larger amount of power as a dc pulse of the bias voltage and current.

The filings coherer was regarded at the time as very insensitive compared to the mercury oxide detector, which is why Marconi used the mercury oxide variant.

It is hard for us to imagine how quiet the ether was in those days. No QRM, only atmospheric QRN (then far away in the southern hemisphere), very few electrical devices to make noise (especially in Newfoundland!) and for this test, QSB if any was irrelevant.

All Marconi and Kemp had to hear was some timed clicks, and they heard about 38 triple-clicks over two days. Fleming designed the transmitter as double-spark to send only sharp pulses, and Marconi designed his receiver to hear only clicks, taking advantage of the sensitivity (and filtering ability) of the human ear.

Jeff Briggs added:

My own conclusions suggest that Marconi may well have heard what he said he did — if his receiver was about 25 dBm more sensitive than most modern experts think it was, say about –25 dBm.

The eastern coast of VO1 is radically closer to the west coast of G than I am here on Prince Edward Island — so I would have to assume that with similar Rx capabilities, GB3SSS would be even more reliably received there.

If it were actually able to detect a –50 dBm signal — and if we factor in the additional daylight path losses to VY2ZM versus Signal Hill, Newfoundland — it begins to enter the realm of true feasibility, especially when we note I could copy reliably EU BC carriers as early as 1630Z.

Marconi was able to copy Poldhu on 272 kHz at night about several months later in 1902 as he entered North Sydney, Nova Scotia, on a ship. If his receiver was good enough to do that (and this is without question) — then how was it incapable of hearing a signal on or about 850 kHz (or higher) during the day on Signal Hill?

So is this the end of the story? I doubt it. We will never really know whether Marconi heard the signals that day in 1901, although the evidence supporting the claim is beginning to mount up. In any event, we cannot change history or destroy Marconi's memory and legacy. In our heart of hearts do we really want to?

References

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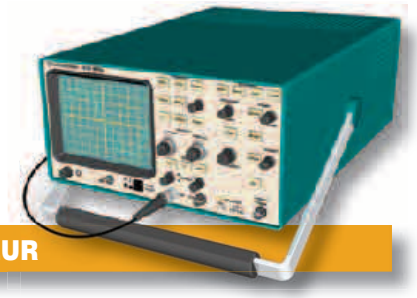
Photos by the author.

Steve Nichols, GØKYA, has been a licensed ham since 1982. He is a member of the Radio Society of Great Britain's (RSGB) Propagation Studies Committee, where he is interested in HF propagation, particularly gray line. He is also a member of CDXC, GQRP and QRPARCI. His daily work is as a business journalist and photographer specializing in technology and avionics. He can be reached at **steve@infotechcomms.co.uk**.

The Doctor is IN



PROJECTS AND INFORMATION FOR THE ACTIVE AMATEUR

Q Merrill, WW6AA asks: I have a long dipole fed with 400 Ω line that goes through the stucco of my house and then goes about 5 feet to the rig, which has built-in tuner. Does it matter whether the balun is placed at rig, outside the stucco or at some magic point (X wavelengths from center) in the line?

A Merrill, the actual impedance at any point on your 400 Ω line feeding your dipole will depend on a number of factors including the length of the antenna, the frequency of operation, the length of the line and the height of the antenna above ground as well as ground conditions. If your antenna is at least λ/2 at your lowest frequency, the SWR on your 400 Ω line is likely to be as high as 10:1. The beauty of low-loss window line is that there will not be much loss on the line even with that high SWR. Thus, the general rule is that you want to use as much of that line, and as little coax, as possible.

The impedance at your transition point could thus vary from 40 to 4000 Ω, as well as through reactive values. Taking the resistive values, the 40 to 4000 Ω would translate into anywhere from a 1.25:1 to an 80:1 SWR when you connect the coax — quite a range! If you have access to an antenna analyzer, it is easy to find out what the impedance is on each band so you know what you're dealing with. Alternately, an antenna analysis program, such as *EZNEC*, combined with a transmission line program such as *TLW*, should give you a good estimate, if you know the dimensions with some accuracy.[1,2] The configuration is shown in Figure 1.

I use a similar setup with a 100 foot dipole fed with about 100 feet of 400 Ω line. I use it from 3.5 to 29.7 MHz with good success recognizing, and taking advantage of, its different directional characteristics on each band, and dealing with the SWR in the station. Because I have less than λ/2 on 80 meters, my 400 Ω SWR is around 25:1.

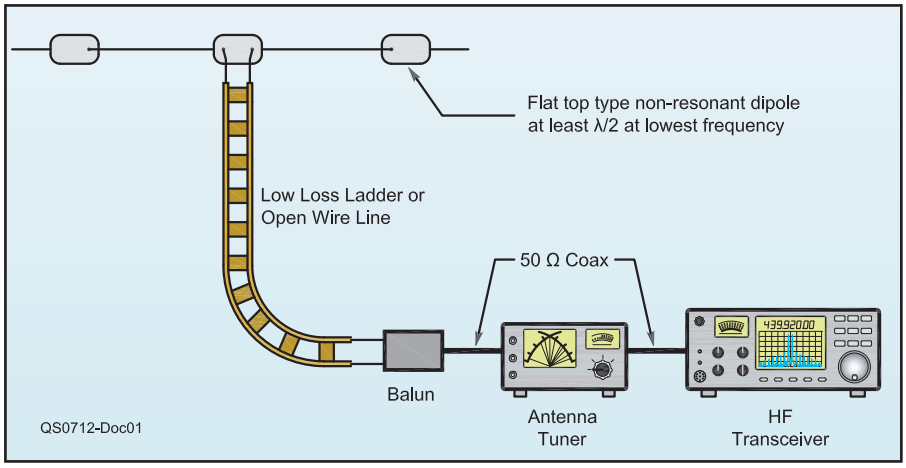


Figure 1 — Antenna configuration with balanced line to coax transition.

The loss picture can change dramatically when the balun and coax are inserted into the picture. A 4:1 balun, for example, will provide an approximate 4:1 transformation ratio for moderate (200 Ω) SWRs, perhaps 4 or 5 to 1. Outside that range, it's anybody's guess. For my case on 80 meters, my 25:1 SWR could end up as a balun load of 16 to 10,000 Ω at the resistive extremes or other complex values in between. So there is a wide range of impedances that can hit the balun and then the coax.

The coax loss will depend on the SWR. Let's assume your 5 foot length is Belden 8237 RG-8. With a 10:1 SWR, you can expect about 0.5 dB loss on 10 meters. With an 80:1 SWR, the loss rises to 1.5 dB. On 20 meters, the loss at 80:1 drops to 0.35 dB.

So, as you can see, even with a large SWR, the loss in 5 feet of coax doesn't make much difference. The balun loss is harder to determine, since it's tough to measure the power out into your ladder line. One way to get a handle on it is to drive the system on a clear frequency (best when the band is dead) with at least 100 W. Either use a steady carrier, if your radio can do that, or a series of dots (don't forget to identify yourself in either case), and check both the cable and balun for heat. If you feel any, you may want to try a different type of balun or change the length of your ladder line.

Q Robert, AB9NP, asks: I have a 100 W HF transceiver and a vintage Heathkit SB-200 linear amplifier. Can I run the amplifier at less than full power to avoid tripping my 15 A circuit breaker?

A You might be able to use it at lower power, but it's not likely to provide as much benefit as you might want. The problem is a 120 V, 15 A circuit doesn't really have enough capacity to run even the usual medium power station.

Linear amplifier manufacturers often provide a power option of either 120 or 240 V for their amplifiers, but they really run better, with less voltage fluctuation in the power branch circuit, at 240 V. If they do operate at 120 V, manufacturers generally recommend a dedicated 15 A (or sometimes 20A) circuit just for the amplifier.

The reason is simple to understand if you start adding up the other station equipment that a single circuit would have to feed. A modern solid-state HF transceiver with internal or external supply is likely to draw at least 4 A. An earlier tube type set will draw even more. Add to that a light, computer and a few other accessories and it is likely you have less than half your 15 A remaining for an amplifier.

[1] *EZNEC* is available from Roy Lewallen, W7EL, including a free sample version that should handle your dipole, at **www.eznec.com**.

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

The amplifier has some overhead as well. The filament supply for the pair of type 572 transmitting tubes in your amplifier will need to provide 50 W of power no matter what the amplifier is doing, likely translating to about 0.5 A of primary power. The other supplies and relay power probably brings that to at least 1 A. That will leave you with about 6 A remaining for the amplifier plate supply, which will be less efficient at lower power levels. At less than 50% efficiency, you will be lucky to get 300 W output. That's until someone turns on another light, or speaks too loud into the mic.

If you could manage that, it would be an increase of less than 5 dB, less than a single S-unit at the far end. I would think it might be worth the trouble to get a 240 V line to the shack to run full power, or at least rearrange your wiring use to make a dedicated 15 A circuit available for the amplifier. With the Heathkit's rated 600 W output, you will have almost an 8 dB increase — that starts to make quite a difference!

Q Don, N4TZH, asks: Well, ARRL Field Day is over and I have to say it was a success. Our club, C3I Amateur Radio Group, operated class 2A (two simultaneous transmitter class) in South Florida. We had two HF stations, a GOTA (get on the air station for beginners) and a VHF/UHF station.[3] We had pretty good antenna separation, but there were still times when the band combinations weren't right and you would have the CW station wiping out the other station's receiver. We worked one station that was in class 19A. That's potentially 21 radios operating at any given time! How do you accomplish this without interference?

A Good question — and now's the time to plan for 2008 Field Day! With the requirement that all equipment (including antennas) must lie within a circle whose diameter does not exceed 300 meters (1000 feet), there isn't a lot of room to physically separate antennas from each station. Having 19 transmitters pretty much implies (at least) both phone and CW operation on most of the popular bands. In addition, the GOTA station will likely show up on whatever band is working best at any time.

The issue is keeping transmitted energy from one station, say 40 meter CW, out of another on the same band, say 40 meter phone. Typically, that means a frequency separation on the order of 100 kHz. If I were Field Day manager, I'd do the following, in order of likely importance:

- Design antennas that are as far apart and couple as little as possible for stations on the same bands — this means maximum separation, but also one horizontal and one vertical if feasible. For 40 meters and lower, a carefully made loop can often be adjusted to deeply null a station from a particular direction.
- Select equipment that includes receivers with high dynamic range. While for the usual contest environment, the 5 and 2 kHz spacing performance may be the most critical, here the wider spacing dynamic range (20 kHz data) is most important.
- Add narrow receive filters in the line to each receiver. The usual receive front-end filters do not attenuate much across the entire band. It is possible to buy or build filters that will operate only over a 10 or so kHz range to reduce the other mode signal. Some radios, notably the FT-2000 and FT-9000 have sharp pre-selector options that should help a lot.
- Have a frequency plan that minimizes the effect of various spurs and unintended receiver responses. You may find that particular frequency pairs interfere less than others. Test before you deploy!
- In addition to two stations in the same band, harmonic and other responses can be a problem. The usual low-pass filter cuts off at 30 MHz. If you are trying to keep your 40 meter CW transmitter out of your 20 meter receiver, a 30 MHz low pass won't help. You need a tuned half-wave or other type of single band filter that notches out the second harmonic. You also must have radios with low transmitter composite noise (oscillator phase noise plus broadband noise in the transmitter) to prevent interference from extra signals generated in the transmitter.

ARRL Antenna Book Editor Dean Straw, N6BV, added some thoughts. If you're using Yagi antennas on the various bands, make sure that they are oriented so that the tips of the elements are "end-on" to the other Yagis. This places the nulls in the pattern for each Yagi in the null of the other Yagi. He says his club did that last year and had absolutely no interference between 20 meter CW and SSB or 40 meter CW and SSB. Yes, he was using a three element Yagi on 40, together with a rotatable dipole. Even the GOTA station didn't cause interference with their dipole.

Q Richard, WAØKKC, asks: Manufacturers don't say much about the implications of using different types of masts on the performance of their Yagi beam antennas. Do metal masts have an impact on performance and what can be done about it?

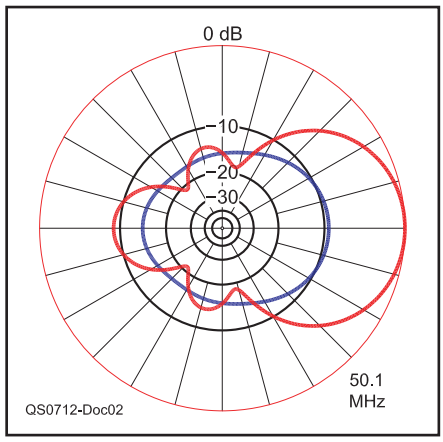


Figure 2 — Azimuth pattern of three element 6 meter Yagi in free space (red), compared to the same antenna with a 10 foot mast behind the driven element.

A Metal masts can indeed make quite a difference. If the Yagi is horizontal, as most HF Yagis are, it makes almost no difference since the vertical mast has minimal coupling to the perpendicular elements. On the other hand, a vertical Yagi with a vertical mast at its usual balance point will significantly degrade the pattern.

Figure 2 shows the azimuth pattern of a three element vertical NBS reference 6 meter beam in free space. Overlaid is the pattern of the same antenna with a 10 foot (chosen to be non-resonant) metal mast 3 inches behind the driven element. The difference should give most readers pause.

There are a few solutions to the vertical Yagi mast issue. A nonmetallic mast solves the problem completely, but only if the coax is run along the boom and well clear of the rear. Thick wall PVC may be suitable for light arrays, while modern carbon fiber poles should rival aluminum in strength. For short Yagis, a mast at λ/8 or farther behind the reflector is a good compromise. The best approach is to have two horizontally spaced vertical Yagis, either phased together for the same band, on add one for a different band. The vertical mast can then be at the balance point of the horizontal structure between them and, if λ/8 away from the elements, will result in acceptable pattern distortion, at least in this *EZNEC* model.

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

[3]ARRL Field Day rules allow GOTA and satellite transmitters in addition to the ones that determine the class.

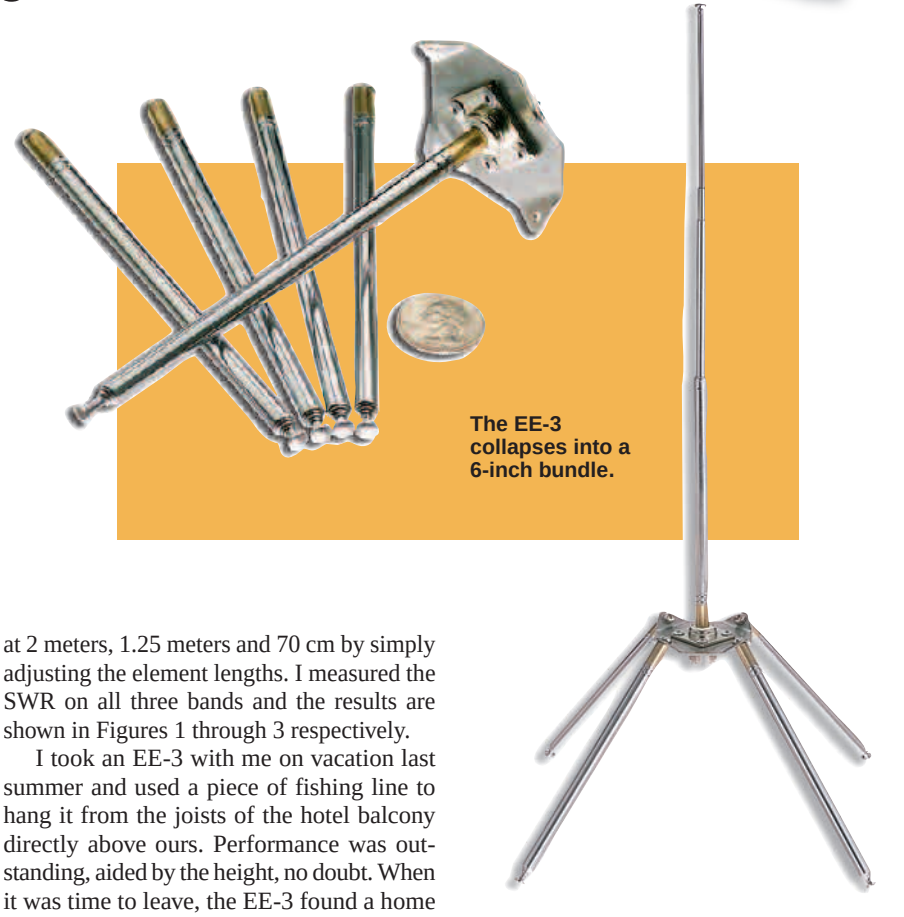
Evans Engineering Tri-Band Portable Antenna

"Aw, geez! Are they really reviewing a ground plane antenna in *QST*?"

Yes, we are, but look closely. The Evans Engineering Model EE-3 is a ground plane unlike any other. In fact, it falls under the venerable why-didn't-I-think-of-this category of ham inventions.

Anyone can build ground planes for VHF+. I've built them from coat hangers and maybe you have, too. They are simple omnidirectional antennas that offer decent performance for their size. When used with handheld transceivers, they beat the pants off the so-called "rubber duck" antennas supplied with these radios.

What the EE-3 offers that traditional ground planes do not is easy portability. That's because the EE-3 is made of telescoping elements. The vertical element is fixed to a base that's outfitted with an SO-239 coaxial connector, but the radial elements can be removed. The EE-3 can be assembled in less than a minute (yes, I timed it) and will disassemble just as quickly, becoming a 6-inch bundle of tubes in your pocket. This antenna is intended for temporary use. You put the elements together, adjust their lengths for the desired band and tape the EE-3 to a convenient nonconductive support, or hang it from the ceiling. If you need to move, the EE-3 easily moves with you.



The EE-3 collapses into a 6-inch bundle.

But How Well Does it Work?

The EE-3 works as well as any ground plane you've probably tried, which means reasonably well. The antenna is made resonant at 2 meters, 1.25 meters and 70 cm by simply adjusting the element lengths. I measured the SWR on all three bands and the results are shown in Figures 1 through 3 respectively.

I took an EE-3 with me on vacation last summer and used a piece of fishing line to hang it from the joists of the hotel balcony directly above ours. Performance was outstanding, aided by the height, no doubt. When it was time to leave, the EE-3 found a home in my jacket pocket faster than my wife could say, "Get that #&*$@ thing off the balcony!" (Well, maybe not quite that fast.)

The EE-3 seems ideal for public service applications, and it may also be a worthy candidate for apartment dwellers. Just collapse the elements and pull up the string whenever the landlord comes knocking!

Manufacturer: Evans Engineering, 2253 Norwegian Dr, #25, Clearwater, FL 33763; **www.ee-3.com**. *$19.95 plus $2.15 shipping and handling.*

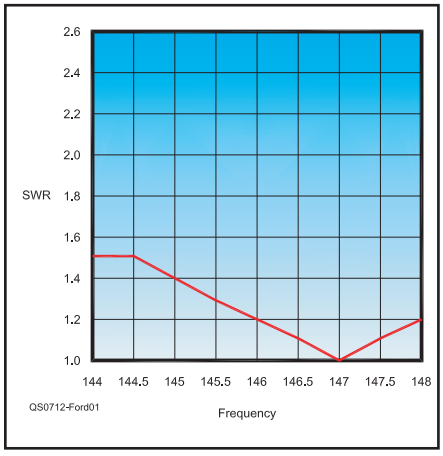


Figure 1—EE-3 2-meter SWR plot.

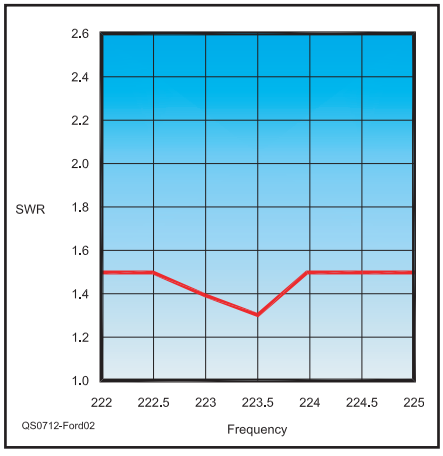


Figure 2—EE-3 1.25-meter SWR plot.

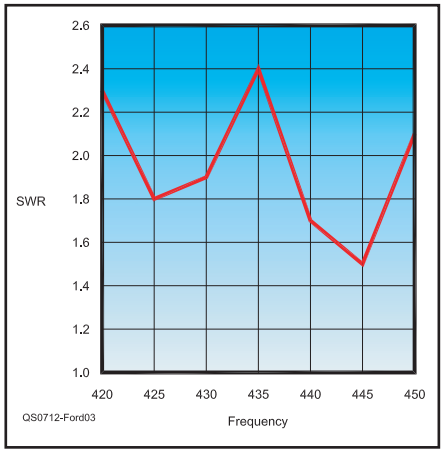
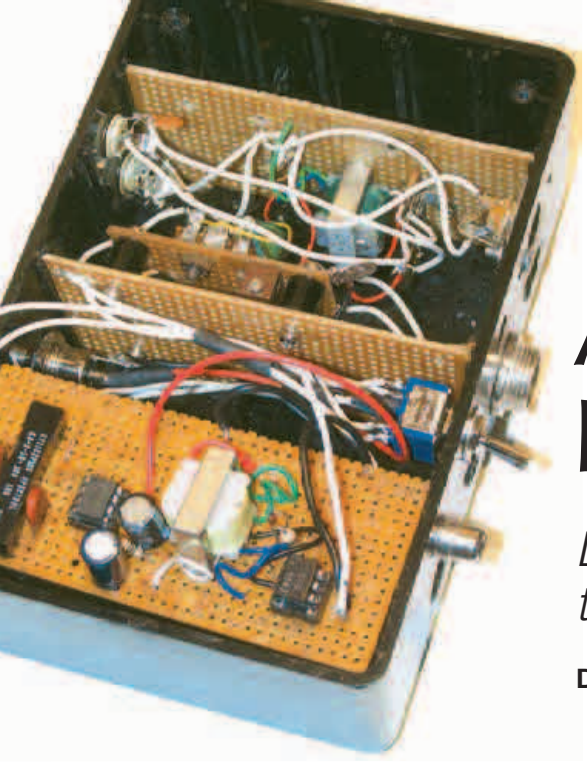


Figure 3—EE-3 70-cm SWR plot.

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



A Computer Interface for CW

Let your PC do the keying with this elegant accessory.

Donald Margeson, W2SBA

In the last couple of years some of my motor skills have deteriorated to some degree. I make many more mistakes with my fist while sending code than in my earlier years. I have experimented with using a bug as well as fingering a paddle or two into an electronic keyer, but the straight key always served me the best. About a year ago, like a bolt from the blue, the thought came to me that maybe, just maybe, a keyboard might be the answer. So, into the computer world I blundered.

The Answer at Last?

I searched through *QST* and found just the item I was looking for — an interface that would provide access to digital CW in a flash or even sooner.

This clever system took characters entered at the computer keyboard and sent them out the sound card to allow them to make CW by putting a tone into the SSB transceiver's MIC jack.

Upon installing this ultimate in technology I found I had been sent to another world where they spoke a language far different than that to which I had grown accustomed. I must say that there were a few words I recognized, such as *mic* and *audio*. I did find, after many hours perusing ARRL sources and HELP tabs that if I pushed the right buttons a CW signal as a tone might appear at an accessible jack, which could be coupled to the MIC input on my transceiver.

Now for the Bad News

In the meantime the sunspots continued their downward travel. Of course I suddenly realized that using the mic interface and SSB mode cut out the sidetone, eliminated the CW filter and eliminated the possibility of parallel keying with my straight key, all so much a part of my usual operating style. Then the worst blow of all, the first dot and first third of the dash (if it were the first character to be transmitted) were missing due to VOX delay. This adventure over several months was finished. I considered phone, going back to the straight key and shelving the ultimate interface. I tried to forget this fiasco.

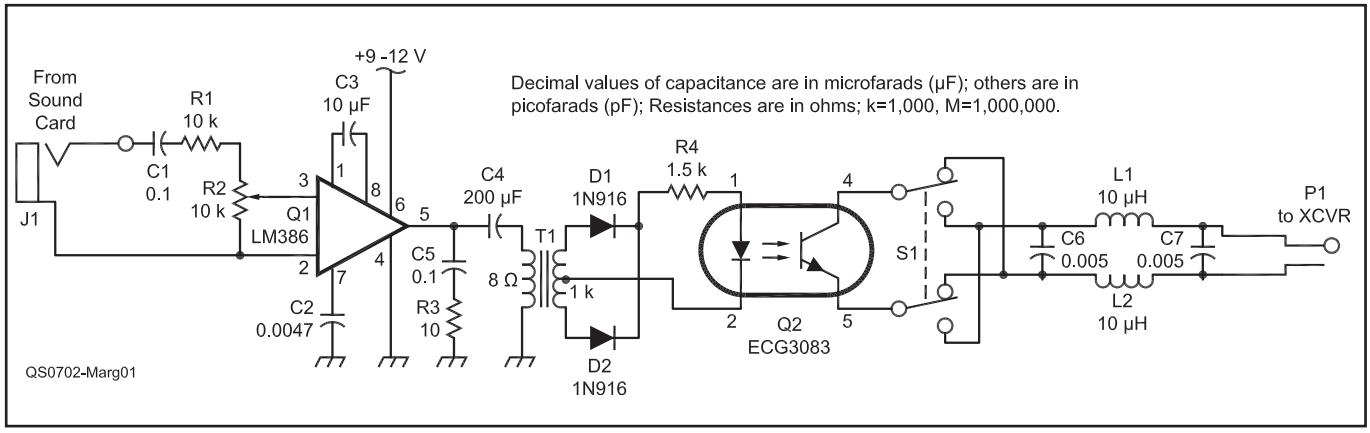


Figure 1 — Schematic diagram and parts list for the CW interface. See www.mouser.com.

C1, C5 — 0.1 µF ceramic capacitor.
C2 — 0.0047 µF ceramic capacitor.
C3 — 10 µF, 25 V electrolytic capacitor.
C4 — 200 µF, 25 V electrolytic capacitor.
C6, C7 — 0.005 µF ceramic capacitor.
D1, D2 — 1N916 or equivalent small signal diodes.
J1 — Miniature audio jack to match sound card cable.
L1, L2 — Miniature 10 µH RF choke.
P1 — Plug to match transmitter key jack.
Q1 — LM386 audio amplifier integrated circuit.
Q2 — ECG3083 optical isolator (Mouser 526-NTE3083).
R1, R3 — 10 kΩ, ¼ W resistor.
R2 — 10 kΩ potentiometer.
R4 — 1.5 kΩ, ¼ W resistor.
S1 — DPDT toggle switch.
T1 — Miniature audio output transformer 1000:8 Ω (RadioShack 273-1380).

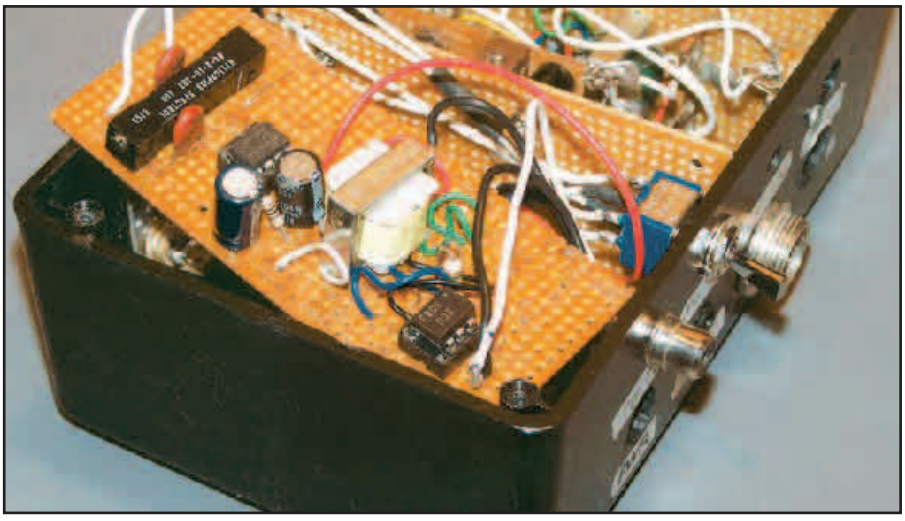


Figure 2 — Construction details of CW interface, built into project box with other station accessories.

The Solution at Hand

As I held my head in despair, I heard a voice! Rectify the sound card output, feed an optical coupler, pass through a polarity reversing switch (to permit plus or minus keying). *Voila*, a digital CW key that will plug into a CW jack, and allow use of all the CW functions on the transceiver.

Figures 1 and 2 should adequately describe the final "black box." The photos show the unit mounted in a box with other boards for RTTY and PSK31. This has solved my problem for some time and should for you as well. It is simple to build and adjust and will get you back on the air very quickly — with a good fist.

There are likely many programs that can be used with this interface — basically any that generate Morse sound card characters in response to keyboard character selection should work. Two that I have successfully employed are *CwType* available from **www.dxsoft.com** and the *MixW* system (with or without receiver decoder) available from **www.mixw.net**.

Don, W2SBA, is an 84 year old who has been an Amateur Radio operator since 1946 and a CW enthusiast since 1950. He holds an Amateur Extra class license. You can reach Don at 35 Edgewood Dr, Baldwinsville, NY 13027 or at **w2sba@arrl.net**. QST

NØAX

HANDS-ON RADIO

Experiment #59 — Smith Chart Fun I

The ways and means of transmission lines can be mysterious and hard to understand. Is the venerable Smith Chart a magic talisman of instant knowledge? No, but it is a window on what's happening "inside the line," enabling a better understanding of transmission line mechanics.

Smith Chart Background

QST articles and the Wikipedia Web pages on the Smith Chart (**en.wikipedia.org/wiki/Smith_chart**) are good references with deeper discussions than this column can provide. You can read these articles first or use them as references throughout this column.[1]

Before discussing the chart, let's back up a step. All impedances consist of two *components*, resistance and reactance. Graphically, these components are represented as a pair of axes at right angles, as in Figure 1. The horizontal axis represents resistance — positive to the right of the origin and negative to the left. The vertical axis represents reactance — positive (inductive) above the origin and negative (capacitive) below.

All possible impedances correspond to one point (Z) on that graph based on the values of resistance and reactance. Those two values are the *rectangular coordinates* of the impedance. Hold that thought.

In a transmission line, when a wave of RF voltage and current encounters an impedance different from the characteristic impedance of the transmission line, Z_0, some of the energy in the wave is reflected back along the line. The phase of the voltage and currents making up the *reflected* wave will differ from those in the incoming or *incident* wave depending on the value of the impedance causing the reflection.

The incident and reflected voltage and current waves combine at every point along the line. At each point, the combination results in voltage and current with a phase relationship different from *either* the incident or reflected waves. It is as if the same energy in the line had been applied to an impedance with values of resistance and reactance that create the same phase relationship. If you cut the line at that point and replace the section beyond the cut with actual components creating that *equivalent impedance*, there would be no change to the waves in the remaining section of the line.

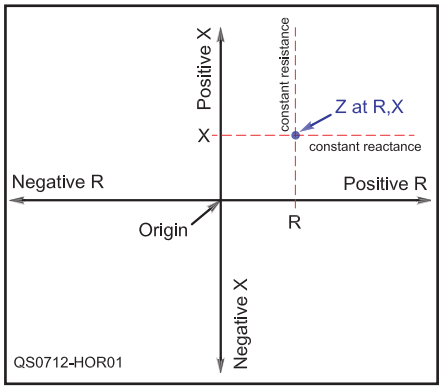


Figure 1 — This graph shows the rectangular coordinates for any impedance against the resistance (R) and reactance (X) axes.

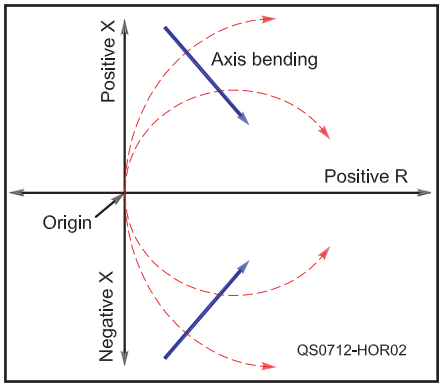


Figure 2 — Distorting or mapping the rectangular graph captures all of its right-hand side impedances inside the circle formed by the bent reactance axes. This is the basis of the Smith Chart.

The voltages and currents of both waves also vary with distance along the line because of the ac nature of the waves. This results in different combinations of incident and reflected voltages and currents and their equivalent impedance. For example, if the equivalent impedance looks like 5 Ω of resistance and +20 Ω of reactance at one point, a bit farther along the line, the equivalent impedance might be 20 Ω of resistance and –5 Ω of reactance. That means the point on the graph of resistance and reactance also moves around with position in the line, returning to its original combination of voltage and current every half-wavelength (λ/2).

Smith Chart Construction

What does all this have to do with the Smith Chart? The formulation describing how that impedance point moves around on a graph of rectangular coordinates is defined by

$$Z = Z_0 [(Z_L + jZ_0 \times \tan(\beta l)) / (Z_0 + jZ_L \times \tan(\beta l))]$$

The path it describes on the graph does not lend itself to easy use. (βl gives the electrical position along the line.) That path does not lend itself to easy use. What Mr Smith discovered, however, was that if you distort the rectangular graph in a certain way (called a *mapping*), the path becomes a circle!

What is this magic mapping? Imagine yourself standing at the origin of the rectangular graph with the positive resistance axis in front of you and the negative behind. The positive reactance axis starts at your feet and goes straight up and the negative straight down. All of the axes extend to infinity.

Now imagine reaching up over your head and bending the positive reactance axis down in front of you (make your favorite bending noise) in a semicircle whose far end then meets the far end of the positive resistance axis. Do the same for the negative reactance axis, bending it up instead. The negative resistance axis still extends behind you, as straight as ever. This process is sketched in Figure 2.

Step off to the side and view your handiwork. You have created a circle from the two reactance axes bisected by the resistance axis. The infinite points of all three join together at the right of the chart. All of the points that were once in the right-hand side of the rectangular graph are now somewhere inside or on the boundary of that circle. Points on the left-hand side of the rectangular graph are now outside the circle. Nothing has been lost, just squashed or stretched.

The Smith Chart (shown in Figure 3) only contains the circle and what's inside. It ignores everything outside the circle because of the negative resistance value of those points. Originally they were on the left side of the

[1]G. Hall, K1PLP, "Smith-Chart Calculations for the Radio Amateur, Part I," *QST*, Jan 1966, pp 22-26, and "Part II," Feb 1966, pp 30-33. Also see D. Walraven, K5DVW, "Understanding SWR by Example," Nov 2006, pp 37-41.

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graph. Those impedances can not be present in a transmission line.

The circles and arcs on the Smith Chart show what happens to straight lines on the rectangular graph after remapping. Lines of constant resistance originally vertical and on which all points had the same value of resistance are now nested as *constant resistance circles* that share a common point at the far right of the Smith Chart. That should make sense because all of those straight lines originally went where? To infinity — now the point at the right side of the Smith Chart. Horizontal lines of points having the same reactance are now bent into *constant reactance arcs* with one end on the outer circle (the original vertical reactance axes) and the other end at…yes, that's right…infinity! This distortion results in the path of the impedance point becoming a circle on the Smith Chart as we look at each point along the line.

Making a Circle

You can see how this works by plotting the circle for yourself. You'll need an SWR analyzer that shows both resistance (R) and reactance (X) values. It does not need to show the sign of the reactance.

Cut a piece of 50 Ω transmission line approximately an electrical λ/2 long at 10 MHz. The free-space λ/2 at 10 MHz is 15 meters. If the velocity of propagation of your feed line is 0.66, the length of line needed is 9.9 meters (15 × 0.66).[2] Put a coax connector on one end, short the other end and use your analyzer to find the lowest frequency at which the meter show 0 Ω (or a minimum value) of X. That is the frequency at which the line is electrically λ/2 long. Note this frequency. Replace the short with a 150 Ω resistor. Your SWR meter should now show an SWR of 3:1 and the impedance at the analyzer should be 150 Ω of R and 0 of X. On the rectangular graph, this would be a point on the horizontal resistance axis at 150 Ω.

Print out a copy of the Smith Chart.[3] If you look for the point of 150 Ω of R and 0 of X, you will find it squashed way over in the nest of circles at the right-hand side of the chart — not very easy to use. Mr Smith avoided the problem of big numbers by *normalizing* all of the coordinates to the characteristic impedance of the line, Z_0. Normalization replaces the values of all points by their ratio to Z_0, in this case dividing them by 50 Ω. So instead of the impedance you just measured being found at 150 on the horizontal axis, it is found at 150/50 = 3.0 instead. Much better! From here on, all of the values you plot on the Smith Chart will be the value you read on the meter divided by 50 Ω.

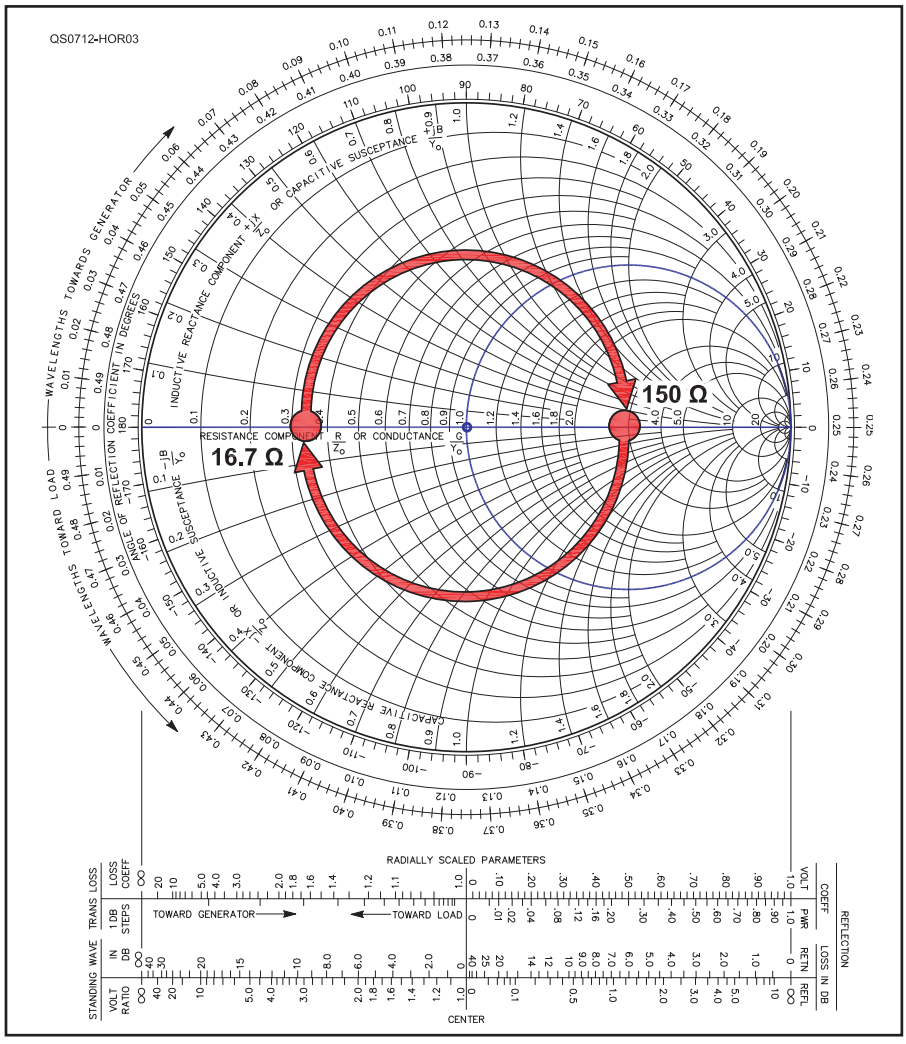


Figure 3 — Plotting the impedances measured on an SWR analyzer forms a circle as the electrical length of a line of fixed length increases with increasing frequency.

Increase the frequency on the analyzer in 0.5 MHz steps, recording R and X on the Smith Chart. Because the meter may not show the sign of the reactance, assume the reactance values become negative (capacitive) as you increase frequency. Stop when you see the reactance go to zero again, halfway around the Smith Chart at a resistance near 50/3 = 16.7 Ω, plotted as 16.7/50 = 0.33 on the Smith Chart's horizontal axis. This is the frequency at which the line is 3λ/4 long, approximately 13.3 MHz. While you are recording the points, note that the SWR reading does not change.

The points you have plotted should form a semicircle as shown in Figure 3 with its lowest point approximately 0.6 Ω of R and –0.8 Ω of X or an unnormalized impedance of 30 – *j*40 Ω. Continue increasing the frequency until the points return to the horizontal axis near the 3.0 mark at which you started. The line is now 1 λ long and the frequency should be twice what it was when you started. The complete circle of points is called a *constant SWR circle* because all the points have the same SWR.

If you'd like to see the reason the Smith Chart is so helpful, plot these normalized values on a piece of rectangular graph paper scaled to show 0 to 5 Ω on the horizontal axis and –5 to +5 Ω on the vertical. Egads! Which path would you rather work with? I thought so.

Next Month

This was only the beginning! Next month, we'll explore more of the Smith Chart, so hang on to that analyzer and continue to review the referenced articles and books. I hope the Smith Chart is starting to make a little more sense now!

References

A number of articles on the Smith Chart are listed by the ARRL Technical Information Service's Publication's Search Web page at **www.arrl.org/tis**. Enter "smith chart" in the KEYWORD window. The *ARRL Antenna Book* also discusses the Smith Chart.[4]

[2]R. D. Straw, Editor, *The ARRL Antenna Book*, 21st Edition, p 24-20, Fig 23. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 9876. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop/**; **pubsales@arrl.org**.

[3]**www.printfreegraphpaper.com/**.

[4]See Note 2.

The Skunk at the Digital Party

It's time to clean up those stinky signals!

Steve Ford, WB8IMY

Nice to meet you on PSK31, Steve. Glad to hear I am new DXCC for you. Here is my QSL address— *Brrrrrrrrrrrrrrrrrrrrrr*

…so thanks for the QSO. Must sign off quickly. 73 and—

Brrrrrrrrrrrrrrrrrrrrrr

At about this time I'm staring slack-jawed at my computer monitor, watching helplessly as a nearby broad-as-a-barn-door PSK31 signal obliterates the text from my precious DX contact. If it was a matter of the other guy accidentally firing up on the frequency, or being so strong that he swamped my receiver, I'd understand. That's life in Amateur Radio. But I am doomed to leave this contact unfinished simply because a brother amateur on a nearby frequency has a dirty signal. Intentionally or otherwise, he is pumping too much audio into his transceiver and creating grossly distorted RF that is splattering to kingdom come.

Tuning for Maximum Smoke

For nearly a decade hams have been using their computer sound cards to enjoy digital communications on the HF bands. PSK31 is the most popular digital mode, but there are many others. The software is either inexpensive or free altogether, and hooking up the necessary cables and hardware is easy.

As my mother would say, however, "It's all innocent fun until someone puts their eye out." With sound card hamming, that moment arrives when the new operator decides to adjust his audio output level. He watches his RF wattmeter and cranks up the audio, pushing the indictor higher and higher — tuning for "maximum smoke." He wants the most bang possible for his RF buck and he won't stop until he gets it.

What he *should* be watching instead is his ALC (Automatic Limiting Control) meter. Almost every transceiver has one. Most of the time this meter should read zero, but when too much audio is applied to the radio, the ALC struggles to keep the transceiver from being overdriven. When operating HF digital, a frantic ALC meter is a sure sign that you are sending too much audio to the radio. Chances are excellent that you are overdriving the audio stages of your transceiver and creating a hideous signal that's sure to set teeth on edge (see Figure 1).

The Power Myth

If you reduce the audio output of your sound card to the point where the ALC is reading zero, it's likely that you'll see a significant drop in your radio's RF output. That's okay — *really*. One of the great advantages of HF digital is that you don't need a rock-crushing signal to work the world. Most of the people I chat with are running 50 W output or less.

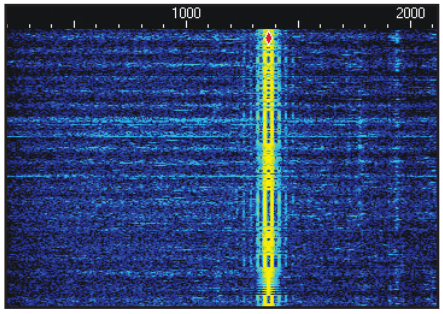


Figure 1 — A real-life stinky PSK31 signal. Notice the lines to the left and right of the signal track in the waterfall display. This is actually a mild offender; I've seen much worse with garbage throughout the display.

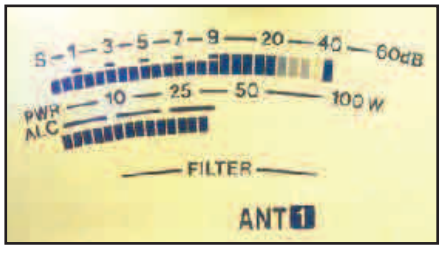


Figure 2 — Lots of RF output (top scale), but way too much audio. Notice the ALC begging for mercy in the bottom scale.

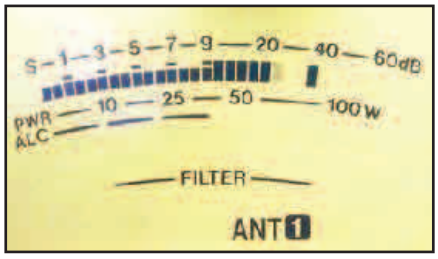


Figure 3 — Much better! I've lost a bit of RF output (top scale), but now there is no ALC activity (bottom scale).

The IMD Meter by KK7UQ helps you keep an eye on your signal quality.

In Figures 2 and 3 you'll see actual before and after photos showing the effects of overdriving a transceiver. Notice in Figure 3 that when the sound card output is reduced and the ALC drops to zero, the RF output drops a bit as well. Your output may drop much more than this. Trust me — you won't miss it.

In most cases, ensuring that the ALC rests at zero will be sufficient to guarantee a clean signal, but not always. When in doubt, ask. Once you make contact, ask the other guy how your signal looks at his end.

You can also purchase devices such as the KF6SVK PSKMeter (**www.ssiserver.com/info/pskmeter/**) or the KK7UQ IMD Meter (**www.usinterface.com/**) and keep an accurate eye on the quality of your PSK31 signals.

Finally, you know what they say about bad breath — even your best friends won't tell you. When you encounter a nasty signal on the air, you're not doing the operator any favors by keeping quiet. *Politely* tell him he has a problem and offer to monitor his signal as he reduces his audio level or otherwise attempts to fix it.

And if someone tells you that your digital signal is stinky, don't become defensive. ("How dare you!") Just lower the audio output until you're pronounced "clean." Everyone will be happier and you'll sleep better knowing that you aren't polluting the airwaves.

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

WR1B

HINTS & KINKS

ISOLATION TRANSFORMERS

◊Getting rid of a ground loop was very difficult with my Yaesu FT-920 transceiver and the attached amplifiers. The exciter and peripheral equipment were operating on 120 V and the amplifiers on 240 V. The problem turned out to be uneven current on the 240 V line coming to the radio shack, which was about 75 feet from the main breaker box. Even a ground rod in a 35 foot well next to the rig did not help.

The cure turned out to be an isolation transformer. By dropping the 240 V line to 120 V to drive the exciter and peripherals, the balance on the 240 V line became even, and eliminated phase shift and the current on the neutral line. Result — no ground loop. — *73, Bill Trippett, W7VP, 15525 NE 195th St, Woodinville, WA 98072*; **w7vp@arrl.net**

PACKET RADIO AND THE YAESU FT-221

◊The Yaesu FT-221 dates to the late 1970s and is a solid-state, all mode 2 m rig whose still fresh design complements the FT-301 HF series. Commanding a premium price on eBay, but owned by many Amateur Radio operators that prize its SSB and CW abilities, it makes a very adequate rig for packet radio at 1200 baud with its 15 W (input) FM power level.

Most who employ the FT-221 for packet radio will inject ASFK through the front panel mounted, 4-pin mic jack and take audio from the nearby ⅛ inch phone plug. A more effective connection may be had using the rear panel's 5-pin DIN accessory socket. Connecting a TNC here allows the user to preserve the microphone and headphone connections for normal use. This socket is identified in the Yaesu manual as the interface for a touch-tone keypad, but since receive signals are available, it is ideal for packet.

Interface Details

The owner's manual is not altogether clear on the signals found at each of the socket's pins. I cross-referenced the schematic and confirmed the functionality as summarized in Figure 1.

Audio-in and audio-out work well with TNC signal levels without modification. In my testing, both a Timewave PK-232 and an MFJ-1270 produced good results transmitting and receiving local APRS packets.

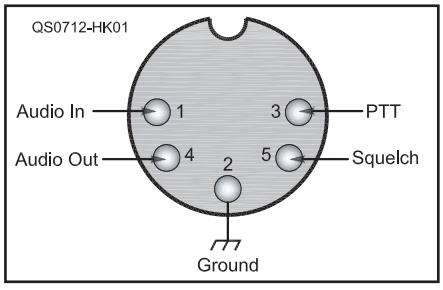


Figure 1 — Connections at 5-pin DIN plug to fit FT-221 accessory socket. (Note that this is a mirror image of the socket's pins.)

Audio-in and audio-out levels are not affected by the Mic Level or AF Gain controls, so a user may mute the packet burst by turning down the volume. Another way is to insert an unused ⅛ inch plug at the headphone jack.

General Observations on the FT-221

The FT-221 VFO is subject to some drift during warm-up, but is sufficiently stable for the generous bandwidth of an FM voice channel.

The Yaesu design provides for a dozen crystal-controlled channels. Those with particular sensitivity to drift might consider going "rock bound," which would also permit rapid switching from, for example, APRS monitoring to TELPAC.

Various CCTSC solutions are available to permit repeater access. Communications Specialists carry two versions of their externally programmable encoder and several companies offer kits for internal installation, using smaller but cumbersome DIP switches.

Mutek once sold a very well regarded front-end for low signal work and it appears they may once again be made available on a custom-order basis.

The typical failure mode for 1970s vintage Yaesu equipment is Relay 1 (RL1), which weakens over time and fails to properly connect various circuits. These relays are still manufactured by Matsushita (Japan) but are not presently imported to North America. They are available directly from Yaesu at a premium price.

Conclusion

Since late winter 2007, I have been using two FT-221 radios for remote weather station telemetry to the county EOC, and simple APRS beaconing and monitoring. As these rigs are thirty years old, typical maintenance was required, including replacement of RL1. They have functioned flawlessly, however, in 24/7 operation with observed two-way results comparable to other stations in the neighborhood, using either a Cushcraft Ringo with Belden 9913 or a RadioShack discone antenna with plain old RG-8 coax. — *73, Joseph Ames Jr, W3JY, 10 Andrews Rd, Malvern, PA 19355*; **w3jy@arrl.net**

IMPROVING ALUMINUM CHASSIS BOX RIGIDITY

◊Have you noticed that the common "store-bought" aluminum chassis boxes available at your local electronics parts stores have gotten "softer" over the past few years? I have some very old aluminum chassis boxes, and they seem to be made with thicker material than the newer versions carried at my local electronics parts shop. This did not bother me too much in the past, but recently, while testing one of my 10 GHz radio systems, I noticed that the frequency of my 2556 MHz RF synthesizer would "wobble" when I squeezed or pushed on its cabinet. Figure 2 shows the synthesizer in the original box.

I decided to stiffen the box by adding some small lengths of half-inch aluminum angle stock to the covers. I drilled holes every half-inch or so along the edges of the angle stock, and into the box. Small sheet metal screws pull the box tight, as seen in Figure 3. Figure 4 shows the 2556 MHz synthesizer installed in one of my 10 GHz rigs.

By the way, the 2556 MHz synthesizer is very handy for use as a local oscillator in 10 GHz systems. This project, and many others, appears on the San Bernardino Mi-

KH6WZ

Figure 2 — Many "store-bought" aluminum chassis boxes these days are made of flimsy material. In the case of my 2556 MHz synthesizer, some frequency wobble was attributed to the wobbly box.

Larry D. Wolfgang, WR1B ♦ Senior Assistant Technical Editor ♦ h&k@arrl.org

KH6WZ

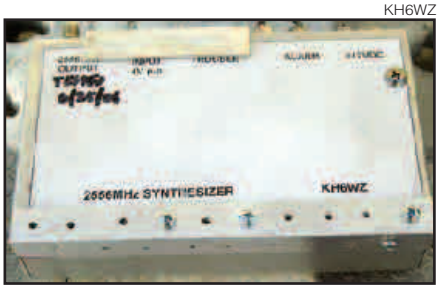


Figure 3 — Fastening some small angle aluminum stock along the seams makes the box more rigid.

KH6WZ

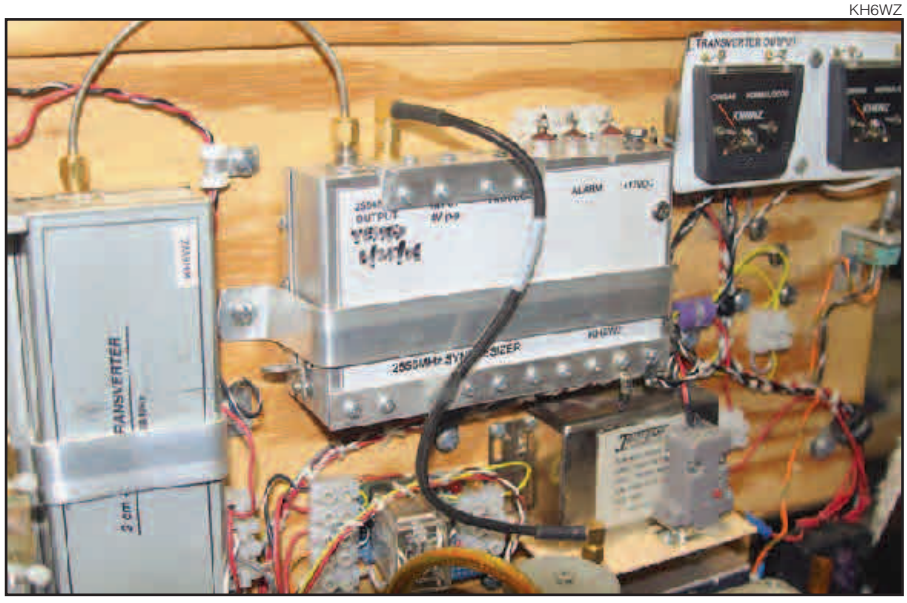


Figure 4 — The 2556 MHz synthesizer installed in the X-band radio called "Ms June." [Many of the San Bernardino Microwave Society (SBMS) members name their rigs, much like sailors name their ships. — *Ed.*]

crowave Society Web site: **www.ham-radio.com/sbms/.**

For more information about my synthesizer, see Microwave Group of San Diego, "Modification of the Rectangular 3036/3236 Qualcomm Synthesizer." The Web version by Ed Munn, W6OYJ, is at: **www.ham-radio.com/sbms/sd/rplldoc1.htm**. — *73, Wayne Yoshida, KH6WZ, 16428 Camino Canada Ln, Huntington Beach, CA 92649;* **kh6wz@arrl.net**

CRACKIN' WALL WARTS — A HOW-TO TIP

◊All of us have several wall-warts around the shack to power those hand-held radios and/or recharge battery packs. When they quit working, most often it is because of a broken wire in the dc lead. If the break is near the plug end of the wire, the repair is simple; just cut off the plug and solder on a new one. All too often, however, the break is where the lead exits the wall-wart, and there is not enough slack to make a decent splice. So, we have the choice of buying a new wall-wart, or opening the old one.

In times past I have attacked the wall-wart with a hacksaw, but that pretty well eliminates reusing the case. Somewhere I read a better method, and since it seems to be largely unknown, I want to pass it along.

Usually a wall-wart can be cracked open without damaging the case. Simply clamp it in a bench-top vise, corner to diagonally opposite corner, with the ac pins up and with the plastic base above the vise jaws. Figure 5 shows a wall-wart ready to be cracked open. Begin tightening the vise until you hear it crack, or pop. Loosen the vise, turn the wall-wart 90° to the other corners, and repeat the process. At this point the base and the cover should have separated. See Figure 6. If not, return to the first position and try again.

With the cover removed, it is a simple matter to replace the broken lead, or even replace a shorted diode or capacitor. Figure 7 shows the wall-wart ready for repair. After the repair, the cover can be glued back together, but I prefer to use plastic tape as shown in Figure 8, so that future repairs will be even easier. — *73, Curt Goodson, W4QBU, 12905 Watermill Cv, Austin, TX 78729*; **w4qbu@arrl.net** and *Mitch London, KD5HCV, 5601 Lewood Dr, Austin, TX 78745*; **kd5hcv@arrl.net**

KD5HCV

Figure 5 — This wall-wart has been carefully placed in a vise, and is ready to be cracked open.

KD5HCV

Figure 6 — The wall-wart case has started to split open under gentle pressure from the vise jaws.

KD5HCV

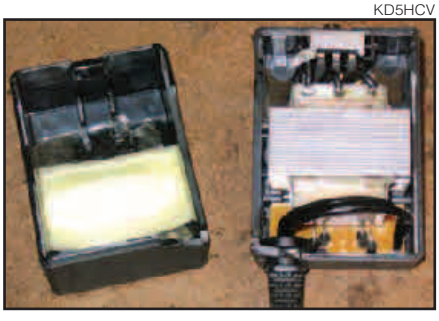


Figure 7 — With the case carefully cracked open, you can repair a broken wire or replace a diode or capacitor.

KD5HCV

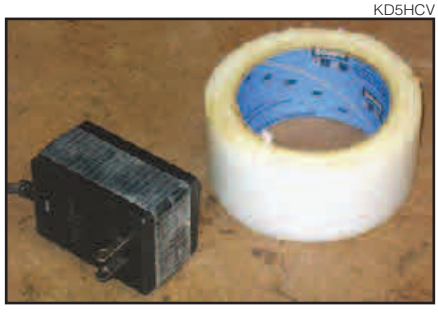


Figure 8 — You could glue the case back together, but heavy plastic tape will make the next repair easier.

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

PRODUCT REVIEW

Yaesu FT-450 HF and 6 Meter Transceiver

Reviewed by Rick Lindquist, N1RL
ARRL Contributing Editor

The FT-450 is Yaesu's latest entry in the HF/50 MHz transceiver field. It's a sturdy and competent general-purpose radio in the under $1000 price class. It's generously endowed with an array of features, a few borrowed from its more vaunted brethren. It is *not* a mini FT-2000, however, as some Internet wags have speculated. Let's take a closer look at what it has to offer.

In broad strokes, the FT-450 is a lightweight, compact — but not *too* compact — multimode 100 W transceiver that will do yeoman's duty in a variety of Amateur Radio applications, including portable (but probably *not* mobile) operation and HF or 50 MHz beacon service. It has two VFOs, gobs of memories, general coverage receive and scanning capability and, in the unit we reviewed, a snappy optional automatic antenna tuner. Digital signal processing (DSP) in the 24 kHz second IF handles filtering and interference-rejection tasks and the FT-450 features a *10* kHz roofing filter — that's 5 or 10 kHz narrower than many transceivers. The radio also integrates audio level speech compression and DSP transmit audio tailoring (equalization) for phone operation, a digital voice recorder and a CW keyer with three memories. Like some other Yaesu radios, the FT-450 includes a Morse code trainer. As the *Operation Manual* suggests, "you can improve your CW proficiency whether or not the bands are open."

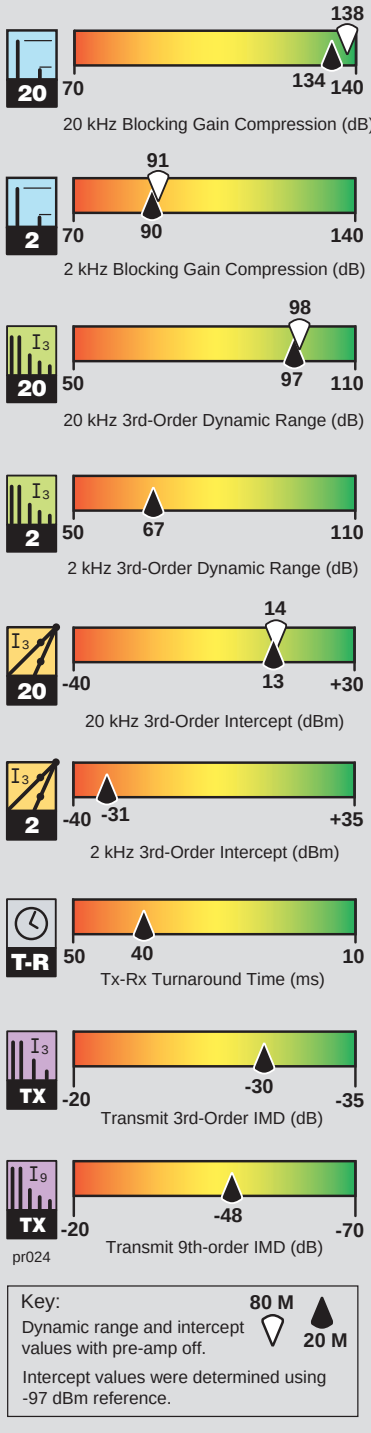
Physical Attributes

The FT-450's monochrome "black-nega" LCD display dominates the front panel. It deserves high marks for being especially easy to read; the ample, albeit segmented, white numerals for the frequency readout and current VFO setting are visible from a distance of several feet. On the downside, the FT-450 has neither a bail nor extendable front feet to raise this excellent display to a comfortable viewing angle.

The smallish main tuning knob is less impressive, especially given the rather commodious front panel. Most purchasers' comments I saw on the Internet expressed a strong desire for a larger knob. The tuning "dimple" is virtually useless, but the knob's nicely rubberized grip makes it possible to twirl it from its outer circumference with thumb or index finger. The FT-450 does not provide a way to enter a frequency directly nor does it have band-stacking capability.

There are four display brightness levels, plus an OFF position to conserve power. I felt the display looked anemic at any setting other than 4, and it's always possible to see the non-illuminated legends in the background. The FT-450 incorporates a neat frequency annunciator, a convenience for the vision impaired or for operating with the display dark. Just press a button, and a female digital voice *verrrrrry* deliberately ticks off the frequency setting — within one decimal place — one numeral at a time. "She" also indicates the mode setting and, using an alternate menu setting, adds the S-meter reading.

Key Measurements Summary



Bottom Line

The FT-450 is a sturdy and competent general-purpose HF/50 MHz radio suitable for home station or portable operation. It's well endowed with features and performance for a radio in this price class, but the multifunction controls and menus took some getting used to.

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

The front panel is largely devoid of knobs — just four, in addition to the main tuning knob. As a result, some knobs serve multiple functions. At least initially, this may steepen your learning curve. Access to most functions is via the radio's two dozen push buttons. That's not counting the multifunction DSP/SEL knob, which also works as a pushbutton for certain settings. More on that later.

At first I found it a little confounding to get this radio up and running without having to refer to the manual. Even after I was more familiar with it, I kept the book close at hand. Your experience may vary, of course.

Legends above front-panel controls are in white capital letters, while blaze orange labels adorn push buttons. All are easy to read, provided sufficient light is flooding the front panel, since the buttons are not backlighted. More obscure are the raised, but unpainted, letters identifying the 3.5 mm KEY and PHONES jacks, leaving them virtually indistinguishable from the black background in the upper left-hand corner.

This is a nit in the greater scheme of things, however. More to the point: Several FT-450 owners posting to the Internet expressed the desire for a second key jack on the rear apron, and a few wanted ¼ inch jacks (as erroneously shown in the manual) instead of 3.5 mm for KEY and PHONES. My CW paddles have a ¼ inch plug, so I made up my own adapter for the key jack since I couldn't find one in the junk drawer.

The display includes a "flow chart" of sorts that depicts the receive signal path, starting with the antenna. This chart indicates current ATT/IPO (attenuator and preamp), NB and AGC button settings. It also includes an R.FLT graphic that suggests there might be a choice of roofing filters. As the manual points out, however, the R.FLT indicator "is always turned on." The chart's antenna symbol will blink if the internal automatic antenna tuner cannot find a reasonable match.

Manifold Menus

Working in concert, the DSP/SEL knob and the F (function) button offer access to the FT-450's hidden assets, available via one of the unit's 65 menu choices (you can set the menu to display only the 19 most commonly used items). Pressing and holding the F button opens the menu, the DSP/SEL control lets you make your selection and a final press and hold of the F button clinches the deal. Some may argue that more common functions ought to be accessible outside of the menu system, and it is possible to delegate the C.S. (custom switch) key to access almost *any* menu item — or several front-panel buttons for that matter.

Table 1
Yaesu FT-450, serial number 7F030194

Manufacturer's Specifications	Measured in the ARRL Lab
Frequency coverage: Receive, 0.03-56 MHz; transmit, 1.8-2, 3.5-4, 5.3305, 5.3465, 5.3665, 5.3715, 5.4035, 7-7.3, 10.1-10.15, 14-14.35, 18.068-18.168, 21-21.45, 24.89-24.99, 28-29.7, 50-54 MHz.	Receive, as specified (sensitivity degrades below 1 MHz). Transmit, as specified.
Power requirement: 13.8 V dc; receive, 1.5 A (signal present); transmit, 22 A (100 W out).	Receive, 1.3 A; transmit, 18 A; tested at 13.8 V dc.
Modes of operation: SSB, CW, AM, FM, FSK, AFSK.	As specified.

Receiver — **Receiver Dynamic Testing**

SSB/CW sensitivity, 2.4 kHz bandwidth, 10 dB S+N/N: 1.8-30 MHz, 0.25 μV; 50-54 MHz, 0.2 μV.

Noise Floor (MDS), 500 Hz bandwidth:

Preamp	*Off*	*On*
1.0 MHz	–107	–114 dBm
3.5 MHz	–133	–138 dBm
14 MHz	–132	–136 dBm
50 MHz	–126	–136 dBm

Noise figure: Not specified.

14 MHz, preamp off/on: 14/10 dB.

AM sensitivity, 6 kHz bandwidth, 10 dB S+N/N: 1.8-30 MHz, 2 μV; 50-54 MHz, 1 μV.

10 dB (S+N)/N, 1 kHz, 30% modulation:

Preamp	*Off*	*On*
1.0 MHz	12	4.5 μV
3.9 MHz	1.1	0.49 μV
50 MHz	2.2	0.52 μV

FM sensitivity, 15 kHz bandwidth, 12 dB SINAD: 28-30 MHz, 0.5 μV; 50-54 MHz, 0.3 μV.

For 12 dB SINAD:

Preamp	*Off*	*On*
29 MHz	1.1	0.3 μV
52 MHz	1.0	0.26 μV

Blocking gain compression: Not specified.

Gain compression, 500 Hz bandwidth:

	20 kHz offset Preamp off/on	*5/2 kHz offset Preamp off*
3.5 MHz	138/134 dB	92/91 dB
14 MHz	134/128 dB	91/90 dB
50 MHz	119/119 dB	80/* dB

Reciprocal Mixing (500 Hz BW): Not specified.

20/5/2 kHz offset: –95/–89/–21 dBc.

Two-Tone IMD Testing**

Band/Preamp	*Spacing*	*Input level*	*Measured IMD level*	*Measured IMD DR*	*Calculated IP3*
3.5 MHz/Off	20 kHz	–35 dBm	–133 dBm	98 dB	+14 dBm
		–21 dBm	–97 dBm		+17 dBm
14 MHz/Off	20 kHz	–35 dBm	–132 dBm	97 dB	+13 dBm
		–21 dBm	–97 dBm		+17 dBm
		0 dBm	–36 dBm		+18 dBm
14 MHz/On	20 kHz	–43 dBm	–136 dBm	93 dB	+3 dBm
		–26 dBm	–97 dBm		+9 dBm
14 MHz/Off	5 kHz	–57 dBm	–132 dBm	75 dB	–19 dBm
		–32 dBm	–97 dBm		+0 dBm
		0 dBm	–34 dBm		+17 dBm
14 MHz/Off	2 kHz	–65 dBm	–132 dBm	67 dB	–31 dBm
		–40 dBm	–97 dBm		–11 dBm
		0 dBm	–25 dBm		+12 dBm
50 MHz/Off	20 kHz	–30 dBm	–126 dBm	96 dB	+18 dBm
		–17 dBm	–97 dBm		+23 dBm

In addition, you can assign any one of a handful of other commonly used menu functions — mic gain or keyer speed, for example — to the DSP/SEL key.

Another convenient feature: It's possible via the menu to set up the radio to access only those bands and/or modes you typically operate. Yaesu calls these "My Bands" and "My Modes." For example, if you're contesting, you can deselect the non-contest bands, 10, 17 and 12 meters. If you typically only operate SSB and CW and never plan to use FM, AM or data modes, you can set up your FT-450 to only select USB, LSB and CW when you punch the MODE buttons. The radio's two MODE buttons mean never having to step through every available mode, as some other radios make you do, to reach the one you want. This is especially handy if you commonly switch among just two or

Second-order intercept: Not specified.	Preamp off/on: +63/+31 dBm.**
FM adjacent channel rejection: Not specified.	20 kHz offset, preamp on: 29 MHz, 83 dB; 52 MHz, 81 dB.
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz offset, preamp on: 29 MHz, 83 dB; 52 MHz, 81 dB;† 10 MHz offset: 52 MHz, 99 dB.
S-meter sensitivity: Not specified.	S9 signal at 14.2 MHz: preamp off, 88 μV; preamp on, 30 μV; 50 MHz, preamp off, 467 μV; preamp on, 33 μV.
Squelch sensitivity: SSB, HF, 2.5 μV; VHF, 1.0 μV; FM, HF, 0.32 μV; VHF, 0.16 μV.	At threshold, preamp on: SSB, 14 MHz, 1.5 μV; FM, 29 MHz, 0.14 μV; 52 MHz, 0.26 μV.
Audio output power: 1.5 W into 8 Ω at 10% THD.	1.9 W at 10% THD into 8 Ω.
IF/audio response: Not specified.	Range at –6 dB points, (bandwidth): CW (500 Hz): 369-1035 Hz (666 Hz),‡ Equivalent Rectangular BW: 561 Hz; USB: 367-2190 Hz (1823 Hz); LSB: 400-2330 Hz (1930 Hz); AM: 266-1976 Hz (1710 Hz).
Spurious and image rejection: HF, 70 dB; 50 MHz, 60 dB.	First IF rejection, 14 MHz, 100 dB; 50 MHz, 56 dB; image rejection, 14 MHz, 83 dB; 50 MHz, 93 dB.
Transmitter	***Transmitter Dynamic Testing***
Power output: HF & 50 MHz: SSB, CW, FM, 100 W (high); AM, 25 W (carrier).	HF: CW, SSB, FM, typically 106 W high, 4 W low; AM, typ. 25 W high, 3 W low; 50 MHz: CW, SSB, FM, typ 101 W high, 4 W low; AM, typ. 24 W high, 2 W low.
Spurious and harmonic suppression: HF, >60 dB; VHF, 70 dB.	HF, 62 dB; VHF, 60 dB. Meets FCC requirements.
SSB carrier suppression: >60 dB.	HF, 62 dB; VHF, 61 dB.
Undesired sideband suppression: >60 dB.	HF, 68 dB; VHF, 63 dB.
Third-order intermodulation distortion (IMD) products: –31 dB PEP at 100 W.	3rd/5th/7th/9th order (worst case band): HF, –30/–37/–42/–48 dB PEP; VHF, –29/–41/–59/–70 dB PEP.
CW keyer speed range: 4 to 60 WPM.	8 to 70 WPM.
CW keying characteristics: Not specified.	See Figures 1 and 2.
Transmit-receive turn-around time (PTT release to 50% audio output): Not specified.	S9 signal, 40 ms. Unit is not suitable for use on AMTOR.
Receive-transmit turn-around time (tx delay): Not specified.	SSB, 20 ms; FM, 16 ms.
Composite transmitted noise: Not specified.	See Figure 3.

Size (height, width, depth): 3.3 × 9 × 8.5 inches; weight, 7.9 pounds (not including power supply or accessories).

Price: FT-450, $900; FT-450 with automatic antenna tuner, $1000.

*On 6 meters, at 2 kHz offset, the receiver gain compressed by 1 dB at a level 36 dB above the noise floor; however, it did not compress further until a level of about 76 dB above the noise floor.

**ARRL Product Review testing now includes Two-Tone IMD results at several signal levels. Two-Tone, 3rd-Order Dynamic Range figures comparable to previous reviews are shown on the first line in each group. The "IP3" column is the calculated Third-Order Intercept Point. Second-order intercept points were determined using –97 dBm reference.

†Measurement was noise-limited at the value indicated.

‡Varies with pitch control setting.

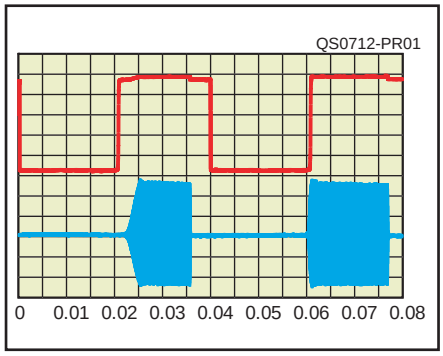


Figure 1 — CW keying waveform for the Yaesu FT-450 showing the first two dits in full break-in (QSK) mode using external keying. Equivalent keying speed is 60 WPM. The upper trace is the actual key closure; the lower trace is the RF envelope. (Note that the first key closure starts at the left edge of the figure.) Horizontal divisions are 10 ms. The transceiver was being operated at 100 W output at 14.2 MHz. The first dit is noticeably shortened.

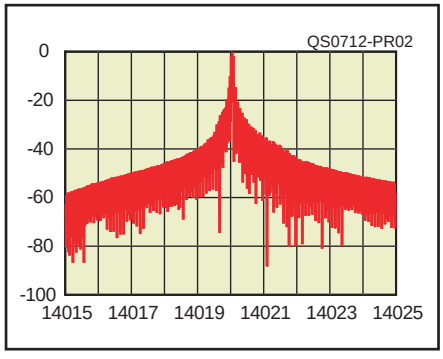


Figure 2 — Worst-case spectral display of the Yaesu FT-450 transmitter during keying sideband testing. Equivalent keying speed is 60 WPM using external keying. Spectrum analyzer resolution bandwidth is 10 Hz, and the sweep time is 30 seconds. The transmitter was being operated at 100 W PEP output at 14.2 MHz.

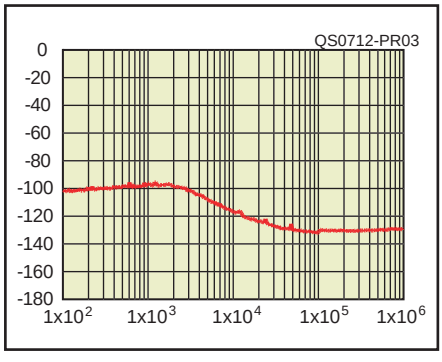


Figure 3 — Worst-case spectral display of the Yaesu FT-450 transmitter output during composite-noise testing. For the black trace, power output is 100 W at 14.2 MHz. The carrier, off the left edge of the plot, is not shown. This plot shows composite transmitted noise 100 Hz to 1 MHz from the carrier.

three modes and don't care to deselect any available modes.

In addition to being the key that unlocks the menu, the F button activates the secondary functions of the six "command buttons" (as Yaesu calls them) grouped on the upper right-hand side of the front panel. For example, to turn on VOX — a secondary function on the VOX/STO button — you first press the F key, then VOX/STO. Writing to one of the radio's 500 memories entails pressing the F key, using the DSP/SEL knob to pick the desired memory then pressing and holding the MW/VM button. The FT-450's memories store operating frequency and mode; bandwidth, attenuator, preamp, contour, DNR (digital noise reduction), and notch settings; repeater shift and CTCSS tone.

The DSP/SEL knob is as central to the radio's operation as the main tuning knob

and controls a wider range of functions than its big brother. Aside from its menu role, the DSP/SEL knob selects the desired DSP function — you can only adjust one at a time — and it provides a means to dial up memory channels and to make fast frequency excursions — at a menu selectable rate.

The DSP Package

The digital signal processing package is the nerve center of the FT-450's interference abatement capabilities. The front-panel's DSP button steps through CONTOUR, NOTCH, DNR and WIDTH settings, and these are reflected via a graphic display visible below the S-meter. Contour, a DSP filter enhancement found on the FT-2000 series and other higher-end Yaesu transceivers, is arguably the FT-450's most effective feature. It operates a bit like the Q multipliers of yesteryear by either nulling or peaking (at a choice of low or high gain level) signals within the receiver's passband. Judicious use of the CONTOUR control can yield dramatic results, with formerly difficult signals to copy — phone or CW — suddenly standing Q5 out of the noise.

The FT-450 does not have an automatic notch filter, but the manual notch is very effective. It incorporates a coarse and fine adjustment, so using the notch can entail a bit of dial cranking to move the NOTCH graphic across its display. There are 11 possible coarse settings, which indicate the notch's approximate position within the passband. Then you can fine tune for the desired notch within each coarse range. With the FT-450's contour and notch capabilities, it's possible to do some rather creative filter shaping!

DNR works very well. There are 11 possible algorithm settings, and it takes some tinkering to get the right one for a given situation. Employing a more aggressive setting can render SSB signals bassy and a bit distorted. Using DNR, I was able to minimize atmospheric noise from an incoming weather front while listening on SSB.

The WIDTH function sets the IF bandwidth, and it's mode dependent. The DSP filters seem to work well and do not impart a disagreeable level of digital distortion or ringing.

Unlike transceivers that permit continuous adjustment of the DSP bandwidth, the FT-450 offers just three fixed settings per mode. In SSB these are 1.8, 2.4 and 3.0 kHz. On CW, the choices are 500 Hz, 1.8 kHz and 2.4 kHz. For AM, you can select 3.0, 6.0 or 9.0 kHz, and on FM, 2.5 and 5.0 kHz. The simple front-panel width graphic makes it hard to tell just which setting is in play.

On CW, the narrow 500 Hz setting, which the ARRL Laboratory determined to be closer to 600 Hz, will prove too wide for some circumstances, and 1.8 and 2.4 kHz are too wide for most situations. Better options for CW might have been something on the order of 250, 500 and 800 Hz.

The three SSB choices are appropriate and work well on phone. The data modes use the SSB filters as well, so you're stuck with a rather broad "narrow" filter of 1.8 kHz when operating PSK31 or RTTY. That's true for FSK or AFSK RTTY, unlike some radios that allow use of the CW bandwidth filters for FSK.

A separate IF SHIFT control lets you shift the center of the receive passband to avoid QRM. As noted, the DSP functions act upon the 24 kHz second IF, and the NOTCH, WIDTH and SHIFT functions clearly operate within the AGC loop (it's possible to view their effect via the S meter).

Getting on the Air with the FT-450

The first time I powered up the FT-450, a random staccato frying or popping noise began issuing from the top firing loudspeaker. The radio was connected to a dummy load at the time, so this wasn't a matter of mere "background" noise. The apparent culprit is some sort of DSP artifact, and judging from complaints posted by other FT-450 owners, they *all* do this (Yaesu *has* corrected a reported problem with hum on transmitted audio in early production units). The DSP hash seems worst when the attenuator and the preamp are off (IPO enabled) and the bandwidth is at its narrowest setting. Once you connect an antenna, the background noise overwhelms the DSP noise. The DSP noise didn't affect normal operation. For example, the FT-450 made it possible for me to work 3B7C on 40 meter CW, since my own transceiver was on the fritz.

For SSB, the FT-450 offers a generous selection of 10 different transmit audio equalization curves, including a "flat" response. A little experimenting on the air or via the radio's monitor will yield the optimum choice. Each menu selection includes a helpful graphic display of the approximate audio response curve.

As with many other functions, you turn the monitor on or off by assigning it to the C.S. button, but the front panel does not indicate when it's active. As the manual warns, unwelcome feedback can result if the monitor is on while listening on a speaker. The radio's AF GAIN control sets the monitor level. Of course, if you've already assigned *another* function to the C.S. button, you can't quickly enable or disable the monitor either. It is possible to assign the monitor (and other transceiver functions) to the buttons of an optional Yaesu microphone, however.

Although it's not readily obvious — you'll have to read the manual — there is an audio compressor. It's enabled via the MIC GAIN menu, which offers three settings: LOW, NOR and HIGH. Audio compression is disabled at the LOW setting but enabled at the NOR (factory default) and HIGH positions. As with other settings on the FT-450, parameter flexibility is limited to the choices the menu offers. The manual does not indicate compression level in decibels, but it's easy to observe the diminished dynamic range via the power output meter with the compressor online.

There are *two* digital audio recorders. One will record and play back (but not transmit) up to 20 seconds of received audio. The other is a digital voice recorder (DVR) that can store up to 10 seconds of user-provided audio — a CQ or quick contest-type report, for example. Including these features is a nice touch for a radio in this price class, but I found the voice memories rather clumsy to use. They rely on assigning first the recording operation, then the playback operation to the radio's much-overworked C.S. button, which can handle just one function at a time. Any other function you may have assigned the C.S. button will be lost for the duration.

As a longtime CW operator, I was pleased to see Yaesu had included full-break-in keying (QSK), but its implementation in the FT-450 was not quite the way I would have liked it. Not only is the internal keying relay annoyingly noisy, the QSK itself is poor due to the radio's slow turnaround time. While it works okay at, say, 10 or 15 WPM, you'd be hard pressed to hear another station break your transmission at speeds of 25 to 35 WPM. ARRL Laboratory testing showed that the FT-450's CW keying is very hard (see Figure 1), and in QSK, the first element is shortened slightly.

The internal keyer works well, although ARRL Laboratory testing determined that the front panel CW speed readout is inaccurate, mainly at the lower and upper limits of its range, which turned out to be from 8 WPM to an amazing 70 WPM! The readout is in the ballpark at more conventional sending speeds, however.

"Beacon mode" includes the capability to program three canned Morse messages; this is what passes for a CW memory keyer in the FT-450. You select the text characters one at a time via the menu, not by sending them. This feature may be sufficient to call CQ or handle a canned message but, like the DVR, getting to these memories is inconvenient and again involves — you guessed it — programming the C.S. key.

There's no separate knob for receive incremental tuning (RIT), which Yaesu calls a "clarifier." The clarifier uses the main tuning knob. There is no provision for transmit

incremental tuning. Pressing the CLAR button for one second clears the setting.

Split is very simple to use, and you can quickly and easily swap VFOs to listen on your transmitting frequency (or program the C.S. key to go there on a press-and-release basis). There's also a "Quick Split" mode you can set up for an instant split in the range of ±20 kHz. Then, press and hold the STEP/SPLIT key, and you're in business.

You'll have to dig into the *Operation Manual* a bit to find out how to get on 60 meters with the FT-450. As explained in the book's "Memory Operation" section, Yaesu has programmed the 60 meter channels (plus USB operating mode) into a discrete set of memory channels. Similar to the implementation in the FT-857 and FT-897, the FT-450 displays the "channel center" frequency rather than the tuning frequency most transceivers show — in other words, 5332.0 kHz as opposed to 5330.5 kHz for the first channel. While this may confuse some users, FT-450 owners can rest assured that the radio will transmit and receive on the *correct* channel frequencies on USB.

For FM operation on 10 or 6 meters, the FT-450 is equipped both for simplex and repeater work. It can run full power on FM. Features for this mode include CTCSS tone squelch and tone scanning.

AM operation is at the usual 25 W carrier level. This corresponds to 100 W, the maximum power a radio limited to 100 W PEP can run without distortion.

The FT-450 can operate AFSK or FSK for RTTY. Packet, PSK31 and other sound card modes also are possible using AFSK. A rear-apron DATA jack provides access to the necessary connections for both AFSK and FSK, but it's not possible to adjust the input level to the DATA jack via the radio for data modes. Yaesu recommends reducing the radio's power output during extended RTTY operation.

All told, it can involve a bit of button pushing and control twisting to enable various functions. Getting comfortable with all of this can be unsettling at first. Even so, becoming familiar with the FT-450 is no more daunting than learning how to operate some other transceivers in this price class; the ICOM IC-706 series with its multiple menus comes quickly to mind. After just a few days with the FT-450, I was able to enable split mode and some other functions literally in the dark (but with the display illuminated) and *without* my reading glasses!

The Numbers Game

While not a competition-grade transceiver, the FT-450 acquitted itself pretty well during ARRL Laboratory testing in the parameters that count most (see Table 1). In terms of the Key Measurements Summary chart we include with each transceiver Product Review, the FT-450 pretty much equaled the FT-2000D reviewed in October 2007 in terms of 20 kHz blocking gain compression, and it slightly bested the more expensive transceiver at 2 kHz bandwidth. Same for third order dynamic range testing: The radios tested equally well at both 20 kHz and 2 kHz spacings at 14 MHz.

While Yaesu boasts a 3 kHz maximum bandwidth for SSB reception and up to 9 kHz for AM, the IF/audio response, as measured in the ARRL Laboratory (see Table 1) indicated a much narrower passband at the default (middle) filter settings. In particular, the AM bandwidth of 1710 Hz is pretty tight, especially given the default 6 kHz filter setting. On SSB, the widest (3 kHz) setting increases the high-end cutoff by about 100 Hz and lowers the bottom end by about 150 kHz. There's plenty of audio, however, and the filter skirts are fairly broad, so what comes out of the speaker (or into headphones) by and large is acceptable "communication grade" audio.

On the transmit side, the ARRL Laboratory swept the transmitter response at the default 2.4 kHz bandwidth setting for USB. The –6 dB response extended from 309 to 2317 Hz for a bandwidth of 2008 Hz. The –60 dB response was 116 to 3015 Hz, or 2900 Hz bandwidth. At least a couple of stations suggested the FT-450's audio on transmit tended to be on the treble side.

Puffs and Pans

• The CW training feature was a lot of fun to use. The radio offers three sending modes, and speed is determined by the keyer's speed setting. You can set up the trainer to send only numeric characters, only alphabet characters or a combination of both. It sends five-character code groups, and it displays what it sent afterward.

• Some users considered the radio's "step mode" ATT/IPO feature inconvenient and possibly confusing, mainly because IPO ON really means the radio's preamplifier is *off*. It takes a little getting used to, and popping through the four setting combinations possible on HF will yield one that fits the bill.

• The radio includes a "Quick Memory Bank" (QMB) feature that can store just one set of operating parameters. This is handy during contests, where you might want to bookmark the location of a new multiplier until the pileup dies down. Several more QMB registers would be useful.

• The noise blanker (NB) is quite effective. It readily vanquished the heavy ignition noise from my boat's V-8 engine on 20 meters, although it was somewhat less successful doing this on 30 or 40 meters.

• Yaesu did not include a carrying handle with the FT-450, but you can purchase one for less than $20. Unfortunately, you cannot buy a support bail or front-leg extenders at *any* price.

• The FT-450 thoughtfully incorporates a TCXO (temperature-compensated crystal oscillator) to maximize frequency stability. This is an option in many other radios.

• Rear apron jacks to interface the FT-450 with accessories, such as a PC for data mode operation, an external antenna tuner or a linear amplifier, are mini-DIN connectors. You'll have to supply your own plugs, and, by all accounts, the 10-pin mini-DIN plug to access the linear amplifier jack on the rear apron can be hard to come by.

• The FT-450 has a single SO-239 antenna jack on the rear apron. Some users wished for two (one for HF, one for 6 meters).

• The continuously running cooling fan is *extremely* quiet, and the radio never got more than mildly warm during hours of use.

• Rear apron jacks to interface the FT-450 with accessories, such as a PC for data mode operation, an external antenna tuner or a linear amplifier, are mini-DIN connectors. The 10-pin mini-DIN plug to access the linear amplifier jack on the rear apron can be hard to come by, so in response to customer requests, Yaesu now offers the correct plug with pigtail leads. Part number is T9207451.

• The *Operation Manual* is fairly well executed, but it contains some fractured English as well as some outright errors. Ours came with one erratum on a small, loose sheet.

• The internal antenna tuner does its job very quickly! It can be set to tune only on transmit or on transmit and receive, and it works on 6 meters.

• The *Operation Manual* indicates you can control the FT-450 via an RS-232 serial connection to a computer, but you'll need to download the *FT-450 CAT Operation Reference Book* from **www.yaesu.com** for details. The Web site also has instructions and files for updating the radio's firmware via the serial connection. More to the point: Few newer computers even offer RS-232 serial connections, so you may need a USB to serial adapter.

Finale

The FT-450 will find a home as a suitable first transceiver for the new ham on a budget. It also will make a satisfactory backup or emergency service radio, perhaps as part of a standard "Go Kit." It may even find a place on the road or even on the high seas, although it's a bit large for the typical mobile installation. It would be ideal for the RV owner, however.

Manufacturer: Vertex Standard, 10900 Walker St, Cypress, CA 90630; tel 714-827-7600; **www.yaesu.com**.

M³ Electronix FPM-1 Frequency Counter/ Power Meter Kit

Reviewed by Rich Arland, W3OSS
ARRL Contributing Author

Although my current interests in Amateur Radio revolve around restoring vintage amateur and military communications equipment, I enjoy the modern conveniences our solid-state world has to offer. After attending Four Days In May (FDIM) in 2005, I became a firm believer that today's radio amateurs have a leg up when it comes to test equipment compared to what was available just a few years ago. (FDIM features programs and activities devoted to the art of homebrew construction; it runs concurrently with the Dayton Hamvention.)

While at FDIM, I met Mike Knox, KC8WR, and Mike Doty, WØMNE, of a new company called M³ ("M cubed") Electronix. They offered an inexpensive ($50 at the time) piece of test gear called a semiconductor analyzer to participants in the FDIM equipment building event (it's still available in the M³ product line).

Focus on Test Gear

Two years have passed and the M³ crew has put together a stable of reasonably priced, quality test gear you can build. Additions to the line include the versatile FPM-1, a dc to 1.3 GHz frequency counter and RF power meter. They also offer an LCRZ meter for measuring inductance, capacitance, resistance and impedance, and a built and tested RF calibrator that provides signals at a known frequency and power level for checking and calibrating your homebrew gear. There's also a 40 dB tap attenuator for making high-power measurements with low-power devices such as the FPM-1.

M³ can provide a bench full of useful test gear for a very attractive price. Remember, you don't need to buy all of the test gear at one time, so take stock of what you really need on your bench and buy accordingly.

Building the FPM-1

The FPM-1 Universal Frequency Counter/Power Meter kit arrived in a small brown box. After completing an inventory and satisfying myself that all the parts were present, I started building.

The kit contains two circuit boards (see Figure 4). The larger main circuit board has some moderately dense component population. All surface mount components were factory installed, thereby negating the tedious task of soldering these small parts into place. That's good news for us old timers whose eyes aren't what they used to be. Be sure to *read the instruction steps* thoroughly before you start placing parts. This saves embarrassment when you have to pull out the solder wick to remove an offending part!

Overall, the build was straightforward. I followed the instructions in the manual precisely, including changes on the enclosed errata sheet. Initial tests with an ohmmeter were within 10% of the listed values, so I figured that I hadn't made any serious mistakes. A word of caution, however, when it comes to the precision resistors: Do yourself a favor and use an ohmmeter to be sure you are placing the proper resistor at the right place on the PC board. Color bands can be difficult to read, so err on the side of caution and use a meter to verify the value of the precision resistors.

The display board is the smaller of the two PC boards and nests on top of the main board. Follow the manual's instructions *exactly* when it comes to fitting this board. If you don't, the tiny pushbutton switches that protrude from the holes in the case may not line up correctly. It's a real hassle to go back and try to refit the display board. So slow down, read the instructions carefully and do it right the first time.

With the initial fitting complete, the next step is to apply voltage to the coaxial POWER connector. While the manual says that you can go as low as 9 V dc, I recommend that you use 12 V dc from your regulated bench supply. Initially I tried using 9 V from a "wall-wart" and found that while the counter powered up, I encountered some problems during calibration. The trouble was traced to the wall-wart. Even though it was specified for 9 V at 800 mA, the voltage sagged under load and threw off some of my calibration readings. With a solid 12 V dc from my regulated bench supply, I was able to run through the calibration procedure quite easily.

Bottom Line

The FPM-1 kit from M³ Electronix is an affordable way to add an accurate and useful test instrument to your workbench.

Calibrating the FPM-1

One thing I'm always leery about when it comes to homebrew test gear is, "How do you ensure accuracy of measurement?" The manual has a very detailed method of calibrating the counter and RF meter using a calibrated source. We ordered the optional M³ RF Calibrator and used it for the setting the clock on the frequency counter and calibrating the power meter. The RF Calibrator provides a fixed 10 MHz reference sine wave at 0, –10, –20 and –30 dBm power levels. You could also use a good signal generator for this task if one is available.

I followed the procedure carefully before sending the FPM-1 and calibrator off to Michael Tracy, KC1SX, in the ARRL Lab to see how well it compared to the League's professional instruments. Initial testing revealed low sensitivity in the VHF/UHF mode, particularly above 500 MHz. An e-mail to Tech Support at M³ brought a quick response: Since our kit was produced, the prescaler IC and two diodes have been changed to improve performance at the higher end of the range. The new parts are included in current kits and available to purchasers of earlier versions (contact Tech Support at M³ for details). The measurements in Table 2 were taken with the new parts installed.

Table 2

M³ FPM-1 Universal Frequency Counter/Power Meter

Manufacturer's Specifications	*Measured in the ARRL Lab*
Power requirement: 9-15 V dc, 200 mA max.	150 mA max at 13.8 V dc.
Counter sensitivity: 2 Hz to 50 MHz, 20 mV; 50-70 MHz, 30 mV; 70-100 MHz, 40 mV; 100-1300 MHz, 50 mV.	As specified to 1150 MHz, decreasing to 160 mV at 1300 MHz.
Frequency accuracy: 3 ppm (first year aging rate).	As specified.
Power meter input range: –72 dBm to +16 dBm.	As specified.
Power level accuracy: ±1 dBm typical, dependent on calibration accuracy, to 500 MHz.	As specified.
Size (height, width, depth): 4 × 6.125 × 1.5 inches; weight: 13 ounces.	
M³ RF Calibrator	
Power requirement: 8-15 V dc, 40 mA.	As specified.
Frequency accuracy: ±1 ppm.	Better than 1 ppm at room temperature, tested at 8-15 V dc.
Output level accuracy: ±0.1 dBm.	See note below.
Size (height, width, depth): 2.5 × 5 × 2 inches; weight: 5 ounces.	
Price: FPM-1 kit, $155; RF Calibrator, $89; FPM-1 with calibrator, $210.	

Note: The RF Calibrator output level was set according to M³'s laboratory power meter. Any two properly calibrated lab-grade power meters cannot be expected to agree within 0.1 dBm, so this level of accuracy cannot be determined using another laboratory type power meter. Readings with the FPM-1 as calibrated with the M³ calibrator were within 0.5 dB of the ARRL Lab power meter at all frequencies tested, well within the uncertainty of two good power meters and plenty accurate for home users. See Jul 2006 *QST*, page 63, for further discussion on this topic.

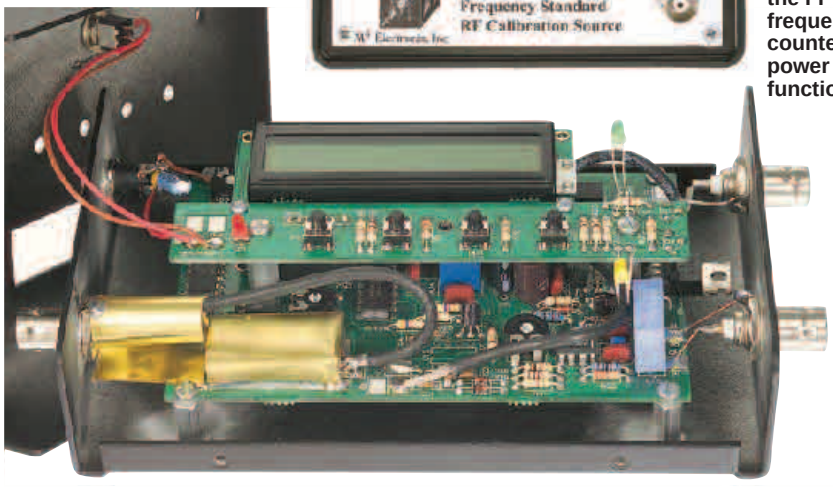


Figure 4 — Here's an inside view of the finished unit. The only tricky part was lining up the two PC boards, switches and holes in the case.

Figure 5 — The optional RF Calibrator provides an accurate signal source for calibrating the FPM-1's frequency counter and power meter functions.

Using the FPM-1

The finished FPM-1 is packaged in a sturdy, compact aluminum case. A two line LCD with backlighting and adjustable contrast shows the various measurement values and settings. The LCD also displays the various control menus that are set via a row of four pushbuttons below the display.

So, what will this critter do? For starters, the frequency counter section covers 2 Hz to 1.3 GHz with a resolution from 1 µHz to 1 kHz depending upon gate time and input signal. The FPM-1 has two frequency counter input ports, accessed via BNC connectors on the right side. Input channel 1 (CH1) is a high impedance input that works from 2 Hz to 100 MHz. As shown in Table 2, sensitivity is quite good. Input channel 2 (CH2) is a 50 Ω input for 50 MHz to 1.3 GHz. Again, sensitivity is quite good and useful across the range, falling off somewhat at the very top of the range.

The counter can store frequencies and make offset measurements compared to the stored values. For example, you might store the output frequency of an oscillator and use the offset feature to monitor frequency drift over time.

There's a BNC connector on the left side for power measurements from 1 to 500 MHz over the range of –72 dBm to +16 dBm. Accuracy is rated at ±1 dBm, and it's usable to 800 MHz with reduced accuracy. You can toggle the readout between dBm and milliwatts (or watts or other units, as appropriate for the power level). Note that the watt display is mathematical computation based on the measurement in dBm so it may not track exactly.

The FPM-1 has built-in frequency compensation for power measurements. If the level of the signal you want to measure is too low for an accurate reading on the counter, you can enter the frequency manually. In fact, you can use the memory feature to store and recall up to 10 different frequencies — a handy feature if you're working on something that requires repeated adjustment and measurement over a range of frequencies.

If you need use an external attenuator (or amplifier) to make power measurements outside the FPM-1's range of operation, you can program the unit to account for an external attenuator/amplifier from –49.9 dB to +49.9 dB and still give an accurate reading. Up to nine values can be stored. For example, if you normally make measurements using a 20 dB attenuator, you can store this value in a memory and 20 dB will be added to displayed measurements when this memory is selected.

There's also a mode for making relative power measurements. With the initial power applied, press ZERO and the display will show changes in power in 0.1 dB steps relative to the stored value.

Most of my work involves power and frequency measurements, but the manual explains how to use the FPM-1 to measure period (500 ms to 10 ns), pulse width (10 µs to 500 ms) and duty cycle. You can download the manual from M³'s Web site to read more about the FPM-1's capabilities.

In Summary

In addition to a spot on your test bench, the FPM-1's small size makes it an ideal piece of portable test gear. I would consider the FPM-1 a "must have" piece of test equipment for the active radio amateur, technician or electronics experimenter. Construction was a snap, and the manual and instruction set are well written and easy to follow. Don't forget, if you end up getting stuck, there is always a quick call or e-mail to the M³ folks and they will get you back on track pronto. Overall I consider it a great value for money.

Manufacturer: M³ Electronix Inc, 4300 Winchester Southern Rd, Circleville, OH 43113; fax 740-420-9060; **www.m3electronix.com**.

HAPPENINGS

ARRL and MARS Team Up for Washington Demo

The ARRL and Virginia radio amateurs associated with the Army Military Affiliate Radio System (MARS) put their emergency communications skills to the test on October 3, demonstrating to members of Congress and other Federal agencies how ham radio continues to work when other means of communications are disabled during hurricanes or other natural or man-made disasters. The demonstration took place in a compact portable communications center erected on the Capitol grounds near the Rayburn House Office Building and was equipped with transmitting and receiving equipment to handle messages typical of a real emergency. More than 50 MARS operators from Virginia, Maryland, West Virginia, Pennsylvania, Delaware and other states participated in the event.

According to the scenario issued by exercise planners, the event assumed a Category 3 hurricane named Quincy that deposited heavy rains over a multi-state area on October 2 and made landfall in the Delaware, Maryland and Virginia region later that day. The "storm" moved north into New Jersey and Pennsylvania, turned counterclockwise and traveled southward before returning to the Atlantic through the Carolinas and Georgia on October 5.

During the exercise, MARS operators also monitored other Amateur Radio emergency frequencies and coordinated the exchange of messages across their networks as well, honing their ability to work with other radio emergency providers such as the Amateur Radio Emergency Service (ARES).

ARRL Emergency Preparedness and Response Manager Dennis Dura, K2DCD; ARRL Chief Development Officer Mary Hobart, K1MMH, and ARRL Media and Public Relations Manager Allen Pitts, W1AGP, made the trek down to Washington. "As the unusually hot October sun fried us, despite the lack of sunspots," Pitts said, "representatives of ARRL, MARS and the Southern Baptist Disaster Response organizations fought poor propagation to make contacts through the day primarily on VHF, 20 and 40 meters. Dennis Dura worked the ARRL's HF rig most of the day as W1AW/3. Arkansas Congressman Mike Ross, WD5DVR — one of only two Amateur Radio operators in Congress — also made contacts from the site."

LAUREN SLUSHER

Arkansas Congressman Mike Ross, WD5DVR (right), discusses emergency communications activities with ARRL Media and Public Relations Manager Allen Pitts, W1AGP (center), and Mike Barrett of US Army MARS during an emergency communications exercise conducted on the grounds of the US Capitol.

Pitts said that the ARRL team used the *When All Else Fails Banner* at the site. "We hoisted the banner in front of the Capitol dome. It attracted many vacationing hams in the area who stopped by to see what was happening, and some even were able to be brief 'guest operators.' But the day was mostly spent showing Amateur Radio capabilities to the Congressional staffers and others who work behind the scenes to make the wheels of government go. Janet Worthington, KB3PDS, of Chwat & Co — the ARRL's lobbying firm — was able to use the demonstration as a topic and drop off ARRL materials about HR 462 and Amateur Radio in every congressional office." HR 462, introduced by Representative Ross, is known as The Emergency Amateur Radio Interference Protection Act of 2007.

MARS operators used a variety of modes to move messages from the originator to the final recipient, depending on the operating conditions in place at the time. Operators used voice, CW and Winlink2000 to move messages. Winlink uses an e-mail-type interface, making it simpler for served agencies to send and receive their emergency traffic.

MARS volunteers are required to complete a variety of training courses to be a part of the program. They use personal radio equipment and are capable of operating on emergency power when conditions dictate. Many members are former servicemen and women who first learned radio communication skills while serving in the Army. MARS is a Department of Defense sponsored organization of Amateur Radio operators trained and equipped to provide emergency communications for military and government agencies when normal links are interrupted by accident, natural calamity or hostile action

QST.org WEB ADDRESS NOW IN HANDS OF THE ARRL

Long-time ham and ARRL member David Lien, W6OVP, of Battle Ground, Washington, has transferred the Web address **www.QST.org** to the ARRL. If you head to that URL, you'll now find yourself in the *QST* section of the ARRLWeb.

"I bought the rights to it about nine years ago," he said. "I was just trolling — I own quite a few [Web addresses]. I came across **QST.org** and grabbed it. It's so important to ham radio, and there's only one use for it."

An aerospace engineer for many years, Lien is also a prolific author. Of his many books, the majority of which helped computer neophytes learn the ins and outs of the TRS-80 and other early personal computers and systems, his best-known were *Learning IBM BASIC* and *The BASIC Handbook*. In fact, Lien was a consultant on the development of the ground-breaking TRS-80, which was among the first mass market personal computers.

David Lien, W6OVP (second from left), with his wife, son Wes, W6WES, and daughter.

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

FCC News

FCC ENFORCEMENT ACTIONS

♦ Raymond W. Czyzewski, Jr, WA2SEI, of Interlachen, Florida, received notification from the FCC of a complaint alleging he "interfere[d] on the Six Meter Amateur band on June 19, 2007. The complaint also enclosed a threatening communication apparently from you to the complainant subsequent to the incident. The information contained in the complaint, if true, raises serious questions regarding your qualifications to retain an Amateur license." Czyzewski was given 20 days to respond and was directed to "support your response with a signed and dated affidavit or declaration under penalty of perjury, verifying the truth and accuracy of the information submitted in your response." He was warned that the FCC will use "all relevant information...including information that you disclose in your reply" to make a decision in his case, and that penalties could include "license revocation, suspension of your operator privileges, or monetary forfeiture (fine). Fines normally range from $7,500 to $10,000."

♦ Guy E Weitl, WB6HGJ, of San Diego, California, received notification from the FCC of a complaint alleging "numerous instances of out of band operation on Twenty Meter frequencies 14.003, 14.005, 14.011 and 14.106 MHz, frequencies for which you are not authorized as a General Class licensee. The complaint also alleges that you have been sent several notices about out of band operation. The information contained in the complaint, if true, raises serious questions regarding your qualifications to retain an Amateur license." Weitl was given 20 days to respond and was directed to "support your response with a signed and dated affidavit or declaration under penalty of perjury, verifying the truth and accuracy of the information submitted in your response." He was warned that the FCC will use "all relevant information...including information that you disclose in your reply" to make a decision in his case, and that penalties could include "license revocation, suspension of your operator privileges, or monetary forfeiture (fine). Fines normally range from $7,500 to $10,000."

♦ David B. Huston, WD8RFS, of Ely, Minnesota, received notification from the FCC regarding a complaint "concerning the operation of your repeater on 145.370 MHz. The complaint alleges lack of control and defective signals and indicates that you have been contacted about these problems but have declined to address them." Huston was given 20 days to respond and was directed to "describe in detail" and include with his response "the procedures you use to control the repeater and provide the names and addresses of all control operators."

♦ Darin W. Colville, KM0Q, of O'Fallon, Missouri, received notification from the FCC that he would face a six month restriction on his Amateur Radio license. The Commission said, "On March 16, 2007, we sent you copies of complaints received by the Commission concerning the operation of your Amateur station. The complaints alleged deliberate interference, broadcasting and failure to identify. Our letter stated that the information contained in the complaints, if true, raised serious questions regarding your qualifications to retain an Amateur license. We requested detailed information from you pursuant to Section 308(b) of the Communications Act of 1934, as amended, 47 U.S.C. S: 308(b), which gives the Commission the authority to obtain information from applicants and licensees about the operation of their station and their qualifications to remain a licensee." After telephone conversations between Colville and FCC representatives, it was agreed that Colville would accept "a six month restriction on your license that would prohibit operation on any Amateur station on UHF or VHF for a period of six months in order to avoid further enforcement sanctions. That restriction is retroactive to July 9, 2007, and will end at midnight January 6, 2008."

♦ James J. Grinton, K7VNI, of Bellingham, Washington, received a *Notice of Apparent Liability for Forfeiture* from the District Director of the FCC's Western Region Enforcement Bureau in Seattle and is apparently liable for a forfeiture in the amount of seven thousand dollars ($7,000)." The FCC said Grinton "apparently willfully and repeatedly violated Section 97.113(b) and Section 97.119(a) of the Commission's *Rules* ('*Rules*') by transmitting one-way communications and by failing to transmit his assigned call sign in the Amateur Radio Service."

Section 97.113(b) of the *Rules* states that "[a]n amateur station shall not engage in any form of broadcasting, nor may an amateur station transmit one-way communications..." Section 97.119(a) of the *Rules* states that "[e]ach amateur station, except a space station or telecommand station, must transmit its assigned call sign on its transmitting channel at the end of each communication, and at least every 10 minutes during a communication, for the purpose of clearly making the source of the transmissions from the station known to those receiving the transmissions."

The FCC concluded that "Pursuant to the Commission's *Forfeiture Policy Statement and Amendment of Section 1.80 of the Rules to Incorporate the Forfeiture Guidelines*, ('*Forfeiture Policy Statement*'), and Section 1.80 of the *Rules*, the base forfeiture amount for unauthorized emissions is $4000 and base forfeiture amount for failure to provide station ID is $1000. In assessing the monetary forfeiture amount, we must also take into account the statutory factors set forth in Section 503(b)(2)(E) of the *Act*, which include the nature, circumstances, extent, and gravity of the violations, and with respect to the violator, the degree of culpability, and history of prior offenses, ability to pay, and other such matters as justice may require. Based on the criteria in Section 503(b)(2)(E) of the *Act*, and the upward adjustment criteria in the *Forfeiture Policy Statement*, we find that an upward adjustment of the base forfeiture amount of $1000 for failure to provide station ID is warranted. Grinton apparently failed to transmit his amateur operator call sign on over 160 transmissions in a five month period. Grinton had previously been warned by the Seattle Office concerning FCC Rule violations. Considering the entire record and applying the factors listed above, we conclude that Grinton is apparently liable for a forfeiture in the amount of $3000 for his failure to provide station ID, and is apparently liable for a $4000 forfeiture for unauthorized emissions."

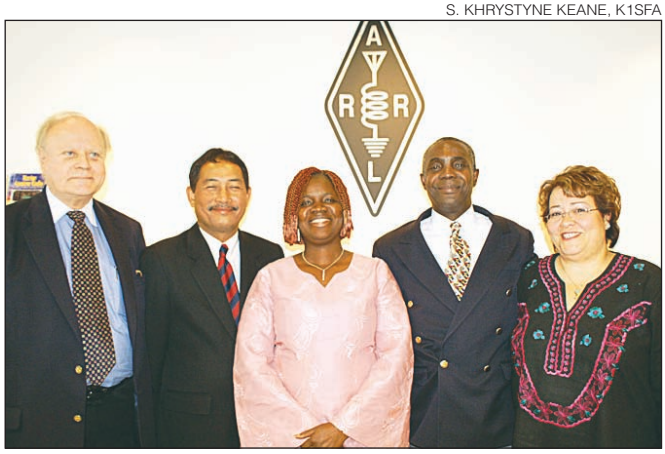
"I was pleased I was in the right place at the right time to rescue the name and hold it for the League until they were ready [to request it]," he said.

ARRL Chief Operating Officer Harold Kramer, WJ1B, who first contacted Lien about the address, commented: "We really appreciate David's generosity in transferring **QST.org** back to us. It will make it easier for our members and others interested in Amateur Radio to find information about *QST* and its content on the Web. We have some other exciting plans in the works for **QST.org** that we will be implementing in the upcoming months."

USTTI STUDENTS GAIN KNOWLEDGE OF AMATEUR RADIO ADMINISTRATION AT ARRL HQ

ARRL Headquarters hosted students from Liberia, Thailand and Barbados Oc-

S. KHRYSTYNE KEANE, K1SFA



The USTTI Amateur Radio Administration Class of 2007. From left to right: ARRL Technical Relations Specialist Walt Ireland, WB7CSL; Oros Chattanond, of Thailand; Eva Marie Flomo, of Liberia; Sylvan Ronald Kennedy, of Barbados, and ARRL Assistant to the Chief Executive Officer and Meeting Planner Lisa Kustosik, KA1UFZ.

tober 8-12 for the United States Telecommunications Training Institute (USTTI) Amateur Radio Administration Course. ARRL Technical Relations Specialist Walt Ireland, WB7CSL, coordinated the session and led the course, and ARRL Assistant to the Chief Executive Officer and Meeting Planner Lisa Kustosik, KA1UFZ, coordinated with USTTI for the ARRL. Although five students were scheduled to attend, two had difficulty with the new US visa process.

The students — Sylvan Ronald Kennedy, of Barbados; Eva Marie Flomo, of Liberia, and Oros Chattanond, of Thailand — all work in their respective government telecommunications offices dealing with telecommunications and Amateur Radio testing, licensing and monitoring. Ireland said that this year's students were especially interested in both Amateur Radio regulations and the International Telecommunication Union's (ITU) process of submitting drafts and recommendations. "It was a most interesting group because of the questions they asked, their sincere interest in the subject matter and the feedback they provided. For example, Mrs Flomo stated that Liberia was starting its communications agency 'from scratch' as a result of the recent past governmental turmoil, and she was particularly interested in every step of US Amateur Radio regulations and the FCC," Ireland said. The curriculum also covered the ITU and ITU regulations as well as the World Radiocommunication Conference 2007 (WRC-07).

The USTTI/ARRL course was a learning experience for Ireland, as well. He said that he put a lot of emphasis on disaster communications, the Amateur Radio operator as a national asset during disasters and processing issues through the ITU. ARRL HQ staff assisted with the course, too. Assistant VEC Manager Perry Green, WY1O, covered US Amateur Radio Licensing Structure and the VEC program. Dan Henderson, N1ND, presented FCC changes to the Amateur Service and international licensing. Dennis Dura, K2DCD, presented the Disaster Communications module. ARRL Publications Manager and *QST* Editor Steve Ford, WB8IMY, spoke on HF digital and Amateur Radio satellites.

ARRL Laboratory staff members — Mike Gruber, W1MG, Mike Tracy, KC1SX, Zack Lau, W1VT, and Ed Hare, W1RFI — also contributed to the training effort. Hare delivered presentations on RFI and RF safety, while Lau, W1VT, demonstrated 10 GHz equipment. Gruber and Tracy assisted the students in assembling 40 meter receivers.

The ARRL and USTTI have been working together for more than 20 years. The Amateur Radio Administration course is designed for those in developing countries who regulate and manage their country's Amateur Radio Service and will help participants create, administer and foster an Amateur Radio Service in their home countries. Now in its 25th year, USTTI is a nonprofit venture involving leading US-based communications and information technology corporations and leaders of the federal government cooperating to provide tuition-free management, policy and technical training for talented professionals from the developing world.

ARRL/TAPR CELEBRATE 26TH ANNUAL DIGITAL COMMUNICATIONS CONFERENCE

The ARRL and TAPR held their 26th Annual Digital Communications Conference September 28-30, in Hartford, Connecticut. The DCC is an international forum for radio amateurs to meet, publish their work and present new ideas and techniques. Presenters and attendees had the opportunity to exchange ideas and learn about recent hardware and software advances, theories, experimental results and practical applications.

With more than 150 in attendance during the three-day event, ARRL Chief Operating Officer Harold Kramer, WJ1B, said, "It was exciting to see and hear about the latest developments in Amateur Radio digital technology. The depth of knowledge, commitment and enthusiasm were very impressive and bode well for the future of Amateur Radio."

According to *QST* Editor Steve Ford, WB8IMY, most of Friday's seminars were devoted to the Automatic Position Reporting System (APRS). Bob Bruninga, WB4APR, gave the first session of the conference, "The APRS Local Voice Repeater Initiative." Bruninga is the developer of APRS.

Other seminars at the conference included "The Flex 5000 and SDR Software," "HPSDR Update," "AMSAT's Phase IV," "A Method for Automatic Image Balancing in IQ Mixer Based Software Defined Receivers" and "SuitSat 2 Update." Ford also gave a standing-room-only seminar on an introduction to HF digital.

Ford said one of the highlights at the DCC was the NUE-PSK device. This gizmo makes it possible to do PSK31 without a PC. There

S. KHRYSTYNE KEANE, K1SFA

Bob Bruninga, WB4APR, gave the first presentation at the DCC. Bruninga is the developer of APRS.

is no word yet on when kits will be available for this item. "The latest FlexRadio software-defined transceiver also drew a great deal of attention," Ford said. RPC Electronics debuted their all-in-one APRS tracker (2 meter transmitter, packet TNC and GPS receiver in one compact package). The company said it would be available for sale in December, just in time for holiday giving.

The 2008 Digital Communications Conference will be in Chicago, but no date has been set.

HAMS NAMED TO KEY NASA POSITIONS

Veteran astronaut Ellen Ochoa, KB5TZZ, has been named the next deputy director of NASA's Johnson Space Center. Ochoa is a four-time space flier who has served as Director of Flight Crew Operations at Johnson. She will succeed Bob Cabana, KC5HBV, who was named Director of NASA's Stennis Space Center in Mississippi.

Ochoa considers La Mesa, California, her hometown. She earned a BS in physics from San Diego State University and a Master's and PhD in electrical engineering from Stan-

In Brief

● **New Contest Manager on the Job**: Sean Kutzko, KX9X, joined the ARRL Headquarters staff on October 8 as the ARRL Contest Manager. First licensed in 1982 as KA9NGH, Kutzko developed a taste for contesting after winning the Illinois section in the 1988 ARRL Novice Roundup. Since then, he has been active in both HF and VHF contesting, as well as HF DXing and VHF weak-signal communications. A long-standing member of the Society of Midwest Contesters (SMC) and a strong advocate of mentoring new contesters, Kutzko has won several contest and DX awards, including several Top Ten finishes in the ARRL Sweepstakes SSB contest as a QRP entrant. He has been on two HF contest DXpeditions, including 6Y7M in the 1994 CQ WPX CW contest, and V26NA in the 1997 ARRL International DX CW Contest. Kutzko also enjoys activating rare grid squares by going on "Grid DXpeditions" in the continental US for the VHF/UHF community. In the late 1990s, Kutzko published a regular column in the *National Contest Journal* (*NCJ*) that focused on DX locations available for hams to rent for contests or DXpeditions. "It's a great honor to be the Contest Branch Manager. Everybody at HQ has been very friendly and generous of their time and knowledge for me, the newcomer. There is a lot of work from several folks — hams and non-hams alike — that goes on behind the scenes to keep your contest logs properly scored and managed. While I still have a lot to learn, rest assured that as a fellow HF and VHF contester myself, my primary interest is to ensure logs are received and processed correctly, scores are reported quickly and accurately and awards are mailed in a timely fashion."

S. KHRYSTYNE KEANE, K1SFA

Sean Kutzko, KX9X

● **ARRL Receives MARS Call Sign**: The ARRL now has a new Emergency Communications tool in its toolbox — MARS call sign AAN1ARL. According to W1AW Station Manager Joe Carcia, NJ1Q, "The call sign was requested to reflect both the holder of the license (ARRL) and the various MARS services — Army, Air Force and Navy." The MARS station will be housed at W1AW, the Hiram Percy Maxim Memorial Station. ARRL Emergency Preparedness and Response Manager Dennis Dura, K2DCD, said, "The establishment of an Army MARS call sign for W1AW begins a relationship with the Military Affiliate Radio System and the ARRL. Our two organizations are working toward the near-term establishment of a Memorandum of Understanding. Additionally, the League and MARS will utilize each other's personnel and technical capabilities to further enhance our emergency preparedness and response capabilities."

● **Newly Elected Section Managers Converge on Newington**: Those Section Managers who are new to their post — Delaware SM Frank Filipkowski, AD3M; Kentucky SM Jim Brooks, KY4Z; Sacramento Valley SM Ron Murdock, W6KJ; Puerto Rico SM Roberto Jimenez, KP4AC, and San Diego SM Mitch Mitchell, K6BK — came to Newington for an orientation October 12-14. According to Supervisor of the ARRL Field Organization Team Steve Ewald, WV1X, "The Section Manager Workshop is an orientation and training event for new Section Managers that have come on board within the last year or so. ARRL has conducted this training once a year at HQ for the past several years, and it has been well received by past participants. The Membership and Volunteer Programs Department Staff, and its Field Organization Team are the lead coordinators of the event." The primary purposes of the Workshop sessions are to share ideas and to provide basic administrative, management, leadership and motivational training. "We also cover the responsibilities and functions of the Section Manager's position, and the SMs are able to visit with ARRL Headquarters staff members and learn more about the many programs that ARRL supports. The Workshop sessions are presented by several ARRL Headquarter staff members who are experts in their respective areas," Ewald said.

S. KHRYSTYNE KEANE, K1SFA

Supervisor, ARRL Field Organization Team Steve Ewald, WV1X; Frank Filipkowski, AD3M; Ron Murdock, W6KJ; ARRL Field and Regulatory Correspondent Chuck Skolaut, KØBOG; Roberto Jimenez, KP4AC; Mitch Mitchell, K6BK, and Jim Brooks, KY4Z.

● **Longtime ARRL Staffer Retires**: Eileen Sapko, ARRL Awards Manager, retired September 28 after 23 years at League HQ. We wish her the best! If you have any questions concerning any of the ARRL awards programs, please direct them to Bill Moore, NC1L, at **bmoore@arrl.org**.

ford University. She managed the Intelligent Systems Technology Branch at NASA's Ames Research Center in Moffett Field, California, before being selected as an astronaut in 1990. She flew on space shuttle missions STS-56 on *Discovery* in 1993; STS-66 on *Atlantis* in 1994, STS-96 on *Discovery* in 1999 and STS-110 on *Atlantis* in 2002, logging a total of 978 hours in space. She became Deputy Director of Flight Crew Operations at Johnson in December 2002 and Director of Flight Crew Operations in September 2006.

Cabana, originally from Minnesota, is a graduate of the US Naval Academy in Annapolis, Maryland; upon graduation, he entered the US Marine Corps, retiring as a Colonel in 2000. He has logged more than 7000 hours in 34 different kinds of aircraft, including the A-6 Intruder and A-4 Skyrider. A graduate of the US Naval Test Pilot School, Cabana served there as the A-6 program manager, X-29 advanced technology demonstrator project officer. He was also a test pilot for flight systems and ordnance separation testing on A-6 and A-4 series aircraft. A veteran of four space flights, Cabana has logged more than 1010 hours in space. He served as pilot on STS-41 in 1990 and STS-53 in 1992, both on *Discovery*. He was mission commander on STS-65 on *Columbia* in 1994 and STS-88 on *Endeavour* in 1998, the first International Space Station assembly mission. QST

PUBLIC SERVICE

SKYWARN Recognition Day is December 1

David Floyd, N5DBZ
Warning Coordination Meteorologist
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The 9th annual SKYWARN Recognition Day (SRD) special event will take place Saturday, December 1, 2007. An event co-sponsored by the National Weather Service and the American Radio Relay League, SKYWARN Recognition Day is the National Weather Service's way of recognizing the commitment made by Amateur Radio operators in helping to keep their communities safe. During the 24 hour special event, Amateur Radio operators visit their local NWS office and work as a team to contact other hams around the world.

"While ham radio operators provide valuable information throughout the year, they are probably most recognized in their role as 'SKYWARN spotters' during the Spring and Summer months," says Scott Mentzer, NØQE, organizer of the event and Meteorologist-In-Charge at the NWS office in Goodland, Kansas. "Their reports are invaluable to National Weather Service operations."

NWS offices receive reports of hail size, wind damage and rainfall amounts from a variety of sources during warning operations. At times these reports are after-the-fact or are relayed by someone who did not witness the event. It is the direct and immediate communication provided by mobile Amateur Radio spotters beneath the storm that is vital. When these reports are correlated with Doppler radar, it many times translates to the issuance of a warning several minutes earlier than would otherwise have been possible. The end result is better service to local communities and enhanced public safety.

When summer turns to fall, many ham groups begin turning their attention to winter weather operations. Amateur Radio reports of snow totals, drifting snow, reduced visibility and whiteout conditions, ice accumulations and ice damage help NWS offices assess the impact of large-scale winter storm events. This vital information is then relayed to the public and media outlets.

Each year, National Weather Service offices continue to play a larger support role in non-weather hazardous events, assisting in fire weather and hazmat incidents. Real time Amateur Radio reports of the locations of thick smoke and zero visibility during wildfires has allowed forecasters to provide crucial weather updates for firefighters and firefighting aircraft.

While NWS offices utilize the real-time reports of ham operators, Hurricane Katrina in 2005 reminded us that radio amateurs are equally important during the recovery phase of natural disasters. Large-scale weather events can knock out nearly all of the high-end emergency communications gear, 911 centers, cell towers and normal phone lines. Ham radio operators often step in to relay emergency traffic where normal communications are nonexistent.

SKYWARN Recognition Day will be held from 0000 UTC to 2400 UTC on December 1. In 2006, 90 National Weather Service offices participated and logged 16,209 QSOs during the 24 hour event! To learn more, check out the Web site **hamradio.noaa.gov**.

ARRL INVITES NOMINATIONS FOR 2007 INTERNATIONAL HUMANITARIAN AWARD

Nominations are open for the 2007 ARRL International Humanitarian Award until December 31, 2007. The award is conferred upon an amateur or amateurs who demonstrate devotion to human welfare, peace and international understanding through Amateur Radio. The League established the annual prize to recognize Amateur Radio operators who have used ham radio to provide extraordinary service to others in times of crisis or disaster.

A committee appointed by the League's President recommends the award recipient(s) to the ARRL Board, which makes the final decision. The committee is now accepting nominations from Amateur Radio, governmental or other organizations that have benefited from extraordinary service rendered by an Amateur Radio operator or group.

Amateur Radio is one of the few telecommunication services that allows people throughout the world from all walks of life to meet and talk with each other, thereby spreading goodwill across political boundaries. The ARRL International Humanitarian Award recognizes Amateur Radio's unique role in international communication and the assistance amateurs regularly provide to people in need.

Nominations should include a summary of the nominee's actions that qualify the individual (or individuals) for this award, plus verifying statements from at least two people having first-hand knowledge of the events warranting the nomination. These statements may be from an official of a group (for example, the American Red Cross, The Salvation Army, a local or state emergency management official) that benefited from the nominee's particular Amateur Radio contribution. Nominations should include the names and addresses of all references.

Members of the VU4 DXpedition team, winners of the 2005 International Humanitarian Award: From left — Sarath Babu, VU3RSB; Bharathi Prasad, VU2RBI; S. Ram Mohan, VU2MYH; D. Varun Sastry, VU3DVS, and D. N. Prasad, VU2DBP.

All nominations and supporting materials for the 2007 ARRL International Humanitarian Award must be submitted in writing in English to ARRL International Humanitarian Award, 225 Main St, Newington, CT 06111 USA. Nomination submissions are due by December 31, 2007. In the event that no nominations are received, the committee itself may determine a recipient or decide to make no award. Please see **www.arrl.org/FandES/field/awards/humanitarian.html**. The winner of the ARRL International Humanitarian Award receives an engraved plaque and a profile in *QST* and other ARRL venues.

The last recipients of this award were the members of the Andaman and Nicobar Islands VU4RBI/VU4NRO DXpedition team who were selected to receive the 2005 ARRL Humanitarian Award. Team members included Bharathi Prasad, VU2RBI; D. N. Prasad, VU2DBP; S. Ram Mohan, VU2MYH; R. Sarath Babu, VU3RSB, and D. Varun Sastry, VU3DVS. The board's resolution stated that, "The group's immediate actions and their use of Amateur Radio to render assistance to victims of the December 2004 Indian Ocean tsunami while on location in the Andaman Islands are in the highest tradition of Amateur Radio." — *Chuck Skolaut, KØBOG*

CIBOLA COUNTY ARES CALLED TO ACTION

Jonathan Pickens, KD5PHG
kd5phg@arrl.net

On August 12, 2007, at approximately 1750 MST, I received a phone call from an El Morro Ranches (New Mexico) resident requesting to speak with my wife, Pam Pickens. The resident had checked on an elderly neighbor at the request of the neighbor's granddaughter and had found her semi-conscious on the floor of her home. The neighbor tried to reach the area ambulance and EMT services, but CenturyTel long distance

service had been disabled by an electrical storm. Shortly after we were contacted, CenturyTel local phone service also went down. Cell phones had been tried, but 911 was yielding a constant busy signal apparently due to the storm. Knowing that my wife was a first responder, the El Morro Ranches resident asked that she come to the residence and assess the situation and administer the care she was authorized to give.

We left our business, and upon entering El Morro Ranches met another El Morro Ranches resident who had been able to contact the Cibola County Sheriff and notify them of the situation. The Sheriff's office was unable to contact El Morro area ambulance services but dispatched a unit to El Morro Ranches.

Arriving at the scene, my wife and another first responder, Wanda Wallace-Thomas, ascertained that the patient, an 86 year old female, had suffered a possible stroke, with a possible broken hip as a result of a subsequent fall. The patient was having difficulty speaking but was able to say that she had been lying in her home for two days or more. Because she was unable to move, she couldn't reach her cell phone to call for help. Realizing that the situation required an ambulance or possible life flight and that local communication was inoperative, I decided to use my mobile Amateur Radio to contact the Cibola County Amateur Radio Emergency Service. I was able to contact Dana Farmer, WA5SOX, and Kathy Farmer, KB5QGH, on the 145.43 MHz repeater and give them a rundown of the situation and the need for an ambulance.

Dana and Kathy had local phone service but were unable to contact ambulances near us because their CenturyTel long distance service was also down. Using Amateur Radio and local phone service, Dana and Kathy contacted Gallup Metro dispatch, who then contacted the Vanderwagon Fire Department. They, in turn, contacted the Ramah Fire Department. The Ramah Fire Department dispatched a unit but apparently also contacted the Pine Hill Clinic ambulance. The Pine Hill Clinic ambulance arrived first on the scene and was led to the patient's residence by the resident stationed at the El Morro Ranches gate. The patient's vital information was given to the EMTs. After the EMTs had finished their examination, we assisted in loading the patient on a backboard and moved her to the ambulance gurney and the ambulance. The patient was then transported to RMCH in Gallup per her request.

During the entire incident, Amateur Radio operators KD5PHG, WA5SOX, and KD5QGH maintained constant radio contact until the patient was transported.

NEW POLICE VEHICLE HAS HAM PLATES

Constable Bob McKinlay, VE3GIV, of the Hamilton Police Service in Hamilton, Ontario, Canada is pictured in front of the vehicle. Among his many duties as a police officer assigned to Emergency Support Services, Bob is also the Incident Command Unit Operations Manager as well as the Amateur Radio licensee/liaison of the Hamilton Police Service. Bob is shown with the newly acquired Incident Command Unit, 999. Note the license plate — VA3HPS. It is believed

COURTESY BOB MCKINLAY, VE3GIV

Constable Bob McKinlay, VE3GIV, of the Hamilton Police Service in Hamilton, Ontario, Canada is pictured in front of newly acquired Incident Command Unit, 999.

that this is the only police vehicle in Ontario, if not in all of Canada, to be registered with ham radio call letter license plates. The vehicle's onboard radio inventory includes a 40 W VHF Motorola Spectra programmed with 67 repeater pairs and 14 simplex frequencies. The antenna is a ⅝ wave vertical mounted on the roof. The antenna inventory alone is staggering: 8 antennas in all, mostly 800 MHz.

If you're interested in public service and emergency communications, subscribe to the ARES e-Letter *at* **www.arrl.org/ares-letter**. *It's free to ARRL members!*

Field Organization Reports

Public Service Honor Roll
September 2007

This listing is to recognize radio amateurs whose public service performance during the month indicated qualifies for 70 or more total points in the following 6 categories (as reported to their Section Managers). Please note the maximum points for each category:
1) Participating in a public service net, using any mode. —1 point per net session; maximum 40.
2) Handling formal messages (radiograms) via any mode. —1 point for each message handled; maximum 40.
3) Serving in an ARRL-sponsored volunteer position: ARRL Field Organization appointee or Section Manager, NTS Net Manager, TCC Director, TCC member, NTS official or appointee above the Section level. — 10 points for each position; maximum 30.
4) Participation in scheduled short-term public service events such as walk-a-thons, bike-a-thons, parades, simulated emergency tests and related practice events. This includes off-the-air meetings and coordination efforts with related emergency groups and served agencies. — 5 points per hour (or any portion thereof) of time spent in either coordinating and/or operating in the public service event; no limit.
5) Participation in an unplanned emergency response when the Amateur Radio operator is on the scene. This also includes unplanned incident requests by public or served agencies for Amateur Radio participation. — 5 points per hour (or any portion thereof) of time spent directly involved in the emergency operation; no limit.
6) Providing and maintaining a) an automated digital system that handles ARRL radiogram-formatted messages; b) a Web page or e-mail list server oriented toward Amateur Radio public service — 10 points per item.

Amateur Radio stations that qualify for PSHR 12 consecutive months, or 18 out of a 24-month period, will be awarded a certificate from Headquarters upon written notification of qualifying months to the Public Service Branch of the Membership and Volunteer Programs Department at ARRL HQ.

477
KI4GEM
371
W2LTB
355
KG4TND
330
KB9KEG
315
K2DYB
310
N2LTC
307
W2MTA

299
KA2ZNZ
280
K7EAJ
256
WB8RCR
255
N7CM
235
KØIBS
230
AK2Z
209
K8MFK

202
WA2BSS
195
NØYR
192
K1HEJ
190
KB2ETO
187
KK1X
185
K4RLD
184
KK1X
KB1LCS

182
W7LUX
181
K5SFM
180
KK3F
KE5HYW
170
KC2LIX
160
KD1LE
KGØGG
159
KD8BGQ

155
AB1AV
150
WB5ZED
145
K9LGU
144
KD7THV
K4DND
140
KA8ZGY
WØLAW
W4DNA
K7BFL

135
W3YVQ
WB9JSR
WA2YBM
N1LKJ
NIØI
132
N5KWB
KC2ODN
W2DWR
130
KD5TXD
W4FAL
N1UMJ
WØSJS
W7ELB
N2QZ
K9FHI
AG9G
128
KØBLR
WG8Z
WD8Q
N8DD
WB8SIQ
K8RDN
127
KJ7NO
126
W9XAN
W1PLW
125
NN7H
124
K7BC
122
WD8USA
121
KK7TN
120
N7BEC
K4FQU
KA4FZI
KC5OZT
KJ6T

KC9IED
W5PY
K2UL
KA5KLU
W7IG
W5ESE
K4IWW
KW1U
W2CC
W8UL
118
KA2BCE
K8AMR
117
N3RB
115
KC8WSE
AB8SY
114
W3ZQN
112
W4ZJY
110
W7GB
W7GHT
N4ABM
NA7G
N3YTD
K5MC
K4GK
KK5GY
N7XG
N7YSS
KF7GC
KE4JHJ
W2EAG
K1YCQ
N8IO
108
WA4UJC
KD1SM
N2GJ
107
N2VC
105
KD5DLZ

107
N2VC
W3CB
102
W4TY
100
W3TWV
WA4EIC
NØMEA
NR2F
WX4H
N9MN
KE4PAP
K2VX
WV8RG
WB2LEZ
N4MEH
K2AN
N5OUJ
NX1Q
N7DRP
WB4FDT
K2TV
WB2KLH
W2DSX
KM1N
W4LN
W4TTO
AF2K
98
WB8OIF
96
AD4BL
95
KØBLR
WG9Z
94
AB5WF
KS3Z
N1NH
93
W5CU
WAØVKC
91
AA3SB
KØBXF

90
KA8WNO
WD8DHC
K3IN
N3ZOC
KA1RMV
KA1GWE
NDØN
KD7ZLF
WB4BIK
KD4FUN
KI4YV
WB2IJH
WA2CUW
N1JX
NUØF
WØCLS
N3SW
WE2G
W8IM
K1JPG
KF4WIJ
N3KB
N1JX
N8OD
WD8Q
N8DD
WB8SIQ
86
KBØDTI
AA4BN
85
KE3FL
KE4CB
KO4OL
84
W5HUD
83
KC2JCB
K4BEH
82
KB3LFG
KM1N
81
W5GKH
NR4DW
W4NTI

80
WB6OTS
NN7D
KA1ZIA
K8AE
K8KV
KE5DKV
N4EJF
79
WDØGUF
78
WA5OUV
K8GA
K6RAU
77
NØZIZ
NA7G
76
KI4JQB
75
W5XX
W4CAC
74
N9WS
WA1JVV
KC2IYC
73
K8ZJU
WA2NDA
W3GQJ
KA4LRM
71
W9RSX
70
AAØLD
WØAZD
KAØFUI
KØDUW
NØMHJ
NØUKO
WØWSP
NØDUW
NØDUX
KCØZQC
KØNLE
KB7ZUP

The following stations qualified for PSHR in previous months but were not recognized in this column: (August) W4DNA 175, KI4RBB 160, K4RLD 145, W4FAL 130, W9AL 126, K4IWW 120, KE4JHJ 110, W2EAG 110, WA2YBM 110, NA9L 110, WB4FDT 100, W4TTO 100, KI4YV 90, W4LN 83, KO4OL 82, KE3FL 74. (July) W4DNA 170, K4RLD 160, WA2YBM 150, KI4RBB 148, W4FAL 130, K4IWW 120, KE4JHJ 110, W2EAG 110, W4LN 105, W4TTO 100, KI4YV 90, KO4OL 84. (June) KO4OL 90. (May) KO4OL 88.

Section Traffic Manager Reports
September 2007

The following ARRL Section Traffic Managers reported: AK, AL, AZ, CO, EMA, ENY, EPA, EWA, GA, ID, IL, KS, KY, LA, MN, MO, MS, NC, NFL, NH, NLI, NNJ, NNY, NTX, OH, OK, OR, SC, SFL, SD, SJV, SNJ, STX, TN, UT, VA, WCF, WI, WMA, WNY, WV, WY. The Ohio STM reported in August, but was not recognized in this column last month.

Section Emergency Coordinator Reports
September 2007

The following ARRL Section Emergency Coordinators reported: AZ, EMA, EWA, IL, IN, KS, KY, ME, MI, MO, NC, NTX, OH, OK, NV, SD, SNJ, SFL, STX, SV, VA, WPA, WTX, WV, WWA.

Brass Pounders League
September 2007

The BPL is open to all amateurs in the US, Canada and US possessions who report to their SMs a total of 500 points or a sum of 100 or more origination and delivery points for any calendar month. All messages must be handled on amateur frequencies within 48 hours of receipt in standard ARRL radiogram format.

Call	*Orig*	*Rcvd*	*Sent*	*Dlvd*	*Total*
WB5ZED	15	1824	2042	56	3917
W4ZJY	0	947	1064	0	2011
N1IQI	0	285	1716	0	2001
KK3F	16	902	892	10	1820
WB5NKC	61	325	998	28	1412
KA9EKG	44	631	618	29	1322
W8UL	0	498	503	7	1008
W1GMF	0	300	661	0	961
WB9JSR	1	437	432	13	883
KW1U	0	365	476	0	841
WB5NKD	1	82	720	0	833
KA5KLU	0	448	375	0	823
WX4H	0	320	391	8	719
N8IXF	1	356	303	12	672
N2LTC	0	279	274	69	622
W4UEF	18	286	304	0	608
N1UMJ	18	290	270	6	584

The following station achieved BPL with originations plus deliveries: KK5GY 165.

The following stations qualified for BPL in August but were not recognized in this column: W8UL 1073, N8IXF 643.

W3ZZ

THE WORLD ABOVE 50 MHz

Road Trip

Denizens of the VHF+ bands suffer from a unique communications problem. The nature of the bands we operate limits the distance we can cover to something in the order of 600 km under ordinary conditions. Even on 6 m, where E_s contacts are common during the summer, we cannot depend on being able to work stations beyond regional distances. Thus if we want to know what is happening in another area of the country, we can't normally talk with these folks — we actually have to go there.

What's the best way to do this? Why go to a convention, of course. There's no lack of opportunities in the VHF+ world, if you are willing to travel. I go to conventions primarily to see people from other areas and to talk about their interests and what they are doing. I also go to keep abreast of the state of the art in many areas. I have also been known to buy specialized parts for my own VHF+ station, and to discuss upcoming operating events like contests and meteor showers.

In this column I want to describe some of the conventions I have attended — the structure of conventions; some of their unique features, if any; and even some special things to see and do. It's now time to start generating your calendar for 2008. I hope you will consider attending one or more of these conventions.

Convention Structure

Almost all VHF+ conventions contain certain repeating elements. Conventions are usually built around technical programs that cover a wide-ranging series of topics. This is perhaps more important for the VHFer than for the HF operator because building and maintaining a VHF+ station often takes somewhat more than pulling out your checkbook and plugging in a group of equipment components. Tolerances are tighter than they are on HF and you have to learn what is important and what is not. The technical program at conventions is one place to do this. Many of the presentations provide very useful information. For instance, looking back at the printed *Proceedings* of some conferences I notice papers on rover station design; 28 V relay drivers; tower trailers; EME antennas, including parabola design and feeds; EME on microwave bands; reference-locked oscillators; design and construction of SHF and millimeter band equipment; solid state microwave amplifiers; software-defined radios, and VHF DXpeditions to name only a few.

Where else can you find detailed information about these subjects? Certainly not in *QST*, where these topics are often too specialized for the general readership. And not even in *QEX*, because many of the practical VHF articles are more about operating than technical details. Add to that the fact that many of the speakers are professional experts in the areas about which they are speaking, and you have some great opportunities to learn something new and important. How could you go wrong listening to Paul Drexler, W2PED, or Tom Williams, WA1MBA, talk about the design of upper microwave equipment; Joe Taylor, K1JT, talk about ultra weak signal digital communication on EME and meteor scatter; Brian Justin, WA1ZMS, talk about millimeter wave communication; Kent Britain, WA5VJB, talk about cheap Yagis, or Jimmy Treybig, W6JKV, talk about his latest DXpedition?

Most conventions provide a ready and accurate means of testing your preamplifiers and antennas. How good does that preamp really hear? Is that antenna really working? Antenna gain measurements are made on a homebrew antenna range, usually a parking lot, comparing against a calibrated dipole or a microwave horn. Preamplifier noise figure measurements are made with the latest in well-calibrated test equipment, in many cases costing many tens of thousands of dollars. These tests are carried out by some real experts like W5LUA, WA5VJB, K1VT, and others, many of whom have been doing this for years at various conventions.

Need exotic parts for your latest project? What about an entire radio? Almost every convention has a mini flea market. It may be one evening or immediately following the convention on Sunday, but this is the one place you can find what you need, often at reasonable prices. Try finding an SPDT SMA microwave relay at an *ordinary* hamfest. Over the years I have bought many such relays, a 23 cm water cooled ampli-

This Month

December 14	Geminids meteor shower peaks at 1645Z
December 16	Good EME conditions*

*Moon data from W5LUU

Table 1
A Sampling of VHF-Plus Conventions With 2008 Locations Where Known

See text for abbreviations.

Date	*Name*	*Sponsor*	*Locations*
April			
3rd wk	Eastern VHF/UHF Conference	NEWS	Enfield, CT
4th wk	SVHFS Conference	SVHFS	Orlando, FL
May			
3rd wk	Dayton Weak Signal Banquet WA8WZG	WA8RJF	Dayton, OH
July			
4th wk	CSVHFS Conference	CSVHFS	Wichita, KS
October			
1st wk	PNWVHFS Conference	PNWVHFS	Moses Lake, WA
1st wk	MidAtlantic VHF Conference	Pack Rats	Philadelphia, PA suburbs
3/4th wk	Microwave Update (MUD)	NLRS	Minneapolis, MN*

*Tentative

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fier, most of the parts for a 24 GHz transverter, a 3 W 24 GHz solid state amplifier, a 24 GHz commercial dish, and a wide variety of connectors and cables.

Every convention has a banquet. This is probably one of the best places to talk to people — and that's a major reason why you came, isn't it? There is often a banquet speaker. They have touched on an enormous variety of topics from soup to nuts [okay, I couldn't resist that!], both directly concerning VHF radio and otherwise. Regardless of the topic, I have found these presentations enjoyable and interesting.

Let's look at some of the conventions I have attended. See Table 1 for a summary of these events for 2008.

Convention Tour

April (Third Week): The first convention of the year for me is the Eastern States VHF/UHF Convention, sponsored by Northeast Weak Signal Group (NEWS). It has been held on the Connecticut/Massachusetts border, in Enfield, Connecticut. The conference itself is a single day event (Saturday) but it has a couple of unique features: Concurrent with the technical presentations are three "band" sessions covering 50-222 MHz, 432-1296 MHz and 2304 MHz and above. These discuss what's happening operationally on the VHF+ bands. This convention attracts some of the most active 10 GHz portable operators in the country so the latter provides some very interesting discussions. During the banquet, all the attendees get to take the VHF-Microwave Trivia quiz. And the questions are as trivial as it gets. The top score wins two prizes: a piece of history — custody of the Sam Harris, W1FZJ, Memorial wavemeter, said to have been used by Sam himself. I won this one time and I must say since Sam was one of my heroes, it was great to display this in my shack for a year. The winner is responsible for making up the following year's quiz, however, and trying to fool such perennial competitors as K1WHS and AF1T is a difficult task. Friday night you should consider having dinner at Rein's Deli in Vernon, Connecticut, or the newer version in Springfield Massachusetts. This is the closest you will get to an authentic deli outside New York City.

April (Fourth Week) The Southeastern VHF Society conference has been held in various cities in the Southeast including Atlanta, Georgia; Charlotte, North Carolina; Greenville, South Carolina; Nashville and Oak Ridge, Tennessee and Huntsville, Alabama. In 2008 it will be in Orlando, Florida, and that will give me a chance to meet the Florida weak signal crowd. This is a day and a half conference featuring a luncheon keynote speaker on Friday. At least one time in Atlanta, antenna measurements were made on the Georgia Tech professional antenna range. I missed Nashville, but had I gone, I wouldn't have missed a chance to attend the Grand Ole Opry.

May (Third Week): On the Friday of the Dayton Hamvention® Tony Emanuele, WA8RJF, Tom Whitted, WA8WZG, and the VHF Weak Signal Group (3843 kHz at 0200Z Monday nights) sponsor the Dayton Weak Signal Banquet at the Holiday Inn in Dayton. This one has a speaker and lots of prizes. There is also a 2 hour VHF session during one day of the Hamvention. I have always been partial to the good Midwestern bratwursts outside the arena and the glazed nuts inside the arena.

July (Fourth Week): The Central States VHF Society convention brings together VHF+ operators from perhaps the widest geographic area of any convention. It is usually held in locations west of, — but near — the Mississippi River, but it has ranged from Winnipeg and Toronto, Canada to Colorado Springs, Colorado. CSVHFS gives two prestigious awards at their convention: the Chambers Award for technical achievement is named for John Chambers, W6NLZ, who did pioneering work on the transpacific Hawaiian duct, and the Wilson Award for service to the CSVHFS and the VHF+ community, which is named for propagation expert Mel Wilson, W2BOC.

I have not missed Central States since my ex-neighbor and column predecessor, Bill Tynan, W3XO, ran the convention in Kerrville, Texas in 1992. When he still lived in the Washington, DC area I promised him I would attend when he moved to Texas. I had doubted that I would know anyone, since I am located a long way from the "central states" and many of the natives are only a fleeting whisper off a meteor trail. Wrong! Many of the attendees are among the most active VHF operators, and you would be surprised at how many you have worked and even spoken with at some length, even if you live more than 1000 km away. There are lots of things to do and eat depending on where it is: Pikes Peak, the Mall of America and Elvis' Graceland for a few. As a lover of BBQ, the CSVHFS convention has given me a chance to eat some of the best — Arthur Bryant's in Kansas City and Corky's and the Rendevous in Memphis.

September (Fourth Week)/October (First Week): The Pacific Northwest VHF Society convention is held in various locations in Washington and Oregon. I was invited to give a presentation in Seaside, Oregon in 2005, and came away with a much better understanding of limitations facing the VHF+ world in the Northwest, with the ocean to the west and large mountains everywhere. Depending on the convention location there are tons of things to see and do — Mt Rainier, the Olympic Peninsula temperate rain forest, the gorgeous Oregon coast for a few. I'm partial to the fish — king crab, salmon, bluefish and oysters, and who would have thought that there was excellent pizza in Seaside at Papa's Pizza?

October (First Week): One of the oldest and best attended gatherings is the Mid-Atlantic VHF conference, sponsored by the Mt Airy VHF Radio Club (Pack Rats). The Rats are actually a much smaller club than one might expect from the large number of scores they submit in the VHF contests, but a large proportion of the membership is active and has a station good enough to work people many miles away. On the Sunday following this convention is the Hamarama, perhaps the best hamfest for VHF parts anywhere. The Philadelphia area is associated with many excellent diners (not the greasy spoons you are used to) and is the home of the Philly cheesesteak.

October (Third / Fourth Week): Microwave Update (MUD) has rotated throughout the country and been sponsored by most of the large VHF clubs from California (San Bernadino Microwave Society) to Seattle (PNWVHFS) to Texas (North Texas Microwave Society) to Ohio (Dayton and Sandusky) to the East Coast (Rochester VHF Group, Pack Rats and NEWS). If you want to build a microwave station, get on a new microwave band or improve the microwave station you have, this is the place to meet the leaders in the field. Many MUD conferences (such as Dallas and Philadelphia) have been preceded by a tour of the local microwave surplus houses.

These are only the conferences that I have attended. There are others, like Aurora, run by the Northern Lights Radio Society, that I would like to attend some day.

You can get the printed *Proceedings* of any of these conferences from the ARRL Bookstore.[1] But it's not the same as hearing the presentation and asking questions directly to the presenter. As you may have gathered, I enjoy going to conferences. I believe it is part of the job of writing this column to get to other parts of the country and find out what is on people's minds and where they think this part of the hobby is going. Even if I weren't the column editor, however, I would still go to as many of these conventions as possible. Try it. I think you will like it, too.

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

50 MHz Standings by DXCC Entities Worked

Call Sign	State	States Worked	DXCC Entities Worked	Grids Worked	DX† (km)
1					
K1TOL	ME	50	173	1264	15,185
W1JJ	RI	50	173	—	15,594
K1SIX*	NH	50	167	1012	15,549
K1SG*	MA	50	151	500	15,622
W3EP/1	CT	50	147	1102	15,750
K1AC	NH	50	142	—	14,535
K1MS	MA	50	139	—	14,498
W1AIM	VT	50	130	537	14,928
K1TEO	CT	50	125	903	14,430
K7BV	CT	50	111	623	14,813
W1LP	MA	50	109	575	15,295
2					
K2ZD	NJ	50	155	468	15,610
K2MUB	NY	50	149	—	—
W2CNS	NY	50	127	639	15,120
K2OVS	NY	50	115	498	13,124
K1JT	NJ	50	90	561	14,150
3					
W3ZZ	MD	50	140	861	15,769
N3II	MD	50	133	778	15,831
N3DB	MD	50	131	850	15,083
W3TC	PA	50	131	776	15,221
W3CMP	PA	50	125	—	—
AK3E	MD	50	107	689	14,445
N3JPU	MD	50	86	450	—
4					
K4MM	FL	50	149	—	16,326
W4UM	FL	50	134	298	—
W4TJ	VA	50	128	730	15,688
NN4DX	NC	50	128	124	14,675
NW5E	FL	50	123	701	15,103
K4QI	NC	50	121	840	—
K4RWP	TN	50	115	748	15,228
AA4H	TN	50	107	696	12,580
W4WA	GA	50	107	336	—
KB4ET	FL	50	106	—	—
K3XA	VA	50	101	—	15,150
W4WTA	GA	50	98	700	16,851
WA4CQG	AL	50	86	—	—
K4RF	GA	50	69	375	16,288
5					
K5CM	OK	50	164	—	—
W5OZI	TX	50	157	1086	15,131
WD5K	TX	50	144	1128	14,924
K5AM	NM	50	136	849	17,861
WB5HJV	TX	50	115	—	15,106
AA5AM	TX	50	111	728	14,963
W5HNK*	TX	50	109	504	14,815
WA5UFH	TX	50	100	551	—
W5UWB	TX	50	91	300	—
W3UUM	TX	50	89	618	15,933
W5ZN	AR	50	65	507	14,952
W5RCI	MS	50	60	515	—
K5YPV	MS	50	32	272	8,759
AA5JG	OK	50	28	409	—
W5LUA*	TX	50	—	—	—
6					
K6QXY*	CA	50	141	—	15,555
KB6NAN	CA	50	84	717	16,638
KR7O*	CA	50	68	586	12,783
N6ZE	CA	47	70	330	—
7					
W7GJ*	MT	50	114	708	16,102
WA7JTM	AZ	50	112	800	18,138
W7KNT	MT	50	101	734	15,557
K7XC	NV	50	22	532	11,230
8					
K8MFO	OH	50	154	—	—
W8PAT	OH	50	106	487	13,459
W8UV	OH	50	106	350	12,349
K8NXI	OH	50	103	—	12,107
W8TN	WV	50	101	475	12,436
WA8RJF	OH	50	84	583	15,365
N4DB	OH	50	76	367	11,037
9					
W9RPM	WI	50	126	574	14,092
K9LCR	IL	50	109	550	15,872
W9RM	IL	50	107	726	13,712
K9SM	IL	50	93	517	15,148
WA9PWP	WI	50	52	426	10,400
KB9TLV	WI	50	45	125	15,905
KA9UVY	IL	50	37	289	7,969
Ø					
KØFF	MO	50	123	740	16,246
KØGU	CO	50	103	778	17,142
KØCS	CO	50	82	526	13,409
KØCJ	MN	50	78	—	15,500
KØAWU	MN	50	44	458	11,748
KØALL	ND	50	42	—	—
Canada					
VE2PEP	PQ	50	95	663	11,574
VE3TMG	ON	50	68	539	15,454
VE2PIJ	PQ	49	57	433	6,104
International					
NP3CW	PR	50	107	582	13,533
SM7FJE	INT	43	206	1119	15,912
GØJHC	INT	42	211	1107	15,951
IKØFTA	INT	38	229	1053	18,263
F5DE	INT	36	163	717	15,789
W3CMP/VP9	INT	36	39	—	—
GW3HWR	INT	31	95	472	10,970
SV1DH	INT	29	235	950	16,600
SP5EWY	INT	—	178	—	15,256

†Terrestrial
*Includes EME (moonbounce) contacts
— Information not supplied

ON THE BANDS

The leading event this September was the first 1296 MHz WAS. Although there was nothing spectacular, a series of slow moving high pressure systems produced quite a bit of enhanced tropo propagation. Very few correspondents felt any of this was worth reporting, so more of this report than usual comes from trolling through the propagation reflectors at **dxworld.com** and the VHF Contesting Reflector. Six meters was its seasonal poor self, as most E_s disappeared, but there was a surprise meteor shower to enliven the faithful. Let's take a look.

Tropospheric Ducting

Tropo conditions were enhanced in both the 2 m and 222 MHz Sprints. On 2 m, Jeff, K1TEO (FN31) worked 18 W8 stations and 37 grids, west to EN82 and south to EM95 and 96. Len, K3TUF (FN10) had 31 grids west to EN70 (K9MRI) and northeast to FN35. Your conductor also found conditions enhanced to the west, and worked K9MRI among my 25 grids. Jeff, K1TEO, made a good point: the usually quite accurate Hepburn maps did not suggest in advance that conditions would be that good.

Conditions during the 222 MHz Sprint were up, but not quite as good. Ron, WZ1V (FN31) had 26 grids (but no FN32) and I had 19 grids. The only tropo report — from Russ, K4QI — notes that he worked W1ZC (FN42) on 1296 on Sep 19 from FM06, and K5EMP (EM30) on 2 m on Sep 16, portable from EM85.

Meteor Scatter

Having been warned by several sources that the September 1 Aurigid meteor shower might be better than normal, the MS crowd was rewarded by a brief but solid peak between 1050Z and 1200Z. I thank propagation maven Carl Luetzelschwab, K9LA, for the heads up based on a report from the professional journal, *Eos*. Shelby, W8WN, noted a solid mass of stations crowded around 144.200 MHz after 1100Z, and lots of activity on the Ping Jockey reflector (**www.pingjockey.net/cgi-bin/review-pingtalk**). Several others said 6 m was sufficiently ionized to sound like an E_s opening. Sam, K5SW (EM25) worked seven stations as far as FN10 and FM16. Jay, KØGU (DN70) worked three stations including EM88, a new 2 m grid at 1210 miles. John, W5UWB (EL17) ran a number of long haul 2 m / 222 MHz skeds with one completion, WA3LTB (EN92 — 1384 mi) on FSK441. Dave, K1ZZ (FN31) worked K9CT (EN50). Arliss, W7XU (EN13) got full calls but nothing further from K4HV (EL97) at 1410 miles on 222 MHz FSK441. Ping Jockey reported activity from NØPB (EM39), KØAWU (EN37), KACFD (EN40), AJ6T (CM87), WB2SIH (FN31), K8MD (EN82) and VE1RG (FN76) among others. The **dxworld.com** reflector reported K4LY (EM85), K2DRH (EN41), K5QE (EM31) and K8TQK (EM89). All in all it was an interesting morning, where a usually minor shower sounded better than this year's Perseids for a short time.

6 Meters

Much to everyone's surprise, the ARRL VHF contest featured some 6 m sporadic E. Jon, NØJK (EM17) reports that between 1900Z on Sep 8 and 0030Z on Sep 9, stations particularly in TX and OK were working both north to WØ, W9 and northeast to W1, W2 and W3. KØMU (EN44) got only about seven E_s contacts, but W5PR (EL29) had 95 grids, mostly on E_s. Here on the east coast, K8GP enjoyed 34 E_s QSOs, but overall we found the band to be rather mediocre, with only 100 grids total. Most of those were tropo and scatter QSOs. Roger, K6LMN/R, worked into TX on both Saturday and Sunday from the central CA coast (CM94). Otherwise, activity was pretty sparse. Dave, N3DB (FM18) heard YV4 and 9Y beacons on double hop on Sep 3, but no humans. Russ, K4QI (FM06) worked FN74 on Sep 21. The **dxworld.com** reflector notes auroral E at high latitudes on Sep 2/3, 12, 24 and 28/29.

HERE AND THERE

First 1296 MHz WAS

This month's highlight is a signal achievement: the first 23 cm WAS. Al Ward, W5LUA (EM13) earned 1296 MHz WAS No. 1 by confirming contacts with Wyoming, Utah and Idaho with an EME DXpedition by Paul Perryman, WA5WCP. Number 50 was with Idaho on Sep 4. A few minutes later Jay Liebmann, K5JL (EM15) worked Paul in Idaho to complete his 23 cm WAS. Both Al and Jay thank Paul, WA5WCP, without whose efforts this event would not have been possible. For both these gentlemen, 23 cm WAS has been a labor of love spanning decades. Congratulations to both Al and Jay!

Geminids Meteor Shower

There are lots (up to 120/hr) of slow-moving (35 km/s) rocks in this shower, which peaks on Dec 14 at 1645Z. The short radio bursts associated with the Geminids make it an ideal shower for FSK441 digital contacts.

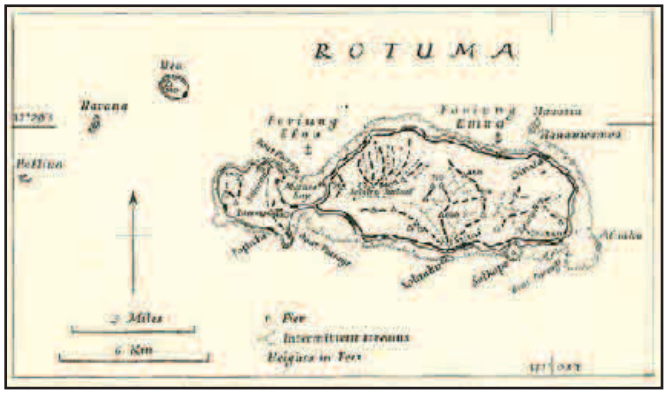
To all my readers I wish the very best of the Holiday Season. May good fortune smile upon your VHF endeavors for all of 2008. QST

W3UR

HOW'S DX?

Rotuma Island

Tony, 3D2AG/FO5RK, says things are on track for the December-January Rotuma Island Dxpedition. He will use the call sign 3D2AG/p on the air. Depending on transportation, he hopes to be on the air from December 15 until January 20. He will leave from Suva, Fiji on an interisland shipping vessel for the 48 hour voyage. Rotuma is about 500 kilometers northwest of Suva. Tony's ICOM IC-706-MKII will have 100 W. He will not have an amplifier. He will be using a 20-10M Spiderbeam 5-band donated by DF4SA, and an inverted-V for 80-30. He will be powered by a 120 Ah battery charged by three solar panels, supplemented by a generator if fuel and oil are available. He plans to be on 80-10M CW and SSB, plus 6M if there are openings. Look for him in the typical DXpedition frequency ranges plus or minus QRM, split if needed. Tony notes that he makes a point of listening for QRP signals. QSL direct only, with adequate return postage, one valid IRC or 2 US dollars. He says the QRZ.com address is good, and asks that you please put your country and "airmail" label on the envelope. He prefers the self-adhesive types. He says the QSL cards will be nice, with color panoramic photos, printed by UX5UO. Tony will have online logs on his Web site after the operation. E-mail him at **fo5rk@hotmail.com** with inquiries and comments. He will not have e-mail during the expedition itself.



Tony says that being single op he will not be on the air all the time, especially while relying on battery power. He will try to be on for the most QSOs in a wide area of coverage. To conserve power, he says, he will not be able to get on 160. And the possibility of digital modes operation, PSK, MFSK and RTTY, will depend on the availability of power for his portable computer. When the bands are open he would like to limit QSOs to call sign and signal report exchanges, saving ragchewing for slower times. He asks that you listen carefully for split frequency and call area during pileups and try to be a little bit orderly. Here are propagation openings he expects from Rotuma, based on his past experience:

USA
1800-2000 UTC 20m long path
2200-0200 UTC 15m — 10m short path
0400-0600 UTC 20m short path
0600-1400 UTC 30m / 40m / 80m

EUROPE
0400-0700 UTC 20m longpath
0600-1200 UTC 40m / 30m
0800-1200 UTC 15m short path
1800-2000 UTC 20m short path

JA / ASIA
2100-0300 UTC 10m / 15m short path
0500-0800 UTC 20m short path
0800-1200 UTC 15m short path
0600-1400 UTC 40m / 80 m
0800-1200 UTC 6m (if TEP)

DX NEWS AROUND THE GLOBE

C5 — THE GAMBIA

C56JJ will be on the air again from November 30 until December 7. Operator Jan, PA4JJ, says he will probably have an online log this time on his Web site, **c56jj.pa4jj.nl**.

C9 — MOZAMBIQUE

C91R will be on the air until August 2008 on 20, 17, 15, 12 and 10M, all modes, but concentrating on RTTY. On 20M he will have a dipole. He hopes to put up a Spiderbeam but doesn't think he has the parts he needs. QSL via CT1BXT. He will answer the cards when he returns home to Portugal. QSL direct or bureau, or e-QSL or LoTW. If direct, include an SAE and IRCs or 2 US dollars.

CLOSED QSL BUREAUS

The IARU Web site has a report that the QSL bureaus for 9L, Sierra Leone, and HH, Haiti, have closed.

FH — MAYOTTE

FH1LE is the new call sign for Alain, F4RPW, now that he lives full-time on Mayotte. He arrived there in late August and is getting his gear sorted out. He hopes to have the station operational soon. He will start out with a 4BTV vertical and his FT-897 rig running 100 W. He will be on SSB and maybe CW if he can get in a little practice. He also plans to get on PSK31 and RTTY with a Microham interface box. And he has a KT-34 beam, the latest upgrade, but has to work out some issues with the small space he has to work with at his QTH.

FO — FRENCH POLYNESIA

Freddy, F5IRO (TO4E, FK/F5IRO, FR/F5IRO, FY/F5IRO, TO7R), is currently on a four month assignment in Papeete (OC-046), French Polynesia. He has picked up his FO5RU license and will be QRV until about mid-January 2008. Look for him in his spare time on all HF bands on CW, SSB and RTTY. It is possible that he may activate

Bernie McClenny, W3UR ♦ 3025 Hobbs Rd, Glenwood, MD 21738-9728 ♦ w3ur@arrl.org

some other IOTAs while in the French Polynesian islands. QSL via Rafik, F5CQ, either direct with SAE and postage or via the French REF QSL bureau. Rafik has a Web page at **www.f5cq.net/dxp/2007-FO5RU/fo5ru-fr.htm**.

HS — THAILAND

Charles, HSØZCW (K4VUD), has installed a bazooka sloper for 160 meters. He also has an 80 meter dipole around 75 feet at the apex sloping down to around 50 feet at the ends. Schedule requests can be made but must be between 0001Z on Saturdays and 2359Z on Sundays, due to local regulations. Skeds (in UTC) can be made via e-mail to **k4vud@hotmail.com**.

INDEXA

The International DX Association, INDEXA, has announced its new officers for 2007-2008. They are:

President — Gary Dixon, K4MQG

Vice President — John Scott, K8YC

Secretary-Treasurer — Bill Jennings, W4UNP

Directors: Nellie De Lazard, XE1CI; Bob Allphin, K4UEE; Lynn Lamb, W4NL; Franz Langner, DJ9ZB; Carl Smith, N4AA, and Richard Grant, W9RG.

For more information on INDEXA, go to **www.indexa.org**.

KHØ — MARIANA ISLANDS

Preston, NHØ/N6SS, says hello from Saipan, where he is helping Jun, WHØV, install a transmitting antenna for 160M. They have a 35-foot-tall whip made of fiberglass tubing with no. 10 wire inside. They plan to topload it with final tuning and matching at the base and hope to be operational in time for the ARRL 160 Meter contest in December.

NEW DXERS?

Bob, K4UEE, says of the Southeast DX Club, "As part of our thrust to bring both new and old HFers into DXing, we have a new tag line for our club. It is: SEDXC, Helping DXers for 50 years." Along with that is a new Web site, **www.dxpros.com**. Bob says to take a look at the links page. Contact Chaz, W4GKF, at **chaz@chazcone.com** if you have a link that should be added.

OLD IRCS

US ops that have old International Reply Coupons (IRCs) that were issued in the US can redeem them, but it needs to be done quickly. Unfortunately by the time you read this the IRCs issued prior to 2002 (the old small ones) will no longer be accepted as they had to be redeemed by October 10. However, the US stamped IRCs with an expiration date of December 31, 2006 can also be redeemed for 1 penny less than the issue price and must be submitted to the post office by September 1, 2008. All non-US stamped IRCs issued prior to December 31, 2006 are non-redeemable. This information can be found in the US Postal Bulletin 22215, dated September 13, 2007, on pages 28 and 57. You can see the bulletin at **tinyurl.com/37usq3**.

ROCKALL ISLAND

The previously announced June 2008 Rockall Island (EU-189) has been cancelled due to the cost. Details can be found at **tinyurl.com/2xdcu5**.

SEC RENAMED

The National Oceanic and Atmospheric Administration (NOAA) has renamed the Space Environment Center (SEC) effective October 1, 2007. The new name is the Space Weather Prediction Center (SWPC), one of nine centers under the National Centers for Environmental Prediction (NCEP) umbrella of NOAA's National Weather Service. The purpose of the change is to express its "operational nature." Although the SWPC Web pages will have a new look, "there will be no changes to the file formats or content."

T8 — PALAU

T88RY will be the call sign for Frank, I2DMI, December 26-January 1, on Palau. He will be on all the HF bands, but RTTY only. Frank says, "Please do not ask me to try different modes." Frank calls his trip a "DX holiday." He will only be on where there's good propagation — that is, bands when they are really open — but look for him on 3582, 7037, 14082, 21082, 28082, 10139, 18102, 24922 and 50602, split up two, or 2-10, depending on the size of the pileup. Online log, thanks to N6RT, will be on **dx.qsl.net/cgi-bin/logform.cgi?t88ry**. Frank says he will confirm via Logbook of The World (LoTW) and e-QSL the second week of January, via bureau to everyone in March, and direct if requested. Mail to I2DMI, PO Box 55-22063, Cantu, Italy. Include an SAE and $2 for return postage. Direct answers should go out starting the second week of February, after the cards are printed.

VE7 QSL BUREAU CHANGE

The RAC reports Dennis Livesey, VE7DK, is retiring as the incoming QSL Manager for VE7 QSL Bureau. Dennis has been serving as the QSL Manager for the past 19 years. Effective September 24 Ken Clarke, VE7UQ, is the new manager and will take "a team approach to speed the flow of QSL cards." Plans are to set up a Web site for users to check for credits and cards waiting. The new VE7 QSL Bureau address is VE7-VA7 Incoming QSL Bureau, Ken Clarke, VE7UQ, 12441 — 58A Ave, Surrey, BC V3X 1X6, Canada. You can contact Ken via phone at 604-596-8786 or via e-mail to **ve7uq@shaw.ca**.

VK — AUSTRALIA

Steve, VK2IAY/4 (aka GØUIH), will be on from some Australian IOTAs from mid-December to mid-January. First, Great Keppel Island, OC-142, December 16-22. Later, South Molle, OC-160, January 7-11. He prefers 14260 and may also go to 17M and 15M. QSL via his home call, direct or bureau. **www.percy.me.uk**.

XU — CAMBODIA

John Stransky, KFØRQ/XU7ACQ, says his 11 year old grandson, KDØBAN, is now active in Cambodia as XU7ADT. He will be just on 20M. John himself will be in Cambodia November 18-December 22 with his XU7ACQ call sign. He plans to put up a Hex beam and be active on 20 and 17M. Look for him around 14245 from 14-17Z. He is trying to get Worked All States from Cambodia.

YA — AFGHANISTAN

Denny, KI4WDW, is in Afghanistan until March 2008. He is now QRV, as YA/KI4WDW, on 17 and 20 meters SSB and hopes to be active on 40 and 80 meters next week. Denny is waiting for some RTTY equipment to arrive and once it does he'll start on 30 meters. He will be active most days.

YV — VENEZUELA

Venezuela's Grupo DX Caracas is putting together its first DXpedition, this one to the "Triple Point," Mount Roraima landmark between Venezuela, Guyana and Brazil. Station YW6R will be on the third and fourth weeks of December. The Venezuelan ops are inviting operators from around the world to join them. Details are available at **gdxc.org**, or send an e-mail to **gdxcaracas@gmail.com**, **yv5lmw@gdxc.org** or **yv5eed@gdxc.org** to express your interest.

WRAP UP

That is all for this month's column. A special thanks to KE3Q and *The Daily DX* for helping with this month's DX news. Going somewhere? Don't forget to let your DX editor know the full details. Until next month, see you in the pileups! — *Bernie, W3UR*

New Products

MFJ SINGLE-BAND MINI DIPOLE ANTENNAS

◊ With the MFJ-347 mount, you can build your own shortened rotatable dipole using HF stick-type mobile whips for 80 to 6 meters. The MFJ-347 is made of aluminum and mounts on masts up to 1.25 inches OD. Price: $19.95

MFJ also offers kits including the MFJ-347 mount and a pair of stick antennas for the band of your choice. Available models: MFJ-2275, 75 meters; MFJ-2240, 40 meters; MFJ-2220, 20 meters; MFJ-2217, 17 meters; MFJ-2215, 15 meters; MFJ-2210, 10 meters; and MFJ-2206, 6 meters. Price: $49.95 per band.

To order or for your nearest dealer, call 800-647-1800 or see **www.mfjenterprises.com**.

K2TQN

OLD RADIO

When Homebrew was King

WA2WDF

Art Moore, W2MJD, left with the transceiver and Don Degerdon, WA2WDF, in the North Arlington RACES station, about 1968.

Hams had been homebrewing since the beginning. During the Depression ordinary hams of normal means honed their skills by improvising, making parts and building radios out of older discarded radio sets. This skill they gained is one good example of how we won World War II; we were good at making and fixing things without all the parts or pieces.

After the war, we had tons of inexpensive surplus radios and parts to work with, so the tradition continued. In the late 1950s and 1960s homebrewing slowed down as higher salaries and commercial radios and time payments became available. Hams started to buy most, if not all of their gear ready made. Today homebrewing is almost a lost art, but not completely. Many of the readers of this column have been or still are homebrewers. And better yet are the newer hams who have picked up the gauntlet and are beginning to build radios, mostly out of the leftover surplus gear and parts that are appearing in abundance at hamfests.

As you know I enjoy finding and collecting well-made homebrew equipment. A good percentage of my collection is homebrew. Some of it is not too pretty, but other pieces are really well designed and constructed with great skill. I'm always on the lookout for another one to bring home.

Visiting the local Gloucester County Amateur Radio Club Hamfest last year produced an exceptional homebrew transceiver. It was brought to my attention by my friend John Ruccolo, a ham want-to-be who has collected at least 25 nice old boat anchor receivers over the last few years, all the time threatening to get his ticket. After taking a close-up look at the rig and fine workmanship, John and I discussed who was going to take it home (he likes homebrew, too). We finally flipped a coin, and I won.

Meeting a Real Homebrewer

The builder was there and we all had a great conversation that day. Don Degerdon, WA2WDF, had built it back around 1968. He had been a member of RACES in North Arlington, New Jersey. The group of hams there decided to build identical rigs, following the plans drawn up by Art Moore, W2MJD. It was a 2 and 10 meter rig; actually it was a 10 meter receiver with a 2 meter converter and a 2 and 10 meter transmitter. Art, who was an engineer with radio station WMCA in New York, honchoed the project. Art gathered all the parts and the cabinets from Radio Row, and helped build the five rigs. Art is now a SK.

This story is similar to my May 2007 column "The Club Saver Project," where a group project made building a radio instead

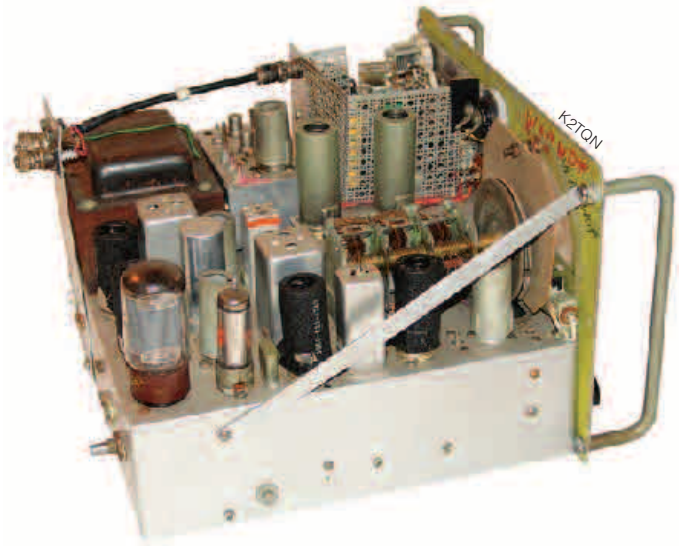
K2TQN

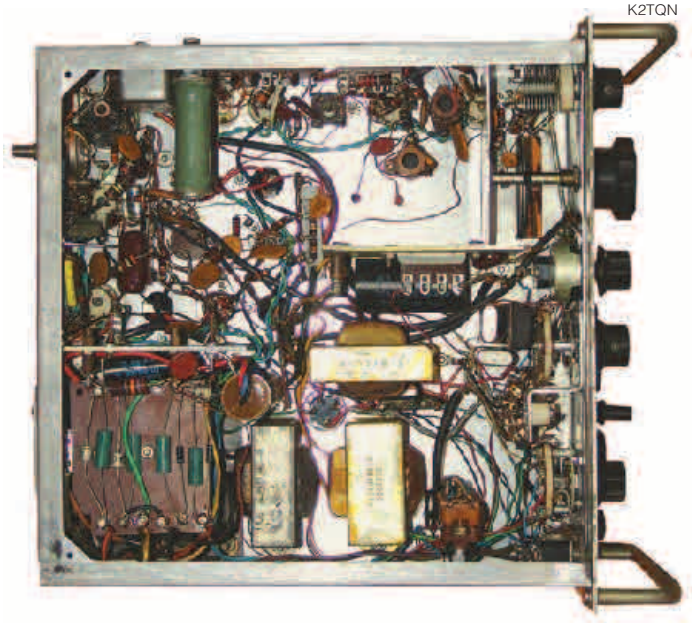
K2TQN

K2TQN

John Dilks, K2TQN ♦ 125 Wharf Rd, Egg Harbor Township, NJ 08234-8501 ♦ k2tqn@arrl.org

K2TQN

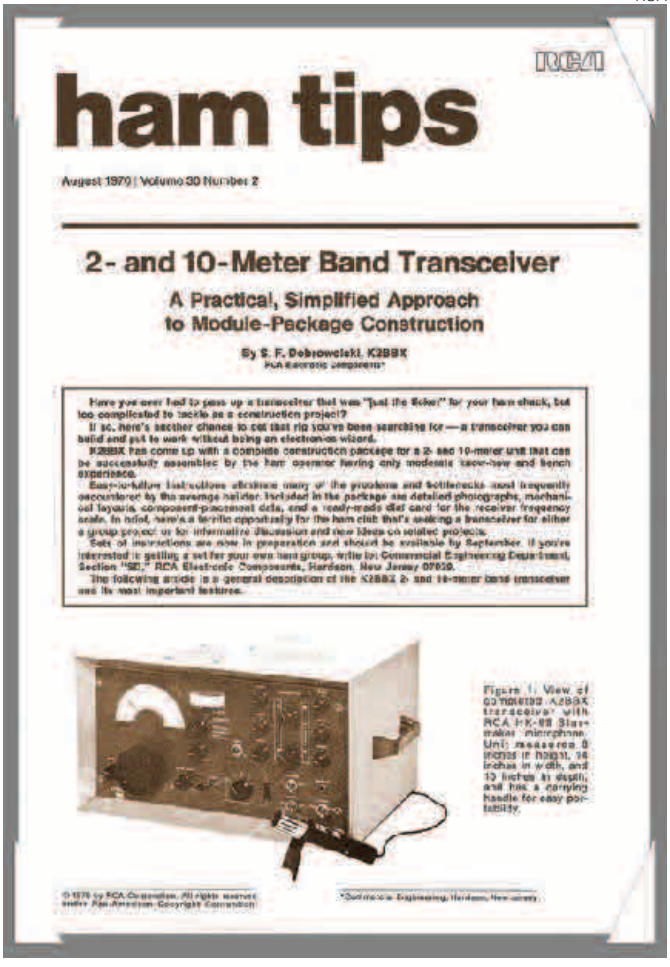




of buying one fun and educational. Clubs should consider doing something like this again, even if it is building a bunch of kits. Do it together. You'll never regret the experience.

Stan Dobrowolski, K2BBX, also wrote up this project radio in the August 1970 RCA publication *Ham Tips*. According to the article it had an impressive list of features: push to talk, four meter positions, transmitter spot frequency while in the receive mode, "sectionalized" modular design for simplicity, front panel automatic noise limiter, five transmitter frequency positions, including a front-panel crystal or VFO socket, front panel jack for phones or an external speaker, and front panel squelch. The transmitter output was 7 W on 2 meters and 10 W on the 10 meter band. With its built-in power supply it was an ideal radio for fixed or portable operation. The final is the popular 2E26 tube modulated by a 6L6, which doubled as the audio output stage.

RCA



RCA

ham tips

August 1970 | Volume 30 Number 2

2- and 10-Meter Band Transceiver

A Practical, Simplified Approach to Module-Package Construction

By S. F. Dobrowolski, K2BBX

RCA Electronic Components

Have you ever had to pass up a transceiver that was "just the ticket" for your ham shack, but too complicated to tackle as a construction project?

If so, here's another chance to get that rig you've been searching for — a transceiver you can build and put to work without being an electronics wizard.

K2BBX has come up with a complete construction package for a 2- and 10-meter unit that can be successfully assembled by the ham operator having only moderate know-how and bench experience.

Easy-to-follow instructions eliminate many of the problems and bottlenecks most frequently encountered by the average builder. Included in the package are detailed photographs, mechanical layouts, component-placement aids, and a ready-made dial card for the receiver frequency scale. In brief, here's a terrific opportunity for the ham club that's seeking a transceiver for either a group project or for informative discussion and new ideas on related projects.

Sets of instructions are now in preparation and should be available by September. If you're interested in getting a set for your own ham group, write to: Commercial Engineering Department, Section "58," RCA Electronic Components, Harrison, New Jersey 07029.

The following article is a general description of the K2BBX 2- and 10-meter band transceiver and its most important features.

Figure 1. View of completed K2BBX transceiver with RCA 1-K-88 Slim-Line microphone. Unit measures 8 inches in height, 14 inches in width, and 12 inches in depth, and has a carrying handle for easy portability.

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*Commercial Engineering, Harrison, New Jersey

RCA *Ham Tips* cover from August 1970.

Transceiver Specifications

It tuned from 26 to 30 MHz on 10 meters and 144 to 148 MHz on 2 meters. The 10 meter receiver is a double-conversion, superheterodyne type. The separate built-in 2 meter converter is switched in line when 2 meter operation is desired.

Don reports that it worked great and he spent many happy hours talking to his friends on 2 meters and on the RACES and Civil Defense nets. Don has been retired for quite a few years now, and is still on HF occasionally.

Don still keeps up with another old friend who built one of these sets, Ralph Latorre, WA2ORP. Ralph and Don get together once in a while and talk over old times. Both Don and Ralph insisted that Art Moore, W2MJD, be given all the credit for making the project and all the radios work.

I'll have a complete set of photos on my Web site and an Adobe PDF file of the 1970 RCA *Ham Tips* article along with Art Moore's schematic, just in case anyone wants to duplicate it. Visit **www.k2tqn.com/** and I'll see you at the hamfests. And remember there should be four more of them out there.

1939 Ham Radio Video

Last, here is a video treat for you. The Web site *YouTube* has collected a number of interesting short videos on ham radio. Here is one from 1939 titled: "Radio Hams" Film (Pete Smith Specialty). Pete Smith produced, wrote and narrated a series of shorts known as "Pete Smith Specialties" for MGM. The one-reelers covered just about every subject imaginable, from the animal world to the latest technology to how to handle annoying patrons in movie theaters, all delivered with Smith's trademark wry, bemused narration. To view it, go to **www.youtube.com/** and search on "ham radio Pete Smith" or type in this long URL: **www.youtube.com:80/watch?v=vBGIdf0VjQ4**. You can spend quite a lot of time surfing the ham radio videos on there. I'll have this link on my Web page too, so you don't have to type it. Have fun. — *K2TQN*

WB8IMY

ECLECTIC TECHNOLOGY

Vista Hams Unite!

The number of amateurs using *Windows Vista* has tended to track with national trends. That's another way of saying that not many are doing so! In fact, an informal survey on the ARRLWeb a few months ago seemed to indicate that only about 10% of all amateurs were using *Vista* in their station PCs.

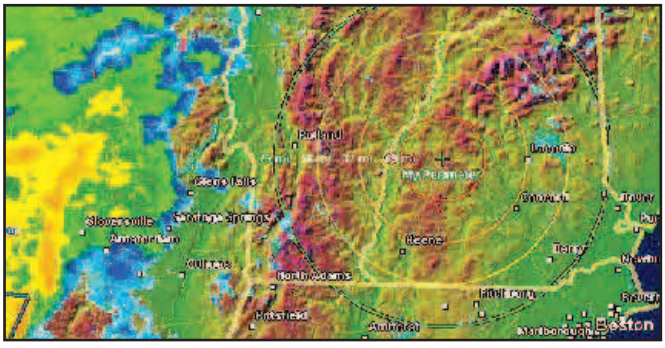
I'm one of the *Vista* holdouts. Frankly, I have yet to be sufficiently impressed with *Vista* to warrant making the switch from *XP*. Unless I make the jump to *Linux*, or dump the PC altogether in favor of a Mac, I'll be more-or-less forced into *Vista* one of these days. Microsoft will eventually stop supporting *XP* and the next time I need to reinstall I won't be able to obtain the magic key. With luck, that unfortunate day is a few years down the road.

I remain somewhat optimistic about *Vista*, though. Microsoft has announced that they will release the first *Vista* "Service Pack" in 2008 and perhaps that will fix some of the *Vista*-isms I find objectionable. We'll see.

In the meantime, the hams that have made (or are making) the transition to *Vista* have formed a Yahoo group. I've found that a well-run user group is one of the best sources for advice when you encounter a problem. You can join the Vista-Ham group at **http://groups.yahoo.com/group/vista-ham/**.

Extreme Weather

If you simply must overdose on weather information, this may be your ultimate destination. Check out SwiftWX at **www.swiftwx.com/**. This subscription service offers just about every form of real-time weather information you can imagine. It's like drinking from a digital fire hose. Hams involved in SKYWARN and similar groups may be excellent candidates for SwiftWX. You can try the 14-day free trial, but an annual subscription is going to set you back about $160. That may seem stiff, but I spend more than that each year on the family newspaper.



A screen shot of a SwiftWX "perimeter alert" that lets you know when severe weather is approaching.

Flexible Wireless Power

A team of Japanese researchers has created a wireless power-transmission device that is thin, flat and flexible. Looking like little more than a sheet of plastic, the device can be put on desks, floors, walls and almost any other location. It delivers power to electronics placed on or near it without the use of cables or connectors.

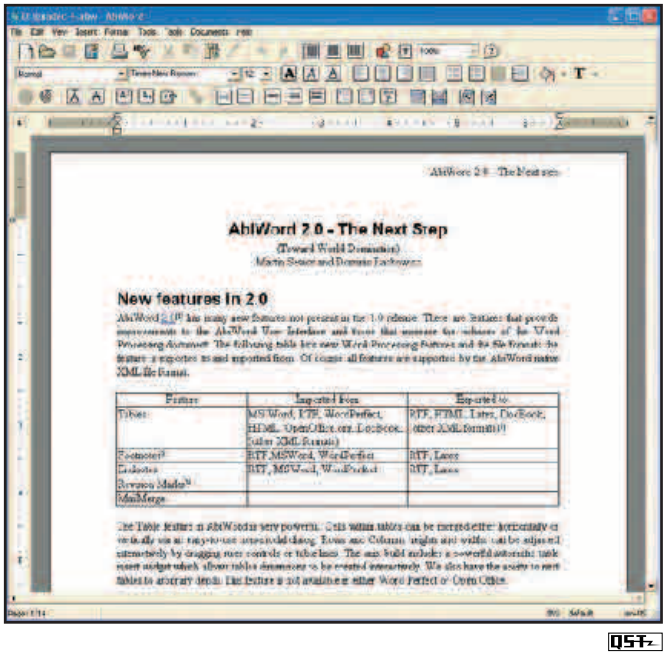
The sheet can transmit up to about 40 W, enough to power light bulbs and small electronics (cell phones, clocks, etc) that are equipped to accept wireless power. The sheet has an impressive 81% efficiency, meaning 81% of the emitted power is received by devices. Power is delivered via electromagnetic induction. A voltage applied across the "sender" coils produces a magnetic field, which induces current flow in nearby devices that need power, as long as those devices are equipped with "receiver" coils. In other words, the sheet acts like a transformer with the primary windings corresponding to the sender coils and the secondary windings corresponding to the receiver coils.

Appropriate to the season, a Christmas tree lights up via "wireless" power provided by the plastic sheet beneath.

Portable Software Applications

A few months ago in this column I discussed the notion of running *Linux* from a tiny USB flash drive. Now there are "portable" *Windows* applications that you can put on a USB drive and run without installing them in *Windows*, or leaving any personal information behind. This means that you can take a USB drive to any *Windows* PC, plug it in, and immediately start using a word processor, instant messenger, Web browser or even a virus scanner. Imagine going to the club meeting with your presentation *and* the required software ready to go, or taking utilities to another computer to hunt down virus issues or other problems—all without the hassle of having to actually install new software.

You'll find it all at the PortableApps Web site at **portableapps.com/**.



***AbiWord* is one of the portable software applications that you can run on any *Windows* PC with nothing more than a USB flash drive.**

QST

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

IARU Region 2 Meets in General Assembly

The ARRL sent delegates to Region 2's 16th General Assembly, which met September 10-14 in Brasilia, Brazil. The United States is a part of Region 2. Members of the ARRL's delegation included President Joel Harrison, W5ZN; Vice President Kay Craigie, N3KN; CEO David Sumner, K1ZZ; Southeastern Division Director Frank Butler, W4RH; Chief Technology Officer Paul Rinaldo, W4RI, and Technical Relations Specialist Jon Siverling, WB3ERA. Forty delegates and observers representing 18 countries in the Americas — 11 in person, seven via proxy — attended the Conference.

Opening

The first day of General Assembly began with Region 2 President Rod Stafford, W6ROD, leading the delegates in a solemn moment of silence for radio amateurs who have died since the last General Assembly in 2004. In his opening remarks, he pointed out the challenges in urging IARU Member-Societies to do more to promote Amateur Radio in their countries, as well as finding ways to more effectively represent the radio amateurs of countries where the IARU Member-Society is not sufficiently active on their behalf.

The president of Brazil's national telecommunications agency, ANATEL, Ambassador Ronaldo Sardenberg also addressed the delegates. He said he was pleased to report that Amateur Radio is growing in Brazil, with 36,000 active operators, and was also pleased to note that the Brazilian administration supports the Amateur Service in its desire for a low-frequency allocation. He also provided some details of ANATEL's investigation of broadband over powerline (BPL) systems and radio interference. Brazilian tests first showed a great potential for interference, but more recent tests show some improvement. Sardenberg expressed optimism that ANATEL will find a way to allow the deployment of BPL without endangering radio services.

On behalf of the host society, LABRE President Roberto Batista Pereira, PT7YV, greeted the delegates and expressed the hope that their stay in Brasilia would be pleasant and productive. He also reported that LABRE has been active in monitoring the BPL issue. LABRE, Liga de Amadores Brasileiros de Rádio Emissão, is the Brazilian IARU Member-Society.

Committee A

Committee A, which deals with administrative matters, was chaired by Norma Leiva, HR2NL, of Honduras; the ARRL's Siverling served as secretary and interpreter. This committee presented the first report at the final day's Plenary and made a number of recommendations for Conference action, all of which were adopted. They include:

- The establishment of a Region 2 Relief Fund with an initial transfer of $5000 from the general reserve of Region 2; additional contributions will be solicited. The Fund will be administered by the Executive Committee and will be available solely to assist Region 2 Member-Societies whose club stations and buildings, including antenna systems, are damaged by natural disaster.
- The Executive Committee will develop a conference call process for Region 2 that includes objectives, action plans, due dates and score cards in order to improve communication among the Member-Societies and the Executive Committee
- An offer by Radio Club Argentino to be responsible for the Spanish translation of the IARU Region 2 electronic bulletin was accepted.
- Terms of reference for the Amateur Radio in Education Project that was adopted by the 15th General Assembly in 2004 were revised slightly to simplify the grant application process and encourage applications.
- The Conference recognized Wolf Baron, TI2BY, of San Jose, Costa Rica, for his outstanding service to Amateur Radio by conducting on-the-air training on Sunday mornings for more than five years.
- Several recommendations from the Region 2 Working Group on Emergency Communications were adopted. These include establishing an Emergency Communications Committee that will be responsible to the Executive Committee for carrying out planning, training and the maintenance of equipment and personnel inventories for emergency assistance deployment.

Committee B/C

The Conference next received the report of Committee B/C, a combined technical and operational committee dealing with both HF and VHF/UHF matters. This committee was chaired by Ramón Santoyo, XE1KK, of Mexico City, Mexico; the ARRL's Rinaldo, served as secretary. The Plenary adopted all of the Committee's recommendations, including:

- A new Region 2 band plan for 160-10 meters was adopted, effective January 1, 2008. The new plan is modeled on one adopted previously by IARU Region 1, with regional differences taken into account (**www.iaru-r2.org/band-plan/**).
- Steps were taken to try to reduce interference to national emergency Nets, including establishing an inventory of such Nets and calling their importance to the attention of the radio amateur community.
- An IARU Region 2 Diploma was approved, with some details remaining to be worked out by the Executive Committee.

Election of Officers

The Conference's last order of business was the election of officers and other Executive Committee members for the next three years. Rod Stafford, W6ROD, declined to stand for re-election as President but will remain a Director. Moving to the office of President is Secretary Reinaldo Leandro, YV5AMH, of Venezuela. Dario Jurado, HP1DJ, of Panama was re-elected Vice President, and Noel Donawa, 9Y4NED, of Trinidad Tobago, was re-elected Treasurer and Director. Santoyo was newly elected as Secretary and joins the Executive Committee for the first time. The other Directors were re-elected: Daniel A. Lamoureux, VE2KA, of Canada; Pedro Rodriguez, CO2RP, of Cuba; Marco Tulio Gudiel, TG9AGD, of Guatemala; Gustavo de Faria Franco, PT2ADM, of Brazil, and Ron Szama, LU2AH, of Argentina. A provision of the Bylaws was amended to permit the Executive Committee to consist of 10 members rather than the customary nine.

The 17th General Assembly will be in 2010, hosted by the Club de Radio Aficionados de El Salvador (CRAS). QST

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

SILENT KEYS

It is with deep regret that we record the passing of these amateurs:

N1ASA **Hackney**, Richard L., Bowling Green, KY
K1DNW **Sochon**, Edward J., Plainfield, CT
N1DPG **Gaboury**, Dana P., North Attleboro, MA
K1EPC **Sholl**, Lawrence E., Rockville, IN
W1FAJ **Nowak**, Edward F., Farmington, CT
W1HLP **Browning**, Frederick P., Jamestown, NC
W1LYV **Connell**, William L., Monterey, VA
KB1OIX **Gardiner**, Frank A., Cranston, RI
W1QWJ **Stevens**, Richard B., Winchester, NH
W1RME **Hughes**, John E., Norwalk, CT
W1RVO **Gemma**, Peter B. Sr, Warwick, RI
W2BYZ **Lanctot**, Edward K., Norwood, NY
♦WA2CJW **Mooney**, William P., Pleasantville, NJ
♦N2EH **Holdsworth**, Edwin J., Honeoye Falls, NY
W2FY **Rice**, Michael G., Rochester, NY
WA2GQX **Miller**, Hubert V., Scotia, NY
N2JH **Hagle**, John R., Ripley, NY
NP2KD **Brady**, Robert D., Simpsonville, SC
KB2OJ **Howe**, Lloyd G., Hannawa Falls, NY
KD2OQ **Kitt**, Peter, Syracuse, NY
K2OXW **Carle**, William E., Groton, CT
K2SSP **Detmer**, Raymond J., Poughkeepsie, NY
WA2TTQ **Smith**, Virgil P., Java Center, NY
W2VVN **Lipsky**, Stephen E., Barnegat Light, NJ
W2WIT **French**, John E., Brockport, NY
KB2WJT **Zillioux**, June R., Rochester, NY
W2WQL **Edwards**, Thomas F., Northfield, NJ
WB2YTA **Veth**, Fred E., Nescopeck, PA
WA3ASQ **Peirson**, John E., Phoenixville, PA
N3DO **Ackerman**, Mark I., Meadowbrook, PA
N3ETX **Pershing**, Frank E. Jr, Greensburg, PA
KB3FUS **Miller**, Nancy, East Stroudsburg, PA
WB3HNN **Logan**, James G., Baltimore, MD
♦K3NZ **Zoltack**, Norman, Schnecksville, PA
W3NZ **Hauff**, Frederick A., Royersford, PA
WA3T **Moseley**, Robin C., Allentown, PA
♦KB3UU **Grillo**, Rocco, Lansdale, PA
KB4BB **Butler**, Robert M., Fuquay Varina, NC
W4CUB **Gates**, James L., Margate, FL
KE4FLC **Gowdy**, Clyde C., Mary Esther, FL
♦W4PG **Warren**, William T., Durham, NC
♦W4PPN **Cochran**, Howard A., Maiden, NC
KQ4PS **Jones**, Martha S., Camden, TN
WZ4Q **Huff**, William R., Brazil, IN
KB4SU **Miller**, Sherwood B., Lancaster, SC
KJ4UG **Marshall**, Bryan K., Onley, VA
KA4UZH **Van Pelt**, Ronald R. Jr, Jacksonville, FL
N4VGJ **Ward**, Ronald C., Louisville, KY
W5LWR **Dorsey**, John W., Bishop, TX
♦WB5NOL **Anderson**, Melvin H. Jr, San Antonio, TX
KG5RX **Goree**, Carl K., Texarkana, TX
W5TGJ **Parke**, Thomas, Madisonville, TX
K5WFL **Scriven**, R L., Richardson, TX
KC6APJ **Appleton**, Gerald W., Bakersfield, CA
♦W6CUX **Lyon**, Stewart D., Winnetka, CA
K6ENQ **Schmidt**, Harold K., Citrus Heights, CA
W6EYC **Umbraco**, Raymond O., Richmond, CA
AB6GN **Gatewood**, Emmette T. Jr, Santa Barbara, CA
WA6HIP **Carlile**, Gerald S., Manteca, CA
KI6IGG **Dague**, Michael G., Pasadena, CA
♦W6RDK **Byerley**, Dewey L., Sutter Creek, CA
KJ6SB **McGregor**, James W., Hot Springs Village, AR
W6THN **Leonard**, Radford P., Santa Barbara, CA
KK6WD **Labutski**, John P., Ocala, FL
K7JP **Price**, John W., Bellingham, WA
W7KPF **Wise**, Harry D., Saint Paul, MN
KC7LIP **Kruse**, James A., Carson City, NV
N7LWI **Kerns**, Kenneth R., Coulee Dam, WA
KD7LWW **Keeton**, Phyllis A., Salem, OR
N7MVP **Lowe**, B. Wayne, Litchfield Park, AZ
♦K7NWN **Hargrave**, Benjamin S. Jr, Bellevue, WA
WN7SKD **Sayko**, Robert, Mukilteo, WA
♦KB7WS **Cameron**, Archie, Grants Pass, OR
W8AXR **Waters**, Robert B., Westland, MI
KC8BSK **Hein**, Charles E., Calumet, MI
W8BXW **Abbott**, Lawrence I., Muskegon, MI
KB8DV **Alexander**, Gabriel N., Sarasota, FL
KA8EAT **Koja**, Bruno, Roseville, MI
KB8IFI **Pawlicki**, William F., Largo, FL
W8JZC **Taylor**, Robert K., Livonia, NY
K8NEI **Kynett**, Virgil L., Salem, OH
WA8QXW **Beacham**, Gerald, Munising, MI
W8RBX **Johnson**, James A., Napoleon, OH
NU8R **Crobaugh**, Christopher, North Ridgeville, OH
W8TTA **Barker**, Everette C., Woodstock, GA
♦W8WQ **Merrill**, Bruce A., Flint, MI
WB9CHW **Stauffer**, C. David, Reno, NV
W9EE **Timberlake**, Floyd A., Keokuk, IA
W9FJT **Sievers**, Robert S., Fort Wayne, IN
♦W9IV **McDougall**, Dugald S., Haines City, FL
KA9PZQ **Halpern**, Bernard, Glenview, IL
W9QWW **Hyndman**, Phillip L., Bradenton, FL
WA9SNU **Daniels**, James, Sheboygan, WI
WA9YOV **Verkruysse**, David P., Erie, IL
W9ZCU **Heinritz**, Carl A., Appleton, WI
WBØIGH **Miller**, Angelene M., Clarinda, IA
AAØKS **Amsler**, Ben E., Lenexa, KS
♦KØOVQ **Raney**, Roy A., Denver, CO
NØOWV **Ask**, David R., Houston, MN
KØQEM **Toth**, Stephen, Davenport, IA
WØRIM **Butler**, Richard H., Willmar, MN
KTØR **Ranney**, Dave, Plymouth, MN
NBØR **Johnson**, Glen T., Ely, MN
WAØSQW **Carlson**, Kenneth G., Aitkin, MN
NØZWR **Johnson**, Brice E., Loveland, CO
♦VE4VV **Belbas**, Derrick J., Winnipeg, MB Canada
DK2LP **Mann**, Erwin, Muenchen, Germany
GW3CDP **Evans**, William Denzil, Skewen Neath, West Glam, Wales
SM5DQC **Magnusson**, Osten B., Odeshog, Sweden

♦ Life Member, ARRL

Note: Silent Key reports must confirm the death by one of the following means: a letter or note from a family member, a copy of a newspaper obituary notice, a copy of the death certificate, or a letter from the family lawyer or the executor. Please be sure to include the amateur's name, address and call sign. Allow several months for the listing to appear in this column.

Many hams remember a Silent Key with a memorial contribution to the ARRL Foundation or to ARRL. If you wish to make a contribution in a friend or relative's memory, you can designate it for an existing youth scholarship, the Jesse A. Bieberman Meritorious Membership Fund, the Victor C. Clark Youth Incentive Program Fund, or the General Fund. Contributions to the Foundation are tax-deductible to the extent permitted under current tax law. Our address is: The ARRL Foundation Inc, 225 Main St, Newington, CT 06111. QST

Amy Hurtado, KB1NXO ♦ Silent Keys Administrator ♦ sk@arrl.org

In The November/December 2007 Issue:

• Cornell Drentea, KW7CD, introduces his "*Star-10* Transceiver," a high performance, fully synthesized, continuous coverage, coherent HF transceiver.

• Ralph Gaze, W1RHG, describes an easy-to-build piece of test gear in "A Direct-Reading Reflection Coefficient and Power Meter."

• Roland Cordesses, F2DC, shows how to connect an old spectrum analyzer to a computer in "SAN2PC: A Spectrum Analyzer to PC Interface."

• Steve Gradijan, WB5KIA, explains how to use the free *Delphi Turbo Explorer* software described in the last issue in "Program Your Own Voice Keyer/Recorder."

• Daniel Crausaz, HB9TPL, helps select a digital mode for keyboard-to-keyboard chats in "Signal Resilience to Ionospheric Distortion of HF Digital Chat Modes."

• John Raydo, KØIZ, found a rubidium oscillator on eBay, and built "A Low-Cost Atomic Frequency Standard."

• Peter Anderson, KC1HR, gives us a fun way to use a paddle with his ASCII Keyer in "Tech Notes."

• Contributing Editor L.B. Cebik, W4RNL, looks at some compact choices for horizontally polarized omnidirectional antennas in "Antenna Options."

• Contributing Editor Ray Mack, W5IFS, shares news of new filter design software and several new components in "Out of the Box."

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VHF/UHF Century Club Awards

Compiled by Bill Moore, NC1L
Awards Manager

The ARRL VUCC numbered certificate is earned to 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 August 10, 2007 to October 9, 2007.

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 VUCC questions to **vucc@arrl.org**.

50 MHz
100
1583 WW5W
1584 KD7WPJ
1585 N9IV
1586 XE2AT
1587 AB8JH
1588 WA5TLP
1589 WA5IPS
1590 AK4F
1591 WB4VHF
1592 N2SLO
1593 K5WMH
1594 N8AID
1595 W8FR
1596 N6ORB
1597 AA4SC
1598 AF6O
1599 K3FN
KMØA 900
WØKKK 350
KT1J 525
K1BD 250
K1ZN 150
K3FN 175
KA1LMR 250
W4WM 350
KN4SM 525
AF4HX 375
KD4TDI 200
W5OZI 1075
N5PA 200
W7KNT 700
K8YC 150
K8VFV 150
K9CS 225
W9RPM 500

144 MHz
100
678 VE7TIL
679 WF4R
680 WB9PNU
681 AF6O
682 K4EQH
KMØA 400

432 MHz
50
WW2R 80

1296 MHz
25
WW2R 80

3.4 GHz
5
77 KA1LMR

10 GHz
5
180 NQ2O
181 KDØAR

Satellite
100
XE2AT 825

Special Note: After 23 years Eileen Sapko has retired from ARRL! VUCC issues will now be handled by Bill Moore, NC1L (**vucc@arrl.org**). QST

75, 50, AND 25 YEARS AGO

December 1932

• The cover photo shows a pair of hams huddled in their uninsulated attic ham shack, trying to keep warm with two kerosene heaters. December radio conditions trumps December cold anytime!

• The editorial looks back upon the Year 1932, and likes what it sees.

• Howard Anderson, W1BVS, tells us how to make "Ham-Band Receivers from B.C. Midgets," using plug-in coils for the short-wave bands and adding a c.w. oscillator for receiving the Morse boys.

• Ross Hull describes "An All-Purpose 56-mc. Station" that we can build, complete with a push-pull oscillator as the transmitter, a Class B modulator, and a three-tube receiver.

• H. A. Robinson, W3LW, presents Part I of "Modulating the Screen-Grid R.F. Amplifier."

• F. J. Fink, W9FJY tells us about "Boosting the Output of the Low-Power Transmitter," by using *four* type '10 tubes in a self-controlled push-pull oscillator!

• "About This 56-mc. Band" gives a review of current 5-meter work on the East Coast and reports the results of an expedition on the Pacific Coast. Although 5-meter propagation is not yet entirely understood, the v.h.f pioneers are continuing to learn what it can do, and continuing to make contacts over progressively longer paths.

• Robert Foreman, W9ZZE, tells how to have "Break-In Operation with Crystal Control," using blocked-grid keying in a high-power transmitter.

December 1957

• The cover art by Gil, W1CJD, shows a young ham dreaming of getting a Christmas gift of wonderful, modern ham equipment.

• The editorial discusses the Disaster Communications Service's 14 channels in the 160 meter band. It also discusses the new Soviet *Sputnik* and the forthcoming US satellite, *MOUSE* (Minimal Orbit Unmanned Satellite of Earth). By the way, the articles about satellites caused this issue to be the largest issue of *QST* ever published.

• "A Brief Report" is a photo essay showing hams across the country listening to the beep-beeps coming from *Sputnik I*.

• George Grammer, W1DF, tells us "What to Do about Satellites," and how to make useful reports of satellite tracking to the Vanguard Control Center of the Naval Research Laboratory.

• Mason Southworth, W1VLH, jumps on the satellite bandwagon, with "Cutting Costs in the 108-Mc. Converter."

• An item in "Strays" reminds us of the Elser-Mathes Trophy, on display at HQ, that is to be awarded to the first earthbound ham who makes the first two-way amateur radio contact with the planet Mars.

• Ed Tilton, W1HDQ, chimes in with "Antennas for Satellite Monitoring on 108 Mc."

• Henry Richter, W6VZA, describes "Microlock," a frequency-tracking receiver for listening to satellites.

• Lew McCoy, W1ICP, resisting the siren call of *Sputnik I*, describes "A Three-Band One-Tube Novice Transmitter."

December 1982

• The cover photo shows a compact broadband HF MOSFET amplifier.

• The editorial discusses "Volunteer Examining: The Ideal, The Real and *You*.

• Helge Granberg, K7ES/OH2ZE, presents Part 1 of "MOSFET RF Power: an Update," showing that you can run a kilowatt with an FET amplifier.

• Paul Zander, AA6PZ, urges the reader to "Build the AA6PZ Power Charger," for charging your NiCd batteries.

• Thomas Leary, WØVTP, tells about "The Torsion Bar Key," a new twist on a CW paddle.

• Clifford Appel, WB6AWM, discusses "Semiconductor Testing — in or out of the Circuit."

• Fred Brown, W6HPH, gives us Part 2 of "Antenna Gain Measurements."

• John Belrose, VE2CV, always looking at antennas, tells about "The Effect of Supporting Structures on Simple Wire Antennas."

• Robert Rose, K6GKU, discusses "MINIMUF: A Simplified MUF-Prediction Program for Microcomputers."

• "Build a Universal T-R Controller," by George Collins, KC1V, describes his homebrew semi-break-in control box."

Al Brogdon, W1AB ♦ Contributing Editor

W1AW SCHEDULE

W1AW's schedule is at the same local time throughout the year. From the second Sunday in March to the first Sunday in November, UTC = Eastern US Time + 4 hours. For the rest of the year, UTC = Eastern US Time + 5 hours.

♦ **Morse code transmissions:** Frequencies are 1.8175, 3.5815, 7.0475, 14.0475, 18.0975, 21.0675, 28.0675 and 147.555 MHz.

Slow Code = practice sent at 5, 7½, 10, 13 and 15 WPM.

Fast Code = practice sent at 35, 30, 25, 20, 15, 13 and 10 WPM.

Code bulletins are sent at 18 WPM.

W1AW qualifying runs are sent on the same frequencies as the Morse code transmissions. West Coast qualifying runs are transmitted on approximately 3.590 MHz by K6YR. See "Contest Corral" in this issue. Underline one minute of the highest speed you copied, certify that your copy was made without aid, and send it to ARRL for grading. Please include your name, call sign (if any) and complete mailing address. Fees: $10 for a certificate, $7.50 for endorsements.

♦ **Digital transmissions:** Frequencies are 3.5975, 7.095, 14.095, 18.1025, 21.095, 28.095 and 147.555 MHz.

Bulletins are sent at 45.45-baud Baudot and 100-baud AMTOR, FEC Mode B. 110-baud ASCII will be sent only as time allows.

On Tuesdays and Fridays at 6:30 PM Eastern Time, Keplerian elements for many amateur satellites are sent on the regular teleprinter frequencies.

♦ **Voice transmissions:** Frequencies are 1.855, 3.99, 7.29, 14.29, 18.16, 21.39, 28.59 and 147.555 MHz.

♦ **Notes:** On Fridays, UTC, a DX bulletin replaces the regular bulletins. W1AW is open to visitors 10 AM to noon and 1 PM to 3:45 PM on Monday through Friday. FCC licensed amateurs may operate the station during that time. Be sure to bring your current FCC amateur license or a photocopy. In a communication emergency, monitor W1AW for special bulletins as follows: voice on the hour, teleprinter at 15 minutes past the hour, and CW on the half hour.

During 2007, Headquarters and W1AW are closed on New Year's Day (Jan 1), Presidents' Day (Feb 19), Good Friday (Apr 6), Memorial Day (May 28), Independence Day (Jul 4), Labor Day (Sep 3), Thanksgiving and the following Friday (Nov 22-23), and Christmas Eve Day and Christmas Day (Dec 24-25).

For more information, see **www.arrl.org/w1aw.html**.

PACIFIC	MTN	CENT	EAST	MON	TUE	WED	THU	FRI
6 AM	7 AM	8 AM	9 AM		FAST CODE	SLOW CODE	FAST CODE	SLOW CODE
7 AM-1 PM	8 AM-2 PM	9 AM-3 PM	10 AM-4 PM	VISITING OPERATOR TIME (12 PM-1 PM CLOSED FOR LUNCH)				
1 PM	2 PM	3 PM	4 PM	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE
2 PM	3 PM	4 PM	5 PM	CODE BULLETIN				
3 PM	4 PM	5 PM	6 PM	DIGITAL BULLETIN				
4 PM	5 PM	6 PM	7 PM	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE
5 PM	6 PM	7 PM	8 PM	CODE BULLETIN				
6 PM	7 PM	8 PM	9 PM	DIGITAL BULLETIN				
6:45 PM	7:45 PM	8:45 PM	9:45 PM	VOICE BULLETIN				
7 PM	8 PM	9 PM	10 PM	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE
8 PM	9 PM	10 PM	11 PM	CODE BULLETIN				

COMING CONVENTIONS

November 17-18
Indiana State, Fort Wayne*

December 1-2
West Central Florida Section, Palmetto*

January 12
SWOH Digital and Technical Symposium, Middletown, OH

February 2
South Carolina State, Ladson
Virginia State, Richmond

February 8-10
Northern Florida Section, Orlando

*See November *QST* for details.

Attention Hamfest and Convention Sponsors: ARRL HQ maintains a date register of scheduled events that may assist you in picking a suitable date for your event. You're encouraged to register your event with HQ as far in advance as your planning permits. Hamfest and convention approval procedures for ARRL sanction are separate and distinct from the date register. Registering dates with ARRL HQ doesn't constitute League sanction, nor does it guarantee there will not be a conflict with another established event in the same area.

We at ARRL HQ are not able to approve dates for sanctioned hamfests and conventions. For hamfests, this must be done by your division director. For conventions, approval must be made by your director and by the executive committee. Application forms can be obtained by writing to or calling the ARRL convention program manager, tel 860-594-0262.

Note: Sponsors of large gatherings should check with League HQ for an advisory on possible date conflicts before contracting for meeting space. Dates may be recorded at ARRL HQ for up to two years in advance. QST

HAMFEST CALENDAR

Attention: 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 **December 1** to be listed in the **February** issue. Hamfest information is accurate as of our deadline; contact sponsor for possible late changes. For detailed directions to the event, see the event Web site or contact sponsor. For those who send in items for Hamfest Calendar and Coming Conventions: Postal regulations prohibit mention in *QST* of prizes or any kind of games of chance such as raffles or bingo.

Abbreviations: *Spr* = Sponsor, *TI* = Talk-in frequency, *Adm* = Admission.

Louisiana (Minden)—Dec 15 F V S H
8 AM-2 PM. *Spr:* Minden ARA. Minden Civic Center, 520 Broadway St. 15th Annual Christmas Hamfest, QRP demonstration, Emergency Communications forum, VE sessions. *TI:* 147.3. *Adm:* $4. Tables: $5/$10. Dusty Collins, KB5WFE, 231 Garrett Dr, Dubberly, LA 71024; 318-371-0636; fax 318-681-6975; **dusty@bellsouth.net**; **www.bayou.com/~k5dlh/**.

Michigan (Lowell)—Dec 16 F V H
9 AM-noon. *Spr:* AR Group of Youth in Lowell. Lowell High School, 11700 Vergennes St. 5th Annual Hamfest, VE sessions, refreshments. *TI:* 145.27 (94.8 Hz), 146.62 (94.8 Hz). *Adm:* $5 (Elementary, Middle School, and High School Students free). Tables: $7. Al Eckman, WW8WW, 725 Bowes Rd, Apt K6, Lowell, MI 49331; 616-897-7659; **al.eckman@sbcglobal.net**; **www.argyl.org**.

Mississippi (Ocean Springs)—Nov 16-17 V S H
Friday 5-9 PM, Saturday 8 AM-2 PM. *Spr:* Jackson County ARA. St Martin Community Center, Lemoyne Blvd. VE sessions, forum. *TI:* 145.11. *Adm:* $3. Tables: $7. Don Arnold, KB5FHX, 3206 Moreland St, Pascagoula, MS 39567; 228-762-9795; **kb5fhx@cableone.net**; **www.jcmsara.org**.

Tennessee (White Pine)—Jan 5 F H V
8 AM-3 PM. *Spr:* Lakeway ARC. Smoky Mountains Expo Center, 1615 Pavilion Dr. 17th Annual Morristown Hamfest, VE sessions, handicapped accessible. *TI:* 147.03. *Adm:* $6. Tables: $15. Henry McClary, AG4QG, 2105 Tobes Creek Rd, Cosby, TN 37722; 423-487-0332; **qsl@hughes.net**; **www.lakewayarc.org**.

Texas (Austin)—Dec 7-8 V H
Friday 6-10 PM; Saturday 7 AM-noon. *Spr:* Austin ARC. Sons of Hermann Mixed Lodge #120, 9611 Decker Lake Rd. Austin Radio RoundUp, Friday eve Christmas Party, VE sessions. *TI:* 146.94. *Adm:* $2. Tables: $15. Lori Schmidt, KM5MQ, 903 Fieldstone Pl, Round Rock, TX 78664; 512-255-6753; **km5mq@arrl.net**; **www.AustinHams.org**.

Wisconsin (Waukesha)—Jan 5 F V H
8 AM-2 PM. *Spr:* West Allis RAC. Waukesha County Expo Center Forum, 1000 Northview Rd (County Trunk FT). 36th Annual Midwinter Ham Radio, Computer, and Electronics Swapfest; VE sessions (9-11:15 AM, AMF Waukesha Lanes, across from Expo; bring your original license plus copy, CSCEs plus copy, photo ID, $5 fee); ham radio group meetings; free parking; refreshments. *Adm:* advance $4, door $5. Tables: 8-ft, advance $18 each (1 or 2 tables), $16 each (3 or more tables); door $20 (if available), plus admission; electrical outlet $19 (advance only). Send #10 business size SASE for advance reservation by Dec 30 to WARAC Swapfest, Box 1072, Milwaukee, WI 53201. Phil Gural, W9NAW, 414-425-3649; **janphil68@att.net**; **www.warac.org**.

F = FLEA MARKET
D = DEALERS / VENDORS
H = HANDICAP ACCESS
V = VE SESSIONS
S = SEMINARS / PRESENTATIONS

Attention All Hamfest Committees!
Get official ARRL sanction for your event and receive special benefits such as an announcement in these listings, donated ARRL publications, handouts, discounted rates for display advertising, and other support.

It's easy to become sanctioned. Contact the Convention and Hamfest Branch at ARRL Headquarters, 225 Main St, Newington, CT 06111, 860-594-0262, or send e-mail to **giannone@arrl.org**. QST

Gail Iannone ♦ Convention and Hamfest Program Manager
giannone@arrl.org

Strays

LIFE MEMBERS ELECTED OCTOBER 6, 2007

♢ James L. Aguirre, W7DHC; Kiah S. Albert, N5UAO; Robin A. Alexander, W7YED; Jawahar Almeida, VU2JAB; Michael E. Amaral, N1MX; James A. Andreolo, WB2ZOP; Warren E. Anglin, AD5YI; Anthony S. Annese, KG4EXA; Bradford D. Armstrong, W1YX; Curtis R. Atkins, N9OGZ; Thomas G. Azlin, N4ZPT; Trudy Baird, KD6NUY; Joseph R. Barbuscia, N6TED; Dee E. Bartholomew, K3KAT; Roy A. Beebe, KC8UGJ; Joerg Behrens, HB9TSX; George H. Bellairs, KBØZZT; Alan Benoit, WQ5W; Tad C. Beverage, KC5DPT; Shannon Boal, K4GLM; David H. Bollinger, KE4FXY; Alan D. Bredon, W6BGK; Thomas A. Brehmer, NØLOH; Jeremy B. Briggs, K4OCD; Karen A. Briggs, K8KB; James P. Cessna, KB8N; David Chan, KI6FPO; Haworth A. Clover, KC5LUB; Casey Coley, W9LP; Nancy R. Cravey, KG4FNW; Donald G. Crawford, N5MWG; Rene A. Culross, KE5KAR; Richard R. Davis, W4NMH; Fadel Derry, MØSFD; Andre Dusablon, KB7VTY; James T. Fagan, KE7IDC; Edward J. Fedor, N2RWH; Gerald E. Finsen, N2NE; Evelyn J. Forsyth, N7VJW; Scott H. Freile, KE5TO; Theodore T. Fukushima, N6ZZK; Steven B. Gladstein, N8FH; Stephen M. Gocala, KB8VAO; Gregory J. Goddard, KG4PHB; Mark J. Gorlinsky, AF6EK; James W. Grumbach, KD7NDH; Nelson Guadalupe, K4FGV; David M. Hamilton, KØDMH; James A. Harrison, KD5LMX; H C. Hasper, KL7SP; Frank R. Hilligas, KFØZ; Hugh T. Hodges, W6RRE; Mark A. Hollingsworth, N3UXF; Stephen M. Holton, N1NB; Aaron T. Hsu, NN6O; Michael Ingram, N5GBD; Noboru Ishii, JH1VVW; Noah S. Jaffe, W4IEI; James D. Jenkins, K1JXK; Jon R. Jensen, ACØGU; David P. Johnson, W4YD; Steven Jones, WB5SGN; Tanner W. Jones, W9TWJ; Frank J. Kashinski, KB9NOA; S. Khrystyne Keane, K1SFA; John P. Keller, W4JPK; Kurt Kiesow, KF6QNC; Sheppard R. Kilby, KC2PUF; Robert L. Kluck, N4IJS; Bruce R. Koyle, K6BRK; Al R. Kroell, W6MOS; Christy M. Kroell, K6XTY; Byron D. Lichtenwalner, W3WKR; Thomas J. Mc Cormick, AE5BW; Michael E. Mertel, K7IR; Archie Mills, KG6IY; Martin Minnicino, WN2SJL; David P. Mitchell, N5PSM; Richard E. Myers, AD5MF; Michael R. Newell, K2MMO; G. M. Ohlen, W5TGP; Rich Paleski, N2EYK; Edward M. Palmer, KU4LY; Frederick W. Percival, KC5ZCN; Mitchell J. Pittinger, KB3MXK; Alfredo A. Potthoff, HB9IQP; David A. Reed, W7TAX; Gerald L. Richmond, N5ZXJ; John Ronan, EI7IG; Bruce W. Rose, WB7CDQ; Carl Roszczybiuk, WB9AVW; Phyllis M. Rowley, KD5SUV; Tommy R. Rowley, NK5Z; James L. Rutten, KCØZEB; Elias R. Salazar, KD7JRX; Christopher R. Schmid, N6AUN; Joseph C. Sciammarella, AE2Y; James M. Sens, KX8C; Sidney J. Sherwood, N5ZKD; Jim A. Skeen, WD4CTP; Thomas W. Sneed, NØZK; Ron South, K5JBR; Jana A. Spencer, KD5UVM; John W. Spencer, WA1MDD; Jari R. Staffen, KCØOZR; Victoria L. Stafford, KI6GNT; Tim O. Stanford, AD5SY; Daryl Stout, N5VLZ; George M. Tamayo, WD6EJO; Nick Taylor, KDØAIC; Keith E. Thompson, KA6LRR; Susan A. Tipton, K9PDL; Ralph Tullo, NØLO; Stephen M. Wardlaw, KN6Y; George Warrick, W3GCW; Brian L. Weidenmaier, AE5CF; Jesse D. Whitehouse, ACØCL; George A. Williams, WA5EBP; Lawrence E. Wilson, K6SCH; Dave W. Witt, WS9T. QST

CONTEST CORRAL

courtesy of the *National Contest Journal*

W1AW Qualifying Runs are 10 PM EST Friday, December 7 (0300Z December 8), and 9 AM EST (1400Z) Tuesday, December 18. The K6YR West Coast Qualifying Run will be at 2 PM PST (2200Z) Saturday, December 15, originating from Maritime Historical Society station KPH/K6KPH, on 3581.5, 7047.5, 14,047.5 and 21,067.5 kHz. Unless otherwise indicated, code speeds are from 10-35 WPM. Check the W1AW Schedule elsewhere in this issue for details.

Abbreviations

SO — Single-Op, M2 — Multiop — 2 Transmitters, MO — Multi-Op, MS — Multi-Op, Single Transmitter, MM — Multi-Op, Multiple Transmitters, AB — All Band, SB — Single Band, S/P/C — State/Province/DXCC Entity, HP — High Power (>100 W), LP — Low Power, QRP (5 W or less), Entity — DXCC Entity.

No contest activity on 30, 17 and 12 meters. Refer to the contest Web sites for information about awards. Unless stated otherwise, regional contests only count QSOs with stations in the region. Publication deadline for Contest Corral listings is the first of the second month prior to publication. For updates and additional contests, see the Contest Corral Web page at **www.arrl.org/contests**.

Dec 1-2

Repeat after me, "Antennas WANT to work!" It's not necessary to have a huge skyhook to work lots of stations on Top Band. Load up what you've got and prepare to be pleasantly surprised!

ARRL 160 Meter Contest — CW, from 2200Z Nov 30-1600Z Dec 2. (See Nov *QST* p 102, or **www.arrl.org/contests**.)

TARA RTTY Mêlée — sponsored by the Troy Amateur Radio Assn, from 0000Z-2400Z Dec 1. Categories: SOAB-HP (>150 W), SOAB-LP (<150 W), MOAB, SWL, 10 min band change rule for MO. Frequencies: 160-10 meters, operate 16 hours max. Exchange: RS + State/Province or serial number for DX. QSO points: 1 pt/QSO. Score: QSO points — S/P/C counted once only (US and VE only count as S/P). For more information: **www.n2ty.org/seasons/tara_melee_rules.html**. Summary sheets (no logs) due Dec 31 via online submission form at **www.n2ty.org/seasons/tara_melee_score.html**.

Top Operators Activity Contest (TAC) — CW, sponsored by the PRO-CW-CLUB, from 1600Z Dec 1 to 1800Z Dec 2. Frequencies: 80 meters. Categories: SO (HP, LP, QRP) MO, PRO-CW-Club and TOPS members. Exchange: RST + serial number (+ PRO or TOPS if member). QSO points: own entity: 1 point, own continent: 2 pts, different cont: 6 pts, with MM: 6 pts, with TOPS and PRO members 2 pts, between TOPS and PRO members 8 pts. Score: QSO points × WPX prefixes. For more information: **www.procwclub.yo6ex.ro**. Logs due Dec 31 to **yo2rr@clicknet.ro** or mail to Nelu Brange, YO2RR, Str Imparatul Traian nr 2, RO-30500 Lugoj, Romania.

Bruce Kelley Memorial 1929 QSO Party — CW, sponsored by the Antique Wireless Association from 2300Z Dec 1-2300Z Dec 2 and 2300Z Dec 8-2300Z Dec 9. Frequencies (Mcs): 3.550-3.850 and 7.030-7.050. 10 watts plate input power max (20 watts after 0500Z). Exchange: RST, Name, State or QTH, type of transmitter (TNT, MOPA, TGTP, etc), transmitter year (27, 28, 29, etc), and power. Use circuits, tubes, and techniques available to hams in 1929. For more information: **www.antiquewireless.org**.

Dec 8-9

The band may have been dead all week, but come 0000Z on Saturday (Friday afternoon-evening in the US), you might be surprised to hear a sudden band opening! Hand out a signal report and your state — have fun!

ARRL 10 Meter Contest — 0000Z Dec 8-2400Z Dec 9. (See Nov *QST* p 102 or **www.arrl.org/contests**.)

28 MHz SWL Contest — runs at the same time as the ARRL 10 Meter Contest. Categories: SO-SSB, SO-CW, SO-Mixed (separate logs). Log stations making contest QSOs. QSO points: first station from S/P/C — 5 pts, second station — 3 pts, third station — 1 pt. Score: QSO points × DX entities. For more information and logging software: **www.veron.nl/cie/nl/swlcontest**. Logs due Jan 31 to **NL290@amsat.org** or Ruud Ivens, NL290, Hittekamp 29, 3956 RE Leersum, The Netherlands.

PSK31 Death Match — PSK31 and PSK63, sponsored by the Michigan DX Association, 0000Z Dec 15-2400Z Dec 16. Frequencies: 80-6 meters, PSK31 and PSK63 count as separate "bands." Categories: SO, Class 1 (<100 W), Class 2 (<25 W), Class 3 (<10 W). Exchange: Name + S/P/C. QSO points: 20 meters — 1 pt/QSO, 6 meters — 3 pts/QSO, other bands — 2 pts/QSO. Bonus points: W8DXI 500 pts (once) and 100 pts for uploading logs to LoTW within 30 days of contest. Score: QSO points × total S/P/C + bonus points. For more information: **www.mdxa1.org/deathmatch.html**. Logs due Jan 20 to **w8vom@sbcglobal.net**.

Russian 160-Meter Contest — CW/SSB. sponsored by *Radio* Magazine, from 0000Z-0200Z Dec 16. Categories: SO, MO, SO and MO 18 years and younger, Mixed Mode only. Exchange: RST, serial number, and square ID (see **www.radio.ru/cq/contest/rule/map-2.gif** for a map showing the squares) QSO points: own square — 1 pt, adjacent sq — 2 pts, 1 additional pt each additional square distant. Score: total QSO points. For more information: **www.radio.ru/cq/contest/rule-results/index11.shtml**. Logs due Jan 16 to **contest@radio.ru** or *Radio* Magazine, Seliverstov per. 10, Moscow 107045, Russia.

Croatian CW Contest — sponsored by Hrvatski Radioameterski Savez (HRS), from 1400Z Dec 15-1400Z Dec 16. Frequencies: 160-10 meters. Categories: SOAB (HP >100 W, LP, QRP <5 W), SOSB (HP, LP), MO, SWL. Exchange: RST + serial number. QSO points: 9A stations — 10 pts on 160-40, 6 pts 20-10; different cont — 6 pts 160-40, 3 pts 20-10; own cont and country — 2 pts 160-40, 1 pt 20-10. Score: QSO points × DXCC entities (+ 5 WAE countries) on all bands. For more information: **www.hamradio.hr**. Logs due 30 days after the contest to **9acw@hamradio.hr** (preferred) or Hrvatski Radioameterski Savez (HRS), Croatian CW Contest, PO Box 149, 10003 Zagreb, Croatia.

Bruce Kelley Memorial 1929 QSO Party (see Dec 1-2).

Dec 13-17

OK DX RTTY Contest — sponsored by the Czech Radio Club, 0000Z-2400Z Dec 15. Categories: SOAB (LP, HP >100 W), SOSB, MOAB, SWL. Frequencies: 80-10 meters according to IARU band plan. Exchange: RST and CQ Zone. QSO points: 80 and 40 — 3 pts on same continent, 6 pts different cont, 20-10 — 1 pt same cont, 2 pts different cont. Score: QSO points × DXCC entities and OK stations (multipliers counted once per band). For information: **www.crk.cz/eng/dxcconte.htm**. Logs due Jan 15 to **okrtty@crk.cz** or Czech Radio Club, OK DX RTTY Contest, PO Box 69, 113 27 Praha 1, Czech Republic.

North American Meteor Scatter Contest — sponsored by the WSJTGROUP from 0000Z Dec 13 to 0700Z Dec 17 during the Geminids meteor shower. Frequencies (MHz): 50, 144, 222, 432, via meteor scatter. Exchange: full call signs, grid square and QSOs must be acknowledged. For more information: **www.sportscliche.com/wb2fko/w07/rules_w07.html**. Logs due Jan 17 to **mph@swcp.com**.

If you've built a transceiver from a kit or from scratch, you'll be a star in this short contest! Store-bought rigs are welcome, too, just listen hard.

Holiday Spirits Homebrew CW Sprint — sponsored by the QRP ARCI, from 2000Z-2400Z Dec 16. Frequencies (MHz) — 1.810, 3.560, 7.040, 14.060, 21.060, 28.060 kHz. Categories: SOAB, SOSB, SO20-10, SO160-40, MOAB, DX stations are SOAB only. Exchange: RST, S/P/C, and Power or QRP ARCI number. QSO points: members — 5 pts, non-members/different continent — 4 pts, non-members/same cont — 2 pts. Score: QSO points × S/P/C (counted once per band) × Power multiplier (<250 mW ×15, 250 mW — 1 W ×10, 1-5 W ×7, >5 W ×1) + Bonus Points (2000 for homebrew (HB) xmtr, 3000 HB rcvr, 5000 HB xcvr). For more information: **www.qrparci.org**. Logs due 30 days after contest to **contest@qrparci.org** or ARCI Fall QSO Party, c/o Jeff Hetherington, VA3JFF, 139 Elizabeth St W, Welland, ON L3C 4M3, Canada.

Lighthouse Christmas Lights QSO Party — all modes, sponsored by the Amateur Radio Lighthouse Society, 0001Z Dec 15-2359Z Dec 31. Frequencies (MHz): CW — 1.830, 3.530, 7.030, 14.030, 21.030, 28.030, SSB — 1.970, 3.970, 7.270, 14.270, 21.370, 28.370, plus VHF and repeaters. Exchange: sequential serial number or ARLHS member number or ARLHS Lighthouse number + name + S/P/C. QSO points: 1 pt/QSO, add 2 pts for ARLHS member, add 3 pts for lighthouse. Score is total QSO points. Stations activating light beacons multiply total points by 2. Special logging requirements apply. For more information: **arlhs.com** or send SASE to ARLHS, 114 Woodbine Ave, Merchantville, NJ 08109. Logs due Jan 31 to Dave Ruch, NFØJ, PO Box 20696, Bloomington, MN 55420-0696.

H. Ward Silver, NØAX ♦ PO Box 927, Vashon, WA 98070 ♦ n0ax@arrl.org

Dec 26-Jan 6

Two popular contests running at the same time — what's not to like? The RAC stations will be happy to work Stew Perry stations and vice versa. Through the day, fill in your missing VE provinces and territory counters.

RAC Winter Contest — CW/Phone, sponsored by the Radio Amateurs of Canada, 0000Z-2359Z Dec 29. Frequencies (MHz): CW — 25 kHz up from the band edge (check on the half hour), Phone — 1.850, 3.775, 7.075, 7.225, 14.175, 21.250, 28.500, 50 and 144 MHz. Categories: SOAB (QRP, LP, HP), SOAB-CW, SOAB-Phone, SOSB, MS-LP, MS-HP, and MM. VE stations exchange RST + Province, VEØ and non-VE stations exchange RST + serial number. QSO points: Outside Canada — 2 pts, VE/VEØ stations — 10 pts, RAC stations — 20 pts. Score: QSO points × VE provinces + territories (counted once per band and mode). For information: **www.rac.ca/service/infocont.htm**. Logs due Jan 31 to **ve5sf@rac.ca** or Radio Amateurs of Canada, 720 Belfast Rd, Ste 217, Ottawa, ON K1G 0Z5, Canada.

Stew Perry Top Band Distance Challenge — CW, sponsored by the Boring Amateur Radio Club, 1500Z Dec 29-1500Z Dec 30. Frequencies: 160 meters. Categories: SO and MS. Operate 14 hours max. Exchange: grid square only. QSO points: 1 pt + 1 pt for every 500 km distance calculated between grid centers (see Web page for calculation information), QSOs with QRP stations ×2 and LP stations ×4. Score: QSO points × Power mult (<5 W ×4, 5-100 W ×2, >100 W ×1). For more information: **jzap.com/k7rat/stew.rules.txt**. Logs due Jan 31 (Cabrillo format only) to **tbdc@contesting.com** or Boring Amateur Radio Club, 15125 SE Bartell Rd, Boring, OR 97009.

DARC Christmas Contest — CW/SSB, sponsored by the Deutscher Amateur Radio Club, 0830Z-1100Z Dec 26. Frequencies (MHz): CW — 3.510-3.560, 7.010-7.040, SSB — 3.610-3.650 and 3.700-3.775, 7.040. Categories: SO-Mixed, SO-CW. Exchange: RS(T) + DOK or Special Station code. QSO points: 1 pt/QSO. The station calling CQ must QSY after making a QSO. Score: QSO points × DOK codes + WPX prefixes. For more information: **www.darc.de/referate/dx/fedcx.htm**. Logs due 3 weeks after the contest to **xmas@darc.de** or Markus van Bergerem, Brandenberg 5, D-47533 Kleve, Germany.

ARRL Straight Key Night — from 0000Z-2359Z Jan 1, 2008. (See page 98 of this issue of *QST* or **www.arrl.org/contests**.)

Worked All Britain Christmas Party — CW/SSB/Digital, from 0000Z Dec 26-2359 Jan 6, 2008. Frequencies: 160 meters-microwave. Categories: SO, MO, SWL (Fixed, Mobile, Portable), QRP. Exchange: RS(T) + serial number + WAB area or DXCC entity.
For more information and scoring: **www.worked-all-britain.co.uk/Christmas%20Party%20Award.php**. Logs due 21 days after the contest to **g4iar@worked-all-britain.co.uk** or Dave Brooks, 28 Avon Vale Rd, Loughborough, Leicestershire, LE11 2AA, England. QST

Feedback

♢ In "Are You Using the Right Fuse?" [Oct 2007, p 32], there is an error in the sidebar "Calculating Voltage Drop." In the formula at the bottom of the first column, the right parenthesis should be moved to after "2k" so the formula reads $(2R_W \times \ell \times 0.001 + 2k) \times I = V_D$. — *tnx Wilton Helm, WT6C*

SPECIAL EVENTS

Contact these stations and help commemorate history. Many provide a special QSL card or certificate!

Nov 10-Nov 11, 1400Z-2300Z, Red River Station, TX. North Texas Weather Group, Inc, W5T. 140th Anniversary of Chisholm Trail Founding. 21.367 14.267 7.267 3.867. Certificate. NTWG, Inc, PO Box 1140, Bridgeport, TX 76426. **www.ntwg.org** *(Note: Date changed from October 27-28.)*

Nov 10-Nov 12, 1500Z-0000Z, Duncan, OK. Chisholm Trail Amateur Radio Club. Chisholm Trail 140th Anniversary. 21.375 14.250 7.265 3.870. Certificate. Chisholm Trail Amateur Radio Club, 921 W Walnut, Duncan, OK 73533-4623. **www.wd5iyf.org**. *(Note: Date changed from October 27-28.)*

Nov 24-Nov 25, 1400Z-2000Z, Plymouth, MA. Whitman Amateur Radio Club, WA1NPO. The first Pilgrim landing at Plymouth Massachusetts. 18.140 14.280 7.250 3.890. Certificate. Whitman ARC, PO Box 48, Whitman, MA 02382.

Dec 1-Dec 2, 1500Z-2100Z daily, Chesapeake, VA. Chesapeake Amateur Radio Service, W4CAR. Revolutionary War Battle of Great Bridge Virginia, December 9, 1775. 146.820 21.375 14.275 7.275. Certificate. CARS, PO Box 6867, Chesapeake, VA 23323-6867. **w4car@yahoo.com**

Dec 1-Dec 9, 1500Z-2000Z, Baltimore, MD. W3HEM/W3GR Historical Electronics Museum ARC, W2W. Usage of electronics during Pearl Harbor. 14.271 14.071 7.271 7.071. Certificate. Historical Electronics Museum, PO Box 1693 MS 4015, Baltimore, MD 21203. **www.qsl.net/w3hem***

Dec 7, 1500Z-2230Z, Baton Rouge, LA. USS *Kidd* Amateur Radio Club, W5KID. Pearl Harbor Day. SSB 14.250 to 14.320 CW 28.060 21.060 14.060 10.106 7.040. QSL. W5KID, c/o USS *Kidd* Museum, 305 South River Rd, Baton Rouge, LA 70802. **www.lsu.edu/brarc/USS_Kidd.htm**

Dec 7-Dec 9, 0700Z-2359Z, San Angelo, TX. AB5BG. Pearl Harbor, A Day That Will Live In Infamy. 28.360 21.220 14.260 7.235. Certificate. Donald R. Goff, 1210 Ardmore, San Angelo, TX 76905.

Dec 8, 1600Z-2300Z, San Diego, CA. USS *Midway* CV-41 COMEDTRA, NI6IW. Remembrance of Pearl Harbor December 7, 1941. 14.325 7.260. QSL. USS *Midway* CV-41 Museum, 910 N Harbor Dr, San Diego, CA 92101. **w9bq@aol.com**

Dec 8-Dec 10, 1400Z-0200Z daily, Nazareth-Bethlehem, PA. Christmas City and Delaware-Lehigh Amateur Radio Clubs, WX3MAS. Annual Christmas greetings from the Twin Christmas Cities. 28.465 21.365 14.265 7.270 3.970. Certificate. CARC/DLARC WX3MAS, Greystone Building Gracedale Complex, RR 2, Nazareth, PA 18064. **www.dlarc.org**

Dec 8-Dec 9, 1600Z-0500Z, Charleston-Coos Bay, OR. Coos County Radio Club, N7C. Shore Acres St Park, Oregon Coast Holiday Light Event. 3.980 14.270 14.260 14.250. QSL. Coos County Radio Club, PO Box 698, Coos Bay, OR 97420. **www.coosradioclub.net**

Dec 15-Dec 22, 1300Z-2200Z, Wheeling, WV. Northern Panhandle Radio Club, W8ZQ. Festival of Lights. 14.250 7.240 3.865 145.52. Certificate. Joe McCready, WB8CTC, PO Box 192, Blaine, OH 43912. **fishcrick@aol.com**

Dec 24-Dec 31, 0500Z-0459Z, Newington, CT. Siesta Wireless Society, N1C. New England Christmas 2007. 7.218 7.026 3.818 3.526. QSL. Siesta Wireless Society, c/o Matt Cassarino, WV1K, PO Box 310384, Newington, CT 06131-0384. **www.qrz.com/w1nap**

Certificates and QSL cards: To obtain a certificate from any of the special-event stations offering them, send your QSO information along with a 9×12 inch self-addressed, stamped envelope to the address listed in the announcement. To receive a special event QSL card (when offered), be sure to include a self-addressed, stamped business envelope along with your QSL card and QSO information.

***Note:** Some clubs may ask for a nominal fee to cover the cost of the certificate or QSL. Request will be made on air during the event or on the club's Web site.

Special Events Announcements: For items to be listed in this column, you must be an Amateur Radio club, and use the ARRL Special Events Listing Form, at **www.arrl.org/contests/spevform.html**, or if you prefer, forms are available via Internet (**info@arrl.org**), or for an SASE (send to Special Requests, ARRL, 225 Main St, Newington, CT 06111, and write "Special Events Form" in the lower left-hand corner). Off-line completed forms may be mailed, faxed or e-mailed to ARRL, Attn: Special Events. Submissions must be received by ARRL HQ no later than the 1st of the second month preceding the publication date; that is, a special event listing for **Feb** *QST* would have to be received by **Dec 1**. In addition to being listed in *QST*, your event will be listed on the *ARRLWeb* Special Event page. QST

Maty Weinberg, KB1EIB ♦ Special Events ♦ events@arrl.org

Were You "Bitten By The Bug"? — 2007 ARRL Field Day Results and Stories

With a tip of the cap to those who specialize in "Top Ten" lists…

Dan Henderson, N1ND
dhenderson@arrl.org
ARRL Regulatory Information Manager & Field Day Manager

"Percy" — the 2007 Field Day Hambug was reported at hundreds of Field Day sites across the US, Canada and beyond. After returning to his "home office" in Newington, he was asked to relate some of the stories he uncovered in his travels. So, he has put together a "Top Ten" list. This isn't a list of the Top Scoring Stations, because the highest score really isn't the purpose of Field Day. It isn't a list of the Top Ten best operators he found, the ten most important things about FD or even the ten best FD food locations (though Percy is known to be partial to FD cuisine). It is simply a Top Ten List of "Field Day Things" from 2007…

10) "Amateurs love to talk on the radio."

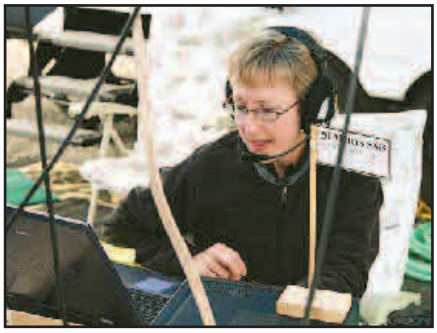
Now mind you this is a given, because after all we *are* communicators, aren't we? And with a total of over 1.2 million QSOs reported during FD2007, that's over 50,000 contacts every hour over a 24 hour period. That's an excellent total — especially when you consider Ol' Sol is being as uncooperative as possible with sunspot. I guess what this really means is that there are always bands that you can utilize, regardless of time of day or propagation.

9) "Amateurs are like us bugs — you find them everywhere."

Everywhere Percy went, we ran into amateurs participating in Field Day. In fact there were a record 2,331 Field Day entries submitted — 4% more than the previous record of 2,241 in 2004. *And* that record number of entries contained yet another record as an all-time high of 34,833 operators, helpers and visitors were reported at FD sites. Modest numbers when compared against the number of licensees in the US, but remember, not every group or individual that participates in Field Day (particularly home stations) submits entries to document their participation.

8) "You gotta GOTA"

Percy was well aware of the two significant changes in the Part 97 rules made since FD2006, and he was pleased to observe that besides participation in general being up, there was also an all-time record number of "Get On The Air" — GOTA — stations available for newcomers to try their hand on the air. Percy thought it a bit ironic that the first year all US amateurs have at least some HF privileges coincided with a year predicted as the very bottom of the sunspot cycle, which meant generally poor propagation on the most popular newcomer HF band — 10 meters. But he did find a silver lining in the fact that perhaps the newcomers would upgrade and gain greater privileges after whetting their appetites at one of the 467 GOTA stations reported in 2007 (an increase of over 8% from last year).



Amy, KE7NVZ, works 'em like a pro on 20 meters SSB at the K7VIT Field Day site in Hillsboro, Oregon.

GOTA station KCØWQY in operation at the KCØAHN site in Wichita, Kansas. Logan, KCØVUH; Matt, KCØVUG; Samantha, KCØMTM; Rachel, and Jacob operating with up to *four* headphones!

Entries by ARRL/RAC Section

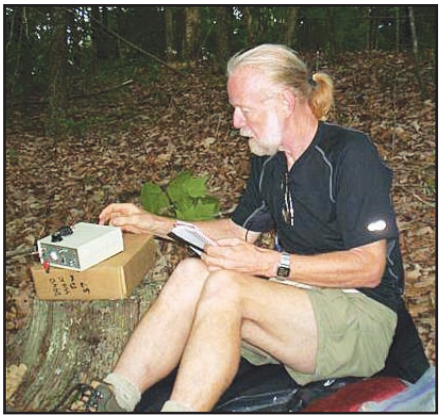
Section	Entries	Section	Entries	Section	Entries
AB	9	ME	26	RI	14
AK	7	MI	85	SB	17
AL	24	MN	40	SC	26
AR	24	MO	49	SCV	31
AZ	48	MS	13	SD	8
BC	30	MT	16	SDG	20
CO	47	NC	59	SF	10
CT	41	ND	8	SFL	27
DE	8	NE	15	SJV	21
DX	2	NFL	47	SK	4
EB	16	NH	19	SNJ	22
EMA	27	NL	4	STX	53
ENY	29	NLI	21	SV	23
EPA	58	NM	28	TN	52
EWA	16	NNJ	46	UT	16
GA	54	NNY	8	VA	72
IA	30	NT	1	VI	1
ID	15	NTX	57	VT	13
IL	80	NV	6	WCF	18
IN	50	OH	116	WI	48
KS	31	OK	26	WMA	10
KY	23	ON	71	WNY	35
LA	20	OR	39	WPA	42
LAX	29	ORG	41	WTX	9
MAR	10	PAC	10	WV	18
MB	2	PR	2	WWA	64
MDC	43	QC	18	WY	13

7) "What's that strange 'buzzing' in my antenna?"

Well, Percy was able to pretty quickly figure out that buzzing was probably yet another increase (though small) in number of Digital mode contacts being made. While the number of both CW and Phone QSOs were down slightly (thanks in large part to poor band conditions), many groups are discovering the relatively easy digital modes, such as RTTY and PSK31, that can be made using computer interfaces and readily available software. While still constituting only a small portion of FD contacts, the number of reported digital contacts has more than doubled since 2000 (up 113%!).

6) "Yummy! Yummy! Yummy!"

Unlike the pesky mosquitoes, Percy found epicurean delights at almost every FD site. From simple hamburger and wiener roasts to steak dinners to home-made chili to desserts that would make Emeril himself proud, FD is always certain to be one of the highlights of most amateurs' "social calendars." After all, the troops have got to be fed, and clubs seem



K1YPP near Damascus, Virginia, on Sunday morning of the contest. Operating from the Appalachian Trail, he used a homebrew 1.25 W/dc receiver and ¼ wave wire antenna.

to take seriously the motto "Only the best for our gang!" Make sure to read the ARRL Field Day Online Soapbox **www.arrl.org/contests/soapbox/** to discover how hundreds of clubs and groups approach this annual event. And why not add your own FD experiences to the site to share with others?

5) "Mommy — Can I go outside and play all night?"

Part of the FD experience is setting up stations quickly in places where you usually do not operate. As usual, the vast majority of entrants choose to test this side of their planning skills, as 1758 (75%) of all entries operated away from home. Fields, parks, campsites, EOCs, boats, campers, tents, hiking trails — you name it and odds are you would find a FD group setting up in those kinds of situations. This isn't meant to downplay the role of those who participate from home stations. On the contrary, it underscores the role ALL stations and operators have to play in emergency operations. (For example, just ask those who were assisted during Katrina by home stations serving as relays and keeping the flow of information going, how important the Class D and E stations are.)

4) "You're sitting there with WHO???"

More and more, Percy found that elected officials and served agencies are gaining a better awareness and understanding of the role that Amateur Radio can play in emergency communications and preparedness. For example, the Sussex Amateur Radio Association and the Nanticoke Amateur Radio Club joint operation played host to Delaware Governor Ruth Ann Minner, who proclaimed June as Amateur Radio Awareness Month; State Secretary of Homeland Security, Dave Mitchell; Sussex County Administrator, Dave Baker and Georgetown Mayor, Mike Wyatt. But it doesn't always have to be that high a profile. Percy observed hundreds of county officials and liaisons from served agencies such as the Salvation Army and American Red Cross, attending FD demonstrations all across the ARRL and RAC territories.

K5SXK inspecting "The Box" of the satellite station at W5IU, Fort Worth, Texas.

Entries by Class

Class	Entries	Class	Entries	Class	Entries
1A	191	2B1	2	3E	14
2A	518	1B2	47	4E	5
3A	299	2B2	27	5E	1
4A	137	1C	63	6E	1
5A	69	2C	2	10E	1
6A	29	3C	3	13E	1
7A	24	1D	300	1F	32
8A	18	2D	14	2F	69
9A	6	3D	6	3F	31
10A	1	4D	1	4F	17
11A	1	5D	1	5F	5
16A	1	7D	1	6F	3
19A	1	1E	203	7F	2
1B1	159	2E	24	9F	1

High Claimed Scores

Regardless of category

W3AO	27,150	19 A
W6ZE	20,246	9 A
W9CA	19,288	3 A
W6YX	17,158	4 F
K1R	16,894	5 A
VE3GMA	16,734	9 A
K2AA	16,680	6 A
W4IY	15,142	7 A
K5TA	14,680	2 E
K7LED	13,786	6 A

3) "If at first you don't succeed, try, try again!"

Even with all of the planning in advance, even if you take all of the possible precautions, at some point Murphy is going to visit your site in some way. For example, a concerted effort was made to put on several of the Antarctic research bases on the air by amateurs in residence. E-mails were exchanged announcing frequencies and information, and announcements were made. But when FD rolled around, there was simply no propagation for them to North America. It certainly was a disappointment, but surely doesn't count as a failure, because the key component of FD isn't making thousands of contacts; it's doing the preparation and planning to be able to do what is possible when the time comes. So in spite of no sunspots, malfunctioning radios, thunderstorms that take out antennas and trees, Percy was impressed with the "stick to it" spirit of the thousands of participants.

Young prospective ham Harrison Sanders making his very first ham radio contact while his dad, Mark (left) and Jack, WMØG, look on at WØDK, Boulder, Colorado.

2) "We're ready for our close-up Mr DeMille."

Percy couldn't accommodate the numerous requests he received from television, radio and print journalists for a personal interview. After all, he is naturally shy. But he was more than pleased to see hundreds of FD participants working with members of the press, telling the story of amateur radio. Sharing the story of amateur radio is important — and getting the media to assist in telling that story is important. Club and section PIOs submitted what has to be a record number of media hits to Percy in the days and weeks after FD2007. And he isn't worried about using up your Andy Warhol 15 minutes of fame promoting the Amateur Radio Service.

And, finally, Number 1 on Percy's Top Ten List for Field Day 2007…

Field Day is FUN!

Look at the photos in this article… Peruse the smiling faces posted in the ARRL Online Soapbox. It is obvious that the common ingredient to all of them is *fun*. It's fun to spend time with good friends… It's fun to learn new things… It's fun to get on the air… It's fun to be part of a group working for a common purpose and helping friends and neighbors… It's fun to set a goal and achieve it during Field Day… It's fun to take pride in our skills and put them on display to mentor others.

So to all who participated in FD2007, Congratulations! Whether you only completed a handful of QSOs to whet your appetite or posted the most claimed points in your category — if you maximized your fun during the weekend of June 23-24, you are a Field Day champion.

Field Day is always the fourth full weekend in June — which means it will be coming around again June 28-29, 2008. Why not start your own Top Ten list of things you want to accomplish for FD2008? See you on the air!

Scores

Class A stations are clubs or groups operating with more than two operators. Score listings are grouped according to the number of transmitters in simultaneous operation. The listings show club or group name, call sign(s) used, total number of QSOs, number indicating power output used (5 is less than 5 W, 2 is less than 150 W; 1 is more than 150 W), number of participants and total score including bonus points and ARRL section. Scores are listed from highest to lowest in each class. Class B stations are portables manned by one or two operators. When there are two operators, the other operator's call is listed in parentheses, if it is known. Class C stations are mobiles. Class D stations are home stations using commercial power. Class E stations are home stations using emergency power. Class F stations are EOC stations.

1A

South Heartland Contest Society
WØICT 2225 2 7 8,280 KS
San Diego DX / Pt Loma ARC
W6PT 1970 2 17 7,782 SDG
Mother Lode DX & Contesting Club
K6AO 1693 2 7 6,698 SV
Central NC DX Chasers
N4OL 1380 2 13 6,650 NC
Acadiana ARA
W5DDL 1420 2 39 6,398 LA
Ham Radio Brasspounders
W1HR 1503 2 3 6,096 SFL
Robert F Heytow Memorial RC
K9YA 1234 2 4 5,886 IL
Southern IL DX & Contest Club
W9HUZ 1152 2 6 5,754 IL
Pitkin ARC
WØFD 1753 2 6 4,950 CO
Friends of W8LT
K1LT 1156 2 4 4,880 OH
Union City Wireless Assn
W3CG 1405 2 10 4,638 WPA
W6XU 1201 2 4 4,636 SF
Case Western Reserve Univ ARC
W8EDU 1181 2 4 4,364 OH
Metro DX Club
W9TY 1075 2 11 4,102 IL
Gila ARS
K5GAR 1079 2 8 4,020 NM
AE6C 876 2 3 3,964 SV
Associated Radio Amateurs of So NE
W1AQ 1278 2 17 3,874 RI
Mobile Em Com Club
W3USA 1048 2 4 3,834 OH
Big Hill ARC
KØHP 821 2 8 3,830 SD
Truckee ARES
K6NV 936 2 8 3,688 SV
Loop Group
KØRK 1059 2 26 3,498 WCF
Garden State ARA
K2USA 1024 2 12 3,380 NNJ
Laurens ARS
K4LSC 718 2 10 3,340 SC
Tilson Contest Group
K5WA 867 2 3 3,282 STX
South Georgian Bay ARC
VE3SGB 1107 2 10 3,164 ON
The Motley Crew ARC
W9GG 1160 2 12 2,978 IL
Stanly Co ARC
K4OGB 706 2 17 2,722 NC
Bear Mtn QRP Group
N5IMW 264 5 7 2,700 NM
Alberta Clippers
VE6EX 576 2 5 2,684 AB
Sam Houston AR Klub
K5MV 520 2 35 2,662 STX
Team IOOK
W8ED 530 2 10 2,604 WV
Loudun Co ARES
W4FLO 639 2 9 2,598 TN
Oklahoma DX Assn
K5YAC 1475 1 3 2,551 OK
Greer ARC
AF4NQ 569 2 15 2,542 SC
Club Radio Amateur de Beauce
VE2CRB 675 2 15 2,536 QC
Chicago FM Club / Soc Radio Operators
W9EJ 754 2 48 2,446 IL
Athens Co ARA
W8MHV 456 2 9 2,430 OH
Jasper RC
K4BEH 522 2 10 2,368 GA
Red Ant Annihilators/SCAN
WA6P 1003 2 5 2,360 LAX
KB7TG 564 2 6 2,336 MT
Idaho Oregon DX Club
K7VAN 1589 1 7 2,239 ID
St John ARC
N2PL 439 2 7 2,214 VI
Avaya Lincroft ARC
W2IMU 474 2 4 2,144 SNJ
Univ of Arkansas ARC
K5GOE 429 2 10 2,076 AR
WNØG 930 2 3 2,060 IA
Florida Keys ARES
N4UM 441 2 20 1,998 SFL
WPPS RC
W7POE 359 2 4 1,886 MT
Geneva ARS
W4GEN 365 2 9 1,882 AL
Monroe ARC
WZ4V 708 2 17 1,866 TN
Union Metropolitaine des Sans-filistes de Montreal
VE2UMS 372 2 52 1,852 QC
Lanark North Leeds ARES Group
VE3LCA 330 2 17 1,846 ON
Gratiot Co ARA
W8AWE 464 2 6 1,828 MI
K4HY 358 2 22 1,800 KY
Blackstone Valley ARC
W1DDD 549 2 15 1,786 RI
WYoming 7 Field Day
WY7FD 489 2 3 1,728 WY
Reno Co Kansas ARA
WØWR 344 2 27 1,704 KS
KS3F 497 2 3 1,642 VA
South Point ARC
KH6EL 997 1 26 1,633 PAC
Newton ARA
WØWML 281 2 9 1,630 IA
Wyomissing Area High ARC
K3ATO 151 5 1 1,605 EPA
USS Jurassic ARC
K8SSJ 160 2 10 1,598 OH
Covey Hill ARC
VE2CYH 431 2 22 1,598 QC
Holmes Co Ham Club
N4LMI 469 2 15 1,588 NFL
Royal George ARC
NCØA 286 2 7 1,544 CO
Muskegon River CW Group
N8VYS 351 2 5 1,542 MI
Albuquerque DX Assn
W5UR 490 2 7 1,530 NM
Southern Plains ARC
NØRZ 452 2 20 1,508 KS
I Walton Portable Radio Op Club
N8KV 350 2 3 1,498 MI
Flathead Valley ARC
K7LYY 492 2 14 1,476 MT
Hellgate ARC
W7PX 477 2 25 1,470 MT
West Island ARC
VE2CWI 224 2 20 1,460 QC
Monroe Co Comm Assn
W8DWL 601 2 6 1,452 MI
Southwest MS ARC
W5WQ 488 2 22 1,430 MS
Prescott-Russell ARES Group
VE3PRV 309 2 8 1,426 ON
Halton ARC
VE3OD 204 2 14 1,418 ON
Marshall Co ARC
WØGCJ 253 2 14 1,406 KS
Morris RC
W2YD 294 2 18 1,384 NNJ
Four Mile Grove RG
KDØQ 373 2 6 1,366 IA
W6GL/7 230 2 3 1,354 OR
Washington Co ARES
WC5AR 260 2 18 1,330 AR
River Cities ARA
K4K 300 2 25 1,304 KY
Everglades ARC
W4SVI 300 2 10 1,282 SFL
Wheat State Wireless Assn
WSØWA 250 2 20 1,150 KS
Bristol RC
W1DHT 451 2 14 1,142 CT
Tidelands ARS
K5BS 187 2 7 1,140 STX
Parma Radio Club
W8PRC 293 2 5 1,136 OH
City of Anaheim RACES
W6APD 317 2 25 1,124 ORG
Bitterroot ARC
W7FTX 357 2 10 1,084 MT
ARC of Augusta
W4DV 131 2 34 1,082 GA
BARC
N9GH 200 2 4 1,078 IL
Anaconda ARC
W7VNE 252 2 12 1,054 MT
Rains ARA / Hopkins Co ARC
W5ENT 190 2 13 1,050 NTX
Arkansas RES
N5AT 337 2 12 1,024 AR
Westcumb ARC
VE1WRC 203 2 12 1,022 MAR
K5GKM 333 2 25 1,016 STX
Heart of TX Ham Operators Group
WA5HOT 282 2 6 1,014 STX
KB8TYJ 260 2 3 992 AZ
Jack Baskin School of Engineering
AC6P 253 2 7 974 SCV
High Plains Drifters
WTØN 306 2 8 964 CO
Lake of the Woods ARS
VE3JJF 320 2 12 956 ON
Lemhi ARC
AD7AN 382 2 8 946 ID
Baltimore City RACES
N3QXX 318 2 8 936 MDC
Baccalieu Amateur Radio Klub
VO1BRK 187 2 9 930 NL
Lewis and Clark RC
K9HAM 55 2 12 906 IL
Cumberland FD Team
VE3CLN 215 2 4 900 ON
N7VF 311 2 4 892 OR
Smoky Mountains AR Team
N4GSM 219 2 5 888 NC
WF2V 183 2 3 860 WNY
VE3SAR 291 2 22 852 ON
NR9F 199 2 4 848 IN
Juneau ARC
KL7IG 277 2 5 846 AK
WA1HRE 312 2 3 834 CT
TERAC
K7AUO 277 2 3 810 WWA
Sandia National Labs ARC
W5MPZ 225 2 5 800 NM
Jamestown ARC
WØFX 62 2 4 794 ND
N4VYT 199 2 2 794 GA
AEØMW 293 2 12 776 IA
Williston Basin ARC
KØWSN 318 1 5 768 ND
Ogdensburg ARC
K2RUK 126 2 18 752 NNY
Lapeer Co ARA
W8LAP 175 2 23 750 MI
KY4K 250 2 7 750 IN
KC2HTV 93 2 1 746 ENY
Pathfinders ARC
VE4PAR 284 2 12 738 MB
Kluender-Hahm ARC
W9JFK 137 2 5 720 WI
Kona ARS
KH7T 69 1 22 719 PAC
Laurel ARS
K4XXX 86 2 10 706 KY
Brockville ARC
VA3BCR 139 2 30 704 ON
Northern Michigan ARES
KD8FQP 124 2 45 694 MI
Bawating AR Group
VE3LSC 195 2 6 690 ON
Georgian Bay ARC
VE3OSR 105 5 16 635 ON
Saint Cloud ARC
WØSV 180 2 11 616 MN
WA1QGC (+N2HLN)
52 5 3 575 VT
WEDIXIE ARC
WB4MZO 39 2 9 574 GA
KA8PIZ 167 2 5 568 MI
Melfort Repeater Group
VE5YD 134 2 7 568 SK
Jackson Hole Area ARC
K7JAC 158 2 8 566 WY
WD8MQN 132 2 15 528 VA
Hickory Corners Engineering Soc
W8JGC 164 2 5 528 MI
SE Montana ARC
K7HWK 111 2 10 522 MT
KD5RED 29 2 4 508 NM
Watertown ARC
N9HR 123 2 20 502 WI
Athens RC
K5EPH 150 2 19 500 NTX
Rim Country ARC
W7RIM 122 2 10 494 AZ
Brampton AR Federation
VE3VDN 113 2 4 488 ON
Comstock ARA
W7FD 243 2 3 486 SJV
Bi-State ARC
KNØBS 111 2 6 472 IA
CT ARL of Youth
K3KID 130 2 6 470 CT
KC5RED 29 2 5 458 AR
N6DNA 143 2 3 436 SJV
St Mary's ARC
VE3SDF 63 2 3 426 ON
Madison CO ARES
KI4MMM 27 2 4 424 GA
Channel Islands Expedition
WA6FGW 114 2 5 408 SB
Winchester ARS
WA4RS 108 2 5 366 VA
KH6IB 65 1 7 365 PAC
Greene Co ARA
N3GC 106 2 6 358 WPA
WD6LL 94 2 3 338 SV
Mayerthorpe Flying Dinosaurs
VE6FD 117 1 9 317 AB
Dog Hollow Contest Grp
AK9D 101 2 3 302 KS
VE7HPS 188 1 1 288 BC
Southern KY Amateur Transmitting Soc
AA4VO 214 1 27 264 KY
WD4NIT 3 2 4 256 GA
103rd Battalion AL State Defense Force ARC
N3BN 52 2 5 254 AL
KI6DAR 23 2 5 196 SCV
Radio Free Gainesville
KK5CT 47 2 3 194 NTX
KØLVS 20 2 3 190 VA
Concord University ARC
N8VFD 1 2 4 152 WV
Phelps Co AR Technical Soc
KCØYZA 42 2 8 84 MO

1A Battery

Chews' Ridge Gang
K6MI 992 5 6 10,940 SCV
Manti Contest Club
NC7X 801 5 3 8,860 UT
High Knob QRP
N4DD 696 5 3 7,310 VA
Motorola ARC
K9MOT 583 5 29 6,415 IL
QCWA Chapter 17
W3GS 408 5 4 4,365 EPA
Hilo ARC & Hawaii QRP Club
KH6IN 175 5 14 2,600 PAC
Los Chupacabraderros
N5JO 258 5 6 2,545 STX
Indian Hill ARC
AA9NF 202 5 6 2,270 IL
Hiawatha / Falls City ARC
KØERX 176 5 19 2,170 KS
Rochester ARC
N8MHD 77 5 19 1,690 MN
North Country ARC
W2LCA 117 5 11 1,560 NNY
VE3YAP 51 5 4 1,310 ON
Terrace ARC
VE7NWZ 74 5 10 1,120 BC
AB6S 147 5 4 1,005 EB
K7HZ 73 5 4 980 OR
Department of State ARC
W3DOS 42 5 3 850 MDC
Yarmouth Radio Club Inc
KB1PEF 52 5 3 710 ME
KI4BKE 11 5 3 205 NC

1A Commercial

Central WI Radop Amateurs at UWSP
K9UW 609 2 4 2,056 WI
Englewood ARA
W2RJ/2 114 2 7 632 NNJ
Butte ARC
W7FO 359 1 10 359 MT
Wellesley ARS
W1TKZ 34 2 28 346 EMA
K3WQ 89 2 8 292 VA
Border ARS
K5H 49 2 3 98 STX

2A

Colorado QRP Club
WØCQC 1351 5 8 13,595 CO
Raytown ARC
KØGQ (+WBØJNP)
3510 2 44 12,696 MO
Radio Amateurs of Northern VT
W1NVT (+W1PU)
3968 2 29 12,368 VT
Buckhead Contest Club
W4TE (+W4KJ)
3399 2 12 12,060 GA
NCAARS / BARC
NG5M (+AB5ER)
2916 2 18 11,338 AR
Hoosier DX & Contest Club
KJ9D (+WN9O)
2617 2 25 11,036 IN
Udder RC
W1MOO (+W1ARF)
3221 2 29 10,680 VT
Big Bend ARC
K5FD (+KM5VM)
2823 2 21 10,534 WTX
Pikes Peak DX Group
WØGG (+KFØW)
3115 2 15 10,414 CO

Minnesota Wireless Assn
WØAA (+NØSTL)
2480 2 16 10,320 MN
Decatur ARC
W4ATD (+KB4CAY)
2909 2 23 9,284 AL
Wayne ARC
W8AV (+N8IW) 2271 2 11 9,126 OH
Canton ARC
W8AL (+NX8J) 2171 2 18 8,580 OH
Schaumburg ARC
N9RJV (+W9KAO)
2109 2 30 8,166 IL
Sudbury ARC
VE3ZI (+VE3SNA)
1787 2 11 8,108 ON
Lafayette DX Assn
W9LDX (+WR9A)
2352 2 12 8,106 IN
NC Contesters
N4Q 2093 2 6 8,054 NC
Sakonnet 49'ers
KD1MW (+W1LY)
2204 2 18 7,948 RI
McMinn CO ARC
NA4K (+K4BP) 1958 2 33 7,850 TN
Falmouth ARA
K1RK (+W1HQH)
1956 2 79 7,588 EMA
Cape Fear ARC
K4MN (+KG4KMV)
2293 2 28 7,550 NC
Madera Co ARC
W6A (+W6WYT)
1994 2 25 7,544 SJV
North Shore RC
K9OR (+K9RST)
1875 2 75 7,448 IL
Fond Du Lac ARC
W9EBV (+N9NE)
1867 2 55 7,392 WI
Eastern MI ARC & Thumb Area Contest Club
K8EPV 1749 2 10 7,388 MI
Sussex Co ARC
W2LV (+N2IEL) 1805 2 22 7,344 NNJ
Randallstown ARC
N3IC (+K3MZ) 1866 2 18 7,344 MDC
Williamson CO ARC
N5TT (+WC5T) 1719 2 37 7,312 STX
Minden ARA
N5RD (+KB5WFE)
2206 2 28 7,266 LA
Motor City RC
W8MRM (+W8GTZ)
1996 2 86 7,260 MI
Tampa ARC
N4TP (+N4SEX)
2049 2 45 7,254 WCF
Stones River ARC
K4FUN (+K4CM)
1651 2 24 7,244 TN
Montrose ARC
KØIIT (+KIØKY) 1770 2 36 7,140 CO
ARC of Parker Co
W5PC (+WC5C) 1651 2 11 6,990 NTX
Massanutten and Valley ARA
W4XD (+KZ1A) 1899 2 90 6,988 VA
Pacific Co ARC
W7RDR (+AB7CF)
1732 2 11 6,968 WWA
Saratoga ARA
K6SA 2026 2 21 6,878 SCV
Spokane DX Assn
K7SDX (+W3AS)
1627 2 19 6,862 ID
Twin City FM Club
WØEF (+WBØN)
1750 2 50 6,850 MN
ARC of Greater Milwaukee
N9AW (+W9DUB)
1796 2 9 6,826 WI
CARS
K4M 1824 2 18 6,798 NC
Muskogee ARC
KK5I (+K5ZEP) 1877 2 20 6,776 OK
The Providence RA
W1OP (+W1PRA)
2019 2 22 6,704 RI
KØLIR (+KGØKP)
1897 2 25 6,640 MO
MIT RS & Harvard Wireless Club
W1MX (+W1AF) 1799 2 25 6,600 EMA
N8OO 1763 2 16 6,570 LA
Santa Barbara ARC
K6TZ 1730 2 22 6,438 SB
Ozark Wireless Soc
K5OWS (+W5SXV)
1752 2 20 6,418 AR
Fresno ARC
W6TO (+W6PSQ)
1706 2 21 6,330 SJV
Delaware Valley RA
W2ZQ (+KB2SYB)
1289 2 18 6,212 SNJ
Kanawha ARC
W8GK (+N8LW)
1755 2 32 6,196 WV
Northeast Tarrant ARC
N5EOC (+W5DWS)
1460 2 25 6,172 NTX
Fidelity ARC
K1KT (+WA1WM) 1466 2 25 6,072 RI
Northern Ohio DX Assn
W8DXA 1754 2 26 5,970 OH
Temple ARC
W5LM (+W5T) 1444 2 35 5,962 NTX
K4OO 1614 2 6 5,920 NC
Koolau ARC
KH6J (+KH7Q) 1600 2 70 5,916 PAC
Bald Peak Contest Club
K7ZS (+KE7DKG)
1873 2 10 5,788 OR
MITRE Bedford ARC & Billerica ARS
W1ON (+W1MJ)
1558 2 54 5,706 EMA
WØBU (+KCØIOF)
1245 2 53 5,654 MN
Mid-MO ARC
NØSS (+KØETY)
1463 2 28 5,648 MO
Tallahassee ARS
K4TLH (+KG4YZM)
1439 2 70 5,494 NFL
Green River Valley ARS
K9WM (+W9RI) 1490 2 20 5,484 IL
Kent Co ARC
W3HZW (+W3DOV)
1277 2 31 5,464 DE
Williamsburg Area ARC
K4RC (+K8LF) 1690 2 36 5,408 VA
Boulder ARC
WØDK (+WMØG)
1656 2 34 5,382 CO
Scorpion Ranch Crew
WS4Y 1691 2 7 5,368 KS
Montgomery ARC
W4AP (+KU4PY)
1390 2 76 5,352 AL
Lake Amateur Radio Assn / ARES
N4FLA 1212 2 33 5,328 NFL
Trident ARC
W4ANK (+N4EE)
1143 2 22 5,258 SC
Escondido ARC
N6SD (+N6WB) 1276 2 30 5,256 SDG
Mecklenburg ARS
W4BFB (+NC4DP)
1512 2 58 5,248 NC
Harris-Intersil ARC
K4HRS (+WA4AQV)
1556 2 18 5,236 SFL
Tennessee Valley DX Assn
W4PL (+N4LT) 1640 2 21 5,202 GA
Philips ARC
W1HP 1408 2 19 5,196 EMA
Gallatin Ham RC
W7ED 1671 2 25 5,194 MT
MARCA
W7MOT (+WA7ZQK)
1325 2 25 5,136 AZ
OH-KY-IN ARS
K8SCH (+NG8A)
1509 2 34 5,132 OH
Arrowhead RAC
WØGKP 1177 2 30 5,076 MN
West Allis RAC
W9FK 1358 2 15 5,062 WI
Anderson RC
N4AW (+KI4CCZ)
1244 2 18 5,042 SC
Massillon ARC
W8NP (+W8DEF)
183 2 45 4,984 OH
Oakville ARC
VE3HB (+VE3OGP)
1264 2 19 4,968 ON
Explorer Post 599
WA2DFI (+W7BSA)
1496 2 17 4,950 AZ
Candlewood ARA
W1QI 1448 2 25 4,928 CT
Souris Valley ARC
KØAJW 1253 2 10 4,920 ND
Lynchburg ARC
K4CQ (+KC1BH)
1448 2 31 4,876 VA
Reelfoot ARC
K4RFT (+N4MJ) 980 2 15 4,828 TN
Hancock ARC
W9ATG (+N9TT)
1215 2 32 4,758 IN
Conifer Contest Club
WT7TT 1344 2 3 4,758 WY
Montgomery ARC
W3EXP (+W3TDH)
1671 2 29 4,746 MDC
Central OR DX Club
N7LE (+W9CZ) 1198 2 15 4,710 OR
Mountaineer ARA
W8SP 1158 2 30 4,644 WV
CTRI Contest Group
WA1RR 1250 2 12 4,564 RI
Austin ARC
W5KA (+K5LBJ)
1053 2 45 4,524 STX
San Mateo RC
W6UQ (+KI6HJJ)
1481 2 12 4,520 SCV
North Shore ARC
VE7NSR (+VE7CTV)
1017 2 33 4,516 BC
Lake Co ARC
W9LJ 1117 2 18 4,500 IN
New Providence ARC
N2XJ (+WB2BOI)
1176 2 28 4,434 NNJ
York RC
W9PCS (+NN9L)
1144 2 17 4,388 IL
Nashoba Valley ARC
N1NC (+K1NNJ) 895 2 31 4,370 EMA
Heartland DX Assn
NIØDX 1161 2 7 4,348 NE
LeFrog
W9VBQ (+N9ENR)
1046 2 20 4,324 WI
Howell Co ARC
WØHCA 1057 2 12 4,324 MO
Blue Ridge ARC
W4YK 977 2 38 4,260 NC
Central Missouri Radio Assn
KØSI (+WMØH) 1051 2 30 4,202 MO
Johnson Co Radio Amateurs Club
WØERH 1195 2 26 4,190 KS
Benton ARS
K5NE (+K5BKT) 1124 2 15 4,142 AR
Utica ARC
K2IQ 1123 2 20 4,104 WNY
West Nodaway Rockets
WØWNR (+K4PAT)
1045 2 12 4,064 MO
High Desert Contest Club
K7AW 1061 2 4 4,038 WWA
Carbon ARC
W3HA (+WB3W) 898 2 14 3,986 EPA
Putnam Emerg & Amateur Repeater League
K2PUT (+K2PC) 780 2 49 3,912 ENY
Vashon-Maury Island RC
W7VMI (+W7PDZ)
664 2 26 3,862 WWA
Northeast Wyoming ARA
NE7WY (+KE7KBF)
952 2 24 3,836 WY
Richmond Am Telecommunications Soc
W4RAT (+WK4Y)
1171 2 24 3,816 VA
Antelope Valley ARC
K6OX (+KG6PQA)
915 2 20 3,782 LAX
North Franklin ARS
N2NNY 776 2 8 3,764 NNY
Ft Madison ARC
WFØRT (+NWØX)
743 2 30 3,762 IA
Richmond ARC
VE7RAR (+VA7XP)
735 2 37 3,754 BC
Trojan ARC
WØWOB 649 2 10 3,738 KS
Parkersburg AR Klub
N8NBL 917 2 31 3,680 WV
Reno QRP Group
W7FST (+WD7Y)
313 5 10 3,670 NV
Eastern Panhandle ARC
K8EP (+N3JDR) 859 2 19 3,654 WV
KF3M 1005 2 14 3,652 EPA
Tippecanoe ARA
W9REG (+WB9SWD)
660 2 13 3,598 IN
Stillwater ARA
WØJH (+KBØSCE)
1097 2 30 3,586 WI
Fox Cities ARC
W9ZL 704 2 30 3,572 WI
Sierra Blanca ARC
KR5NM (+K5RIC)
611 2 47 3,568 NM
Valencia Co ARA
K5OUR (+KC5OUR)
749 2 81 3,558 NM
Foothills ARS
K6YA (+AE6RM) 779 2 25 3,536 SCV
Hidden Valleys ARC & UW-Platteville ARC
KC9KQ 737 2 53 3,524 WI
Cedar Valley ARC
WØGQ (+AAØII) 819 2 30 3,506 IA
Sturdy Memorial Hospital ARC
W1SMH 866 2 32 3,488 EMA
Ellsworth Amateur Wireless Assn
W1TU (+KA1BFA)
718 2 14 3,372 ME
Mineral Wells ARC
W5ABF 717 2 21 3,364 NTX
Quinte ARC & Prince Edward RC
VE3RL 759 2 15 3,348 ON
Pen Bay ARC
W1PBR 776 2 24 3,346 ME
Lakes Region Repeater Assn
W1BST 905 2 9 3,332 NH
Mt Baker ARC
K7ZC 877 2 41 3,318 WWA
Greater New Orleans AR Em Com
NO5FD (+NO5S) 756 2 65 3,308 LA
Bullitt ARS
KY4KY (+W4KBR)
764 2 40 3,298 KY
Kamloops ARC
VE7UT 622 2 28 3,250 BC
Tyler ARC
K5TYR (+W5ETX)
995 2 54 3,240 NTX
Livonia ARC & Ford ARL
K8UNS 814 2 40 3,232 MI
America Red Cross ECS
WB2QBP 933 2 18 3,218 NLI
Palos Verdes ARC
K6PV (+K6JW) 777 2 25 3,216 LAX
Southtowns ARS
WB2ELW (+N2MRN)
716 2 39 3,194 WNY
Jefferson Co ARC
W7JCR (+N7PL) 572 2 78 3,188 WWA
EPCOM
VE7PCE (+VA7PCE)
914 2 25 3,178 BC
Bonac ARC
K2EC (+K2DQ) 1084 2 21 3,176 NLI
Table Mtn Maniacs
N7QT 832 2 4 3,154 EWA
NC Contest Group
K4KQ 1051 2 51 3,152 NC
Ottawa ARC
VE3RC 623 2 50 3,132 ON
Six Meter Club of Chicago
K9ONA 648 2 17 3,096 IL
Humboldt ARC
K6XG (+W6ZZK)
610 2 25 3,078 SF
Machias Radio Group
W7MRG 792 2 8 3,068 WWA
Ham Assn of Mesquite
W5M (+KC5EWI)
823 2 40 3,066 NTX
Tamaqua Area ARA
W3SX 645 2 6 3,062 EPA
Radio Operadores Del Este
KP3RE 587 2 25 3,060 PR
Pearl River Co ARC
K5PRC (+N5WLW)
827 2 26 3,046 MS
Tri CO ARC
W9MQB (+K9LO)
652 2 12 3,044 WI
Yonkers ARC
W2YRC (+NS2M)
754 2 43 3,034 ENY
Ridley Range Rats FD Strike Grp
KI6VC 821 2 2 3,016 SJV
Rockwall ARC
AB5M (+KE5OVO)
743 2 26 2,994 NTX
Bristol Co Repeater Assn
W1ACT (+N1JOY)
754 2 7 2,960 EMA
Grand Rapids ARA
W8DC 1192 2 15 2,918 MI
Peekskill / Cortlandt ARA
W2NYW 1019 2 14 2,906 ENY
Douglas Co ARC
WØUK (+NØTFU)
492 2 30 2,890 KS
Hoosier Lakes Radio Club
K9CWD (+K9GV)
686 2 17 2,880 IN
Hospital Disaster Support Com System
N6ER (+W6KOS)
646 2 32 2,852 ORG
Rockingham Co ARC
N4IV 635 2 25 2,842 NC
Central Michigan ARC
W8MAA (+KC8QZB)
608 2 15 2,758 MI
W4UOT (+KG4ORX)
706 2 35 2,742 TN
K9DIY (+K9SOU)
443 2 64 2,732 IN
Twin City Ham Club
W5EA (+N5KWB)
850 2 44 2,712 LA
Mountain ARC
W6BW 529 2 55 2,698 SJV
Olive Branch ARC
W5OBM (+AI4GI)
820 2 25 2,674 MS
Northville ARA
NA1RA (+WJ1D)
601 2 15 2,668 CT
Paso Robles ARC
W6T (+N6KKS) 1053 1 14 2,663 SB
ARC Hohenwald
K4TTC (+K4HFD)
519 2 50 2,648 TN
Fort Pierce ARC
K4RS 453 2 37 2,640 SFL
Green Bay & Key Club
K9EAM (+N9UPU)
721 2 35 2,634 WI
Lafayette Co ARES
KBØNHW 399 2 58 2,628 MO
Foothills ARC
W4FAR 975 2 9 2,616 NC
Fancy Gap Contest Club
KI4SNY 1166 2 6 2,582 VA
Hambuds
KA5E 765 2 15 2,566 STX

Los Alamos ARC & Northern NM ARC
W5PDO 608 2 15 2,546 NM
Charlotte ARC
W4CQ 621 2 25 2,540 NC
Santa Clara Co ARA
W6UW (+W6UU) 529 2 47 2,536 SCV
Rappahannock ARA
K4YM 816 2 30 2,522 VA
Blossomland ARA
W8MAI (+W8KIT) 557 2 49 2,520 MI
Crawford ARS
W3MIE 562 2 11 2,494 WPA
Turkey Heaven Mtn Repeater Assn
N4THM 622 2 15 2,482 AL
Kingsport / Bays Mtn ARC
W4TRC (+WB2SIN) 895 2 25 2,480 TN
Long Island Mobile ARC
W2VL 524 2 55 2,472 NLI
San Jose State Univ ARC
W6YL 578 2 8 2,468 SCV
Fists Along the Mohawk
W2FAM 461 2 2 2,444 WNY
Midwest ARS
W9MAR 975 1 9 2,439 IN
South Bay ARC
W6SBA 586 2 24 2,436 LAX
Central Ohio ARES
K8DDG (+WA8RES) 799 2 82 2,426 OH
Okee Three
KK4TA 884 2 3 2,422 SFL
Orchard City ARC
VE7OGO 615 2 25 2,418 BC
Irvine Disaster Em Com
N6IPD (+K6NL) 683 2 43 2,412 ORG
Dixie ARC
W7DRC 849 2 41 2,368 UT
Tar River ARC
W4DCG (+NC4FM) 716 2 15 2,352 NC
Indian Hills RC
W8DDD 574 2 13 2,350 OH
Harrisburg RAC
W3UU 631 2 20 2,346 EPA
Orrville ARS
KD8SQ 1007 2 9 2,338 OH
Santa Fe Trail Amateur Trail RC
KSØKS (+NWØI) 406 2 31 2,328 KS
Mid-Atlantic ARC
W3NWA 767 2 23 2,316 EPA
Penn-Mar RC
W3MUM 673 2 18 2,314 EPA
Franklin Co ARC
WE4A 616 2 16 2,304 NC
Shuswap ARC
VE7RAW 412 2 38 2,304 BC
Michigan AR Alliance
W8USA (+KC8KVR) 566 2 10 2,300 MI
CARL
KSØB 706 2 27 2,282 MO
Palms West ARC
W4SS (+AI4PW) 580 2 6 2,250 SFL
Kawartha AR Group
VE3KRG (+VE3RB) 375 2 24 2,244 ON
ARLRC
K3TC 553 2 4 2,228 MDC
St Clair ARC
K9GXU 673 2 12 2,226 IL
W8BNZ 578 2 42 2,216 MI
Franktown FD Club
WØCBH 698 2 17 2,166 CO
Arlington ARC
K5SLD (+WB5CTQ) 402 2 28 2,142 NTX
First State ARC
K3QBD 481 2 17 2,134 DE
Huber Heights ARC
NO8I 406 2 12 2,134 OH
Garland ARC
K5QHD 440 2 23 2,132 NTX
Franklin Co ARC
AC1L (+N1AW) 339 2 22 2,128 WMA
Goddard ARC
WA3NAN (+W3ABC) 561 2 15 2,126 MDC
Iowa City ARC
WØJV 437 2 21 2,124 IA
Old Post ARS
W9EOC 631 2 22 2,122 IN
Issaquah ARC
W7BI 312 2 17 2,114 WWA
21 Repeater Group / Kendallville Contesters
W9N (+N9VI) 341 2 37 2,114 IN
Lanierland ARC
W4E 564 2 20 2,114 GA
Coastside ARC
WA6TOW 521 2 16 2,100 SCV
Faulkner Co ARC
W5AUU (+KD4TA) 500 2 21 2,090 AR
Mid-South ARA
W4EM (+K4GMT) 687 2 50 2,084 TN
South Baldwin ARC
W4DYF 573 2 35 2,070 AL
Mt Magazine ARC
W5MAG (+KK5JR) 646 2 12 2,062 AR
550 DX Club
K4TDP 460 2 8 2,060 AL
DOERS - Ste Genevieve
KØQOD (+NR9A) 398 2 12 2,058 MO
Englewood ARS
N4FA 511 2 17 2,050 WCF
Hill Country ARC
N5HR (+K5EWS) 598 2 63 2,050 STX
HF Radio Group
W2US 400 2 3 2,048 NNY
Mills Co ARC
K5TRO (+N5QBU) 405 2 15 2,022 NTX
Southern Counties Amateur Networks
WS9CAN 290 2 29 2,010 IL
North Okaloosa ARC
W4AAZ (+KI45FR) 393 2 15 2,006 NFL
Coshocton Co ARA
W8CCA 417 2 23 2,000 OH
Pine State ARC
N1ME 447 2 25 1,998 ME
Club Radio Amateur de Quebec
VE2CQ 496 2 30 1,996 QC
NØCS 527 2 14 1,994 MO
Indian River ARC
W4NLX 610 2 20 1,976 SFL
Red River Radio Amateurs
WØILO 441 2 25 1,952 ND
Villagers ARC
K4VRC (+KI4DYE) 536 2 21 1,952 NFL
Athens RC
W4G 473 2 15 1,942 GA
NARS
W5NC (+K5DX) 350 2 50 1,936 STX
Central Georgia ARC
N4CI 550 2 15 1,930 GA
Hendricks Co ARS
N9HC 396 2 20 1,930 IN
Western Tidewater Radio Assn
WT4RA 603 2 20 1,916 VA
Spartanburg RC
K4II 582 2 37 1,916 SC
Keystone Radio Amateurs of PA
W3BD 603 2 5 1,896 EPA
St Augustine Log Cabin Gang
KF4AAF 416 2 8 1,890 NFL
West Palm Beach ARC
W4HAW 418 2 14 1,886 SFL
Assn des RadioAmateurs Independants
VE2REG 440 2 6 1,886 QC
Central Kansas ARC
WØCY 454 2 22 1,882 KS
SouthWest Louisiana ARC
W5BII (+W5GAP) 230 2 30 1,870 LA
St Louis and Suburban RC
WØDCW 376 2 45 1,870 MO
Rainbow Canyon ARC
N7BO 562 2 12 1,866 UT
Sand Hills ARC
WØMI 424 2 34 1,862 KS
Boone Amateur Radio Klub
NØN (+KBØTLM) 373 2 13 1,840 IA
Brooks ARC
VE6NEW 435 2 4 1,808 AB
Ozark & Twin Lakes ARC
K5BAX 490 2 40 1,798 AR
Verde Valley ARA / Yavapai ARC
W7EI (+W7EI) 540 2 60 1,792 AZ
Zanesville Arc
W8ZZV (+KC8SUM) 417 2 15 1,754 OH
Wantagh ARC
W2VA 304 2 12 1,752 NLI
Northwest Harris Co / Waller Co ARES
KC8EO 272 2 16 1,734 STX
Golden Triangle ARC
W6GTR (+K6PYE) 315 2 48 1,732 ORG
Anchorage ARC
KL7AA 440 1 62 1,713 AK
Theodore Roosevelt ARC
KØND 370 2 25 1,710 ND
Randolph ARC
NC4ZO 288 2 38 1,704 NC
WF4Q (+KG4ZWJ) 275 2 10 1,694 TN
Clinton Co ARC
W9AH 352 2 10 1,694 IN
Moosehorn ARC
AL7LE 316 2 30 1,676 AK
Black Diamond RG
KC9GQN 300 2 37 1,674 WI
Convair/220 ARC
W6UUS 361 2 15 1,674 SDG
Androscoggin Valley ARC
K1AVR 256 2 11 1,660 NH
Armed Forces Retirement Home ARA
AF3RH 350 2 10 1,650 MDC
Grumman ARC
WA2LQO 321 2 12 1,648 NLI
Seattle Auxiliary Com Serv
W7ACS (+K7YHB) 229 2 38 1,636 WWA
HBO ARC / Suffolk Police ARC
WB2HBO 271 2 25 1,622 NLI
Ellis Co ARC
WD5DDH 442 2 30 1,616 NTX
Ellis Co ARC
WD6DDH 442 2 30 1,616 NTX
Renfrew CO ARC
VA3NRR 322 2 31 1,616 ON
ARA OF Bremerton
W7VE 296 2 8 1,596 WWA
Cascade Pacific Council Radio Program Center BSA
K7RPC 322 2 15 1,594 OR
Cape Ann ARA
W1GLO 289 2 30 1,592 EMA
Durham FM Assoc
NC4FD 431 2 10 1,592 NC
Victor Valley ARC
K6QWR 268 2 19 1,590 ORG
Lake Erie ARA
WB8CQR 346 2 6 1,586 OH
DeSoto ARC
W4MIN (+K4NOT) 265 2 21 1,578 WCF
Metuchen RC
K2YNT 342 2 12 1,572 NNJ
Lincoln Co Volunteer Com
NC4LC 212 2 34 1,570 NC
N7PI 394 2 11 1,568 ID
VE7NA 366 2 25 1,564 BC
Sooland ARA
KØTFT 340 2 32 1,560 IA
North Hills AR Contest Society
W3WPA (+W3WC) 299 2 20 1,552 WPA
Parsons Area ARC
NØRRY 321 2 7 1,550 KS
Charles Co ARC
K3SMD (+KB3KOW) 241 2 18 1,540 MDC
Outer Banks Repeater Assn
W4PCN 444 2 7 1,538 NC
Alhambra High School ARC
K6R 227 2 7 1,536 SB
W2FHA (+N2ZWO) 190 2 9 1,524 WNY
Stockton-Delta ARC
W6SF 421 2 19 1,522 SJV
Nashville ARC
K4CPO 417 2 18 1,516 TN
Sonoma Co Radio Amateurs
W6SON (+W6LFJ) 298 2 30 1,514 SF
Maple Valley ARC
KC7KEY 375 2 30 1,506 WWA
Central Arkansas UHF Group
AE5AR (+K5NP) 392 2 25 1,498 AR
Wyandot Co Ham Operators Org
KD8BNV 321 2 11 1,494 OH
Santa Clarita ARC
W6JW (+N7TN) 245 2 18 1,490 LAX
Enterprise ARS
WD4ROJ 445 2 24 1,482 AL
KI6ZX (+W6KJ) 299 2 12 1,478 SV
Nutley Amateur RC
W2GLQ 288 2 8 1,476 NNJ
Southern Oregon ARC
KL7IX (+WM7K) 279 2 23 1,470 OR
K2ESE 316 2 6 1,462 NNJ
OARS
W6AF (+K6DYT) 278 2 10 1,450 SV
KE1IU 174 2 3 1,446 CT
HMB ARES
WR6HMB 426 2 20 1,444 SCV
Ogle Co ARES
W9GD 425 2 6 1,442 IL
Clark Co ARC
W9WWI (+NM9A) 125 2 36 1,428 IN
Peace River Radio Assn
W4DUX (+W4MPJ) 409 2 37 1,418 WCF
Reading RC
W3BN 233 2 46 1,416 EPA
NØUY 337 2 5 1,414 MN
Cass Co ARC
W9VMW 514 1 43 1,410 IN
Meeker Co ARC
KØMCR 401 2 8 1,404 MN
Scott Co ARS
K4GV 300 2 15 1,400 VA
Wattsburg Wireless Assn
K3WWA 404 2 25 1,398 WPA
Cupertino ARES
K6KP 160 2 10 1,396 SCV
SARES
N6HM 150 2 67 1,390 SCV
Mountain ARC
NXØG 304 2 20 1,380 CO
Mesilla Valley RC
N5BL (+N9OG) 343 2 28 1,372 NM
NAARS
KK5XF 221 2 30 1,368 AR
RA Soc of Norfolk
W4NPS (+KQ4JE) 305 2 8 1,358 VA
Mercer Island Radio Ops
W7MIR 199 2 16 1,356 WWA
Vacaville RC
W6VVR 218 2 8 1,352 EB
Anoka Co RC & Anoka-ARES
WØYFZ 219 2 15 1,346 MN
DeForest ARC
K8GE 178 2 11 1,342 OH
The Outlaws
AC9X 366 2 4 1,326 IN
Alcorn Co ARES
W4TX 264 2 17 1,324 MS
Casper ARC
W7VNJ 434 2 9 1,318 WY
BEARS - Seattle
K7NWS 302 2 9 1,318 WWA
Eastern Shore ARC
K4BW 343 2 20 1,312 VA
Greenwood ARC
VE1ARC 256 2 15 1,304 MAR
Orange Co RACES
W6HK 216 2 16 1,302 ORG
Sullivan ARC
WØLOU 237 2 18 1,294 MO
Moore CO ARS
NC4ML (+W3CY) 212 2 19 1,284 NC
West Virginia AR
WV8AR 307 2 29 1,280 WV
Ohio State Univ ARC
W8LT 358 2 10 1,264 OH
Laguna Beach Em Com Team
N6L 206 2 50 1,262 ORG
Wichita ARS
N5WF 127 2 38 1,258 NTX
SE Louisiana ARC
WB5NET (+K5NDT) 337 2 25 1,252 LA
WC9AR 426 2 8 1,242 IN
Mt Shasta ARC
W6BML 369 2 5 1,240 SV
KV7V 335 2 6 1,238 UT
Area AR Operators
W9YPS (+N9ZK) 253 2 18 1,236 IL
Montgomery ARS
NC4MC (+KG4FYN) 205 2 18 1,230 NC
PRARL
KP4ES 76 2 25 1,224 PR
WA6JGM 280 2 3 1,224 MO
Southern Illinois University ARC
W9UIH (+K1JNX) 208 2 12 1,216 IL
Northrop Grumman RC
WI6NG 443 2 7 1,216 LAX
Meridian ARC
W5FQ 150 2 37 1,210 MS
Yellowknife ARS
VE8RAC (+VE8YK) 59 2 8 1,202 NT
Sandoval Co ARES
W5SCA 115 2 13 1,200 NM
Big Island ARC
KH6EJ 82 2 43 1,200 PAC
W4AVA 264 2 10 1,200 VA
DCS-22 Lost Hills / Malibu Group
N6FDR 220 2 35 1,196 LAX
Phillips Co ARC
KBØVBL 294 2 10 1,188 KS
Ocean State AR Group
K1OS 294 2 8 1,188 RI
Pike Co ARC
W9UL 267 2 24 1,188 IN
Lockheed Employees RC
W4LMA 201 2 21 1,172 GA
ARA of Bloomington
WCØAAA 307 2 32 1,164 MN
Androscoggin ARC
W1NPP (+WE1U) 139 2 18 1,162 ME
Tech ARS & Socorro RA
KC5ORO 279 2 10 1,156 NM
Raritan Bay Radio Amateurs
K2GE 150 2 5 1,150 SNJ
Ogden ARC
W7SU 427 2 12 1,144 UT
Radops of El Jebel Shrine
KØFEZ 249 2 8 1,128 CO
Egyptian RC
W9AIU 230 2 12 1,124 IL
Pearland ARC
K5PLD 282 2 52 1,110 STX
Campbell River ARS
VE7CRC 326 2 11 1,102 BC
Westcoast ARA
VE7VCC 255 2 25 1,100 BC
Sierra Nevada ARS
W7TA 224 2 25 1,100 NV
South Piedmont AR Klub
W4SRM 212 2 6 1,094 VA
Hamilton CO ARES
N9EOC 174 2 10 1,084 IN
Texas A&M ARC
W5AC 195 2 6 1,080 STX
White Mountain ARC
W1MVW 272 2 15 1,076 NH
AZ Contest Conspiracy & Camping Club
K7DD 362 2 3 1,074 AZ
Pioneer AR Fellowship
W8CTT (+WD8KND) 140 2 42 1,068 OH

Seneca RC
W8ID 161 2 27 1,068 OH
Flint Hills ARC
KBØVAC 186 2 9 1,064 KS
Haulapai AR
WB6RER 83 2 43 1,048 AZ
Carolina AR Services
WX4SC 171 2 14 1,044 NC
Beaufort Radio Amateur Group
W4BFT 246 2 12 1,042 SC
Clear Lake ARC
NU5M (+K5HOU) 40 2 30 1,036 STX
Granite State ARA
N1QC 257 2 29 1,030 NH
Red River ARA
KE5OPP 179 2 14 1,028 LA
Thurston Co ARES/RACES
KE7KDM 69 2 24 1,028 WWA
W8GUC 187 2 4 1,024 OH
Willits ARS
W6MMM 135 2 16 1,020 SF
Grant ARC
W8STZ 197 2 20 1,002 OH
Navarro ARC
N5VO 170 2 26 994 NTX
Conyers ARG
K4UDR 25 2 22 970 GA
Platte Co ARG
KØKEX 179 2 27 968 MO
Huron ARA
WØNOZ 138 2 7 964 SD
Holiday City ARC
W2HC 130 2 13 960 SNJ
JVARC
K3DNA 210 2 7 958 WPA
ARA of Central California
KI6GIL 130 2 25 950 SJV
Portland ARA
W1KFI 100 5 21 950 ME
Ft Wayne Assembly RC
KC9DRG 167 2 3 942 IN
Amador CO ARC
K6ARC 90 2 36 936 SV
Piqua ARC
W8SWS 111 2 35 934 OH
W8GO 228 2 6 926 OH
Moreno Valley ARA
AB6MV (+KC6FJC) 162 2 10 924 ORG
KRNH Aviators
W9DKB 176 2 7 918 WI
Marshall ARC
WØBMJ 124 2 13 916 MN
Fulton Country ARC
K9ILS 206 2 11 896 IL
Sunset Group
K6TSG 221 2 3 892 ORG
Channel Islands ANG ARC
W6ANG 205 2 4 880 LAX
K5PC 354 2 1 864 NTX
Central Vermont ARC
W1BD (+KB1N) 77 2 20 854 VT
NV8N 277 2 7 850 MI
ACØCY 190 2 23 850 KS
New Testament Knights ARC
NT1CS 54 2 10 848 EMA
Macon Co ARC
NØPR 273 2 10 846 MO
Wexaukee ARC
K8CAD 192 2 22 834 MI
Waldo CO ARA
N1TN 137 2 35 824 ME
STARS
W9SRC 179 2 7 818 IL
Mercer Co ARC
W3LIF 74 2 25 800 WPA
Sevier Co
AG4P 215 2 3 778 TN
W2RCX (+W2RCX) 62 2 34 774 WNY
W4RYZ 156 2 13 772 NFL
Gorge East AR
KE7EEM 111 2 9 746 OR
Madison Co DX Club
KCØIEE 178 2 4 726 IA
Cass Co Area Hams
NØUMP 118 2 6 722 MO
Chatham-Kent ARC
VE3NCQ 32 2 3 718 ON
High Sierra FD Group
WB6W 250 1 9 713 SJV
Chesco ARA
K3BKG 172 2 4 706 EPA
Mountain Gang
KB2HAP 163 2 4 696 ENY
Land of Lakes ARC
K9HD 210 2 8 670 IN
Sky Valley ARC
W7SKY 23 2 18 670 WWA
NØIME 133 2 8 666 SD
International Assn for Astronomical Studies
WØNHS 54 2 11 664 CO
Seaway Valley ARC
VE3VSW 91 2 8 662 ON
North Shores ARC
K6HAI 119 2 15 660 SDG
Laurel ARC
W3LRC 152 2 15 656 MDC
Weakley Co ARES
W4UTM 128 2 6 650 TN
Delaware Co ARES / RACES
W3AEC 80 2 3 624 EPA
Upper Cumberland ARA
KU4WD 88 2 4 618 TN
Limestone ARES
N4SEV 48 2 14 612 AL
Benton Co ARES
K7CVO (+KB7TNJ) 54 2 20 598 OR
Country Cabin RC
WØAXT 55 2 7 540 IA
Potatoc Co ARA
KE5BWG 114 2 10 528 OK
Nebraska ARC
NEØRC 109 2 3 518 NE
Idaho Soc of Radio Amateurs
K7BSE 66 2 8 518 ID
Lewes ARS
W3LRS 45 2 10 510 DE
Pacific Northwest DX Soc
KW7HR 91 2 4 482 EWA
Knox Co ARC
W9GFD 30 2 7 460 IL
Clifton ARS
K3GDX 53 2 7 456 NNJ
KD7RIX 78 2 3 456 AZ
Nantucket ARA
N1NBQ 59 2 7 454 EMA
Sunparlor ARC
VE3SPR 141 2 4 410 ON
Durant ARA
K5KIE 44 2 6 404 OK
Aurora Repeater Assn
NØARA 98 2 8 396 CO
Union Co ARS
NC4UC 63 2 15 338 NC
Estero RC
W6JU 152 2 15 304 SB
Conneaut ARC
KA8TUU 11 2 5 222 OH
Pioneer Valley Repeater Assn
N1XG 218 1 8 218 CT
Turkey Ridge Radio
WA3WSB 60 2 4 170 VA
N9KIM 9 2 3 168 IL
University ARC
N7UW 142 1 2 142 WY
K9NWI 44 2 3 138 IN
Lower Yellowstone ARC
W7DXQ 50 2 7 110 MT

2A Battery

Buffalo Lighthouse Crew
K2ZR 1138 5 8 12,690 WNY
Toronto FD Club
VE3FDC 381 5 4 4,880 ON
Western KY DX Assn
K4CMS 542 5 4 4,410 TN
Barstow ARC
WA6TST (+KC6IIH) 462 5 50 4,255 ORG
Tommy Atkerson Memorial FD Club
W4RRW 392 5 6 4,170 GA
Northern VT QRP Soc
N1QS 452 5 8 4,115 VT
Forsyth ARC
W4NC (+W4WS) 381 5 57 3,710 NC
Paulding ARC
W4TIY 561 5 20 3,660 GA
Flying Pigs QRP Club - MD/DC Chapter
K3OQ 293 5 5 3,225 MDC
Walton Radio Assn
W2LZ 268 5 9 3,130 WNY
Rosier FD Group
K4OCE (+N5TER) 258 5 3 3,070 STX
SCVRA / MNQRP
KØCD 268 5 10 2,950 WI
Silver Comet ARS
W4RSC (+WB3ILX) 244 5 17 2,810 GA
Albany ARC
KK4PQ 212 5 3 2,305 GA
Marconi RC of Newfoundland
VO1MRC 66 5 19 1,820 NL
Radio-Active Contesting Club / Nortex QRP
K5RAC 147 5 4 1,760 NTX
Colorado QRP Club - Aloha Site
ABØCD 124 5 13 1,715 CO
Head Lake Group
VE3LM 166 5 4 1,375 ON
Niagara QRPers
VE3CW 79 5 7 1,320 ON
Pioneers ARC
W9DA 72 5 3 970 IL

2A Commercial

Newton & Hesston Colleges ARCs
NØNK (+KØHC) 2125 2 20 7,644 KS
Order of Boiled Owls of NY & Radio Central ARC
KW2O (+W2RC) 1393 2 21 5,424 NLI
Ottumwa ARC
WAØDX 1293 2 9 4,878 IA
East Greenbush ARA
W2EGB 766 2 24 2,382 ENY
Community Service RC
KCØYNE (+ABØOA) 398 2 9 2,042 MO
NC5RG 510 2 18 1,764 OK
Tobacco Valley ARC
K7EUR (+K7BIR) 469 2 16 1,648 MT
Canadian Lakes ARC
K8PAO 688 2 11 1,626 MI
Club Radio Amateur de L'Estrie
VA2UT (+VA2VYZ) 425 2 34 1,560 QC
Independent Radio Assn
N1FZ 265 2 14 1,518 OH
Cumberland ARC
K3IEC (+AF3I) 379 2 18 1,310 EPA
Sweetwater ARC
WY7U 172 2 17 860 WY
Scott CO ARES
NØBHC 192 2 15 854 MN
Mayes Co ARC
WB5Y 85 2 22 680 OK
Yell Logan ARC
K5RLB 261 2 5 672 AR
Elkhorn Valley ARC
WØOFK 256 2 8 662 NE
Apopka Amateurs
K9P 217 2 3 582 NFL
Hill Country Mountain Toppers Assn
W5Z 104 2 3 396 STX
Rowlett RACES
KM5VZ 17 2 15 384 NTX
Southern MD ARC
W3SMR 95 2 32 346 MDC

3A

CorTek Radio Assn
W9CA (+N9BR) 5079 2 25 19,288 IL
Rochester DX Assn
W2RDX (+W2AN) 3836 2 19 13,360 WNY
Utah DX Assn
K7UM (+K7XV) 3811 2 27 12,122 UT
Southwest Dallas Co ARC
W5AUY (+W5WB) 2788 2 10 11,086 NTX
Kennebec Co ARES Team
WA1N (+K1XI) 3380 2 47 10,894 ME
Palo Alto ARA
W6ARA (+K6OTA) 3207 2 12 10,774 SCV
Midland ARC
W5QGG (+WJ5DX) 2925 2 43 10,662 WTX
Grand Mesa Contesters
KØG (+WØYH) 3479 2 8 10,550 CO
Magnolia DX Assn
K5MDX (+W5NO) 3042 2 30 10,148 MS
Baton Rouge ARC
K5DF (+K5LSU) 861 5 29 9,115 LA
OCARS
W8TNO (+K8IY) 3018 2 32 8,930 MI
Fauquier ARS
W4VA (+N2VA) 2629 2 13 8,814 VA
N4N 2317 2 10 8,662 GA
Redxa and Marin ARS
W6KB (+W6SYT) 2585 2 50 8,398 SF
Old Barney ARC
N2OB (+N2CW) 2366 2 40 8,036 SNJ
Hudson Valley Contesters & DXers
W2MU 2785 2 12 7,994 ENY
Kishwaukee ARC
WA9CJN (+KG7EV) 1997 2 15 7,954 IL
Medina 2 Meter Group
W8EOC (+W8MFU) 2155 2 22 7,434 OH
Michiana ARC
W9AB (+W9BOE) 1783 2 44 7,022 IN
Lockheed Martin Recreation Assn RC
W5IU 1690 2 40 6,784 NTX
Stonewall Jackson ARA
K8DF (+K8TPH) 2117 2 21 6,782 WV
Columbus ARC & Russell Co ARC
W4AN (+WX4RUS) 1479 2 55 6,702 GA
Murgas ARC
K3YTL (+K3JML) 1850 2 27 6,546 EPA
Northern Arizona DX Assn & Coconino ARC
W7TB (+AA7DK) 1655 2 26 6,370 AZ
Jupiter Tequesta Repeater Group
W4J (+AD4C) 1745 2 32 6,256 SFL
Greater Norwalk ARC
N1EV (+W1NLK) 1769 2 30 6,226 CT
McKinney ARC
W5MRC (+K5EEN) 1705 2 93 6,170 NTX
East Bay ARC
W6CUS (+WS6V) 1397 2 35 6,130 EB
Eau Claire ARC
W9EAU (+KI9H) 1620 2 33 5,898 WI
South Orange ARA
K6SOA (+K6WO) 1415 2 52 5,852 ORG
Sterling Park ARC
K4NVA (+K4LDT) 1403 2 25 5,846 VA
Hazel Park ARC
W8HP (+N8AE) 1801 2 43 5,846 MI
MicroHams and Icom
N7OS (+N7IH) 1522 2 41 5,818 WWA
HOTARC / TSGARC
W5ZDN (+W5TSA) 1580 2 50 5,718 NTX
Buckeye DX Club
W8OS (+KB8WQ) 1667 2 43 5,704 OH
Nassau ARC
K2VN (+KC2PPN) 1340 2 25 5,700 NLI
Nittany ARC
W3YA 3891 1 25 5,689 WPA
Albany ARA
K2CT 1533 2 35 5,668 ENY
BGMRC
K4NRC 1498 2 30 5,628 GA
Loveland Repeater Assoc & No Colorado ARC
WØFT (+WØDWI) 1456 2 34 5,556 CO
W6BX (+AE6RF) 1089 2 26 5,458 SCV
Rochester ARC
WØMXW (+KØRGR) 2723 1 62 5,445 MN
Edmond ARS
K5EOK 1231 2 46 5,330 OK
Davis CO ARC
K7DAV (+N7CN) 1367 2 75 5,288 UT
Lincoln ARC
KØKKV (+KBØDNP) 1454 2 75 5,242 NE
Historical Electronics Museum ARC
W3HEM (+KB3GSA) 1105 2 20 5,132 MDC
South Georgia ARC
K4GA 1609 2 8 5,086 GA
Utah ARC
W7SP (+N7MFQ) 1204 2 71 4,764 UT
SCARS
W5NOR 947 2 76 4,652 OK
Kankakee Area RS
W9AZ (+N9MBR) 968 2 18 4,634 IL
Southern VT ARC
K1SV (+N1OI) 1625 2 40 4,600 VT
Ascension ARC
K5ARC 1076 2 22 4,546 LA
Xerox ARC
KE2T (+W2KRH) 1058 2 15 4,536 WNY
San Andreas Faultline Survivors
W6SW (+WQ6X) 1292 2 13 4,534 SJV
CORE Group
W4IO (+W4MAC) 998 2 23 4,422 WCF
Camden Co ARS
K4B (+KB4CC) 1086 2 18 4,384 GA
Kilocycle Club of Fort Worth
W5SH 889 2 20 4,380 NTX
Peconic ARC
W2AMC 1389 2 37 4,258 NLI
St Paul RC & Mining ARC
WØMR (+KØAGF) 943 2 33 4,236 MN
San Fernando Valley ARC
W6SD (+K6KLP) 939 2 50 4,228 LAX
Naval Postgraduate School ARC
K6LY (+K6NPS) 850 2 28 4,116 SCV
Stamford ARA
W1EE (+K1FC) 994 2 16 4,098 CT
Ashe Co ARC
W4FD (+W4YSB) 751 2 41 4,066 NC
Yucaipa Valley ARC
K6YRC (+KG6WZN) 1136 2 30 4,062 ORG
Elkhart Co Club Coalition
K9WJU (+K9HDH) 833 2 39 3,946 IN
Dial ARC / Butler Co VHF
K8PI 922 2 45 3,922 OH
Hernando Co ARA
K4BKV 615 2 10 3,898 NFL
K4RAN 1219 2 11 3,894 AL
NF4GTA 1037 2 30 3,892 GA
NF4GA 1037 2 30 3,892 GA
NEKSUN / Kaw Valley ARC
KØHAM 798 2 94 3,882 KS
Eaton Co ARC
K8CHR (+WA8WPI) 1188 2 27 3,870 MI
Alliance ARC
W8LKY (+AB8KV) 879 2 15 3,800 OH
Cambridge ARA
W8VP 1015 2 35 3,798 OH

BARS & STARC
K4TN (+W4HSO)
804 2 61 3,760 WCF
Shreveport ARA
K5SL (+N5SH) 857 2 35 3,758 LA
Northwest Illinois ARC
W9F (+W9UIJ) 807 2 18 3,752 IL
Aero ARC
W3PGA (+AE3RO)
810 2 15 3,726 MDC
MNARC & Mobile 6ers & DCARA & DELCO
DUG
W3JEF 812 2 39 3,714 EPA
VE5NN 1019 2 12 3,706 SK
Charleston ARS
WA4USN 1003 2 29 3,684 SC
Radio Farmers
NØMA 2358 1 15 3,675 IA
Kennehooche ARC
W4BTI 976 2 42 3,672 GA
WØWTN 838 2 22 3,668 SD
Surrey ARC & Langley ARC
VE7SAR (+VE7LGY)
871 2 20 3,666 BC
Paducah ARA
W4NJA (+KI4GKW)
900 2 18 3,660 KY
South Texas ARC
N5CRP (+KY5V) 893 2 25 3,600 STX
Smokey Mtn ARC
W4OLB (+KI4UTJ)
831 2 49 3,572 TN
Riverside Co ARA
W6TJ (+AE6YD) 898 2 80 3,528 ORG
Milwaukee Repeater Club
WI9MRC (+K9VS)
900 2 14 3,498 WI
South Lyon Area ARC
N8SL 899 2 15 3,460 MI
Guilford Co ARES
NA4GC (+KF4ZGZ)
870 2 35 3,410 NC
Monessen ARC
W3CSL (+KA3VEB)
788 2 35 3,384 WPA
Maryland Mobileers ARC
W3CU 658 2 40 3,318 MDC
Hamilton ARC
VE3DC 917 2 27 3,292 ON
Milford ARC
W8MRC 943 2 24 3,292 OH
St Charles ARC
KOØA 796 2 37 3,240 MO
Forx Amateur RC
NØGF 778 2 22 3,234 ND
Roanoke Valley ARC
W4CA (+KK4HR)
1107 2 25 3,218 VA
Al Ahzar Shrine Calgary Com Unit
VE6NMS 618 2 6 3,188 AB
Univ of MS ARC
W5UMS 698 2 21 3,184 MS
Satellite ARC
W6AB 691 2 11 3,184 SB
Mich-A-Con ARC
KC8VC (+N8LT) 795 2 15 3,180 MI
Gaston Co ARS
N4GAS 746 2 23 3,146 NC
Overlook Mtn ARC
N2LL (+N2WCY) 643 2 6 3,140 ENY
Oregon Tualatin Valley ARC
W7OTV (+W7TVC)
566 2 61 3,080 OR
Runestone ARC
WØALX (+KCØSAL)
612 2 17 3,072 MN
Eastern PA ARA
N3IS (+N3SI) 760 2 20 3,014 EPA
Milford ARC
W8YDK (+K8ZKJ)
966 2 31 2,956 MI
Hewlett Packard Boise ARC
AB7HP (+KD7KKC)
1016 2 21 2,954 ID
WD5IYF 824 2 3 2,940 OK
Lakeland ARC
K4LKL 634 2 20 2,904 WCF
Hot Springs ARC
KØHS 746 2 14 2,898 SD
Dallas ARC
W5FC 814 2 30 2,866 NTX
Clallam Co ARC
W7FEL (+KE7XX)
702 2 27 2,864 WWA
Cumberland Plateau ARC
W4CV 659 2 17 2,826 TN
Eastern CT ARA
KZ1M (+K1MUJ) 702 2 26 2,818 CT
Bristol ARC
W4UD 845 2 50 2,762 TN
Springhill ARC
N5II 654 2 8 2,752 LA
Keowee-Toxaway ARC
K4WD 824 2 21 2,706 SC
Bluff Country DX Assn
W9IDX 714 2 4 2,672 WI
Charter's Own
AC4Q 821 2 3 2,646 SC
Catalina RC
W7SA (+W7LB) 890 2 15 2,638 AZ
XWARN
W8XRN 600 2 65 2,586 OH
Aroostook ARA
K1FS 794 2 34 2,568 ME
Troy ARA
N2TY (+KL7TJZ)
771 2 49 2,556 ENY
Joplin ARC
WØIN 780 2 16 2,542 MO
Brightleaf ARC
W4AMC (+W4UHS)
525 2 50 2,542 NC
Burlington Co RC
K2TD (+W2MAT)
551 2 32 2,534 SNJ
Southern Maryland AR Technical Group
N3PX 487 2 6 2,502 MDC
Jackson ARC
W5PFC (+WX5JAN)
590 2 57 2,476 MS
Genesee County Radio Club
W8ACW (+WA8MY)
650 2 8 2,470 MI
Magnolia / LoCo ARCs
AA5MT (+KC5OXI)
665 2 32 2,428 MS
Nixa Amateur Radio
NØA 532 2 20 2,390 MO
Montachusett ARA
W1GZ (+K1YTS)
433 2 12 2,378 WMA
Boone Co ARA
N9VXQ (+KC9GLD)
566 2 36 2,374 IN
COOKEN & NARA
N8ARA (+W8TNX)
382 2 61 2,366 OH
Northwest Texas ARC
WA5CSF 636 2 20 2,336 WTX
Rolla Regional ARS
WØGS 377 2 12 2,320 MO
Fredericton ARC
VE9ND 473 2 12 2,312 MAR
Ramapo Mtn ARC
WA2SNA 446 2 9 2,308 NNJ
Chicago Suburban Radio Assn
N9BAT 487 2 28 2,286 IL
Saratoga CO ARA
WA2UMX 681 2 22 2,286 ENY
Susquehanna Valley ARC
W3VPJ 441 2 16 2,270 EPA
Vero Beach ARC
W4OT 357 2 13 2,256 SFL
Olympia ARS
NT7H (+W7CPU) 560 2 32 2,252 WWA
Green Valley ARC
WE7GV 523 2 38 2,248 AZ
Southern Berkshire ARC
W1BAA/2 (+K1LEE/2)
316 2 31 2,236 ENY
Spring Hill ARC
N4WO 395 2 35 2,230 NFL
WØCRC 479 2 20 2,226 MN
W5NAC 566 2 24 2,212 NTX
BudLog Radio Group
WA1BUD 600 2 12 2,210 WMA
North Bay ARA
NN6MI 269 2 30 2,170 EB
Panorama Land ARC
K7JAR (+KE7MAK)
447 2 38 2,148 EWA
Hampton Public Service Team
W4HPT (+W4QR)
496 2 50 2,104 VA
Lenoir ARC / Caldwell ARES
KF4WØD 446 2 13 2,104 NC
Kings Co RC
W2RAK 520 2 12 2,068 NLI
Wilderness Road ARC
WN4E (+WD4DZC)
388 2 29 2,052 KY
Snohomish Co Hams Club
WA7LAW 334 2 66 2,036 WWA
Orange Co ARC Inc
W2HO 448 2 29 2,030 ENY
Valley RC of OR - DX SIG
W7MJJ 558 2 6 2,030 OR
Bladen ARS
W4BLA 617 2 17 1,992 NC
Horned Toad Acres Wireless Assn
N7KQ (+K7AWA) 525 2 8 1,990 AZ
CRES ARC
W8ZPF 524 2 23 1,970 OH
Northwest Ohio ARC
W8EQ 395 2 21 1,964 OH
FPL Group
K8ESQ (+N8CAK)
494 2 5 1,952 MI
W9DK 432 2 15 1,944 WI
Bloomfield ARC
W1CWA 494 2 13 1,944 CT
West River RC
W1RRC 369 2 30 1,934 VT
DuPage Co Office of Em Manag
KB9RDZ 298 2 25 1,932 IL
Inland Empire ARC
W6IER (+KG6CH)
391 2 23 1,930 ORG
Grayson Co ARC
K5GCC 387 2 20 1,896 NTX
Corona Police CSV Team
W6CPD 319 2 45 1,896 ORG
Blue Ridge ARS
W4KA 452 2 20 1,856 SC
Delaware Lehigh ARC
W3OK 510 2 10 1,848 EPA
Quality Amateur Radio Klub
K7VIT (+N1KEZ) 257 2 13 1,840 OR
South Alabama RC & Opp ARC
WC4M (+K4BOE)
392 2 37 1,812 AL
Wellington RC
K4WRC 530 2 46 1,810 SFL
Cumberland Valley ARC
W3ACH 354 2 44 1,802 WPA
Bridgerland ARC
W7IVM 386 2 40 1,790 UT
Community Em Response Volunteers
VA3CVC 259 2 51 1,768 ON
San Joaquin Valley ARS
WA6SJV (+K6YRZ)
362 2 25 1,764 SJV
Warren ARA
W8VTD 409 2 16 1,746 OH
Sun Country ARS
W4CW 379 2 4 1,732 NFL
Squaw Island ARC
K2BWK 325 2 20 1,720 WNY
San Angelo ARC
W5QX (+KC5ILD)
262 2 30 1,698 WTX
Carteret Co ARS
W4YM/3ANC 382 2 18 1,696 VA
N6SR (+KA6IYS) 170 2 9 1,690 SJV
Gastonia Area ARC
K4GNC 237 2 12 1,688 NC
Skyline Tower ARC
W7DTV 611 2 24 1,686 OR
Pierre ARC
WØPIR 567 2 18 1,684 SD
Great Bay Radio Assn
W1FZ (+K1WO) 459 2 11 1,678 NH
Ottawa Valley Mobile RC
VE3RAM 257 2 16 1,678 ON
W5DSC 206 2 20 1,676 STX
Ashtabula Co ARC
K8CY 396 2 22 1,662 OH
Jones Co ARC
KGØDP 442 2 9 1,632 IA
RASON
N1NW 199 2 30 1,626 CT
Ramona Outback ARS
NG6B (+NG6B) 158 2 14 1,622 SDG
Alamo Area Radio Org
AA5RO (+W5QS)
289 2 56 1,618 STX
Neptune ARC
W2NRC 382 2 67 1,616 NNJ
Sacramento ARC
W6AK 265 2 12 1,606 SV
Red River Valley ARC
WB5RDD 425 2 15 1,594 NTX
Kamiak Butte Amateur Repeater Assn
K6SG (+KB7ARA)
324 2 19 1,594 EWA
Metropolitan ARC
K8NOW 451 2 11 1,592 MI
Wide Area AR Network
WA1ARN 389 2 18 1,582 ME
Champlain Valley ARC
W2UXC 391 2 16 1,570 NNY
PJ'S GROUP/WAFAR
W9FT 399 2 26 1,548 IL
Thunderbird ARC
W7TBC 340 2 11 1,530 AZ
KB4EOC 137 2 16 1,516 AL
Holmesburg ARC
K3FI 303 2 12 1,512 EPA
W8JXN 327 2 15 1,508 MI
Boise Co ARC
WT7B 576 2 5 1,502 ID
Mt Pleasant ARC
WØMME 271 2 5 1,500 IA
Fallbrook ARC
N6FQ 356 2 30 1,482 SDG
San Jose RACES
W6SJC 304 2 21 1,458 SCV
Buffalo CO ARES
NØK (+KCØWZL)
217 2 14 1,444 NE
Thunder Bay ARC
K8PA (+W8CX) 384 2 13 1,442 MI
Valdosta ARC
WR4SG (+K4DXT)
365 2 26 1,440 GA
Somerset Co ARC
K3SMT 297 2 10 1,436 WPA
ARC of Savannah
W4HBB 215 2 50 1,428 GA
Presque Isle Co ARC
W8HIB 372 2 10 1,414 MI
RAC of Knoxville
W4BBB 216 2 33 1,390 TN
955 Group
N3D 383 2 11 1,388 DE
Northwest Georgia ARC
W4VO 219 2 3 1,372 GA
Dixie Renegades
K7Q 246 2 8 1,358 UT
Fort Armstrong Wireless Assn
K3TTK 328 2 13 1,356 WPA
Buffalo Amateur Radio Repeater Assn
W2EUP 465 2 19 1,352 WNY
Gulf Coast ARC
WA4GDN 249 2 25 1,342 WCF
Portage ARC
KJ3Ø 172 2 18 1,334 OH
Stubblefield RC
K4HJ 283 2 23 1,304 KY
Laguna Woods ARC
W6LY 131 2 15 1,302 ORG
Murray State Univ & Marshall Co ARA
K4MSU 317 2 15 1,284 KY
Naval Research Lab ARC
W3NKE 264 2 6 1,262 MDC
Irving ARC
N5BB (+WA5CKF)
164 2 33 1,234 NTX
Salem Area ARA
K8BTP 99 2 15 1,226 OH
RECWA
WW2FD 182 2 4 1,214 ENY
Pasadena RC
W6KA 280 2 63 1,210 LAX
KB3IRR 359 2 3 1,176 EPA
Big Rapids Area RC
N8OE (+KB8QOI)
188 2 10 1,166 MI
N1MV 149 2 24 1,150 EMA
Russell Co ARC
WR4RC 124 2 3 1,098 VA
Totah ARC
K5RZI 142 2 25 1,092 NM
ROADs
W7ORE 216 2 29 1,086 OR
N7SEE 234 2 4 1,078 MT
KI7EL 80 5 3 1,075 WWA
Bartow county ARES
N4B 110 2 4 1,070 GA
Long Island AR Simplex Club
W2LIS (+W2CYK)
242 2 26 1,054 NLI
NJ2GC 101 2 7 1,052 SNJ
Chattanooga ARC
W4AM 267 2 35 1,038 TN
Radio Amateurs of Corry
W3YXE 127 2 12 1,020 WPA
Wilderness Center FD Group
WD8ITF 213 2 3 1,002 OH
Desert Circle ARC
NU7DE 163 2 4 996 NM
Univ of Southern California ARC
W6YV 70 2 3 990 LAX
Union City ARES/RACES
KV6DC 135 2 10 970 EB
High Point ARC
W4UA 292 2 14 968 NC
Schenectady Museum ARA
W2IR 198 2 8 966 ENY
RIT ARC
K2GXT 197 2 5 964 VT
Hall of Science ARC
WB2JSM 179 2 10 948 NLI
K4T (+KG4CQK) 116 2 10 942 NFL
DCAR
KØRGT (+KCØROM)
68 2 21 926 MO
South Bay ARS
K6QM 66 2 10 920 SDG
Radio Amateurs of the Gorge
KC7KLB 90 2 23 900 OR
Lunenburg / Queens ARC
VE1QW 110 2 12 890 MAR
Matanuska AR Assn
KL7JFU 68 2 35 886 AK
N6CG 217 2 25 884 ORG
Tonto AR Assoc
N7TAR 133 2 37 866 AZ
TCARAUS
W8EEJ 234 2 11 840 MI
Lockport ARA
W2RUI 135 2 24 822 WNY
Morgan Co R-2 RC
KCØLZD 65 2 29 818 MO
WBØAA 271 2 5 808 CO
Tri-County ARC
VE9TCA 64 2 12 802 MAR
Arapahoe Co District 22 ARES
WAØRES 122 2 18 800 CO
Shore Points ARC
K2B 71 2 15 792 SNJ
Western WA Medical Services Team Dist 5
AD7AW 62 2 4 774 WWA
Gladwin Area ARC
W8GDW 211 2 14 772 MI
West Central Ohio ARA
WC8OH 47 2 13 744 OH
Campaign Co ARES
WB8UCD 121 2 12 642 OH
NC State Univ Student ARS
W4ATC 225 2 9 626 NC
Juneau Co ARC
NØTRQ 54 2 3 458 WI
RF Wireless ARC of Burley
W7JQ 145 2 7 440 WWA
Northern Lakes ARC
KØGPZ 149 2 25 324 MN

Oglethrope ARES
N2YYP (+KE4GVX)
70 2 12 260 GA
Gopher ARC
WØYC 5 2 3 60 PAC

3A Battery

Eastern PA QRP Club
N3EPA 464 5 12 4,210 EPA
ARC of Alameda
K6QLF 97 5 20 2,100 EB
QCWA162 SEWI
K9AKG 165 5 25 2,060 WI
Ottawa Valley QRP Club
VA3OVQ 95 5 8 1,745 ON
OU ARC
W5TC 67 5 10 1,185 OK
Thunderbolt ARA
KJØT 57 5 7 935 CO
KU4IS 4 5 3 390 SFL

3A Commercial

Splitrock ARA
K2RF (+N2NYP)
1874 2 25 7,100 NNJ
New York City Transit ARC
K2IRT 958 2 15 3,510 NLI
Zamora Shrine Radio Unit
W4ZHR (+WB4PMW)
904 2 19 3,352 AL
HCARC
K8HRC 311 2 15 1,384 MI
Dubois Co ARC
N9NAU 501 2 24 1,352 IN
K1UI 353 2 4 1,106 EMA
Southboro Rod & Gun ARC
W1SRG 382 2 10 1,058 EMA
W4ZA (+W4FJ) 123 2 47 970 VA
WØKEM 320 1 3 372 MO

4A

Huntsville ARC
K4BFT (+KI4PMW)
3807 2 43 12,962 AL
Delara ARC
K8ES (+N8OB) 3125 2 82 10,836 OH
North Shore Radio Assn
NS1RA 3148 2 70 10,402 EMA
ARROW/UMARC Field Day Team
W8UM (+W8PGW)
2639 2 50 10,034 MI
Virginia Wireless Soc
K4XY (+K4HTA)
2426 2 10 9,052 VA
BOARS
NG5A (+AD5NR)
1872 2 22 7,490 NTX
Arkansas River Valley AR Foundation
K5PXP (+W5MAN)
1745 2 25 7,456 AR
Birmingham ARC & Shelby Co ARC
W4CUE (+KD4AY)
1830 2 48 7,166 AL
Franklin Co ARC
W4FCR (+W4BOT)
642 5 10 6,910 VA
Two Rivers ARC
W3OC 1674 2 33 6,842 WPA
Contoocook Valley RC
K1BKE (+K1DFQ)
2036 2 52 6,438 NH
JPL ARC / CALTECH ARC
W6VIO (+W6UE)
2035 2 38 6,276 LAX
Green Mtn Wireless Society
N1VT (+AB1CH)
1431 2 31 5,910 VT
Oxford Co ARES / CERT
W1OCA (+N1GZB)
1088 2 54 5,712 ME
Westchester Em Com Assn
N2SF (+AB2WS)
1784 2 12 5,710 ENY
Boeing Employees ARS ST Louis
WØMA 1625 2 25 5,548 MO
Lake Monroe ARS
N4EH 1653 2 73 5,118 NFL
Des Moines RAA / ARTS
WØAK 1272 2 32 5,084 IA
Florence ARC
W4ULH 1067 2 55 4,986 SC
Cuyahoga Falls ARC
W8VPV 1452 2 34 4,930 OH
L'Anse Creuse ARC
N8LC 1465 2 24 4,886 MI
Columbia-Montour ARC
WC3A (+KB3BJO)
972 2 20 4,654 EPA
Penn Wireless Assn
W3SK (+KB3MTW)
1235 2 20 4,628 EPA
Cowell ARC
W8LRC 1196 2 51 4,336 MI
Marion ARC
W8GVB (+K8DHC)
852 2 8 4,208 OH
ARTS of Louisville
W4CN (+KY4DX)
1083 2 25 4,160 KY
Alford Memorial RC
W4BOC (+KF4OKA)
800 2 75 4,158 GA
Washington Amateur Com
WA3COM 1015 2 30 4,118 WPA
Bellevue ARC
WØWYV 864 2 27 4,114 NE
Livermore ARC
N6A 1057 2 10 3,950 EB
Plano Amateur Radio Klub
K5PRK (+K5LOL)
889 2 50 3,888 NTX
Kokomo ARC
W9GO 830 2 24 3,882 IN
Cherryland ARC
W8TCM 1651 2 25 3,878 MI
Portage Co AR Service
KD8CKP (+KC8PD)
914 2 76 3,854 OH
Bellbrook ARC
W8DGN 888 2 68 3,834 OH
InterCity ARC
W8WE (+W8WER)
713 2 54 3,744 OH
Dixie Amateur Radio Klub
W4DAK 809 2 20 3,652 NFL
London ARC
VE3LON 1027 2 60 3,548 ON
W4VIY 859 2 14 3,488 NFL
K5NRH 842 2 66 3,402 NTX
K3CSG (+N3UVR)
640 2 35 3,236 EPA
Ole Virginia Hams ARC
W4OVH (+W4PVA)
628 2 70 3,202 VA
Findlay RC
W8FT 634 2 46 3,130 OH
Skyline ARC
K2IWR (+W2CM)851 2 40 3,066 WNY
Northwest Society of AR
K7RX (+KD7WBP)
527 2 37 3,026 WWA
Chaos Theory
KZ9B 640 2 35 3,000 WI
Oakland Radio Com Assn
WW6OR (+N6ORC)
551 2 27 2,996 EB
Sussex ARA
W3D (+W3D) 828 2 10 2,960 DE
West Chester ARA
WC8VOA 1759 1 20 2,938 OH
Yakima ARC
W7AQ (+KK7KI) 653 2 10 2,914 EWA
Northern KY ARC / KY District 7 AR Em Team
K4CO (+KY7ET)
613 2 28 2,892 KY
Trilake ARC
KCØM 553 2 9 2,862 MO
RA of Erie
W3GV 798 2 9 2,862 WPA
Maury ARC
W4GGM (+NQ5F)
658 2 35 2,736 TN
Peel ARC
VE3XR 550 2 20 2,694 ON
Greater Vancouver Radio Group
VE7VRG 866 2 32 2,656 BC
Riverside RA Club
KC8YXF 815 2 12 2,626 MI
Pamlico ARS
W4USR 970 2 40 2,622 NC
AARC Group
W7PU 603 2 5 2,578 WWA
Wilson ARC
WC4AR 416 2 13 2,476 TN
Wayne Co ARA & Goldsboro Am Repeater Club
K4CYP 519 2 57 2,438 NC
Southern PA Com Group
K3AE 624 2 36 2,428 EPA
Toothless Talkers
N8IVE (+KC8YDS)
725 2 24 2,414 OH
Sheboygan Co ARC
W9VCL 577 2 10 2,374 WI
Ozark Mtn Repeater Club
AEØAA 481 2 63 2,348 MO
Antietam Radio Assn
W3CWC (+K2AVA)
385 2 9 2,242 MDC
Horseshoe ARC
K3HRC 357 2 40 2,220 WPA
Plattsmouth ARC
KBØSMX 327 2 21 2,218 NE
W5JPJ (+WB5JZP)
607 2 40 2,184 LA
Sangamon Valley RC
W9DUA 506 2 42 2,182 IL
Clark Co ARC
W7AIA (+K7JAO)318 2 12 2,120 WWA
The Knightlites
WF4I 509 2 6 2,070 NC
Palisades ARC
W9YS 493 2 20 2,064 IL
Lassen ARC
K6LRC 480 2 26 2,058 SV
DeKalb Co ARC
W4GBR 322 2 19 2,056 AL
KE9GM 370 2 18 1,996 IN
Society of Newfoundland RA
VO1AA 158 2 21 1,962 NL
Huntington Co ARS
K9HC 502 2 16 1,926 IN
WD8IEL 472 2 14 1,854 MI
K7SI 329 2 14 1,850 ID
Saint Croix Valley ARC
WW1IE 271 2 9 1,844 ME
Rip Van Winkle ARS
WD2K 321 2 25 1,828 ENY
Em Com Assn
KE3JP 517 2 13 1,734 WPA
Santiam Canyon ARC
KM7P (+KD7BCF)
374 2 8 1,710 OR
Insurance City Repeater Club
K1DFS 262 2 12 1,660 CT
Shoreline ACS
W7AUX 391 1 17 1,634 WWA
Thumb ARC
W8AX 453 2 31 1,620 MI
East River ARC
W8MOP 280 2 8 1,616 VA
Madison Oneida ARC
W2MO 234 2 19 1,540 WNY
Arlington Com League
KD9XR 321 2 7 1,540 IL
Endless Mountains ARC
N3EP 244 2 13 1,538 EPA
NEMO ARC
WØCBL 273 2 12 1,528 MO
Natchaug ARC
NA1RC 374 2 12 1,494 CT
Ft Venango Mike & Key Club
W3ZIC 306 2 15 1,488 WPA
West Santa Barbara Co ARES
W9EC 249 2 10 1,486 SB
Cherokee ARS
AI4GL 122 2 12 1,484 GA
K5BWD (+KE5NYB)
210 2 16 1,472 NTX
Portsmouth ARC ARES
W4POX 261 2 32 1,472 VA
Enid ARC
W5HTK 154 2 44 1,458 OK
Independent RC
WA6IRC 129 2 30 1,454 SB
Chehalis Valley ARS
WA7UHD 342 2 12 1,434 WWA
Sunset Empire ARC
W7BU (+WA7TEM)
184 2 40 1,378 OR
Waterville Area Wireless Assn
WA1WA 141 2 22 1,374 ME
Island Co ARC
W7AVM 174 2 15 1,368 WWA
MCWA & WeLCARS ARCs
K9RN (+N9IFG) 851 1 22 1,362 IL
Boyer Valley ARC
KØBVC 237 2 24 1,318 IA
NBC ARC
N2EW 269 2 6 1,310 LAX
Calhoun Co ARA
WB4GNA 60 2 50 1,300 AL

Dalton ARC
W4DRC 271 2 10 1,262 GA
Hoosier Hills Ham Club
W9QYQ 203 2 28 1,260 IN
Cherokee Capital ARS
K4WOC 147 2 12 1,226 GA
GCARES
WC5B 187 2 26 1,210 MI
Gas Line Groovies ARC
NG4I 327 2 15 1,204 VA
Mile High RC
K6GUN 97 2 13 1,144 ORG
Riverland ARC
WR9ARC 143 2 15 1,134 MN
McMinnville ARC
W7RXJ 141 2 64 1,132 OR
Pilot Knob ARC
KSØLV 62 2 12 1,096 KS
W7GLG 157 2 9 1,086 OR
NV8E 466 2 4 1,068 OH
Delaware Valley Ragchew Club
N2HQX 228 2 13 1,006 SNJ
Indiana Co ARC
W3BMD (+KB3JOF)
181 2 62 906 WPA
Davie Co ARC
KI4ORW (+NW4O)
218 2 7 896 NC
Middlesex ARS
W1EDH 233 2 21 834 CT
Maple Ridge ARC
VE7CML 200 2 11 800 BC
Carol Co ARC
KD8AMX 44 2 9 788 NE
Capital City ARC
W7TCK 106 2 10 426 MT

4A Battery

Portland ARC
W7LT 718 5 22 7,345 OR
Zuni Loop Mtn Expeditionary Force
N6GA 663 5 9 6,400 LAX
St Louis QRP Society
NØWM 234 5 12 3,480 MO
Northern Virginia QRP Group
WA4MM 269 5 5 3,475 VA
Elgin ARS
VE3RSE 131 5 20 1,780 ON
W7TF 65 5 5 1,735 ID

4A Commercial

Anthracite Repeater Assn
W3SJI 1045 2 20 3,142 EPA
Radio Assn of Western NY
W2PE 365 2 19 1,696 WNY
W4FPC 220 2 23 1,354 NFL
North Bay ARC
NØBRC (+K6MAP)
601 2 14 1,272 SF
NØGAF 191 2 7 432 WI

5A

PCARC
K1R (+W1WQM)
5230 2 35 16,894 NH
Ozaukee RC
W9LO (+AA9W)
3578 2 35 12,270 WI
Loudoun ARG
K4LRG (+KE5APC)
2675 2 66 10,782 VA
Virginia Beach ARC & VADXCC
W4UG (+W4DZ)
2706 2 60 9,518 VA
TARC/WAARS/UAARC/DCARA
W4XI (+KI4IKM)
2602 2 50 8,186 AL
Peoria Area ARC
W9UVI 1357 2 34 5,744 IL
Four Lakes ARC
W9JZ (+NQ9A)1288 2 15 5,686 WI
Wireless Assn of South Hills
N3SH 1430 2 60 5,312 WPA
Fort Myers ARC
W4LX (+N3NAI)1158 2 27 4,968 SFL
Warminster ARC
K3DN 1272 2 45 4,892 EPA
St Petersburg ARC
W4TA 1117 2 35 4,878 WCF
Big Bear ARC
K6BB (+KE6QI) 1243 2 30 4,806 ORG
Butler CO ARA
W3UDX (+AA3YW)
1354 2 21 4,760 WPA
Highlands Co ARC
K4W (+AG4ZM)
1136 2 30 4,744 WCF
RF Hill ARC
W3AI 1413 2 25 4,704 EPA
Philmont Mobile RC
W3EM (+W3PSH)
1196 2 20 4,596 EPA
Schenectady ARA
K2AE 970 2 50 4,412 ENY
Hoodview ARC
W7Q (+N7QR) 979 2 32 4,372 OR
Twin City ARC
K9CU 1118 2 50 4,288 IL

York Region ARC
VE3YRA 1056 2 52 4,234 ON
North Texas Wear Group
ND5X 1046 2 18 4,034 NTX
ARA of Southwest FL
K4YHB (+AI4CZ)
1522 2 23 3,942 SFL
NOBARC
N1WM 964 2 30 3,680 WMA
Cambridge ARC
VE3SWA 969 2 5 3,528 ON
Mt Vernon ARC
K4US 885 2 20 3,370 VA
W9MKS 611 2 56 3,292 IL
Iredell Co ARS
W4SNC 715 2 31 3,128 NC
Appalachian ARG & Lebanon Valley Soc of RA
AA3RG (+K3LV) 728 2 19 2,970 EPA
Alexandria RC
W4HFH 687 2 20 2,944 VA
Nortown ARC
VE3NAR 755 2 12 2,886 ON
Assn Radio Amateurs of Long Beach
W6RO 584 2 57 2,834 LAX
Radio Amateurs of Greater Syracuse
W2AE 500 2 61 2,822 WNY
Anne Arundel RC Jr
KI3DS 676 2 10 2,798 MDC
M&M ARC
W8PIF 667 2 61 2,740 MI
Golden Empire ARS
W6RHC 707 2 12 2,738 SV
Smarts
WBØRMK 550 2 14 2,678 MN
Wood Co Em Com
WC8EC 513 2 22 2,620 WV
Coachella Valley ARC
NR6P 413 2 12 2,464 ORG
Thin Air Radio Society
KØUE 586 2 5 2,440 CO
LARC
AB4GA 908 2 25 2,392 GA
Triple A ARA
AC3J 748 2 20 2,304 WPA
Lake Oswego ARES
WA7LO (+KD7ZDO)
305 2 51 2,230 OR
Silvercreek ARA
W8WKY 659 2 9 2,192 OH
Upper Valley ARC
K8FBN 264 2 38 2,164 OH
Chesapeake AR Service
W4CAR 531 2 20 2,154 VA
Boling Brook ARS
K9BAR 580 2 20 2,126 IL
River City AR Com Soc
N6NA 500 2 37 2,062 SV
Lakeway ARC
W2IQ (+NX6R) 385 2 32 2,052 TN
The Northern Ohio ARS
K8KRG (+N8CX)
398 2 18 2,026 OH
TRI-County CW ARC
W3TCW 358 2 25 1,874 WPA
Fulton Co ARC
K8BXQ 443 2 10 1,804 OH
Pioneer ARC
KØJFN 251 2 26 1,784 NE
AREA
W9YPC 362 2 10 1,734 IL
Barry ARA
KC8VTO 296 2 33 1,732 MI
VARECS
W2DU 255 2 9 1,722 NFL
Sabine Valley ARA
N5T 322 2 12 1,712 NTX
Roane Co ARC
KE4RX 120 2 10 1,492 TN
Southern CA Japanese Ham Club
K6JP 395 1 15 1,393 LAX
Silver Springs RC
K4GSO 186 2 23 1,344 NFL
AC6RM 227 2 7 1,114 LAX
Jonestown Mountain Repeater Assn
N3CSE 97 2 15 966 EPA
Pasadena ARC
N5BCK 63 2 8 876 STX
Capital City ARS
WB3KIC 39 2 15 578 MDC

5A Battery

Durham Region QRP Club
VE3QDR 787 5 5 8,265 ON
Anne Arundel RC
W3VPR (+N3HU)
864 5 65 7,500 MDC
Scenic City ARS
W4SCA 293 5 16 3,490 TN
North Coast ARC
N8NC 319 5 37 2,565 OH

5A Commercial

Milledgeville ARC
W4M 1018 2 27 4,266 GA
Falls ARC
K9RHH 366 2 10 1,442 WI

6A

South Jersey Radio Assn
K2AA (+W2EA) 4886 2 51 16,680 SNJ
Mike & Key ARC
K7LED (+K7OV)
4337 2 69 13,786 WWA
Lake Co ARA
N8BC 2419 2 23 9,288 OH
Ft Smith Area ARC
W5ANR 2061 2 45 7,626 AR
United RAC
K6AA 2490 2 33 7,454 LAX
South Bay ARA
KU6S (+KF6Y) 1561 2 50 6,182 EB
DuPage ARC
W9DUP (+KC9IAH)
1302 2 75 4,836 IL
Fort Wayne RC
W9TE (+KB9WWM)
1011 2 45 4,698 IN
Wheaton Community Radio Amateurs
W9CCU 1125 2 20 4,582 IL
Central NH ARC
W1JY (+W1CNH)
992 2 25 4,110 NH
Holland ARC
K8DAA (+KC8QDE)
984 2 21 3,980 MI
Tipp City Amateur Radio
K8ZC 780 2 13 3,880 OH
Muskegon Area AR Council
W8ZHO (+KD8BGQ)
567 2 21 3,688 MI
Ventura Co ARS & Simi Settlers ARC
N6R (+K6VCS) 632 2 29 3,362 SB
WR4MG (+KJ4O)
965 2 30 3,220 GA
Saginaw Valley ARA
K8DAC (+N8YXR)
726 2 20 2,900 MI
Beloit ARC
W9DL 686 2 12 2,892 IL
Northeast Georgia ARC
NE4GA (+WT4XX)
645 2 25 2,722 GA
Fountain Valley RACES / West Coast ARC
N6F 647 2 27 2,690 ORG
Rockford ARA
W9AXD 435 2 10 2,508 IL
Wisconsin Valley RA
W9NA 834 1 19 2,301 WI
Lancaster ARC
W2SO 509 2 10 2,176 WNY
Keuka Lake ARA
AI2U 320 2 24 2,094 WNY
Midland ARC
W8KEA 351 2 25 2,052 MI
Friends of 045 Repeater
W6V 372 2 14 1,888 EB
Whitewater Valley ARC
N9JM 249 2 14 1,528 IN
Glendora Em Response Com
KE6DOJ 97 2 21 1,344 LAX
Sun City Center ARC
KE4ZIP (+N1OV)195 2 60 1,116 WCF

6A Commercial

Milwaukee Radio Amateurs Club
W9RH (+KA9OFA)
498 2 27 1,888 WI

7A

Woodbridge Wireless
W4IY (+N2PJ) 4199 2 40 15,142 VA
RC of Tacoma Inc
W7DK (+W7OS)
2762 2 10 10,234 WWA
Raleigh ARS
W4DW (+K4HF)
3224 2 51 9,220 NC
Gainesville ARS
K4EAC 2524 2 90 9,042 NFL
Central KY ARS
AA4NJ (+KE4YVD)
1957 2 25 7,812 KY
Carroll Co Contesters
WY3P (+WX3B)
1905 2 19 6,992 MDC
Hampden Co Radio Assn
W1NY (+WB1Z)
1820 2 55 6,912 WMA
South Pickering ARC
VE3SPC 1573 2 20 5,844 ON
Radio Society of Tucson
K7RST 1608 2 34 5,520 AZ
Sun Parlour Retirees ARC
VE3OW 1562 2 30 4,894 ON
Gwinnett ARS
W4GR (+AF4FG)
1043 2 77 4,320 GA
Delta ARS
VE7SUN (+VE7FKY)
998 2 56 4,162 BC
BEARS of Wichita
KCØAHN 1049 2 43 4,054 KS
SARS
W6CO (+KO6FR)560 2 21 3,158 EB
Monongalia Wireless Assn
W8MWA 576 2 25 3,032 WV
Kern Co Central Valley ARC
W6LIE 718 2 26 2,932 SJV
K4ORE (+W4CHM)
477 2 17 2,486 TN
Calveras ARS
N6FRG 385 2 12 2,222 SJV
W6ERE 292 2 37 2,156 SJV
TCARES
K6TUO 325 2 19 1,900 SJV
Kendall ARS
KB5TX 248 2 16 1,796 STX
Five Flags ARA
W4UC 154 2 40 1,578 NFL
Vinton Co ARC
AB8XG 161 2 10 1,072 OH

7A Battery

David Sarnoff ARC
N2RE 366 5 45 4,505 SNJ

8A

Nashua Area ARC
N1FD (+KB1OGL)
3887 2 30 12,724 NH
Fox River Radio League
W9NE (+W9CEQ)
2462 2 85 9,876 IL
K4TS (+N9JH) 2020 2 58 7,930 VA
Cuyahoga ARS
W8BM 1573 2 40 6,566 OH
10-70 Repeater Assn
N2SE (+KC2PJH)
1301 2 58 6,178 NNJ
Kalamazoo ARC
W8VY 1665 2 31 6,162 MI
Orlando ARC
W1SE 1413 2 25 5,910 NFL
Wabash Valley ARA
W9UUU 1228 2 50 5,046 IN
Andrew Johnson ARC
W4WC 1013 2 16 4,536 TN
Mahoning Valley Amateur Radio Assn
W8QLY (+N8SEJ)
1046 2 50 4,228 OH
Bears of Manchester
W1BRS (+KA1MM)
760 2 50 3,400 CT
ARC of El Cajon
WA6BGS 727 2 62 3,332 SDG
Crawford Co ARC
W8BAE 1011 2 47 3,258 OH
Johnston ARS
K4SWR 535 2 18 2,872 NC
Toledo Mobile Radio Assn
W8HHF (+KB8PAI)
428 2 43 2,194 OH
Wizard DX and ARC
WI6ZRD 416 2 11 2,032 ORG

8A Battery

West Valley ARA
N6N (+W6PIY) 1119 5 30 10,745 SCV
Orange Co Radio Amateurs
W4EZ (+KI4LLL)
865 5 52 8,025 NC

9A

Orange Co ARC
W6ZE (+N1AB)
6217 2 86 20,246 ORG
GMA RC
VE3GMA 5161 2 19 16,734 ON
W2MMD 1768 2 50 7,864 SNJ
El Dorado ARC
AG6AU 960 2 27 3,790 SV
Conejo Valley RC
AA6CV 578 2 45 3,182 SB
Short Mountain Repeater Club
W4IV (+KA4BTA)
197 2 27 2,328 TN

10A

Mid-Atlantic DX and Repeater Assn
K3MAD (+K3ICT)
967 2 57 4,552 MDC

11A

Mississauga ARC
VE3MIS 1332 2 28 5,958 ON

16A Battery

USECA ARC
K8UO (+N8ZI) 1193 5 11 12,340 MI

19A

Potomac Valley RC and Columbia ARA
W3AO (+KE3Q)
8147 2 45 27,150 MDC

1B-1 Op Battery

N4OGW 954 5 1 9,690 MS
K3WW 761 5 1 7,460 EPA
NØHT 627 5 1 6,025 NFL
K5WNH 550 5 1 5,850 NTX
W3TS 517 5 1 5,470 EPA
K7IA 475 5 1 5,200 NM
K9AY 459 5 1 4,935 WI
WA8RC 412 5 1 4,770 MI
N8BB 446 5 1 4,560 MI
K4EJQ 445 5 1 4,550 TN
AA1XV 408 5 1 4,530 CT
K7EN 381 5 1 4,110 UT
KØMF 367 5 1 3,820 CO
VA3DF 340 5 1 3,455 ON
K8AB 305 5 1 3,285 OH
W4SK 300 5 1 3,150 TN
K4RDU 292 5 1 3,020 VA
AA5CK 255 5 1 3,000 OK
KXØR 295 5 1 3,000 WY
WA4DOU 263 5 1 2,880 NC
W8VK 252 5 1 2,645 OH
AI4BJ 239 5 1 2,530 KY
W9NJY 214 5 1 2,490 WI
WØYHE 234 5 1 2,440 MN
KD2JC 227 5 1 2,370 NNJ
W1PW 200 5 1 2,350 AZ
WUØL 194 5 1 2,290 SDG
W4DIT 187 5 1 2,220 TN
NR8Z 165 5 1 1,900 OH
AD7L 157 5 1 1,820 OR
W7IY 148 5 1 1,730 SC
WØCZ 130 5 1 1,630 ND
W6RA 138 5 1 1,570 OR
AJ4F 140 5 1 1,450 TN
K1PDY 110 5 1 1,350 NH
W1KRT 117 5 1 1,270 NH
KFØUU 90 5 1 1,250 MN
AB4EL 139 5 1 1,190 NC
N3AB 108 5 1 1,180 EPA
K4FHI 114 5 1 1,140 NC
W7CD 87 5 1 1,135 WWA
N3ZP 107 5 1 1,130 WV
N8XMS 86 5 1 1,110 MI
WD8DSB 91 5 1 1,060 IN
W3WT 70 5 1 1,050 EPA
VE3CG 70 5 1 1,020 ON
KB7LJP 74 5 1 990 WWA
K6RXL 84 5 1 990 AZ
W6UR 82 5 1 970 SJV
K9SIU 72 5 1 870 IL
VE6ZC 61 5 1 860 AB
KC8SQC 60 5 1 850 MI
K3TW 40 5 1 850 MDC
VE3HJV 54 5 1 790 ON
KA1HSP 55 5 1 700 WMA
AB8XX 32 5 1 700 OH
KB9NK 78 5 1 660 MI
AE6N 40 5 1 640 AZ
VA7RMM 61 5 1 625 BC
N9AMW 48 5 1 615 WI
AB4VF 36 5 1 560 NFL
AC4LS 12 5 1 540 TN
K6ZCL/7 25 5 1 500 WY
N3GWZ 50 5 1 480 EPA
K4AHO 33 5 1 480 NFL
WD9EWK 3 5 1 465 AZ
N2JPR 49 5 1 460 ENY
WG5F 30 5 1 450 OK
K4FOY 20 5 1 450 VA
NKØE 30 5 1 450 CO
AE5BH 20 5 1 450 STX
KB3FXI 64 5 1 425 VA
N2WN 15 5 1 400 TN
AA7UF 22 5 1 360 WWA
W6ZQ 39 5 1 345 AZ
WØTDD 15 5 1 325 MN
KQ6ES 6 5 1 310 ORG
KBØVSN 31 5 1 305 MN
KØQH 4 5 1 285 MO
K8KMB 5 5 1 275 OH
N8XA 51 5 1 275 OH
AE6ZY 3 5 1 265 SCV
WØLM 1 5 1 260 MN
K1YPP 8 5 1 230 VA
VA7CPC 9 5 1 225 BC
KIØNY 15 5 1 225 CO
KD2MX/9 14 5 1 190 IL
KA5GIS 17 5 1 170 AR
KI4FW 9 5 1 140 SNJ
WA1TDA 1 5 1 105 ME

1B-1 Op

KF9D 951 2 1 4,454 IL
KEØG 361 5 1 3,710 MN
NØTW 794 2 1 3,308 NFL
WB8JUI 625 2 1 2,700 OH
N4UF 518 2 1 2,186 NFL
KE7NO 712 2 1 2,184 MT
N5JB 551 2 1 1,910 NTX
WO9K 364 2 1 1,706 WI
W4AWM 523 2 1 1,696 VA
W1VR 686 2 1 1,622 NFL
KV2X 350 2 1 1,544 NNY
N7CEE 129 5 1 1,490 AZ
N3OX 321 2 1 1,434 MDC
N7SVX 604 2 1 1,378 MS
WO9Z 556 2 1 1,364 IN
N8TD 278 2 1 1,282 OH
KU7K 300 2 1 1,098 OR
K1RFD 235 2 1 1,020 CT
KØRFD 207 2 1 926 CO
W7CH (+N7RHY)
267 2 2 834 EWA
WB6BMV 226 2 1 702 SDG
W6CBA 150 2 1 700 LAX
W9KHH 125 2 1 700 WI
K9UH 104 2 1 658 IL

WS8H	229	1	1	657	MI
WB2AXF	110	2	1	640	ENY
K3ZT	151	2	1	552	EPA
N7CFO	159	2	1	528	WWA
KC7O	152	2	1	518	SB
VA2NU	102	2	1	504	QC
K3SOM	175	2	1	500	WPA
KD3SB	187	2	1	474	WPA
NØBHT	103	2	1	458	CO
NA6Q	51	2	1	454	ORG
VE3EDX	63	2	1	444	ON
WB7S	35	2	1	436	WY
WB5OSD	125	2	3	410	LA
WØTF	128	2	1	406	CO
ABØSD	125	2	1	400	IA
W9TQV	60	2	1	370	WI
ABØUO	59	2	1	368	KS
VA4CQD	6	2	1	362	MB
W3RP	129	2	1	358	WPA
W9TO	49	2	1	344	ME
N3AZ	157	2	1	342	AL
AE6PS	42	2	1	334	SV
N3GVL	72	2	1	320	OH
K3CMC	32	2	1	314	EPA
KØWRZ	87	2	1	274	KS
VE3ZIS	15	2	1	230	ON
N6RZR	10	2	1	220	OR
KKØD	74	2	1	198	CO
NC8D	71	2	1	192	WNY
KC8JJT	6	2	1	182	MI
K1ZK/2	4	2	1	158	ENY
KM4QE	16	2	1	132	IN
N5KEV	10	2	1	88	NM
AA1LL	9	2	1	36	ME
W1BJ	17	2	1	34	ME
W7CNN	11	2	1	22	WWA

1B-1 Op

KM5VI	1619	2	1	3,388	WI
N8KD	570	2	1	2,246	MI
W1TJL	860	2	1	1,770	CT
WØXR	404	2	1	1,366	CO
KØHW/0	330	2	1	1,294	IA
VA3BMC	131	1	1	332	ON
KD5BBR	134	2	1	318	OK
N5EYT	34	2	1	282	STX
N5OKW	16	2	1	82	NTX

2B-1 Op

KW8N	1657	2	1	6,058	OH
N2EVD	28	2	1	256	ENY

1B-2 Op Battery

W5YA	986	5	2	10,375	NM
N4RE	317	5	2	3,420	NC
VE3EQP	350	5	2	3,250	ON
AAØZZ	280	5	2	3,050	MN
W7RIN	263	5	2	2,755	AZ
K2WNY	236	5	2	2,665	WNY
K4MUT	151	5	2	2,035	MDC
Tioga 2					
K2QR	60	5	2	1,100	WNY
AK2S (+WB2PKG)					
	73	5	2	830	SNJ
VE7GDS	46	5	2	720	BC
WA5ZNU	16	5	2	625	WNY
KE7HUX	5	5	2	495	WWA
AA7IH	20	5	2	450	OR
N2JFS	16	5	2	430	VT

1B-2 Op

WØDX (K4LT)	1633	2	2	7,232	OH
K7QD	1155	2	2	4,770	ID
K8MN	1070	2	2	4,604	WV
W9PC	925	2	2	4,496	IN
K7GGG	1063	2	2	3,338	AZ
VE6KZ	739	2	2	3,306	AB
K9ZA	793	2	2	3,014	IL
K8RYU (+KD8CWV)					
	865	2	2	2,992	OH
N9TTX	531	2	2	1,588	WI
AB7QG	715	2	2	1,580	UT
W3SW	583	2	2	1,516	WNY
KG5E	268	2	2	1,052	NTX
W5JMC	287	2	2	1,024	VA
WO4R	356	2	2	862	VA
KI7T	213	2	2	812	WWA
K9WD	159	2	2	690	WI
K5NOT	55	2	2	660	NTX
W8OHR	43	5	2	530	MI
KG2RF	255	2	2	510	SNJ
VA7RAT	124	2	2	416	BC
AE6UP	17	2	2	384	SF
W4KP	112	2	2	366	KY
K7OVW	89	2	2	328	OR
KU4UV	77	2	2	304	KY
K5NLX	40	2	2	280	AR
NØOMC (+KC0AMF)					
	28	2	2	256	KS
KD7DMP	53	2	2	256	EWA
KCØRPS	88	2	2	226	CO

1B-2 Op

KK5CA	107	2	2	1,168	STX
K9OM	242	2	2	1,100	WI
NRØT	251	2	2	988	MN
N9OQT	118	2	2	744	IL
KAØZPP	204	2	2	658	MN

2B-2 Op Battery

N8EFO	366	5	2	3,635	OH
NZ5A	358	5	2	3,405	STX
W1FYM	247	5	2	2,600	CT
NH7O	216	5	2	2,495	PAC
K6S	93	5	2	1,385	SDG
W9ILF	85	5	2	1,340	IN
WØAZ	103	5	2	1,230	CO
KA2KGP	91	5	2	1,155	WNY
N7A	88	5	2	1,105	EWA
N6MBY	111	5	2	1,055	SB
KW4JS	94	5	2	990	TN
KE2K	18	5	2	340	IL
N5VWN	22	5	2	240	SV

2B-2 Op

K8MP	2656	2	2	8,302	OH
KE4R	663	2	2	2,490	GA
N8LPQ	604	2	2	2,158	OH
N4RAT (+WA4OAB)					
	381	2	2	1,964	WCF
KC5JFO	580	2	2	1,918	NTX
W7SST	455	2	2	1,680	OR
AD5VM	665	2	2	1,680	NM
K6TY/Ø	224	2	2	1,146	MO
K2OAK	207	2	2	874	NNJ
KØJJM	247	2	2	694	KS
AD7LL	68	2	2	688	ID
K7WXO	114	2	2	478	EWA

2B-2 Op

NT2A	640	2	2	2,610	NLI
KI4JSQ	131	2	2	332	NC

Mobile Stations

1C

WX7G	461	5	4	4,400	LAX
N8LXR	905	2	1	4,102	SNJ
AA6DP	976	2	4	3,712	LAX
KG6IYN	513	2	1	1,844	SDG
K7RE	358	2	1	1,482	SD
W4ZW	296	2	1	1,234	WCF
KØAAA	299	2	1	1,156	MN
W9XS	223	2	1	1,142	IL
KK7SM	254	2	2	1,020	STX
K3GHH	204	2	1	966	NNY
W7ON	282	2	2	942	AZ
N7DLV	283	2	1	916	WWA
WC5D	149	2	1	746	NTX
N4LS	192	2	1	658	AZ
WA4KDO	80	2	1	470	GA
K8TL	91	2	2	464	OH
KA5PNE	38	5	1	415	NFL
K1UR	100	2	2	350	RI
K2NV/VE3	75	2	1	350	ON
K6LMN	53	2	1	306	CT
K7CN	38	2	1	302	OR
W4ZPR/M	75	2	1	300	VA
WE9L	103	2	1	298	WI
K1UQE	59	2	1	236	CT
K5VHH	113	2	1	226	STX
W1ZR	37	2	2	224	WNY
KD7RBX	31	2	1	212	ID
K1KI/M	40	2	1	208	EMA
NS7F	73	2	2	204	AZ
WA4A	48	2	2	202	VA
W9ILY/M	19	2	1	188	IL
KK7YG	19	2	1	188	NV
KK5JY	55	2	1	186	OK
W9BNO	11	2	1	182	CO
K5GBW	13	2	1	176	IL
K5DHY	11	2	1	172	NTX
KF6HDD	6	2	7	162	MAR
K7MM	4	2	2	158	AZ
W1NCY	3	2	2	156	WNY
KEØL	52	2	1	154	MN
VE7LD	1	2	1	152	BC
WA6MHZ	23	2	2	146	SD
W5VDM/M	4	2	1	116	STX
KF4IBU	16	2	1	114	GA
KC2KMI	22	2	2	112	NNJ
KG6EAD	4	2	1	108	LAX
WG4P	27	2	1	104	GA
K8PNW	2	2	1	104	MI
N2GKM	25	2	1	100	ENY
WX5ARK	24	2	2	98	MI
KA5FQA	48	2	1	96	OR
NB7N	20	2	1	90	WWA
WØKU	25	2	1	86	CO
W4EJY	13	2	1	76	NFL
W1WTG	10	2	1	70	ME
ABØYM	9	2	1	68	CO
W7KI	5	2	1	60	LAX
KB1CVH	3	2	1	56	SB
N8KSL	2	2	1	54	MI
KB8PXV	1	2	1	52	MO
WA3BKD	13	2	1	52	WV
KA3KSP	19	2	1	38	WPA
W5OK	1	2	1	2	OK

2C

NB1RI	504	2	3	1,852	RI
N9PBY	35	2	4	120	WI

3C

K1HRO	309	2	4	1,394	NH
K1EHO	82	2	6	764	AZ
KZ3AB	53	2	3	112	MDC

Home Stations Commercial Power

1D

N4PN	2045	2	1	5,578	GA
KE1AF	1329	2	1	4,480	RI
K9LJN	1050	2	1	4,250	IL
WA1ENO	898	2	3	2,258	EMA
W4ARM	505	2	1	1,956	SFL
NW St Louis ARC					
KØAXU	613	2	1	1,784	MO
K8EE	404	2	1	1,766	OH
Florida Contest Group					
W4EIP	410	2	1	1,640	SFL
KØMPH	408	2	1	1,614	MN
VE3SOO	752	1	1	1,526	ON
VE3XD	425	2	1	1,498	ON
VA7ST	351	2	1	1,454	BC
KG4W	410	2	1	1,358	VA
K5ZD	348	2	2	1,320	WMA
NS2X	400	2	1	1,292	TN
N3KR	302	2	1	1,258	EPA
W8MJ	305	2	1	1,220	MI
W7ZMD	276	2	1	1,154	AZ
W8LBZ	562	2	1	1,124	OH
KØVM	264	2	1	1,056	IA
Old Timer's					
WBØCW	251	2	1	1,004	ND
W6AEA	218	2	1	922	EWA
W3DQN	211	2	1	894	MDC
K6MM	443	1	1	894	SCV
N2TS	195	2	1	880	WCF
W3ZJ	205	2	1	870	MDC
WA3AAN	200	2	1	850	EPA
WA3BRR	410	2	4	820	ON
VA3BRR	410	2	4	820	ON
WS7WS	218	2	1	808	WWA
K2MK	188	2	1	802	SNJ
WØQQG	185	2	1	790	VA
W2LHL	221	2	1	774	NNJ
VE3XK	176	2	1	754	ON
W7QN	176	2	1	754	WWA
WJ2D	347	2	1	748	NC
VE3CX	225	2	4	730	ON
N4HAI	245	2	4	712	OH
AA8IA	165	2	1	706	OH
VY2LI	252	2	2	702	MAR
VE2HLS	135	2	1	690	QC
N3HL	309	2	2	684	EPA
WØRIC	317	2	1	684	CO
K1GPL	158	2	1	682	STX
WA6BOB	158	2	1	682	LAX
Eastern Connecticut ARA					
K1OQ	174	2	1	678	CT
KB9YGD	275	2	1	676	IN
WO2N	154	2	1	666	NLI
N1WQ	149	2	1	646	MN
K4BK	148	2	1	642	NFL
N3KN	158	2	1	628	VA
VE3IFS/W2	591	1	1	603	NNJ
W6AFA	296	2	1	592	LAX
NA2M	130	2	1	570	ENY
N3AO	141	2	1	564	VA
W8AEZ	246	2	3	562	MI
W6SJ	101	2	1	554	ORG
W2LRO	177	2	1	538	NNJ
KI6OY	43	2	2	518	EB
NA5VY	119	2	1	518	NTX
K6DGW	266	1	1	512	SV
K9UQN	90	2	1	510	IL
KQ6RV	129	2	3	508	SDG
North Shenandoah DX Assn					
NS4DX	160	2	1	508	VA
WA5ZUP	229	2	1	508	NM
VE2FFE	87	2	1	498	QC
KF7VG	203	2	4	496	WWA
WB9ICL	108	2	1	482	IN
W5PQ	120	2	1	480	LA
W8TM	82	2	1	478	OH
KCØCQD	163	2	1	476	MO
Geezer ARC					
W6AW	273	1	3	474	SV
KGØZZ	210	2	1	470	KS
N2QGV	129	2	1	466	NFL
W1WIU	174	2	1	464	RI
W5QLF	113	2	1	460	STX
VE3ERC	227	2	18	454	ON
W3KS	200	2	1	450	DE
KG6AZV	111	2	1	444	ORG
K6CSL	106	2	1	428	SJV
KC9DKQ	212	2	1	424	WI
AA6RR	113	2	1	424	EWA
WS2N	95	2	1	418	NLI
W6SX	198	1	2	417	SJV
VA3HST	183	2	1	416	ON
KØEWS	104	2	1	416	IA
WA9PYH	90	2	1	410	IN
KD5ZEZ	124	2	1	398	STX
KD7MSC	173	2	1	396	OR
Club de Radio Amateur Outaouais					
VE2CRO	172	2	7	394	QC
WT5U	134	2	1	390	STX
VA3QWW	191	2	1	382	ON
KBØJQO	129	2	1	382	IA
KG4YTL	85	2	1	382	SC
KK3Q	70	2	1	366	NFL
WØJRM	99	2	1	360	IA
NY7P	108	2	1	360	MDC
VO1HE	124	1	1	357	NL
VA3OPN	75	2	1	356	ON
KK5AA	151	2	1	352	AR
Cary ARC					
N4NC	63	2	1	352	NC
VE3MGY	100	2	1	350	ON
W5UGD	140	2	3	350	SC
W5OV	75	2	1	350	NTX
W9HR	87	2	1	348	WI
KB3GDG	120	2	3	340	WPA
AL1G	218	1	1	335	AK
WN2Y	142	2	1	334	ENY
WS7R	166	2	1	332	AZ
VE3FJ	70	2	1	330	ON
KG2NI	164	2	1	328	WNY
K2DBK	85	2	1	322	NNJ
WA7SHP	136	2	1	322	OR
K4DGW	103	2	1	320	VA
Morse Telegraph Club					
W6MTC	54	2	1	316	ORG
KG4WNA	53	2	1	312	KY
AD8J	73	2	1	306	WPA
WN2A	66	2	2	304	NNJ
KG4DZN	75	2	1	300	NFL
WD4IEC	124	2	1	298	KY
N4SHY	122	2	1	294	SC
W7DML	68	2	1	290	UT
N3GGT	58	2	1	280	EPA
KZ2G	70	2	1	280	NLI
WA7YNU	112	2	1	274	MT
KD5J	58	2	1	268	AR
NØWP	109	2	1	268	VA
CRA Rive-Sud de Montreal					
VE2CLM	49	2	17	264	QC
KV5WS	57	2	1	264	STX
W1WSN	66	2	1	264	SFL
KA2FHN	43	2	1	262	WNY
N3ALN	104	2	1	258	MDC
K9AHH	64	2	1	256	IL
W4CLQ	53	2	1	256	NH
W2BXR	85	2	1	254	NNJ
WØECM	127	2	1	254	KS
K4UO	63	2	1	252	VA
K4RST	50	2	1	250	TN
K6GEP	53	2	1	248	ORG
K1VIJ	49	2	1	246	CT
K8WZS	240	1	4	240	MI
WB9FJO	44	2	1	238	MI
KT4NN	37	2	1	236	NFL
K8GVK	92	2	1	234	MI
WJ4E	58	2	1	232	SC
VE3BDB	90	2	1	230	ON
KB5HPL	47	2	1	230	STX
N7WI	61	2	1	226	WWA
W9KB	176	1	1	226	MI
K2MFW	78	2	1	226	SNJ
AB1BW	59	2	1	226	CT
KG6ZHC	122	1	1	221	SCV
VA3TTU	44	2	1	220	ON
K3VED	110	2	1	220	WPA
KAØITA	85	2	1	220	KS
N2EZY	85	2	2	220	WNY
K1PAR	84	2	1	218	ME
KD7GUS	82	2	2	214	EWA
ACØGP	70	2	1	212	MO
NAØBR	51	2	1	204	CO
KD7CDU	102	2	1	204	WWA
KH6HME	1	2	1	202	PAC
KB5DRJ	38	2	1	202	NTX
KB9JLF	25	2	1	200	IN
VA7PX	99	2	1	198	BC
N6QZS	49	2	1	196	SV
KX8C	71	2	1	192	OH
WA2BSG	71	2	1	192	WPA
K7SDU	39	2	1	190	WWA
KD7GIM	35	2	1	190	AZ
ABØOX	19	1	1	188	NNJ
N5LUL	38	2	1	186	WTX
N5ARA	34	2	1	186	AR
N4LCC	34	2	1	186	LA
K7MY	132	1	1	182	AZ
KCØUJC	66	2	1	182	IA
KC6MIE	65	2	1	180	SDG
Panther ARC					
W3YI	52	2	7	176	WPA
WAØVPJ	85	2	1	176	MN
W7JFF	63	2	1	176	WWA
KD5UFQ	12	2	1	174	MDC
WØDSA	61	2	1	172	ID
KB1CJ	44	2	1	172	EMA
W8GHZ	7	2	1	172	MI
K1UHF	114	1	1	171	CT
W4HRC	59	2	1	168	TN
WO3T	83	2	2	166	WPA
W2LP	56	2	1	162	ENY
VE3OWO	55	2	1	160	ON
K7RQN	29	2	1	158	AZ
AA5JG	50	2	1	156	OK
N2YO	76	1	1	152	VA
KB1MNN	61	1	2	151	WMA
WY2Y	50	2	1	150	VT
KØCOP	50	1	1	150	SC
WB4DHI	84	1	1	147	NFL
WS2Z	37	2	3	144	NNJ
KA2HJH	47	2	1	144	NNJ
N5XGG	26	2	1	142	STX
N1MD	23	2	1	142	CT
K8HUG	45	2	1	140	OH
WB2LEB	43	2	1	138	NNJ
KØKRH	68	2	1	136	NE
VE3CNA	43	2	1	136	ON
KB8VCE	42	2	1	134	SV
KF3CV	21	2	1	134	MDC

AE6SP	32	2	1	134	ORG
K6ZTW	41	2	1	132	SB
KD5UBC	65	2	1	130	MS
KD5WJS	40	2	1	130	NTX
KC2LYK	40	2	1	130	NNJ
KCØHUJ	40	2	1	130	KS
K2BBQ	39	2	1	128	NLI
K2FEO	39	2	1	128	WNY
K1PIR	33	2	1	126	ME
W1SRB	37	2	1	124	EMA
NK4IT	36	2	1	122	KY
AI4G	21	2	1	120	KY
KBØMPY	35	2	1	120	CO
K4MGA	59	2	1	118	NC
W7MEW	18	1	1	118	WY
HCA Emergency Group					
WF7T	67	1	2	117	TN
W2UH	32	2	1	114	NNJ
KB7HDX	31	2	1	112	EWA
K3TEZ	27	2	1	112	VA
WX1CT	30	2	1	110	CT
VA2LGQ	30	2	1	110	QC
KC7EHE	29	2	1	108	AZ
W1WML	29	2	1	108	CT
VE2DNF	29	2	1	108	QC
W6WXO	58	1	2	108	SV
N1DBS	14	2	1	106	CT
KE7CPE	31	1	1	106	WWA
WA1WQG	14	2	1	106	CT
N7GMT	27	2	1	104	UT
WD4MKW	52	2	1	104	NC
N1LDT	51	2	1	102	VT
KD6RWF	21	2	1	102	NV
KG6YUN	26	2	1	102	SCV
AD4YQ	25	2	1	100	WCF
K6CSP	24	2	1	98	LAX
KI4CBF	24	2	1	96	VA
KB8RQW	22	2	1	94	OH
N1IVY	21	2	1	92	ME
KU1Q	46	2	2	92	CT
KB9Q	23	2	1	92	WI
KA5YOM	20	2	1	90	OK
KB5ENP	13	2	2	90	MO
NFØP	60	1	1	88	CO
KB3PU	19	2	2	88	SC
AA2JZ	22	2	1	88	NFL
K7EMJ	18	2	1	86	SC
W4SUL	43	2	1	86	NFL
AB8IR	41	2	1	82	WV
W3KM	8	2	1	82	EPA
KE7JZE	15	2	2	80	AZ
NØUB	15	2	1	80	MO
N5SPX	14	2	1	78	MO
KB9AFW	39	2	1	78	MI
K6JRA	39	2	1	78	EB
K7III	7	2	1	78	WWA
N3KTA	13	2	1	76	WPA
KB7QAG	11	2	1	72	WWA
AC7CJ	11	2	1	72	EWA
KE7EMW	8	2	1	66	WWA
W5WAG	8	2	1	66	STX
N5BGE	7	2	1	64	SFL
KC5QNK	7	2	1	64	OK
KK7CG	7	2	1	64	OR
VE3YVT	32	2	2	64	ON
KG6PEX	6	2	2	62	ORG
N1AOK	31	2	1	62	CO
K7II	29	2	1	58	WWA
KC6ZZT	4	2	1	58	EB
WA8RUM	3	2	1	56	OH
KL7QN	2	2	1	54	AK
KC2JRQ	2	2	1	54	NLI
AD7HM	1	2	1	52	WWA
KCØMJY	1	2	2	52	NM
KA6FBB	25	2	1	50	ORG
W1RAI	49	1	1	49	VA
W5VDM	12	2	1	48	STX
N1KN	23	2	1	46	CT
N1SWK	22	2	1	44	MO
KC2PBJ	22	2	1	44	NNJ
K4IJK	21	2	1	42	RI
WA2IAU	16	2	1	42	SNJ
WB9MII	20	1	1	40	IL
K4GOP	19	2	1	38	NFL
VE5EEE	38	1	1	38	SK
KC7KML	18	2	1	36	AZ
K4ME	23	1	1	23	VA
NØBGT	10	2	1	20	MN
W6GB	5	2	1	20	GA
KCØSUM	8	2	1	20	CO
KC9DOW	10	2	1	20	IL
KB1CSG	9	2	1	18	NH
WA5YNE	15	1	1	15	OK
KD7HCU	7	2	1	14	WWA
N3JNX	4	2	1	10	EPA

2D

Northeast Wisconsin RC					
W9NEW	1257	1	4	1,345	WI
K2HIG	410	2	3	1,338	STX
W5SSV	388	2	6	1,284	STX
N1YF	286	2	2	888	ME
W2LI	204	2	15	888	NNJ
KSØP	364	2	2	884	CO
West Central MN ARC					
KØLQP	260	2	14	870	MN
Lancaster & Fairfield Co ARC					
K8QIK	125	2	25	478	OH
N3IP	198	2	3	474	DE
Dayspring School ARC					
NR3I	82	2	6	372	DE
KI4JQB	54	2	3	360	VA
W7ASC	81	2	31	342	AZ
K6VBC	131	2	6	330	SB
K4PDW	7	2	1	64	NC

3D

W4W	1487	2	9	3,024	AL
K2UGH	183	5	4	1,335	SFL
Funky Fontana FD Forum					
W6DA	325	2	10	1,252	ORG
Eastern New Mexico ARC					
KA5B	502	2	12	1,156	NM
K3VOA	155	2	3	654	MDC
East Coast DX Assn					
K2VK	53	2	4	284	NNJ

4D

WC4J	548	2	5	1,216	VA

5D

W7EK	261	2	21	1,042	WWA

7D

W8BAP	306	2	14	908	OH

Home Stations Emergency Power

1E

N4BP	1137	5	2	11,645	SFL
W6JTI	695	5	1	7,200	SF
AA3B	1576	2	1	6,654	EPA
AB7E	588	5	1	6,130	AZ
Chain Lakes ARA					
W2BC	1395	2	7	5,880	WNY
N6TV	1570	2	1	5,516	SCV
WK6O	1002	2	5	4,034	IA
K3SS/7 (+WF4U)					
	386	5	2	3,885	UT
W9TS	340	5	1	3,650	IL
K1EEE	360	5	3	3,490	NH
W9RCA	1449	2	12	3,098	IN
AA1O	281	5	1	3,060	EMA
W3HGT	1145	2	4	3,044	WPA
N1URA	279	5	1	3,035	ME
K7HP	625	2	1	2,860	AZ
K4KSR	270	5	1	2,850	VA
WA2EQF	574	2	5	2,848	NNJ
N7WS	1093	2	1	2,508	AZ
N3HBX	1012	2	1	2,274	MDC
K5QQ	475	2	1	2,150	MO
W8UE	216	5	1	2,150	MI
W7GB	426	2	1	2,084	EWA
WA8KAN	200	5	1	2,050	WV
Two Rivers Contest Club					
KL2R	313	2	2	2,000	AK
N3EF	435	2	1	1,990	MDC
KE3D	808	2	1	1,972	STX
WA3RML	182	5	1	1,870	NTX
K4WW	500	2	1	1,850	KY
VO1NO/VE3	688	2	2	1,846	ON
WA1VKO	596	2	1	1,842	NH
VE2AWR	479	2	1	1,834	QC
KC5R	823	2	1	1,820	LA
AA1PL	174	5	1	1,765	RI
K4DZR	171	5	1	1,760	TN
K8ET	756	2	2	1,742	MI
NT4A	165	5	1	1,700	TN
AB4ET	139	5	1	1,690	SFL
N3FJP	735	2	6	1,680	MDC
AA7FY	464	2	2	1,674	NTX
VA7XX	1182	1	1	1,590	BC
W7NNN	536	2	1	1,554	WWA
WA8SDA	125	5	1	1,495	WV
KØGEO	325	2	1	1,450	STX
WR4I	134	5	1	1,390	VA
K6QK	586	2	1	1,322	SDG
K6TD	399	2	3	1,318	SCV
KG9JP	524	2	1	1,306	AZ
ND4X	251	2	2	1,278	TN
WØQL	111	5	1	1,260	CO
W5TTE	100	5	1	1,250	NM
K4WOP	274	2	3	1,246	VA
N6QQ	510	2	1	1,240	ORG
VA7MM	237	2	3	1,234	BC
K2KGJ	102	5	1	1,220	ENY
W3AG	96	5	1	1,210	WPA
KC8UR	234	2	1	1,208	OH
KM1N	104	5	1	1,190	NH
KF7PG	296	2	1	1,184	WWA
W5ODS	282	2	2	1,178	OK
AG4V	1072	1	1	1,172	TN
WA4FOM	82	5	1	1,170	NNJ
KØINR	256	2	1	1,150	IA
KØLUW	244	2	1	1,126	NE
NI7R	102	5	1	1,120	AZ
KD4YDC	472	2	1	1,114	GA
WD9FTZ	179	5	1	1,110	OH
VE5JZ	99	5	1	1,090	SK
W6PRI	269	2	1	1,072	SCV
N3ZI	93	5	1	1,070	NV
N7NB	88	5	1	1,030	WWA
KD4HXT/6	121	5	1	1,005	SJV
W5ORM	100	5	1	1,000	NTX
N4EEB	318	2	1	978	NFL
WB8ZSK	72	5	1	970	MI
W1KLM	142	5	1	960	AR
W4ZKE	200	2	1	950	KY
WA State Net					
N7EIE	126	2	5	948	WWA
KO8S	78	5	1	930	MI
W3EQ	160	2	1	790	MDC
W3DP	79	5	1	790	EPA
NN9X	145	2	2	782	IN
AA1OF	61	5	1	760	NH
N3FG	46	5	2	760	EPA
WB8EJN	145	2	1	730	MO
AC4YD	277	2	1	704	KY
N4DXI	115	2	1	698	NFL
WB5BKL	53	5	1	680	STX
K7VGF	109	2	1	670	WWA
WØVHV	125	2	1	650	MO
AA8YN	119	2	1	626	OH
WBØIWG	115	5	1	625	WPA
K6CEQ	62	5	1	620	SDG
W2TI	36	5	1	610	NNJ
VE7TI	128	2	1	606	BC
K4QET	100	2	2	596	VA
KF4VXJ	80	2	1	590	NC
W6MSB	135	2	1	584	SCV
AA8V	96	2	1	584	MDC
K4ADI	140	2	1	560	SC
KE3Y	149	2	1	550	AL
KJ7IZ	137	2	2	544	MT
WA4B	212	2	1	524	NFL
Amherstburg RC					
VA3ARG	186	2	7	522	ON
KCØRET	131	2	1	508	MN
K2OGT	203	2	1	506	EPA
WB9HFK	50	5	1	500	IL
VE3OZ	225	2	1	500	ON
W7FC	33	5	2	480	OR
W3DQT	82	2	1	478	MDC
AB5JR	113	2	1	476	NM
K9VIC	13	5	1	475	IL
WA8TBL	81	2	1	474	MI
KAØEIC	69	2	1	472	KS
KD5ASV	156	2	1	462	NTX
KT4OO	175	2	2	454	SC
NYØO	19	5	1	440	IA
KC4ONA	88	2	1	438	NFL
VE3VID	117	2	1	434	ON
KA8CLN	74	2	1	432	MI
N9BT	26	5	1	410	IL
WØTDH	102	2	1	404	NC
VE1SD	125	2	1	400	MAR
AE1P	50	5	1	400	NH
K4NI	111	2	3	392	WWA
KD4FBI	170	2	2	390	NFL
K6OTT	19	2	1	388	SCV
KC6WTA	49	2	1	388	SJV
K4CRM	58	2	2	386	SFL
W8RS	91	2	2	382	MI
W6GMT	25	5	1	375	MN
KB5URQ	112	2	3	374	STX
N6NFB	44	5	2	370	WWA
KG4GWB	84	2	1	368	CO
W6ZAP	77	2	1	354	SF
AA1JM	59	2	1	338	CT
KC2PUF	43	2	1	336	SNJ
KG4WQN	68	1	4	336	GA
WØHXL	117	2	1	334	NE
KØXXX	140	2	3	330	AR
N5IAC	113	2	1	326	NM
VE6CCL	15	5	1	325	AB
WB5EXI	8	5	1	325	STX
AI4CJ	86	2	1	322	SFL
KE5HHU	29	5	1	315	NM
N4MUH	104	2	1	314	NFL
K7EMS	82	2	1	314	WY
KCØCZ	80	2	1	310	CO
WA5ZTD	23	2	1	310	OR
WA5JEC	120	2	8	310	STX
N1IH	6	5	1	310	CT
VE2WMA	16	5	1	310	QC
KB8DDZ	78	2	1	306	OH
KK6T	64	2	1	306	ORG
K3DI	81	2	1	298	MDC
W6RXQ	71	2	1	292	SCV
K9UT	73	2	1	292	IN
K2LDC	19	2	2	288	NLI
WA8SSQ	67	2	1	284	OH
VE7RO	39	2	1	278	BC
K7JVC	63	2	1	276	AZ
WO3X	62	2	1	274	OH
W1AFV	112	2	1	274	MN
KF6LY	58	2	1	266	CO
AC4PQ	54	2	1	266	GA
K1MSH	56	2	1	262	CT
KK6TV	44	2	4	260	SDG
K6III	61	2	1	252	SV
N2WLS	47	2	1	246	WNY
WB4QNG	44	2	1	238	KY
N2MTG	117	2	1	234	ENY
KS2X	66	2	2	232	TN
WB2TVB	38	2	1	226	LAX
KI5FJ	112	2	1	224	NM
KD7NPP	19	2	1	188	ID
N3JON	19	2	1	188	MDC
N4CDB	18	2	1	186	NFL
AK6QJ	18	2	1	186	SDG
KV8Z	17	2	1	184	MI
AF9J	36	2	1	182	WI
WØAVM	15	2	1	180	NE
KI6GFT	15	2	1	180	EB
KI4EBD	7	2	1	178	NFL
KD5WBW	11	2	1	172	NTX
KG6WOU	32	2	1	164	SF
KI5JF	14	1	1	164	STX
KB9OOK	12	5	2	160	IL
W9INA	27	2	1	158	IN
K7YJ	27	2	1	154	CO
W6HG	35	2	1	140	ORG
KBØRQE	65	2	1	130	MO
N5BF	14	5	1	120	LAX
N5DFW	6	2	1	112	STX
KC7WDL	26	2	1	102	NM
WD6FDD	4	5	1	90	SDG
AD5SE	17	2	1	84	NTX
AE6JK	15	2	1	80	SV
N8CMZ	5	5	1	80	OH
W1MAW	10	2	1	70	EMA
VP9HW	4	2	1	66	DX
N8HC	32	2	1	64	OH
KC2QEG/AG	7	2	6	64	NNJ
VE7YE	2	2	1	54	BC
KH6BZF	1	2	1	2	PAC

2E

K5TA	1403	5	4	14,680	NM
AA2DC	2648	2	3	8,302	NLI
N2BJ	2158	2	4	6,794	IL
W8VM	619	5	19	6,100	OH
W5ROK	1178	2	8	4,118	NTX
AC3V	379	5	5	3,245	EPA
N2MO	580	2	24	2,546	NNJ
Shenandoah Valley ARC					
W4RKC	525	2	24	2,400	VA
York CO ARS					
K4YTZ	693	2	21	2,264	SC
N4ZI	593	2	7	2,096	TN
Keystone VHF Club & Hilltop Transmitting Assn					
W3HZU	619	2	20	2,072	EPA
W5ES	636	2	29	1,722	WTX
AB2DE	591	2	3	1,552	NNJ
KCØLKG	606	1	2	956	MO
KØXI	472	2	6	944	MO
K4LF	161	2	2	872	TN
KI4NGM	21	2	2	714	NC
KB6TR	166	2	2	674	SV
K4DCS	47	2	3	644	SFL
Bayouland Emergency AR Service					
KE5EAO	31	2	17	562	LA
KBØYTO	75	2	1	550	NE
N9ANA	12	2	1	330	IL
N9QID	7	2	2	264	IN
KC9ISQ	122	2	5	244	IL

3E

BEARONS					
W7FLY	965	2	12	3,904	WWA
South Carroll AR Group					
N3DUE	1060	2	5	3,590	MDC
WC7S	310	5	1	3,570	WY
N3XLS	823	2	5	2,948	EPA
Sun City ARC					
K5WPH	903	2	45	2,898	WTX
Steel City ARC					
W3KWH	633	2	18	1,992	WPA
VE6FI	1258	1	5	1,608	AB
W5STR	405	2	31	1,468	AR
Dauberville DX Assoc					
K3TI	485	2	15	1,270	EPA
Marietta ARC					
W8HH	191	2	19	1,186	OH
EMCOMM ECI					
W9YFD	223	2	10	1,096	IN
Hamilton Co AR Public Service Corps					
K8YOJ	213	2	11	1,076	OH
N8PVC	103	2	5	576	OH
VE6NQ	83	2	10	216	AB

4E

Carolina DX Assn					
W4DXA	3353	2	17	12,702	NC
K3MJW	1549	2	40	5,652	WPA
KC8UAV	763	2	4	1,976	MI
Mound ARA					
W8DYY	1045	1	12	1,837	OH
N9ZUT	51	2	1	744	IL

5E

KE6SWS	141	2	18	1,132	SB

6E

Whitman RC					
WA1NPO	424	2	26	1,714	EMA

10E

WØNT	3340	2	22	11,442	CO

13E

KBØHH	419	1	9	1,823	OK

EOC Stations

1F

Sarasota Co EM					
WC4EM	1142	2	7	3,850	WCF
New Providence ARC					
K2JV	703	2	10	3,468	NNJ
West Essex ARC					
W2EF	754	2	12	3,394	NNJ
Shelby Co ARES					
K8EMA	636	2	15	2,428	OH
OCARS					
W4EEE	493	2	26	2,136	GA

Cal Fire - Santa Clara Unit VIPS
W6HUL 216 2 19 1,820 SCV
Will Co Em Manag Amateurs
W9WIL 279 2 8 1,724 IL
NABRC
K4NAB 336 2 9 1,692 SC
Gray Maine Hams
N1XT 395 2 10 1,660 ME
WØRR 342 2 10 1,618 MO
Clermont ARES
W8EMA 275 2 11 1,200 OH
Thibodaux ARC
W5YL 285 2 7 1,092 LA
Mansfield EMA Com Group
KB1JJE 195 2 7 1,050 EMA
Okeec Hober ARC
K4OKE 186 2 5 992 SFL
AA2OW 148 2 7 830 NNY
Oakland Police EOC
K4OPD 211 2 5 822 TN
Raritan Bay Radio Amateurs/Manalapan RACES
K3GNZ 70 2 15 810 NNJ
TARA
KB3BWO 139 2 7 668 EPA
Loyalist City ARC
VE9OEC 156 2 15 562 MAR
ARC Amateur Radio Club
NY2RC 62 2 3 474 ENY
Seal Beach / Los Alamitos RACES
K6ZT 86 2 7 472 ORG
Public Safety ARA of Permian Basin
K5PSA 10 2 1 470 WTX
Cox Monett Hospital/Barry Co Em Management
ACØBN 77 2 3 454 MO
Iowa Wing CAP
NØCAP 100 2 5 450 IA
North Shore ARC
VA7EMO 103 2 3 432 BC
RCMP E Division HQ
VE7HQE 174 2 1 398 BC
Clarke Co ARES
N4NFI 23 2 2 396 GA
South Co ARES
K6MPN 5 2 7 310 SCV
Roseland ARC
K2GQ 59 1 5 216 NNJ
Clarke Co ARES
N4ZRA 14 2 3 180 GA
KD5DLZ 60 2 1 170 OK
Jamaica ARA @ Red Cross EOC
6Y5RA 36 2 1 122 DX

2F

WØCW (+KØEJC)
2983 2 26 12,900 MO
Platinum Coast ARS
W4MLB (+AF4Z)
2150 2 27 8,646 SFL
Halifax ARC
VE1FO (+VE1YO)
2252 2 38 8,482 MAR
Lake Co RACES / ARES
K9IQP (+W9QL)
1512 2 30 5,624 IL
East Alabama ARC
W4LEE (+WB4BW)
1330 2 49 5,390 AL
Alamance ARC
K4EG (+W4VGZ)
1197 2 22 4,982 NC
Houston ECHO Soc / Houston Red Cross
W5ECO (+AG5T)
1092 2 23 4,758 STX
Montgomery Co RACES/ARES
W3CF (+AA3E)
1230 2 37 4,624 EPA
Story Co ARC & Cyclone ARC
WØISU (+WØYL)
929 2 16 4,334 IA
Meriden ARC
W1NRG (+W1XPW)
916 2 33 4,284 CT
McHenry Co RACES/ARES
K9ESV 1199 2 15 4,220 IL
Madison Co ARC
KE8RV (+N8HSU)
638 2 25 3,352 OH
Merrymeeting ARA
KS1R (+N1TRC)
503 2 22 3,160 ME
Braintree EM Agency & K1USN RC
W1PD 802 2 35 2,974 EMA
North Wildwood OEM
N2TEW 614 2 5 2,900 SNJ
Massasoit ARA
W1MV 467 2 20 2,756 EMA
Chickasaw ARA
W5K 918 2 19 2,618 MS
South Mountain Repeater Assn
N3TWT (+K4ITO)
531 2 15 2,470 EPA
Cowichan Valley ARS
VE7CVA 1058 2 22 2,454 BC
K1RFI 540 2 85 2,438 EMA
Treasure Valley Radio Assn
K7OJI (+K6SPS)
439 2 9 2,088 ID
Washington Co ARES
WC7EOC 442 2 24 2,034 OR
Quad CO ARC
N3QC 419 2 18 1,988 WPA
Picorams
K9IYP 309 2 20 1,986 IL
Waterbury ARC
W1LAS (+N1BF)
647 2 10 1,984 CT
ARA Tonawandas
W2SEX 327 2 20 1,874 WNY
Benicia ARC
KB6EOC 543 2 31 1,836 EB
Hays Caldwell ARC
KE5LOT (+AD5JT)
260 2 16 1,826 STX
Fair Lawn ARC
W2NPT 432 2 25 1,656 NNJ
Marshall ARC
KB5MAR 400 2 20 1,590 NTX
Okanogan Co Em Com League
KK7EC 185 2 5 1,516 EWA
CCARCT
NC4CC 275 2 10 1,490 NC
Burlington ARC
W1KOO 619 2 16 1,416 VT
Carteret ARC
K2ZV 366 2 9 1,388 NNJ
Falls Township EOC
W3FTP 301 2 7 1,368 EPA
Metro ARC
W9FO 384 2 14 1,270 IL
Atchafalaya Amateur DX Assn
WA5MC (+KC5OKP)
258 2 8 1,260 LA
Westminster RACES
WB6LBY 138 2 12 1,228 ORG
Denver RC
WØTX 351 2 24 1,172 CO
Mountain View ARES
K6MTV 75 2 34 1,168 SCV
Algonquin ARC
N1EM 301 2 14 1,130 EMA
Huron Co ARES
KG8BT 309 2 14 1,126 OH
Wild Horse Desert Hams ARC
K5WHD 177 2 12 1,106 STX
RCMP
VA3MPC 304 2 9 1,034 ON
EOAWA/NPARC/MCARES
W8TPY 195 2 19 1,034 OH
Macon-Bibb EMA AR Group
WX4EMA 134 2 12 1,018 GA
ARA of the Southern Tier
W2ZJ 168 2 20 992 WNY
key City ARC
K5ABI 285 2 20 990 WTX
Blount Co ARC
W4BLT (+W4BBN)
223 2 12 980 AL
Coffee Co ARES
NØEUU 287 2 7 954 TN
Preston Co ARES
NN8W 201 2 5 952 WV
Tillamook Co ARES/RACES
KB7EOC 75 2 11 946 OR
Tillamook Coy ARES/RACES
KB5EOC 75 2 11 946 OR
Maricopa Co Sheriff's Posse
K7MCS 171 2 7 892 AZ
Piscataquis ARC
K1PQ 133 2 4 876 ME
Madison Co ARC
W9VCF 264 2 7 870 IN
Deming ARC
W5DAR (+N5XNF)
161 2 4 854 NM
Corona Norco ARC
W6PWT 218 2 8 786 ORG
Statesboro ARS
KF4DG (+NC4D)
254 2 12 758 GA
N3PC 204 2 6 758 WPA
Ak-Sar-Ben ARC/ Douglas Co EMA
KØUSA 232 1 10 682 NE
Medical Univ of SC Hospital
W4HRS 157 2 6 670 SC
Branch Co ARC
WD8KAF 70 2 18 666 MI
Palatine RACES
KB9YQX 60 2 8 644 IL
DMAT OK-1 ARC
ND5MS 129 2 3 618 OK
Mason Co RC
K8DXF 50 2 10 500 MI
Newport Co RC
W1SYE 129 2 7 408 RI
Virginia Dept of Em Management EOC
W4V 97 2 5 244 VA
City of Toronto EOC
VA3EOT 30 2 3 124 ON

3F

West Jersey DX Group
W2EN 3320 2 17 11,866 NNJ
Williamson CO ARES
N4FR (+W4SQD)
1884 2 55 6,810 TN
Bergen ARA
K2BAR 1849 2 31 6,638 NNJ
Mississippi Valley ARA
W9FCC (+W9O)
1581 2 12 6,304 WI
East Pasco ARS
K4EX 593 5 9 5,745 WCF
Oak Ridge ARC
K4PJ 1160 2 35 4,546 TN
Adams Cou ARS
W3KGN (+K3DCS)
967 2 11 4,502 EPA
Dickson Co ARC
WC4DC (+NA4C)
1078 2 12 4,426 TN
Oakland Co ARPSC
W8OAK 838 2 11 3,522 MI
Montgomery Co ARES & Co AR Enthusiasts
WA5EOC 724 2 11 3,460 STX
Mt Vernon ARC
K8EEN 930 2 12 3,420 OH
Cochise ARA
K7RDG (+KD7OED)
483 2 23 3,094 AZ
Southern Counties ARA
K2BR 573 2 26 3,060 SNJ
Central Illinois RC
W9AML 718 2 16 2,992 IL
Grand Strand ARC
W4GS (+KQ4BH)
705 2 22 2,982 SC
Middle East TN Em Radio Service
KG4NLF (+WR4MS)
561 2 30 2,106 TN
Utah Box Elder Thiokol RC
K7UB 408 2 73 1,974 UT
Aeronautical Center ARC
W5PAA (+KW5FAA)
288 2 45 1,806 OK
WC1SW 294 2 13 1,736 WMA
Tazewell Co ARL
W9TAZ 524 2 13 1,718 IL
Pikes Peak RAA
AFØS (+WAØVTU)
292 2 30 1,620 CO
Tri-State ARA
W8VA 221 2 35 1,584 WV
Pickens Co Em Com Group
K3ZX 404 2 6 1,558 SC
K6UCI ARC
K6UCI 283 2 8 1,494 ORG
Sammamish ARES / RACES Group
W7S (+W7SRG)
261 2 21 1,312 WWA
Service Incendie de Cowansville
VA2SIC (+VE2CLD)
377 2 5 1,124 QC
Arizona DPS ARC
K7DPS 440 2 8 1,052 AZ
Oklahoma City Office of EM
WX5EOC 410 2 23 990 OK
St Louis Co RACES
NØEOC 80 2 4 924 MN
Radio Amateurs de Drummondville
VE2CRD 111 2 4 876 QC
West Central Alabama ARC
KI4PND 115 2 15 480 AL

4F

Stanford ARC
W6YX (+K6SU)5057 2 40 17,158 SCV
W8FY (+K8VGL)
1998 2 24 6,042 OH
Maxim Memorial Station at ARRL HQ
W1AW (+W1HQ)
804 2 30 3,554 CT
Tri-Town RAC
W9VT 796 2 30 2,920 IL
Flagler Em Com Assn
AF2C 450 2 29 2,838 NFL
Racine Megacycle Club
W9UDU (+KC9LBU)
368 2 35 2,506 WI
MCECG / SARC
KM7EOC (+N7IZM)
480 2 11 2,476 AZ
Southern MI ARS
W8DF 679 2 12 2,208 MI
Kinston ARS
W4OIX 260 2 28 1,780 NC
VMARC
W4COV 430 2 8 1,758 VA
Coppell ARC
KD5OEW 180 2 20 1,590 NTX
Yuma Auxiliary Com Service
N7ACS 134 2 22 1,538 AZ
Southington ARA
W1ECV 460 2 30 1,370 CT
Coastline ARA
N1EG 242 2 75 1,272 CT
S Nye CO ARES
W7NYE 159 2 14 1,268 NV
K9UXZ 125 2 11 950 IL
Valley Camp North Bend
K7S 225 2 5 826 WWA

5F

Palomar ARC
W6NWG 3003 2 11 9,884 SDG
Forsyth Co ARES
N4AC 2108 2 59 7,236 GA
Worcester Em Com Team
W1C (+WK1H)
1288 2 35 4,938 WMA
Cross Co ARC
WA5CC 435 2 41 2,698 AR
METROPLEX ARC
W2MPX 281 2 34 2,364 NNJ

6F

Queen City Em Net
W8VND (+W8WTD)1162 2 19 3,524 OH
South East Metro ARC
WØCGM 632 2 12 2,438 MN
Ventura Co ARC
K6MEP 231 2 21 1,646 SB

7F

SATERN San Bernardino / Riverside Co
W1SAT 216 5 14 3,335 ORG
Metro Detroit SATERN
N8SE 336 2 11 2,122 MI

9F

Arlington ARC
W4WVP (+AI4QB)
284 2 24 2,366 VA

2007 ARRL June VHF QSO Party Results

Your log was either half empty or half full.

Rick Rosen, K1DS
rick1ds@hotmail.com

The most interesting question for the June 2007 VHF QSO Party is how you think it compared to the same event in 2006. Split decision! An emphatic yes for some, including the multi-operator team at K8GP and all the long-haul QSOs they had on 144-222 and 432 MHz. But for others it was a struggle to fill the logs, as 6 meters did not have the conditions encountered last year for much of the country or much of the contest period. Sixty scoring records were set last year. Undoubtedly many will say the 2007 event, held June 9-10, was a mere shadow of 2006, as there was so little propagation on 6 meters. And supporting that opinion is the fact that top scores in 5 out of 6 operating categories were about half of what they were last year.

One contestant in the Midwest put it this way, "How bad was it? It was so bad that I didn't hear K2DRH on 6 meters all weekend." On the other hand, single-operator K2DRH shows up with a respectable 6 meter total of 82 grids. And WB8JUI/R asked, "Who turned off the propagation?" Yet 16 stations, including one low-power single op and two high-power single ops worked 100 grids or greater on 6 meters, with K8GP working 180 grids. K3GM added this note to his entry, "Once again, the Magic Band didn't let us down for the June contest. We had a fine opening here in northeast to the midwest, and later on, to the south. I'm hooked on 6." WØDJM sent this comment, "Got on 6 meters with a 10 element Yagi 12 feet above ground for the band opening during the last hours and had a blast!" As a counterpoint to some of the fixed stations in areas untouched by 6 meter propagation, the rovers were again out in force, having more time to concentrate on what they do best, lighting up rarer grids on the higher bands, and having a ball while giving out all of those QSO points and multipliers.

Another interesting question for the June 2007 VHF QSO Party is how many stations managed to increase scores with less 6 meter propagation? That answer is found by looking at the number of QSOs made on the rest of the bands, where operators spent more time and effort for higher value QSOs when the frenzy was absent on the magic band. Last year there were 143k 6m QSOs represented in the submitted logs, while in 2007 the entries showed only 52k QSOs. However, this year the submitted QSO numbers increased by 1300 on 144 MHz, 1000 on 222 MHz, 1700 on 432 MHz, 60 on 902 MHz and 500 on 1296 MHz, despite a reduction of 20% in the number of participants submitting their scores. It also appears many folks have added capabilities on the higher bands.

KB5YZG on his first VHF outing (on Mt Mitchell, North Carolina) using an ICOM IC-706, with an 11 element Yagi on top of a stack of fiberglass tent poles. Car battery provided talk power; elbow provided rotator power.

Weather: Always an Adventure

The weather seemed to be more reasonable this year than it was last year. A high pressure area seemed to dominate the central part of the country. Some groups reported hot muggy weather for their portable setups, interspersed with thundershowers and lightning. KI7JA, SOLP in his portable tent setup in DNØ3 (SE Oregon) told the harrowing story on the ARRL Web site soapbox of winds, rain and freezing weather that knocked down his antennas multiple times, tearing holes in his tent, allowing water to drip onto his electronics. With the moisture in his rig it wouldn't work, but then in the daylight it dried out and came back to life again. The final straw was the ticks he found on his body, sharing the weekend with him.

Kevin, KLØRG, and Paul, K7CW, visited Prince of Wales Island, Alaska (IOTA NA-041) in rare grid locator CO35 to take part in the 2007 June contest. Kevin lives nearby, in Ketchikan, but Paul traveled by Alaska Marine Highway ferry from Bellingham, Washington to get there. They were able to hand out that rare grid multiplier to 74 other stations over the weekend, with many of the contacts made using *WSJT* and meteor scatter. (Be sure to see the Sidebar on the ARRLWeb results.)

There are several multi-op groups that bring their VHF gear and teams to the same spots each year to keep a tradition of friendly competition, continuous station improvement to facilitate the on-the-air experience for old-timers, newcomers and rovers. Single-ops have often had the experience of planning out a weekend with schedules for various *WSJT* modes and propagation and operating time characteristics, to use the contesting hours efficiently. The synergies created between the casual ops, single-ops, multi-ops, rovers and QRP portable stations makes for some predictable results and some challenges. The issue of use of the calling frequency has been raised again on the vhf contesting reflector. In more VHF-active areas, with higher population densities, activity is spread across 200 kHz or more, with CQ callers and CQ responders often moving up and down the band, and with the "big gun" multi-ops spacing themselves to avoid excessive QRM. Gene, W3ZZ, an active member of the Grid Pirates, related his experience this year with the calling frequency dilemma.[1] When they called CQ on 144.200, they found many more responders from the central part of the country, but missed many of the northeast corridor stations on 2 meters and were unable to "run the bands" with them.

Although log submission numbers were down this year by almost 20% from 2006, it was up from 2005. The anomaly of 2006 in the dramatic increase in logs submitted appears to be related to the six meter conditions that year. In comparing my personal contest logs to all of the contest logs submitted to the ARRL, it appears that there are still a large percentage of participants who never submit their scores, but certainly enjoyed the event and made it fun for others. Fun, I say, as there is always joy in adding another call

[1]G. Zimmerman. *QST*. Oct 2007, pp 79-80.

Top 10

Single Operator, Low Power

K2DRH	242,505
WB1GQR (W1SJ, op)	156,738
W3SZ	110,600
KB8U	100,036
AF1T	80,388
NØKP	69,293
N4QWZ	61,500
WB2SIH	60,900
NØVZJ	57,260
NØLL	55,870

Single Operator, High Power

K1TEO	541,206
KA1ZE	268,745
K1RZ	232,848
KMØT	188,895
K8EB	183,799
WA2FGK) (K2LNS, op	183,169
WB9Z	127,792
K4TO	124,992
K8TQK	123,096
N3HBX	111,384

Single Operator Portable

KA1LMR	63,731
KG4LEV	19,344
W4RXR	12,144
W1JHR	10,945
N8XA	10,650
WB6FFC	7,950
N7IR	7,614
WB2AMU	3,132
N6RZR	2,666
W3DQT	1,932

Limited Multioperator

W3SO	443,421
W4IY	440,744
K9NS	405,805
AA4ZZ	362,523
N3EMF	300,384
W1QK	169,600
K5TR	113,160
N8ZM	83,832
W3HZU	55,860
KK4US	47,580

Multioperator

K8GP	2,382,600
W2SZ	2,080,878
W3CCX	792,640
K5QE	528,000
K3YTL	506,924
W4NH	368,676
N2NK	178,948
KBØHH	154,070
KM5PO	132,050
WØEEA	122,176

Rover

N6TEB/R	322,577
N6DN/R	284,700
K2TER/R	157,176
K2QO/R	106,153
W1RT/R	88,816
WØZQ/R	85,916
W9FZ/R	76,360
KC3WD/R	71,040
VE3NPB/R	67,456
KF8QL/R	54,352

into the log and another band-multiplier into the score; and there is nothing more frustrating than tuning or calling CQ and having no response. Even if things appear to be slow, a contact in the log every now and then with a new band multiplier keeps the operators interested and operating.

The Rover entries continue to expand, and this year the number was up to 98 rover logs. Rovers have learned that VHF contesting can be very fulfilling, once their antennas are above the treetops and buildings and looking at relatively clear horizons. Not only do the rovers allow stations to fill in some needed grids from sparsely populated areas, but a review of the entries showed that half of the rovers were loaded with 6 bands or more, and almost half of those had 10 bands or more, making for great band multipliers.

Records

With conditions as they were, could records be set? Yes, one division and eight division section records were broken this year. Going alphabetically by section, KL7FF in Alaska topped the previous Limited multi-op scores with a new 2788 score. WA3QPX scored 23,763 to set a new low-power single-op record in Delaware. In the Portable category for Indiana, K9AKS had 1650 points for a new high water mark. Moving down to North Carolina, the W4NH multi-op group had a 368k score for a new record. WA2VNV captured the NLI single-op low power record with 24k. In the San Diego section, KG6IYN scored 64k in the single-op high power category. NN4AA set a portable record in South Florida with 1520. In the more detailed write-up below you will note K8GP breaking the West Virginia Multi-op section record and Roanoke Division record with a 2.38 million score. Even when propagation was lacking, there were several opportunities for record-setting. Check the June VHF QSO Party Section Records on the ARRL Web site (**www.arrl.org/contests/results/june-vhf-section-records.html** and **www.vhfscores.info/**) to see the records through 2006 and the many categories in several sections without entries.

Single Operator

Although it's always exciting to see the "battle of the bands" between the top scorers, the hams who make the attempt to be on for a few hours, check the propagation, pull out a few weak signals and submit a log, are always my heroes. Without them, we wouldn't be enticing newcomers and spreading the VHF-UHF and microwave joy. Although many have decried the loss of complete contest listings in *QST*, the downloadable and sortable comprehensive results are posted on the ARRL Web site for "members only." That gives every ARRL member a chance to see where their scores and efforts stacked up against the local, regional and national competition.

The top scorers in many divisions remain the same year after year, not surprisingly due to the station quality, antenna arrays, geography and determination of the operators. Four of the SOLP top 10 have appeared in the box 3 of the last 3 years, another 4 have appeared twice, and there are 2 newcomers. K2DRH again had top honors with 242k. Following in second place as he did in 2005 was WB1GQR with W1SJ as operator at 156k. Creeping up the chart is W3SZ in 3rd place with 110k. KB8U is making his third appearance in the top 10 box in the past 3 years with 100k, followed by another three-time top 10 boxer, AF1T with 80k. The next five stations in order are NØKP, N4QWZ, WB2SIH, NØVZJ and NØLL, demonstrating that the activity and competition is widely spread, at least to the middle of the country.

In the SOHP category, K1TEO nearly doubled the score of the nearest competitor with another fantastic score of 541k in modest conditions. Here again, the top 5 stations have been seen in the top 10 box for several years running, although the next 5 stations have just broken into the box this year. KA1ZE was in 2nd place with 268k and in 3rd place K1RZ had 232k. KMØT in 4th place with almost 189k showed an excellent effort from Iowa, and K8EB with almost 184k from Michigan was in 5th place, proving again that there is substantial VHF activity in the middle of the country. K2LNS is resurrecting the WA2FGK station and managed a 6th place finish. He lost all of his antennas a few years back, but is managing to get things restored with a five band effort. In order of finish for 7th through 10th places were WB9Z, K4TO, K8TQK and N3HBX, all scoring more than 100k.

There were 23 log entries for the Single Operator Portable category this year, down from last year's 39 submissions. Could the weather have been a factor or were the scores so much lower that some operators decided to forgo log submissions? Last year's high scorer KA1LMR repeated honors in 1st place with bands through 3456 MHz, but with 63k, he had about half of his 2006 score. In this category also we found that 6 of the top 10 scorers made multi-year appearances in the top 10 box. KG4LEV took second place with a 5 band effort from North Carolina. His score was 19k, an improvement over his last year's 16k effort. In 3rd place, W4RXR had a 12k result as a fresh call appearing in the top 10 SOP category this year. W1JHR had an 8 band portable station that scored 11k from the mountains of VT, and was also a newcomer to the top 10. N8XA managed to compile 10k to make 5th place moving up from 9th last year. With scores from 8k down to 2k, WB6FFC, N7IR, WB2AMU, N6RZR and W3DQT rounded out positions 6-10. Any of us who had calls from these SOP ops are grateful that they made the effort to be out in the field, providing more opportunity, especially on the microwave bands. Considering the rules, the power limitation

Affiliated Club Competition

	Entries	*Score*
Unlimited Club		
Society of Midwest Contesters	55	1,106,960
Medium Club		
Potomac Valley Radio Club	35	3,633,086
Mt Airy VHF Radio Club	17	1,260,783
North East Weak Signal Group	17	990,537
Northern Lights Radio Society	20	605,675
Carolina DX Assn	6	439,435
Rochester VHF Group	6	341,786
Badger Contesters	11	254,311
Yankee Clipper Contest Club	16	241,916
Grand Mesa Contesters of Colorado	10	214,062
Northern California Contest Club	12	162,790
Contest Club Ontario	17	157,632
Florida Weak Signal Society	9	148,956
Pacific Northwest VHF Society	14	130,683
Alabama Contest Group	3	111,219
Roadrunners Microwave Group	4	100,286
Western States Weak Signal Society	4	91,939
Bergen ARA	4	59,317
Mad River Radio Club	4	49,064
Central Arizona DX Assn	4	15,642
Dauberville DX Assn	4	11,304
Tennessee Contest Group	6	4,553
Local Club		
North Texas Microwave Society	7	773,427
Downey ARC	4	333,272
Eastern Connecticut ARA	5	111,104
Chippewa Valley VHF Contesters	5	100,618
10-70 Repeater Assn	3	32,613
Michigan VHF-UHF Society	3	30,945
Raritan Bay Radio Amateurs	8	12,184
Nacogdoches ARC	3	10,406

Northeast Region (New England, Hudson and Atlantic Divisions; Maritime and Quebec Sections)			Southeast Region (Delta, Roanoke and Southeastern Divisions)			Central Region (Central and Great Lakes Divisions; Ontario Section)			Midwest Region (Dakota, Midwest, Rocky Mountain and West Gulf Divisions; Manitoba and Saskatchewan Sections)			West Coast Region (Pacific, Northwestern and Southwestern Divisions; Alberta, British Columbia and NWT Sections)		
WB1GQR (W1SJ, op)	156,738	A	N4QWZ	61,500	A	K2DRH	242,505	A	NØKP	69,293	A	NU6S	33,453	A
W3SZ	110,600	A	K4LY	55,245	A	KB8U	100,036	A	NØVZJ	57,260	A	K6TSK	24,633	A
AF1T	80,388	A	K2DEL (WA2SEI, op)	35,910	A	WZ8T	39,550	A	NØLL	55,870	A	N7CFO	18,395	A
WB2SIH	60,900	A	W2BZY	26,602	A	W9GKA	35,695	A	WB5ZDP	45,045	A	K6XN	11,684	A
K5MA	39,984	A	K5YPV	22,176	A	KC9BQA	32,421	A	NØPOH	34,400	A	W6OMF	11,656	A
K1TEO	541,206	B	K4XR	110,589	B	K8EB	183,799	B	KMØT	188,895	B	KG6IYN	64,315	B
KA1ZE	268,745	B	KE2N	92,616	B	WB9Z	127,792	B	WØGHZ	94,200	B	AF6O	61,870	B
K1RZ	232,848	B	K4QI	91,264	B	K4TO	124,992	B	K9MK	56,942	B	W7CE	27,888	B
WA2FGk (K2LNS, op)	183,169	B	W4ZRZ	90,216	B	K8TQK	123,096	B	W3UUM	45,000	B	KC6ZWT	22,536	B
N3HBX	111,384	B	W4WA	57,524	B	K8MD	100,608	B	K5LLL	41,968	B	W7FI	19,584	B
KA1LMR	63,731	Q	KG4LEV	19,344	Q	N8XA	10,650	Q				WB6FFC	7,950	Q
W1JHR	10,945	Q	W4RXR	12,144	Q	K9AKS	1,650	Q				N7IR	7,614	Q
N2TEB	1,536	Q	W3DQT	1,932	Q							N6RZR	2,666	Q
N3XG	630	Q	NN4AA	1,520	Q							KG6TGI	874	Q
N3HU	160	Q	N3AWS	468	Q							W7KK	270	Q
W3SO	443,421	L	W4IY	440,744	L	K9NS	405,805	L	K5TR	113,160	L	VA7ISL	36,890	L
N3EMF	300,384	L	AA4ZZ	362,523	L	N8ZM	83,832	L	WDØT	46,505	L	AD6IJ	28,670	L
W1QK	169,600	L	KK4US	47,580	L	K8ZIZ	27,448	L	WØLSD	14,325	L	WA7JTM	10,419	L
W3HZU	55,860	L	NR4CQ	28,840	L	W9VW	26,265	L	NØEO	13,020	L	K7XC	8,896	L
N3YRR	33,300	L	KI4SNY	16,632	L	WN8R	25,245	L	WØFRC	4,788	L	W7MRG	6,669	L
W2SZ	2,080,878	M	K8GP	2,382,600	M	W8BAE	84,738	M	K5QE	528,000	M	N6CW	80,325	M
W3CCX	792,640	M	W4NH	368,676	M	N9UHF	80,565	M	KBØHH	154,070	M	W6TV	67,320	M
K3YTL	506,924	M	K4EJQ	88,322	M	N2BJ	67,080	M	KM5PO	132,050	M	N6GKJ	20,026	M
N2NK	178,948	M	AG4V	59,823	M				WØEEA	122,176	M	W6YX	13,200	M
K1MUJ	98,420	M	N4JQQ	33,136	M				WØKVA	25,276	M	N6VMO	10,640	M
K2TER/R	157,176	R	W1RT	88,816	R	W9FZ/R	76,360	R	WØZQ/R	85,916	R	N6TEB/R	322,577	R
K2QO/R	106,153	R	KC3WD/R	71,040	R	VE3NPB/R	67,456	R	WDØACD/R	31,326	R	N6DN/R	284,700	R
KE3HT/R	40,754	R	N4DXY/R	21,924	R	KF8QL/R	54,352	R	WYØX/R	17,424	R	N6MU	48,635	R
K3LFO/R	39,450	R	AH8M/R	17,875	R	NE8I	38,836	R	WØSD/R	12,948	R	KE6QR/R	14,080	R
WA3PTV/R	37,080	R	N5AC	16,059	R	WB8BZK/R	33,456	R	KCØIYT/R	12,532	R	N7EPD/R	13,719	R

of 10 W and the use of portable power, these stations required an excellent elevation in a relatively populated area with lots of gain in the antenna to make their impressive scores. There appear to have been considerable opportunities to break section scoring records in this category.

Multi-Operator

Pooling resources and mobilizing a team creates a common goal for a formal or informal group of VHFers, and often provides new opportunities for newcomers to participate. VHF beginners can also take this experience to appreciate the differences between the higher and lower bands, equipment, location, propagation and operating skills. Having lived in a VHF-compromised QTH, I had been a multi-op participant and for the past 20 years, I have participated as a rover. I experienced the frustration of foliage and fixed structure signal blockage, and as a result I always head for the hills. Almost all of the multi-operator groups have established themselves at excellent elevations, with towers and antennas that have a clear view of the horizon in most directions. A well planned and executed group station brings a high level of on-the-air activity to all of these radio-contesting events, with many of them propagating additional single-ops and rovers over time.

A small margin separated the top scorers in the Limited Multi-operator category. The top scoring stations in this group have been in a tight competition for several years. First, 2nd and 3rd places were separated by less than 10 percent at the 400k point level. The Wopsonock Mountain group scored 443k for top honors here, having moved into 1st place after being 2nd last year and 3rd the year before. The W4IY group also climbed a notch in each of the last three years and was in second place this year with 440k. Knocked out of first place in the last two years, K9NS was third with 405k. In 4th place the AA4ZZ group had 362k, also advancing one position from the 5th spot they held the past two years. N3EMF partnered with WG3E to make it to 5th place in this category, just breaking 300k. The 6th though 10th places were earned by W1QK, K5TR, N8ZM, W3HZU and KK4US with scores from 169k down to 47k.

The big story this year was the dramatic scores of two excellent multi-operator stations K8GP and W2SZ who battled it out for 1st place, as they have for several years. And the winner is: K8GP, the "Grid Pirates," taking advantage of some unique propagation, calling CQ incessantly, scouring the bands, seeking the rovers and moving stations up the bands. They amassed 2.38 million points to beat W2SZ, the "Mount Greylock Expeditionary Force" by 300,000 points. Both of these multi-operator groups beat their 2006 scores by 300,000 and 100,000 respectively.

There is no competition as keen as one between the two multi-operator giants, K8GP and W2SZ. The Grid Pirates celebrated their 10th anniversary of contesting on Spruce Knob in West Virginia at 4863 feet above sea level. With a set of well equipped vehicles that grind up the marginal mountain roads and a highly dedicated team of operators, they parlayed their win from last year into a repeat performance. It seems that everything went well for them, including a fantastic tropospheric opening into the midwest and southwest and working stations out to over 600-700 miles. They appear to have set an all time high record for 222 grid multipliers, topping an old record of 76 grids with an incredible 84 grids worked this year. They also broke their own record of 77 grid multipliers on 432 with a whopping 94 grids this year. Their final score was 2.382 million points. A complete report of the Grid Pirates contesting efforts including pictures, video and audio clips can be seen on their Web site (**www.k8gp.net/**).

The Mt Greylock Expeditionary Force (**www.mgef.org**), W2SZ, continues to set a standard for multiops with a score of 2.080 million points. This year the road and the summit of Mt Greylock was closed to the public for a major road rebuilding project. The group's cordial relationship of more than 35 years with the state officials as well as the fact that ham radio operators are first responders in time of emergency went a long way to obtaining special permission to allow the group to access their usual portable QTH, albeit with a smaller crew and lacking a working lodge on the summit. In a band-by-band analysis, it's clear that the MGEF

holds an advantage over the Grid Pirates in the area of microwave contacts, thanks to so many rovers in the Northeast that are equipped by the team for QSOs on the upper frequencies. On the other hand, the opening experienced by the Grid Pirates gave them a 130 grid multiplier advantage, despite having 450 fewer QSOs in their logs. This competition is bound to continue as both groups have several dedicated well maintained vehicles with powerful transmitters and sensitive receivers, substantial towers and antennas, well situated operating locations and a loyal and finely trained group of operators.

In 3rd place, for a third year in a row W3CCX, the Pack Rats (**www.packratvhf.com/**) scored 792k. It was a year of change for this club as the operating configurations were changed, a newer and reduced number of operators participated, and an unanticipated set of minor problems slowed some of the microwave operations. They also faced some mountaintop changes in power availability, but an additional run of 250 feet of cable overcame the gap. K5QE held 4th place again with a score of 528k and in 5th place was maintained by K3YTL with 506k points. The order of finish of these top 5 multi-operator groups was exactly the same as last year. Again sharing some of the top scoring activity across the country, 6th through 10th places were captured by W4NH, N2NK, KBØHH, KM5PO and WØEEA.

Rover

N6TEB took first place this year with 322K, and improvement of 30k from last year. In second place, N6DN with 284k improved his score from 2006 by 23k. K2TER in third place with 157k and K2QO in 4th place with 106k seemed to share similar routes in western NY. W1RT in 5th place had his first serious outing in the jitney that he purchased from now silent key W3IY and scored 89k in a Mid-Atlantic set of grids. Sixth through 10th places were won by WØZQ, W9FZ, KC3WD, VE3NPB and KF8QL with scores from 86k down to 54k. Although the Rover category continues to have some regulars in the top 10 box, there are some welcome newcomers to this revered status. Reviewing the similar QSO numbers and the grids worked on the microwave bands by the top two scorers, you can draw your own conclusions; what tactics and strategies did they use to garner scores in the 300k range when there were no other West Coast stations appearing in the top 10 box scores.

As the numbers of rovers increase, and their band capabilities continue to improve, they have become a new force and source of substantial opportunity for fixed stations. I was stung by a remark that showed up recently on the VHF contesting reflector; a rover was told by a fixed station that they would have to check and see if they needed the rover's grid multiplier before completing a contest exchange. Hopefully this was just a misguided and mistaken comment by a newcomer rather than an attitude of that particular station toward rover activity. Each and every contact should be another building block of score, communications ability and efficiency, and no contact should be refused. What's more, several multi-operator groups and single operators have analyzed their logs and noted that rovers account for 20-35% or more of their contest scores.

The KL7FF QTH: **The 2 meter 12 element Yagi can be seen mounted on the mast on the deck to the left side of the cabin. The 6 meter 8 element Yagi can be seen in the right foreground, mounted on 3 tower sections. The 2 meter station ran 400 W output and the 6 meter station ran 600 W output.**

Complete Results are on the ARRLWeb

For the complete 2007 June VHF Contest Results, including scores for all entries, see **www.arrl.org/contests/**. Soapbox comments are at **www.arrl.org/contests/soapbox/**.

Club Competition

Watch out! The Society of Midwest Contesters put together 55 logs to post a 1.1 million point score in the Unlimited Club category. The SMC has grown in number and activity, as they entered 28 logs in '05 and 36 logs in '06. Competition leads to more activity, something we all enjoy. The Potomac Valley Radio Club had their three-peat topping the Medium Club category with a 3.6 million aggregate score from 35 members. The Mt Airy VHF Radio Club swapped places again with the North East Weak Signal Group coming in second with a score of 1.2 million. The NEWS Group in 3rd place had 990k points with 17 logs. Welcome to the Alabama Contest Group who made their first appearance in the Medium VHF Club Category with 3 logs and a total of 111k points.

In the Local Club listings, the North Texas Microwave Society placed first with 7 logs accumulating 773k points, tripling their scores from last year. The Downey ARC was second in this listing with 4 entries and 333k points, another welcome to a new group. The Eastern Connecticut ARA was in third with a 111k score from 5 logs.

Observations and Web scores

There were 3 brief "DX" logs reported this year, two of them with only 1 QSO each, and CU2JT adds, "Rotten conditions but glad I could give one guy the HM77 grid."

With only a few more months to go until the 2008 ARRL June VHF QSO Party (scheduled for June 14-16) it is likely that many of the "regulars" are already setting aside the time, planning their strategy and ensuring that their gear is in top working order. With so many balls in the air to juggle, it takes a defined and disciplined plan and execution to be a top scorer. Single ops carefully track rovers, set schedules and use *WSJT* to enhance their efforts. Multi-ops use similar strategies, and often equip and support rovers to increase grid-multipliers. Portable QRP ops find that when they are at a good elevation and in the open that even very little power and a lightweight, directional antenna is all that is needed to work many of the well equipped fixed stations. KB5ZYG, a first-timer operating portable from Mt Mitchell, North Carolina, said, "Learned a lot, had a lot of fun…next time I'll bring a table, umbrella and a friend with another band to operate."

We are on the upslope of the next sunspot cycle, 6m conditions are bound to improve, and tropo-ducting and aurora enhancements can make their appearances at any time. If you have already been bitten by the VHF bug, stay with it, as conditions for future contests are always unpredictable. Newcomers with low or modest power and antennas are always welcome. K3NK commented, "First time in this contest. Had fun and will be back." AK9F reported, "Operated 6, 2 and 432 using only a 6 meter loop at 15 feet… amazingly, it actually radiated." If you haven't yet pushed the band switch toward 50 MHz and higher on your new multi-band rig, you're missing an exciting opportunity. Subscribe to a VHF reflector or a VHF club newsletter. Visit a VHF club near you, or perhaps their Web site if you're not in their neighborhood. Aside from some excellent ARRL publications, there is a wealth of information available on all phases of VHF and microwave theory, construction, operation and contesting available from these resources. QST

2008 ARRL International DX Contest Announcement

0000 UTC February 16 – 2359 UTC February 17 (CW)

0000 UTC March 1 – 2359 UTC March 2 (Phone)

How to participate: W/VE amateurs work as many amateurs in as many DXCC countries as possible on 160, 80, 40, 20, 15 and 10 meters. Single Operators may participate as all-band High power, Low power or QRP, Single Band (with no power differentiation) or Assisted (with no power differentiation). Multioperator categories are Single, Two or Unlimited transmitters (with no power differentiation).

What to say: US and Canadian stations send a signal report and their state or province/territory. DX stations send a signal report and a number indicating their transmitter output power. If you use standard abbreviations and phonetics, you will find yourself being asked for fewer repeats.

Special interest: Operators will travel to many interesting DX locations — who wouldn't rather be on a warm Caribbean island in mid-February instead of the frozen tundra of the upper US Midwest? Many DX newsletters and mailing lists publish an extensive list of DXpeditions to look for the week before each mode of the contest. The weekly DX bulletin from W1AW also has a good list of reported stations. Be on the lookout for some great opportunities.

Quirks: Remember that the ARRL Multioperator Single Transmitter category does not allow a second transmitter that only works mults: it is a true Single Transmitter category. Multi Singles and Multi-Two stations must remember the six-band change per hour rule for each transmitter. Lastly, remember that *there are no separate power categories for Single Operator, Single Band entries.*

Rule changes this year: None.

Best reason to participate: It is possible to work enough countries to complete DXCC in a weekend. In fact, many stations may work enough stations to work DXCC on more than one band. Activity is always high with a lot of stations to work. Any station that completes a minimum of 100 QSOs during either weekend is eligible to purchase an attractive 2006 DX Contest Pin commemorating their accomplishment. If your time to participate is limited, consider a single band entry — you will still have time for your non-contest obligations, and you might be surprised by winning at least your section with a smaller effort on a single band.

Rick, K6RJ, seems none the worse for wear after his first CW contest effort in the 2007 ARRL DX CW Contest.

Relative challenge: You don't have to have the fanciest equipment or the biggest station to make plenty of contacts in this contest. The exchange is simple, and there is always propagation to somewhere. Sunspots are scarce right now, so openings on 10 and 15 meters will be hard to find. Good operating practices and courtesy are even more important as some bands become more crowded.

Scoring: Each completed non-duplicate QSO counts three points. For W/VE stations, each DXCC entity worked counts as a multiplier once per band. For DX participants, each US state (except KH6 and KL7), the District of Columbia and Canadian province or territory counts as a multiplier once per band. Your final score is QSO points times total Multipliers worked.

How to report your score: For CW, you must send in your entry by *March 17, 2008.* For Phone, you must submit your entry by *April 1, 2008.* E-mail Cabrillo format log for CW to **dxcw@arrl.org** and Phone to **dxphone@arrl.org**. Send paper logs and complete summary sheet to DX CW Contest (or DX Phone Contest), ARRL, 225 Main St, Newington, CT 06111.

Complete rules: The complete rules may be found at **www.arrl.org/contests/forms** where you will also find links to the General Rules for all ARRL Contests, General Rules for ARRL Contests on bands below 30 MHz (HF) and other forms and operating aids, including log sheets for submitting your entry. If you don't have Web access, you can obtain the complete rules and forms by sending a self-addressed, stamped envelope with postage for 2 ounces to ARRL International DX Contest Rules, ARRL, 225 Main St, Newington, CT 06111.

For more information: E-mail **contests@arrl.org** or phone 860-594-0295. QST

Participation Pins Popular Again This Year

Once again the ARRL is please to offer participation pins for the 2008 International DX Contest. Just make 100 contacts and you are eligible. The cost is $7 for US participants and $10 for non-US entries. If you use a paper log, simply attach a note ordering a pin along with the payment to your entry summary sheet. If you submit the entry electronically, simply send a copy of the first page of your Cabrillo log file (which shows your header information) along with payment. We can only guarantee orders postmarked by April 1, 2008. Orders may be sent to ARRL DX Contest Pins, 225 Main St, Newington, CT 06111. You may also phone 860-594-0295 with a credit card to place your order.

ARRL Emergency Communications Course Honor Roll

We honor the following individuals who have passed all three ARRL Amateur Radio Emergency Communications courses (Levels I, II and III) between July 1 and September 30, 2007. This list also includes recertified individuals. If you are interested in taking an Amateur Radio Emergency Communications course, or one of our other ARRL online courses, see **www.arrl.org/cce/**.

Melvin Carr, KI4NBF
Stuart Carter, W4NHC
Bryson R Carter, KA8AUZ
Glen Clayton, W4BDB
David Crawford, KØKSI
David Drawdy, K4DLD
James Emerson, W4JEE
Bernie Farthing, NP2CB
John Ferguson, K3PFW
Robert Gault, KD4NEC
H Hasper, KL7SP
Bennie Henley, KI4IGX
David Jeffries, N9KDJ
Charles Johnson, AB9MW
Ray Kassis, N4LEM
Harry Kempke, ADØHK
Jon Kreski, AB9NN
Robert Lewis, W3IGE
Robert Lunsford, KB8UEY
James Mahon, KB9YRQ
Robert Meyer, WAØNZI
Louis Milone Jr, KA2NTT
David Norton, AI4FY
Randall M Payne, K4EZM
David Potter, W4RPI
Robert Pugh, KGØCX
Keith Rather, KBØZAI
Gary Sherard, WA5FLV
Galen Shubert, KØKS
Ronnie Smith, NØEJD
John Stephens II, KDØAAA
Benjamin Voelker, KC9HHO
Hal Whiting, KI2U
Scott Wilkerson, W9VHE
Richard Wonson, AC4KA
Polly Wonson, AE4AU
Robert Woolery, KC5VML
Gordon Wyatt, KQ4ZO QST

www.arrl.org/cce/

Join the Digital Fun in the 2008 ARRL RTTY Roundup

1800 UTC January 5 – 2400 UTC January 6

How to participate: Amateurs worldwide complete QSOs with each other on 80, 40, 20, 15 and 10 meter bands using Baudot RTTY, PSK31, Packet (attended operation only) and other digital modes. You may enter as either High or Low power in either a Single Operator or Multioperator Single transmitter category. Use of spotting assistance makes your entry Multioperator. You may work a station once per band (regardless of mode).

What to transmit: US and Canadian stations send a signal report and their State or Province. Other stations send a signal report and a consecutive serial number (starting with 001).

Special interest: The ARRL RTTY Roundup is one of the premier worldwide digital contests. The highest score in each category in each ARRL Division or DXCC entity is eligible for a beautiful plaque. There are plenty of opportunities to sponsor plaques for the Roundup. Contact Carol Michaud at 860-594-0238 if you are interested in plaque sponsorship.

Quirks: You may operate a total of 24 hours of the contest period. Your six hours of off-time must be taken in no more than two blocks (if you operate the full 24 hour period). Remember that total power output by Novice and Technician licensees may not exceed 200 W. On 40 meters, don't forget to look for European activity between 7.030-7.040 MHz.

Rui, CT2HAR, takes a break from his first-ever RTTY contest during the 2007 ARRL RTTY Roundup.

Rule changes this year: None for 2008.

Best reason to participate: The RTTY Roundup brings out the premier digital operators across the US and around the world. It is a great way to either get started on a digital WAS or DXCC award, or to add to your existing totals. It is also a great chance to try out some of the newer digital modes, such as PSK31 or MFSK or some of the modes you may not have tried, such as Hellschreiber.

Relative challenge: Today's advances in computer interfaces, sound cards and software make it relatively easy for anyone with basic digital operation experience and skills to excel. The bands are almost always packed with stations to work during the Roundup.

Scoring: Count each completed non-duplicate QSO one point. Each US state (except KH6 and KL7 which count as a DX multiplier), the District of Columbia, Canadian province or territory and each DXCC entity (other than W and VE) count as a multiplier. Multipliers count only once (not once per band). Your final score is QSO points times total Multipliers worked.

How to report your score: You must send in your entry by February 5, 2008. E-mail Cabrillo format log to **rttyru@arrl.org** or send paper logs and complete summary sheet to RTTY Roundup, ARRL, 225 Main St, Newington, CT 06111. Submissions may also be made using the Web-based applet at **www.b4h.net/cabforms**.

Complete rules: The complete rules may be found at **www.arrl.org/contests/forms** where you will also find links to the General Rules for all ARRL Contests, General Rules for ARRL Contests on bands below 30 MHz (HF), other forms and operating aids, and log sheets for submitting your entry. If you don't have Web access, you can obtain the complete rules and forms by sending a self-addressed, stamped envelope with postage for 2 ounces to ARRL RTTY Roundup Rules, ARRL, 225 Main St, Newington, CT 06111.

For more information: E-mail **contests@arrl.org** or phone 860-594-0295.

Going Up? The 2008 ARRL January VHF Sweepstakes Contest

1900 UTC January 19 –
0400 UTC January 21

How to participate: Any amateur station on any band above 50 MHz may be worked. The entry classes for Single Operator are high power, low power or portable. A Limited Multioperator station may either use four bands or fewer. A Multioperator Unlimited uses more than four bands. A Rover is a 1 or 2 person station that operates from two or more grid squares. Any station may be worked once per band, regardless of the mode. You may re-work a rover station each time they move to a new grid square. Use of a spotting network makes your station a Multioperator entry. DX stations may only work W/VE stations for credit.

What to say: All stations give their call sign and 4 digit grid square locator (such as W1AW FN31). Information on how to determine your grid square is found on page 86 of the April 1994 issue of *QST* or online at **www.arrl.org/locate/gridinfo.html**.

Special interest: If the solar flux index is high, be sure to check out activity on 50 MHz. Also, if you live in a coastal region, watch for some coastal tropospheric propagation. It won't be as prevalent as in the summer months, but if it occurs, you can get some great conditions for operating.

Quirks: A Single Operator Portable station operates from a single location away from home and must use a portable power supply, portable station and a maximum of 10 W PEP output. Replacement operators are not allowed for rover entries — it must be the same person or persons.

Zack, W9SZ, braves the Illinois cold as a QRP-Portable entrant in the 2007 ARRL January VHF Sweepstakes.

Rule changes this year: None.

Best reason to participate: This contest is a good way to build up totals for the ARRL VHF/UHF operating awards such as the VHF/UHF Century Club award. A band opening on 50 MHz could also present the opportunities to find new states for an ARRL Worked All States award or add countries to a DXCC total.

Relative challenge: VHF / UHF / Microwave operation presents unique challenges that test the best equipped operators, but it is also possible for someone to participate in this event with a modest station. You will get better results utilizing SSB or CW instead of FM. For VHF/UHF newcomers, remember that SSB/CW operating on VHF uses antennas that are horizontally polarized, so avoid verticals on those modes if possible. The more bands you are able to utilize the better your results. Inclement weather will definitely impact operations — so flexibility is crucial.

Scoring: QSOs count one point each on 50 and 144 MHz, two points on 222 and 432 MHz, four points on 902 and 1296 MHz and eight points each on 2.3 GHz and higher. On each band, every time you work a different grid square, you receive a multiplier. Your multiplier total is the sum of grids you worked per band. The final score is your QSO point total times your multiplier total.

How to report your score: You must send in your entry by February 20, 2008. E-mail Cabrillo format log to **JanuaryVHF@arrl.org** or send paper logs and complete summary sheet to January VHF SS, ARRL, 225 Main St, Newington, CT 06111. Scores may also be submitted using the Web-based applet at **www.b4h.net/cabforms**.

Complete rules: The complete rules may be found at **www.arrl.org/contests/forms** where you will also find links to the General Rules for all ARRL Contests, General Rules for ARRL Contests on bands above 50 MHz (VHF) and other forms, operating aids and log sheets for submitting your entry. If you don't have Web access, you can obtain the complete rules and forms by sending a self-addressed, stamped envelope with postage for 2 ounces to January VHF SS Rules, ARRL, 225 Main St, Newington, CT 06111.

For more information: E-mail **contests@arrl.org** or phone 860-594-0232.

The Allure of History: 2008 ARRL Straight Key Night

Step back from the technology for a few hours this New Year's Eve and enjoy ham radio the way our grandfathers knew it.

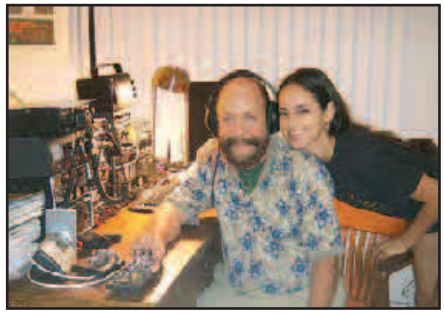
Sean Kutzko, KX9X
kx9x@arrl.org

Every interest or hobby has a history behind it. It's a reminder of the origins of that hobby and helps show how much evolution has taken place. Engaging a hobby's history may not be the most efficient way to participate in that hobby, but they still offer an allure that many enjoy. A Model T may not be as efficient or as sleek as a new hybrid, but many enjoy the nostalgia of the older cars.

First Key

I was unpacking boxes in my new apartment, after just moving to the area to begin working at ARRL HQ. Among the many possessions I found was my first straight key from my Novice days back in Illinois in 1982. It wasn't anything fancy, just a simple key that RadioShack sold back then. I had mounted it on an old piece of wood plank I'd stained and made hundreds of QSOs with it in my early years as a ham. Holding it in my hand after unpacking it, the memories were, to paraphrase James Earl Jones in *Field of Dreams*, so thick I could brush them away with my hand.

I remember my first CW QSO: May 22, 1982. My fist was shaking from nerves as I worked a fellow Novice in Arizona on 15 meters. Several months later, I worked my first DX, a station in Brazil, and recall the feeling of how big my world had suddenly become; I had communicated with another human being several thousand miles away, using essentially the same tool that had been used since the earliest days of Amateur Radio. These are the memories that many a ham revisit every time they use a straight key.



David Johnson, W4YD, and daughter Gabriela enjoy Straight Key Night 2007 from St Petersburg, Florida.

The 24 Hours of SKN

The 2008 running of Straight Key Night begins at 7 PM EST December 31, 2007 and runs for 24 hours through 7 PM EST January 1, 2008 (0000-2400 UTC January 1, 2008). SKN is more of an operating event than a contest. To participate, simply send CQ SKN or listen for CQs that have SKN in them. The object of this friendly event is to enjoy some good old-fashioned QSO fun, using straight keys. The emphasis is on rag-chewing rather than fast contest-style exchanges. Take pleasure in sending and receiving CW sent without a computer or keyer, listen for the best fist you encounter, and be sure to tell us all about your activities. Even better, connect that straight key to some vintage gear you haven't used in a while. Many interesting QSOs take place during SKN, so be sure to let us know about a memorable QSO you have.

Don't forget to post your comments and interesting photographs from your SKN adventure to the ARRL Contest Online Soapbox at **www.arrl.org/contests/soapbox**. Entries should be e-mails to the Contest Branch at **StraightKey@arrl.org** or may be sent via regular mail to SKN, ARRL, 225 Main St, Newington, CT 06111. The Soapbox becomes an online album of stories and photographs to share with others.

Vote for Best Fist, Most Interesting QSO

Entries for SKN must be received no later than January 31, 2008. Votes for "Best Fist" and "Most Interesting QSO" will be tabulated and included in the April 2008 issue of *QST*. If you have questions about SKN, please visit the Contest Branch Web Page at **www.arrl.org/contests** or send e-mail to **contests@arrl.org**. QST

ARRL VEC Volunteer Examiner Honor Roll

The ARRL VEC Honor Roll recognizes the top 25 Volunteer Examiners according to the total number of exam sessions they have participated in since their accreditations. Since each session requires an average time commitment of 2-4 hours or more, the thousands of hours these VEs have invested is extraordinary! Whether you are one of our VE Teams that test once a week, once a month or once a year, we want to express our warmest appreciation to all volunteers for their generous contributions to the ARRL VEC program.

If you are an ARRL VE, you can see your session stats online at **www.arrl.org/arrlvec/veparti.php**.

If you're not a VE, become one! See **www.arrl.org/arrlvec/become-a-ve.html**.

Examiner	*Sessions*	*Accreditation Date*
AE6Z, Emmett Freitas	533	31-Aug-1984
N5AF, Sammy Neal	452	20-Nov-1984
K6VIP, Royal Metzger	368	29-Apr-1985
K6RQ, Frank Glass	353	29-Apr-1985
KAØCDN, Karen Schultz	315	6-Sep-1984
WØIJR, Glenn Schultz	305	28-Sep-1984
KA6RHF, David Laurel	287	22-Apr-1985
W6IO, Leonard Scarpelli	285	1-Nov-1992
AC2T, Paul Maytan	278	6-Sep-1984
AC2V, Emily Maytan	267	6-Sep-1984
K3FL, Franz Laugermann	264	1-Dec-1991
ABØSX, Harry Nordman	263	9-Jan-2002
KP4PQ, Victor Madera	261	1-Mar-1992

Examiner	*Sessions*	*Accreditation Date*
KSØF, John Mackey Jr	258	1-Oct-1990
W7QGP, Mary Lewis	252	12-Aug-1985
K6PYP, Scott Swanson	251	1-Dec-1992
W6EOA, Salvatore Teresi	251	21-Aug-1989
AA2HX, Daniel Calabrese	243	1-Nov-1991
N8MPC, James Henderson	241	1-Nov-1991
KØIH, John Hauner	239	11-Jan-1985
KB5PGY, David Fanelli	239	1-Oct-1991
NI5S, Leslie Dale	239	6-Sep-1984
WA1RHP, Thomas Sefranek	236	1-Jun-1991
WB5R, Gerald Grant	235	4-Jan-1985
NØRN, Robert Hamilton	233	19-May-1987

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**.

A Computer Interface for CW

Electronic keyer — Circuitry that generates sequences of Morse code dots and dashes initiated by switch contact closures. The switches are usually made in the form of easy to operate levers in what is called a paddle (above).

Sidetone — Local copy of a transmitted signal. Originally the sound heard in the earpiece of a telephone handset while talking into the microphone. In this context a local copy of the Morse being sent to aid in proper character generation and spacing.

Straight key — Traditional up and down motion telegraph key with no automation.

The Doctor is IN

Antenna analyzer — Test equipment that can measure the complex impedance of an antenna or end of a transmission line.

ARRL Field Day — ARRL annual operating event (fourth full weekend in June) in which stations, often clubs or groups with multiple transmitters, take to the field to operate under simulated emergency conditions. Not, strictly speaking, a contest, but rather a fun event. Nonetheless scores are kept and clubs compete with each other in multiple classes.

The Hybrid Cascode — A General Purpose AGC IF Amplifier

Cascode circuit — Amplifier circuit in which two active devices (transistors or vacuum tubes) are used in combination to provide high gain, a high output impedance and isolation from output to input to avoid self-oscillation. See **en.wikipedia.org/wiki/Cascode**.

IF amplifier — Amplifier for the intermediate frequency stages of a superheterodyne receiver. This is generally a set of fixed frequency stages at which the system bandwidth is set.

Noise figure — A measure of the noise generated in a receiver in comparison to an ideal low noise amplifier. This is a prime figure of merit for VHF and UHF receivers at which the internal receiver noise is often the system limitation.

The Octopus — Four Band HF Antenna for Portable Use

ARES — Amateur Radio Emergency Service. Consists of licensed radio amateurs who have voluntarily registered their qualifications and equipment for communications duty in the public service when disaster strikes. See **www.arrl.org/FandES/field/ares2.pdf**.

DX — Long distance communication. Often used to refer to desired countries and prefixes needed for various operating awards.

Hamstick — Trade name for a type of shortened, single band, quarter-wave monopole antenna designed for mobile use. It is characterized by being a thin axially wound structure generally encapsulated in shrink tubing. See **www.hamstick.com**.

Hamstick dipoles — Use of two Hamstick antennas to form a usually horizontal dipole for fixed or portable operation.

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

Maritime Mobile Service Net — Group of Amateur Radio operators who meet on 14.3 MHz SSB daily (noon to 10 PM, Eastern Time) to serve and assist those on the high seas, or in the military in need of communications or support. See **www.mmsn.org**.

NVIS — Near vertical incidence skywave. A mode of communication in which HF signals are launched at vertical, or near vertical, elevation angles to return from the ionosphere and provide short and medium range (typically to 1000 miles) communication.

SO-239 — Designator of the panel mount socket for a UHF type coax connector.

A Remotely Controlled Station for HF Digital Modes

ADSL — Asynchronous digital subscriber line. Telephone company term for the use of a copper telephone pair to provide broadband digital service. Asynchronous because the bandwidth and data rate toward the Internet (upstream) is less than downstream.

FORTRAN — Computer programming language designed by IBM for scientific and engineering use (*FORmula TRANslation*) in the 1950s. Versions are still in use.

Double L antenna — Dual band (160 and 80 meter) bent vertical dipole designed by Don Toman, K2KQ, as an antenna for long-range work without need for ground radials. See **www.yccc.org/Articles/double_l.htm** for details.

Half square antenna — Shortened two element vertical antenna array typically used on 160 through 40 meters to provide broadside gain and directivity.

IP address — Internet protocol address that is assigned to every Internet device. It is in the form of dotted decimal notation, for example 161.58.186.233 (this is ARRL Web page IP address — try it in your browser). Depending on the size (class) of the network, the first one, two or three groups are the network address, while the remainder identifies the computer on the network. A domain name server (DNS) on your network receives your request to send a request to a universal resource locator (URL) and returns the IP address, so you don't have to remember it.

Lazy H antenna — Center fed two element horizontal broadside array named for its appearance as the letter H rotated 90°.

MFSK — Multi-frequency shift keying. The name for a number of digital transmission modes in which a relatively large number (typically 16 or 64) of shifted frequencies are allowed in order to send multiple bits per transmitted character. See **www.arrl.org/FandES/field/regulations/techchar/Q15X25.html**.

Olivia — Digital protocol using MFSK combined with forward error correction (FEC). See **www.arrl.org/FandES/field/regulations/techchar/olivia.html**.

OCXO — Oven controlled crystal oscillator. Type of frequency reference in which a miniature oven is used to maintain a constant temperature. This makes the frequency relatively constant even if the ambient outside temperature is changing.

PSK31 — Digital transmission protocol used for keyboard to keyboard communication sent via phase shift keying. Designed to be used with PC sound cards and associated software.

RS232 serial connections — Computer to terminal or accessory connection arrangement that sends one bit at a time on a single wire in each direction. It includes additional control and multiple handshaking ("are you ready to receive data?" / "yes start sending") functions each on a dedicated wire.

RTTY — Radioteletype. Keyboard to keyboard communications systems originally using special typewriter like keyboard and printer machines with data sent by frequency shifting a radio channel. Now often simulated using a PC with sound card and special software.

TCP/IP — Transmission control protocol/Internet protocol. Data transmission and management protocol suite used to send data over the Internet.

VoIP — Voice over Internet protocol. Generic term for any of the many different implementations of digitizing and packetizing of voice information for transmission over the Internet. See **en.wikipedia.org/wiki/VOIP** or February 2003 *QST*, pp 44-47, for more information.

[1] *The ARRL Handbook for Radio Communications,* 2008 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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Professional Communications Receiver

- 0.005 - 3335 MHz*
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- ±3 dB*[2] Accuracy of dBμ/dBμ(emf)/dBm Meter
- Professional Grade Operation, Functionality and Build
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IC-R5 Wide Band Receiver

Compact Performance

- 150 kHz–1.3 GHz*
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- 1250 Alphanumeric Memory Channels
- CTCSS/DTCS Decode
- Weather Alert Scan
- Dynamic Memory Scan (DMS)
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IC-7000

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• 55 watt VHF/50 watt UHF • Wide RX: 118-173, 230-549, 810-999 MHz (cellular blocked on US versions) • Analog/Digital Voice & Data • Callsign Squelch • CTCSS & DTCS Encode/Decode w/tone scan

IC-7800 All Mode Transceiver

• 160-6M @ 200W • Four 32 bit IF-DSPs+ 24 bit AD/DA converters • Two completely independent receivers • +40dBm 3rd order intercept point

IC-756PROIII All Mode Transceiver

• 160-6M • 100W • Adjustable SSB TX bandwidth • Digital voice recorder • Auto antenna tuner • RX: 30 kHz to 60 MHz • Quiet, triple-conversion receiver • 32 bit IF-DSP • Low IMD roofing filter • 8 Channel RTTY TX memory • Digital twin passband tuning • Auto or manual-adjust notch with 70 dB attenuation

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1 Noise Canceling Controller

- Reduce overload or interference by nulling a strong local signal or noise before it gets to your receiver
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- Peak weak signals hidden under a strong signal on the same frequency
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- Null out noise from power line arcing, lamp dimmers, motors and consumer electronics from a single direction

2 Antenna Phasing Controller

- 2 antenna alternative to DX Engineering's Receive Four-Square antenna
- Combine two antennas to create a directional pattern
- The NCC-1 enables you to adjust the antenna array pattern as if you were moving the antennas
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- Vastly superior dual channel complementary phasing system
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- Separate controls for reversing channel and phase
- Works on all modes, 300 kHz to 30 MHz
- Provides power for external active antennas
- Input for mute on transmit

DXE-NCC-1 Noise Canceling/Phasing Controller **$495.00**

Phase any two antennas at any spacing. For optimal results, use identical antennas.

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- Now available with relay protection from transmitter overload when used with TVSU-1
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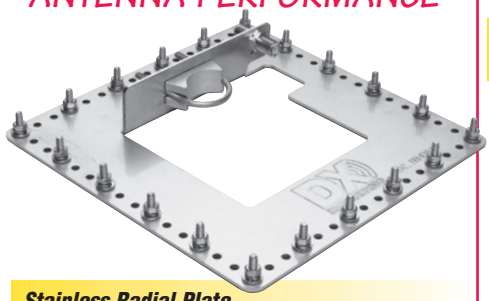

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HUSTLER BTV ADD-ONS

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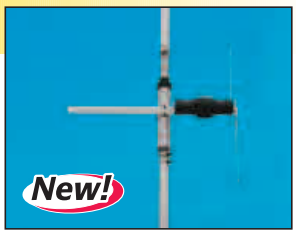
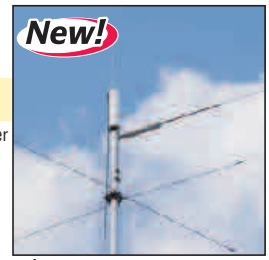


- Full band under 1.5:1 SWR
- Minor adjustments for other bands
- Simple installation
- 500W SSB/CW power rating

Patent Pending

DXE-AOK-17M 17m add-on kit for BTV.....**$49.95**

60m Add-on Kit



- 60m coverage for Hustler BTV series antennas
- Operates across the complete 60m band
- SWR of 1.5:1 or less
- Includes new capacitive compensator
- Retains all bands at peak performance

DXE-AOK-60M 60m Add-on Kit for Hustler BTV.....**$69.95**

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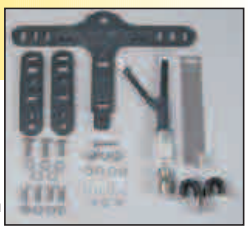
Universal Wire Antenna Hardware Kit



- Multi-purpose center-T and end insulators to create many types of wire antennas
- Create single band, multi-band, multi-frequency and folded dipole antennas
- Easy solder-free construction
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- Use with doublet, inverted-V, off-center fed, Zepp, long wire, rhombic, V-beam, and loop antenna configurations
- Kits available for coax or ladder line feed
- Center-T attaches to all DX Engineering baluns, including the new lightweight balun below

DXE-UWA-KIT Universal Wire Antenna Hardware Kit, no Coax Adapter **$17.95**
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Z-11Pro

"The Z-11 Pro virtually operates itself - just talk or key and the tuner will tune."

The original portable Z-11 was one of LDG's most popular tuners, accompanying adventurous hams to their backyards, or to the ends of the earth. Now meet the Z-11Pro, everything you always wanted in a small, portable tuner designed from the ground up for battery operation.

Only 5" x 7.7" x 1.5", and weighing only 1.5 pounds, it handles 0.1 to 125 watts, making it ideal for both QRP and standard 100 watt transceivers from 160 - 6 meters.

"With 8,000 memories in LDG's exclusive "3-D Memory" array, the Z-11Pro uses LDG's state-of-the-art processor-controlled Switched-L tuning network. It will match dipoles, verticals, inverted-Vs or virtually any coax-fed antenna. With an optional LDG balun, it will also match longwires or antennas fed with ladder-line. All cables included. **Suggested Price $179**

NEW! AT-1000Pro

New!

Building on the success of the AT-1000, LDG Electronics has refined and expanded its 1KW tuner. The AT-1000Pro has an Auto mode that automatically starts a tuning cycle when the SWR exceeds a limit you set. Other features include:

- Operates at any power level between 5 and 1,000 watts peak. RFRelay protection software prevents tuning at greater than 125 watts
- 2 Antenna connections
- Tunes from 1.8 to 54.0 MHz (including 6 meters)
- Tuning time usually under 4 seconds, transmitting near a frequency with stored tuning parameters, under 0.2 seconds. 2000 memories.

All cables included. **Suggested Price $599**

LDG Now Includes All Cables Ready to go!

AT-200Pro

"As far as bang for the buck for a limited budget shack, this was money well spent!"

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 MH **(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

AT-100Pro

"For the money and the features it doesn't get any easier than this."

This desktop tuner covers all frequencies from 1.8 – 54 MHz **(including 6 meters)**, and will automatically match your antenna in no time. It features a two-position antenna switch, allowing you to switch instantly between two antennas. The AT-100Pro requires just 1 watt for operation, but will handle up to 125 watts. All cables included.
Suggested Price $219

AT-7000

"It works perfect and FAST. Comes with needed cables. And powers from rig. I think it's priced right. What more can I say."

The AT-7000 is the ideal tuner for IC-7000 & other ICOM Radios: Covers all frequencies from 1.8–54 MHz **(including 6 meters),** and will automatically match your antenna in a flash. Requires just 0.1 W for operation, but will handle up to 125 W (100 W on 6 m), making it suitable for everything from QRP (IC- 703Plus) to a typical 100 W ICOM transceiver.

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Suggested Price $169

Z-100

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Designed from the ground up to provide the 100 watt power handling you asked for, in a small, lightweight package, perfect for portable as well as sitting on your desk in your shack!

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AT-897 for the Yaesu FT-897

"If you want a tuner for the FT-897, this is definitely the one to go with."

If you own a Yaesu FT-897 and want a broad range automatic antenna tuner, look no further! The AT-897 Autotuner mounts on the side of your FT-897 just like the original equipment. We even added the ability to mount the "feet" on the side of the tuner so when you are transporting your rig by the handle, you can safely set it down and not worry about scratching the case. The AT-897 takes power directly from the CAT port of the FT-897 and provides a second CAT port on the back of the tuner so if you are using another CAT device, hooking it up couldn't be easier. **Suggested Price $199**

AT-200PC

The First Automatic Tuner Designed Specifically for PC Rig Control

Now you can have a state-of-the-art, high performance automatic tuner and still run your whole station right from your keyboard and mouse.

LDG's AT-200PC is a special version of the popular AT-200Pro, designed for PC control. All of its functions are controlled entirely by a program running on your PC. The tuner itself can be installed out of the way, on the floor or even in another room, interfacing to your PC via a serial or USB cable. All cables included. **Suggested Price $259**

New FT Meter

"Just what the doctor ordered for tired eyes. That backlight is a perfect addition"

LDG's new version of its popular FT-Meter presents a lush, highly readable 2.5" meter face with calibrated scales for signal strength and discriminator reading on receive, and power output, SWR, modulation, ALC action and supply voltage on transmit. Each function is selectable from the radio's menu.On/Off switch for the light

- LED back-illuminated in cool, high-visibility blue
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The FT-Meter comes fully assembled and ready to go; just plug it into the radio and you're in the picture like never before.

Still Only $49

The DTS Series Antenna Switches

"Now all the cables are out of sight and its easy to tell which radio is going to which antenna"

Instantly switch your rig between 4 or 6 antennas with the press of a button. Auto-grounding when you shut your rig down. Purchase the additional remote control and put the DTS Series switch anywhere indoors and operate it from your desk. They handle up to 1500 watts of RF power on HF (250W on 6M), and can be used with any coax-fed antenna.

Suggested Price: DTS-4 $79, remote $39 DTS-6 $99, remote, $49

Your Cable Problems—Solved!

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The RCA-14 is compatible with: Icom 703, 706, 718, 746, 756, 7000 and 7800, Yaesu 817, 857, 897 and 840, Kenwood 480, 570, 2000 Ten Tec Orion and many more.

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"The Forward Power is 112 Watts"

The "Talking" Watt Meter

"*Excellent unit for the price, level of accessibility and the simplicity of operation."*

The TW-1 Talking Wattmeter provides an oral spoken indication of power and SWR using a digitally recorded voice. It is ideal for the vision-impaired, for those of us in the "bi-focal set", or just for those times when you need to be looking somewhere else. At the press of a button, the TW-1 speaks the forward power, reverse power or SWR. Three languages are available: English, Spanish and German. It includes its own internal speaker; no external audio hookups are needed. Also available TW-2 UHF/VHF. **Suggested Price $149**

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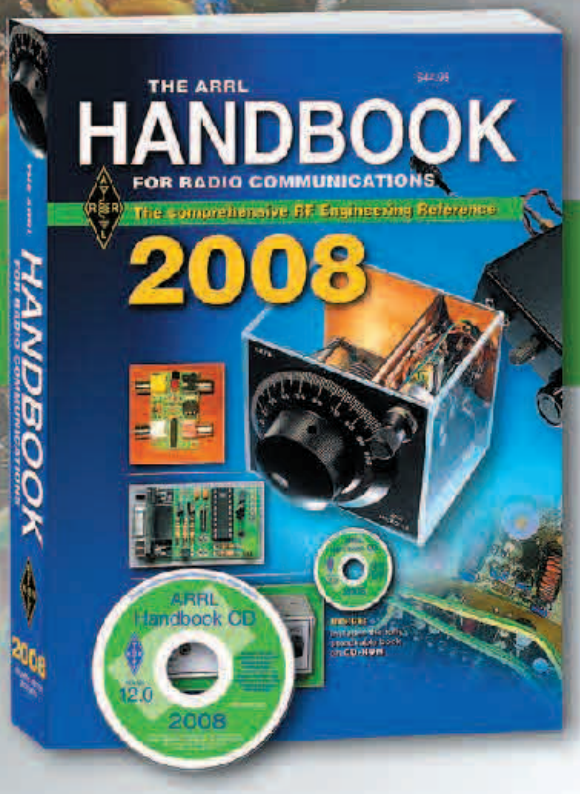

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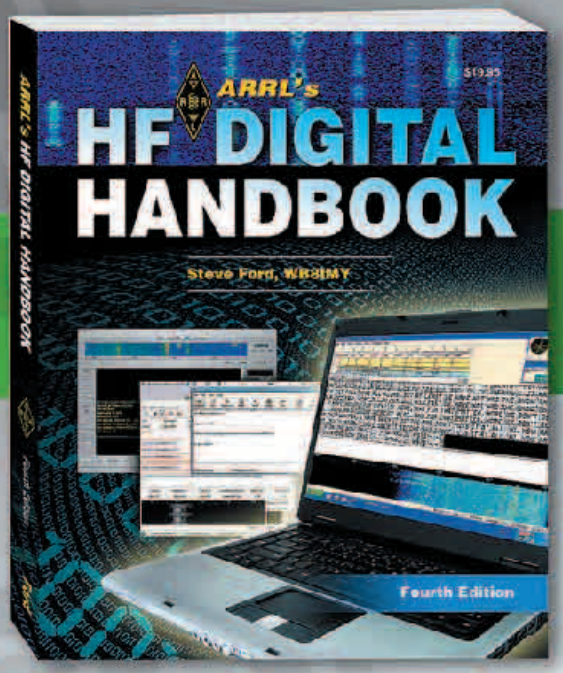

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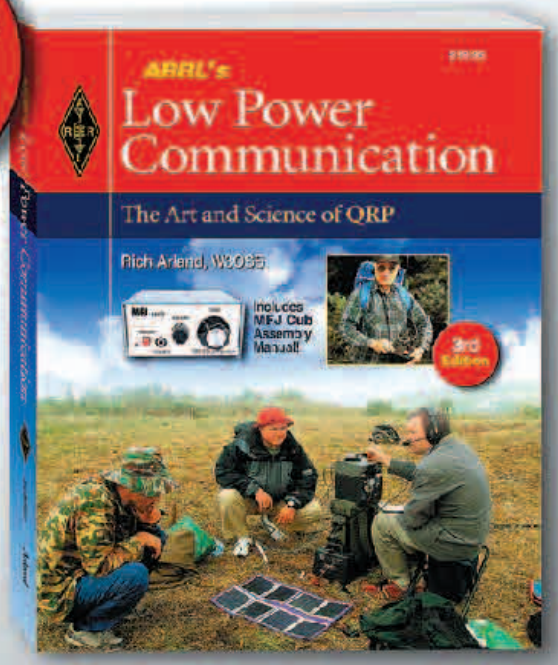

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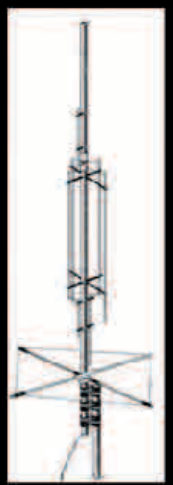

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10m, 12m, 15m, 17m, 20m, 30m, 40m, & 80m

25' tall 25 lbs

Mounts on 1-1/4" OD mast

No radials required.

*VSWR under 2:1 on 80m 100 KHz

CHALLENGER DX

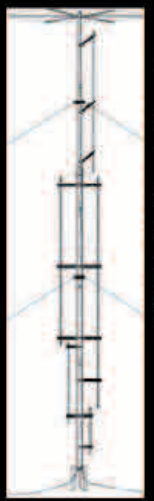
2m, 6m, 10m, 12m, 15m, 20m, 40m, & 80m

31.5' tall 21 lbs

Drop in ground mount supplied.

3 counterpoises required 25' long.

*VSWR under 2:1 on 80m 130 KHz



VOYAGER DX

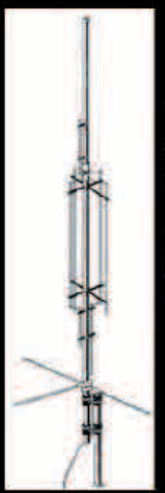
20m, 40m, 80m, & 160m

45' tall 39 lbs

Supllied with hinged ground mount.

3 counterpoises required 57' long.

*VSWR under 2:1 on 160m 90 KHz



EAGLE DX

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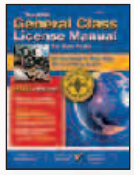

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Technician Class manual
for the 2006-10 entry-level exam! Gordo has reorganized the questions into logical topic groups for easier learning! Key words are highlighted in the explanations to help you remember the material for test success. Web addresses for more than 150 helpful, educational sites. Bonus audio CD teaches VHF propagation. GWIM $18.95

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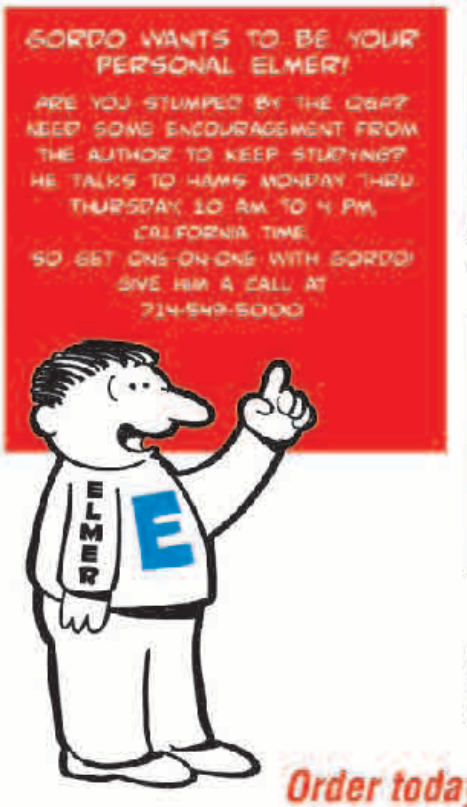

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General Class book
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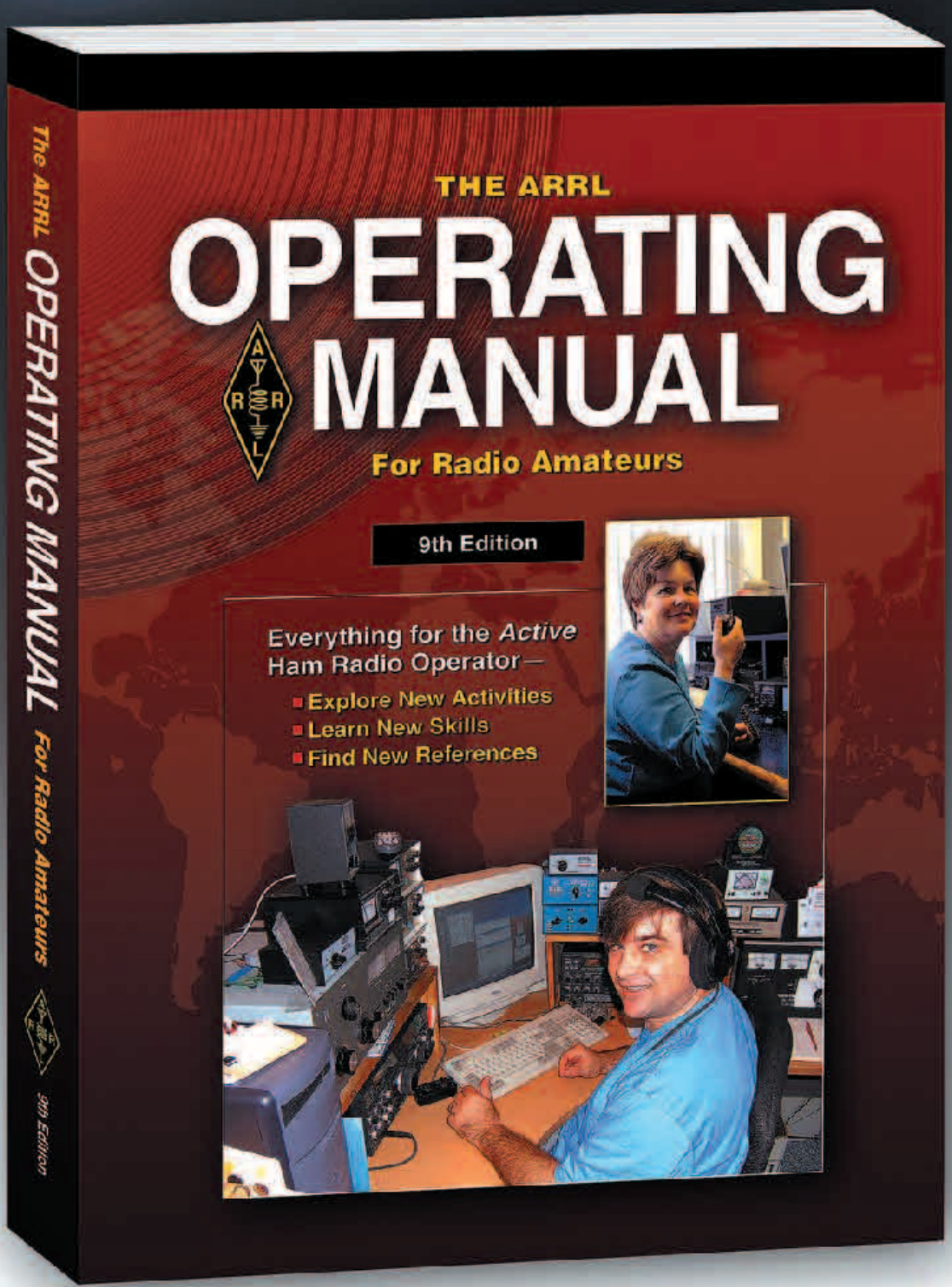

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VECTRONICS uses the finest components available to build the highest quality 300 Watt antenna tuner ever made.

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).

8 position antenna switch, 50 Ohm dummy load, peak reading backlit Cross-Needle SWR Power meter, 4:1 balun for balanced lines. Scratch-proof Lexan front panel. 10.2x9.4x3.5 inches. 3.4 pounds.

300 Watt Mobile Tuner

VC-300M
$129.95

The VC-300M *Mobile* Antenna Tuner is compact, lightweight, easy-to-operate and is our most economical tuner.

It's compatible with *any* mobile antenna, any HF transceiver and fits in the smallest car. It can also be used at home with any coax fed antennas -- dipoles, vees, verticals, beams or quads.

Backlit Cross-Needle meter simultaneously monitors Forward/Reflected power and SWR. Covers 1.8 to 30 MHz.

Handles 300 Watts SSB PEP, 200 Watts continuous, (150 Watts on 1.8 MHz). 7.25x8.75x3.6 inches. 3.4 pounds.

SWR/Power Meters

PM-30
$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.
144/220/440 MHz, 30/300 SWR/Wattmeters
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.

Low Pass TVI Filter

LP-30, $89.95 Eliminates TVI by attenuating harmonics at the source. Plugs between transmitter and antenna or tuner. 1.5 kW.

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HPF-2, $34.95 Installs between VCR/TV and cable TV/antenna cable. Eliminates or reduces interference caused by nearby HF transmitters.

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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

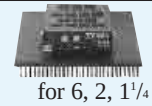
6 Meter Amplifier

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



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Commercial Amps for 150-174, 450-470 MHz, VHF marine bands, 70-130 Watts out.

70 cm Amplifiers (420-450 MHz)

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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.

In-shack or Mast-Mount models.

Frequency, MHz	*In Shack, $149.95*	*MastMount,$199.95*
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50-54	KP-1/6M	KP-2/6M
144-148	KP-1/2M	KP-2/2M
220-225	KP-1/220	KP-2/220
430-450	KP-1/440	KP-2/440

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).

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.

1¼ Meter Amps (223-225 MHz)

10 models -- 20-220 Watts out for 2-50W in, $169-$739.

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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 . . .

MFJ-269
$389.95

You can instantly get a complete picture, check and tune any antenna from 1.8 to 170 MHz and 415 to 470 MHz -- an MFJ-269 exclusive -- with this rugged easy-to-use hand-held antenna test lab! You can measure virtually every antenna parameter.

You won't believe its capability and versatility. This rugged handheld unit literally replaces a workbench full of expensive delicate test equipment.

SWR Analyzer

You can read SWR, return loss, reflection coefficient and match efficiency at any frequency simultaneously at a single glance.

Complex Impedance Analyzer

Read Complex Impedance (1.8 to 170 MHz)as series equivalent resistance and reactance (Rs+jXs) or as magnitude (Z) and phase (degrees). Also reads parallel equivalent resistance and reactance (Rp+jXp) -- *an MFJ-269 exclusive!*

Coax Analyzer

You can determine velocity factor, coax loss in dB, length of coax and *distance to short or open in feet (it's like a built-in TDR).*

CoaxCalculator™ lets you calculate coax line length in feet given electrical degrees and vice versa for any frequency and any velocity factor -- *an MFJ-269 exclusive!*

Use any Characteristic Impedance

You can measure SWR and loss of coax with *any* characteristic impedance (1.8 to 170 MHz) from 10 to over 600 Ohms, including 50, 51, 52, 53, 73, 75, 93, 95, 300, 450 Ohms -- *an MFJ-269 exclusive!*

Inductance/Capacitance Meter

Measures inductance in uH and capacitance in pF at RF frequencies, 1.8-170 MHz.

Frequency Counter/Signal Source

You can also use it as a handy frequency counter up to 170 MHz and as a signal source for testing and alignment.

Digital and Analog displays

A high contrast LCD gives precision readings and two side-by-side analog meters make antenna adjustments smooth and easy.

415 to 470 MHz Range features

Just plug in your UHF antenna coax, set frequency and read SWR, return loss and reflection coefficient simultaneously. You can read coax cable loss in dB and match efficiency.

You can adjust UHF dipoles, verticals, yagis, quads and others and determine their SWR, resonant frequency and bandwidth.

You can test and tune stubs and coax lines. You can manually determine velocity factor and impedances of transmission lines.

You can adjust/test RF matching networks and RF amplifiers without applying power.

Has easy-to-read LCD *logarithmic* SWR bargraph and SWR meter for quick tuning.

Much Better Accuracy

New 12-bit A/D converter gives much better accuracy and resolution than common 8-bit A/D converters -- *an MFJ-269 exclusive!*

Super Easy-to-Use

Select a band and mode. Set frequency. Your measurements are instantly displayed! Smooth reduction drive tuning makes setting frequency easy.

Take it anywhere

Take it anywhere - to remote sites, up towers, in cramp places. Fully portable -- battery operated, compact 4Wx2Dx6¾ in., weighs 2 lbs. *Free* "N" to SO-239 adapter.

Has battery saver, low battery warning and built-in charging circuit for rechargeables.

Use 10 AA Ni-MH or Ni-Cad or alkaline batteries (not incl.) or 110VAC with MFJ-1312D, $15.95.

MFJ SWR Analyzer Accessories

MFJ-39C, $24.95.
Tote your MFJ-269 anywhere with this *genuine* MFJ custom carrying case. Has back pocket with security cover for carrying dip coils, adaptors and accessories. Made of special foam-filled fabric, the MFJ-39C cushions blows, deflects scrapes, and protects knobs, meters and displays from harm. Wear it around your waist, over your shoulder, or clip it onto the tower while you work -- the fully-adjustable webbed-fabric carrying strap has snap hooks on both ends. Has clear protective window for frequency display and cutouts for knobs and connectors.

MFJ-66, $24.95.
Plug these MFJ dip meter coupling coils into your MFJ *SWR Analyzer™* and turn it into a sensitive and accurate *band switched* dip meter. Set of two coils cover 1.8-170 MHz depending on your MFJ-269 *SWR Analyzer™*.

MFJ-99C, $40.90.
SWR** Analyzer Power Pack.* 10 Pack MFJ *SuperCell™* Ni-MH batteries, and power supply for SWR analyzers. ***Save $5!

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MFJ-269*PRO™* Analyzer

Like MFJ-269, but has extended coverage in UHF range ***(430 to 520 MHz)*** and ruggedized cabinet that protects LCD display, knobs, meters and connectors from damage.

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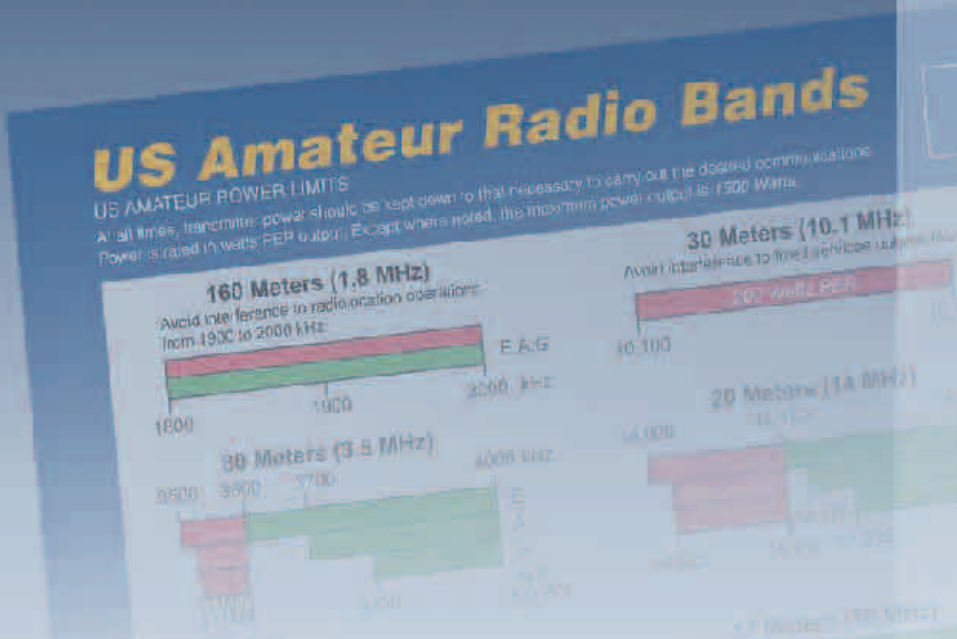

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MFJ TUNERS

MFJ *IntelliTuner*™ Automatic Tuners

The MFJ-993B *IntelliTuner*™ lets you tune any antenna *automatically -- 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.

You get a highly efficient L-network, 6-1600 ohm matching at 300 Watts SSB/CW or *extra-wide* 6-3200 Ohm matching at 150 Watts SSB/CW, 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***

600 Watt MFJ Automatic Tuner

MFJ-994B
$359.95

Like MFJ-993B but handles 600 Watts SSB /CW, matches 12-800 Ohms. 10,000 memories. Does not have LCD display, antenna switch, 4:1 current balun, audio SWR meter/feedback. 10Wx2¾Hx9D in.

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-9982 ***2500 Watt*** Tuner

The MFJ-9982 *ContinuousCarrier*™ antenna tuner handles 2500 Watts *continuous carrier* output on all modes and all HF bands into most unbalanced antennas -- even 160 Meters. 6-position antenna switch, 4-core balun, 1.5kW dummy load, true *peak*/average SWR/Wattmeter, 13¾Wx7Hx6¼D".

MFJ-9982
$699.95

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. 12⅞Wx6Hx11⅝D".

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. 10¾Wx4½H x10⅞D in.

MFJ-969 300W ***Roller Inductor*** Tuner

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. 10½Wx3½Hx9½D inches.

MFJ-969
$219.95

MFJ-949E ***deluxe*** 300 Watt Tuner

More *hams use MFJ-949s than any other antenna tuner in the world!* Handles 300 Watts. Full 1.8 to 30 MHz coverage, custom inductor switch, 1000 Volt tuning capacitors, *full size* peak/average lighted Cross-Needle SWR/ Wattmeter, 8 position antenna switch, dummy load, *QRM-Free PreTune*™, scratch proof Lexan front panel. 10⅝Wx3½Hx7D inches.

MFJ-949E
$179.95

MFJ-948, $159.95. Economy version of MFJ-949E, less dummy load, Lexan front panel.

MFJ-941E ***super value*** Tuner

The *most for your money!* Handles 300 Watts PEP, covers 1.8-30 MHz, *lighted* Cross-Needle SWR/ Wattmeter, 8 position antenna switch, 4:1 balun, 1000 volt capacitors, Lexan front panel. Sleek 10½Wx2½Hx7D".

MFJ-941E
$139.95

MFJ-945E HF/6M ***mobile*** Tuner

Extends your mobile antenna bandwidth so you don't have to stop, go outside and adjust your antenna. Tiny 8Wx2Hx6D 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-945E
$119.95

MFJ-974HB ***Balanced Line*** Tuner

The MFJ-974HB *true* fully balanced antenna tuner tunes any balanced lines. Matches 12-2000 Ohms. Covers 1.8-54 MHz *continuously* including all WARC bands. 300 Watts SSB/150 Watts CW. Lighted Cross-Needle SWR/Wattmeter. 7½Wx6Hx8D in.

MFJ-974HB
$209.95

MFJ-976, $499.95. 1500 Watt *fully balanced* antenna tuner. 1-30 MHz.

MFJ-971 ***portable/QRP*** Tuner

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. 6Wx6½Hx2½D in.

MFJ-971
$119.95

MFJ-902 ***Tiny Travel*** Tuner

Tiny 4½Wx2¼Hx3D", full 150 Watts, 80-10 Meters, has tuner bypass switch, for coax/random wire.

MFJ-902
$99.95

MFJ-904H, $149.95. Same but adds Cross-needle SWR/Wattmeter and 4:1 balun for balanced lines. 7¼Wx2¼Hx2¾D in.

MFJ-16010 ***random wire*** Tuner

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 2Wx3Hx4D inches.

MFJ-16010
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MFJ TUNERS

New, Improved MFJ-989D 1500 Watt *legal limit* Antenna Tuner

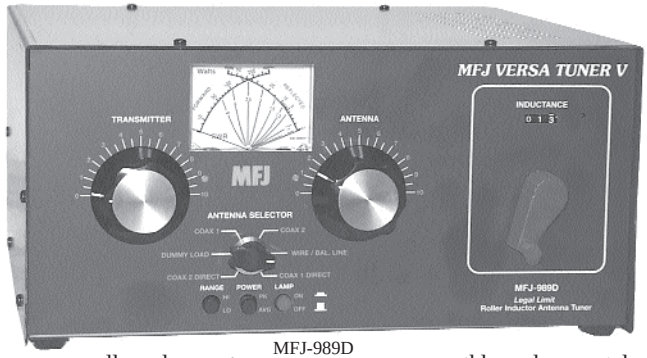
World's most popular 1500 Watt Legal Limit Tuner just got better -- much better -- gives you more for your money!

New, improved MFJ-989D *legal limit* antenna tuner gives you better efficiency, lower losses and a new *true* peak reading meter. It easily handles *full* 1500 Watts SSB/CW, 1.8 to 30 MHz, including MARS/WARC bands.

New dual 500 pF *air variable capacitors* give you twice the capacitance for more efficient operation on 160 and 80 Meters.

New, improved *AirCore*™ *Roller Inductor* gives you lower losses, higher Q and handles more power more efficiently.

New *TrueActive*™ peak reading Cross-Needle *SWR/Wattmeter* lets you read *true* peak power on all modes.



MFJ-989D **$389.95**

New high voltage *current balun* lets you tune balanced lines at high power with no worries.

New *crank knob* lets you reset your roller inductor quickly, smoothly and accurately.

New larger 2-inch diameter *capacitor knobs* with easy-to-see dials make tuning much easier.

New cabinet maintains components' high-Q. Generous air vents keep components cool. $12^{7}/_{8}$Wx6Hx$11^{5}/_{8}$D inches.

Includes six position ceramic antenna switch, 50 Ohm dummy load, indestructible multi-color Lexan front panel with detailed logging scales and legends.

The MFJ-989D uses the superb time-tested T-Network. It has the widest matching range and is the easiest to use of all matching networks. Now with MFJ's new 500 pF air variable capacitors and new low loss roller inductor, it easily handles higher power much more efficiently.

***No Matter What*™ Warranty**

Every MFJ tuner is protected by MFJ's famous one year *No Matter What*™ limited warranty. We will repair or replace your MFJ tuner (at our option) for a full year.

More hams use MFJ tuners than all other tuners in the world!

MFJ-986 Two knob *Differential-T*™

MFJ-986 **$349.95**

Two knob tuning (differential capacitor and *AirCore*™ roller inductor) makes tuning foolproof and easier than ever. Gives minimum SWR at only one setting. Handles 3 KW PEP SSB amplifier input power (1.5 KW output). Gear-driven turns counter, lighted peak/average Cross-Needle SWR/Wattmeter, antenna switch, balun. 1.8 to 30 MHz. $10^{3}/_{4}$Wx$4^{1}/_{2}$Hx15 in.

MFJ-962D *compact* kW Tuner

MFJ-962D **$299.95**

A few more dollars steps you up to a KW tuner for an amp later. Handles 1.5 KW PEP SSB amplifier input power (800W output). Ideal for Ameritron's AL-811H! *AirCore*™ roller inductor, gear-driven turns counter, pk/avg lighted Cross-Needle SWR/Wattmeter, antenna switch, balun, Lexan front, 1.8-30MHz. $10^{3}/_{4}$x$4^{1}/_{2}$x$10^{7}/_{8}$ in.

MFJ-969 300W *Roller Inductor* Tuner

MFJ-969 **$219.95**

Superb *AirCore*™ Roller Inductor tuning. Covers *6 Meters* thru 160 Meters! 300 Watts PEP SSB. *Active* true peak reading lighted Cross-Needle SWR Wattmeter, *QRM-Free PreTune*™, antenna switch, dummy load, 4:1 balun, Lexan front panel. $3^{1}/_{2}$Hx$10^{1}/_{2}$Wx$9^{1}/_{2}$D inches.

MFJ-949E *deluxe* 300 Watt Tuner

More *hams use MFJ-949s than any other antenna tuner in the world!*

MFJ-949E **$179.95**

Handles 300 Watts. Full 1.8 to 30 MHz coverage, custom inductor switch, 1000 Volt tuning capacitors, *full size* peak/average lighted Cross-Needle SWR/Wattmeter, 8 position antenna switch, dummy load, *QRM-Free PreTune*™, scratch proof Lexan front panel. $3^{1}/_{2}$Hx$10^{5}/_{8}$Wx7D inches. **MFJ-948, $139.95.** Economy version of MFJ-949E, less dummy load, Lexan front panel.

MFJ-941E *super value* Tuner

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-941E **$139.95**

MFJ-945E HF/6M *mobile* Tuner

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-945E **$129.95**

MFJ-971 *portable/QRP* Tuner

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-971 **$119.95**

MFJ-901B *smallest* Versa Tuner

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-901B **$99.95**

MFJ-902 *Tiny Travel* Tuner

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-902 **$99.95**

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

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-16010 **$69.95**

MFJ-906/903 *6 Meter* Tuners

MFJ-906 has lighted Cross-Needle SWR/Wattmeter, bypass switch. Handles 100 W FM, 200W SSB.

MFJ-906 **$99.95**

MFJ-903, $69.95, Like MFJ-906, less SWR/Wattmeter, bypass switch.

MFJ-921/924 *VHF/UHF* Tuners

MFJ-921 covers 2 Meters/220 MHz. **MFJ-924** covers 440 MHz. SWR/Wattmeter. 8x$2^{1}/_{2}$x3 in.

MFJ-921/924 **$89.95**

MFJ-931 *artificial* RF Ground

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.

MFJ-931 **$109.95**

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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 *High Current* DC Multi-Outlet Strips

Choose super versatile 5-way binding posts AND/OR Anderson PowerPole(R) connectors

Anderson PowerPole® is a registered trademark of Anderson Power Products.

Provide multiple high current DC outlets for transceivers and accessories from your main 12 VDC power supply – keeps you neat, organized and safe. Prevents fire hazard. Keeps wires from tangling up and shorting. Outlets are fused and RF bypassed.

All MFJ DC power strips have *built-in* six foot, eight gauge, flexible color-coded cable with ring tongue terminals -- *no extra cost*. *RF-tight* aluminum cabinet has mounting ears and ground post with wing nut.

Choose MFJ's *super versatile* super heavy duty 5-way binding posts (spaced for standard dual banana plugs) and/or *Anderson PowerPole®* outlets.

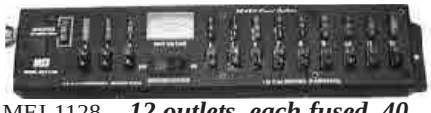
Each *Anderson PowerPole®* is individually fused as needed. Standard color coded automobile fuses plug in externally. Extra *PowerPole®* connectors, contacts, fuses are included at *no extra cost.*

Versatile 5-Way Binding Posts

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 with master fuse, ON/OFF switch, and "ON" LED provide 15 Amps for accessories. 12½x2¾x2½ in.

All PowerPoles®



MFJ-1128
$104.95

12 outlets, each fused, 40 Amps total. Three high-current outlets for transceivers. Nine *switched* outlets for accessories. Mix and match in-cluded fuses as needed (one-40A, one-25A, four-10A, four-5A, three-1A fuses installed). *Built-in 0-25 VDC Voltmeter*. Includes *extra* 12 pairs of *PowerPole®* contacts and *extra* 10 fuses (2 each: 1, 5, 10, 25, 40A) -- *no extra cost*. 12Wx1¼Hx2¾D in.

MFJ-1126
$84.95

8 outlets. each fused, 40 Amps total. Factory installed fuses: two 1A, three 5A, two 10A, one 25A, one 40A. *Built-in 0-25 VDC Voltmeter*. Includes *extra* 6 pairs of *Anderson PowerPole®* contacts and *extra* 5 fuses (1, 5, 10, 25, 40A) -- *no extra cost*. 9Wx1¼Hx2¾ inches.

PowerPoles® AND 5-Way Binding Posts

MFJ-1129
$114.95

The best of both worlds! ***10 outlets, each fused, 40 Amps total.*** Three high-current outlets for rigs -- 2 *PowerPoles®* and 1 versatile high-current 5-way binding post. Seven *switched* outlets for accessories (20A max) -- 5 *PowerPoles®* and 2 versatile binding posts. Mix and match included fuses as needed (1- 40A, 2-25A, 3-10A, 3-5A, 2-1A installed). *Built-in 0-25 VDC Voltmeter*. Includes *extra* 7 pairs of *PowerPole®* contacts, and 10 fuses (2 each,1,5,10, 25, 40A) -- *no extra cost*.12½Wx1¼Hx2¾D in.

MFJ-1124
$64.95

6 outlets, each fused, 40 Amps total. Four *PowerPoles®* and two high-current 5-way binding posts, Installed fuses: 1-40A, 2-25A, 2-10A, 1-5A, 1-1A. Includes 4 pair *PowerPole®* contacts, and 5 fuses -- *no extra cost*.

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Hold near your receiver -- it instantly displays CW in English!

Automatic Speed Tracking . . . Instant Replay . . . 32 Character LCD . . . High-Performance Modem . . . Computer Interface . . . Battery Saver . . .

MFJ-461
$89.95

Is your CW rusty?

Relax and place this tiny pocket size MFJ Morse Code Reader near your receiver's speaker . . .

Then watch CW turn into solid text messages as they scroll across an easy-to-read LCD display.

No cables to hook-up, no computer, no interface, nothing else needed!

Use it as a backup in case you miscopy a few characters - - it makes working high speed CW a breeze - - even if you're rusty.

Practice by copying along with the MFJ-461. It'll help you learn the code and increase your speed as you instantly see if you're right or wrong.

Eavesdrop on interesting Morse code QSOs from hams all over the world. It's a universal language that's understood the world over.

Automatic Speed Tracking

MFJ *AutoTrak*™ automatically locks on, tracks and displays CW speed up to 99 Words-Per-Minute.

Simply place your MFJ-461 close to your receiver speaker until the lock LED flashes in time with the CW.

Four Display Modes

1. Bottom line scrolls and fills with text, then that entire line is displayed on top line until bottom line refills -- makes reading text extra easy! Automatically displays speed in WPM.

2. Same as **1**, without speed display -- gives you maximum text display.

3. Top line scrolls, bottom line displays speed in Words-Per-Minute.

4. Both top and bottom lines scroll.

Two-line LCD display has 32 large 1/4 inch high-contrast characters.

MFJ Instant Replay

The last 140 characters can be instantly replayed. This lets you re-read or check your copy if you're copying along side the MFJ-461.

High Performance Modem

Consistently get solid copy from MFJ's high performance *PLL* (*phase-lock loop*) modem. Digs out weak signals. Even tracks slightly drifting signals.

Of course, nothing can clean up and copy a sloppy fist, especially weak signals with lots of QRM/QRN.

Computer Interface

The MFJ-461's serial port lets you display CW text full screen on a bright computer monitor -- just use your computer serial port and terminal program.

More Features

When it's too noisy for its microphone pickup, you can connect the MFJ-461 to your receiver with a cable.

Battery saving feature puts MFJ-461 to sleep during periods of inactivity. It wakes up and decodes when it hears CW.

Uses 9 Volt battery (not included).

True Pocket Size

Fits in your shirt pocket with room to spare - smaller than a pack of cigarettes. Tiny $2^1/_4$x$3^1/_4$x1 in. $5^1/_2$ ounces.

No Instruction Manual needed!

Super easy-to-use! Just turn it on -- it starts copying instantly!

Accessories

MFJ-26B, $9.95. Soft leather protective pouch. Clear plastic overlay for display, push button opening, strong, pocket/belt clip secures MFJ-461.

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MFJ-5163, $10.95. Cable lets you use external speaker when MFJ-461 is plugged into radio speaker jack. 3.5 mm.

MFJ *Pocket* Morse Tutor

MFJ-418
$89.95

Learn Morse code anywhere with this tiny *MFJ Pocket-sized Morse Code Tutor*™! Practice copying letters, numbers, prosigns, punctuations or any combination or words or QSOs. Follows ARRL/VEC format. Start at zero code speed and end up as a high speed *CW Pro!* LCD, built-in speaker.

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MFJ-557
$39.95

MFJ-557 Deluxe Code Practice Oscillator has a Morse key and oscillator unit mounted together on a heavy steel base -- stays put on your table! Portable. 9-Volt battery or 110 VAC with MFJ-1312D, $15.95. Earphone jack, tone and volume controls, speaker. Adjustable key. Sturdy. $8^1/_2$x$2^1/_4$x$3^3/_4$ inches.

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Built-in Iambic Paddle. Thumbwheel speed control. Adjustable weight. Adjustable sidetone with speaker. Iambic modes A or B. Fully automatic or semi-auto "bug" mode. Reversable paddle. Tune mode. RF-proof. Battery Saver. Tiny $2^1/_4$Wx$3^1/_4$H x1D inches.

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MFJ *Speech Intelligibility* Enhancer

. . . makes barely understandable speech highly understandable!

MFJ-616
$189.95

"What did you say?" ***Can you hear but . . . just can't always understand everything people are saying?***

As we get older, high frequency hearing loss reduces our ability to understand speech. Here's why . . .

Research shows that nearly *half* the speech intelligibility is contained in 1000 to 4000 Hz range, but contains a miniscule 4% of total speech energy.

On the other hand, the low frequencies, 125 to 500 Hz have most of the speech energy (55%) but contribute very little to intelligibility -- only 4%.

To dramatically improve your ability to understand speech, you must:

First, drastically increase the speech energy above 500 Hz, where 83% of the speech intelligibility is concentrated.

Second, drastically reduce speech energy below 500 Hz where only 4% of speech intelligibility lies.

The MFJ-616 splits the audio speech band into four overlapping octave ranges centered at 300, 600, 1200 and 2400 Hz. You can boost or cut each range by nearly 20 dB.

A balance control and separate 2½ Watt amplifiers let you equalize perceived loudness to each ear so both ears help.

By boosting high and cutting low frequencies and adjusting the balanced control, speech that you can barely understand become highly understandable!

Even if you *don't* have high frequency hearing loss, you'll dramatically improve your ability to understand speech. You'll get an edge in contesting and DXing and enjoy ragchewing more.

Here's what *QST* for April, 2001 said . . . *"I expected a subtle effect at best, but I was astonished . . . The result was remarkably clean, understandable speech without hissing, ringing or other strange effects . . . made a dramatic improvement . . ."*

Immuned to RFI. Has phone jack, on/off speaker switch, 2 inputs, bypass switch. 10Wx2½Hx6D". Needs 12 VDC.

MFJ-1316, $21.95. For 110 VAC operation. Provides 12 VDC/1.5 Amps.

MFJ-72, $69.80. *All-in-one MFJ-616 Accessory Pack.* Includes MFJ-392 headphones, two MFJ-281 speakers and MFJ-1316 power supply. ***Save $7!***

Try it for 30 Days

Order from MFJ and try it -- No obligation. If not delighted, return it within 30 days for refund less shipping.

MFJ Contest Voice Keyer

Transformer-coupled -- No RFI, hum or feedback . . . 75 seconds total, 5-messages . . . Records received audio . . .

MFJ-434B
$199.95

Let this *new* microprocessor controlled MFJ *Contest Voice Keyer*™ call CQ, send your call and do contest exchanges for you in your own natural voice!

Store frequently used phrases like "CQ Contest this is AA5MT", "You're 59" . . . "Qth is Mississippi" . . . Contest by pressing a few buttons and save your voice.

Record and playback 5 natural sounding messages in a total of 75 seconds. Uses *eeprom* -- no battery backup needed. Use your mic or its built-in mic for recording.

You can repeat messages continuously and vary the repeat delay from 3 to 500 seconds. Makes a great voice beacon and calling CQ is *so* easy.

You can also record and play back off-the-air signals -- great help if you didn't get it right the first time! No more "*Please repeat*".

A playing message can be halted by the *Stop Button*, your microphone's PTT/VOX, remote control or computer.

Has jack for remote or computer control (using CT, NA or other program). Lets you select, play and cancel messages.

Your mic's audio characteristics do not change when your MFJ-434B is installed.

All audio lines are RF filtered to eliminate RFI, audio feedback and distortion. An audio isolation transformer totally eliminates hum and distortion caused by ground loops.

New! **It's** easy to use -- just plug in your 8 pin round or modular mic plug, set the internal jumpers for your transceiver and plug in the appropriate (included) cable for your rig.

Built-in speaker-amplifier. Speaker/phone jack. Use 9 Volt battery, 9-15 VDC or 110 VAC with optional MFJ-1312D, $15.95. 6½Wx2½Hx6½D in.

MFJ-73, $34.95. MFJ-434B Remote Control with cable.

60 dB Null ***wipes out*** noise and interference

MFJ-1026
$199.95

Wipe out noise and interference *before* it gets into your receiver with a 60 dB null!

Eliminate all types of noise -- severe power line noise from arcing transformers and insulators, fluorescent lamps, light dimmers, touch controlled lamps, computers, TV birdies, lightning crashes from distant thunderstorms, electric drills, motors, industrial processes . . .

It's *more effective* than a noise blanker! Interference much stronger than your desired signal can be completely removed without affecting your signal.

It works on *all modes* -- SSB, AM, CW, FM -- and frequences from BCB to lower VHF.

You can null out strong QRM on top of weak rare DX and then work him! You can null out a strong local ham or AM broadcast station to prevent your receiver from overloading.

Use the MFJ-1026 as an *adjustable phasing network*. You can combine two antennas to give you various directional patterns. Null out a strong interfering signal or peak a weak signal at a push of a button.

Easy-to-use! Plugs between transmitting antenna and transceiver. To null, adjust amplitude and phase controls for minimum S-meter reading or lowest noise. To peak, push reverse button. Use built-in active antenna or an external one. MFJ's exclusive *Constant Amplitude Phase Control*™ makes nulling easy.

RF sense T/R switch automatically bypasses your transceiver when you transmit. Adjustable delay time. Uses 12 VDC or 110 VAC with MFJ-1312D, $15.95. 6½x1½x6¼ in.

MFJ-1025, $179.95. Like

MFJ-1026 less built-in active antenna, use external noise antenna.

MFJ ***tunable*** Super DSP filter

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Only MFJ gives you *tunable* and *programmable* "brick wall" DSP filters.

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Use sound card and rig for all digital modes!

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MFJ1275/M/T

$109.95

New!

Includes AC power supply, RS-232 cable!

Plug this new MFJ-1275/M/T sound card interface between your transceiver and computer and enjoy operating all digital modes.

Everything you need is included -- software, audio cables, RS-232 serial cable and AC power supply.

Provides fully automatic operation with audio and push-to-talk control. It matches sound card audio, eliminates ground loops and provides microphone override.

Models available for all transceivers with 8-pin round, 8-pin modular (RJ-45) or 4-pin round microphone plugs.

Operate PSK-31, packet, APRS, AMTOR, RTTY, SSTV, CW, high speed CW Meteor Scatter and many others. Also use as Contest Voice Keyer and CW Contest Memory Keyer.

Digital Modes or Normal Operation

Select the ON digital mode -- all connections are made between your rig and computer for instant digital operation.

Select BYPASS normal mode -- your transceiver and computer connections are restored for their normal operation.

Audio Isolation Transformers

Audio isolation transformers and relay eliminate ground loops, audio hum, noise and distortion.

RFI-Proof

Extensive RF suppression and line isolation eliminates RF feedback problems.

Automatic Microphone Override

Transmit mic audio at any time by pressing PTT to override digital modes -- great for SSTV and Contest Voice Keyer.

More Impressive Features

Serial port -- lets computer control radio to override/interrupt digital transmissions.

VOX Control -- lets you use VOX control when not using computer serial port control.

Level Controls -- for transmitter drive and for receiver-to-sound card drive level. No need to adjust microphone gain or sound card level when you change modes.

Stereo or Mono Audio Input -- A front panel switch selects left, right, or both sound card audio output channels to accommodate various programs.

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Use any Transceiver

Internal jumpers program microphone wiring for any brand or model radio -- no soldering required. Order **MFJ-1275** for 8-pin *round* mic plug. Order **MFJ-1275M** for 8-pin *modular* mic (RJ45) plug.

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Plug and Play!

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- **Headphone Jack:** Use your stereo headphones so you won't disturb your XYL (also turns off external speaker).
- **Footswitch:** Use footswitch or other for PTT (push-to-talk) when not using VOX.

Plug and Play! Includes software CD, RS-232 and audio cables, AC power supply.

Order MFJ-1279 for 8-pin round mic, MFJ-1279M for 8-pin modular (RJ-45) mic, MFJ-1279T for 4-pin round mic.

Add "X" suffix for 220VAC.

Basic Digital Interface

New!

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You'll find tons of uses!

Tune up your transceiver, linear amplifier or antenna tuner into a safe 50 Ohm dummy load at *full power*. Then instantly switch to your antenna and monitor SWR, forward and reflected power.

Use for testing/tuning transmitters, transceivers, amplifiers, antenna tuners, baluns, transformers, filters, matching networks, coax, stubs, transmission lines and antennas.

The 50-Ohm dry dummy load works DC to 60 MHz. SWR is below 1.3:1 at 30 MHz. Can handle 100 Watts for ten minutes or 1500 Watts for ten seconds. Comes with power derating curve.

Extra-large three-inch lighted Cross-Needle meter reads SWR (1:1 to 8:1), forward and reflected power *simultaneously*.

Reads *true peak* PEP or average power on 300/3000 Watts forward and 60/600 Watts reflected power ranges 1.8-54 MHz.

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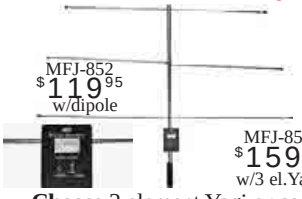

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JTPS14

14 amp max, 12 amp continuous power supply.

13.8 VDC, 14 Amp Surge 12 Amp Continuous, Voltage and Current meters, Voltage adjust 9-15VDC, Light Weight, only 2.7 lbs!, Compact, only 6.5" x 5.75" x 2.25", Over voltage protection, Over current protection, Quiet internal cooling fan with auto/on fan switch Switchable, AC input voltage, 115 or 230 Vac AC line fuse (3 amps for 230V, 6 amps for 115V)

JTPS28

28 amp max, 25 amp continuous power supply.

28 amps max, 25 amps continuous at 13.8 Vdc, Light weight, only 4 lbs!, Compact, only 7" x 2.25" x 8", Five way binding post for high current radios, Quick connectors for low current accessories, Over voltage protection, Over current protection, Quiet internal cooling fan with "fan on" LED, Switchable AC input voltage, 110 or 220 Vac, AC line fuse (5 amps)

JTPS28M

28 amp max, 25 amp continuous power supply.

28 amps max, 25 amps continuous, adjustable 9-15VDC, Volt and current meters, Light weight, only 4 lbs!, Compact, only 5.75" x 4.5" x 7", Five way binding post for high current radios, Quick connectors for low current accessories, Over voltage protection, Over current protection, Quiet internal cooling fan with "fan on" LED, Switchable AC input voltage, 110 or 220 Vac, AC line fuse (5 amps)

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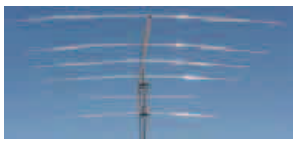

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1.500"	.058"	$2.25
1.625"	.058"	$2.55
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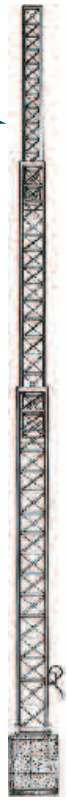

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