QST

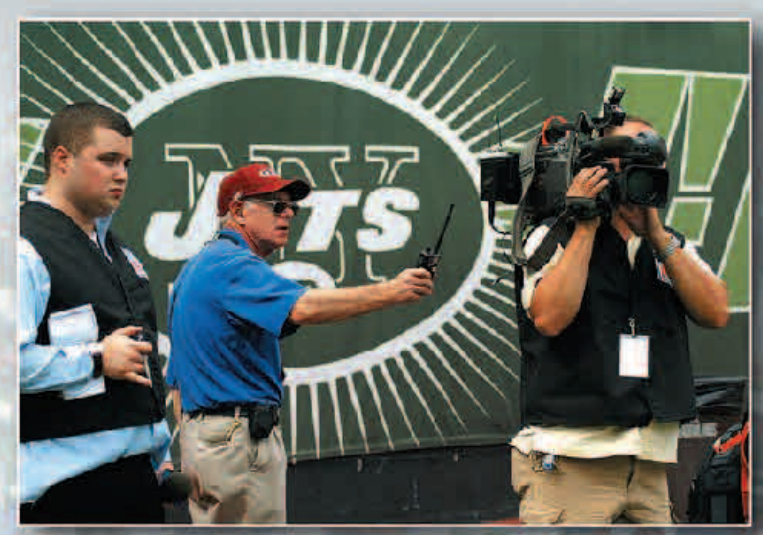
Official Journal of ARRL The national association for AMATEUR RADIO

Devoted entirely to **Amateur Radio**

www.arrl.org

November 2007

On-Field Hams Assist During Game Day



QST reviews:

ICOM IC-2820H
Dual Band FM Transceiver

Kenwood TM-V71A
Dual Band Mobile Radio

Inside:

A Comparison of HF Mobile Antenna Designs

Build a Sideband Transceiver

Extend the Range of your Handheld Transceiver

$4.99 US $6.99 can.

11>

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Time for a contest station upgrade?

NEW IC-7700
The new "run rig" of choice...

IC-756PROIII
...to go along with your trusted spotting receiver.

What a nice compliment.

ICOM®

*This device has not been approved by the FCC. This device may not be sold or leased, or be offered for sale or lease, until approval by the FCC has been obtained.

Bringing the world to your desktop.

Your car dash. Kitchen table. Flybridge.

Rec room. Office cubicle. Hotel room.

Vacation home. Ham shack. Cockpit.

IC-PCR1500

- 0.01 ~ 3299.99 MHz***
- AM, FM, WFM, CW, SSB
- Record and Save Audio as .WAV File
- USB Cable Connection
- Optional DSP

IC-PCR2500

- 0.01 ~ 3299.99 MHz*** (Main)
  50 to 1300 MHz*** (Sub)
- AM, FM, WFM, CW, SSB
- Optional APCO 25 and D-STAR
- Dual Wideband Receivers
- Dual Watch PC window

Icom black box receivers

It all starts with a little black box. Plug it in to your PC or opt for one of the remote head versions. Whichever way you go, go with Icom wide-band!

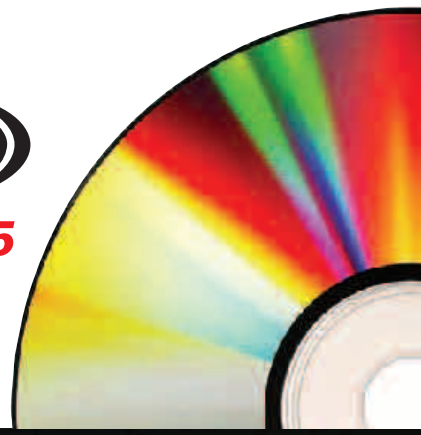
IC-R1500

- 0.01 ~ 3299.99 MHz***
- AM, FM, WFM, CW, SSB
- Single Receiver
- Mobile or PC Controlled

IC-R2500

- 0.01 ~ 3299.99 MHz*** (Main)
  50 to 1300 MHz*** (Sub)
- AM, FM, WFM, CW, SSB
- Dual Wideband Receiver
- Mobile or PC Controlled
- Optional APCO 25 and D-STAR
- Dual Receiver Diversity

Bonito



Now bundled with RadioCom 4.5

Icom's black box radios now come bundled with Bonito's RadioCom 4.5. With Radio-Control, Equalizer-Filter-Analyzer, AudioRecorder, RTTY-, CW-, WFAX-, SatFax, SSTV-, PSK- and Time Signal Decoding, Frequency- and Schedule-Manager, as well as SatTracking...(whew), you have EVERYTHING in one program.

THE WORLD IN YOUR HAND:

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ADVANCED OPS
0.150 – 3304.0 MHz***

IC-R5
SHIRT-POCKET COMPACT
0.5 – 1300.0 MHz***

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

hy-gain® ROTATORS

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

HAM-IV

HAM-IV
$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!

UNIVERSAL LIP MOUNTS WITH COAX CABLE COMBINATIONS

Several mounts with coax combos are available to chose from depending on your vehicles available mounting space and antenna size.

No holes to drill, held securely in place with set screws and adjust in multiple planes. Attach to virtually any lip edge that is 1/4" thick or less: trunk lids, van doors, SUV doors, truck doors, hoods, etc...

Deluxe low loss cable assy included for easy entry thru the weather seal without causing water leaks, wind noise, and/or cable damage.

Max power: HF 200W
VHF 75W
UHF 50W

Combine the coax style and length you need with a bracket from below.
(assemblies also available with N-connectors)

COMET
3D5M / 3D4M
Standard low loss cable assy.
Gold plated SO-239 / PL-259 connectors.
3D5M length 16' 6"
3D4M length 13'

COMET
CK-3M5 / CK-3M
Deluxe low loss cable assy.
Includes 18" of mini RG-188A/U type coax for easy entry from a lip mount without causing water leaks, wind noise or coax damage.
CK-3M5 length: 16'6"
CK-3M length: 9'9"

Choose the bracket that best fits your antenna and vehicle. All have multiple adjustments and fit virtually any lip 1/4" thick or less. Soft rubber protects vehicle finish.

For small antennas & limited space

MODEL / ANT CONN / COAX CONN
Maldol EM-5M SO-239 / PL-259

Footprint: 1.1"x .75"
(Less than 1 sq inch!)
Max Antenna: 40"

For medium size antennas

MODEL / ANT CONN / COAX CONN
COMET CP-5M SO-239 / PL-259
COMET CP-5NMO NMO / PL-259

Footprint: 3.4" x 1.25"
Max Antenna: 60"

For tall or multi-band HF antennas

MODEL / ANT CONN / COAX CONN
COMET HD-5M SO-239 / PL-259
COMET HD- 5 3/8-24 3/8-24 / PL-259

Footprint: 3.75" x 1.1 "
Max antenna: 80"

COMET
RS-840
Heavy-duty, 2 adjustment planes. For HF and heavier antennas up to 80".

COMET
RS-730
Heavy-duty, 4 adjustment planes, up to 60" antenna.

COMET
RS-720 / RS-720NMO
Med-duty, 3 adj planes, 60" ant.
RS-720: Accepts SO-239 conn
RS-720NMO: Accepts NMO conn

COMET
RS-520
Light-duty, 3 adjustment planes, up to 45" antenna.

Maldol
PRM-T
Heavy-duty, 3 adjustment planes, up to 80" antenna.

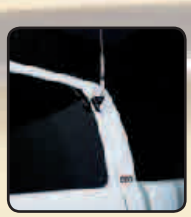
Maldol
MK-30H
12VDC motorized mount. Mounts to vertical or horizontal door lip. Up to 70"/19 oz. antenna.

Maldol
EM-B80
Light-duty, 2 adjustment planes, up to 40" antenna.

COMET
GRB-5M
Trunk lip mount, low-profile,black anodized stainless steel. Offset washers provide up to 17 deg. vertical adjustment of antenna.16'9" of deluxe cable included, 18" of mini RG-188A/U style coax for easy entry thru the weatherseal. Gold-plated SO-239/ PL-259 connectors.

COMET
CP-5M
Universal lip mount with coax, SO-239 andPL-259 connectors.

The rear doors on newer trucks are the perfect place to mount antennas • No holes to drill • Above roof line • Easy access • When mounting to a van, SUV, truck, etc., use the CP-5M or build your own system with components shown above. There are several mount sizes, coax diameters and coax lengths from which to choose.



COMET and Maldol Mobile

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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Contents

This Month in QST

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Technical

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.

Membership without *QST* is available to the immediate family of a member living at the same address, and to anyone who is legally blind, for $8 per year.

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QST is available to blind and physically handicapped individuals on audio cassette from the Library of Congress, National Library Service for the Blind and Physically Handicapped. Call 1-800-424-8567.

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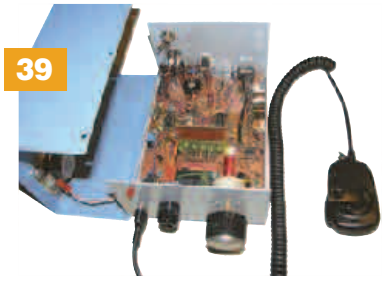
QST Workbench

Operating



OUR COVER
Are you ready for some football? The NFL Game Day Frequency Coordinators are — it's their job to coordinate and manage the almost 200 frequencies in use on the 120 yard field at an NFL game. To do this job, you need to know a lot about RF, so it's no wonder that many hams are GDCs. ARRL News Editor S. Khrystyne Keane, K1SFA, attended the New York Jets season opener against the New England Patriots in September as a guest of Jets GDC Steve Mendelsohn, W2ML; her story is on page 55. In the photo, Patriots quarterback Tom Brady readies his team during the game. *Inset:* Mendelsohn tries to pinpoint some RFI by using his frequency counter to discover just what frequency this cameraman is using. Photos by S. Khrystyne Keane, K1SFA.

Departments

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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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http://www.vertexstandard.com

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:

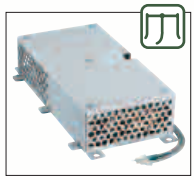
- **CONTOUR Control Operation**
  The Contour filtering system provides a gentle shaping of the filter passband.
- **Manual NOTCH**
  Highly-effective system that can remove an interfering beat tone/signal.
- **Digital Noise Reduction (DNR)**
  Dramatically reduces random noise found on the HF and 50 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

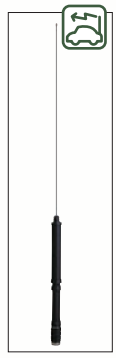
The rugged aluminum die-cast chassis with cooling fan

■ 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

For the latest Yaesu news, visit us on the Internet:
http://www.vertexstandard.com

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

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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.

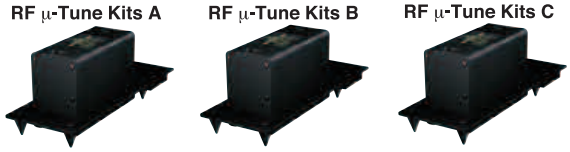
HF/50 MHz Transceiver
FT-2000D
200 W Version
(External Power Supply)

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.

For the latest Yaesu news, visit us on the Internet:
http://www.vertexstandard.com

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

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Public Service

Advocacy

Education

Membership

"It Seems to Us"

Where Do You Stand?

"This month I am asking for a few minutes of your time so I may tell you where the ARRL stands on defending your access, as a licensed radio amateur, to the radio spectrum. Then I am going to ask you a question: Where do you stand?"

It's easy to say where the ARRL stands. **The ARRL stands up for Amateur Radio whenever and wherever needed.**

Are we effective? Yes, we are. But you don't have to take my word for it. Listen to Michael Gallagher, the new head of the Entertainment Software Association.

In July Mr Gallagher was interviewed by Reuters about the problems he faced defending his industry. He said that video game enthusiasts could help by emulating Amateur Radio operators. **"They are passionate, they are heard and they are accommodated. If there is one group to look at and say: 'It can be done,' simply look at the Amateur Radio community,"** he told Reuters.

Here is what led him to hold the Amateur Radio community in such high regard, and why his opinion matters.

In 2001 Michael Gallagher was appointed Deputy Assistant Secretary for Communications and Information in the Department of Commerce. This is the #2 position in the National Telecommunications and Information Administration (NTIA), the agency responsible for administering the federal government's use of the radio spectrum. In 2003 he took charge of the NTIA as Acting Assistant Secretary and held the position of Assistant Secretary and NTIA Administrator from 2004 to 2006.

From that vantage point he observed the ARRL's preparations for the 2003 World Radiocommunication Conference, WRC-03, where Amateur Radio made important gains — including an unprecedented reallocation of broadcasting spectrum at 7 MHz in Regions 1 and 3 (the entire world outside the Americas). He also was on the receiving end of ARRL lobbying on the issue of radio interference from broadband over power line (BPL) systems.

I and other ARRL representatives met with Mr Gallagher several times while he was at the NTIA. He was obliged to uphold an administration policy of encouraging BPL in the face of mounting evidence that it would contribute *nothing* to reaching the administration's stated goal of "universal, affordable access to broadband technology by the year 2007." The ARRL's concern was not whether BPL ultimately succeeded or failed, but whether the administration would fulfill its obligation to ensure that BPL systems — if and when they were deployed — would not pollute the radio spectrum.

Apparently, our lively discussions made an impression.

Michael Gallagher is right — we *are* passionate. But passion is not enough. We must also be patient, because spectrum defense is a never-ending mission. We must be resolute, and not discouraged by the occasional setback. We must be creative, seeking alternate paths to success. Above all, we must be accurate. Credibility is a precious commodity that is too easily lost.

The BPL interference issue is a good example of how the ARRL works on all fronts to protect Amateur Radio.

It was five years ago, on this page in October 2002, that we first identified BPL as a potential source of "radio smog." Since then we have fought for stronger protection against BPL interference in the FCC's rules, and when the FCC failed to go far enough we took them to court — a huge but necessary financial commitment. We have taken our case to Congress, seeking legislation directing the FCC to do a serious study of the interference issue. We have done our technical homework, verifying the inadequacy of the FCC's rules and documenting violations by irresponsible BPL companies.

But we also have cooperated with reputable firms, helping them to understand the seriousness of the issue and the steps they need to take to avoid problems with radio amateurs. We've made some important gains on that front — no thanks to the FCC, which (unlike many in the BPL industry) remains more interested in defending its early errors than in correcting them.

As an ARRL member and a supporter or potential contributor to the ARRL Spectrum Defense Fund, you are an essential part of the team. Because of members and supporters like you, the ARRL is able to stand up for Amateur Radio — just as the League has done since its founding nearly a century ago.

The Spectrum Defense Fund is the major source of revenue that is restricted to funding these activities. When you make your contribution of whatever amount fits into your budget, you can be sure that your contribution is spent on these, and only these activities. If you've checked the ARRL audited financial statements that we post on the ARRL website each year, you know that the expenses attached to protecting our frequencies are never fully funded by the Spectrum Defense Fund. Membership dues and other revenues cover the rest. In fact, every penny of income the ARRL receives is devoted to the protection, promotion and advancement of Amateur Radio. It's why the League was created in 1914 and why it exists today.

The year ahead will be another challenging one. In 2008 we will begin preparing for the 2011 World Radiocommunication Conference, addressing the agenda items that will be selected at WRC-07 this fall. We will continue to defend our spectrum access against reallocation as well as against the insidious threats posed by unlicensed devices and systems such as BPL. As we lay plans to work on your behalf to protect our frequencies both at home and abroad, I hope that we can count on your voice and your support for the Spectrum Defense Fund and the comprehensive program the Fund supports, year after year. Please visit **www.arrl.org/defense** to make your contribution.

Will you stand with your ARRL? I hope you will.

David Sumner, K1ZZ
ARRL Chief Executive Officer

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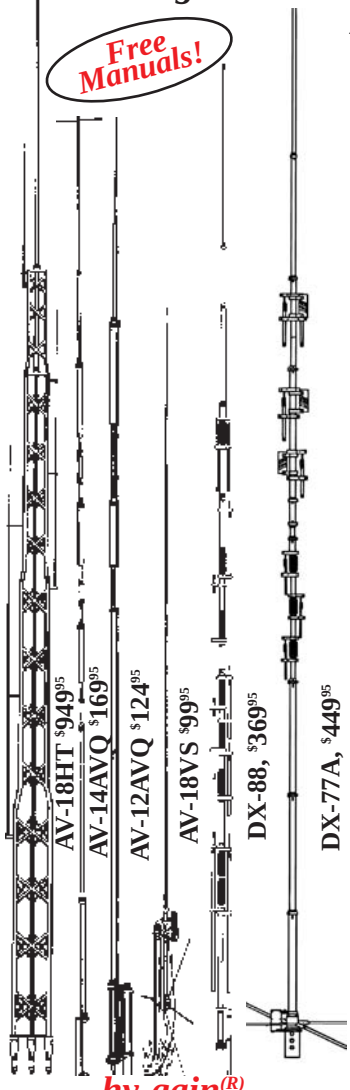

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AV-14AVQ	**$169.95**	**10,15,20,40**	**1500 W PEP**	**18 feet**	**9 pounds**	**80 MPH**	**1.5-1.625"**
AV-12AVQ	$124.95	10,15,20 M	1500 W PEP	13 feet	9 pounds	80 MPH	1.5-1.625"
AV-18VS	**$99.95**	**10 - 80 M**	**1500 W PEP**	**18 feet**	**4 pounds**	**80 MPH**	**1.5-1.625"**
DX-88	$369.95	10 - 40 M	1500 W PEP	25 feet	18 pounds	75 mph no guy	1.5-1.625"
DX-77A	**$449.95**	**10 - 80 M**	**1500 W PEP**	**29 feet**	**25 pounds**	**60 mph no guy**	**1.5-1.625"**

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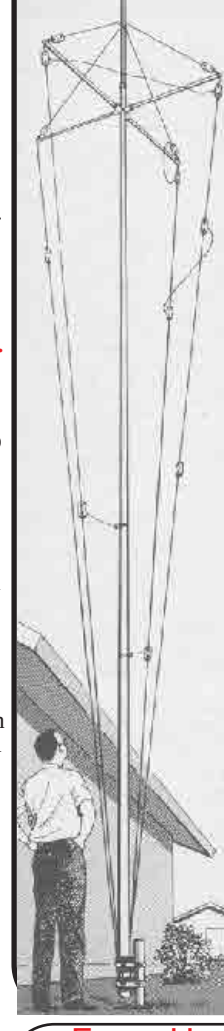

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This Just In

Joel P. Kleinman, N1BKE
jkleinman@arrl.org

In Brief

- Arkansas congressman Mike Ross, WD5DVR, was a featured speaker at the ARRL Arkansas State Convention on September 8.
- IARU Region 2 held its 16th General Assembly in Brasilia, Brazil.
- Al Ward, W5LUA, of Allen, Texas, became the first to earn the ARRL's Worked All States Award on 1296 MHz, making him 1296 MHz WAS #1.
- ARRL Delta Division Director Henry Leggette, WD4Q, has received a Lifetime Achievement Award from the Mississippi Valley State University National Alumni Association.
- The Information Systems Technology group, part of NATO's Research and Technology Organization, released a report that "address[es] the concerns raised by the potential for unintentional radio interference to be caused by the widespread operation of broadband wire-line telecommunications systems."
- The FCC's Dallas Field Office issued *Citation*s on July 25 to two utilities in a longstanding power line noise case in Lubbock, Texas.
- The winner of the *QST* Cover Plaque Award for August is L.B. Cebik, W4RNL, for his article "A Short Boom, Wideband 3 Element Yagi for 6 Meters."
- The following online courses are to begin in October: Technician License Course (EC-010), Amateur Radio Emergency Communications Level 1 (EC-001), Radio Frequency Interference (EC-006), Antenna Design and Construction (EC-009), Analog Electronics (EC-012) and Digital Electronics (EC-013).
- MFJ Enterprises observed their 35th anniversary with "A Day in the Park" open house September 7-8 at their Starkville, Mississippi headquarters.
- Several ARES groups were activated as Hurricane Humberto, a Category 1 hurricane and the first hurricane to make landfall in the US in two years, came ashore in Texas September 13.
- The Hurricane Watch Net secured operations September 4 after more than 20 hours of operation with Hurricane Felix, which slammed into Nicaragua and Honduras as a Category 5 hurricane.
- Record rainfall and resultant flooding and mudslides in southeastern Minnesota disrupted communications and prompted emergency response officials to call upon Amateur Radio Emergency Service (ARES) groups for communications assistance.
- Michigan's Genesee County ARES and SKYWARN were activated due to a severe thunderstorm watch that resulted in two tornados that caused severe damage to several towns.
- The FCC reduced the regulatory fee to obtain or renew an Amateur Radio vanity call sign by more than 40 percent effective September 17. The new fee is $11.70.
- Dakota Division Vice Director Twila Greenheck, NØJPH, has resigned her position effective October 1.
- Working with ARRL Media Relations Manager Allen Pitts, W1AGP, Cliff Segar, KD4GT, of Rockwood, Tennessee, has installed a message promoting Amateur Radio on a billboard on his property.
- September featured the ARRL September VHF QSO Party, the 10 GHz and Up Contest and the International EME Competition (2304 MHz and up). The School Club Roundup will be held October 15-19, and the 50-1296 MHz part of the EME Competition will be October 27-28.

Media Hits

Allen Pitts, W1AGP

The Public Information Officers of the ARRL did not take vacations in late summer of 2007 but churned out many excellent media hits. Grouping the piles on my desk by topic showed an interesting story in itself.

- *Newszap.com* (AZ) published an article by Dave Casadei on September 3 reporting on the complaints of some Sun City residents about having ham radio antennas on the roof of area homes. Casadei's article showed that not only were the hams acting legally and in compliance with local laws and FCC rules, but they provide critical services to the community.
- The importance of having Amateur Radio operators around your community in a crisis (antennas and all) became a major issue further north. Bill McAuliffe of the *Star Tribune* (Minneapolis, MN) wrote of the storm spotting work of the West Metro Skywarn for the NWS on August 22. Just three days later the lead lines of the Savage Pacer (Savage, MN) were "Local volunteers help flood victims" and the excellent work of Scott County ARES in the flood-stricken areas of Minnesota. The ARES group's emergency work was also praised in the front of the August 30 Burnsville *Sun-Courant.*
- Meanwhile, much of the country kept their eyes on the Caribbean to see if another hurricane was coming this season. No one is taking the threat lightly, and there were several stories such as WPTV-CH5 (West Palm Beach, FL) video news story of September 4, "South Florida hams provide vital link for hurricane victims."
- Other national level news about Amateur Radio came out of Texas in unexpected ways. First were stories such as KCBD-TV's (Lubbock) August 27 report on powerline noise and Bryan Edwards, W5KFT. After trying to get resolution since 1994, Edwards was able to get the FCC involved. He also did an excellent PR job by showing linkages of the noise to the interference problems experienced by non-ham residents in addition to any ham radio troubles.
- Texas scored national media attention a second time by acting on the ban of Amateur Radio in school classrooms. James Alderman's writing in *The Dallas Morning News* August 30 not only spoke about the ban itself, but went into detail about the use of Amateur Radio in teaching science. The article may not have gotten the name of the ARRL quite correct, but it was a very positive piece that was noticed.
- One media hit is still "in play" as this is being written. September has been proclaimed as "National Preparedness Month" by the DHS and they have provided a swarm of PR materials useful to clubs and groups. In addition, just in time for "Amateur Radio Awareness Day" on September 15, Al Tomkins of *Poynter Online* gave a major plug for Amateur Radio directly to reporters around the country. In his "Al's Morning Meeting" blog that goes out to reporters daily, he used the September 11 anniversary column to encourage reporters to get to know their local ham radio people and explained why. (Thanks, Al!)

Texas Club Promotes Public Awareness Day

The Bedford Amateur Radio Club had a very successful PR event on Amateur Radio Public Awareness day, September 15. We used the ARRL public relations information at an annual event called "Be Bedford Prepared" held at the Texas city's Wal-Mart store. We set up several operating stations to showcase various modes of communications including VHF/UHF phone for local communications and IRLP/EchoLink, an APRS station with a laptop and mapping software, and a station for working satellites. We also showed our emergency preparedness capability by running all the equipment (radios and computers) totally from solar power. We gave continuous demonstrations of our radio communications capabilities to the visitors, had a handful of potential new hams and even got about a dozen youngsters who were brave enough to take the mic and make some contacts. — *Roy Rabey, AD5KZ*

FRANK KNOX, KS5F

Bedford (Texas) ARC club members demonstrating the solar power system to the city's Deputy Fire Chief. From left: Kelly Kohls, N5TLE; Roy Rabey, AD5KZ; Mike Heskett, WB5QLD; Wes Hartman, KC5FGK, and Tony Bissell, WR5T.

CARL ZETTELMEYER, WA4CZ

***Special event*: Molly Behan shares the mike with Pete Rimmel, N8PR, at special event station W4H at the Hillsboro Lighthouse Arborists' Day event September 15 in Pompano Beach, Florida. Personnel from the US Coast Guard, the Hillsboro Lighthouse Preservation Society, Cub Scouts from Pack 441 and numerous other volunteers pitched in to complete the final landscaping tasks necessary to restore the grounds and buildings to their appearance circa 1920. Members of the South Florida DX Association, the Broward ARC and the Gold Coast ARA logged 172 contacts during the four-hour life of W4H with stations from Peru to California and from Calgary, Alberta, to Italy.**

RON TREMBLOG, WAØPSF

***Congratulations!* At the recent Kansas State Convention in Salina, Don Fitzgerald, KAØEIC, of Salina, was named Kansas Amateur Radio Operator of the year. Attendance was up over last year's event.**

Inside HQ

The 2nd Annual On-Line Auction

Bidders, buyers and staffers all had a lot of fun with last year's ARRL Auction, so we have decided to do it again! Our second annual ARRL On-Line Auction will be held this year from October 24 at 10 AM Eastern Time to November 2 at 3 PM Eastern Time. The Auction will go live for preview beginning on October 17. ARRL Business Services Manager Deb Jahnke, K1DAJ, and her staff are again managing the Auction. You can send any questions about the Auction to Deb at **k1daj@arrl.org**.

Last year's On-Line Auction was our first and it was a great success. When the bidding ended, we realized that we had sold 104 items and we had raised just over $37,000. While we do not have a specific education fund set up for Auction revenue, proceeds from the Auction benefit ARRL education programs including activities to license new hams, strengthen Amateur Radio's emergency service training, offer continuing technical and operating education, and creating instructional materials.

This year's Auction, like last year's, will be on-line for two weeks. There is no live Auctioneer and all bidding will only be on-line at our own dedicated Auction Web site at **www.arrl.org/Auction**. There will also be a link to the Auction site from the ARRL home page.

Anyone with Web access can view the Auction. Last year, the Auction attracted more than 4300 bidders from 36 countries. While the majority of buyers were from the USA, Canada and the UK, there were buyers from Australia, Malaysia, Grenada and Tanzania.

You do not need to be an ARRL member or a radio amateur to participate and you can bid at any time during the Auction period. If you want to bid, you need to register with a username and password on the Auction Web site. Here's a tip based on what we learned last year: Auction usernames and passwords are not the same as your ARRL Web site username and password. You must create new ones for the Auction. Payment for Auction items is by credit card only.

This year's Auction will include many products tested by the ARRL Lab for *QST* Product Review. These items include an ICOM IC-7800, a Ten-Tec Omni VII, a Palstar Auto Antenna Tuner, an MJF 974H Balanced Antenna Tuner and a Heil Traveler Headset. Vintage items will include the antique transmitter featured in John Dilks' "Old Radio" column in this issue and a Hallicrafters SX-25 Super Defiant Receiver. Also, returning by popular demand will be five ARRL Lab unique "junque boxes."

Check out the site often since we will be adding new Auction items throughout the event. You're sure to find something of interest to bid on. It's for a great cause and we wish all bidders good luck.

73,

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

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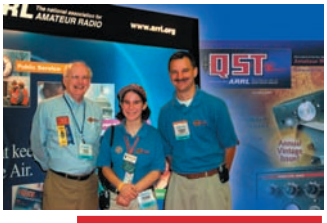

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ARRL is an incorporated association without capital stock chartered under the laws of the State of Connecticut, and is an exempt organization under Section 501(c)(3) of the Internal Revenue Code of 1986. Its affairs are governed by a Board of Directors, 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.

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

Membership inquiries and general correspondence should be addressed to the administrative headquarters:
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As an ARRL member, you elect the director and vice director who represent your division on ARRL policy matters. If you have a question or comment about ARRL policies, contact your representatives at the addresses shown.

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- Compact unit. Easy to operate.
- Utilizes a uniquely designed high performance DSP engine
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- ARD9800 can also be used for digital slow scan TV and data transmissions (images require optional memory board)

Be sure to check the website at www.aorusa.com for FAQs, links to user groups and more!

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Searching for peak HF performance?

Introducing the Elecraft K3 transceiver

No other rig in this price class comes close to the K3's performance. Its high dynamic range, down-conversion architecture provides roofing filter bandwidths as narrow as 200 Hz, while its 32-bit I.F. DSP handles advanced filtering and noise reduction. The K3 also offers an optional fully independent, high-performance subreceiver, as well as innovative new features like variable-bandwidth, DSP-tracking roofing filters, and 8-band RX/TX EQ.

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Up Front in QST

Ham House

According to the UK's National Trust Web site, Ham House is a unique 17th century house with sumptuous interiors, original collections and restored formal gardens. It is a fine Stuart mansion on the banks of the River Thames, has lavish 17th century interiors with important collections of textiles, furniture and paintings. There are formal gardens with famous lavender parterres, known as the Cherry Garden, and maze-like wilderness. There's a fascinating association with Civil War politics and Restoration court intrigue. If that weren't sufficient, it's reputedly one of the most haunted houses in Britain.

It's location? Ham Street, in Ham (near Richmond Upon Thames, which in turn is near London).

DAVID SPARVELL, G4FTC

Quite the shack! **Ham House, near London, dates back to 1610, and is said to be haunted.**

DICK ZIMMER, W5DZ

DX plate: **Spotted at Texas A&M University.**

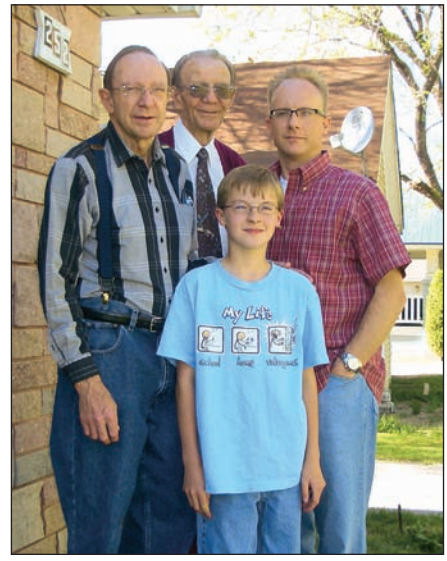
Where's the antenna? **"I was in England and Scotland in August," writes Tom Reis, NØVPR, of Johnston, Iowa, "and passed by this place very near Hadrian's Wall in north England. It was a telephone repeater location in the early 1950s. I did run APRS during the trip and also a dual band."**

TOM REIS, NØVPR

TIM DUFFY, K3LR

What he did on his summer vacation: **Nine (count 'em!) antennas with 7 rotators, all on one tower. On top, there's an 80 meter rotating dipole; next, 6/6/6/6 Optimized Wideband Antennas by WA3FET = 24 elements for 20 meters; followed by 2/2 on 40 meters (W6NL design Moxons); 6/6 M^2 on 15 meters for 2nd station fixed SE. There's more at www.k3lr.com. —** ***Tim Duffy, K3LR, W Middlesex, Pennsylvania***

GREG BARKER, K7CWL



Continuing the tradition: **Griffeth Barker, KE7GIW, front, recently became a fourth generation radio amateur of the Barker Family of Elko, Nevada. Back row: Greg Barker, K7CWL (ex-KE7FFN), Spence Barker (ex-K7CWL) and finally Lynn Barker (ex-K7CVF). Griffeth and Greg recently assumed stewardship of the Heathkit DX-40 transmitter and the National NC188 receiver built by Grandpa and Great Grandpa back in the day.**

Ham Radio Helps the Pony Express Ride Again

Ronald Norton, KJ6XI

Each June, the National Pony Express Association stages a Reride between St Joseph, Missouri and Sacramento, California. For 2007 the Reride started June 11 in St Jo galloping toward Old Sacramento. In 2008 it will go from Sacramento to St Joseph. The trip takes 10 days, the same time as the original trip in 1860-61, and the cost per letter is also the same, $5.

This Reride is a 24 hour a day, non-stop event by over 500 riders and horses. The 1966 mile route is over the Pony Express National Historic Trail from Missouri through Kansas, Nebraska, Colorado, Wyoming, Utah, and Nevada to California. It is the longest event held annually on a historical trail in the nation, even surpassing the famed Iditarod sled dog race.

The event commemorates the Pony Express of 1860-1861. The Central Overland and California Pikes Peak Express Company carried letters and telegrams for 19 months to prove the Central Route through Salt Lake was passable year round. The owners hoped to win a federal mail contract on that route. Pony Express history is preserved in the federally designated Historic Trail, administered by the National Park Service, in museums, Pony Rider monuments, books and the annual NPEA re-creations.

Riders carry Commemorative Letters in a mochila (from the Spanish for knapsack), pony express style. The cachets, honoring Pony Express history, were purchased by NPEA members, historians and philatelists. The envelopes show they were carried by the Pony Express and the first class postage has a special US Postal Service cancellation.

Dennis, N6PMI, and Alice, KG6YNR, Bartoldo are ready and waiting for the rider to come to the POW WOW ride exchange at Tahoe, California.

Volunteers Roy, KB6UT, and Genny Moore, W6BWZ, confer with Dean Freitas, a ride lieutenant on the Pony Express route.

Hams Help

Ham radio operators provide the necessary communication for the NPEA so that Ride Captains and those in authority know exactly where the rider is located. Hams give the name of the exchange, and the time in and out of that exchange. For example, "rider arrived in 'Strawberry' at 1800 and left at 1801. Rider is 15 minutes ahead of schedule." Hams also pass along this information to the relay phone number and those listening will post it to the Internet.

Because of the variation of terrain, VHF, UHF and HF are used for communication during the reride. Riders cover the plains to the Rocky Mountains through the desert and various mountain ranges and then up to and through the Sierras and down to the Sacramento Valley. Hams are stationed along the way throughout Utah, Nevada and California.

In California, RAMS (Radio Amateur Mobile Society), in Nevada, SIERA (Sierra Intermountain Emergency Radio Association) and in Utah, DCARC (Davis County Amateur Radio Club) have come to the aid of the NPEA to provide the necessary information, along with a means to obtain help in an emergency.

For more information on the Pony Express Reride, see **www.xphomestation.com**.

FreeFest in Memphis

In April, a special kind of party was held at the Bartlett Municipal Center in Memphis, Tennessee. While similar parties that celebrate Amateur Radio can be found around the country, this one was special because no one had to pay. It was dubbed "FreeFest — the way a Hamfest should be!" Vendors, flea market tables, club tables and entry into the event were, in a word, free.

In addition to those perusing the new and used gear available for purchase, attendees could get a license or advance their license class at the Volunteer Examiner testing session, learn more about the potential for interference from the transmission of broadband signals over power lines from the ARRL seminar, or understand what it means to be a part of MARS (the Military Affiliate Radio System).

One additional twist to this FreeFest was met with great excitement. All (100%) of the proceeds from the ticket donations went to support St Jude Children's Research Hospital. The goal was to raise $2000 for the hospital and it was with great enthusiasm that a check was presented to St Jude for over $2500! Way to go ham community! — *Keith Price, WA5LPW*

PAT LANE, W4OQG, AND NINA STONE, WB4CHH

As a result of FreeFest, more than $2500 was donated to St Jude Children's Research Hospital.

REDUCE OR ELIMINATE NOISE AND INTERFERENCE

DSP NOISE REDUCTION

CLRspkr

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.

CLRdsp

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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General coverage receive from 10-160 meters with 39 built-in DSP filters. 100 watts output on all bands. Green backlit LCD screen. The SSB transmit audio of this rig is so well regarded that we used the same controls for tailoring transmit audio on the new OMNI-VII! The same great QSK CW as used on our other transceivers. No other transceiver in this price class tops this level of performance.

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CORRESPONDENCE

SPUTNIK REVISITED

♦ It's September 17 and I am reading about *Sputnik* in *QST* [October 2007, pp 50-51]. It is absolutely wonderful to see and read about it. More needs to be forthcoming about the circumstances surrounding *Sputnik* in 1957. It was the International Geophysical Year, and that event certainly helped ham radio. I was only eight years old, but I got heard all about it from my dad and his electronics buddies in Norwalk and Stamford, Connecticut — enough for me to get licensed in 1963. Because of *Sputnik*, ham radio changed my life.

RALPH BAIRD, W5SXX
Houston, Texas

D-STAR NOT D-LIGHTFUL

♦ The article in *QST* entitled "Operating D-STAR" [September 2007, pp 30-33] was, to me, a free multi-page commercial for ICOM and their proprietary system. While I applaud Gary Pearce, KN4AQ, for his explanation of the system and how it works, the fact still remains that this whole system is proprietary in both software and hardware. In this age of open software and hardware design and implementation, one must wonder why ICOM would even try to market a system like this. The lessons taught proprietary personal computer hardware and software design in years past should be enough thwart any idea of a system like this. Good job Gary, bad idea ICOM.

JOHN ROMESBURG, WB3EKB
Irwin, Pennsylvania

[*Editor's Note: I appreciate the compliment! There has been a furious debate on Internet message boards about whether or not D-STAR is proprietary. It isn't. The AMBE vocoder, licensed by Digital Voice Systems, is the only proprietary component, and anybody can buy one. I wrote the article to give the average ham an idea of what was coming down the road, and so far, only ICOM has taken the gamble on VHF/UHF digital technology with a full system that makes the radios more than a novelty. If it finds a market, others will follow. Right now some hams are building their own D-STAR radios and repeaters with non-ICOM components.* — Gary Pearce, KN4AQ]

♦ Thanks for the article on D-STAR. On page 116, the ICOM advertisement states that "20-40 miles is a best case measurement…" I'm all for new modes that help emergency communications, but what is more important: a garbled mess of digital noise or a scratchy faint cry for help? Good old black-and-white television sets always got some signal; with the new digital TVs, the signal is there or not. I suggest keeping 2 meters analog and letting either 70 cm or 23 cm go all-digital voice, or a chaos of mixed signals will occur. Analog voice equipment is cheaper, has a greater communication distance and there currently is an extensive repeater network already built.

JOHN HINSHAW, KE7JSL
Renton, Washington

SAVING ENERGY

♦ I was pleased to see the September 2007 issue focusing on the importance of Emergency Communications. Although there were several informative articles on the subject, I was disappointed that there were no articles on solar or wind power. Many power outages can last for days, weeks or even longer. Having experiencing this first hand, I understand the need for replenishing battery systems during long-term power outages. We need to explore and employ natural energy sources in our emergency communication systems as a matter of practice.

JIM MARCO, WB2LHP
Camillus, New York

[QST *has recently published several articles on alternate sources of energy and we hope to have more. A few examples include "No Fueling: Field Day with Hydrogen" [June 2006, pp 44-45], "Sun, Wind Energize Club Repeater" [November 2006, pp 45-46] and "Hydrogen Driven Hams" [May 2007, pp 32-33]* — Ed.]

SIDELINED SPECIAL EVENTS?

♦ One of the things I enjoy doing while hamming is contacting Special Event Stations. Many of them are in states I need for Worked All States credit and it makes it that much nicer to contact them, get logged on their sheets and receive a QSL card to show for it. The problem I have encountered many times is that the special event stations are not on the frequency (given 5 kHz up or down) listed in *QST* or even during the date and times given.

I wonder why these Special Event Stations even list in *QST* if they're not going to be on when and where they say they will be. I would like to ask future and listed Special Event Stations that if they are not going to be on (or something has happened and they know they will not be on in the future), to please contact ARRL and have the event removed from *QST* or the *ARRLWeb* listing so those of us looking for you won't go crazy.

MARC D. KAUFMAN, WB2DWC
Lynchburg, Virginia

MORE THAN A RADIO

♦ I remember reading in *QST* many years ago about a request to manufacturers to create VHF/UHF radios with open, upgradeable operating systems. To my knowledge, no manufacturer has come forward with an open OS on any VHF/UHF mobile or handheld. I continue to use my venerable Kenwood TH78 because there is nothing that I feel is significantly better. There have been improvements in waterproofing, 3 and 4 band coverage and proprietary features like Internet linking and APRS, but no radio has yet appeared that has the flexibility to do all of the things that hams might want.

My proposal: Build a PDA, Palm OS or *Windows* Mobile with VHF and UHF radios built in. The wireless phone companies have been doing it for years! Your average smartphone has four radios in it already: voice/data radio that works on multiple bands, Bluetooth radio, WIFI radio and GPS radio. Surely one or more of those radios can be adapted as a VHF/UHF broadband voice radio. I would have thought that with the advent of digital voice, an open OS would be almost a necessity, but, alas, it does not seem to be so. So how about it guys? If you build it, I will buy it. Otherwise, my early 1990s era handheld transceiver still seems to be pretty close to state-of-the-art.

MIKE OSWALD, NØLCV
Des Moines, Iowa

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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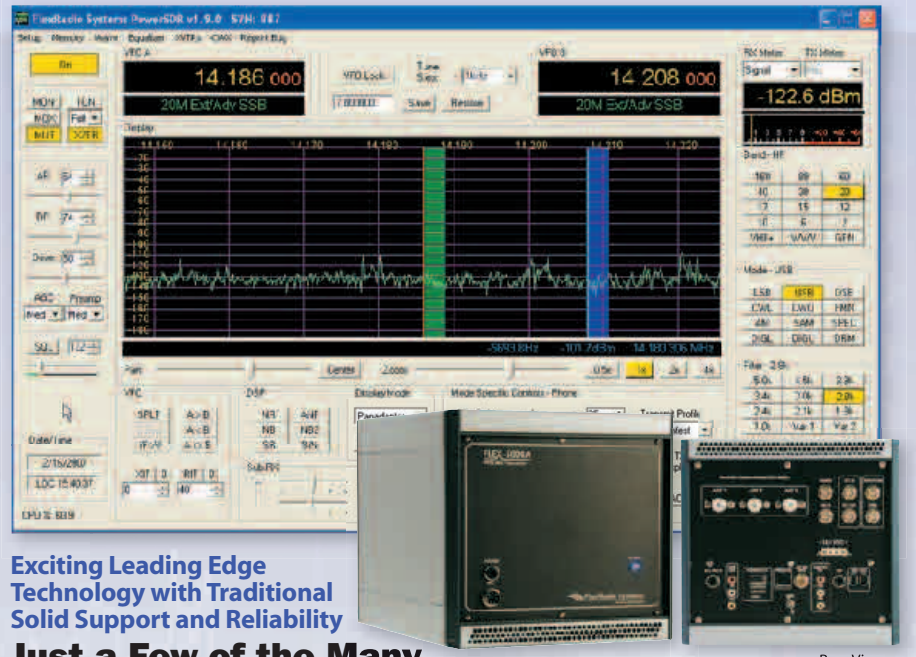

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With most modern ICOM, Kenwood, Yaesu HF Radios

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This compact and lightweight 1kW desktop HF/50MHz linear power amplifier has a maximum input power of 1.75kW. Our solid-state broad-band power amp technology makes it **the smallest and lightest self-contained amplifier in the industry**.

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Drain Current:
40A max.

Input Impedance:
50 OHM (unbalanced)

Output Impedance:
50 OHM (unbalanced)

Final Transistor:
SD2933 x 4 (MOS FET by ST micro)

Circuit:
Class AB parallel push-pull

Cooling Method:
Forced Air Cooling

MPU:
PIC 18F452 x 2

Multi-Meter:
Output Power – Pf 1Kw
Drain Voltage – Vd 60V
Drain Current – Id 50A

Input/Output Connectors:
UHF SO-239

AC Power:
AC 240V default (200/220/235) – 10 A max.
AC 120V (100/110/115) – 20 A max.

AC Consumption:
1.9kVA max. when TX

Dimension:
10.7 x 5.6 x 14.3 inches (Wx-HxD)/272 x 142 x 363 mm

Weight:
Approx. 20kgs. or 45.5lbs.

Accessories Included:
AC Power Cord
Band Decoder Cables included for Kenwood, ICOM and Yaesu
Spare Fuses and Plugs
User Manual

Optional Items:
Auto Antenna Tuner (HC-1.5KAT)
External Cooling Fan (HXT-1.5KF for high duty cycle RTTY)

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A Comparison of HF Mobile Antenna Designs

Picking an HF mobile antenna is often the biggest challenge of getting on the air from your vehicle.

Rich Roznoy, K1OF

Mobile operation on the HF bands has become more and more popular as compact, efficient radios make it easy to put a 100 W signal on the air from your vehicle.[1] Unfortunately, the laws of physics haven't gotten any more lenient and a quarter wave ($\lambda/4$) whip antenna that would be 19 inches long for 2 meters, or a barely manageable 100 inches for 10 meters, is an unwieldy 65 feet long for 75 meters.

So What's the Solution?

While 10 meters is great fun during the peak of the sunspot cycle, offering great worldwide DX contacts, most HF operation now is on much lower HF bands. The traditional solution to the problem is to electrically shorten the mobile antenna so that it is about the 8 foot length of a 10 meter whip. There is no magic here. This can easily be accomplished by inserting a series inductance somewhere in the length of the antenna, resulting in an antenna that is resonant on the desired amateur band.

The three most frequently encountered methods of electrically shortening a mobile antenna are:

- Helically wire wound, vinyl covered, single band types.
- Center-loaded swappable resonator types.
- Base-loaded motor-tuned coils with a whip above.

In addition there are those with various kinds of bottom mounted tuning units. There are also some that combine one of the above whips with a "capacitive top hat." We decided to limit our evaluation to locally available samples representative of the most frequently encountered types.

Which to Choose?

I often hear stories on the bands comparing HF mobile antennas and wondering which is best. Most of these discussions are based on anecdotal evidence at best with measured performance data rarely if ever presented. Unfortunately brand loyalty and personal belief systems (either right or wrong) provide the basis for most of these discussions. The purpose of this article is to attempt to quantify the differences in HF mobile antenna performance by measuring the actual differences between samples of the three types.

Keep in mind that performance is just one of a number of possible selection criteria, others being perceived aesthetics (by us as well as family members), price, ease of changing bands or frequencies, as well as individual mounting and height constraints. Any of these could trump performance as the primary decision maker. For this study we focused on measuring performance. The other criteria can be determined from manufacturers' literature.

Where's the Beef?

The impetus for this investigation came from a conversation with a friend about a shared incident. Recently, one of my HF center-loaded resonators needed some repair and I was able to fix it myself. When I told my story to George, K1EHW (see photo), he said: "By golly I have the same problem." He was also able to repair his and this got us thinking about ways to test mobile antenna to see how well they are working. We soon realized that in our ham careers neither one of us has seen much in the way of performance measurements for mobile HF antennas. We realized we had the necessary equipment and a suitable location to do a side-by-side

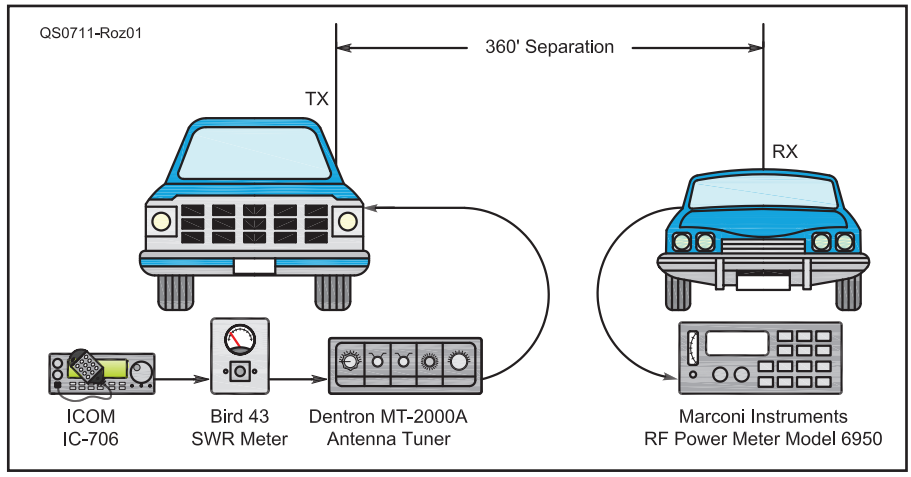


Figure 1 — The Dentron tuner was adjusted to an SWR of 1:1 for each sample.

[1]Notes appear on page 33.

Figure 2 — Marconi 6950 Power Meter.

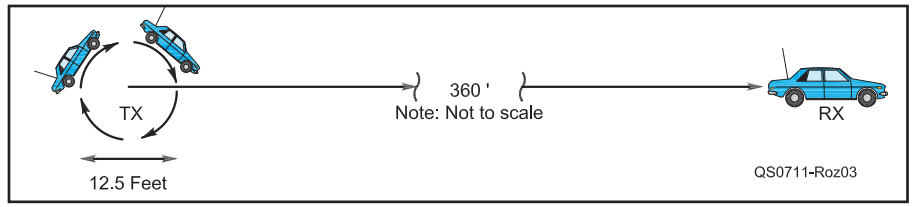


Figure 3 — Each vehicle was turned in a tight circle to determine the orientation for maximum signal.

comparison of our two different types of 60 meter antennas. Now, for the first time I knew how much better or worse my helically wound antenna performed compared to my center-load coil type. Based on these results we were encouraged to test additional antenna types resulting in a comparison of 25 antennas for 80 through 10 meters.

The ARRL Antenna Book devotes an entire chapter to mobile antenna theory but no field measurements are included.[2] If you are inclined to homebrew an antenna, this is an excellent source of theory and will serve you well. Understanding the basic theory behind mobile antenna performance will also go a long way in determining which parameters to look for. If on the other hand, you are like most of us and purchase an off-the-shelf antenna, it is impossible to *see* the parameters that determine performance.

How can you make an informed choice? One way is to compare measured performance between actual antennas and that is what we present here. The data provided in this article will enable the reader to make choices by taking into account the relative field strength measurements and associated trade-offs associated with each of three types of antennas described above. The types chosen are representative samples of the more popular mobile antennas, all of comparable size to a 10 meter whip.

What is Performance?

The most complete picture of mobile antenna performance is one where theory and practice come together. Luckily, a few generalizations can be made that will help make this picture clear. For starters, a definition of performance is needed. For this analysis antenna performance is determined solely by the efficiency of the radiating element. In this context the antenna that radiates or produces the highest field strength for a given input power is the one with the highest performance. This may present a caveat for some because they may think of performance in terms of lowest SWR, widest bandwidth or even the highest price tag. While these are important parameters and vary from antenna to antenna, they do not constitute a single measurable quantity, whereas field intensity or signal strength does. SWR, bandwidth, size, cost, and even aesthetic appeal should be considered as trade-offs and not a measure of performance.

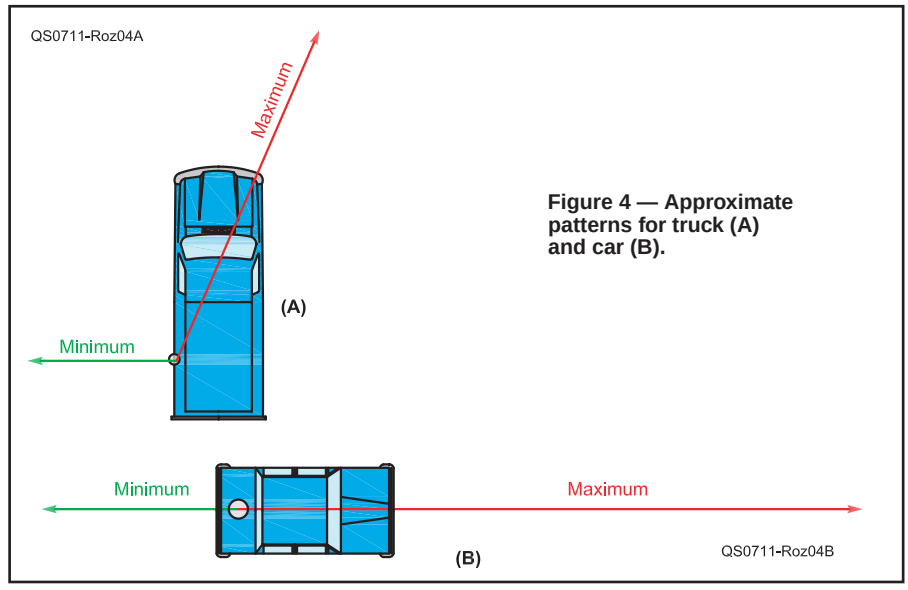


Figure 4 — Approximate patterns for truck (A) and car (B).

Where is the Boundary?

The distinction between an *antenna*, the object you purchase off the shelf, and the *antenna system*, which may be thought of as the combination of the antenna, car body, rig, matching network (if used), interconnecting cables, ground connections and antenna mounting location must be made. In order to measure the performance of just the antenna using a single metric, all of these other factors must be held constant throughout the tests. As a result, only the differences in measured signal strength due to the individual antenna is reported. To further clarify the demarcation, the standard ⅜ × 24 mount has been chosen as a point of demarcation between the *antenna* and the *antenna system*.

What are the parameters that determine performance? In this case it comes down to efficiency. This is where the theory and practice come together. A generalization may be made that the more efficient HF mobile antenna is one with:

- The highest Q, which means it has the lowest RF resistance. All things being equal, this means the conductors have the largest surface area (based on skin effect).
- The one with optimum current distribution.
- All other things being equal, the one with the longer length.

An excellent summary of efficiency factors may be found in *The ARRL Antenna Book*.[3]

Test Setup

Test Site

Two important considerations were made in choosing the test site. First, the site had to be clear of any wires or metallic objects that might reflect or conduct RF and second, it had to free of any movable objects that could alter the signal path during the tests. An open field at a nearby beach was perfect. The test vehicles were located 360 feet apart with their exact locations recorded by GPS. This was done to ensure that the same test conditions could be met if the tests were repeated in the future.

Antenna Setup and Adjustments

The transmitting test antenna was mounted on a pickup truck. A car located 360 feet away was used for receiving. See Figure 1. The receiving antenna is not critical in this case, as long as the same one is used for all tests and it couples enough

power into the Marconi power meter to allow a proper reading. The use of this meter was critical to the success of these tests because it could accurately measure changes as small as 0.1 dB. S-meters could never measure signals with this resolution or accuracy. The meter scale is shown in Figure 2.

A two-step process was used to tune the antennas before taking field strength measurements. First, each antenna was tuned for lowest SWR without the Dentron MT-2000A tuner in line by either adjusting the whip length or by the use of the motor driven "screwdriver" mechanism. Then the Dentron MT-2000A was placed in line and tuned to achieve a 1:1 match. This was done to ensure that the input power was the same for each antenna. This was necessary because the base impedance of each antenna was sufficiently different from model to model, resulting in the ICOM IC-706's SWR protection circuitry reducing power for some samples. On average the tuner provided about a 0.5 dB improvement. To be fair, each antenna tested needed to have the same power applied to it. What we measured is how efficiently each converted that power into RF radiation. The antenna tuner was adjusted for a 1:1 match for each antenna using a Bird reflected power meter to ensure each antenna received the same power. The matching was so good that the reflected power was not perceptible in the Bird meter. This is as close to a 1:1 match as we could get.

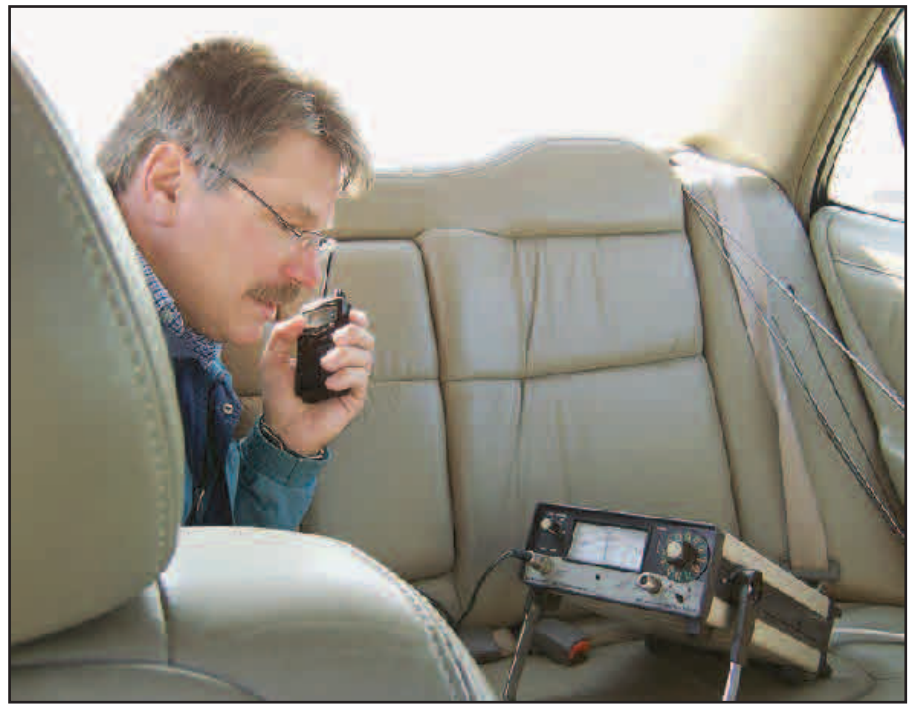


Figure 5 — The author records the received signal strength.

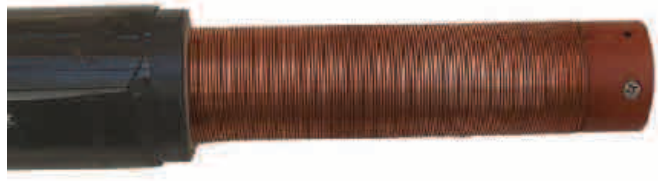


Figure 6 — Exposed coil in the screwdriver antenna.

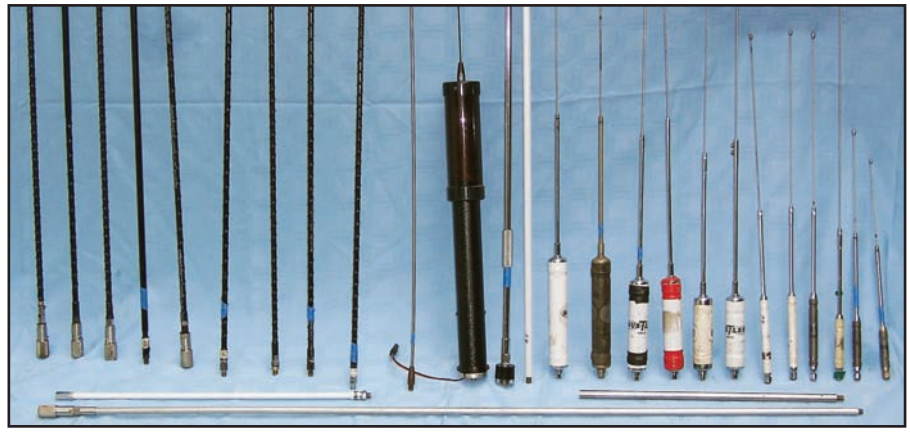


Figure 7 — The parts of all the antennas used in the test.

Always Something!

During our initial set of tests we noticed that the signal varied as people walked around the vehicle with the receiving equipment. The problem was traced to the extension cord used to supply 120 V ac to the Marconi power meter. The extension cord was acting as a ground radial! The solution was to remove the extension cord and power the meter from an inverter inside the car, thus eliminating all extraneous RF paths to the car. A benefit of putting all the equipment and operators inside the vehicles was that the vehicles acted as Faraday shields that prevented operator movement from affecting the radiation pattern.

Measure in the Peak of the Pattern

The radiation pattern of the transmitted signal has no bearing on the efficiency of the antenna. As we wanted to provide as much signal to the power meter as possible we optimized the orientation of the vehicles for maximum field strength. This increased the signal to noise ratio and is a good practice to follow when taking measurements. To accomplish this, each vehicle was driven in a tight circle and the change in the received signal was noted as shown in Figure 3. Since the distance to receiver was much larger than the turning radius of vehicle, the effects of the change in signal strength due to path length change was very small.

In a perfectly symmetrical situation the signal should not vary as the vehicles are turned. The difference between the maximum and minimum reading was 2.5 dB for the truck and 2.0 dB for the car. Our goal was to determine the orientation for maximum signal and not to plot the actual radiation pattern. Figure 4 shows that the maximum radiation occurs in the direction from the antenna through the largest dimension of the vehicle body. For the truck, with its side

Table 1
Relative Performance of Three Types of Mobile HF Antennas

	Helical		Center-Loaded		Motor Driven	
Band	dB	Power	dB	Power	dB	Power
80	–2.2	166	0	100	–4.2	263
60	–2.3	170	0	100	–6.9	490
40	0	100	0	100	–4.2	263
20	0	100	0	100	–3.8	240
15	0	100	–0.6	115	–3.4	219
10	0	100	–0.1	102	–2.4	174

Table 2
Length of Representative Antennas

Band (meters)	Helical	Center-Loaded	Motor Driven
40	95"	87"	83"
20	83"	81"	80"

Table 3
Effect of Length on 40 Meter Radiated Signal Strength

Antenna Type	Length	Relative Output (dB)	Power
Helical	87"	0 (reference)	100
	105"	+1	79
Motorized	83"	0 (reference)	100
	53"	–5	316

mounted antenna, the maximum radiation was off the right front fender. For the car, with its antenna at the center of the trunk, it was directly off the front of the vehicle.[4]

Metrics

Received signals were measured on a commercial test instrument in units of decibels relative to a milliwatt (dBm) as shown in Figure 5. Since we were not trying to determine absolute levels, but differences between antenna types, we shifted the levels for each band so that the strongest signal is shown as 0 dB, and the weaker ones are shown in dB below that point to allow comparison. For those who don't think in terms of decibels, I have provided a conversion to power in watts.[5] For this case, I've shown the strongest signal as 100 W, and the weaker ones as the amount of power needed to obtain the same signal. This is actually a trade-off that could be made since there are a few 500 W amplifiers designed for mobile service. Because most mobile rigs run 100 W many of us will already have an intuitive sense of the performance obtainable with that much power. The results for our three antennas are shown in Table 1. The raw data is available on the ARRLWeb.[6]

Size Matters

The three antenna types we tested were not exactly the same length, although all were relatively close. To complicate matters, each is a somewhat different size depending on the band, and at what frequency it is tuned to within the band. As an example, if we look at 40 and 20 meters, the approximate total lengths are shown in Table 2.

While the length differences are not great, the total length will have an impact on the results. In order to get a gauge on length dependence, we made some spot checks on 40 meters using antennas that were of the same type but of different length. We added an 18 inch extension to the helical antenna and used a 30 inch shorter whip (36 compared to 66 inches above the coil) in the motorized antenna. Each represents potential real cases, but are particularly interesting to see the effect of length on performance. The results are shown in Table 3.

Conclusions

Using the data in Tables 1 through 3 you can judge how much better or worse the performance of one type of antenna is compared to the others. On all bands the motorized antenna we tested is the least efficient. Other motorized models, especially the larger ones with heavier coils, are likely much better performers. The construction of our sample gives us some clues. The coil has lower efficiency because the windings have high RF resistance due to the many turns of thin wire (see Figure 6), the current distribution is not optimum because it is not center or top-loaded, and it is the shortest of all the antennas. This should not be a surprise in light of the three previous generalizations regarding efficiency.

By comparison the center-loaded antenna is more efficient because its base is a thick ½ inch piece of aluminum rod, the coil is center-loaded for optimum current distribution and finally, the whip is thicker (lower loss) and longer. A view of all the antenna samples is given in Figure 7.

Does this mean you should never use a motorized antenna? Perhaps not, since there are some advantages to using this type of antenna. The question now becomes one of convenience versus performance. This type would certainly rank high on the convenience scale. It can be as short as you want and may be left on the car when it is parked in the garage. It is tunable from inside the car. If, however, maximum performance is your goal, choose the one wound with the thickest coil wire, one that is center or top-loaded, one that has the thickest base and whip dimensions, and the one with the longest practical length.

A special thanks goes out to George, K1EHW; Joel, W1ZR, and Dan, N1ZZ, for the loan of their antennas that made these tests possible.

Notes

[1]J. Hallas, W1ZR, "Getting to Know Your Radio — One for the Road," *QST*, Aug 2007, pp 60-62.

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

[3]See Note 2, p 16-11.

[4]You might consider this the next time you are operating mobile from a fixed location and want to provide the most signal toward a specific direction. You may only gain a dB or two, but it may be worth the effort.

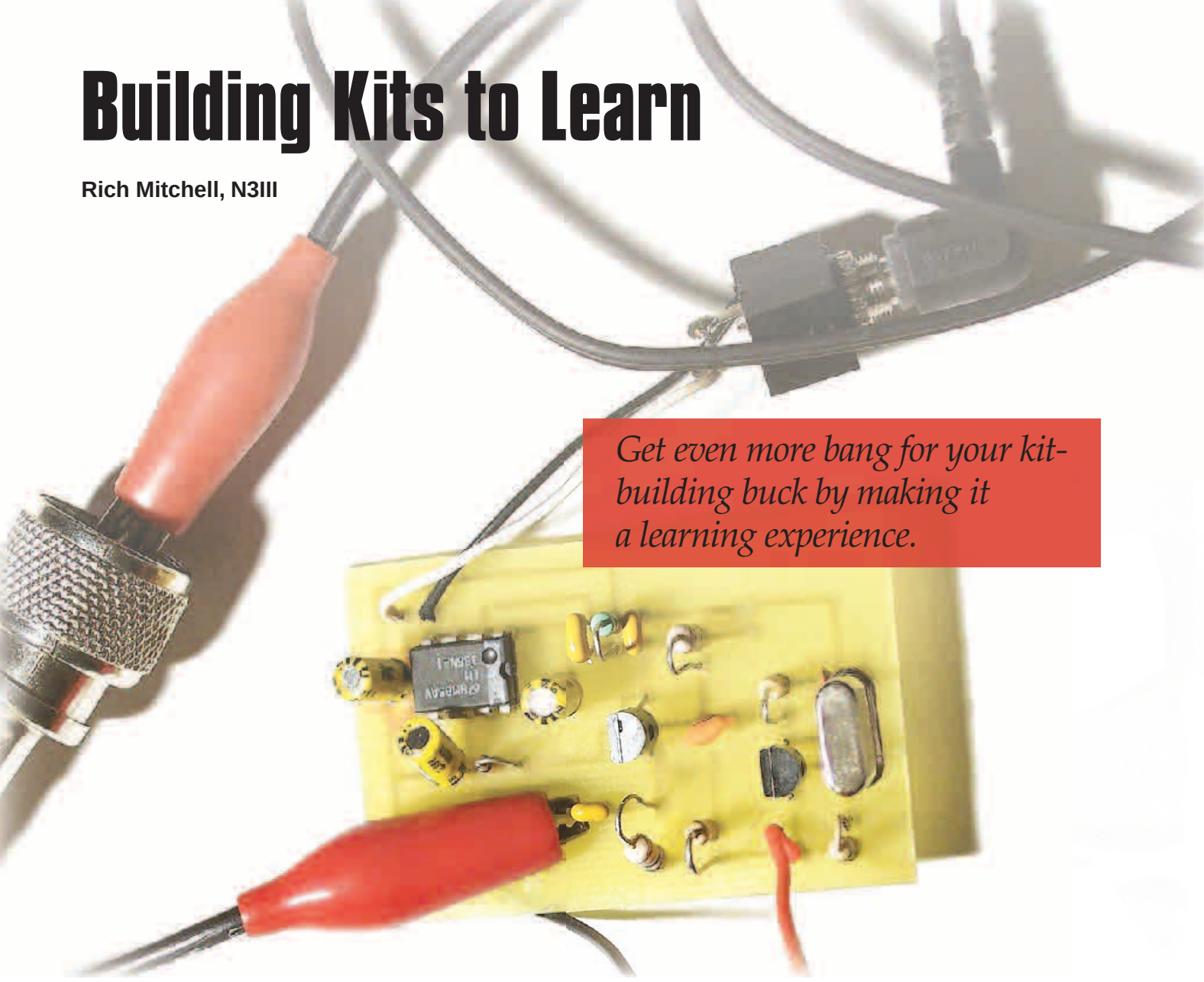
[5]J. Hallas, W1ZR, "Making Sense of Decibels," *QST*, Apr 2007, p 61.

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

Rich was first licensed at age 12 as KN1QKQ. Now, more than 40 years, and a few calls later, he has just as much enthusiasm for Amateur Radio as he did as a youngster. Rich earned a degree in electrical engineering and is the founder of RL Design Group. He is primarily a consultant in the field of statistical process control but occasionally has an opportunity to do what he enjoys most — RF design and construction. He was previously on the ARRL staff as an Assistant Technical Editor. He can be reached at 5 Keyser Rd, Westport, CT 06880 or at **rldes@optonline.net**.

Building Kits to Learn

Rich Mitchell, N3III



Get even more bang for your kit-building buck by making it a learning experience.

How can you get the most out of building a kit? If you just want to get the thing built and on the air, then perhaps you populate all the components and then check it out. I recently "built" a kit that had many surface mount (SMT) components, all of which were pre-installed. All that was left to do was go down the list of the through-hole components, installing them and checking them off. And when it was done you reached that "moment of truth." Would it work? And when it did, I learned that I was a good soldering robot. This is a prime example of the "no learn" method of kit building.

There is a Better Way

If you want to maximize the learning experience from building a kit, you should build a kit one testable group of components, or stage, at a time. In that way, you can understand what each stage does and know that it works before you move on to the next. Building by stages gives you a great logical breaking point if you want to build over a number of evenings. When you complete the last stage, there is no need to troubleshoot, because you have been doing that all along. There is no "moment of truth" because it has been a "process of truth."

Philosophy 101

This building philosophy is similar to that of the old radio servicing approach in which one made sure there was power, then got the audio stage working and finally backed up through the receiver chain stage by stage, injecting signals using the audio stage as part of the test equipment. The testing you do does not have to involve oscilloscopes, spectrum analyzers, or even signal generators (unless it's a superhet). You just need a multimeter, a radio that can tune to the kit's frequencies and few odds and ends from RadioShack. You don't have to be an RF engineer. I'm a history major. Any technical knowledge I have has been picked up from my Amateur Radio experience.

One of the first kits I built using the "build to learn" approach was the 80 meter version of the Small Wonder Labs Warbler for PSK31. I first built the power supply, testing that it provided the appropriate voltages. Next I moved to the receiver, building and testing the audio amplifier. Then I worked back up through the receiver chain building and testing the oscillator, the receiver's mixer, the crystal filter, the RF preamplifier and finally the antenna filters out to the antenna jack. With that done I moved to the transmitter. I started from the input side building the audio amplifier, then the crystal filter, the buffer amplifier and finally power

amplifiers. I put it on the air and worked into New England from Maryland.

It was great fun figuring out what parts belonged to each stage, then building and testing one stage per evening. I probably had more fun building it than I'll have using it.

Build Your Kit — Know Your Kit

Once you start building kits stage by stage you can have even more fun by modifying them. My next kit was a Tuna Tin 2. It has very straightforward stages — the power supply (just a couple of capacitors), master oscillator (MO), power amplifier (PA) and a low pass filter. Originally the power to both the MO and PA were keyed. So I cut the V+ trace, and fed non-keyed power to the MO and keyed power to the PA. I had an old Neophyte receiver that I had built years ago that works, but is not used. I removed the VFO from it (the parts on the NE602's pin 6 and 7) and fed the TT2 MO to pin 6 (through voltage dropping resistors and capacitors). The transmit-receive (TR) switch flipped the antenna between the TT2 and the Neophyte. Behold, the NeoFish transceiver! That first contact (QSO), with a 599 signal report between New Hampshire and Maryland, was a blast.

The highlight, thus far, from this stage by stage approach was the recovery of an NN1G 72 kit I had built in the mid '90s. I had managed to get both the receiver and transmitter boards working. Before I could put them in an enclosure, an errant V+ wire had touched the receiver board putting it out of commission and into a forgotten box. Having built the Warbler in stages, I now knew how to troubleshoot. So I dug the receiver board out of the box, set it up on the bench and applied power.

The LM386 audio amplifier worked fine but the voltage regulator supplying the NE602s and the FET-driven VFO blew (now there's a clue). I replaced both FETs in the circuit and the regulator, applied power and picked up the VFO with my general coverage receiver. I could hear shortwave in the NN1G 72 earphones but no CW. Tuning the VFO made no change, but varying the BFO did. After replacing the VFO's NE602 I got a change in sound but still got no 20 meter CW. But touching pin 1 with the antenna, I did. Backing up to the preceding transformer, I still got CW, which indicated that the first transformer in the chain was defective. Replacing it, I listened to the sweet sound of 20 meter CW from a board that had been dormant for over a decade.

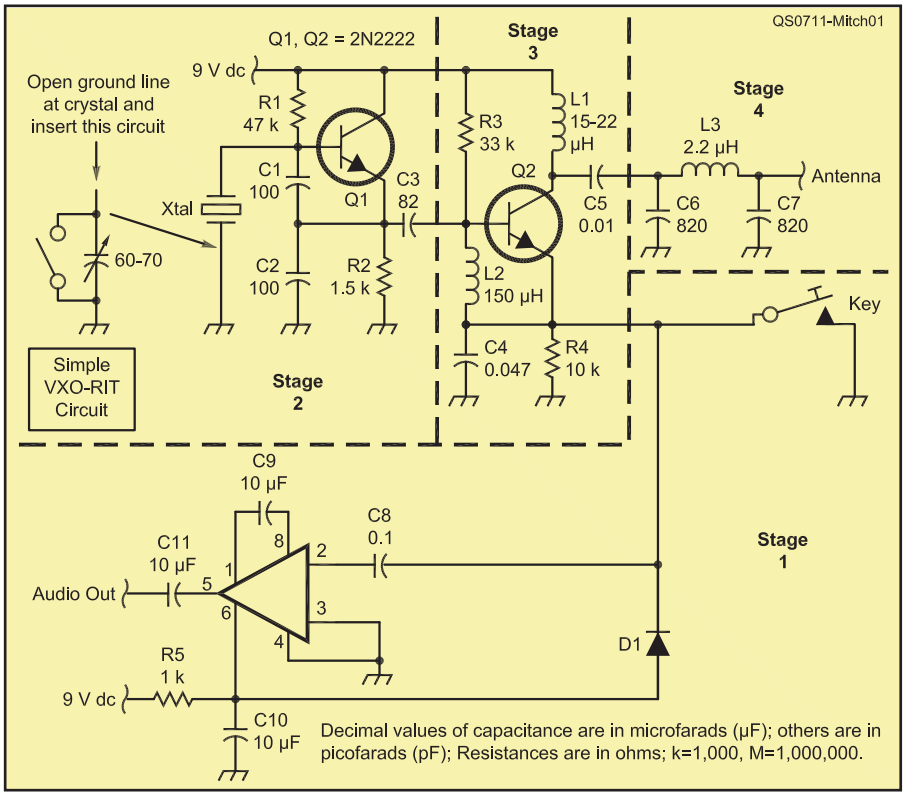


Figure 1 — Pixie2 schematic with lines drawn to separate the four stages.

Stage 1, audio stage parts:
C8 — 0.1 µF capacitor.
C9, C11 — 10 µF electrolytic capacitor.
D1 — 1N914 diode.
U1 — LM386 IC audio amplifier.
R5 — 1 kΩ resistor.

Stage 2, oscillator stage parts:
C1, C2 — 100 pF capacitor.
C3 — 82 pF capacitor.
Q1 — 2N2222 bipolar transistor.
R1 — 47 kΩ resistor.
R2 — 1.5 kΩ resistor.

Stage 3, amplifier and mixer stage parts:
C4 — 0.047 µF capacitor.
C5 — 0.01 µF capacitor.
L1 — 22 µH inductor.
L2 — 100 (or 150) µH inductor.
Q2 — 2N2222 bipolar transistor.
R3 — 33 kΩ resistor.
R4 — 10 kΩ resistor.

Stage 4, antenna filter parts:
C6, C7 — 820 pF capacitor.
L3 — 2.2 µH/1.0 µH inductor.

Building the Pixie 2 by Stages

The Pixie 2 is a very simple transceiver with only 23 parts. It was designed by Dave Joseph, W7AMX, whose 91 year old mother puts together the kits sold by HSC (**www.halted.com**). You can pick up the kit without the crystal for under $10. The instructions say "it's best to start at one end of the board and work to the other." This is, of course, a "no learn" approach. But it's an ideal kit to show the "build to learn" approach. There are four distinct stages: audio, oscillator, amplifier/mixer and antenna filter. To test the stages you will need a radio that can tune to the oscillator frequency.

The audio and the oscillator stages are independent of each other, so either could be built first. We will start building at the audio stage, which is essentially an LM386 chip, and test it by injecting an audio signal from the earphone jack of the test receiver, or just touching it with an antenna wire. The oscillator is built around a transistor and the crystal. We will test it by listening for it on a receiver. Then we will build the amplifier/mixer. The heart of this stage is the second transistor. In passive mode it functions as a single ended diode mixer through the collector and base of the transistor as a direct conversion receiver. When power is applied (actually the emitter is grounded so the power amplifier will run), the transistor will amplify the oscillator frequency for transmitting. Finally we build the antenna filter, which should filter the received signal and make the transmitted signal meet FCC regulations for spurious emissions.

Stage 1 — Audio

The audio section is a basic LM386 op-amp. First we must supply power. This will be from a connection to a 9 V battery. The trick will be to install R5 in such a way as to not block other, later components. We must also supply a stereo headphone jack for the audio output. To test the TR switching, attach a wire to the non-grounded key connection. Install D1 so the cathode end is sticking up to provide an audio input test point.

Testing

Apply 9 V dc. You should hear a click in

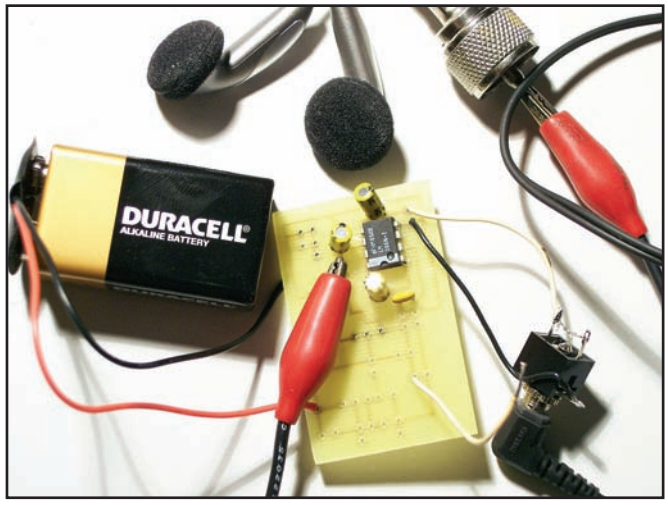


Figure 2 — Stage 1 complete with headphones attached, battery plugged in and clip lead from D1 to the antenna. This produces a hum in the earphones.

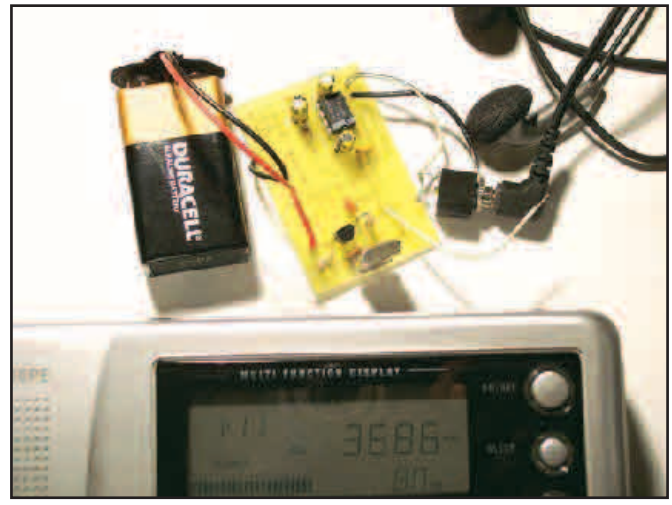


Figure 3 — Stage 2 with headphone and battery attached. The general coverage receiver is tuned to 3.686 MHz, the frequency of the crystal on that particular board. The receiver is picking up the oscillator tone.

the headphones. Touch C8 or D1 with the antenna. You should hear a hum in the headphones. Touch the key wire to ground. The hum should stop.

Stage 2 — Oscillator

This is a crystal controlled Colpitts oscillator. "Hands-On Radio" Experiment #46 describes a similar circuit (*QST*, November 2006, pp 66-67). If you want to switch crystals you should install a crystal holder rather than soldering the crystal to the board. You could also add a small SPST with a capacitor soldered across the leads, and solder one lead to the crystal/holder and the other to ground to provide receive incremental tuning (RIT).

Testing

Tune the test receiver to the frequency of the crystal. Apply 9 V. You should hear the oscillator in the test receiver. Flip the switch if you've installed RIT and the tone should change. If you listen to the headphones you may notice that the volume is less, since the battery is now powering the oscillator as well.

Stage 3 — Power Amplifier/Mixer

Building this section is straightforward with no external connections needed. I install C5 with a lead showing above the board to provide a test point.

Testing

Since this stage will have two functions, power amplifier and mixer, we will test the mixer first. Make sure the crystal is installed. Apply 9 V dc. Touch the antenna to C5. Depending on the crystal and band activity, you should hear 40 or 80 meter signals in the earphones. Hold (attach) a dummy antenna to C5. Turn on the test receiver and ensure you have the oscillator tone. Now touch the key wire to ground. The tone should increase in volume or at least change pitch slightly.

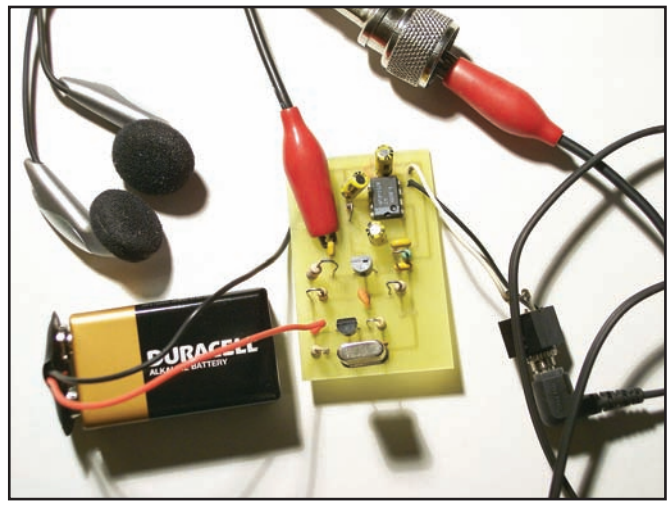


Figure 4 — Stage 3 with headphone and battery attached and clip lead from C5 to the antenna. You can actually pick up CW during this test.

Stage 4 — Antenna Filter

If you want the Pixie 2 to switch bands, set up L3 to use a crystal holder arrangement. Attach the wire, which will lead to the antenna jack.

Testing

Make sure crystal is installed. Apply 9 V dc. Touch the antenna to the antenna jack wire. You should hear 40 or 80 meter signals in the earphones, perhaps with fewer shortwave broadcast signals than in the last test. Connect to the antenna and make a QSO. I tested the stage 4 rig, a bare-bones Pixie 2: no RIT, no volume control, no sidetone, rock bound to 7040. My first QSO was with WA1DD in Connecticut. He was using a RockMite QRP transceiver. Milliwatter to milliwatter, rock to rock. How cool is that!

Rich, N3III, has had an amateur license since 1990 and is now an Amateur Extra class licensee. He built and operated his first low power (QRP) kit, a Ramsey 80 meter station in 1991 and now operates evenings and weekends using FireFly hybrid SDR (see Product Review in Sep 2007 QST*). In addition, Rich operates most lunch hours from a parked car using an Elecraft KX1 or MFJ-9040 into a Hamstick mobile antenna. He is active in the Carroll Amateur Radio Emergency Team and the CCARC and SSAEARC clubs.*

Rich received a BA in history from Cedarville College in 1970, followed by a BD from the Reformed Episcopal Seminary in 1974 and finally an MBA from Southwest Missouri State University in 1980. He has been employed as an information technology professional since 1980.

You can reach Rich at 7012 Carmae Rd, Sykesville, MD 21784 or at **geobra@worldnet.att.net**.

The Handy Yagi Antenna

A merger of transceiver and antenna eliminates many design issues.

Tom Hart, AD1B

After 38 years in Amateur Radio, I finally decided that it was time to try the 440 MHz band. Some decisions should not be rushed.

After using my new Yaesu FT-60 dual band handheld transceiver for a few months, I decided to investigate antenna options on 70 cm. My goal was to build an antenna that travels easily and requires minimal setup. A little daydreaming resulted in a 38 inch long design that supports the handheld transceiver and four directors (see Figure 1). A bicycle handle bar grip permits easy aiming. Finally, a speaker-mic simplifies aiming the antenna while talking or listening.

Simplest is Best

The key to simple feed line and mechanical connections was to mount the transceiver on the antenna in place of a driven element. Director size and spacing data was taken from *The ARRL Antenna Book*.[1] The FT-60 mounts easily using the belt clamp on the rear of the radio (see Figure 2).

Making it Happen

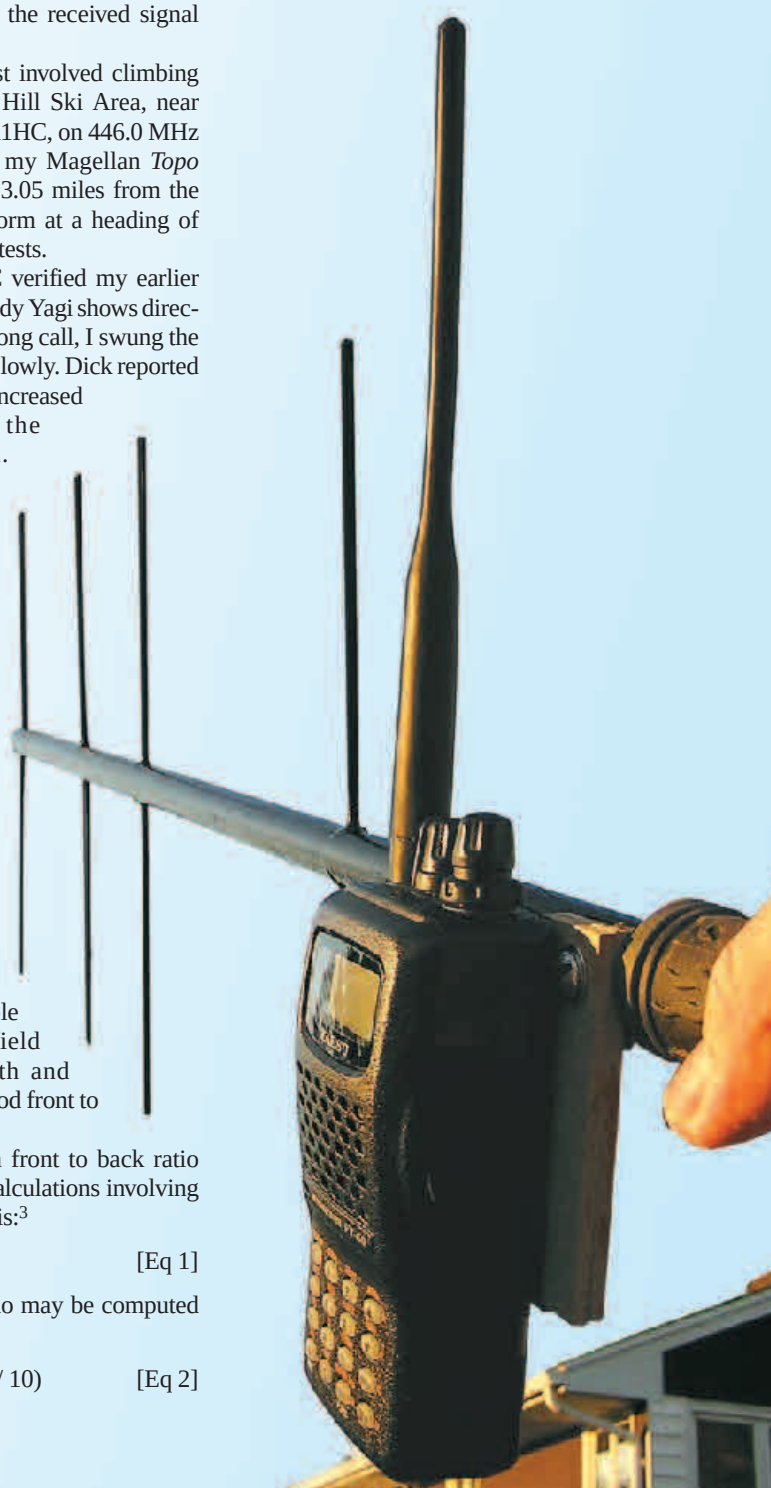
Construction is straightforward. A 38 inch long ¾ inch diameter dowel serves as the boom. The directors were cut from ⅛ inch steel rod stock. The radio holder is made from two pieces of ⅛ inch fiberboard and ¼ inch rubber spacers. Two bolts hold the bracket in place.

Checking it Out

In the absence of proper analytical instruments, I resorted to on-air reports and *EZNEC 4.0* analysis.[2] My initial test involved calling the K1BFD 440 MHz repeater. I am unable to raise Barry's machine from my home location with the FT-60 alone. By adding the Handy Yagi, I had no trouble accessing the machine. The receiver meter was nearly full scale with the antenna pointing at the repeater. By turning the antenna in an arc toward and away from K1BFD/R, I could see the received signal strength rise and fall.

The second field test involved climbing to the top of the Blue Hill Ski Area, near Boston. I called Dick, K1HC, on 446.0 MHz simplex. According to my Magellan *Topo 3D* software, K1HC is 3.05 miles from the top of the ski lift platform at a heading of 282°. I ran ½ W for the tests.

A QSO with K1HC verified my earlier observation that the Handy Yagi shows directivity. While making a long call, I swung the antenna back and forth slowly. Dick reported that the signal strength increased and decreased with the changes in direction. When K1HC transmitted, the same effect was apparent as I moved the antenna back and forth while receiving.



Model Analysis

The *EZNEC* computations involved entering a driven element and four directors. In a compromise, my model uses a ½ wavelength (λ/2) center fed dipole to represent the FT-60. The *EZNEC* predictions provide reasonable agreement with the field observations. Azimuth and elevation plots show good front to back gain.

EZNEC computes a front to back ratio (F/B) of 4.65 dB. For calculations involving power, the relationship is:[3]

$$dB = 10 \log (P2 / P1) \qquad [Eq\ 1]$$

Then, the power ratio may be computed from:

$$(P2 / P1) = \text{antilog} (dB / 10) \qquad [Eq\ 2]$$

[1]Notes appear on page 38.

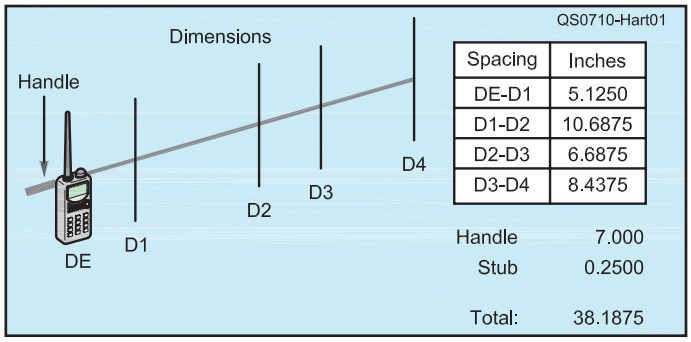


Figure 1 — Orientation and dimensions of the Handy Yagi.

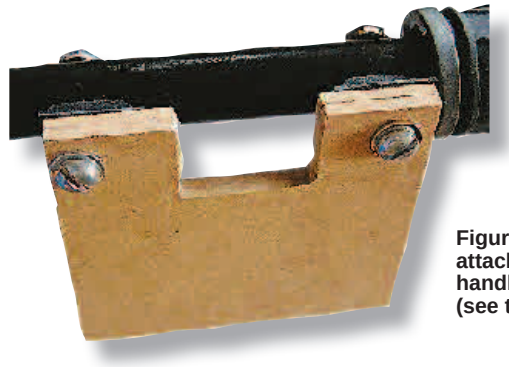


Figure 2 — Details of attachment point for handheld transceiver (see title photo).

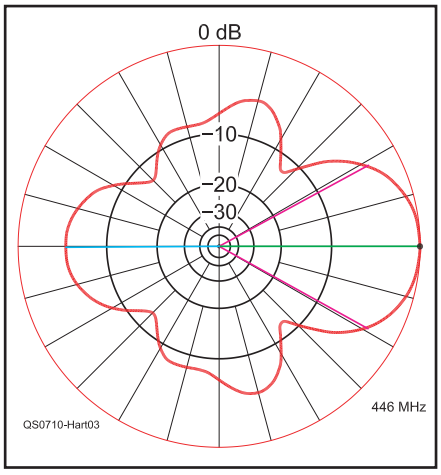


Figure 3 — *EZNEC*-predicted azimuth plot of antenna using dipole driven element.

The *EZNEC* F/B yields a power ratio of:

4.65 = 10 log (P2 / P1) [Eq 3]
antilog (4.65/10) = (P2 / P1) = 2.9

Therefore, the calculated front to back power ratio is nearly 3:1.

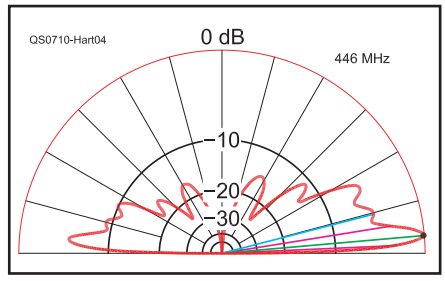


Figure 4 — *EZNEC*-predicted elevation plot of antenna using dipole driven element.

In Conclusion

For anyone interested in temporary or portable operations on the 440 MHz band, the Handy Yagi might be a simple antenna solution. The design may also be useful in foxhunting activities. Larger implementations of the basic design could be mounted on a tripod or suspended from an overhead support. The basic design is very simple and adaptable. The key is the substitution of a transceiver for the driven element and feed line.

Notes

[1]R. D. Straw, Editor, *The ARRL Antenna Book*, 21st Edition, p 18-45. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 9876. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop/**; **pubsales@arrl.org**.

[2]**www.eznec.com**.

[3]J. Hallas, W1ZR, "Making Sense of Decibels" *QST*, Apr 2007, p 61.

Tom Hart, AD1B, began listening to short wave broadcasts in 1961. He received his Novice class license, WN1JGG, in 1968 and has been active on CW, SSB, RTTY, FM and packet ever since. He still monitors the short wave bands, listening to Radio Australia or Radio China International while driving to work every morning.

Tom has a BS from Tufts and an MS from Northeastern. He is an accountant who would rather be chasing or giving out counties on 20 meters. You can reach Tom at 54 Hermaine Ave, Dedham, MA 02026 or via **tom.hart@verizon.net**. QST

Strays

QST congratulates...

♢ Allen Eiermann, K3LSR, who has been named the new acting chief of Air Force MARS. Eiermann takes over for Don Poquette who recently retired form the Air Force. Eiermann holds a General class Amateur Radio license and is a former Navy/Marine Corps MARS member. "I am looking forward to serving the MARS community and will work closely with the Army and Navy-Marine Corps MARS Chiefs to bring the tri-service MARS programs closer to being just MARS. I fully support interoperability between the three services and the efforts to provide communications services to other federal agencies and civilian communities during times of need," Eiermann said.

♢ retired CBS Evening News anchor Walter Cronkite, KB2GSD, and *QST* author and ARRL Technical Advisor John S. Belrose, VE2CV, who will receive the Radio Club of America's foremost achievement award, the Armstrong Medal, at the Club's November 16 banquet in New York. In addition, Cronkite has been conferred honorary membership in the Club in part because of his work to promote Amateur Radio. Dr Belrose is the author or co-author of more than 150 papers, articles and technical correspondence letters written relevant to the fields of radio communications, radio science, antennas and propagation.

♢ Elden P. (WA9IQL) and Ester I. Lafoon, of Bolingbrook, Illinois, who were honored by their village's Mayor and Trustees for making "an outstanding contribution to the community." The honor cited Elden's extensive emergency communications volunteer service to his fellow citizens.

♢ Clay Frienwald, K7CR, of Auburn, Washington, who is to receive the 2007 *Radio World* Excellence in Engineering Award from the editors of *Radio World*, a newspaper for radio managers and engineers. He is being recognized for his work to improve the state of emergency alerting systems in the United States and broadcasters' involvement in EAS, as well as for his accomplishments as a corporate technical executive.

♢ ARRL member Dr Norbert E. Yankielun PE, WA1O, whose book, *How to Build an Igloo and Other Snow Shelters*, has been published by Norton Press.

I would like to get in touch with...

♢ Ken Miller (call sign unknown), who was stationed at Moody AFB, Valdosta, Georgia, in the mid '70s. — *Rick Jandrt, K9SGT;* **k9sgt@arrl.net**

Simple Sideband, Another Approach

We've recently published a phasing method SSB transmitter; now here's a simple filter method SSB transceiver.[1]

David Harrison, W6IBC

Have you ever built a single sideband transceiver from scratch? Well, years ago I did so, and recently, I tried it again. The lead photo shows two views of my latest effort at what I call "simple sideband." When I first entered the ranks of Amateur Radio experimenters at age 15, it seemed that everyone built their own ham gear. My early rigs tended to be tube-based CW or AM phone designs, as single sideband had not yet been widely adopted as a mode by hams.

You Can't Keep a Builder Down

This low power 40 meter SSB filter transceiver follows a minimalist approach. It evolved from designs found in the ham radio literature.[2] All components and parts are still available, and construction does not require patterned circuit boards. Depending upon your own junk box resources, you should be able to build this radio for under $100. I have constructed two different versions with alternative packaging arrangements to suggest a wide degree of freedom in constructing the circuits. This should provide a high likelihood of success for any determined builder.

Architecture

As shown in Figure 1, this rig's design implements a bidirectional signal path, and essentially comprises a crystal filter between two Phillips SA612 Gilbert cell IC mixers (U1 and U2), without any IF amplifier. One mixer (U2) operates between audio and IF as a product detector in receive, and as a balanced modulator in transmit. It includes the BFO/Carrier oscillator function aided by an external crystal and a trimmer capacitor to set the BFO/Carrier oscillator frequency at the edge of the crystal filter passband. The other mixer (U1) operates between RF and IF. It receives a local oscillator signal either from a low power direct digital synthesis (LPDDS) board I designed several years ago, or from a surprisingly stable permeability-tuned oscillator (PTO) shown in Figure 2.[3,4]

Design Details

By using bi-directional signal flow through the crystal filter, signal diplexer components found in similar rigs may be avoided, thereby reducing parts count and further simplifying the circuit design.

Transmit Audio and Control Subsystems

A 74HC4053 analog multiplexer IC (U3) is used, along with several FET switches (Q2 and Q9), to enable push-to-talk capability (FN-6). Since a speaker-mic typically includes an electret (electrostatic magnet) microphone element requiring bias voltage, power switching circuitry is provided to separate the dc control levels present on the mic line from audio also present on the same line.

A common-collector 2N3906 PNP transistor (Q4) provides some audio power gain for the mic input level, and a 10 kΩ trimming potentiometer (R8) sets mic gain level into the SA612 balanced modulator (U2). A relatively large 2N4033 PNP switching-mode transistor (Q5) controlled by current passing through the transmit switch of the speaker-mic supplies power to the transmitter driver stages and operates the receive-mode relay (K1 on transmit amplifier board, Figure 3). When the TRANSMIT button is pressed, the mic audio line presents a dc path to ground of about 1000 Ω. This ground path, when added to the 4.7 kΩ resistor at the base of the 2N4033 transistor, causes it to switch on, thereby supplying transmit voltage to the driver stages and receive relay K1 (Figure 1, control signal A), and a positive bias voltage to turn off the J176 PFET (Q9) in the receive audio path through a diode D1. A capacitor at the gate of Q9 establishes a transmit-to-receive delay interval set to minimize audio pop when the mic switch is opened. The transmit voltage also drives a 2N3904 NPN transistor (Q6) into conduction, which switches from the supply voltage level to a level less than a volt (Figure 1, control signal B). This causes the analog multiplexer (U3) to reverse signal paths through the two SA612s (U1 and U2), and causes the 2N7000 MOSFET switch (Q2) to remove voltage from the receiver preamp stage (Q1).

Crystal Filter Design

The six pole crystal filter uses low-cost 11.059 MHz computer crystals and provides excellent single signal capability. By using 11.059 MHz as the IF frequency for 40 meter phone, locally generated beats, birdies, and harmonics are essentially avoided. The crystal filter follows the Cohn topology.[5] In order to have enough crystals at approximately the same frequency (within about 100 Hz), I ordered 30 computer crystals at a quantity discount from a major mail-order supplier, so it was easy to implement the six pole filter. Initially, I put a small piece of tape on each crystal, gave each crystal a unique number written on the tape and measured oscillation frequency with a simple two-stage transistor oscillator. I recorded the results for each crystal in a notebook. Crystals having the closest frequencies were selected for the six-crystal filters. Three of the 30 inexpensive crystals would not even oscillate in my test circuit! A four-crystal Cohn type filter also worked satisfactorily on both receive and transmit. With the specified 150 pF shunt capacitors, 3 dB bandwidth was about 2.5 kHz. The 470 Ω filter end termination resistors and coupling capacitors C16 and C18 provide a fairly close match to the input impedance of the SA612s and also tend to limit some of the crystal filter circuit's reactance upon adjacent circuits.

View of two versions of the SSB transceiver. The example on the left includes the FREQ-Mite frequency counter offered by Small Wonder Laboratories.

[1]Notes appear on page 44.

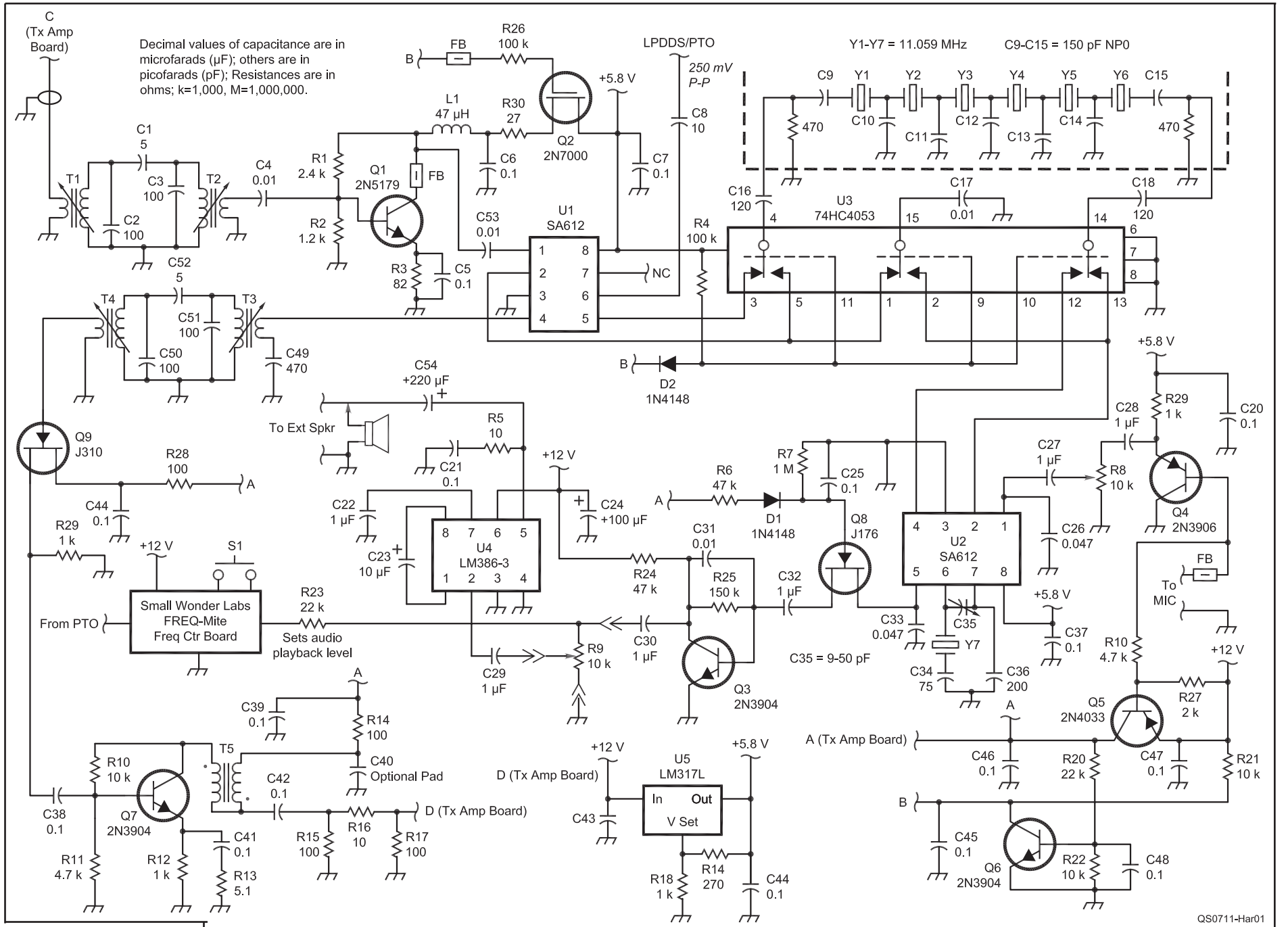

C (Tx Amp Board)
Decimal values of capacitance are in microfarads (µF); others are in picofarads (pF); Resistances are in ohms; k=1,000, M=1,000,000.
LPDDS/PTO
250 mV P-P
Y1-Y7 = 11.059 MHz
C9-C15 = 150 pF NP0
U1 SA612
U2 SA612
U3 74HC4053
U4 LM386-3
U5 LM317L
Q1 2N5179
Q2 2N7000
Q3 2N3904
Q4 2N3906
Q5 2N4033
Q6 2N3904
Q7 2N3904
Q8 J176
Q9 J310
D1 1N4148
D2 1N4148
To Ext Spkr
From PTO
Small Wonder Labs FREQ-Mite Freq Ctr Board
Sets audio playback level
To MIC
A (Tx Amp Board)
B (Tx Amp Board)
D (Tx Amp Board)
Optional Pad
C35 = 9-50 pF
QS0711-Har01

Figure 1 — Schematic diagram and parts list for the main portion of the SSB transceiver. Commercial parts sources include Mouser Electronics (www.mouser.com), Ocean State Electronics (www.oselectronics.com), and Digi-Key Corp (www.digikey.com). The output and driver transistors are available from RF Parts Inc (www.rfparts.com).

C1, C52 — 5 pF ceramic capacitor.
C2, C3, C50, C51 — 100 pF ceramic capacitor.
C4, C17, C53 — 0.01 µF capacitor.
C5-C7, C20, C21, C25, C37, C41, C43-C48 — 0.1 µF ceramic capacitor.
C8 — 10 pF ceramic capacitor.
C9, C15, C49 — 470 pF ceramic capacitor.
C10, C14 — 150 pF NP0 (C0G) capacitor.
C16, C18 — 120 pF ceramic capacitor.
C22, C27, C28-C30, C32 — 1 µF capacitor.
C23 — 10 µF electrolytic capacitor.
C24 — 100 µF electrolytic capacitor.
C33 — 0.047 µF ceramic capacitor.
C34 — 75 pF NP0 (C0G) ceramic capacitor.
C35 — 9-50 pF variable capacitor.
C36 — 200 pF ceramic capacitor.
C49 — 470 pF ceramic capacitor.
C54 — 220 µF, 50 V electrolytic capacitor
D1, D2 — 1N4148 small signal diode.
FB — Amidon FB-43-101 ferrite beads slipped over component lead or 24 gauge insulated hookup wire.
L1 — 47 µH choke. API Delevan Series 1641 (Digi-Key Part No. DN 42101-ND).
Q1 — 2N5179 transistor.
Q2 — 2N7000 N channel JFET switch.
Q3, Q6, Q7 — 2N3904 transistor.
Q4 — 2N3906 transistor.
Q5 — 2N4033 transistor.
Q8 — J176 FET.
Q9 — J310 FET
R1 — 2.4 kΩ, ¼ W resistor.
R2 — 1.2 kΩ, ¼ W resistor.
R3 — 82 Ω, ¼ W resistor.
R4, R26 — 100 kΩ, ¼ W resistor.
R5, R16 — 10 Ω, ¼ W resistor.
R6, R24 — 47 kΩ, ¼ W resistor.
R7 — 1 MΩ, ¼ W resistor.
R8 — 10 kΩ trimmer resistor.
R9 — 10 kΩ, potentiometer.
R10, R21, R22 — 10 kΩ, ¼ W resistor.
R11, R31 — 4.7 kΩ, ¼ W resistor.
R12, R14, R15, R17, R28 — 100 Ω, ¼ W resistor.
R13 — 5.1 Ω, ¼ W resistor.
R18, R29 — 1 kΩ, ¼ W resistor.
R19 — 270 Ω, ¼ W resistor.
R20, R23 — 22 kΩ, ¼ W resistor.
R25 — 150 kΩ, ¼ W resistor.
R27 — 2 kΩ, ¼ W resistor.
T1-T4 — See text.
T5 — 12 bifilar turns on FT-37-43 ferrite core.
U1, U2 — SA612 integrated circuit.
U3 — 74HC4053 integrated circuit.
U4 — LM386-3 audio output integrated circuit.
U5 — LM317L variable output voltage regulator integrated circuit.

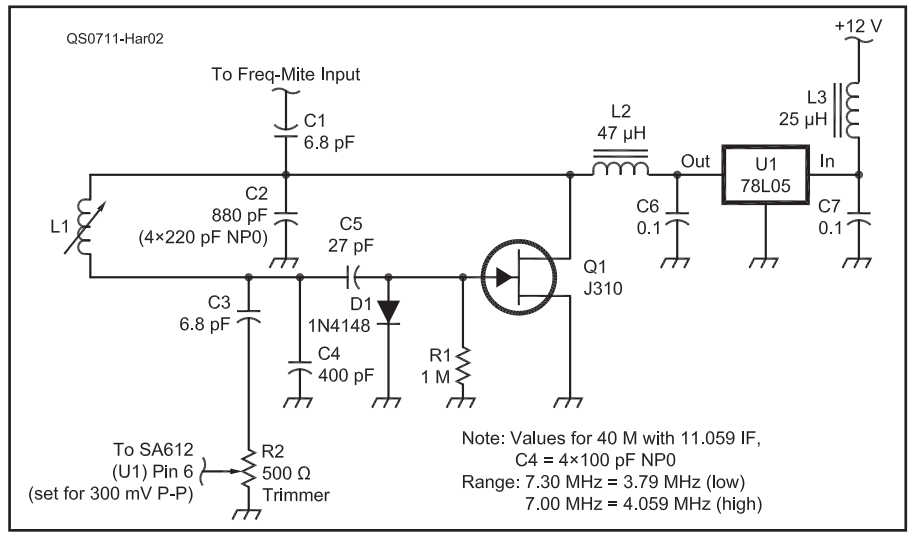


Figure 2 — Schematic diagram and parts list for the permeability tuned oscillator option of the SSB transceiver.

C1, C3 — 6.8 pF ceramic capacitor.
C2 — 880 pF capacitor. Made from four 220 pF NP0 capacitors in parallel.
C4 — 400 pF capacitor. Made from four 100 pF NP0 capacitors in parallel.
C5 — 27 pF ceramic capacitor.
C6, C7 — 0.1 µF capacitor.
D1 — 1N4148 small signal diode.
FB — Amidon FB-43-101 ferrite beads slipped over insulated wires.
L1 — 50 turns, 28 gauge enameled wire on 5/16 inch soda straw. Brass 8-32 screw used as slug. See text.
L2 — 47 µH inductor. Size 1210 surface mount part (Digi-key PCD1-28CT-ND).
L3 — 25 µH inductor. Formed by passing 7 turns of 24 gauge insulated wire through an FT50-43 ferrite core.
Q1 — J310 FET.
R1 — 1 MΩ, ¼ W resistor.
R2 — 500 Ω trimmer potentiometer.
U6 — 78L05 voltage regulator integrated circuit.

RF Amplifier Design

There is no IF amplifier in the present approach. In order to provide adequate receiver gain without excessive noise, a high gain, low noise 2N5179 UHF BJT RF amplifier stage (Q1) is used to provide about 25 dB of signal gain into the first mixer (U1). The receiver input includes a critically coupled double tuned filter (T1 and T2) to eliminate signal images and other interference. I obtained some surplus TOKO slug-tuned 4-6 µH inductors that had three unused connection pins.[6] I carefully disassembled the inductors and wound a three-turn secondary around each primary, connecting the secondary to two of the unused pins. These devices became the transformers used in the receiver input path, and also the signal-isolating transformer (T3) used in the transmitter path. One could easily substitute commercially available transformers, or iron powder toroid core transformers and small variable capacitors, for the adjustable transformers, T1 through T4.

AF Amplifier Design

Each SA612 IC provides about 17 dB gain, leaving the balance of the required gain to be provided by the two audio amplifier stages. The LM386-3 (U4) audio output stage is capable of providing very comfortable listening via the mic speaker or a little 2 inch speaker included in the cabinet of one version. The panel-mounted volume control (R9) is connected between the audio preamp stage and the LM386 output stage. A LM317L voltage regulator (U5) is biased to drop the 12 V supply voltage to 5.8 V to supply voltage to all of the receiver stages other than the audio stages. A 78L06 regulator could be used in place of U5. Superior audio quality over a wider dynamic range was found to result by operating the receiver audio stages at 12 V, with a slight increase in receive power consumption compared to 6 V operation.

Gain Control and Muting

To maintain simplicity and receive audio quality, no automatic gain control (AGC) circuitry is included. I elected not to add an AGC circuit because virtually all of my experiments with AGC (whether derived at IF or audio) have resulted in less than crystal-clear audio quality at the speaker. Without AGC the audio output is clear and crisp, even while zero beating with international AM broadcast signals. During transmit, this design mutes receiver audio by applying a positive voltage to the gate of the J176 P-channel FET (Q9). An audio-derived AGC stage could be easily added if desired.

Local Oscillator Design and Construction

So-called "ugly construction" built on surplus unpatterned copper-clad circuit board material was employed throughout, except where noted.

The permeability tuned local oscillator (PTO) example, shown in the Figure 2 schematic, and shown in Figure 4, is preferably implemented with a single J310 NFET (Q1). It uses a coil (L1) wound on a soda straw that is tuned with a brass screw. As the screw threads into the coil, inductance is reduced without adversely affecting oscillator stability. One of my preferred solutions for the straw-screw interface is to cut a 5/8 inch cylindrical slug from a length of 1 inch wooden dowel. Center drill

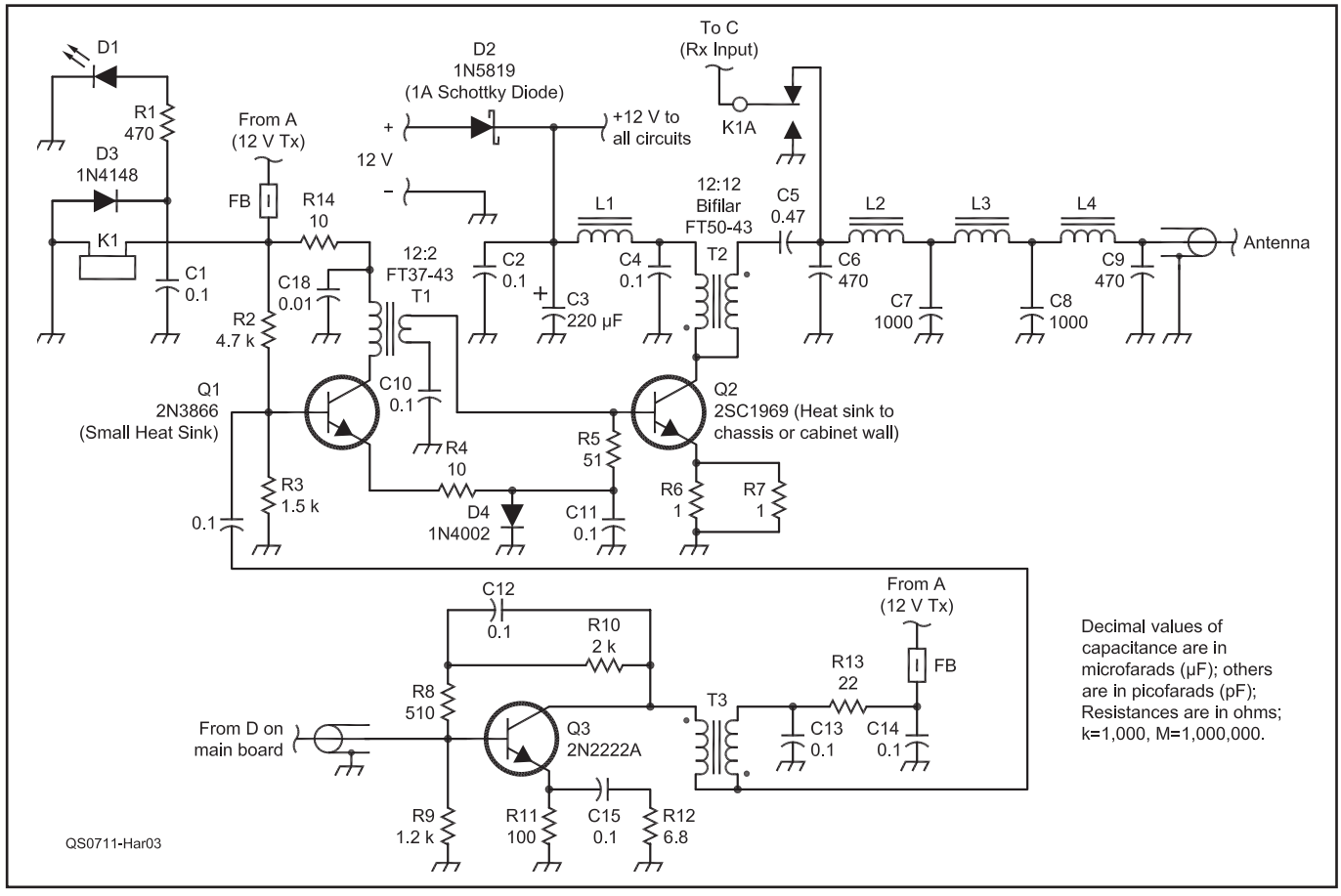


Figure 3 — Schematic diagram and parts list for the transmit amplifier sub-board of the SSB transceiver.

C1, C2, C4, C10-C18 — 0.1 µF capacitor.
C3 — 220 µF electrolytic capacitor.
C5 — 0.47 µF capacitor.
C6, C9 — 470 pF ceramic capacitor.
C7, C8 — 1000 pF ceramic capacitor.
D1 — LED. LiteOnLTL2R3SEK (Jameco Part No. 790401).
D2 — 1N5819 Shottky diode.
D3 — 1N4148 small signal diode.
FB — Amidon FB-43-101 ferrite beads slipped over insulated wires.
K1 — Panasonic DS series low signal relay type DS1E-M-DC12V (Jameco Part No. 842734).
L1 — 20 µH inductor. 5 turns 22 gauge enameled wire on FT37-43 ferrite core.
L2, L4 — 1 µH inductor. 18 turns 28 gauge enameled wire on T37-6 core.
L3 — 1.2 µH inductor. 19 turns 28 gauge enameled wire on T37-6 core.
Q1 — 2N3866 transistor mounted on a small heat sink.
Q2 — 2SC1969 transistor. Heat sink to chassis or cabinet wall.
Q3 — 2N2222A transistor.
R1 — 470 Ω, ¼ W resistor.
R2 — 4.7 kΩ, ¼ W resistor.
R3 — 1.5 kΩ, ¼ W resistor.
R4, R14 — 10 Ω, ¼ W resistor.
R5 — 51 Ω, ¼ W resistor.
R6, R7 — 1 Ω, ¼ W resistor.
R8 — 510 Ω, ¼ W resistor.
R9 — 1.2 kΩ, ¼ W resistor.
R10 — 2 kΩ, ¼ W resistor.
R11 — 100 Ω, ¼ W resistor.
R12 — 6.8 Ω, ¼ W resistor.
R13 — 22 Ω, ¼ W resistor.
T1 — Primary 12 turns, secondary 2 turns 26 gauge enameled wire on FT37-43 ferrite core.
T2 — Primary 12 turns, secondary 12 turns 26 gauge enameled wire bifilar wound on FT50-43 ferrite core.
T3 — Primary 12 turns, secondary 12 turns 26 gauge enameled wire bifilar wound on FT50-43 ferrite core.

a small hole (clearance for brass screw) axially through the slug. Using the pilot hole, drill a recess in one face with a drill sized to receive a threaded brass nut to a depth enabling the nut to be flush with the slug face. I used a large ⅜ inch circumference brass nut. Using a screw as a guide through the slug, carefully glue the brass nut in place in the recess with epoxy, trying to avoid getting any glue on the screw threads.

Using the pilot hole, drill a recess sized to match the soda straw into the opposite face to a depth of about a quarter of an inch to receive the soda straw in a close-fitting engagement. Two small sheet metal screws are used to hold the slug to a front panel of a cabinet. Winding the coil on the straw creates hoop strength and results in a stable construction. I found the larger (5⁄16 inch diameter) McDonald's soda straw to be preferable over quarter inch diameter plastic straws. I used a large needle to punch two holes defining a shallow chord across the straw's circumference at each end of the coil to secure each winding end. I started with 50 turns close-spaced, and reduced the turns to arrive at the final inductance needed to cover the 40 meter band (about 48 turns). The wood mounting plug also provides a small amount of damping and isolation against mechanical vibration that could cause FM.

The coil can be coated with a compound such as Q-dope, or wrapped with Teflon plumbers tape, to stabilize the windings. It doesn't hurt to glue the straw into the wooden slug with a suitable adhesive when all of the trimming adjustments are completed. Use of a 2 inch 8-32 brass screw affords a tuning range across the entire 7.0 to 7.3 MHz of the US 40 meter ham band. If less band coverage is desired, a 2 inch 6-32 screw may be employed. After removal of the screw-head, a ¼ inch diameter threaded brass slug or stand-off is soldered onto an outer end of the screw to match a knob shaft diameter.

Because of ready availability of negative-positive-zero (NP0) capacitors in 1206 surface-mount size format, I constructed the PTO oscillator on a small general purpose printed circuit board. "Surfboard Model 9161" is intended to receive and connect 16-pin SOIC package integrated circuits.[7] This small proto-board includes 16 peripheral edge pad pairs capable of receiving 1206 size surface mount components. I mounted the multiple capacitors of the gate electrode side along

one row of edge pad pairs, and I mounted the multiple capacitors of the drain electrode side along an opposite row of edge pad pairs. Extra edge pads were used for the other circuit components shown in Figure 2 including the 5 V regulator (U1), diode (D1), 1 MΩ resistor, decoupling inductor L2, and associated coupling and bypass capacitors. I interconnected all of the outermost peripheral pads of the pairs along both edges with lengths of braided solder wick which extended beyond the board dimensions to provide grounding straps to the main printed circuit board copper mounting surface as shown in Figure 5.

The PTO oscillator turns out to be surprisingly stable with temperature variations, and can be further stabilized if needed by well-known techniques. A variable resistor trimmer is provided at the gate-electrode-side output of the PTO to drop the PTO output voltage to a level compatible with the SA612 oscillator signal input requirements (nominally 250 to 350 mV). My initial failure to observe this required low input level resulted in amplitude limiting or clipping within the SA612 (U1), and an objectionable PTO second harmonic appearing at about 7.6 MHz (and a third harmonic appearing at about 11.4 MHz) in the transmitter output spectrum. My spectrum analyzer indicated that 200 mV_{P-P} was an ideal compromise level for LO drive for both units. If you have trouble with what looks like less-than-stellar carrier suppression, be sure to investigate this possible cause of unwanted signal injection. You don't want to be transmitting any signal outside the ham bands!

Frequency Readout

A low-power frequency counter, such as the FREQ-Mite, offered by Small Wonder Laboratories (**www.smallwonderlabs.com**), can be used to provide a direct frequency readout during receive. With this dandy accessory unit, when a front-panel-mounted push-button switch (S1) is pressed, the PIC microcontroller leaves a sleep mode and counts the number of zero crossings occurring during a 128 ms crystal-controlled counting interval. The resultant binary count is then converted into Morse code characters. The three-digit Morse code readout is then annunciated through the receiver audio amplifier and speaker at one of two user-selectable code speeds.

A 10 kΩ series resistor was used to equalize the FREQ-Mite audio output with the receiver audio level ahead of the volume control (P2). This connection arrangement enabled the volume control (P2) to set both receive level and playback level from the digital frequency meter. After playing out the frequency, the FREQ-Mite microcontroller goes back to sleep to avoid creating any possible digital noise or interference to the receiver. It is readily programmed with jumpers to set up the 11.059 MHz IF difference offset, and a difference mode is selected by the user at each power-up of the unit.

I strongly recommend considering inclusion of a FREQ-Mite, or an equivalently accurate frequency meter, in any homebrew rig that doesn't have a crystal-calibrated frequency readout. (Build the receiver audio stages and FREQ-Mite first.)

Transmitter Design

The transmitter puts out about 5 W PEP. The final stages are an adaptation of prior work by Zack Lau and Dave Benson.[9] The output transistor is specified as an equivalent of the now obsolete Motorola MRF-476, and is available from a US supplier.[6] The 2N3866 driver transistor is also currently available commercially. Rather than attempting diode TR signal switching, I preferred using a small 12 V single pole double throw (SPDT) relay (K1) that normally connects the receiver input to the transmitter low pass filter during receive and grounds the receiver input during transmit. A diode (D6) protects other circuits from relay switching induced transients. A three-stage low pass output filter including inductors L3, L4 and L5 is used to reduce harmonics to levels in compliance with FCC spectral purity requirements.

Putting it all Together

The speaker jack is most preferably installed adjacent to the microphone jack with a ⅜ inch offset alignment enabling plug-in use of conventional speaker-mics of the type used in some ICOM VHF handheld rigs (FN-15), thereby facilitating field or battery-power portable operation. I drilled a blank hole for the speaker plug rotated 90° from the microphone jack and speaker jack, so that when the active speaker jack is not engaged by the speaker-mic's speaker plug, audio is sent to an internal or external speaker

There is no ON-OFF switch, with that function provided by plugging and unplugging the power supply plug from the coaxial power jack. A 1 A 1N5819 low forward voltage drop Schottky diode (D2 in Figure 3) is placed in series with the positive power lead to protect the circuitry against inadvertent voltage polarity reversals. An LED (D1 in Figure 3) is epoxied to the front panel and connected to the transmit control line (line A) through a current-limiting resistor to provide the operator with a visual indication of transmit mode.

In order to explore alternative packaging arrangements, I built two versions of this rig. In an initial version I used one of my low power AD9834 based DDS boards as the local oscillator, and included the encoder and display. In this original version, the Figure 1 circuitry was constructed, "ugly style" on a double sided printed circuit board and mounted on 1 inch standoffs to the cover lid of a cast 7.4 × 4.7 × 2 inch (LWH) aluminum box, such as a Hammond Model 1590D. In this first version the Figure 3 circuitry was separately constructed on a small circuit board that mounted directly against the inside face of the cover.

The RF power transistor was mounted to the cover with an insulator and heat transfer compound. This arrangement has all of the circuitry mounted to the die cast cover lid of the box and provides ready access to all circuit components and to the TUNING and VOLUME controls and digital display to aid debug and alignment. Because of a two inch height constraint, no internal speaker was included in this version. A small external computer sound system speaker is used in conjunction with, or in lieu of, the speaker mic, to improve audio quality on receive.

For the later version using the PTO and internal speaker, all of the circuitry was constructed "ugly style" on a single board

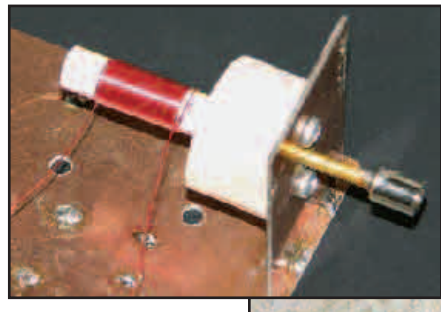


Figure 4 — View of the wooden dowel slug interfacing the brass screw and the soda-straw coil used as part of the PTO in the second version.

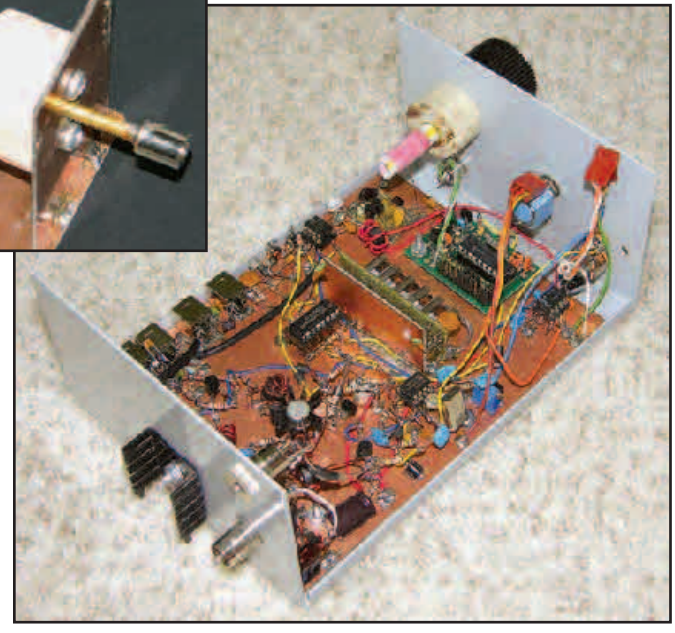


Figure 5 — Side view of the PTO version with the cover removed.

which was mounted within a 7 × 5 × 3 inch (LWH) LMB Crown Royal C.R.-753 clam-shell box. Use of a single printed circuit board substrate for all circuits turned out in the end to provide a more stable and robust transmit circuit arrangement, and is therefore the presently preferred approach. The PTO circuit board and FreqMite counter are mounted adjacent to the front panel, while the transmitter components are mounted adjacent to the rear panel.

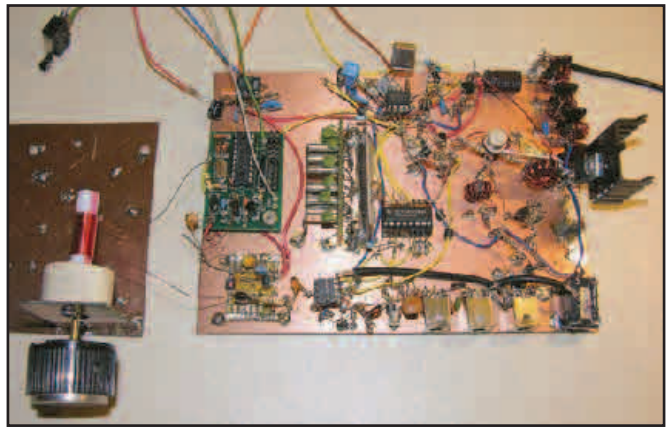


Figure 6 — View of the original prototype version.

The FREQUENCY MEASUREMENT push-button switch (S1) is mounted through the front panel directly below the tuning knob so that one hand can manipulate both controls. The crystal filter is mounted between the two SA612 Gilbert Cell ICs (U1 and U2). A small shield separates the crystal filter from the analog multiplexer stage. RF transformers T1, T2, T3 and T4 are mounted along one side edge, while audio stages and voltage control circuitry are mounted along the opposite side edge. The RF power transistor (Q2 in Figure 3) was mounted to the back wall of the cabinet with an insulator and heat transfer compound. An additional small heat sink was secured to the back of the back wall by the same screw that holds the RF power transistor in place. The driver transistor Q1 is directly behind the output transistor Q2, both in Figure 3. The miniature speaker is mounted to the inside top wall of the outer clam shell of the second version's cabinet and is connected by a Molex 2-pin plug-jack arrangement.

In all versions of this rig I used wire-wrap sockets for the integrated circuits (U1-U4). I formed an L-shaped bend in the IC socket ground leads and soldered them directly to the copper substrate. The other leads are generally bent 90° outwardly away from the socket to facilitate connection of wires and component leads. Use of sockets permits easy removal and replacement of IC components, in case of failures arising from wiring mistakes or supply polarity reversals.

Each crystal filter was built on a small rectangular section of prototyping board with isolated connection pads and plated-through holes surrounded by a ground plane on at least one surface. The assembled and tested filter was then soldered at corners to the copper substrate at a right angle orientation. A copper circuit board shield is placed adjacent to the terminal ends of the filter crystals. In laying out the various stages, a linear signal flow was generally found to be best. Try to keep inputs away from outputs as much as possible. I verified proper operation of each stage as it was added to the prototype. Liberal use of ferrite beads on wires and leads proved helpful in maintaining stability within the rig. Runs of mini-coax such as RG-174 helped keep RF signals where they were supposed to be and away from where they weren't.

How it Works

Receive-mode sensitivity appears only slightly less sensitive than my ICOM IC-756PRO on the same antenna. Using a neighborhood restriction compromised inverted V dipole antenna, I've received excellent signal reports with this rig from stations along the Pacific coast. I must say it has become one of my favorite rigs to operate. I've operated the rig with a small 2.3 Ah sealed lead acid battery with excellent results. Receive current draw (for the later version with the PTO oscillator) is around 50 mA, increasing slightly on audio output peaks. With my LPDDS board used in the first version and its back-lighted LCD display module, receive current increases to around 100 mA.

On transmit, about 1 A is typically drawn from the power supply on audio peaks. I've included a resistor attenuator network between Q7 and the amplifier board to reduce the output power level, if desired. With the network in place, single tone output power was measured at about 3.5 W on a Bird 43 wattmeter with a 50 W slug. With the network removed, output power was measured at about 5.5 W with the same arrangement and a 12 V supply. A small, battery-powered, two selectable-tone, phase-shift-audio oscillator was constructed and used to facilitate the transmitter testing and measurement process.

This project was initially constructed as a prototype (see Figure 6) and subsequently refined as each version was built. I spent a fair amount of time modeling the various stages with computer simulation programs, which greatly aided the design process. I also made extensive use of RF and audio signal generators, a frequency counter, an oscilloscope, and a spectrum analyzer. The AADE L/C meter proved invaluable in checking actual values of reactive components.[10] Obviously a QRP rig, it works well in the shack or in the field. Along with a portable 40 meter antenna, this rig could become a valuable, low cost addition to your emergency Go Kit. There are so many ways to build, house, and improve upon this design and its various elements. With thanks particularly to WA7JHZ and KD1JV for sharing their architectural ideas with the ham community by publishing their Web articles, and to the many other hams who have provided me with ideas, aid and encouragement along the way. I invite your serious consideration and experimentation with this rig design. I hope you'll find the process and result to be as rewarding as it has been for me!

Notes

[1]R. Campbell, KK7B, "The MicroT2 — A Compact Single-Band SSB Transmitter," *QST*, Dec 2006, pp 28-33.

[2]Web articles by David Forsman, WA7JHZ, "75 Meter QRP SSB Transceiver," QRPHB Web site, **www.qrp.pops.net/idaho.htm**, and KD1JV, "Fairly simple 80M SSB transceiver with solid state PTT and QSK switching," **kd1jv.qrpradio.com/page3.html,** inspired the present effort.

[3]W. Hayward, W7ZOI, R. Campbell, KK7B, and B. Larkin, W7PUA, *Experimental Methods in RF Design*. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 8799. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www. arrl.org/shop/**; **pubsales@arrl.org**, "Ugly Construction," pp 1.2-1.3.

[4]D. Harrison, W6IBC, "Low Power DDS with the AD9834 and the Microchip PIC," *QEX*, Sep/Oct 2005, pp 48-53.

[5]See Note 3, "The Min-Loss Filter of Cohn and other Simplified Filters," pp 3.21-3.23.

[6]Dan's Small Parts and Kits, Box 3634, Missoula, MT 59806-3634; **www.danssmallpartsandkits.net**. The output and driver transistors are available from RF Parts Inc (**www.rfparts.com**).

[7]Mouser part no. 42IF124 IF transformer (**www.mouser.com**).

[8]Jameco Electronics part no. 207386CM, for example (**www.jameco.com**).

[9]*The 2002 ARRL Handbook for Radio Amateurs*, "A 30/40 W SSB/CW 20-M Transceiver," pp 17.77-17.81, and D. Benson, NN1G, "A Single Board QRP SSB Transceiver for 20 or 75 Meters," *QST*, Apr 1997, pp 29-33.

[10]**www.aade.com**.

David Harrison, W6IBC, holds an Amateur Extra class license and has been a ham since 1957. After completing a career as a patent attorney in California's Silicon Valley, Dave and his wife, Joy, KI6ASJ, retired to Windsor, California, a small town nestled among the vineyards of Sonoma County. He remains keenly interested in Amateur Radio and keeps his soldering iron warm. In 2007 Dave is serving as president of his local ham club and is currently active on HF and VHF as well as local ARES activities.

David can be reached at 9459 Vinecrest Rd, PO Box 2298, Windsor, CA 95492-2298 or at **w6ibc@arrl.net**. QST

The New Road Map to the FCC Rules

How recent FCC actions have affected Part 97 and how these changes will affect how we operate.

Dan Henderson, N1ND

Amateur Radio exams revolve around three basic components — radio theory, operating practices and regulatory direction. They allow us to operate our stations safely, appropriately…and legally. Eliminate one of these and we could quickly find ourselves in a messy situation.

In some ways *The ARRL Handbook* and *The ARRL Operating Manual* could be compared to the Fodor's or Michelin guidebooks — they provide the details of how our radios work and the common practices for using them correctly. But just as with any journey, you have to have a good map to get you to where you want to go. In Amateur Radio, that road map is known as *Part 97* — the rules that govern the Amateur Radio Service in the US.

Part 97 (or as it's known inside the Beltway, Title 47, Volume 5, Chapter I, Part 97, "Amateur Radio Service") contains the specifics on almost everything affecting Amateur Radio in the US. In it, you'll find:

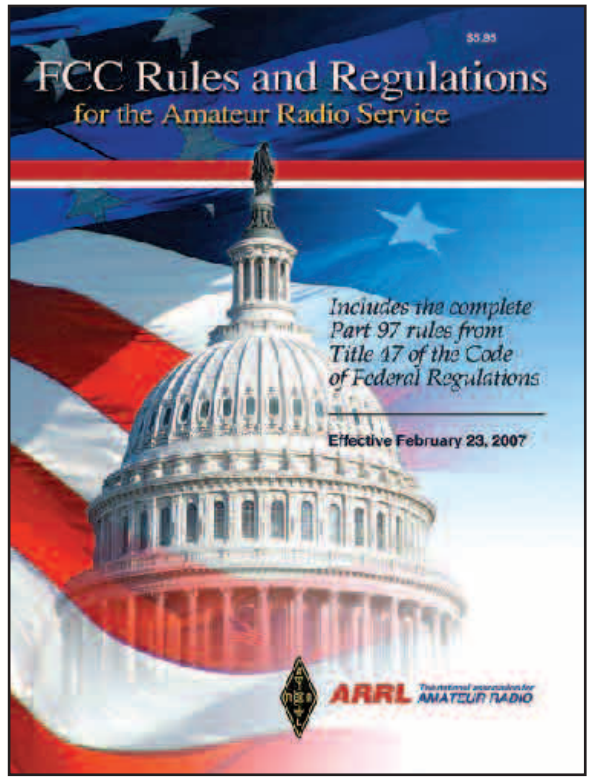
- all the working definitions and terminologies that govern our service;
- what is allowed any place Amateur Radio is under the jurisdiction of the Federal Communications Commission;
- what *isn't* allowed anyplace Amateur Radio is under the jurisdiction of the Federal Communications Commission;
- the procedures for testing and obtaining a license;
- technical standards describing the various modes hams use; and much more.

Whether you could have debated the fine points of Section 97.113(e) with William Jennings Bryan, or you haven't quite gotten around to sitting down with a copy in front of the fireplace, as a licensed amateur you are responsible for ensuring that your transmissions comply with the rules and regulations governing the Amateur Radio Service.

So Many Parts, So Little Time

So what does Title 47 encompass? Table 1 provides some context. Basically, Title 47 contains the rules covering telecommunications in the US. Its various parts, including our favorite, Part 97, set forth the regulations and standards that govern the various aspects of telecommunications. As you'll notice from Table 1, entities aside from the FCC oversee some sections of Title 47.

Just as with any journey, you have to have a good map to get you to where you want to go.



Which other parts of Title 47 affect us?

If you look at Part 2, for starters, you will find details on power restrictions on certain frequency bands. These kick in when the amateur station is located close to certain protected installations (power restrictions in and around Beale Air Force Base and the Kennedy Space Center, for example). Several references to Part 2, entitled "Frequency Allocations and Radio Treaty Matters; General Rules and Regulations," appear in Part 97.

We have all heard the term "Part 15 devices" in reference to low power commercial electronic equipment such as cordless telephones or the remote control for your car doors or television.[1] The technical standards these types of devices must meet are contained in Part 15, "Radio Frequency Devices." Computers fall into the "unintentional radiators" category of Part 15.

Industrial, Scientific and Medical equipment must meet the standards set forth in Part 18, while broadcast television and radio services are governed by Part 73.

Looking for more detail? You can find the full electronic *Code of Federal Regulations* online at **ecfr.gpoaccess.gov**.

Recent Changes to Part 97 and What They Mean to You

Some significant changes affecting the Amateur Radio Service occurred at the end of 2006 and early in 2007. The two most notable: "refarming" of the former Novice subbands on 80, 40, 15 and 10 meters in WT Docket 04-140, and the elimination of Morse code as a testing requirement for the General and Amateur Extra class licenses in WT Docket 05-235.[2]

Aside from these two blockbust-

[1]Notes appear on page 47.

Table 1
How Part 97 Fits into the Larger Scheme of Title 47

Title	*Volume*	*Chapter*	*Parts*	*Regulatory Entity*
Title 47 Telecommunication	1 2 3 4 5	I	0-19 20-39 40-69 70-79 80-199	Federal Communications Commission
		II	200-299	Office of Science and Technology Policy and National Security Council
		III	300-399	National Telecommunications and Information Administration, Department of Commerce

ers, other items included in the dockets have had an impact on the way we conduct ourselves on the air.

Call Signs

Call signs may just be the thing most dear to us hams. In 1996, the FCC rreintroduced a "vanity call sign system," which allowed amateurs to be issued call signs selected by the licensee. Docket 04-140 addressed several petitions related to this program.

For various reasons, some call signs are more desirable than others. For example, the 1×2 format for an Extra class license is attractive to contesters and DXers. Since the pool of available 1×2 calls is very small, there's a great deal of competition when a 1×2 becomes available. Before 04-140 took effect, if more than one applicant requested a specific call when it became available, the FCC would hold a lottery to determine the successful application. Since there was no limit to the number of applications a person could file, it was common for individuals to submit multiple applications for the same call sign, increasing their chances of winning the lottery. To address this, Part 97 was changed, effective December 15, 2006, to allow an individual only one vanity call sign application for any call sign.

Memorial call signs: Another issue addressed in 04-140 dealt with authorizing a call sign as a memorial after the licensee has passed away. Under the old rules, a club the licensee was a member of or the person's family had a voice…but not the licensee. The recent rule changes permit the licensee to designate a club that can claim his or her call sign (if the club wishes to do so).

Other Changes

Shuttle retransmissions: Years ago, in an attempt to stimulate interest in communications, the FCC allowed stations in the amateur service to retransmit signals from a US space shuttle over the amateur frequencies. Since that rule was written, the International Space Station, with its onboard ham radio station, has come onto the scene. The Report and Order in Docket 04-140 allows amateurs to retransmit all manned spacecraft communications originating on US government frequencies. When the time comes for the first manned voyage to Mars, it will be legal to retransmit the signals on the ham bands.

Auxiliary stations: Anyone who has owned a repeater is aware that if you were controlling it via an auxiliary station, Part 97 required that the auxiliary station had to be transmitting on an amateur frequency above 222.15 MHz. As part of the rules changes, the Commission has opened up parts of the 144 MHz band to include auxiliary stations. Note that this doesn't mean you can now solely control the repeater on its input frequency, but if you do use an auxiliary station it can now be on the 2 meter band.

The Report and Order in 04-140 addresses several important items relating to our ability to provide public service.

Spread spectrum frequencies: One of the emissions types hams have been experimenting with is spread spectrum (SS). In 1999, the FCC granted amateurs more flexibility in the types of SS that could be used but did not change the authorized bands. SS experimentation was limited in 1985 to any amateur frequency above 420 MHz. In response to requests for additional SS frequencies, the Com-mission granted access to the 1.25 meter (222-225 MHz) band.

Power amplifiers: Special rules relating to power amplifiers are designed to keep operators from converting them to CB use. In order to allow commercial manufacturers to produce amateur equipment for the 10 and 12 meter bands, the FCC recently removed certain restrictions that they deemed no longer necessary. Simply put, commercially built amplifiers must not exhibit any amplification capability between 26 and 28 MHz in order to receive equipment certification. Further, they must not be manufactured in a way to be easily modified to operate between those frequencies or a grant of equipment certification will be denied.

Emergency Communications Changes

Before anything else in Part 97 you will find (as stated in 97.1) the very first basic purpose of the Amateur Radio Service is the "(a) Recognition and enhancement of the value of the amateur service to the public as a voluntary noncommercial communication service, particularly with respect to providing emergency communications." The Report and Order in 04-140 addresses several important items relating to our ability to provide public service.

The debate about what is authorized in providing emergency and relief communications can often take interesting twists, depending on the perspective of the speaker. The Commission took a fairly straightforward approach when it revised 97.111(a) to include a provision that authorizes an amateur station to make transmissions necessary to meet essential communications needs and to facilitate relief actions at all times and on all frequencies authorized to the control operator. As a control operator, the amateur does what is necessary to meet the needs required of the situation.

The Commission also addressed certain limitations on bands and segments authorized for RACES (Radio Amateur Civil Emergency Service) operations. This does not mean that RACES has been abolished. On the contrary, the FCC recognizes that the Director of the Office of Science and Technology Policy (OSTP) has the authority needed to authorize, modify or revoke the Commission's frequency authorizations in time of wartime emergency. The activation of special frequencies and authorizations for RACES still exists, being derived from the OSTB.

Occasionally the Commission will

address or clarify issues through a Report and Order that do not need to be incorporated directly into Part 97. The actions of 04-140 included one such clarification. I am regularly asked by an individual or a representative of an agency who's looking for guidance on the status of an emergency worker using the amateur bands while on duty responding to an emergency. The question is usually phrased something along the lines of "Can I be operating the radio while I am on paid duty status?"

The FCC clarified that "the rules do not prohibit Amateur Radio operators who are emergency personnel engaged in disaster relief from using the amateur service bands while in a paid duty status. These individuals are not receiving compensation for transmitting amateur service communications; rather, they are receiving compensation for services related to their disaster relief duties and in their capacities as emergency personnel."

This affirms that relief personnel are not violating Part 97 rules if they are "on the clock" during relief operations when Amateur Radio may play a part in providing that relief. Make sure you understand the difference here…. The local Emergency Management can utilize regular paid staff in an emergency on the radio but it would not be permissible for them to hire on an amateur as a "temp" whose sole job would be manning the amateur equipment.

The last substantive area addressed in these changes dealt with revisions to the US implementation of the CEPT treaty, which addresses reciprocal operating between most European countries and the US. CEPT is the abbreviation for the French name for the European Conference of Postal and Telecommunications Administrations. Sometimes the rules must be adjusted to meet international treaty obligations. The R&O for Docket 05-235 amended Part 97 to give amateurs operating in the US under CEPT US Amateur Extra class operating privileges.

It Isn't Always As Easy as 1, 2, 3…

Newton's Third Law of Motion states, "For every action there is an equal and opposite reaction." The same could be said for unintended consequences resulting from rules changes. A comma in the wrong place or a dropped word in a sentence can change the intended meaning of a sentence. Changes in one area might end up causing an unanticipated change in another.

To help keep abreast of the rules, you should have ready access to an up-to-date copy of Part 97.

Such was the case when the Commission added additional phone privileges to the 80 meter Extra class subband. When the FCC moved the bottom of the Extra class phone band to 3.6 MHz, it inadvertently meant that the band segment designated for automatically controlled digital stations on the 80 meter band was now in a portion of the band (3.620-3.635 MHz) where it could not operate. To correct this, the FCC changed the automatically controlled subband to 3.585-3.600 MHz. This had a negative impact on RTTY, data and CW oeprators.

Delving Deeper

Have a specific Part 97 question? Try the Regulatory FAQ page at **www.arrl.org/regulations/**.

New Part 97 Booklet

After this look at some recent rules revisions, it is easy to see that addressing and updating the rules can be a complex and at times confusing process. To help keep abreast of the rules, you should have ready access to an up-to-date copy of Part 97. The ARRL offers a complete, up-to-date copy; every amateur should consider having this "roadmap" in their shack.[3]

Notes

[1]There's more on Part 15 (and Part 18, for that matter) at **www.arrl.org/tis/info/part15.html**.

[2]For more on 04-140, see **www.arrl.org/announce/regulatory/wt04-140/faq.html**, and for more on 05-235, see **www.arrl.org/fcc/morse/**.

[3]*FCC Part 97 Rules & Regulations*, ARRL order no. 1173. Available from the ARRL Bookstore (**www.arrl.org/shop**; **pubsales@arrl.org**, or call toll-free in the US, 888-277-5289).

Dan Henderson, N1ND, is ARRL Regulatory Information Specialist. He can be reached at **n1nd@arrl.org**.

Strays

PASADENA RADIO CLUB'S 50TH ANNIVERSARY POWERED BY HYDROGEN FUEL CELL

Tom Damberger, WA6EHD

◊ In May, at Victory Park in Pasadena, California, members of the W6KA Pasadena Radio Club made history. Aside from celebrating their club's 50th anniversary, they powered the entire event with a hydrogen fuel cell. Their high wattage transceivers were powered by the pure power generated with a cutting edge fuel cell that used hydrogen, a clean-renewable fuel. Club members made radio contacts with stations nationwide on this special occasion. Their history is one of public service during not only emergencies, but in times of nationwide viewing of the annual Pasadena Rose Parade.

Participants arrived at Victory Park at 7 AM to set up the station. The fuel cell was powered up, as were all the radios. There was one computer powered up and one on battery charge. A video on fuel cells played for the public to view as an introduction to help visitors understand how power was being generated. The fuel cell was producing full power (1000 W) right next to the operators. The RF field did not pose any problems for the fuel cell, nor was there any interference on any receiver. There was no utility power available onsite.

TOM DAMBERGER, WA6EHD

To celebrate its 50th anniversary, the Pasadena Radio Club held a special event operation with a twist: all power was provided by a hydrogen fuel cell.

There were several HF rigs to choose from along with operations on the local 2 meter repeater. Contacts were made from multiple states including mobile operators. One contact from a bicycle mobile was made during the final hours of operation. There was a demonstration of CW abilities amongst the old timers. QSL cards for the special event were issued to all contacts (see below). Since this was a public park, people had a natural interest in what the club was doing.

A teacher at the local middle school asked if someone could demonstrate Amateur Radio in his class. A Boy Scout leader requested to be notified of any future events so he could arrange for a field trip for the troop. Volunteers took names and contract information of those requesting group presentations on Amateur Radio. This 50th Anniversary Special Event provided a great platform for public exposure and the innovative avenues one can pursue through Amateur Radio.

S. KHRYSTYNE KEANE, K1SFA

2007 ARRL National Convention and GAREC Rocket to Huntsville

The National Convention, along with GAREC and the Huntsville Hamfest, showed Amateur Radio at its finest in Rocket City, USA.

S. Khrystyne Keane, K1SFA

The 2007 ARRL National Convention, held in conjunction with the Huntsville Hamfest, lived up to its promise to be "chock-full" of activities and exhibits. The centerpiece of the Convention was ARRL EXPO — an entire exhibit area showcasing numerous ARRL programs and services. According to Charlie Emerson, N4OKL, vice president of the Huntsville Hamfest Association, more than 5000 people enjoyed the National Convention and hamfest, held August 18-19 in Huntsville, Alabama, also known as "Rocket City, USA." Huntsville is home to NASA's Marshal Space Flight Center and the Army's Redstone Arsenal.

Above: The mascot of the Alabama Piglets, a group supporting Amateur Radio for youth in Alabama, made its first appearance at the National Convention.

Just prior to the hamfest, the 2007 Global Amateur Radio Emergency Communications Conference (GAREC-07), sponsored by the IARU, was Thursday and Friday, August 16-17. GAREC-07 registrants participated in emergency communications-themed presentations, discussions and demonstrations.

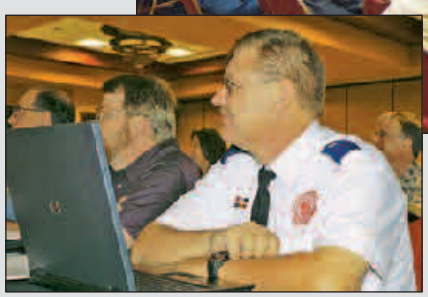
ARRL staff and volunteers ran booths and tables at the Convention, showcasing League services and programs. Representatives from various ARRL departments were in attendance, including the

GAREC-07 "Gets Back to Work" in Huntsville

Almost 100 people from all over the world attended The Global Amateur Radio Emergency Communications Conference, the third event of its kind and the first ever held in the United States, making this truly a global event. GAREC-07's prevailing theme, how to apply advanced technologies to emergency communications, was echoed throughout the two-day event. From presentations to discussion groups to emergency vehicle displays to information about the latest in hardware, GAREC attendees had a sampling of just about everything pertaining to the Emergency Communications arena.

Representatives from the IARU, ARRL, Army MARS, American Red Cross, Southern Baptist Disaster Relief, Department of Homeland Security, the Salvation Army, industry and others attended GAREC. Section Emergency Coordinators, District Emergency Coordinators and Emergency Coordinators from the ARRL field organization were also on hand. Southeastern Division Director Frank Butler, W4RH; CEO David Sumner, K1ZZ; Chief Technology Officer Paul Rinaldo, W4RI; Media and Public Relations Manager Allen Pitts, W1AGP, and Emergency Preparedness and Response Manager Dennis

JON BLOOM, KE3Z



S. KHRYSTYNE KEANE, K1SFA

The third Global Amateur Radio Emergency Communications Conference was held in Huntsville just prior to the National Convention.

Representatives from various disaster relief agencies, such as the Salvation Army, attended GAREC.

S. KHRYSTYNE KEANE, K1SFA

ARRL President Joel Harrison, W5ZN, congratulates the 2007 Young Ham of the Year, Grant Morine, W4GHM, of Wilmington, North Carolina.

JON BLOOM, KE3Z

ARRL Sales and Marketing Coordinator Jackie Cornell (foreground), Membership Manager Katie Breen, W1KRB (left), and VEC Manager Maria Somma, AB1FM, set up the ARRL EXPO area prior to the start of the National Convention.

JON BLOOM, KE3Z

The Youth Lounge was a popular hangout at the ARRL EXPO, sponsoring fox hunts, quiz games, crafts and a youth dinner.

ARRL Lab, Public Relations, Publications, Development, DXCC and Awards, and the ARRL VEC. The expansive ARRL Bookstore offered hundreds of books and other ARRL publications and merchandise.

ARRL Officers and Directors were on hand, too, including ARRL President Joel Harrison, W5ZN, and ARRL CEO David Sumner, K1ZZ. Representatives from the IARU, including President Larry Price, W4RA, and Vice President Tim Ellam, VE6SH, made the trek to Alabama, as well.

ARRL Headquarters staff and Field Organization leaders gave more than a dozen mini-forums on the ARRL Stage during the Convention in ARRL's considerable exhibit area. Presentations on the ARRL Stage included an update on Broadband over Power Line (BPL) given by Ed Hare, W1RFI; suggestions for energizing young — and potential — hams, presented by ARRL Youth Contributing Editor and Georgia Assistant Section Manager/Youth Andrea Hartlage, KG4IUM; a "how-to" session on writing for *QST*, presented by ARRL News Editor S. Khrystyne Keane, K1SFA; an introduction to ARRL Operating Awards and the ARRL QSL Service with ARRL DXCC Manager Bill Moore, NC1L; tips for contesting with *QST* Contributing Editor and ARRL author Ward Silver, NØAX, and an overview of Amateur Radio on the International Space Station (ARISS) presented by Rob Suggs, KB5EZ, NASA Space Environments Team Lead from the Marshall Space Flight Center.

ARRL staff presented forums at the hamfest, as well as on the ARRL Stage.

Dura, K2DCD, attended GAREC on behalf of the ARRL.

Both Pitts and Dura gave presentations. Pitts spoke about the need for a Public Information Officer to be in the Joint Information Center at any ARES deployment. "We lose far too many good stories because no one is in the right place speaking to media at the time of the incident. With a 24 hour news cycle, even a few hours later is too little too late. This idea was well received, and while many of the region's groups have recently added this to their action plans, approximately a dozen other groups stated that they will be adding this component to their activities. This information was also well received by some of the international representatives who asked for copies of our PR materials and permission to translate and modify them for use in their home countries," Pitts said.

Dura presented the topic of using Voice over Internet Protocol (VoIP), EchoLink and Internet Radio Linking Project (IRLP) for establishing and maintaining communications during hurricanes. The session discussed the methods of combining RF links to the Internet to establish a cohesive network. The VoIP Hurricane Net is another tool that Amateur Radio operators, the National Weather Service, the National Hurricane Center and emergency managers use to gather detailed information on local conditions.

Other presentations at GAREC included the use of new technologies and modes in Emergency Communications, such as D-STAR, ALE, EchoLink/IRLP, D-STAR, *Winlink 2000* and TSSG, an advanced system being developed in Ireland.

Outside of the conference venue, various Emergency Communications agencies brought their vehicles, giving a hands-on, hardware feel to GAREC. They were on display and tour for visitors to learn about mobile communications. These vehicles, hosted by Alabama Homeland Security, Alabama Baptist Disaster Relief, American Red Cross, The Salvation Army and the Tennessee Emergency Communications Association, were very popular, drawing large crowds.

Conference Recommendations

While GAREC is not a decision-making body, its ideas and proposals will be submitted to the IARU to be included for discussion at their next Administrative Council meeting, scheduled for June 2008. These ideas may also be discussed at upcoming meetings of each of the three IARU Regions.

The conference made the recommendation to introduce the call sign suffix /D to be used by those in the Amateur Radio Service who handle traffic related to emergency and disaster situations. According to Pitts, this recommendation, made by Willem Visch, PG9W, would let anyone listening immediately know there was emergency traffic and lessen the chances of someone unintentionally breaking in on an emergency net.

Another recommendation included the extension of "EmComm Party on-the-Air," similar to Emergency Communications exercises already in place in Region 1. The Region 1 representative, Seppo Sisatto, OH1VR, proposed holding two annual international drills,

JON BLOOM, KE3Z

ARRL Lab Manager Ed Hare, W1RFI, answers questions at the ARRL Lab table, part of ARRL EXPO.

JON BLOOM, KE3Z

ARRL Pacific Division Director Bob Vallio, W6RGG, helps out at the ARRL EXPO while New England Division Director Tom Frenaye, K1KI (left), looks on.

President Harrison moderated the ARRL Membership Forum. Education Services Manager Debra Johnson, K1DMJ, led the ARRL Education Forums, which included an overview of the ARRL's new Education Services Department. She also covered topics on the new ARRL mission statement on education, new licensing materials, enrichment courses and an update on ARRL outreach activities through the Education & Technology Program and Amateur Radio on the International Space Station (ARISS).

ARRL Membership Manager Katie Breen, W1KRB, took visitors on a virtual ARRL Headquarters tour, sharing stories of ARRL special event activities aimed at encouraging on-air activity among new and newly active hams, including real-time blogs and videos, *Hello-Live!* and the W1AW HF Open House. ARRL Media and Public Relations Manager Allen Pitts, W1AGP, talked about ARES and the media, and discussed ways to help public service activities capture the attention of the media; more than 8000 copies of the 2007 Public Relations brochure, *Getting the Message Through*, were distributed at the Convention, as well as 200 copies of the revamped *Hello!* brochure. ARRL DXCC Manager Bill Moore, NC1L, and ARRL Web and Software Development Manager Jon Bloom, KE3Z, presented ARRL's Logbook of The World (LoTW) and the DXCC award program. Other hamfest forums covered contesting, emergency communications such as D-STAR, public service, education and many technical issues.

One of the busiest places at the ARRL EXPO was the Youth Lounge. Young people, ranging from ages of about 7 to 17 were all over the Convention and hamfest, exploring all that Amateur Radio has to offer. There were many foxhunts throughout the two days, as well as scavenger hunts, a ham radio quiz show, crafts, a youth dinner and more.

After the hamfest closed on Saturday, the ARRL Alabama Section held a reception for retiring ARRL Southeastern Director Frank Butler, W4RH. Butler is retiring after

ARRL CEO David Sumner, K1ZZ, presented Huntsville Mayor Loretta Spencer with the July issue of *QST*, featuring the National Convention.

S. KHRYSTYNE KEANE, K1SFA

lasting only 4 hours, beginning November 11. This, he said, recognizes that major calamities can and do cross international borders, and hams need to prepare for them.

GAREC suggested that the IARU initiate studies in cooperation with its Member Societies and with specialized emergency communication groups. These studies would focus on the development and possible introduction of standard codes for use in international emergency communications, as well as on the need for the development of a list of standard resource types.

The conference announced its support of the IARU's Administrative Council decision to collect information from all Member Societies about the status of implementation and application of the revisions to Article 25 of the ITU Radio Regulations (RR) resulting from World Radiocommunication Conference-03. The part of Article 25 concerning Emergency Communications says "Amateur stations may be used for transmitting international communications on behalf of third parties only in case of emergencies or disaster relief. An administration may determine the applicability of this provision to amateur stations under its jurisdiction" (RR 25.3), and "Administrations are encouraged to take the necessary steps to allow amateur stations to prepare for and meet communication needs in support of disaster relief" (RR 25.9A).

GAREC appealed to all of the IARU Member Societies, as well as specialized emergency communications groups, encouraging the accession to and ratification of the *Tampere Convention on the Provision of Telecommunication Resources for Disaster Mitigation and Response Operations* by their respective national authorities. The US has not yet ratified this document, but word was received during GAREC that Ireland announced their accession to *Tampere*. A total of 37 countries have adopted *Tampere* so far.

The conference also appealed to the IARU to "further encourage the development and the application of new modes and technologies in emergency communications," and to support

JON BLOOM, KE3Z

ARRL DXCC Manager Bill Moore, NC1L (left), and *NCJ* Editor Carl Luetzelschwab, K9LA, check cards at the DXCC table.

JON BLOOM, KE3Z

A bird's-eye view of the flea market at the Huntsville Hamfest.

ARRL Southeastern Division Director Frank Butler, W4RH, received a plaque from the ARRL commemorating his 50 years of elected service to the League. Butler is retiring at the end of this year.

JIM BOEHNER, N2ZZ

more than 50 years of elected service to the ARRL. He began his elected service as Section Communications Manager for the West Florida Section. Butler plans to stay involved with the ARRL, attending the IARU Region 2 Committee Meeting in Brasilia, Brazil as a member of the ARRL delegation in October, and the ARRL Executive Committee Meeting, also in October.

When asked where the next ARRL National Convention would be held, ARRL Sales and Marketing Manager Bob Inderbitzen, NQ1R said, "We're glad to help evaluate National Convention applications, but the ultimate decision is made by the elected officials of the ARRL Board of Directors. In the meantime, we hope that all of our members can someday enjoy attending an ARRL National Convention."

S. Khrystyne Keane, K1SFA, is the ARRL News Editor. She can be reached at **k1sfa@arrl.org**.

the development of training aids. This includes the handbook on emergency communications, initiated by the 2005 and 2006 GAREC conferences, "and the development of a handout to inform the public, in particular during major conferences such as the forthcoming WRC-07, as already decided by the IARU Administrative Council in 2005." GAREC went on to ask the IARU to "continue its support to the continuation and further development of the GAREC concept and process."

GAREC also asked Amateur Radio contest organizers to include a provision in their rules that contest participants avoid frequencies in the immediate vicinity of the Center of Activity frequencies (as proposed at GAREC-05) 14.300, 18.160 and 21.360 MHz. According to Pitts, "This would minimize interference to weak or distant stations which may be passing emergency traffic, but not heard in the contest din." Region 2, of which the US is a part, has not adopted the Center of Activity frequencies, but it was discussed at the Region 2 meeting in Brazil in October.

Conclusions

IARU International Coordinator for Emergency Communications Hans Zimmermann, F5VKP/HB9AQS, said, "Only the actual implementation and application of the recommendations made by GAREC can be the ultimate criteria for the success of these conferences, as a tool for the further development of the role of the Amateur Radio Service in the provision of emergency communications. The appreciation expressed by numerous participants following each [GAREC], and the increasing interest demonstrated by the number of participants must be taken as an obligation to work even harder on the subject, rather than being considered a cause for satisfaction with what has been achieved. The statement of GAREC-07 shows that much remains to be done. In addition to new proposals, it reiterates some still pending issues raised in 2005 and 2006."

Sumner said GAREC stressed interoperability. "In explaining how they are applying specific advanced technologies to emergency communications, speaker after speaker identified interoperability with other technologies and networks as a key objective. It was a joy to share the GAREC experience with nearly 100 dedicated, committed Amateur Radio volunteers who were as intent on cooperating as on explaining and advocating their favorite technologies. This spirit of cooperation and the recognition of the need to preserve our interoperability bode well for the future of Amateur Radio emergency communications, and for our ability to continue to serve our local, national and global communities."

Tying it all together was a call that came in right as GAREC was closing. Beepers went off, text messages were received, radios echoed throughout the hall as the National Weather Service and SKYWARN issued an alert to North Alabama due to high winds and oncoming storms. Pitts said, "The alert and call for ham radio help underscored the dedication and need for those volunteers better than any final speech could have done. It was like, 'The party's over — we go back to work!'" QST

Nominate a Local Reporter for the Leonard Award

This is the time to honor a reporter for a superior job of bringing Amateur Radio before the public.

Allen Pitts, W1AGP

If you've seen a particularly good article on ham radio in print, on television, or heard one on the radio, nominate the reporter who did it for the 2007 Bill Leonard, W2SKE, Professional Media Award. The deadline for nominations is December 7, 2007. Nominated work must have appeared between December 8, 2006 and December 7, 2007.

The annual award honors a professional journalist whose outstanding coverage in TV, radio, print or multimedia best reflects the enjoyment, importance and public service value of Amateur Radio. The award was created as a tribute to the late CBS News President Bill Leonard, W2SKE. He was an avid Amateur Radio operator, and most active on the air during the 1960s and 1970s.

Nominations are judged by members of the League's PR Committee, and the final decision is made during the ARRL Board meeting in January. The winner receives an engraved plaque and a cash award of $500. Please note that some news organizations prohibit journalists from entering contests that offer monetary awards. Checking with your potential nominee ahead of time is a good idea.

Bill Leonard, W2SKE (SK)

Rules for Entry

- The award is called the Bill Leonard, W2SKE, Professional Media Award. The recipient must be a professional journalist in print, electronic media or multimedia. The term "professional" refers to full time, part time, stringers, freelancers and contract journalists. In the case of a group project, the recipient may be the group, but only one prize will be awarded.
- The recipient will receive the award based on a print story, photo essay, audio or video (including broadcast) or multimedia in the English language that covers the topic of Amateur Radio. The scope of the work nominated may be a single story or series. The work must have appeared between December 8, 2006 and December 7, 2007 in a commercially published book, recognized general-circulation (non-trade) daily or weekly newspaper, general or special interest magazine (except publications predominantly about Amateur Radio), commercial or public radio or television broadcast (including services delivered via cable), Internet World Wide Web site operated by a generally recognized journalistic organization (newspaper, magazine, broadcast station or network, for example), or multimedia format (such as CD-ROM), intended for and readily accessible to the general public within the United States.
- "Amateur Radio" means the activities of licensees, clubs and other organized groups participating in the activity of licensed Amateur Radio or "ham radio," as governed by Part 97 of the *Code of Federal Regulations*.
- The story must be truthful, clear and accurate, reflecting high journalistic standards. The award will be granted to the work deemed the best reflection of the enjoyment, importance and public service value of Amateur Radio. Submission may be by the author of the work, or on his or her behalf by another individual who believes the work merits the award.
- The winner will be selected by the Public Relations Committee of the American Radio Relay League. The award will be approved by the ARRL Board of Directors at its January meeting. Individuals on the committee who may be related to or have a professional relationship with any applicant will excuse themselves from the deliberations.

What to Submit

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

Print article: Submit original tear sheets plus one photocopy on 8.5×11 paper. If there are multiple pages, write author's name on the back of each sheet.

Radio: Submit one copy of script on 8.5×11 paper plus one standard audio CD disk.

Television: Submit one copy of script on 8.5×11 paper plus one DVD or CD disk of the video.

Multimedia: Submit photocopy of each screen or Web page and/or CD disk as appropriate.

The ARRL reserves the right to withhold the award for any reason, to grant duplicate awards or to disqualify any entry. All decisions are final. The award winner will receive a plaque and a check for $500. A winning group entry will receive a single plaque and check.

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

Entries may be submitted at any time up to a postmark deadline of December 7, 2007.

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

World's Largest Tides Rise for Amateur Radio

A ham-traveler creates his own type of operating and tries it out where the tides turn more than they do anyplace else on Earth, the Bay of Fundy.

David A. Rosenthal, N6TST

With the promise of a new solar cycle, it's time we get creative about stimulating interest in Amateur Radio. My own solution was to come up with a new activity and then give it a try. It had to be fun and something the radio community would enjoy. I called it an "Interesting Event Station" and if what I accomplished is any indication it could be an idea whose time has come. The best part of running an Interesting Event Station is that it's all yours — no approvals or permissions required; you just do it.

Rising and Falling in Nova Scotia

For my kickoff IES, the plan was to witness and photograph the world's largest ocean tides in the Bay of Fundy in Nova Scotia. This would take place as part of a travel writing trip my wife Donna, KF6ZVE, and I had already planned. At the record-setting location I'd take a photo each hour (the tidal cycle is six hours), process the image and send it out using slow-scan TV. That way anyone could get a complete series by just firing up their HF digital interface and monitoring. As the photo shows, we encountered some impressive coastal scenery along the way.

The world's highest tides occur at the wharf of the Minas Pulp and Power Company in Hantsport, and the folks there have always provided a viewing spot. Because I'd run my laptop for six straight hours, I asked to borrow a 100 foot extension cord. To accommodate me, they had their Electric Shop make one up. Meanwhile, notifying the radio world about my plans was easy. I e-mailed the *ARRL Letter* a short summary of what I'd be doing and it appeared on the Friday before we arrived.

With all the new airport security plus airline crackdowns on baggage weight, I kept the equipment list short and focused: an ICOM IC-7000 transceiver for its compactness, multiband versatility and IF-based

Figure 1 — Bill, N2JAI, sent me the SSTV images he copied off the air to let me know all was well. This one was taken at 1 PM.

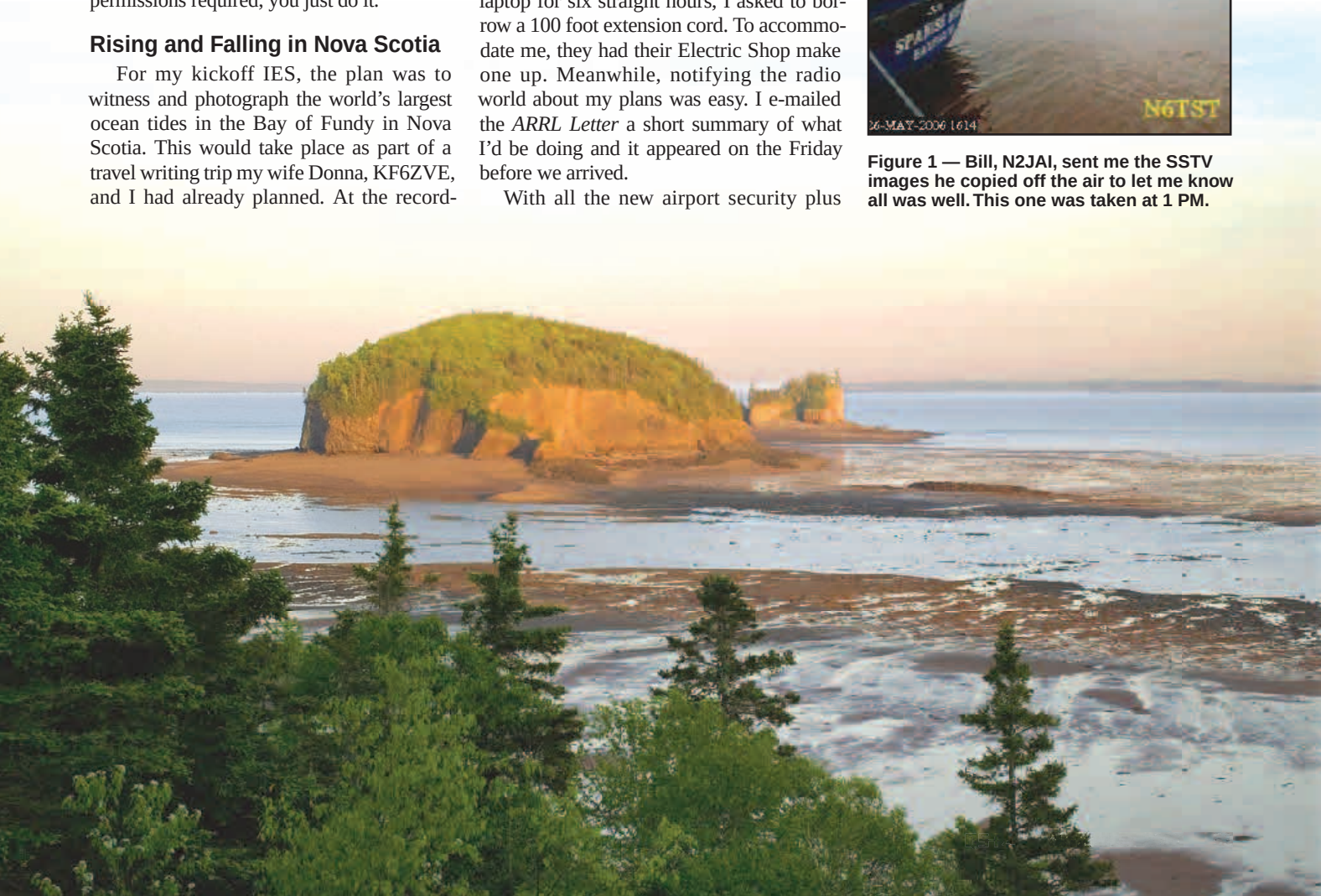
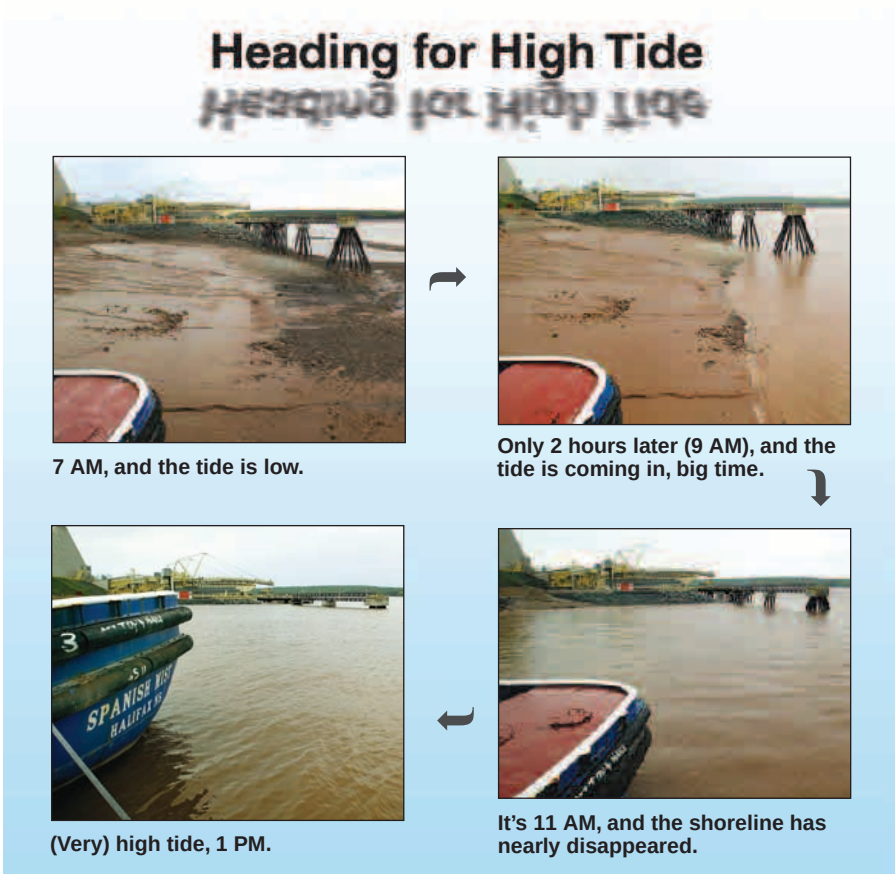


Figure 2 — Thanks to a borrowed 100 foot extension cord, I was able to transmit SSTV images without a battery.



DSP to narrow down my SSTV transmit bandwidth; a RIGblaster Nomic for its cigarette-pack size, and my specially home-brewed suitcase-portable Spider mobile antenna for its DX performance-enhancing top-loaded vertical design. The MFJ-4125, a 2.8 pound, 25 A switching supply provided dc power.

Low tide occurred at 7 AM and I was ready. I took the first shot, made my /VE1 Interesting Event Station announcement, and sent it out. When I got back to the hotel at day's end, an e-mail waited from Bill, N2JAI, in New Jersey who'd sent me off-air copies of all seven of my images. The photos show the rising Bay of Fundy at 7, 9 and 11 AM and 1 PM — only 6 hours!

You Can Do It, Too!

Can an IES work for you? Absolutely. Just be imaginative. Examples can include radio club service events with such image-worthy possibilities as a tightly competitive bicycle race. Another might be to go on a scenic outing and send out photos via SSTV and exchange text using an HF digital mode. Yet another could be taking advantage of the fact that many of us are ARES/RACES members with club connections to emergency services providers. Arranging the setup of a micro-station in, say, a forest service lookout tower for a day might improve your club's relationship, not to mention the enhanced performance you'd get from a mountaintop with your antenna clamped to the tower's massive metal frame. And speaking of counterpoises, let's not forget events like air shows where your club might already have a booth planned. Ever ground an already well performing HF mobile antenna to a large metal building like a T-hangar?

The bottom line is that HF is coming back and there's no reason to wait for it. Between your own cleverness and the ever-improving, high-performance compact gear out there, you'll quickly discover that the doorway to HF adventure is *already* open.

All photos by the author.

David Rosenthal, N6TST, an Electrical Engineer and science travel writer specializing in installing and operating HF gear from unusual places, won the QST *Cover Plaque Award for his most-recent QST article, "Polar Bear Portable," which appeared in the February 2006 issue. He became a Silent Key in March 2007.* QST

Football: Fumbles, Field Goals and Frequencies

Football teams have offensive coordinators and defensive coordinators. But did you also know the NFL has frequency coordinators?

S. Khrystyne Keane, K1SFA

Jets quarterback Chad Pennington's helmet, with the radio receiver inside (inset). The quarterback is able to receive instructions from his coach via this receiver; when the play clock reaches 15 seconds or the ball is snapped (whichever comes first), all transmissions are cut off.

As almost 78,000 fans watch, New England Patriots quarterback Tom Brady listens to his coach, Bill Belichick, bark out commands to him via the receiver inside his helmet. As the 25 second play clock ticks down, Brady nods in comprehension, getting his team in formation. Before time runs out, center Russ Hochstein snaps the ball to Brady, and the play Belichick called through Brady is in motion.

Late in the third quarter, line judge Jeff Seeman throws a penalty flag and confers with referee Jeff Triplette regarding the previous play. After getting the facts from his colleague, Triplette turns on his wireless mic to announce to the crowd (and the millions of fans watching on television) that the Patriots will incur a 10 yard penalty for offensive holding.

On the sidelines, a television reporter stands in front of her camera crew, giving an update on the game. As she holds her microphone in front of her, the feed is carried back to the production truck outside the stadium and broadcast to viewers all over the country.

Just another day at an NFL game, even if it is one of the biggest divisional rivalries in professional football — the New England Patriots vs the New York Jets — on Sunday, September 9, opening day of the 2007 season — on the Jets' home turf, no less. But with 196 different radio frequencies traveling through this 120 yard universe, the Game Day Frequency Coordinator (GDC) is king. And the king of this universe is GDC Steve Mendelsohn, W2ML.

All in a Day's Work

"My job is to take all the different entities that will be using RF at the game and coordinate their frequencies. This whole stadium is connected through radio frequency, from the security to the parking attendants to the television networks to the blimps to the coach and quarterback — it all runs on RF," Mendelsohn, a senior systems engineer for ABC Television, said. "These frequencies all have to be known and coordinated. My ultimate goal is to create an interference-free RF environment by coordinating all Part 74 [the broadcast frequencies] and acting as a clearinghouse to all Part 15 and Part 90 [Private Land Mobile] devices."

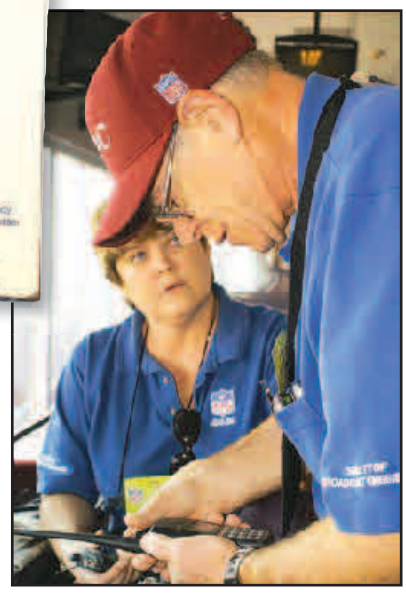
Saying that the number of people in the world who know all the frequencies used in an NFL game number "around 50," Mendelsohn takes his job as GDC very seriously. "If frequencies aren't coordinated, or aren't coordinated correctly, this leads to interference. Coaches shouldn't be hearing anything else except themselves when they're communicating with their quarterback. The blimp shouldn't be hearing anything other than what it's supposed to."

Transmissions between the coach and his quarterback are encrypted. Mendelsohn can hear them communicate, but he can't understand what they are saying; he likens it to something sounding as if it came from *Alvin and the Chipmunks* — high-pitched and garbled. "There are millions of dollars riding on each and every NFL game, from merchandising to broadcast rights. If these transmissions were not encrypted and could be picked up and heard by anyone, can you imagine what the outcome would be?"

He recalled one incident when a coach reported hearing voices coming through his headset during a game. The officials called a

Patriots quarterback Tom Brady listens to coach Bill Belichick transmit plays via the receiver inside his helmet.

This sign is posted at the entrance to the tunnel leading into the stadium, warning all those that RF-emitting devices need to be coordinated through the GDC.



Steve Mendelsohn, W2ML, and his wife Heidi, KC2LEQ, get their scanner/receivers ready in the press box before the game. The Mendelsohns are the Game Day Frequency Coordinators for the New York Jets.

time-out and Mendelsohn was quickly summoned to the bench to fix the problem. "It turns out that the coach was receiving some ambulance company's transmissions through his headset. In just a few minutes, I had it squared away and the game resumed. We were lucky, because the ambulance company couldn't hear us, and even if they could, it would all have been encrypted."

During another game, some of the receivers were picking up transmissions from the State Police headquarters down the road. "I called a friend of mine who happened to be with that particular barracks," Mendelsohn recalled. "He said his men were just sitting down to watch the Jets game on TV. I said to him, 'No they're not, unless you change frequencies on that certain repeater.' For the duration of the game, they did, and the game went on as usual."

As the person in charge of all the RF-emitting devices on the field, the GDC has the right to know every frequency in use at any given time. To help with this, the NFL issues each GDC a frequency counter, a scanner/receiver and a directional UHF antenna with a switchable RF attenuator so they can listen and find potential problems.

How the GDC Program Started

The GDC program began with a meeting in 1996; there had been a lot of radio interference at Super Bowl XXIX in Miami, and the NFL didn't know how to handle it. They approached Jay Gerber, N3AW, then vice president for production of NFL Films, asking for ways to correct the problems from the Miami event, making sure they didn't happen again at Super Bowl XXX in Tempe, Arizona. Gerber called Karl Voss, the Society of Broadcast Engineers' (SBE) regional frequency director for Arizona, and asked if he would like to help. Between them, they coordinated the frequencies at Super Bowl XXX.

"Up until this point, whenever broadcasters would have interference, they just worked it amongst themselves, like 'What frequency are you on? Okay, you're there, I'm here, so I'll change over to this frequency," Gerber said. But with the NFL worldwide audience growing larger, and more and more media outlets broadcasting the game, interference was getting to be more of a problem. "The NFL was hearing complaints from broadcasters, saying they weren't able to talk on their radios without interference." Gerber led a team of SBE frequency coordinators at the next two Super Bowls in New Orleans and San Diego. "There was a problem at Super Bowl XXXII in San Diego when we had to reprogram almost 150 radios at the last minute," Gerber said.

In March 1999, through Gerber's determination, the NFL came to realize the value of having frequency coordination at regular season games. Gerber recruited people as GDCs who actually knew something about how RF works — it's no wonder a good number of NFL frequency coordinators are hams (see sidebar). "We started out just doing the Super Bowl, and then we moved on to coordinating the frequencies at regular season games, and then the playoffs. Now we coordinate all games, including the pre-season," Gerber said.

More to Winning than the Score

Today, the NFL and the SBE jointly run the Game Day Frequency Coordinator program. With 32 teams in the NFL, and at least 26 in action each week, a minimum of 4700 frequencies need to be coordinated each week. "Each of the 32 GDCs will coordinate as many as 300-400 frequencies for a regular season game. For Super Bowl XLII in Glendale, Arizona next year, a coordination staff of 35 will use as many as 1500-2000 frequencies," Gerber said

"And that's where the fun is," Mendelsohn said. "It's great when my team wins, but when I get the report at the end of the game telling me that everything worked fine and there was no interference, that's when I win. To know all the work I put in to allocating these frequencies, talking back and forth with different media, making sure all was smooth — that's when I know I did my job."

All photographs by the author.

S. Khrystyne Keane, K1SFA, is the ARRL News Editor. She can be reached at **k1sfa@arrl.org**.

These Amateur Radio Operators Serve as NFL Game Day Frequency Coordinators

Atlanta Falcons
Jessica Carter, KF4VKP*
Jeff Carter, KD4RBG

Chicago Bears
Jen McCarthy, KBØOPG

Cleveland Browns
Ed Miller, K8EHA

Dallas Cowboys
Johnny Steigler, WA5ZRQ

Detroit Lions
Joe Huk, KA8UUV

Green Bay Packers
Joe Kamenick, K9LWL*
Tom Leas, KC9HLH

Indianapolis Colts
Al Grossniklaus, WD8BUG*
Roger Bishop, KB9MEH
Tom Weber, KC9GMJ

Jacksonville Jaguars
Clayton Roney, KI4FWZ*
Dan Weisenberg, KW4T

Kansas City Chiefs
Bob Schneider, KD5CE*
Jack McKain, KØLVX
Fred Morton, WB5KRD

Miami Dolphins
Rick Edwards, N4RSH
Ernesto Diaz, KG4LXH

New England Patriots
Joe Sweeney, K1NCJ*

New York Giants
Rod Barton, N2UFQ*

New York Jets
Steve Mendelsohn, W2ML*
Heidi Mendelsohn, KC2LEQ

Pittsburgh Steelers
Otto Schelli, NO3U*
Rich Newbould, K3RWN
Glenn Romsos, N3ROW

San Francisco 49ers
Sue Sunder, KC6WXO*
Ben Carlucci, W2NYC

Seattle Seahawks
Jerry Hill, K2JH*

* Primary coordinator

Frequency Measuring Test 2007

The next running of the W1AW FMT is November 15 UTC. Do you know where your signal is?

H. Ward Silver, NØAX

Since its resumption in 2002, the ARRL Frequency Measuring Test (FMT) has attracted a steadily increasing number of participants interested in exercising their frequency measuring abilities. Give the FMT a try — everyone can play!

South Dakota's Black Hills Radio Club WØBLK decided to make the 2006 FMT a club project, with excellent results.

The Basics

The 2007 test repeats the original format of the FMT by asking for measurements of the frequency of an unmodulated carrier. The basic techniques for making the carrier frequency measurements are the same as they were in 2002. The FMT announcement for that year gives detailed instructions on how to make them.[1] You can find the 2002 article at **www.arrl.org/w1aw/fmt/0210051.pdf**.

The frequency accuracy of most radios sold in the past decade is specified as ±10 ppm or better — perfectly sufficient for use in an FMT if the gear is allowed to reach a stable temperature and calibrated against WWV or WWVH. The FMT announcement from 2006 shows a way to temporarily increase a transceiver's frequency precision.[2] (The article also includes definitions of accuracy, precision, and stability.) You may think of other ways to make the measurement. That's what the FMT is for — experimentation and practice! If you do try something new or unusual, be sure to tell your story in the FMT Soapbox.

For more information about the FMT, including a Frequently Asked Questions list and updates to test schedules, the FMT Web page is **www.arrl.org/fmt**.

Group Efforts

The growing popularity of FMT has extended to clubs, as well! We've received reports of clubs making the FMT a special exercise to learn about frequency measurement. The ARRL FMT Web site includes stories from two such groups. The Black Hills Amateur Radio Club WØBLK, measured frequency as a club project, including presentations and training. Another group from Oklahoma led by K5CM is holding its own regular Frequency Measuring Tests! The FMT is a great club project or even an occasion for a competition among the members.

Schedule

The W1AW FMT will be run on November 15, 2007 at 0245Z (Wednesday evening, November 14 at 9:45 PM EST). It will replace the W1AW Phone Bulletin normally scheduled at that time. It is recommended that participants listen to W1AW's transmissions prior to the event to get an idea on conditions to see which band (or bands) will be best for measurement purposes.

West Coast participants will have their own signal to check again this year, courtesy of Mike Fahmie, WA6ZTY. As this article was going to press, exact times and frequencies were yet to be determined. Please check the W1AW FMT Web page for up-to-date information and schedule.

W1AW Format

The FMT will begin with a general W1AW (QST) call beginning exactly at 0245Z sent simultaneously on three amateur frequencies. The test will consist of *three 60*-second key-down transmissions *for each band*, followed by a series of dits, followed by station identification.

The test will last for a period of approximately 15 minutes total. The test will end with a series of V's, followed by station identification. W1AW will identify before, during and after the transmissions. The approximate frequencies are as follows:

160 meters	1854 kHz
80 meters	3583 kHz
40 meters	7045 kHz

During the course of the FMT, W1AW will indicate the band on which participants should measure. For example, after the initial call-up, W1AW will begin sending NOW 160 METERS via Morse code. During the 160 meter measuring time frame, W1AW will continue to indicate the band first by IDing, and then indicate the band in the following way: QST DE W1AW 160 METERS.

Reporting and Results

This year, your report should be submitted via the FMT Report form on the FMT Web site. Along with your call sign and e-mail address, enter your most accurate measurement on each band and indicate whether you measured the W1AW or WA6TZY signal. There will be a window to list your equipment, describe the method you used to make the measurements and enter any Soapbox comments. W1AW will post the transmitted frequencies immediately following the test. This will allow participants to quickly determine the accuracy of their equipment and methods.

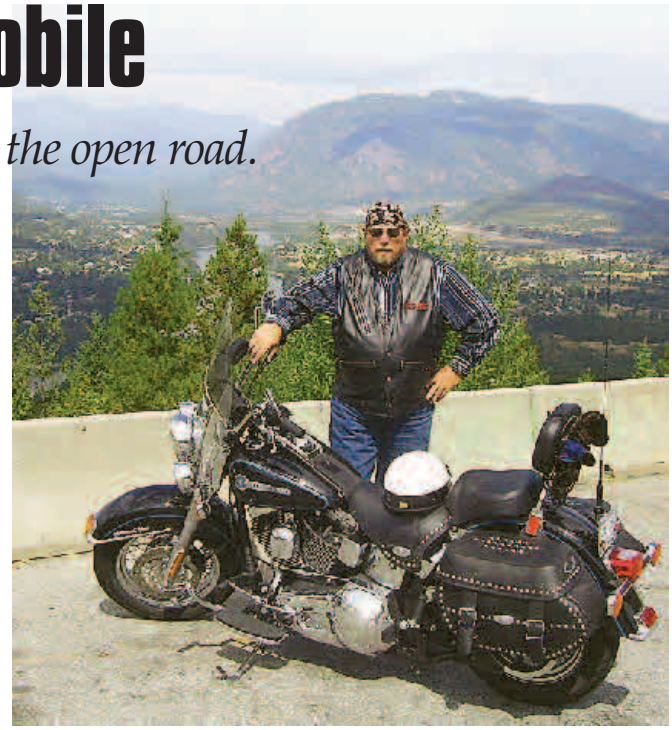
If you'd like more information about the equipment that will be in use at W1AW to generate the test signals, take a look at **www.arrl.org/w1aw.html**. Keep an eye on the FMT Web page for more information about the exercise and its results. QST

[1]W. Silver, NØAX, "The ARRL Frequency Measuring Tests," *QST*, Oct 2002, p 51.
[2]W. Silver NØAX, "The 2006 ARRL Frequency Measuring Test," *QST*, Nov 2006, pp 50-51.

APRS Motorcycle Mobile

Ham meets hog, and it's ham radio on the open road.

Dave Dobbins, K7GPS



Overlooking Castlegar, British Columbia.

My mother calls it a mid-life crisis. I call it one step up the pyramid toward self-actualization. For my 49th birthday in April 2006, which was really my 51st birthday except I decided to start counting backward at 50 last year, I fulfilled a lifelong dream of owning a hog. No, not the pig, the motorcycle. My search began in February. I talked with Harley owners, sat on or test drove nearly all the available bikes at several dealerships, and searched the Internet to get as smart as I could before taking the plunge. I ended up negotiating a purchase, sight unseen, over the phone with a saleslady at the Harley-Davidson dealer in Missoula, Montana and made arrangements to pick it up on April 22, just in time for my birthday celebration.

The Diamond 144/440 MHz antenna on the license plate frame.

I Pick My POSE

My criteria for a motorbike included storage space to install Amateur Radio gear so I could chat on 2 meters or 70 cm, and do APRS tracking at the same time.[1] I liked the Road King because it's made for radio installs and has great storage, but settled on a slightly smaller Heritage Softail cruiser because it was more nostalgic of a Harley-Davidson motorcycle. The particular Heritage I found in Missoula was the Peace Officer Special Edition available only to active or retired law enforcement (I volunteer as a Reserve Police Officer) and it came with a lovely discount from the manufacturer. On delivery day my saleslady, Lindsey, was off for the day, so another salesman completed the deal. A quick test ride, with helmet firmly affixed atop the noggin, assured me this was going to be a fun adventure.

After trailering the motorbike back home, I started plans for the radio install. Engineering the install wasn't all that difficult. I incorporated Anderson Powerpole connectors for all the dc hookups, and found the AutoCom Active-Plus communicator (**www.autocom.co.uk**) to integrate a Kenwood TH-D7AG handheld transceiver and AvMap G4T GPS navigator (**www.geosat.us**), along with several other peripherals, into the communications solution.[2] This also included a microphone and earphones in the rider and passenger helmets.

I selected a Diamond NR-770H 2 m/70 cm antenna because it's radial-less and there's no real ground plane on a motorcycle. I routed power from the battery, and switched voltage, along with the antenna, to the left side saddlebag. I used Velcro to adhere the radio and other components to the inside wall of the bag. The AvMap G4T came with a suction cup mount that adheres to the windscreen. The 5 inch GPS display is perfect for a motorbike install.

[1]Notes appear on page 59.

The AvMap G4T GPS unit mounted atop the handlebars.

The Kenwood APRS-ready transceiver (left) shares space with a cell phone and satellite radio. The communicator, which provides voice communications via push-to-talk or VOX to the rider and passenger, is below.

The author meets HD Missoula salesperson Lindsey.

The AutoCom package included an optional push-to-talk switch that I connected to the left handlebar grip so it's within thumb's reach while riding with two hands. To complete the APRS installation, I set the 'D7AG's path to W1,W2 every two minutes, which effects transmission of a GPS location to the APRS RF infrastructure as WIDE1-1,WIDE2-2, and thus via at least three APRS digital repeater (digipeater) hops. Many of the signals will reach the APRS Internet System (APRS-IS) via the Internet and resulting location plotted on APRS screens and the findu site (**map.findu.com/k7gps-8**). I've been very pleased with the APRS tracking.

To Connect or Disconnect…

I've done a few tests with the headset, too. Sound quality is very good, but the headset pieces fit best in the full-face helmet, and frankly I prefer riding with just a DOT-approved brain bucket that won't accommodate the headset. With the headset and larger helmet I also take advantage of listening to music from a Pioneer Inno XM receiver/MP3 player, and can take phone calls from the cell phone. I don't know why I would want to do this, though; part of the enjoyment of riding, which I find very therapeutic, is the disconnect from the rest of everyday life and just taking in the scenery of the moment.

My first test ride for the tracker was a short afternoon trip to Steptoe Butte, about 35 miles south of Spokane and 3000 feet above the surrounding territory. The view was great. I had an excellent track (checking **www.aprsworld.net**) on another trip over to Finley Point on Flathead Lake in western Montana, while a loose connector on the Powerpole distribution connector shut down the radio on a 375 mile day trip from Spokane to Christina Lake, British Columbia, over Highway 3 via Castlegar to Salmo, and back down into the USA. While it was a long trip, the beauty of the northwest USA and southeast BC was something to behold (see lead photo). A hog is a great way to get in touch with this beauty. I have plans to make lots of little day trips here and there. Maybe I'll run into some fellow hams along the way.

I haven't experienced any RF or engine noise problems, so had no additional issues to combat. I'll take a brief opportunity to thank the NWAPRS group (**www.nwaprs.info/**), as several of them had input helping me pick the right equipment for the radio install. Thanks, guys!

Missoula Meet-Up

Oh, I did finally meet my Harley-Davidson saleslady Lindsey on another trip to Missoula this summer. I had heard she was quite the accomplished salesperson. She's also pretty easy on the eye. When I show folks the picture of the two of us I tell them I just went into the dealership to buy a hat; it gets a laugh out of most folks.

Notes

[1]APRS is a registered trademark. For more on the Automatic Position Reporting System, see S. Horzepa, WA1LOU, "Teaching an Old APRS New Tricks," *QST*, Feb 2006, pp 39-41, and S. Horzepa, *APRS — Moving Hams on Radio and the Internet*. Available from your local dealer or the ARRL bookstore, ARRL order no. 9167. Telephone toll-free in the US 888-277-5289, elsewhere 860-594-0355; **www.arrl.org/shop**; **pubsales@arrl.org**.

[2]For more on the Global Positioning System, see W. Fields, W4WCF, *GPS and Amateur Radio*. Available from your local dealer or the ARRL bookstore, ARRL order no. 9922. Telephone toll-free in the US 888-277-5289, elsewhere 860-594-0355; **www.arrl.org/shop**; **pubsales@arrl.org**.

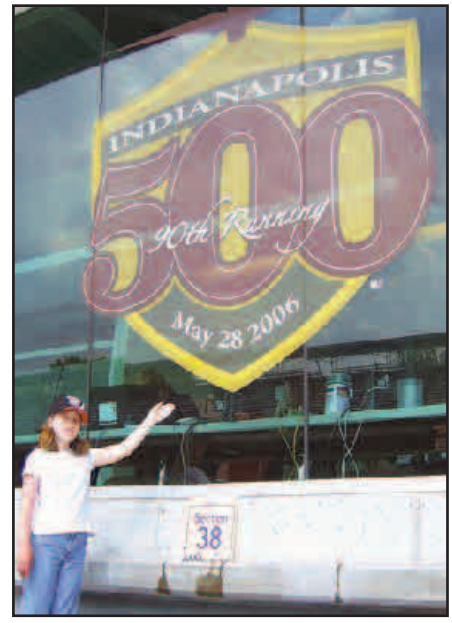
Photos by the author.

David was first licensed in 1992 while serving with the US Navy in Texas. He became interested in packet and APRS and helped spread awareness of APRS in Texas, then southern Arizona, the San Diego area, Hawaii, and finally in the northwest USA upon his retirement from the Navy in 1996. With others he helped develop the Northwest APRS Group, which assists APRS enthusiasts in Washington, Oregon, Idaho, Montana, British Columbia, Alberta and the Northwest Territories. David maintains the group's Web site at **www.nwaprs.info** *and also the NWAPRS special interest group mailing list. To keep the tax man at bay, David is the Security Director at Medical Lake School District on the west plains of Spokane. He is also a reserve police officer, golfer and proud parent of four children. You can reach the author at 920 N Fairchild Dr, Medical Lake, WA 99022;* **ddobbins@gmail.com**.

Girl Meets Brickyard — A Ham Radio Adventure

How a 9 year old Extra class licensee, who arrived along with her family of hams, enlivened our special event at the Indianapolis Motor Speedway, attracted the local media (along with a world of paper chasers) and became a ham radio rock star.

Brian D. Smith, W9IND



The tiny voice emanated from a high octave in the ether, parting the pileup like a piccolo in the tuba section. KILO-GOLF-6-UNIFORM-YANKEE-WHISKEY came the call, which jarred me out of my 5-by-9 haze.

It was the final hour of the final day of one of our final 2005 special event operation, and I'd spent most of the evening at the 20 meter microphone, handing out QSOs by the carload. That's par for the course whenever our group, the Indianapolis Motor Speedway Amateur Radio Club (W9IMS), activates any of our three annual special event operations commemorating Indy's major auto races: the Indianapolis 500, the US Grand Prix and, in this case, the Allstate 400 at the Brickyard.

But the voice in my headphones was, as Monty Python would say, something completely different. "Who was that?" I silently wondered. "It sounded like a little kid."

Right on the first guess. As I soon learned, this was 9 year old General class licensee Amanda Feriante, KG6UYW. She coolly delivered a report from California, leaving me impressed by her prowess. I had a pileup to manage, so I commended Amanda on her achievements and dove back into the heterodyne.

But when we pulled the plug on this curtain-closing operation for 2005, I wanted to do more than send a commemorative QSL. I wanted to encourage this "Unique Young Woman" to stick with the hobby I'd enjoyed since I was a comparatively elderly 15 year old. Yet what kind of "attagirl" could our club bestow from half a continent away?

Creative Camaraderie

Fortunately, our maverick bunch possesses no shortage of creativity. During the 1987 Pan American Games in Indianapolis, we staged what we regard as the most successful special event of all time, W87PAX, which amassed nearly 24,000 QSOs. We've sent VHF transmissions to Mars (and held HF QSOs with W6VIO, NASA's Jet Propulsion Laboratory) during the Red Planet's closest approach; set contesting records; moved health-and-welfare traffic during international emergencies and operated Field Day from a reputed UFO crash site near Roswell, New Mexico.

I figured Mike Koss, W9SU, owner and architect of our well-appointed club station, would have some ideas. I figured right.

With Amanda, KG6UYW, in the foreground, Johanna Fulk mines the 20 meter band during the 2006 special event operation at the W9IMS Comm Center near the Indianapolis Motor Speedway.

A little online research confirmed what we'd already suspected: Amanda wasn't the only ham in her household. To the contrary, no fewer than five other Feriantes with amateur licenses resided at her address. That was all the inspiration Mike needed.

"Hey, why don't we invite them to Indianapolis during next year's 500?" he said. "They could operate the special event, tour the city and maybe even see the race." Heck, I figured, given the number of hams in their family, they could probably run the special event all by themselves.

Amazing But True

Then came an astonishing coincidence. Before we could make contact with the Feriantes, they made contact with us.

It so happens that Mike is the sales manager for Industrial Communications Engineers (I.C.E.), manufacturer of RF filters, lightning arrestors and other popular products. One day he fielded a landline call from a man who wanted filters for his club's Field Day effort. The name? Adam Feriante, KG6HDR.

"Feriante?" Mike said. "Are you any relation to Amanda?"

"I'm her father," Adam replied, and by the end of the conversation, he and Mike had laid the groundwork for what would become a confluence of nearly everything good about ham radio. Besides furthering a spirit of hospitality and camaraderie, our hosting of Amanda and her family enabled us to create an international buzz for an already thriving special event by showcasing the talents of a remarkable young lady.

The Ham Hilton

Our first order of business was to arrange

free "Ham Hilton" lodgings, a necessity given that (1) hotel rooms are scarce during Race Week; and (2) any still available in late May go for a rate approximating the national treasury of a small DXCC country. No problem: My wife and I (five cats, no kids) were in the process of moving into a 5000 square foot lakeside home.

To maximize their Indy encounter, I roughed out a daily itinerary that mixed kid-friendly tourist destinations (the Indianapolis Children's Museum) with full-family experiences (Zydeco's New Orleans Grill, an authentic Cajun restaurant), as well as the mandatory pilgrimage to "the track," as locals refer to the Speedway.

Prior commitments meant the Feriantes' oldest kids, teenagers Joshua, KG6HDT, and Eli, KG6HOA, had to stay behind. That left Amanda — now an Extra — and her newly licensed 7 year old brother, Isaac, KI6DIL, to represent the next generation of hams.

Welcome to Indy

When the big day arrived, we assembled a welcoming party at Indianapolis International Airport. Reckoning that Amanda might relate better to another young female ham than a group of middle-age men, we brought along 20 year old Heather Heininger, KB9ZLB. With boyfriend Joe Black, KC9HDH, in tow, Heather joined Mike and me in awaiting the Feriantes. They weren't hard to spot: Amanda wore a souvenir Indy 500 cap that we'd sent her as a Christmas present. The eight of us got acquainted over deep-dish pizzas at a restaurant near the track, and as we anticipated, Amanda took to Heather like she'd just gained a big sister.

That evening we showed our visitors the Comm Center — a 1930 cottage that serves as our clubhouse/operations hub. Located in the heart of urban Indianapolis, on the 10 acre woodsy property of W9SU, it features a kitchen, a living room, a half bath and multiple stations linked to lofty antennas.

We seated Amanda next to Heather, allowing our more experienced female op to serve as special event *sensei*. But the understudy was a fast learner, progressing rapidly from simply reciting QSL information to bantering with the calling stations. I knew Amanda had arrived when she delivered the pun of the week, identifying Heather and herself as "Chick Factor [a name I had invented after she attracted a cavalcade of calls while operating in a recent contest] and her side*chick*."

It was time to make our special event more special. Grabbing a laptop computer, I decided to enliven the DX Summit board. After noting that we were an SE (special event), I typed an addendum — OP: AMANDA, 9 YR OLD EXTRA.

The self-spot worked magically: Even hams with W9IMS QSLs began clamoring for a chance to work the wunderkind.

From the left: Isaac Feriante, KI6DIL; Terri Stacy; Amanda, AF6YL when photo was taken, and Jeff Pigeon. Terri and Jeff, co-hosts on WIBC, interviewed Amanda in 2007 for their QRO (50,000 W) broadcast station.

Indianapolis Motor Speedway ARC member Heather Heininger, KB9ZLB, teamed up with the visiting Amanda to work the club special event station in 2006.

Ham Radio Rock Star

We knew we'd created a ham radio rock star when DX stations caught the wave. One night, as Amanda sorted through a stateside stampede, Europe quietly opened. Our first clue was an inventive appeal from a frustrated RX3FS, whose DX Summit post implored AMANDA PSE COPY EU. (He was her next QSO once we turned the beams.)

Likening her newfound popularity to that of female race driver Danica Patrick, Mike jokingly nicknamed our young op "Amandica." As the week progressed, we devised more imaginative ways to entertain the masses. One night we put her mother, Kortnee, on the 20 meter station and Amanda on 40 meters. When Kortnee announced, "And my daughter is now on 7.240, so you can work both of us," a flurry of QSYs followed.

Sometimes Adam jumped in, putting three family members on the air simultaneously. Young Isaac never made it to the microphone, but emphatically declared after logging for his dad, "I was a helper."

By the Numbers

Our final QSO count showed phenomenal improvement over not only our 2005 Indy 500 event, but our inaugural 2004 operation. David Spoelstra, N9KT, our club stats guru, reports that we tallied 2932 QSOs in 2004; 2077 in 2005; and 4362 in 2006 — nearly equaling the two previous years combined. It's a stretch to attribute the entire increase to Amanda, but the enthusiasm surrounding her family's visit (not to mention a few barbecues) helped turn out the troops.

Similarly, a return visit from the Feriantes in May 2007 produced a solar cycle-defying 4064 QSOs. Better yet, we used the occasion to publicize Amateur Radio, as Amanda appeared on Indy's Fox TV affiliate and the morning show of 50,000 W AM station WIBC (for links to both clips, go to **www.w9ims.com**). Incidentally, she and her parents have gone the vanity route: AF6YL (for Amanda Feriante/YL), KF6Y (Kortnee Feriante), and ND6N (Adam's preference for a short CW call).

Tending the Garden

A recent conversation with Kortnee confirmed that her daughter remains energized about ham radio. Prior to an outing with her Girl Scout troop, Amanda gave her friends a Morse code lesson. I'd like to believe she won't always be the only licensed Scout in her troop — and that our club will have played a part in keeping the garden growing, so to speak. Still, I couldn't help contemplating whether Amanda might someday find other interests.

"Do you ever worry," I asked Kortnee, "that once she discovers boys, it might get her out of ham radio?"

"Nah," Kortnee replied. "It'll probably just get a couple of boys into it."

Photos by Adam Feriante, ND6N.

Brian Smith, W9IND, was first licensed in 1971 at the age of 15 as WN9ICB after a couple of years as an avid SWL. Nine years after his license expired, he rejoined the fraternity as KA9OIH (Novice) after writing a newspaper story about Field Day. Upgrades to General and Extra class followed, and he was later able to snare W9IND, a call he'd admired since his teenage Novice years. His main interests are DXing, contesting and special events.

Brian has worked as a journalist since graduating from Frankin (Indiana) College in 1978. His work has been published in many national magazines, and his book, Expert Advice, *was published in 1995. He can be reached at 4664 Water's Edge Way, Greenwood, IN 46143;* **bdsmith@indy.net**.

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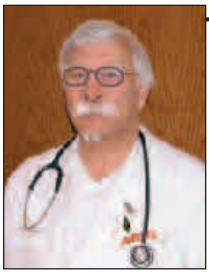
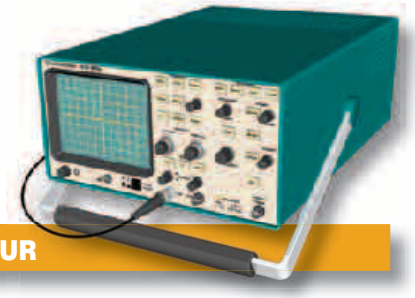


The Doctor is IN



PROJECTS AND INFORMATION FOR THE ACTIVE AMATEUR

Q Chris, KB3KKA, asks: I connected my HF/VHF transceiver as always suggested directly to my 2001 GM vehicle battery, as suggested by the radio manufacturer and your column. My positive battery cable subsequently became corroded and disintegrated. Is this a normal occurrence? Do you have any ideas about what might have caused this problem? The car dealer suggested that I change to a different connection arrangement.

A Battery connections like this can be tricky business, and corrosion is not all that uncommon. According to the folks at GM, the problem is likely related to the side terminal batteries used in your vehicle. The rubber seal around the battery terminals is designed to prevent the connections from exposure to corrosive gases from the battery. See Figure 1. No joint is perfect, and the gases can escape from the battery at the joint where the terminal metal is mounted inside the battery. If a ring terminal or other type radio connection is added between the cable and battery terminal, a gap is likely to be formed. That gap prevents the rubber seal from doing its job, and corrosion can result.

The proper way to do this is by using the special Delco/GM adapters for this purpose as illustrated in the GM Radio Telephone/Mobile Radio Installation Guidelines (**service.gm.com/techlineinfo/radio.html**). While the Delco product is the suggested way to go, NAPA-Belden replacement bolts (part number 728198) are known to be good replacements and other manufacturers may also make bolts that should work. See Figure 2.

Figure 1 — Close-up of side terminal battery connector.

Figure 2 — Photo of the proper type of radio connection for a Delco side-terminal battery.

Another approach is to remove the original terminal bolts, then drill and tap the bolt heads for the additional connections to the radio.

While we can't be absolutely certain of the specific mechanism that caused a problem in your case, corrosive acid and possibly electrolytic action (depending on the metals involved) are probably the biggest culprits. I generally do the following before installing cables to a battery:

- Degrease all connections with brake cleaner or similar solvent. Be careful not to get it on painted surfaces.
- Rinse everything in a solution of baking soda and water. This will neutralize any acid.
- Rinse thoroughly with pure water and dry.
- Clean and remove all oxidation from terminal connection points with a wire brush. They should be shiny. There are special wire brushes for this purpose.
- Clean and remove all particles and residue from terminals.
- Apply a thin coat of grease on terminals. Marine type grease (designed for wheel bearings in boat trailers, etc) doesn't wash out easily and may be a good choice. Be sure to use a high temperature grease that is appropriate for the purpose. Things can get hot under the hood, especially on a warm summer day. There are also special products for this, but I've only used grease. (Note: There may be some controversy over applying grease to the actual mating surfaces. This is the way I've always done it and always was pleased with the results.)
- For external connections to battery, I suggest adapters for this purpose. As previously discussed, special adapters are mandatory for side terminal mount batteries. Be sure to select a suitable adapter for any mounting scheme in your vehicle, however. They are detailed in the *The ARRL RFI Book* and *Amateur Radio on the Move*.[1,2] They are available at most auto supply shops. Do *not* stick wires between mating surfaces and tighten. Although I've done this, and it does work, it's really *not* a recommended practice since it reduces the effective connection surface for the high current auto loads such as the starter.
- Once all connections are tight, I give everything a nice coat of grease for added protection. Cover any exposed cables.
- Maintain an inspection program of every month or so. Correct any corrosion issues as soon as they become apparent. Do not wait for failure to occur before taking action.

Q Don, WA4AVU, asks: In a recent net, we discussed the possibility of needing to operate during inclement weather in support of organizations such as SKYWARN and ARES. Many of the amateurs suggested using an attic antenna, claiming that would be safer than an outdoor antenna. Is this true? It seems to me that it would take a lot more than moving the antenna into the attic to make it safe to operate with nearby lightning.

A That's a good question! The short answer is that for sure it's less safe to operate during thunderstorms than it is

[1] *The ARRL RFI Book*. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 6834. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop/**; **pubsales@arrl.org**.

[2] *Amateur Radio on the Move*. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 9450. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop/**; **pubsales@arrl.org**.

during clear weather! One problem is that many times equipment (and equally possible, operators if in contact with, or near the equipment) is damaged as a result of strike energy being coupled to the equipment via power, phone or cable TV wires, even if the antenna is completely disconnected.

That being said, if there are two objects relatively in the clear, lightning is more likely to strike the higher one. There is a concept known as a "cone of protection" (see Figure 3) that suggests a tall object is more likely to be struck, and thus protects other objects within a cone extending down at an angle from the higher point. The smaller the apex angle, the higher the probability of protection from a direct strike, but note that a *probability* of protection is not a *guarantee* of protection!

Thus, a lower antenna is less likely to be struck than a high one, if there are higher targets in proximity. Even so, lethal currents can be induced into other conductors.

If there is a life or death circumstance that requires communication, we all have to make our personal judgment of risk vs benefit. The indoor antenna might reduce the risk, but not eliminate it. If you do decide to operate, I suggest the following rules to make you as safe as circumstances permit:

- Don't wear headphones.
- Use only one hand.
- Only touch the equipment when absolutely required. A loudspeaker and table mic with VOX would be best.
- Make sure your personal affairs are in order.

Q Richard, K5RB, asks: They are putting in fiber optic cable in our neighborhood. I wonder if fiber optics has any applications to Amateur Radio?

A With appropriate analog to digital conversion and encoding, fiber optics can be adapted to carry almost any kind of information for distances from a few hundreds of yards (multimode fiber) to tens of miles (single mode fiber) without the need for repeaters.

The main benefits of using fiber in Amateur Radio systems that occur to me are:

- They are not susceptible to picking up and carrying RF (unless you make the mistake of getting one with metal structural strands).
- They will not couple nuclear electromagnetic pulse (EMP) or lightning into systems.
- They won't close ground loops.
- They won't act as antennas for the harmonics of the digital pulses they carry.
- They have the ability to carry much greater information content than any other medium except free space.

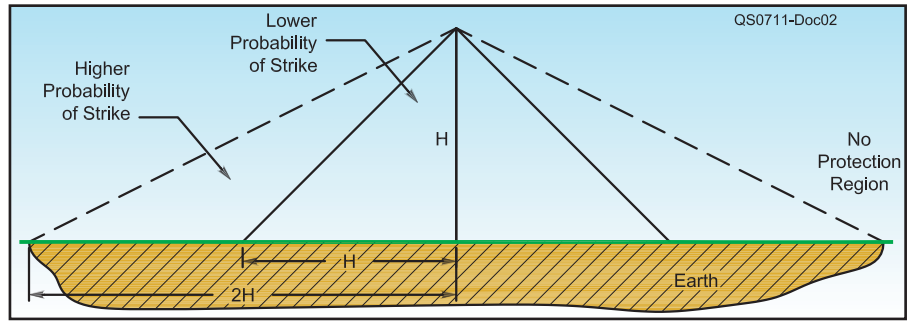


Figure 3 — Illustration of the lightning "cone of protection" concept.

Figure 4 — Photo of "barrel" splice connectors for (L-R) UHF (2), Type-N and BNC coax connectors.

- The cables (but perhaps not the terminal equipment) are comparably priced to copper.

There are a few disadvantages:

- They can't carry power along with signals.
- A certain level of training is required to install connectors, especially on single mode fiber.

To my knowledge, fiber is not yet in common use in amateur stations, except for some advanced computer networking applications, but I wouldn't be surprised to see a fiber connected remote front-panel some day soon.

Q Steve, NI8T, asks: I was wondering what the proper way to splice coax cable is? I know you can put connectors on both ends, but this adds a lot of hardware (and "impedance bumps") to the cable. Is there a more straightforward method?

A The best method, without question, is to just buy a long enough piece of coax! You will likely need the shorter pieces someday for some other project.

The next best method is to use a coax "splice." These are often called "barrel connectors" and for the so-called UHF type have the old mil-nomenclature of PL-258. They are a short section with a female UHF connector on each end and often have threads running continuously. Variants are available in longer lengths, 3, 6 and even 12 inches, to allow passage through partitions. See Figure 4.

Strictly speaking, you are correct that they do add an impedance "bump." The bump, however, is almost unnoticeable below 30 MHz. That can be avoided by using constant impedance connectors such as Type N, or BNC. Those connectors are also waterproof, while the UHF are not and will require protection if exposed to the elements.

Another advantage of Type-N connectors is that female cable connectors are available, thus allowing multiple cables to be spliced together without the need for barrel connectors. Senior ARRL Lab Engineer Zack Lau, W1VT, takes a number of lengths with him for his V/UHF field operations so he can get just the length he needs without having to fabricate in the woods.

The third method is not recommended or approved, but can be applied in an emergency. Strip an inch or two of the outer jacket and push back the braid. Strip around ¾ inch of the insulation around each inner conductor, twist in a "Western Union" type splice (wires wrapped around each other on the axis of the wire) and solder. Carefully remove any resulting sharp points that could puncture the tape. Cover the splice with good quality tape with overlap over the dielectric. Then carefully (without dislodging the inner tape) push the shields back until they meet. Solder the shields in a number of places with the minimum heat to do the job to avoid melting the tape or inner dielectric. Check for shorts with an ohmmeter. Cover the whole splice with another layer of tape.

The last method should be used only as a last resort. The voltage breakdown and power ratings are now limited by a bit of tape, rather than a known quantity of polyethylene, so be careful. Also avoid bending and flexing the joint since the inner splice could easily be pushed through the inner layer of tape.

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/.

Elsie 2.13

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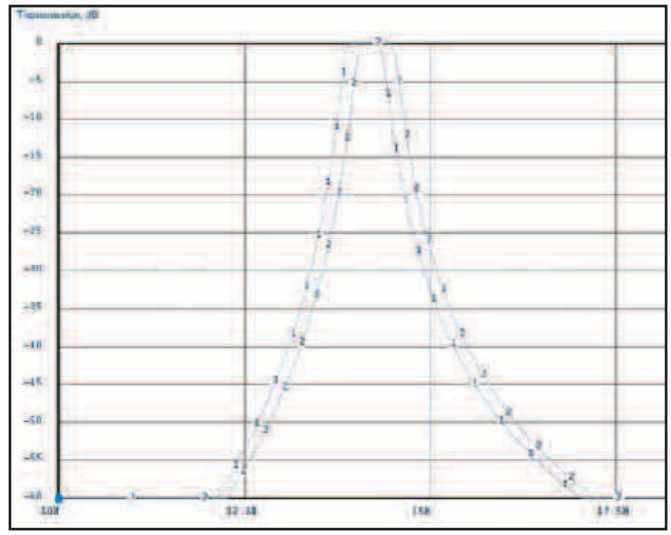


Figure 1—*Elsie* plots the performance of our bandpass filter. Curve #1 is the original and #2 shows the effect of substituting 5% components.

Although we now live in an era of digital signal processing, there is still a great need for analog filters—the kind you make using inductance and capacitance. This is particularly true for receiver front ends and transmitter outputs. We also need analog filters for specific applications such as interference filtering.

The old-school method of analog filter design relied on extensive use of mathematics and component data. That's still the case today, but now we have software that does most of the hard work for us. One highly capable design application is known as *Elsie* and it is the brainchild of James Tonne, WB6BLD. *Elsie* provides professional design power at *no cost* to amateurs and students using the *Windows* operating system. Its unusual name is derived from the fact that *Elsie* is a lumped-element electrical filter design and network analysis program. I've just mentioned that hardware filters are composed of differing values of inductance (L) and capacitance (C). Well, put the L and C together, say them aloud and you get "*Elsie*."

Elsie is like having laboratory signal generators, spectrum analyzers and plotters at your fingertips. With Elsie and an ordinary *Windows* PC, you can design any filter you can imagine.

Let's Build a Filter

To illustrate the power of this software, let's have *Elsie* design a 20-meter bandpass filter by entering our objectives on its design page. We'll use a capacitor-coupled topology, a center frequency of 14.1MHz and a bandwidth of 350 kHz. We'll also select the Chebyshev filter family and enter a passband ripple of 0.044 dB.

The student version of *Elsie* has a limit of seven filter stages (very adequate for amateurs). For a modest degree of performance and complexity, three filter stages is a good choice. *Elsie*'s analysis page allows us to specify the output and in this example we'll use 10 MHz and 20 MHz for start and stop band, and a linear plot and default values for the other variables.

One great feature of *Elsie* is the variety of high-resolution graphical plots and printable outputs available. Any plot can be saved as an overlay to be compared with additional plots perhaps resulting from design adjustments. In fact, *Elsie* stores up to ten plots which can be recalled for comparison. You can create a filter, store the data plots for it, make changes to the filter, and then recall any of the old plots. *Elsie* will overlay the plots on top of your current graph for quick visual comparison.

After adjusting the desired performance parameters for our sample filter, *Elsie*'s initial schematic looked good, but specified nonstandard component values. That would be a problem if you wanted to simply go to a Web site and order your filter parts! Fortunately, *Elsie* can show us the impact of substituting standard 5% components. *Elsie* allows us to manually select components from a menu, which greatly simplifies the design process. These components are shown graphically and include serial and parallel lumped circuit elements along with sections of transmission line.

The *Elsie* component library includes transmission lines and stubs, transformers, arbitrarily-coupled inductors, and resistors, as well as unique-to-*Elsie* parts. You can add these components manually and quickly see the result. For example, you can add a piece of coax (specify the impedance and length) to a filter and see the effect. The edit tool makes it easy to insert and substitute parts. We can also enter reactance as + and – values of j, which is handy for modeling and matching antennas.

Among the most powerful features are tools to optimize filter performance such as tuning the value of individual parts while observing effects graphically in real-time. For our sample filter, we can simply incorporate the standard components, generate a new schematic and have *Elsie* run an analysis. You can see the result in Figure 1.

Yes, *Elsie* showed that there were some performance differences with the new components, but they were negligible. Now we have a "buildable" filter — all thanks to *Elsie*!

The Price is Right

Elsie has many more exciting tools and design capabilities. Most features are intuitive and there is an excellent "help" system. *Elsie* is so easy to use, you can just install the application and immediately begin exploring. If you run into trouble, chances are you'll find the solution in the "help" file.

The difference between the Professional edition and the Student edition is that the Student edition only handles seven stages of components. The Student edition is free and the Professional edition is priced at $175. For ordering or downloading, get on the Web and go to **tonnesoftware.com/elsie.html**. The student version of *Elsie* is also provided on the CD included with the *2008 ARRL Handbook*. QST

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

Motorola VHF Micor Radio Modifications — *Part 2*

The second of a pair of articles describes the final step in putting these retired commercial radios to work in the amateur service.

Robert Conway, KAØVAN

Anyone who's been to a hamfest has probably seen Motorola Micor radios offered for sale and wondered what you could do with them. If you've been looking for a good radio to use for packet radio, automatic position reporting system (APRS) service or any other single channel service, they will likely work great.

While wiring several of these units up for packet radio use, mainly as nodes, two weak areas were discovered, areas most likely already known by those already familiar with these units. While these limitations make them a little difficult to adapt to amateur use as-is, the following is a method used to correct both problems.

Micor Limitations for Amateur Use

Low Receiver Sensitivity When Tuning Out of Band

The first limitation comes from converting them from the 150 MHz commercial band to the 146 MHz, 2 meter, amateur band and keeping the same receiver sensitivity. Usually I found the 150 MHz band units using the TLD8273B receiver unit, which covers 150.8 to 162 MHz. Some refer to this as the VHF high band. This was addressed in Part 1 of this series.[1]

Low Transmit Audio Deviation

The second limitation shows up while using one with a packet radio terminal node controller (TNC). You may find the transmit deviation will be low unless your TNC has a higher level output than most. This will be true with all types of these radios. This is the subject of this article.

[1]R. Conway, KAØVAN, "Motorola VHF Micor Radio Modifications — *Part 1*," *QST*, Oct 2007, pp 55-56.

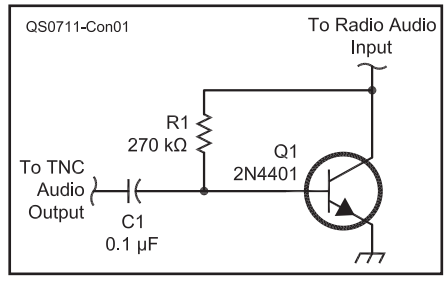


Figure 1 — Schematic diagram and parts list for the audio preamp. Mouser parts are available from www.mouser.com or 800-346-6873.
C1 — 0.01 to 0.1 µF, 16 V or higher small enough to fit into connector (Mouser 74-15D50V0.1).
Q1 — 2N4401 NPN transistor (Mouser 610-2N4401).
R1 — 270 kΩ, ¼ W, 5% composition

Transmit Audio Improvement

For packet radio use, a perfect application for a single channel radio, the packet TNC delivers its audio output to the radio mic input. In this configuration, it is likely that the resulting modulation level, or deviation, will be low. This is because these radios were designed to be used with an amplified microphone and have an input impedance of around 1.5 kΩ. There is also a dc voltage level of around 9 V at this point, as the radio can provide power to an amplified microphone. It receives the audio signal on the same wire. The audio signal is separated from the dc power in the radio.

This is designed on the same principle that an antenna-mounted preamp does with the power supply in the house and the preamp mounted on the antenna. In this case dc power is sent up the cable from the power supply to the preamp and the amplified RF signal is sent down the same cable. Satellite TV systems work in a similar way. One of the reasons the remote preamp microphone system was originally used was because the radio was normally installed in a vehicle's trunk. This configuration requires a longer wire length run, and this will allow for a cleaner audio signal to be sent over the air.

The Circuit

An improvement to the transmit audio level can be made with a simple modification and without going into the radio by taking advantage of this radio design. Adding a small amplifier made up of one transistor, a single resistor and capacitor will cure the problem. See Figure 1 for the schematic diagram and parts list. Since most radio to TNC connections seem to use a DIN type connector, I installed the amplifier in the DIN plug to help reduce any noise problems that could be picked up by external wiring. This will also allow you to run a longer wire between the two units as it puts the amplifier at the TNC end of the cable. The PacComm packet controllers were used in these tests so if you are using the same unit, the pins on the DIN plug should match. For different TNCs, check the TNC manual for the proper connector type and pins wiring.

The single transistor amplifier receives its power from the radio and is biased via the resistor. This final value was determined using a resistor decade box to give the best signal output to the radio. I suggest you stay close to this value. The capacitor was used mainly to provide some transistor protection and its value is not critical. The small size was chosen so it would fit in the DIN plug. If the TNC has a capacitor in its output circuit you can omit this capacitor. However, use caution to make sure that this pin doesn't comes into

contact with a ground point.

This bias method was used to keep parts count to a minimum. No resistor is needed in the collector circuit because the load resistor is located in the radio. A standard microphone cable system can still be used.

The amplifier can be installed anywhere in the line, in a box, or even at the radio. The DIN plug method was used to keep interference lower in the audio input line as a line carrying a higher-level signal is less prone to noise than one that is carrying a low level signal.

Construction

The regular microphone connector could be used, except that you will need an audio output from the receiver, which most microphone connectors in these units don't have. I wired into the control head getting the ground, push-to-talk (PTT) line, audio input and audio output using a four conductor shielded cable about 3 feet long. This cable can be longer as noted.

If you chose to mount the components in the DIN plug the following installation procedure can be used. If not, you can use your own methods and enclosure, and wire according to the diagram.

Position the DIN plug with the pins to the bottom looking at it from the back. It may be helpful to use something to hold the DIN plug for you, such as a third hand tool of some sort. Bend the emitter lead of the transistor out away from the rest of the leads, to the side of the transistor, and away from the flat side about 20°. Bend the base lead in front of the flat surface of the transistor. Then bend the collector lead away from the other leads to that side of the transistor. When finished all leads should extend past the top of the transistor. Cut all the leads so they don't extend past the top of the transistor. Position the transistor so the top of the transistor is almost against the body of the connector and the flat surface is turned up and to the left at about a 45° angle with the emitter lead next to pin 2 as shown in Figure 2. The transistor should in the center area of the plug. Solder the emitter lead to pin 2 (ground).

Be sure to keep the other two parts inside the area covered by the case. Cut the resistor leads to about ¼ inch and bend each back to the body of the resistor on opposite sides so there will be a lead on each side. The resistor will be positioned in the open area with no pins next to the flat side of the transistor. The wire from the resistor that is closest to the body of the plug should be turned toward the collector. Solder this lead to the collector (two connections at this time) and the other resistor lead to the base (two connections at this time). The capacitor is installed last. Cut the lead going to pin 1 to ⅛ inch and solder it to pin 1. Bend the remaining lead around to the base lead where the resistor connection is made and solder them (three connections total). Figure 3 shows the completed unit with all parts installed.

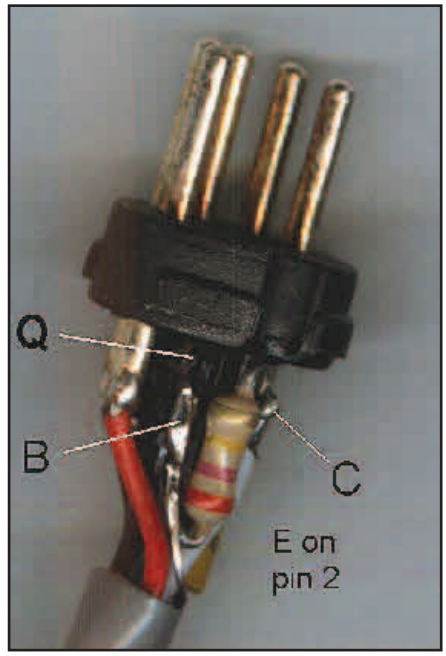


Figure 2 — Close-up of the amplifier mounted inside the DIN plug. The transistor (Q) emitter (E), base (B) and collector (C) leads are identified.

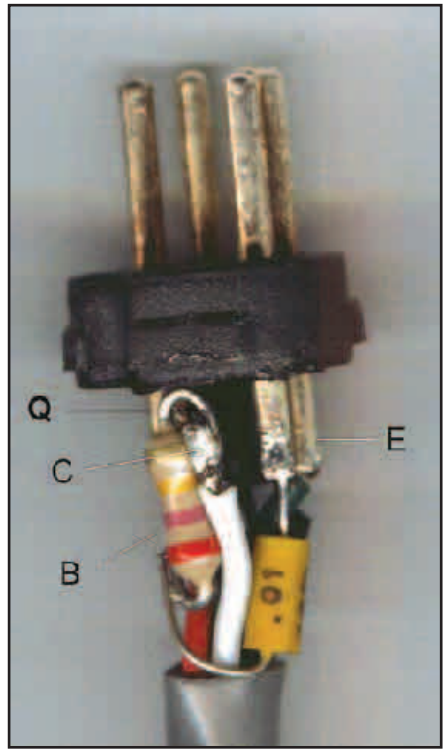


Figure 3 — Close-up of the amplifier from a different angle. The transistor (Q) emitter (E), base (B) and collector (C) leads are identified.

Using your TNC wiring harness solder all wires to the connector pins except transmit audio input wire. Note: The wire colors are your choice and there will be two connections made to pin 2, the emitter lead and the ground wire. The radio transmit audio wire is soldered to the collector lead (three connections total). When assembled properly there should be no need to tape or insulate the added components and they should not short out against the case of the plug. However you may do so. That completes assembly, just set the deviation and you're done.

Robert Conway, KAØVAN, studied electronics in high school and in four years of college. Robert retired as a US Navy Chief Aviation Electrician's Mate after a career maintaining power, instrument, navigational and other aircraft systems. He now serves as an automotive technician in a family owned business.

Robert has been a licensed Amateur Radio operator since 1985 and currently holds an Amateur Extra class license. He is a member of the Chisholm Trail Amateur Radio Club and maintains the club's repeaters and systems. He can be reached at 921 W Walnut Ave, Duncan, OK 73533-4623. QST

Strays

MARK PINSKY, W8MP

Any hams here? **You guessed it — the Pinsky family, consisting of Mark, W8MP; Rosemary, KD8EGG; S. T., WB8TLY, and Brian, KD8EEH, occupy this residence in Ann Arbor, Michigan.**

HANDS-ON RADIO

Experiment #58 — Double Stubs II

NØAX

Readers of the preceding columns on stubs (Hands-On Radio columns #22 and #57) have learned about the workings of the common quarter (λ/4) and half wave (λ/2) versions.[1] We also combined a pair of λ/8 stubs into a resonant circuit with interesting properties at even harmonics of the fundamental frequency. Thus far, removing odd harmonics seems to be off-limits. Using the dual-stub mechanics employed last month, however, even odd harmonics yield to stub filtering.

The Mystery of the Minus Sign

Before beginning, I apologize for a cut-and-paste error in last month's column. The equation for the impedance of an open stub is $X_C = Z_0 \cot (L_E + 90°)$ or $X_C = -Z_0 / \tan (L_E)$. In reviewing the equations with W2VJN, I developed the following descriptions of how the equations work. You may find them helpful.[2]

A shorted stub presents an increasing positive reactance (inductive) as its length increases from zero to 90°. As it approaches 90°, it also approaches infinite positive reactance (open) and then flips over to infinite negative (capacitive) reactance, gradually reducing to zero reactance at 180° (λ/2) at which point the cycle begins again. This is the character of the tangent function; positive between 0 and 90°, then negative between 90 and 180°, with a period of 180° (λ/2), so shorted stub $X = Z_0 \tan (L_E)$.

The open stub presents an infinite negative (capacitive) reactance at zero length, gradually decreasing to zero reactance at 90°. The reactance then becomes positive (inductive) and gradually increases back to infinite reactance (open) at 180° (λ/2). Thus the behavior of the open stub is $X = -Z_0 \cot (L_E)$; negative between 0 and 90°, then positive between 90 and 180°, with a period of 180° (λ/2). Note that cot is the cotangent function (cot = 1/tan). The minus sign in the equation for stub reactance is often omitted with the understanding that the reactance is capacitive, X_C.

Students of the Smith chart (**www.arrl.org/tis/info/chart.html**) shown in Figure 1 can follow the behavior of open and shorted stubs around its outer rim. Beginning from the termination at point A (the shorted stub) or point B (the open stub), increasing the stub's electrical length means its impedance moves clockwise around the chart TOWARDS GENERATOR. A line length of 90° (λ/4) is represented by moving halfway around the chart, returning to the original point at 180° (λ/2). Changing the termination from an open to a short also moves the starting point halfway around the chart.

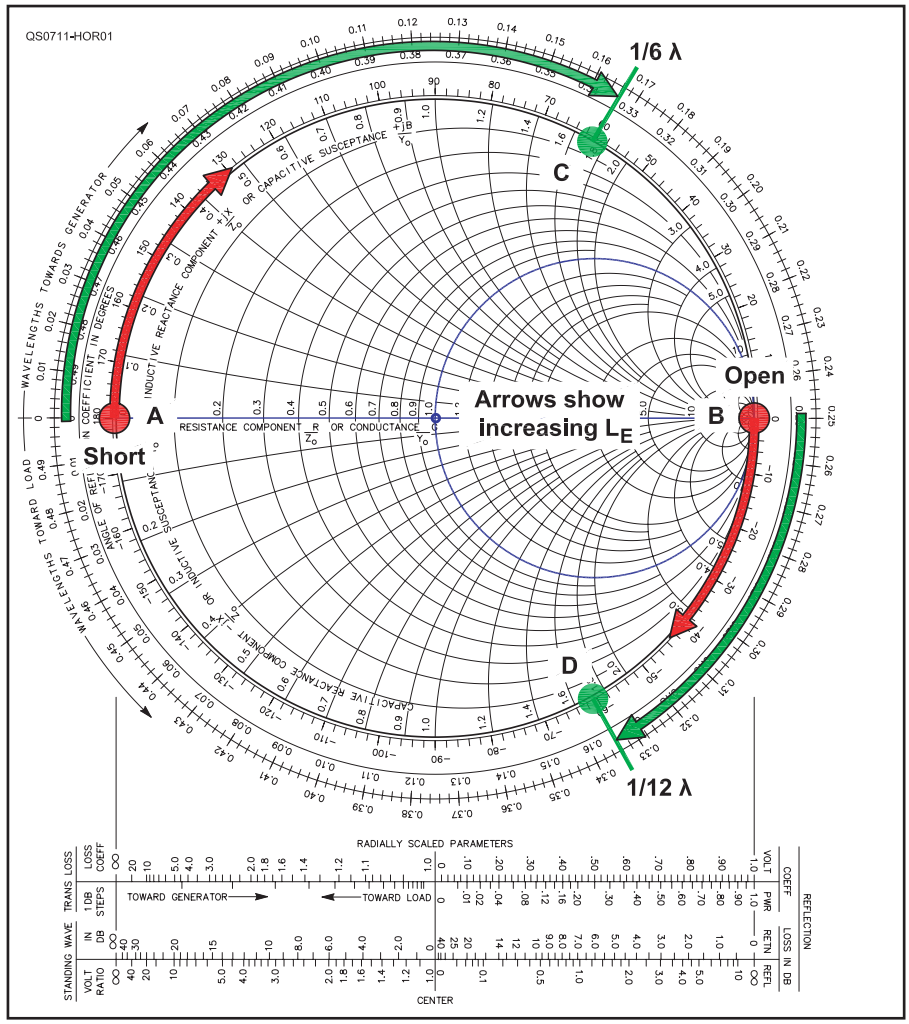


Figure 1 — The Smith chart is a convenient way of describing transmission line behavior. Points A and B and the red arrows show the changes in impedance of shorted and open stubs as electrical length increases. Points C and D represent the impedance of a λ/6 shorted stub and a λ/12 open stub.

Remember that the equations and the Smith chart are based on electrical length that changes with either physical length or operating frequency. As either increases, so does electrical length.

Thirds, Sixths and Twelfths

Now, on with our story — how to get rid of odd harmonics! For example, that nasty third harmonic of the 40 meter station (7 MHz) is often found to be tearing up the band on 15 meters (21 MHz). A λ/4 shorted stub can

[1] **www.arrl.org/tis/info/HTML/Hands-On-Radio**

[2] G. Cutsogeorge, W2VJN, *Managing Interstation Interference*, International Radio (**www.qth.com/inrad**), 2003.

H. Ward Silver, NØAX ♦ PO Box 927, Vashon, WA 98070 ♦ n0ax@arrl.org

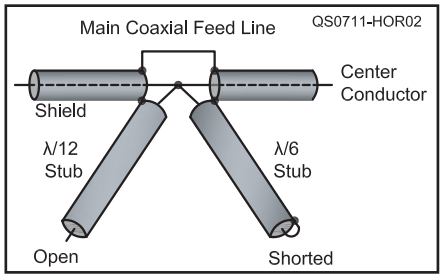


Figure 2 — Connecting a λ/6 shorted stub and λ/12 open stub in parallel creates a way to pass a fundamental frequency while nulling its third harmonic.

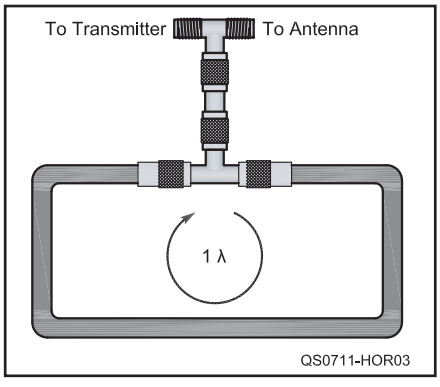


Figure 3 — The odd-looking racetrack stub sends energy on a round trip to create phase delay. This configuration passes even harmonics of the fundamental while nulling the subharmonic f_{FUN} / 2 and its third harmonic.

only null even harmonics. λ/2 open stubs can null a subharmonic (f_{FUN} / 2) and its odd harmonics at 3 × f_{FUN} / 2, 5 × f_{FUN} / 2, etc, but harmonics at 3f_{FUN}, 5f_{FUN}, and so forth are tantalizingly out of reach.

As W2VJN points out in his book, one could just cut a λ/4 shorted stub for 10.5 MHz so that on 21 MHz it becomes a λ/2 shorted stub, nulling the harmonic. The problem is that the stub is not an open circuit on 7 MHz — it is λ/6 at 7 MHz and presents a –*j*86.6 Ω impedance that will create an SWR (Z_0 = 50 Ω) problem when connected to the transmitter's feed line.

The clue that solves the problem was contained in last month's resonant combination of λ/8 stubs. A stub with complementary reactance (equal and opposite) at the fundamental frequency (f_{FUN}) cancels the unwanted reactance when connected in parallel with the first stub, creating an open circuit.

To perform the same trick in this case, we'll need a stub that presents +*j*86.6 Ω of impedance. That turns out to be an open stub λ/12 in length at 7 MHz. When the shorted λ/6 and open λ/12 stubs are paralleled, the result is an open circuit at 7 MHz.

At 21 MHz the λ/6 and λ/12 stubs become three times as long electrically; λ/2 and λ/4, respectively. Figure 2 shows the connection. (If you're following along on the Smith chart, Figure 1 shows the λ/6 and λ/12 stub impedances at points C and D, respectively.) The now λ/2 shorted stub presents a short circuit and so does the now λ/4 open stub. Both stubs null the 21 MHz harmonic, creating a double null that is extra deep.

Table 1
Stub Impedances for Lengths of 50 Ω Z_0 Line

Electrical Length (λ)	*Termination*	*Equation*	*Z at f_{FUN} (Ω)*
1/12	Open	+*j*Z_0 × 1.73	+*j*86.6
1/12	Shorted	–*j*Z_0 × 0.577	–*j*28.9
1/8	Open	+*j*Z_0 × 1	+*j*50
1/8	Shorted	–*j*Z_0 × 1	–*j*50
1/6	Open	+*j*Z_0 × 0.577	+*j*28.9
1/6	Shorted	–*j*Z_0 × 1.73	–*j*86.6
1/4	Open	Short	0
1/4	Shorted	Open	∞
1/2	Open	Open	∞
1/2	Shorted	Short	0

Hands-On Radio FAQ

This column makes frequent references to previous columns, all of which are available to ARRL members at **www.arrl.org/tis/info/HTML/Hands-On-Radio**. The Web page is also host to a collection of tools, tips, observations and errata organized by column number.

Construct this pair of stubs, just as the pair of λ/8 stubs described in the previous experiment. Use barrel and T connectors to connect the stubs together and then to the main feed line. Remember to account for the lengths of the T connector that joins the two stubs as shown last month.

Measure the attenuation of the stub pair by using a receiver's S-meter to observe harmonic strength on 21 MHz with the stub disconnected. Now connect the stub pair and see what the S-meter reads afterward. Multiply the difference in S-meter readings by 6 dB per S-unit to get the attenuation in dB. (This isn't precise and assumes your S-meter changes the standard 1 S-unit for every 6 dB in signal strength. An oscilloscope, spectrum analyzer or network analyzer will give much more accurate results.) Bring this secret weapon to ARRL Field Day or a multi-operator contest station and you'll be a popular person with the 15 meter crew!

A Racetrack Stub

Here's one of my favorite stubs, just because it looks so odd! Figure 3 shows a 1 λ loop of cable with its ends connected together at a T connector. I can hear you readers exclaiming, "Now, wait a minute!" It looks like an April Fool's prank — but it really works!

By now, you're wise to the knowledge that stubs work because of the relative phases of waves bouncing around inside transmission lines, with the amount of phase difference determined by the line's electrical length. Let's analyze the racetrack stub the same way, beginning with the fundamental frequency, f_{FUN}, at which the loop is 1 λ in circumference.

At the point where the ends of the loop are connected together, energy from the main feed line divides equally. Half of the energy goes clockwise and the other half counterclockwise. At f_{FUN}, the energy undergoes 360° of phase delay and is back in-phase at the junction, so no cancellation takes place. This is also the case at frequencies at which the delay is integer multiples of 360° — all the harmonics of f_{FUN}.

At the subharmonic f_{FUN} / 2, the delay is only 180° so the returning energy is out of phase and cancels energy at that frequency in the main feed line. Wherever the delay is an odd integer multiple of 180° — all odd harmonics of f_{FUN} / 2 — the racetrack stub creates a null. A 14 MHz, 1 λ racetrack stub cancels 7 (f_{FUN} / 2) and 21 MHz (3 × f_{FUN} / 2) signals, while passing 14 and 28 MHz. With the loop cut for f_{FUN} = 7 MHz, 3.5 MHz signals are cancelled, while those at 7, 14, 21 and 28 MHz are passed. Do you have any cable left? Have at it!

Recommended Reading

With your newfound knowledge of stubs, review articles or chapters of books on transmission lines that you may have set aside before. Take a walk through the chapter on transmission lines in *The ARRL Antenna Book* or some of the many articles on transmission lines available through the ARRL's Technical Information Service at **www.arrl.org/tis/info/reflections.html**.[3]

Next Month

All this trigonometry whetted my appetite for a little Smith chart work! Next month we'll unlock a few of the secrets hidden in plain sight among the many circles and arcs that make up one of radio's most useful tools. You might want to prepare by browsing some of the articles at **www.arrl.org/tis/info/chart.html**. We'll put the Smith chart to work on a practical task, too!

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

WR1B

HINTS & KINKS

LITTLE SPRING TOOL

◊Little springs are used inside radios for a number of devices that need tension. Some are used on relays, on the end of tuning strings to hold the string on a pulley, and they may also be used in and on other items found around the radio shack.

These little springs often have to be removed and replaced in order to service the equipment, and they tend to go flying into space while removing or putting them back on. Some work locations are surrounded by things that will hide a spring from you, and you may never see it again if it gets away from you. Little springs can jump out of your fingers and hit you in the eye, so eye protection is recommended when removing and replacing them.

So what is this miracle tool that can save your eyesight and sanity as well as keep you off your hands and knees looking for that elusive spring? It is a crochet hook! They come in a variety of sizes and are easy to use for hooking and unhooking the spring from its retainer. Simply place the end of the crochet hook into the spring and pull it off or into place. A little twist of the hook, and it can easily be removed from the spring. Keep the springs and small parts in a container so they don't escape.

No crochet hook? You could take a safety pin or paper clip and open it up, place a small hook in the end and use it the same way. But, it might be a little more difficult to handle if you have large fingers or if you need a little more "reach."

If you are using a metal crochet hook, there can be a shock hazard. Don't work inside equipment with the power on and make sure you have taken precautions so that no electrical components, like capacitors, have destructive or dangerous electrical voltages on them, just in case you accidentally touch or drop the crochet hook onto a circuit board or across energized components. — *73, Chet Chin, N1XPT, 65 Millers Falls Rd, Turners Falls, MA 01376;* **n1xpt@aol.com**

STRENGTHENING A THIRD HAND

◊Many of us use "third hand" soldering tools with alligator clips. Figure 1 is an example of one of these devices. The shanks of the clips are easily crushed by over tightening the holders, as shown in on the left in Figure 2. In my laboratory at the University of Georgia, we prevent this by inserting a no. 6-32 machine screw into the shank and cutting off the head. The clip on the right in Figure 2 shows the result of this modification. The alligator clip is then crushproof. — *73, Michael A. Covington, N4TMI, AI Center, Univ of Georgia, Athens, GA 30602-7415;* **mc@uga.edu**

N4TMI

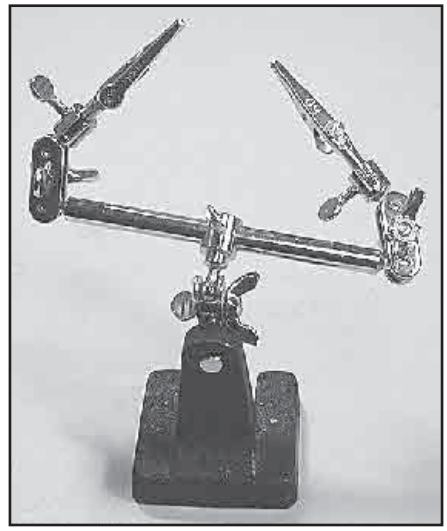


Figure 1 — A "third hand" is useful for holding small parts and small circuit boards while soldering.

N4TMI

Figure 2 — The alligator clip at the left has been crushed by over-tightening the thumbscrew to hold the clip securely in place. The clip at the right shows how a piece of no. 6-32 machine screw has been inserted into the hollow opening. This will prevent the thumbscrew from crushing the clip.

MFJ ANTENNA ANALYZER HINTS

◊The January 2007 Hints & Kinks column suggested a way to protect MFJ Antenna Analyzers from accidental operation. I have another suggestion that doesn't deface the instrument. Simply put a coaxial type power connector in the external power supply socket. This disconnects the batteries. Any 2.1 or 2.5 mm ID connector with a 5.0 or 5.5 mm OD will do the job. I use a right angle plug, which provides a sort of handle for easy removal. — *73, John Roubie, K2JDD, 7205 Coventry Rd N, East Syracuse, NY 13057*

◊When I bought an MFJ-269 Antenna Analyzer, I also purchased the matching MFJ-39C carrying case because I knew that this very useful instrument would get a lot of handling, both inside my shack and out. The carrying case is padded, and has a single large clear plastic window to allow full view of the analog and digital displays. Two punched holes are provided to fit over and under the TUNE and FREQUENCY knobs. If the case is fitted under these two knobs, removal of the analyzer from the case — to service the batteries, for example — is going to be difficult because the padded case is now under the knobs. In addition to this, the case completely covers the FREQUENCY range markings, something that I could just not live with! See Figure 3. Yes, I know I can read out the frequency range on the digital display, but that did not satisfy me. After considering several possible solutions to this dilemma, this is what I decided to do. [It looks to me like the MFJ-259 Analyzer and MFJ-29C case will have the same problem. — *Ed.*]

KO8S

Figure 3 — KO8S modified the carrying case by cutting an opening to show the FREQUENCY and TUNE labels on his MFJ-269 Antenna Analyzer.

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

I removed the analyzer from the carrying case and removed the MFJ leather-like logo tag that was held on with two-way tape and then sewn on around the edges. (This would be in the way of the cutout I decided to make.)

I measured an area around the Analyzer TUNE and FREQUENCY knobs, and found it to be 3 inches by 1¾ inches. I then transferred this dimension to the carrying case using the two punch holes for reference. I inserted a hardwood block inside the carrying case to back up the cutting operation. In the four corners of this rectangle, I used a ⅜ inch diameter hole punch (gasket punch) to give me corners with a small radius rather than sharp corners that might later tear.

The fabric and foam padding are difficult to cut through. After punching the four corners, I used a ruler as a straight edge, and a sharp single edge razor blade to make multiple cuts to cut all the way through. With care I was able to get a nice looking opening.

For the window, I used a 4 inch × 2½ inch rectangular piece of clear, flat, stiff (0.015 inch thick) plastic that was the packaging from an "SD" camera memory card that I had purchased. (The large packaging is used to help prevent theft at the store of such a very small item.)

Next, I removed the two knobs from the analyzer, located the plastic rectangle over the two shafts with respect to the sides and bottom of the analyzer, and marked their location on the plastic. With the plastic on a hardwood block for a back-up, I used a ¼ inch diameter punch to punch the two holes. I then removed the two screws from the bottom of the analyzer that are just below these two knobs. I now placed the plastic window over the two shafts and down flat on the metal case. I then marked the locations of the two screw holes on the plastic, removed it, and punched these two locations with a ⅛ inch diameter punch. With the plastic window back over the two shafts for the last time, I screwed it down using the previously removed screws and replaced the knobs.

When I put the analyzer back in its carrying case, I was really happy with the results! See Figure 3. That is what I wanted! Also, it is now much easier to remove the Analyzer from the carrying case for a battery change. As a final touch, I applied a small portion of two-way tape to the previously removed MFJ label, and stuck it to the top of the carrying case. — *73, Karl T. Schwab, KO8S, 30752 Ridgefield Ave, Warren, MI 48088-3174*; **ko8s@arrl.net**

ELECRAFT KX1 BATTERY PACK

♢After building an Elecraft KX1 I began to look for ways to improve this great radio. One trick is to take out the 1.5 V AA batteries and install six 3.7 V AA-size lithium-ion batteries. I just rewired the battery holders for three cells in parallel with the other three cells, and installed a 5 A protection board so the Li-ion batteries charge properly and are protected from an overload or short circuit. This gives me an 11.1 V, 1.5 Ah battery pack inside my KX1. See Figure 4.

If you decide to install a few 3.7 V Li-ion batteries in your KX1, please check out my "KX1 Pimp Pot" Web site: **www.wa3wsj.com/KX1.html** or go directly to the battery page at **www.wa3wsj.com/KX1-12vPower.html**. You must install a protection circuit board (PCB) so it is safe to charge these batteries, and also to protect against short circuits and other problems. Figure 5 shows the PCB with a wiring diagram for the batteries, radio and charger.

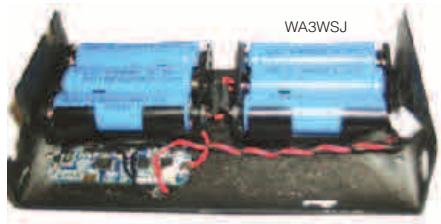


Figure 4 — WA3WSJ modified the battery pack for his Elecraft KX1 by using 3.7 V Li-ion batteries and a protective circuit board (PCB) from Batteryspace.com. Ed connects two cells in parallel for increased ampacity with his 11.1 V battery pack.

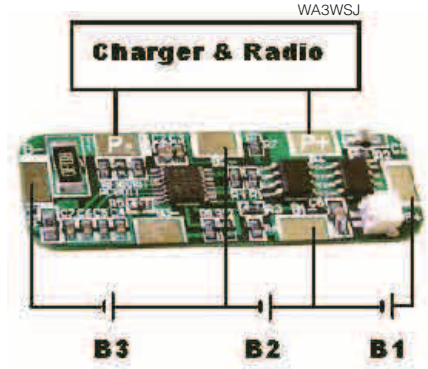


Figure 5 — The protective circuit board used with the 3.7 V Li-ion batteries charges each parallel pair of cells individually, and also provides connections from the battery pack to the radio and charger.

Figure 6 — This photo shows how WA3WSJ brought a set of leads from the battery pack out on the bottom of the KX1 case to connect the battery charger.

I use batteries and PCBs from **battery space.com**. See **www.batteryspace.com/index.asp?PageAction=VIEWPROD&ProdID=2779** for more information. I don't use the "Fuel Gauge" boards, but those add an interesting way to keep track of your battery pack charge condition.

I brought a set of leads from the battery out through a hole in the case and added a charge plug on the bottom of my KX1. See Figure 6. Now I can just plug in my charger and charge the batteries! The plug is the same type of plug used to power my KX1.

I use a Smart Charger for my six-cell Li-ion batteries. It is set for any Li-ion battery pack at 11.1 V (3 cells) with 120 V or 240 V ac input for worldwide power support.

Here's another interesting idea to add to the KX1 battery conversion: A 2 A Poly Switch that resets when the high current load is removed. More details are at: **www.batteryspace.com/index.asp?PageAction=VIEWPROD&ProdID=2687**.

My friend Guy Hamblen, N7UN, uses a 14.6 V, 4 Ah Li-ion battery pack to power his K1. While on a hike, the power cable from the battery froze and cracked, shorting out the battery. One of these poly switches saved the battery.

I tried out my new "pimped-out" Elecraft KX1 on an Appalachian Trail Hike for the January 2007 Polar Bear operating activity. [For more information about the Polar Bear group and their Moonlight Madness activities, see **n3epa.org/Pages/PolarBear.htm**. — *Ed.*] My 2 ounce Bead-Wire Antenna quickly went up and I was on the air Saturday morning making Qs. While hiking on the AT in New Jersey, I had a dozen QSOs using my KX1 and the Bead-Wire Antenna. I checked my battery in the KX1 and it was still at 11.1 V. Plenty of power for more Qs!

My next KX1 Trick will be to put my "pimped-out" KX1 in a Pelican 1060 Micro Case for travel and hiking. — *72, Ed Breneiser, WA3WSJ, 775 Moonflower Ave, Reading, PA 19606;* **wa3wsj@arrl.net**

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

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

PRODUCT REVIEW

Kenwood TM-V71A Dual Band Mobile Radio

Reviewed by Howard Robins, W1HSR
ARRL Contributing Editor

Kenwood's TM-V71A is a feature packed 2 meter/70 cm radio that includes interesting new capabilities. Specifically, the 'V71A supports an EchoLink *sysop mode*, which means it can be configured with an Internet connected computer to work as an EchoLink node or link.[1] EchoLink node call signs and access codes can be stored in and sent from 10 dedicated memory channels. They are sent as strings of dual-tone multi-frequency (DTMF) tones. This feature will allow mobile operators to more easily connect by radio (RF) to remote EchoLink nodes. Of course, local repeater operators must allow such RF access to their nodes. More on this later.

In addition to EchoLink support, the TM-V71A has a long list of traditional features that we've come to expect in mobile transceivers. Transmitter power for both bands is selectable at 5, 10 or 50 W. The wideband receiver provides coverage from 118 MHz to about 1399 MHz in six band steps with some gaps (see Table 1). It also can receive NOAA's weather alert signals and has 10 weather channels.

Putting the TM-V71A to Work

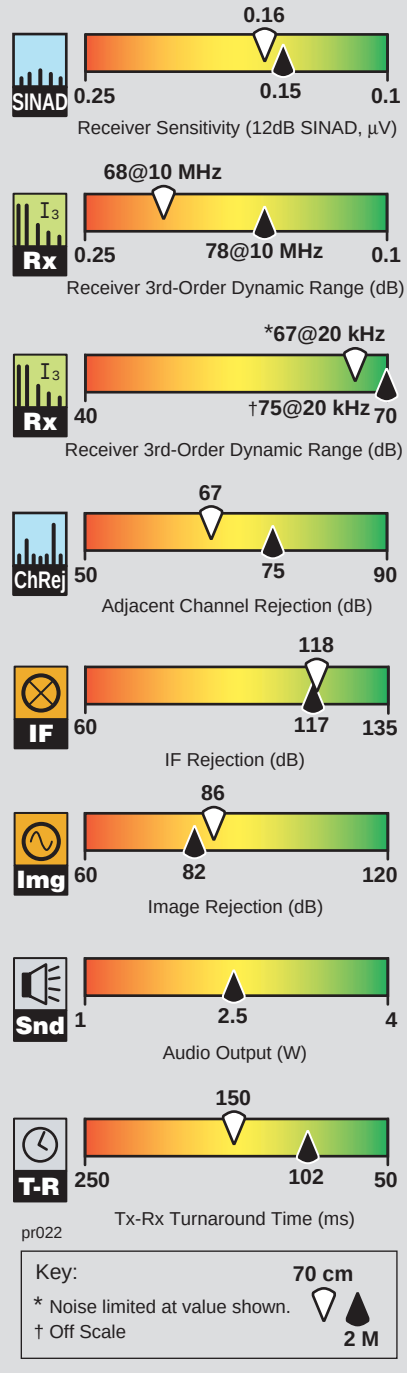
I have some familiarity with Kenwood and other VHF/UHF FM products. I use them regularly in various ways. A Kenwood TM-D700A in my car with the AvMap G4T GPS unit beacons positions on the automatic position reporting system (APRS) by Bob Bruninga, WB4APR. I use a Kenwood TM-G707 at my home station to send APRS weather beacons. My conventional packet station is built on a Yaesu FT-1500M 2 meter radio and is used for both National Traffic System and *WinLink* access. I use an ICOM IC-V8000 for VHF nets, and I carry a Kenwood TH-F6A. The TM-V71A is in the same class as the TM-D700A in terms of form, function and overall quality.

Programming is fairly intuitive, especially after you have done it once or twice. Button labeling is clear and meaningful from both the control head and mic, unlike some radios I have used.

Setting up an EchoLink node/repeater was a new experience for me, so I had a bit of a learning curve to get over. I found several resources to be extremely helpful in getting me up to speed on the technology and its terminology and especially in understanding sysop mode. These included the "Interfacing" section of the EchoLink software Help pages; the "Support and FAQs" link available at **www.echolink.org**; and *VoIP: Internet*

[1]EchoLink software allows licensed amateurs to communicate with one another over the Internet, using voice-over-Internet protocol (VoIP) technology. Connections may be made from station to station or from computer to station. For an overview, see J. Brone, "EchoLink for Beginners," *QST*, Jan 2005, pp 60-61. For detailed information, software and registration, visit **www.echolink.org**.

Key Measurements Summary



Bottom Line

Kenwood's TM-V71A is a solid, high quality dual-band mobile V/UHF transceiver. In addition to a full range of expected features, it includes EchoLink sysop mode, wide receiver coverage and some capable programming software.

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

Linking for Radio Amateurs by Jonathan Taylor, K1RFD, the creator of EchoLink.[2]

After some initial frustration, I sent K1RFD an e-mail requesting his help. Jonathan was very helpful, but I must stress that if you are serious about setting up a sysop node, the references mentioned above are where you should go first. Everything that Jonathan told me is readily available from those EchoLink resources.

Given that EchoLink sysop mode is such a new and prominent feature of this radio, I expected to find a more detailed explanation than I did in the Kenwood *Instruction Manual*. In my opinion a few words about what the feature is, how it should be implemented, and helpful reference links should have been in the manual. I sent an e-mail to Kenwood's support address. The response provided links to the references mentioned above, and to some users' groups.

A Versatile Package

The base unit is of very solid construction. The rear panel has separate jacks for external speakers for bands A and B. These jacks can be programmed for combined or separate outputs. Also on the rear panel are an SO-239 antenna connector, a 6-pin mini-DIN data port and an 8-pin mini-DIN PC port. The data port is typically connected to a terminal node controller (TNC) or PC sound card. The optional PG-5G cable provides connection to a 9-pin RS-232 serial port. The PG-5H option comes with the PG-5G cable and another cable to interface the data port with PC sound card audio jacks. Firmware is user upgradable (see the SUPPORT section at **www.kenwoodusa.com**).

The TM-V71A's control head is removable, so it can be attached to the radio with the internal speaker facing either up or down. Internal speaker audio is crystal clear. The control head can also be separated and mounted remotely with the optional PG-5F extension kit and the DFK-3D panel kit. The mic and speaker jacks are on the base unit, similar to the 'D700A configuration.

The control head has a very crisp liquid crystal display (LCD) with backlighting (adjustable brightness as well as color — amber or green). The lower right corner has a pair of concentric VOLUME and SQUELCH controls for Bands A and B.

Memory Control Program

Memory channels can be easily programmed using Kenwood's *MCP-2A* software (free download from **www.kenwoodusa.com**) and the PG-5G cable. In addition to other memory management features, *MCP-2A* can import files generated by ARRL's *TravelPlus for Repeaters* software and load them directly into the TM-V71A's 1000 memory channels.[3] I used *TravelPlus* to create a list of 341 2 meter and 70 cm repeaters within 70 miles of my station. I sorted the list by state and location (other options are available). Identify the radio programming software you are using and *TravelPlus* produces an export file for it.

MCP-2A imports the *TravelPlus* file and

Table 1
Kenwood TM-V71A, serial number 90200116

Manufacturer's Specifications	Measured in the ARRL Lab
Frequency coverage: Receive, 118-524, 800-1300 MHz (cell blocked); transmit, 144-148, 438-450 MHz.	Receive, as specified; transmit, 144-148, 430-450 MHz.
Power requirement: Receive, 1.2 A (2 W audio); transmit, 13 A (max).	Receive, 0.7 A; transmit, 9.1 A. Tested at 13.8 V.
Modes of operation: FM.	FM, AM (receive only).
Receiver	**Receiver Dynamic Testing**
AM sensitivity: Not specified.	For 10 dB S+N/N: 120 MHz, 0.53 μV.
FM sensitivity, 12 dB SINAD: 0.16 μV.	For 12 dB SINAD, 144 MHz, 0.15 μV; 430 MHz, 0.16 μV.
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz offset: 146 MHz, 75 dB; 440 MHz, 67 dB;* 10 MHz offset: 146 MHz, 78 dB; 440 MHz, 68 dB.
FM two-tone, second-order IMD dynamic range: Not specified.	86 dB.
FM adjacent channel rejection: Not specified.	20 kHz offset: 146 MHz, 75 dB; 440 MHz, 67 dB.
Spurious and image rejection: Not specified.	First IF rejection, 146 MHz, 117 dB; 440 MHz, 118 dB; Image rejection, 146 MHz, 82 dB; 440 MHz, 86 dB.
S-meter sensitivity: Not specified.	Max indication: 146 MHz, 1.8 μV; 440 MHz, 2.1 μV.
Squelch sensitivity: 0.1 μV.	At threshold: 0.11 μV.
Receiver audio output: 2 W at 5% THD into 8 Ω.	2.5 W at 5% THD into 8 Ω.
Transmitter	**Transmitter Dynamic Testing**
Power output (H/M/L): 50/10/5 W.	146 MHz, 52 / 11 / 3.6 W; 440 MHz, 45 / 12 / 4.6 W.
Spurious-signal and harmonic suppression: 60 dB.	VHF, 69 dB; UHF, 70 dB. Meets FCC requirements.
Transmit-receive turnaround time (PTT release to 50% audio output): Not specified.	S9 signal, 146, MHz, 102 ms; 440 MHz, 150 ms.
Receive-transmit turnaround time (tx delay): Not specified.	146 MHz, 75 ms; 440 MHz, 62 ms.
Bit-error rate (BER), 9600-baud: Not specified.	146 MHz: Receiver BER at 12-dB SINAD, 2.8×10^{-4}; at 16 dB SINAD, 1.4×10^{-4}; at –50 dBm, 9.1×10^{-5}; transmitter BER at 12-dB SINAD, 1.7×10^{-3}; at 12-dB SINAD +30 dB, 9.3×10^{-4}. 440 MHz: Receiver BER at 12-dB SINAD, 1.6×10^{-4}; at 16 dB SINAD, 2.7×10^{-4}; at –50 dBm, 1.6×10^{-4}; transmitter BER at 12-dB SINAD, 3.3×10^{-3}; at 12-dB SINAD +30 dB, 9.6×10^{-4}.
Size (height, width, depth): 1.7 × 5.5 × 7.1 inches; weight, 3.3 pounds.	
Price: TM-V71A, $400; VGS-1 voice unit, $70; PG-5H PC interface cable kit, $60; DFK-3D remote mounting kit, $50.	
Note: Unless otherwise noted, all dynamic range measurements are taken at the ARRL Lab standard spacing of 20 kHz.	
*Measurement was noise limited at the value indicated.	

[2]J. Taylor, *VoIP: Internet Linking for Radio Amateurs*. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 9264. Price, $17.95 plus shipping. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop/**; **pubsales@arrl.org**.

[3]*TravelPlus* CD-ROM, 2007-2008 Edition, version 11.0. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 9930. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop/**; **pubsales@arrl.org**.

converts the data for writing to the radio. This entire process took about three minutes. *MCP-2A* has a list of data headers to choose from for channel names. For example, selecting LOCATION will put the first six characters of each location name into the TM-V71A's memory channel name field. So, Bridgeport, Connecticut, repeaters are named BRIDGE, for example.

The *TravelPlus* database includes a REPEATER NOTES field and another named CTCSS. The REPEATER NOTES field includes attributes such as open and autopatch and sometimes includes tone information. In the file conversion process, *MCP-2A* picks up the CTCSS field and loads it into the radio. If a tone is listed under REPEATER NOTES and not in the CTCSS field, the radio will not be programmed with the tone.

One thing to keep in mind is that if a CTCSS tone is specified, the radio is programmed with that CTCSS data for transmit and receive. So unless the radio receives the correct tone on a given channel, the squelch will never open. Not all repeaters that require tone access send the tone with their transmit signal.

I have memory management software for all of my radios, and none of them work with a *TravelPlus* exported file. So, this is a first for me and I have found it a very handy tool. I travel to Florida several times each year and have manually created channel files for those trips. With 1000 channels, I could load them all and eliminate the need to reprogram when I return.

EchoLink Sysop Mode

Sysop mode turns the TM-V71A into a simplex repeater that you can connect to via radio or Internet using the EchoLink software on your computer. I tested this with my friend Tom, K1CEC, who lives in Florida. It took a few tries for me to get all the settings right, but once I did, Tom and I were able to have a QSO — Tom on his computer, and me on my handheld, tuned to the frequency of my TM-V71A simplex repeater. The audio quality was superb both ways.

In another test, using my handheld radio, I connected to another EchoLink node via the TM-V71A and its connection to my computer. On the handheld, I pressed transmit and used the DTMF keypad to enter the distant node's address. The 'V71A passed the tones to the EchoLink sysop feature and its built-in DTMF decoder. In a matter of seconds EchoLink announced over the handheld "connecting to the W1XXX repeater." Then it announced "connected," and I was able to speak with people on the remote repeater. Pretty neat! Speaking via the Internet connection is just like connecting locally via RF, except for a delay. When you use this feature, you might want to remind people you are in QSO with that there will be some delay in your responses. The audio is good enough that they may not realize that you are on EchoLink.

The implications of these features are limited only by your imagination. One consideration is the availability of frequencies. For my tests, I used a quiet frequency in the narrow range reserved for experimenting on 2 meters. A more permanent, coordinated frequency may be hard to find in some locations. This radio could, however, be used as a remote link to an established repeater to provide EchoLink access. In the sysop mode, the 'V71A cannot also be in cross-band or lock-band repeater mode. It can operate as a simplex repeater on one frequency or as a half-duplex repeater on a split frequency pair.

Making it Work

The hardware connections are quite simple if you obtain the PG-5H interface cable set. One cable connects to a computer serial port; the other cable connects to the sound card. I used a Turtle Beach Audio Advantage Amigo USB sound card adapter to avoid having to rearrange connections to the sound card on the computer motherboard. I have been told that computers used for sysop mode are usually dedicated to that purpose. My computer has several serial and USB ports and is definitely not dedicated to any one thing. It's likely that you can use the sound card that came with your computer, but some considerations are mentioned in the references given earlier.

Turning on the sysop mode on the radio could not be simpler — power up while pressing the PF2 button. The band used is the programmed data band. Then tune the radio to the frequency you want to use. The only other setting is the SQUELCH control output used on the serial port so that it doesn't allow incoming EchoLink signals to key the radio when the RF channel is busy. From the radio perspective there is nothing else to do, so I can understand Kenwood's limited treatment of this topic in its manual. Just a few words — pointers into the EchoLink literature — would have helped me to get the feature working with minimal frustration.

From the EchoLink computer perspective, you have to do several things to make this feature work. First, download the software and register as a sysop. I was already registered as a user, so I had to change my call sign to W1HSR-R and have it validated to allow me to use the sysop features.

A few settings that need to be made before your node can operate. The following is what worked for me:

In the EchoLink TOOLS menu, SYSOP SETTINGS screens:

- RX CTRL: SERIAL CTS, set serial com port, invert sense.
- TX CTRL: RTS, set serial com port, key PTT on local transmit.
- IDENT: SPOKEN VOICE, While active, every 6 minutes.

In the *Windows* Control Panel, go to SOUNDS and AUDIO DEVICES and adjust the mic RECORDING control to get enough audio from the radio.

This was a basic setup to test this feature in the radio. There are many possible configurations, so your settings may be different. I strongly suggest that you study the available documentation if you plan to be a node operator.

Connecting to Remote Repeaters

There are 10 dedicated EchoLink DTMF memory channels that can store eight digits in each. These memory channels are easy to program manually or with the *MCP-2A* software. Connecting is as simple as keying up, selecting the memory channel and pushing a button. The code (node number) stored in memory scrolls across the 'V71A's display as the DTMF tones are transmitted.

There are a couple of potential problems that I discovered with this function. One is with the eight digit storage limit. If the repeater operator requires a three digit access code and the node you want to connect to has a six digit number, you won't be able to store all nine digits. Also, the radio limits EchoLink memory codes to digits 0 through 9 and letters A through F.

Other Features

This is a true dual band radio that allows the user to listen to two frequencies at the same time. VHF-VHF, UHF-UHF and VHF-UHF combinations are possible. You can switch the band (A or B) being controlled, allowing you to tune the receiver on band B while transmitting on band A for example.

There are four programmable function (PF) keys on the mic and two on the front panel that can be programmed to execute a variety of functions. One key on the mic must be programmed to ENTER a frequency in VFO mode.

There are six scan modes available. You can scan all frequencies on the current band, all the frequencies in the memory channels, all in a programmed range or all in a 1 MHz chunk. GROUP SCAN allows you set up 10 groups of 100 channels each. Groups can be linked to scan more than 100 channels at a time. CALL SCAN checks the call channel.

Not to be confused with the 1000 frequency channels, there are five programmable memory (PM) channels to store different environmental settings. This feature could be used to allow up to five users (at a club station for example), within limits, to store their own preferences in a PM channel. All five PM channels share the same 1000 frequency channels, EchoLink memory, DTMF memory and a number of other settings.

An optional voice guide and storage unit

(VGS-1) announces changes in modes, frequencies and other settings. It can also record three 30 second memos and conversation on one channel. There are several options for implementing these capabilities. With the VGS-1 installed, this radio is a winner for the blind and visually impaired. There's some 'V71A information on the Courage Handi-Hams Web site at **www.handiham.org/**, including MP3 files with audio from the radio as an operator exercises some of the functions.

Similar to my 'D700A, this radio can be turned into a repeater by powering up with the TONE button pushed. Through programming, it can be set up to either retransmit on the band opposite the receive band (crossband) or on either band A or B (locked-band). Programmable options include Repeater Hold (a 500 ms transmit tail) and Repeater ID (no ID, Morse code or voice with the VGS option installed).

Wide Coverage Receiver

I tested the wide coverage receiver with the program scan feature. I set up the scan frequency ranges by programming lower and upper limit memory channels for each of the ranges I wanted to scan. There are 10 such scan range channel pairs (L1, U1; L2, U2 and so on) and they are programmed in the same way as the other memory channels. For example, I set channel L0 to 118.0 and U0 to 135.995 to scan the AM aircraft band.

The A band and B band can scan different ranges at the same time. Or, you could be scanning band B, while being in QSO on band A. This is a radio that can walk and chew gum at the same time! Only band B can tune above the 440 MHz band, and only band A can tune the AM aircraft band.

I was able to monitor a few local police and fire frequencies. Scanning is pretty fast and it does not get too hung up on noise — it picks up and moves on. The receiver pauses scanning momentarily when it hears a signal, and there is ample time to press the VFO button to stop scanning if you hear something you want to listen to. Pressing and holding the VFO button for 1 second will resume scanning from where you stopped.

Final Thoughts

The Kenwood TM-V71A is a fine addition to their product line. It is a high quality radio with some exceptional features. The free *MCP-2A* software makes managing the programming of all the features and channels very easy. EchoLink sysop mode is a distinguishing capability that offers many possibilities. Repeater operators might find this radio an economical way to add and maintain EchoLink access remotely.

Manufacturer: Kenwood USA Corp, 3975 Johns Creek Ct, Suite 300, Suwanee, GA 30024; tel 310-639-4200, fax 310-537-8235; **www.kenwoodusa.com**.

ICOM IC-2820H Dual Band FM Transceiver

Reviewed by Steve Ford, WB8IMY
QST *Editor*

The ICOM IC-2820H has to be the most complex FM transceiver I have ever operated — and that isn't a bad thing.

No doubt you are familiar with what I like to call *negative complexity*. This concept is embodied by a radio that is packed to the gills with a mind-numbing array of features, most of which you'll never use. *Positive* complexity, on the other hand, is best described as a transceiver that offers numerous features that are genuinely useful, an embarrassment of riches, if you will. The IC-2820H is a positively complex rig.

The primary features of the IC-2820H are those that you *will* use and will *want* to use. Yes, there is a considerable learning curve that begins when you first power up the radio, but I think that is part of the enjoyment of purchasing a new transceiver. The learning is made easier by the fact that the IC-2820H manual is detailed and well written. There is only one slight gap concerning the optional GPS functionality, which I'll discuss later.

Magnetic Personality

FM transceivers with detachable front panels or *control heads* are not new. What *is* new in the IC-2820H is the way the control head secures to the radio, and to other objects, for that matter. The IC-2820H's control head features two powerful magnets about the size of large shirt buttons. These magnets hold the control head tightly to the body of the radio, but not so tightly that you can't remove it quickly. There are two rows of recessed pads on the body to receive the magnets. By attaching the magnets to the upper or lower row you have your choice of positioning the control head "high" or "low" on the front of the body.

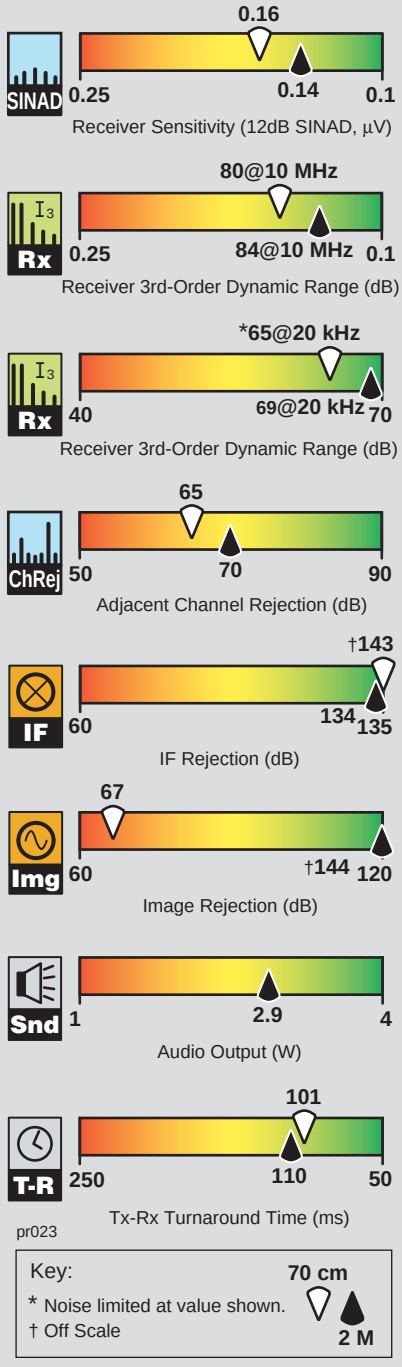
Of course, the main attraction (pardon the pun) of magnetic mounting is that you can, at least in theory, slap the control head onto any metal surface inside your car. The problem I encountered is that my car doesn't have metal surfaces. The IC-2820H comes with a metal plate that you can affix to your dashboard or other location. I was reluctant to put screws into my otherwise pristine interior, so I used an adhesive hook-and-loop fastener strip instead.

The IC-2820H control head is sizeable with a big, bright liquid crystal display (LCD). I had no difficulty reading the display in any light. Of course, brightness, color and contrast are adjustable. There are separate VOLUME and SQUELCH controls for each band positioned on opposite sides of the display. The SQUELCH control is unique in the IC-2820H. As you rotate the knob from about 7 to 10 o'clock, it functions as a normal squelch, completely cutting off the audio until a sufficiently strong signal appears on the frequency. When you rotate beyond the 10 o'clock position the squelch begins functioning as an RF attenuator (up to 10 dB).

Magnets and Microphones

One issue with magnetic mounting is that you have to strike a compromise between magnets that are powerful enough to hold the

Key Measurements Summary



Bottom Line

The IC-2820H is complex and somewhat pricey, but this dual-band radio does it all. With the optional module, D-STAR and GPS features integrate seamlessly. It's got a full set of analog FM features and a sensitive wideband receiver, too.

Table 2
ICOM IC-2820H, serial number 0501881

Manufacturer's Specifications	Measured in the ARRL Lab
Frequency coverage: Receive, 118-550, 810-1000 MHz (cell blocked); transmit, 144-148, 430-450 MHz.	Receive and transmit, as specified.
Power requirement: Receive, 1.8 A (max audio); transmit, 13 A (high power).	Receive, 0.85 A; transmit, 11 A. Tested at 13.8 V.
Modes of operation: FM, AM (receive only).	As specified.
Receiver	**Receiver Dynamic Testing**
AM sensitivity, 10 dB S/N: 118-160 MHz, 1.0 µV; 220-225, 350-360, 375-400 MHz, 1.8 µV; 225-350, 360-375 MHz, 18 µV.	For 10 dB S+N/N: 120 MHz, 0.58 µV.
FM sensitivity, 12 dB SINAD: left band, 118-160, 400-500 MHz, 0.32 µV; 160-180, 220-225, 350-360, 375-400, 500-550 MHz, 0.56 µV; 180-220, 225-350, 360-375 MHz, 0.32 µV; right band, 118-160, 400-500 MHz, 0.32 µV; 160-174 MHz, 375-400, 500-550 MHz, 0.56 µV; 810-880 MHz, 1.4 µV; 880-1000 MHz, 3.2 µV.	For 12 dB SINAD, 144 MHz, 0.14 µV; 440 MHz, 0.16 µV.
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz offset: 146 MHz, 69 dB; 440 MHz, 65 dB.* 10 MHz offset: 146 MHz, 84 dB; 440 MHz, 80 dB.
FM two-tone, second-order IMD dynamic range: Not specified.	74 dB.
FM adjacent channel rejection: Not specified.	20 kHz channel spacing: 146 MHz, 70 dB; 440 MHz, 65 dB.
Spurious and image rejection: 60 dB.	First IF rejection, 146 MHz, 134 dB; 440 MHz, >143 dB. Image rejection, 146 MHz, >144 dB; 440 MHz, 67 dB.
S-meter sensitivity: Not specified.	Max indication: 146 MHz, 7.6 µV; 440 MHz, 9.9 µV.
Squelch sensitivity: 0.13 µV.	At threshold: 0.1 µV.
Receiver audio output: 2.4 W at 10% THD into 8 Ω.	2.9 W at 8.5% THD into 8 Ω. (Closest VOL step to 10% THD.)
Transmitter	**Transmitter Dynamic Testing**
Power output (H/M/L): 50/15/5 W.	146 MHz, 49 / 13 / 4.8 W; 440 MHz, 46 / 13 / 4.0 W.
Spurious-signal and harmonic suppression: 60 dB.	VHF, 62 dB; UHF, 70 dB. Meets FCC requirements.
Transmit-receive turnaround time (PTT release to 50% audio output): Not specified.	S9 signal, 146 MHz, 110 ms; 440 MHz, 101 ms.
Receive-transmit turnaround time (tx delay): Not specified.	146 MHz, 43 ms; 440 MHz, 49 ms.
Bit-error rate (BER), 9600-baud: Not specified.	146 MHz: Receiver BER at 12-dB SINAD, 2.7×10^{-4}; at 16 dB SINAD, $<1.0\times10^{-5}$; at –50 dBm, $<1.0\times10^{-5}$. transmitter BER at 12-dB SINAD, 4.7×10^{-4}; at 12-dB SINAD +30 dB, $<1.0\times10^{-5}$. 440 MHz: Receiver BER at 12-dB SINAD, 6.9×10^{-4}; at 16 dB SINAD, $<1.0\times10^{-5}$; BER at –50 dBm, $<1.0\times10^{-5}$; transmitter BER at 12-dB SINAD, 6.2×10^{-4}; at 12-dB SINAD +30 dB, $<1.0\times10^{-5}$.

Size (height, width, depth): main unit, 1.6 × 5.9 × 7.4 inches; weight, 3.3 pounds; remote head, 2.3 × 5.9 × 1.3 inches; weight, 7.4 ounces.

Price: IC-2820H transceiver: $650; UT-123 GPS/D-STAR module: $300; OPC-1529R serial data cable: $25; CS-2820 cloning software: $35; OPC-440 mic extension cable: $85.

Note: Unless otherwise noted, all dynamic range measurements are taken at the ARRL Lab standard spacing of 20 kHz.

*Measurement was noise limited at the value indicated.

control head firmly, but not so powerful that you need a crowbar to remove it. In the case of the IC-2820H, this compromise means that you must avoid attaching anything to the control head that is likely to tug it off the mount — namely the microphone cable. With the IC-2820H you can mount the control head anywhere (the radio comes with a 10 foot separation cable), but the microphone must plug into the body of the radio — *period*. This can be a hassle when you want to install the body out of sight and out of reach. ICOM's solution is to offer a long (16 foot) microphone extension cable as optional equipment. At $85 the OPC-440 extension is a pricey solution, though. If you're willing to do a bit of shopping, there is a frugal alternative. You could purchase a $5 inline CAT5 cable coupler, a 15 foot long CAT5 network cable for another $5 and assemble your own microphone extension in about 30 seconds. I did exactly that with parts from my junkbox. It worked perfectly.

The supplied microphone puts the most important functions of the radio in the palm of your hand. The buttons are also illuminated for easy viewing at night. The microphone audio level can be set to either HIGH or LOW. I've been told that I have a loud voice, yet I found that I needed to use the HIGH setting. Also, I noticed a lack of low frequency response in my transmit audio. According to on-air reports, the audio was crisp and clear, but rather flat — all midrange and little else.

Speaking of remote installations, it's worth noting that you can plug in one or two external speakers — one for each band — if you wish. The internal speaker is plenty powerful, however, with excellent audio. Despite stuffing the IC-2820H body under the driver's seat, I still had more than enough audio to hear the radio clearly.

Split Personality

The IC-2820H offers two separate receivers, which makes for some interesting possibilities. Either band can be selected as the "Main Band" by simply pressing either the left or right tuning controls, but it is more appropriate to speak of the bands as "left" or "right," which is how the manual approaches the subject.

The left band offers receive coverage from 118 to 550 MHz in AM, Narrow AM, FM, Narrow FM or DV (D-STAR digital voice, assuming you've installed the optional UT-123 module). The right band takes the coverage all the way to 999.99 MHz, with the usual cellular-telephone gaps.

There are two SO-239 antenna ports on the IC-2820H's rear panel. ANT1 is for transmission and reception, but ANT2 is receive only. If you have two separate antennas, you can connect them both to the IC-2820H and take advantage of its *diversity reception* feature. I had some experience with diversity reception during my review of the ICOM IC-R2500 receiver (January 2007 *QST*) and it functions the same way in the IC-2820H. When you're listening in diversity mode, the radio compares the strengths of the signal at both antennas and "chooses" the strongest signal. This is a useful feature when you're monitoring a mobile station directly (not through a repeater). As the mobile's signal fluctuates, you will always hear the best result possible as the radio switches between one antenna and the other. Diversity reception only works in the FM or DV modes, and works best when signals are reasonably strong.

For most of this review, I operated the IC-2820H with a single dual-band antenna connected to the ANT1 jack. Thanks to the radio's twin receiver design, I could listen to separate bands simultaneously, or monitor two signals within the same band at the same time. My favorite mobile pastime was scanning through a set of memory channels (the IC-2820H offers 522 of them) on the left band while monitoring local fire and rescue continuously on the right band. Yes, that can be confusing at times, but the IC-2820H gives you the ability to automatically mute the sub band when a signal appears on the main band (remember that either the right or left bands can be "main" or "sub" — it's up to you).

The IC-2820H provides a band scope that creates a visual representation of all signals within a range you specify. The individual signals appear as spikes in the band scope display. You can turn the dial and sweep a tiny cursor among the spikes, selecting and monitoring various signals.

Of course, you also have all the other features and functionality you've come to expect of transceivers in this price class: continuous tone coded squelch system (CTCSS) tone decode and tone squelch, dual tone multifrequency (DTMF) encoder and decoder, flexible scanning options (including CTCSS tone scanning), automatic power off, weather channel monitoring and more.

With DTMF remote control enabled, you can use another transceiver to change the IC-2820's frequency through DTMF commands. Remote access is protected by a three digit password that you create.

When it comes to transmit power, you have three choices in the IC-2820H: 5, 15 and 50 W (both bands). You can transmit from either the right or left band, as long as you've designated it as the "main" band.

Software Programming

A complicated transceiver tends to have a complicated menu system and the IC-2820H is no exception. ICOM did its best to simplify menu navigation from within the main display, but it is still a bit of a strain.

My preference was to purchase ICOM's CS-2820 "cloning software" and their OPC-1529R data cable. Although ICOM calls it cloning software, you can use this convenient *Windows* application to set up all the memory channels and many of the most commonly used features from your PC. This is a well-written piece of software and it takes much of the pain out of programming the IC-2820H. Within minutes I was able to enter all my favorite frequencies, tone options, splits, and so forth — and write everything to the transceiver's memory — all from the comfort of my laptop.

GPS and D-STAR

For this review we installed the optional UT-123 module to add D-STAR and GPS (Global Positioning System) functionality to the IC-2820H. The UT-123 comes with a tiny GPS antenna with a magnetic base attached to a 16 foot cable. The cable plugs into the front of the IC-2820H body.

With the DV mode enabled and GPS function selected, data appears on the radio's display showing your position and direction of travel. A large compass arrow makes this pretty obvious. If you receive a transmission from another GPS equipped D-STAR radio, you can display its location data along with the distance between your stations. There is even an alarm function that sounds when you are within a preset distance of a given location.

Note that I said the IC-2820H will display the location data, *not* locations on a map as you may be accustomed to seeing with APRS. The LCD is big, but it isn't that big. It is possible to connect the IC-2820H to a computer and display the received GPS data, but the output is not in APRS format. Instead, it is in a similar, but incompatible format that ICOM calls *GPS-A*. There is a free application for *Windows* called *D-PRS* that will convert the GPS-A data to APRS format for display within *UI-View* or other APRS software. You'll find it on the Web at **www.aprs-is.net/**.

But even though you may be able to convert the GPS-A data and view the results in APRS software, *transmitting* APRS is a different matter. To put it bluntly, you can't transmit APRS with the IC-2820H in the DV mode. D-STAR and APRS are both digital modes, but the similarities end there. To transmit APRS you need to operate in the analog FM mode and use an external packet radio TNC. The IC-2820H TNC port supports 1200 and 9600 baud packet signals.

The good news — and this is the part that isn't well documented in the manual — is that the IC-2820H's DV data port spits out standard NMEA GPS "sentences" that can be parsed by any GPS-compatible TNC and used to create APRS packets. The data stream is there even when you are operating analog FM, as long as you have GPS DATA enabled. I tried it with a packet radio TNC and it works. In fact, I was also able to feed the GPS data directly to a mapping program and it displayed my position infor-

D-STAR Operation with the IC-2820H

Plug in the optional UT-123 module and the world of D-STAR digital voice opens to you — if you have a D-STAR repeater in your area. The IC-2820H is the latest in a series of D-STAR radios from ICOM (so far, the only manufacturer selling D-STAR capable radios in the US).

Digital voice operation on the '2820H is "routine," in that it works the same as ICOM's other D-STAR radios. Dial up a frequency with a digital repeater, enter DV mode from a menu selection, and you're in business. At this point, though, it's hard to call digital voice operation of any kind routine.

The '2820H has the same D-STAR "sound" as the other radios — a slightly mechanical or robotic sound and a somewhat more restricted audio passband than the best sounding analog FM radios. It also has digital's signature lack of noise and mobile flutter, all the way down to the minimum signal threshold. At that point, there can be some garble, but most of the time a signal is either clear, or it's gone. You see the usual information on the display, including the call sign and message of each transmitting station.

One '2820H advantage is in its large display that lets you see multiple options and settings (see Figure 1). There are plenty of options and settings in analog operation, but they multiply with digital operation. An example: You can see all the fields used to route a call through a Gateway to a distant repeater.

Another advantage: The IC-2820H is the first D-STAR mobile capable of monitoring two frequencies at once (ICOM's other dual band D-STAR mobile, the ID-800, is strictly one band at a time). The IC-91AD handheld is also capable of two frequency operation, but only the "B" band supports the digital mode. The '2820 lets you use digital on either side of the radio, with one limitation — you can only monitor one digital channel at a time. If you put a digital frequency on both sides, the sub band will be muted, because the UT-123 module contains only one digital coder/decoder (codec). As with other D-STAR radios, you can mix and match analog and digital channels in memories and scan through them all.

The memory bank system, useful in analog, is especially useful for D-STAR. Many D-STAR operations require programming call signs to route signals from one repeater to another through the network. Call sign routing can be stored in memory, and D-STAR "power users" have learned to use memories, and alphanumeric displays, to store frequently used routes for easy recall. The memory banks let you group channels together and scan them any way you want. You don't want to be programming call signs and routing while driving a car.

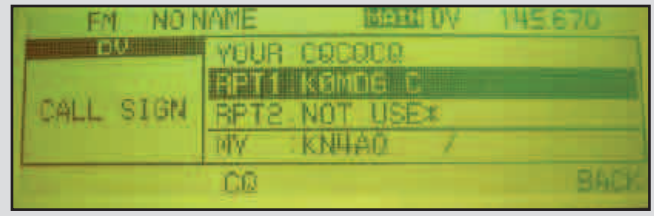


Figure 1 — One of the IC-2820H D-STAR menus. This radio is configured to talk to anyone (CQCQCQ) through the KØMDG 2 meter digital repeater, making a local contact. The frequency (145.67) is being adopted in some areas as the D-STAR simplex channel. (If you use 146.52 for digital simplex, analog users would hear your signal as white noise that they can't "squelch out.")

The UT-123 module includes a built-in GPS. The GPS data can be included in each DV transmission, and with the '2820H you can set an alarm that beeps if another DV/GPS user's transmission is close to your location. The display can show how far, and in what direction, other GPS equipped D-STAR stations are, locally or anywhere in the world.

I only encountered one minor issue operating D-STAR with the IC-2820H. On a few occasions I was transmitting on UHF DV but not being repeated. Several other users mentioned this as well. ICOM has determined that if you put UHF DV on the left side, the '2820H would not always transmit the header information. (UHF on the right side worked perfectly, so you could just remember to always use UHF DV there.) They have fixed this issue (with a resistor change) in current production radios. If you have an older IC-2820H and experience the difficulty, contact ICOM America service.

The digital option makes a fairly expensive radio even more expensive, but you'll enjoy the deluxe digital operation. — *Gary Pearce, KN4AQ*

mation without difficulty.

But what about D-STAR? This digital protocol, developed by the Japan Amateur Radio League (JARL), allows you to operate digital voice, either directly or through D-STAR repeaters, or exchange low-speed data files at about 1200 bits per second. You can even exchange voice and low-speed data simultaneously. There are not yet any D-STAR repeaters in range of my station, but *QST* contributor Gary Pearce, KN4AQ, is another IC-2820H user who is active on D-STAR.[4] See the accompanying sidebar.

All This and Satellites Too

During this review I took the IC-2820H along when my family made its annual summer pilgrimage to the Rhode Island shore. With a ground plane antenna on the balcony, I was in radio heaven. I was working FM stations on 2 meters and 70 cm all up and down the shoreline. Eavesdropping on marine radio and aviation traffic was fun, too.

With the IC-2820H's flexible dual-band capability there is another dimension of Amateur Radio enjoyment available — and it is not mentioned in the manual. We have two satellites in low Earth orbit that usually function as FM repeaters: OSCARs 27 and 51. These birds listen on 2 meters and repeat on 70 cm. The frequencies and additional information are available from AMSAT-NA at **www.amsat.org**. With nothing more than 50 W to my balcony ground plane, I used the IC-2820H to make several contacts through the satellites and received outstanding reports from hundreds of miles away. I transmitted on the left band and received on the right band. It was surprisingly easy.

In conclusion, the ICOM IC-2820H is one of the best dual-band FM rigs to come my way in quite some time. At a selling price of well over $600, the radio is financially intimidating. Equipping it for GPS and D-STAR will push the price near $1000. Even so, what you have in the end is a highly versatile transceiver that can do everything short of SSB. It is an investment you are not likely to regret.

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

[4]G. Pearce, "Operating D-STAR," *QST*, Sep 2007, pp 30-33.

Greenheck Resigns as ARRL Dakota Division Vice Director; Greg Widin, KØGW Appointed

Dakota Division Vice Director Twila Greenheck, NØJPH, resigned effective October 1 due to family responsibilities; her term expires in 2008. She plans to continue serving the League as an ARRL Education Advisor and consultant to the Board of Director's ad hoc Scouting Committee.

Twila Greenheck, NØJPH

ARRL Dakota Division Director Jay Bellows, KØQB, said, "Twila has been a joy to work with over the past eight years. From the first time I met her to the present she has been a tireless and effective advocate of increased ARRL efforts to reach out to youth and strengthen education in Amateur Radio. I look forward to her continued service to the League, especially as a member of the ARRL's Educational Advisory Group."

"Being part of the ARRL Board Family has been an incredible experience that I will always remember and cherish. The opportunity to serve with Director Jay Bellows representing the amateurs in the Dakota Division has surely been an honor," Greenheck said.

Greg Widin, KØGW

ARRL President Joel Harrison, W5ZN, appointed Greg Widin, KØGW, of Stillwater, Minnesota, as Dakota Division Vice Director. Widin has been a licensed ham and ARRL member for more than 40 years. Originally licensed as WB2ZSH, he became KØGW in Minnesota in the late 1970s after obtaining his Amateur Extra class license. Currently Vice President and Training Director for the Stillwater Amateur Radio Association, Widin has also served as Assistant Section Manager and Technical Specialist in the Minnesota section; he is an ARRL Life Member.

A 3M Company employee since 1982, Widin earned his AB in 1974 from Kenyon College in Ohio and his PhD in hearing science from the University of Minnesota in 1979. He completed a post-doctoral fellowship at MIT's Research Laboratory of Electronics in 1982, followed by an MS in management of technology in 1992 from the University of Minnesota. Widin is a member of the Institute of Electrical and Electronics Engineers and Phi Beta Kappa. He is also the holder of five US patents.

Greg Widin, KØGW

Widin belongs to the Twin Cities DX Association and Minnesota Wireless Association. He holds Worked All States (WAS) on HF, DXCC (294 entities confirmed) and is just shy of WAS on 6 meters. His main current operating interests are DX and casual contesting along with ARES and emergency communications; he also enjoys constructing electronic equipment. Widin also is a member and serves as treasurer of Boy Scout Troop 224 in West Lakeland and Woodbury, Minnesota.

BALLOTS MAILED FOR UPCOMING DIRECTOR AND VICE DIRECTOR ELECTIONS

Ballots for Director and Vice Director were scheduled to be mailed to all full ARRL members (as of September 10, 2007) on or before October 1 in the following divisions: Pacific, Rocky Mountain, Southeastern, Southwestern and West Gulf.

To be valid, ballots must be received at ARRL Headquarters no later than noon (Eastern Standard Time) on Friday, November 16, 2007. If you are a full ARRL member living in one of the five Divisions holding elections and you have not received your ballot by the end of October, please contact the ARRL Secretary for a replacement.

AL WARD, W5LUA, MAKES 1296 MHz WAS #1

Al Ward, W5LUA, of Allen, Texas, is the first person ever to achieve the ARRL's Worked All States (WAS) on 1296 MHz, making him 1296 MHz WAS #1. Ward first started on his pursuit January 25, 1977, with his first 1296 MHz contact with Leroy May, W5HN (SK). His 30 year quest ended September 4, with confirmed contacts with Wyoming, Utah and Idaho, giving Ward his last three needed states, thanks to Paul Perryman's, WA5WCP, EME DXpedition. "I couldn't have done this without Paul," Ward said. "Also, thanks to Ron Roche, KØALL, and Barry Malowanchuk, VE4MA, in North Dakota for number 47 in August. Without them, it just wouldn't have been possible." After collecting his 50th QSL card, Ward drove from his home in Texas to Little Rock, Arkansas so ARRL President Joel Harrison, W5ZN, could verify his cards and complete his WAS paperwork. "Verifying QSL cards from 30 years of activity brought back a lot of memories of several stations active on 1296, many who are Silent Keys now," Harrison said.

ARRL DELTA DIVISION DIRECTOR RECEIVES LIFETIME ACHIEVEMENT AWARD FROM ALMA MATER

ARRL Delta Division Director Henry Leggette, WD4Q, received the Lifetime Achievement Award from the Mississippi Valley State University National Alumni Association in June. Leggette, a native of Kemper Springs, Mississippi, graduated from then-Mississippi Valley State College in 1967 with a BA in automobile mechanics. Leggette completed all the undergraduate courses for a BSEE degree at Memphis State University (now University of Memphis), and in 1987,

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

he earned an MSEE from that institution.

Leggette had a distinguished US Civil Service career. He has served as an electronics technician for the Federal Aviation Administration at the Memphis Air Traffic Control Tower and Memphis Air Route Traffic Center. He has received extensive training at the FAA Academy in Oklahoma City and at Rockwell Collins in Cedar Rapids, Iowa. He has held management positions, including managing flight data processing and supervising electronics technicians in charge of the Telecommunications and Communication Unit at the Memphis ARTCC.

First elected Vice Director of the ARRL Delta Division in 1989, he has served on Volunteer Resources, Membership Services, National Emergency Response Planning and Public Relations committees. In 2005, he chaired the ARRL Holiday Toy Drive. This nationwide project sent more than 5000 toys and $10,000 to children in areas affected by hurricanes Rita and Katrina.

A Life Member of the ARRL, Leggette became Director in January 2006, succeeding Rick Roderick, K5UR, on his ascension to ARRL Vice President. He serves on the Administration and Finance, and Ethics and Elections committees. An ARRL Volunteer Examiner and Certified Instructor, Leggette also holds many ARRL awards, including Worked All States (WAS), 5 Band Worked All States (5BWAS), DXCC, Worked All Continents (WAC), as well as *CQ* magazine's Worked All Zones (WAZ).

NEW SWEEPSTAKES MANAGER ANNOUNCED

Starting with this year's running of the ARRL November Sweepstakes, the ARRL is proud to introduce Ken Adams, K5KA, as the Sweepstakes Contest Manager. ARRL Membership and Volunteer Programs Manager Dave Patton, NN1N, said, "We look forward to tapping Ken's wealth of ideas and sincere respect for what is considered by most to be the best and most popular domestic radio contest."

First licensed as WDØARY in 1977, Adams took an interest in contesting early on and entered his first ARRL Sweepstakes CW in 1978. Over the years he has participated in multi-operator efforts from KØRF, K5GO, 6D2X, KL7RA, VE3EJ and HC8N several times. Adams has managed the Sweepstakes record-keeping effort for ARRL for the last several years.

He served in the US Air Force from 1965-1968 and subsequently earned a BS in mathematics and computer science in 1971.

In 1980, a career move took Adams to Oklahoma where he was active as KM5H for many years. He held various management positions with a major oil company and retired in 2002. An ARRL Life Member,

In Brief

● **Arkansas Congressman WD5DVR Speaks at ARRL State Convention**: Arkansas congressman Mike Ross, WD5DVR, was a featured speaker at the ARRL Arkansas State Convention in Mena on September 8. Ross, who represents Arkansas' 4th District, spoke about the ham radio legislation he introduced in

Congressman Mike Ross, WD5DVR (second from right), with Arkansas State Convention chairman Randy Baggett, KG5NE (left); former Arkansas Section Manager Bob Ideker, WB5VUH (second from left), and current Arkansas Section Manager David Norris, K5UZ.

Congress, the "Emergency Amateur Radio Interference Protection Act of 2007" (HR 462). ARRL Lab Manager Ed Hare, W1RFI, was also at the convention, speaking about BPL. Held at Queen Wilhelmina State Park in Mena, the convention drew hams from several nearby states including Texas, Oklahoma, Louisiana and Mississippi. Ross is one of two licensed amateurs in congress; Greg Walden, W7EQI, of Oregon's 2nd District, is the other.

● **ARRL Helps MFJ Celebrate 35 Year Anniversary**: MFJ Enterprises observed their 35th anniversary with "A Day in the Park" open house September 7-8 at their Starkville, Mississippi headquarters. ARRL Chief Development Officer Mary Hobart, K1MMH, was on hand to help MFJ celebrate, as was Mississippi Section Manager Malcolm Keown, W5XX; ARRL Delta Division Director Henry Leggette, WD4Q, and Starkville Mayor R. Dan Camp. This two-day celebration was filled with tours of MFJ's facilities, a Friday evening bar-b-que and a Saturday fried chicken picnic. MFJ makes Amateur Radio equipment such as tuners, SWR wattmeters, antenna analyzers and power supplies. Martin Jue, K5FLU, founded the company in 1972 while he was still attending graduate school at Mississippi State University. A ham since high school, Jue decided to build products for hams — his first products were active filters for CW and phone, selling for $9.95 and $12.95, respectively. Thirty-five years later, MFJ features more than 1000 products.

● **ARRL HQ Bids Farewell to Contest Manager**: ARRL Contest Manager Tom Hogerty, KC1J, has left ARRL HQ for the greener pastures of Maine. Hogerty worked for the League for almost 20 years, most recently in the Membership and Volunteer Programs Department as Contest Branch Manager. After joining the League staff in 1988 as Regulatory Information Department manager, Hogerty subsequently served as DXCC manager, Regulatory Information Supervisor and Web assistant among other positions. MVP Manager Dave Patton, NN1N, said, "Tom will be missed by his co-workers and friends. We wish him well in his new endeavors." A new Contest Manager is expected to be named soon.

FCC News

FCC LOWERS VANITY CALL SIGN FEES

The FCC reduced the regulatory fee to obtain or renew an Amateur Radio vanity call sign by more than 40 percent on September 17. In a *Report & Order* (*R&O*) released August 6, "Assessment and Collection of Regulatory Fees for Fiscal Year 2007," in MD Docket 07-81, the Commission will cut the fee from its current $20.80 to $11.70. This marks the lowest fee in the history of the current vanity call sign program. The FCC is authorized by the Communications Act of 1934 (as amended) to collect vanity call sign fees to recover the costs associated with that program. The vanity call sign fee has fluctuated over the 11 years of the current program — from a low of $12 to a high of $50. The FCC says it anticipates some 14,700 Amateur Radio vanity call sign "payment units" or applications during the next fiscal year, collecting $171,990 in fees from the program.

The vanity call sign regulatory fee is payable not only when applying for a new vanity call sign, but also upon renewing a vanity call sign for a new term. The first vanity call sign licenses issued under the current Amateur Radio vanity call sign program that began in 1996 came up for renewal last year. Call signs issued prior to 1996 are not considered vanity call signs, even if the holder was able to request a specific call sign.

Amateur Radio licensees may file for renewal only within 90 days of their license expiration date. All radio amateurs must have an FCC Registration Number (FRN) before filing any application with the Commission. Applicants can obtain an FRN by going to the ULS and clicking on the "New Users Register" link. You must supply your Social Security Number to obtain an FRN.

The ARRL VEC will process license renewals for vanity call sign holders for a modest fee. The service is available to ARRL members and nonmembers, although League members pay less. Routine, non-vanity renewals continue to be free for ARRL members. Trustees of club stations with vanity call signs may renew either via the ULS or through a Club Station Call Sign Administrator, such as ARRL VEC.

League members should visit the "ARRL Member Instructions for License Renewals or Changes" page, while the "Instructions for License Renewals or Changes" page covers general renewal procedures for nonmembers. There is additional information on the ARRL VEC's "FCC License Renewals and ARRL License Expiration Notices" page at **www.arrl.org/arrlvec/renewals.html**.

FCC Enforcement Actions

♦ Smith Trucking, Inc, of Smithfield, Pennsylvania, was cited by the FCC for "operating radio equipment without a license on the frequency 28. 535 MHz and causing interference to licensed stations in the Ten Meter Amateur Band. The drivers were observed operating unlicensed in April and May 2007 on Route 19 between the Fairmont, West Virginia area and the Haywood power plant near Shinnston, West Virginia." The FCC admonished Smith Trucking to "[p]lease advise your drivers that operation of radio transmitting equipment without a license is a violation of Section 301 of the Communications Act of 1934...and subject them to a fine or imprisonment, as well as in seizure of any non-certified radio transmitting equipment."

♦ The FCC issued an Order of Dismissal and Termination against Jack R. Sharples of Florida concerning the matter of his application for a new Amateur Radio license. In May, in a Hearing Designation Order, the FCC called Sharples "a convicted felon and registered sexual predator," and said "Sharples' felony conviction for at least one sexual-related offense involving children raises material and substantial questions as to whether he possesses the requisite character qualifications to be a Commission licensee. Although Sharples' felony adjudications occurred more than seven years ago, the nature of the criminal misconduct, and the fact that the Amateur Radio Service is particularly attractive to children, call into serious question whether he should be permitted to obtain an Amateur Radio authorization." Sharples had 20 days since the release of the HDO to file a written appearance, "on or before June 13, 2007"; on June 19, "he submitted to the Presiding Judge a document in which he set forth reasons for filing an [Amateur Radio license] Application, notwithstanding his felony convictions [and] the document was received as a good faith Notice of Appearance. Sharples, in a telephone call with the FCC requested more time to consider whether he would continue to prosecute his Application. The request was granted without objection." On June 27, Sharples sent a fax to the Presiding Judge withdrawing his application for an Amateur Radio license. The FCC's request to dismiss the application with prejudice and terminate the proceding was granted, as was Sharples' application for an Amateur Radio license, also with prejudice, on August 1.

♦ On March 8, 2007, David O. Castle, WA9KJI, of Evansville, Indiana, was first notified by the FCC to "refrain from using the repeater system operating on

he enjoys domestic and DX contesting.

Adams will work closely with the ARRL Contest Branch Manager and with several other volunteers who assist ARRL with its large contest program. "Ken will lead the creative charge to inject new life into this great old contest while helping to ensure the highest levels of adjudication, fairness and fun for all," said Patton.

Ken resides with his wife Vicki in Bartlesville, Oklahoma, where he is active with volunteer work and his other passion, golf. They have one adult daughter.

TOM ATKINS, VE3CDM (SK)

Former ARRL Canadian Division Director and IARU Region 2 President Thomas B. J. Atkins, VE3CDM, passed away at home in Toronto, Ontario, September 18. He was 81. Atkins was the last Director of the ARRL's Canadian Division before the Canadian Radio Relay League (CRRL), a predecessor to the Radio Amateurs of Canada (RAC), began to operate independently in 1988. He served as ARRL Director from September 20, 1982 to January 1, 1988.

Atkins also served as President of IARU Region 2 for two three-year terms, 1995-2001, after holding every other office in Region 2 — Treasurer, Secretary and Vice President — in succession between 1983 and 1995. He also served on the IARU Administrative Council and as an IARU Expert Consultant.

Tom Atkins, VE3CDM (SK)

According to his children, Atkins' proudest accomplishments occurred in the world of Amateur Radio, not only serving on the

146.79/146.19 and 147.15/147.75 MHz," stemming from a complaint by the trustee of the Tri-State Amateur Radio Society, W9OG. In May 2007, the FCC notified Castle that it was designating his license renewal application for hearing in the wake of alleged misconduct extending back several years and continuing at least until earlier this year. In its Hearing Designation Order from May, the Commission said, "Since 1998, Castle has been warned repeatedly to refrain from intentionally interfering with radio communications; broadcasting without communicating with any particular station; causing interference on amateur repeaters; using amateur repeaters without authorization, and using indecent, slanderous or harassing language. We find that Castle's continuing course of conduct raises questions as to whether he possesses the requisite character qualifications to remain a Commission licensee." Castle was given 20 days to respond to the HDO, but according to the Memorandum Opinion and Order released August 20, 2007, "to date [August 1, 2007], no written appearance has been filed by, or on behalf of, Mr Castle. In addition, a prehearing conference was held on August 13, 2007, in the Commission's Washington, DC offices. No one attended or entered an appearance on behalf of Mr. Castle."

The Commission, however, did receive a number of communications by or on behalf of Castle, one requesting that the contents of the HDO be sent to him "in an audible form (cassette or cd)" because he has "limited eye sight." The MO&O said Castle told the FCC that "[t]ravel will not be possible due to health and finances. Representation by an attorney is not in my budget." The FCC complied with Castle's request and sent him a disc containing audio files of all the documents released in his proceeding to date. Castle's daughter, Donna J. Dill, sent the Presiding Judge a fax on June 18 stating, among other things, that her father "is not able to travel or hire an attorney...He tells me that he has sent his statement and this is all he is able to do as his eye sight is limited and health poor."

It was concluded through Castle's and Dills' submissions to the FCC that Castle did not intend to appear as directed, and "even assuming that these documents can somehow be construed as 'pleadings,' as defined in Section 1.204 of the Commission's Rules, they are procedurally deficient and may not, therefore, be considered." As such, it was ordered that Castle's application to renew his Amateur Radio license be dismissed with prejudice.

♦ Todd C. Browne, KDØPA; Keith W. Coad, KW2C; Santos J. Rodriguez Colon, KP4DC; Jerry L. Counsellor, WE5JC; Pablo Diaz-Alequin, KP4MC, and Donald B. Flowers, NC4DF, received notification from the Commission concerning their vanity call signs. These amateurs allegedly received their vanity call signs by stating they were former holders of these call signs, but the FCC can find no documentation substantiating their claims. Robert C. Moldenhauer, W9CO, received a letter concerning his vanity call sign that he requested as a "close relative" of the former holder of that call sign, but the FCC can find no documentation of Moldenhauer's claim.

♦ Steve L. Wingate, K6TXH, received notice from the Commission that the recordings he had requested concerning complaints alleging his lack of station control and deliberate interference had been sent to him. Wingate was also granted an additional 30 days to respond to Commission correspondence.

international front, but in Canada in various Ontario ham radio organizations. He led the communications team on the Canadian side of the joint Canada-USSR trans-polar ski trek in 1988, leading to a number of lasting international friendships. In recognition of his many years of service to all these various organizations and initiatives, Atkins was elected Canadian Amateur of the Year in 1991 by his fellow hams, and was named to the Radio Amateurs of Canada Hall of Fame in 2003.

IARU Vice President Tim Ellam, VE6SH, said, "Tom was a mentor to many amateurs, especially those who worked with the CRRL in the late 1980s. He encouraged me to become involved with the Canadian Radio Relay League and the IARU, and was very helpful to me personally when I became General Counsel of the CRRL. Tom will be sorely missed."

A memorial service to celebrate Atkins' life was held September 22 in North York, Ontario. In lieu of flowers, the family requests that donations in Atkins' memory be made to the Canadian Diabetes Association, the Alzheimer Society of Canada or St Matthew The Apostle Oriole Parish.

Section Manager Nomination Notice

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

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

We suggest the following format:

(Place and Date)

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

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

(Signature___ Call Sign__ City__ ZIP__)

Any candidate for the office of Section Manager must be a resident of the Section, an Amateur Radio licensee of Technician class or higher and a full member of the League for a continuous term of at least two years immediately preceding receipt of a nominating petition. Petitions must be received at Headquarters by 4 PM Eastern Time on December 7, 2007. If more than one member is nominated in a single Section, ballots will be mailed from Headquarters on or before January 2, 2008, to full members of record as of December 7, 2007, which is the closing date for nominations. Returns will be counted February 19, 2008. Section Managers elected as a result of the above procedure will take office April 1, 2008.

If only one petition is received from a Section, that nominee shall be declared elected without opposition for a two-year term beginning April 1, 2008. If *no* petitions are received from a Section by the specified closing date, such Section will be resolicited in the April 2008 *QST*. A Section Manager elected through resolicitation will serve a term of 18 months. Vacancies in any Section Manager's office between elections are filled by the Membership and Volunteer Programs Manager. — *David Patton, NN1N, Membership and Volunteer Programs Manager* QST

Another Side of Public Service

Reg Leister, N3KAS
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Despite unseasonably mild temperatures in the winter of 2006 and 2007, our club's fox-hunting activities were already wrapped up until the spring of 2007.[1] For some guys already undergoing withdrawal symptoms, it was a welcomed call when just a few days before Christmas, 2006, Lou Marcelli, K3EMG, sent out an e-mail on the Pottstown Area Amateur Radio Club (PAARC) e-mail reflector about a very strong (30 dB+) signal on 151.090 MHz transmitting digital tones. He wanted to enlist the Transmitter Hunting Team to track down the source of the interference which was not listed in the FCC Data registry for anywhere in Pennsylvania. His other concern was that a neighboring community's public service radios were licensed on 151.100 MHz, and they had all gone silent for obvious reasons. He stated that the pulsing noise had been evident for a few weeks, and he was copying the noise from quite a distance from home on his way to and from work.

Immediately Jim Toth, K3CHJ, and Bob Rex, K3DBD, took various readings from several locations around Pottstown. In the meantime, the author noticed from daily travels that a sewer excavation along a local road near Lou's home had a pair of mobile traffic lights controlling a single lane of traffic and three driveways to an apartment complex and a cemetery. They were on automatic operation and were radio-controlled as evidenced by a base-loaded vertical antenna atop their booms. I immediately suspected them as the culprits and given the fact that it was now Christmas Eve, was distracted with the impending holiday deadline to finish two rocking chairs and a computer desk for my grandchildren.

These mysterious signals were significantly strong to be copied as far away as 8 miles over rather challenging terrain. Through triangulation, everyone confirmed that the traffic controllers appeared to be the offending devices. Bob, K3DBD, having done extensive digital design work, recorded his findings from home on his scope: "It appears to be some sort of telemetry. It pulses on for 120 milliseconds every 275 milliseconds. It is Manchester encoded with a preamble at 840 Hz. I would recognize that anywhere. There is a lot of data between the preamble and postamble, so whatever it is sending is quite complex."

Finally, on Friday morning December 29, Jim, K3CHJ, and I both converged on the site around 7:45 AM. He was armed with his tracking equipment taking some final measurements and I with my camera. Jim tried to figure out just how the units were "talking" to each other. It appeared that one was in a "master control mode." It did most of the transmitting and sent data to the other unit about 225 feet away. There were also other sensors mounted on top of the booms to detect any movement of vehicles in any of three driveways that entered the controlled lane of traffic.

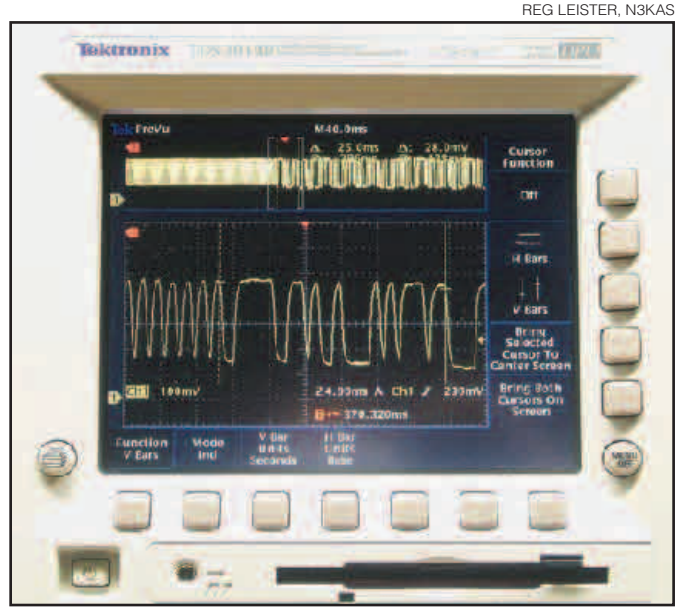
I took several pictures of the site for the club Web page and to identify the owners of the equipment. Upon arriving at home, their website was located and I notified them of the problem that their unlicensed equipment was creating for the licensed public service radios in the next town-- which was also in another county. Despite this being the

[1]There's more on fox-hunting at **www.arrl.org/tis/info/direction-finding.html**.

REG LEISTER, N3KAS

Jim Toth, K3CHJ, was the lead tracker using: a modified 3 element Arrow Yagi modified to WB2HOL "tape measure" specs; ICOM IC-W32A and homebrew 2 MHz active offset attenuator.

REG LEISTER, N3KAS



A close-up of the stored signal capture.

start of a holiday weekend and normally a day off for most businesses, a response was received back from their Technical Services Department within a few hours late in the afternoon.

"We use the SRM6000 Data-Linc radio in conjunction with our portable traffic signals in the US. The radios are operated in the 900 MHz band. In Europe we utilize the 151 MHz band you referenced. I will have our people investigate the system in Pottstown to ensure the appropriate radio was deployed. If there is a problem it will be corrected immediately. Thank you for bringing this to our attention." By the next morning the interference was gone!

Throughout this entire event, the activities and results of our Transmitter Trackers were being posted on our club reflector. Paul Kennedy, W3PMK, decided to check a little further on the SRM6000 Data-Linc radios (**www.data-linc.com/srmfamily/srm6000.htm**). He learned that they are license-free units operating at 1 W in the 902-928 MHz ISM (industrial/scientific/medical) band. This band (33 cm) permits amateur use on a secondary basis. These were the radios that were supposed to be in use.

It is gratifying that our club was able to identify and mitigate this problem as a different kind of public service to our community. Having interviewed key personnel from the affected municipality, they were at a total loss as to what was causing the problem and more so, how to resolve it. They had initially enlisted the county's radio technicians to assist them to no avail. Keep in mind that this township's frequency is shared by Public Works, Fire and Police Departments. No one knew what to do. Having it jammed for nearly a month was a significant communications issue for them. In some cases, they were forced to use cell phones which at times were impractical from a coverage standpoint. They were quite relieved when I notified their Township Manager and Chief of Police that our club had identified the source of the interference, the company responsible and that the problem had been corrected. To say the least, they were very appreciative of our efforts.

Lou, K3EMG, filed this report following New Year's Eve activities by that Township's police department which operated DUI Enforcement Check Points and was able to finally communicate again on their radios. "Several car stops were made that evening for DUI-related reasons. One car was stopped after being clocked at driving 107 MPH!"

For those who usually associate hams as doing disaster-related communications, this adds a different dimension to saving lives. As I reflect on Lou's observations, I can only wonder what would have happened had the police been unable to remove those irresponsible drivers from the roads that evening! Or what if Lou had simply ignored that digital hash heard on his scanner and locked-out that channel? The New Year might have started out much differently and tragically for some families. How many potential lives were saved that evening because of the efforts of a few hams! Once again amateur radio had proven its value and, might I say with pride, made a great public relations statement at the same time.

HOW TO MAKE A PRO INTO AN AMATEUR

Brian Short, KCØBS
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Getting public safety professionals interested in utilizing ham radio to its fullest potential is a little like the weather: It depends on where you live; it changes every day; and if you're not prepared, it can make you look "all wet."

If you have struggled and strained to convince a local, county, or state official to include you in his or her disaster planning, disaster responses, or public event communications, then you may be ready for a new approach. Remember Troy and that horse! Instead of fighting to try to get your foot in the EOC's (Emergency Operations Center) door, why not recruit an insider? Katrina was a singularly catalyzing event that has caused almost every agency in the country to seriously consider the what-ifs of a complete communications failure. The time is ripe in the US to for hams to "infiltrate" the offices of emergency preparedness groups and public safety communications teams.

Some areas are already so well integrated they might not need hams within the emergency manager's office. The ARES group in Shawnee County, Kansas, for example, is regularly called out on all major fires and SWAT deployments and recently received kudos from the Department of Homeland Security for its ability to act as interoperability technicians for the county's communications system.

Other localities have proven the value of having hams on the inside. In Independence, Missouri, hams are so well integrated that they are cross-trained with other public safety staff. They serve as back up to the city's Emergency Preparedness Manager with the ability to independently activate their emergency operations center. They support the city, and the city supports them. Their four-element Stepp IR beam towering 75 feet over the fire station is a visible symbol of that support.

This mutual trust and respect did not happen overnight. It was built on an uncommon faith by their city's Emergency Preparedness Manager, Mark Widner, and the RACES group's willingness to take on tasks outside the traditional amateur operator role.

These examples are the exception to the norm, but they shouldn't be. Many groups struggle to prove their worth to emergency managers who "know all about hams" from some unfortunate prior experience. You can't make everyone like you, but to ensure we have the opportunity to fill our public service mission, we have to reach out to those who can help us integrate and serve effectively.

Brian Short, KCØBS, talks about getting gain out of antennas by changing their radiation pattern.

The key to getting your public safety or emergency preparedness agency to rely on you is building and maintaining excellent personal relationships. Making ham radio the common bond enables you to establish the contact and build trust and soon these new hams will come to rely on you for their departmental disaster communications as well. They will realize what an amazing resource ham radio is for their agencies and will look to your group for assistance with peak demands that might stress — but not break — their system. When you are participating in their drills, you will know your "infiltration" has worked.

It is up to motivated individuals to take advantage of the current interest in interoperability and reliable back up communications and convert those with that interest into new hams. It is up to you to seek out those individuals and make sure they succeed!

Matt May, KC4WCG, and I decided to take on this challenge in October 2006. Matt is the Metropolitan Emergency Communications Committee President. Following a very successful nighttime search and rescue exercise with a local fire department, it was evident that the emergency managers and public safety professionals were impressed with the effective use of amateur operators. They also expressed interest in getting their own licenses. The problem is that these full-time professionals don't have the spare time to devote long hours of seat time for the typical eight- to ten-session ham class. Based on this experience, Matt and I developed a curriculum for the type of ham class that we thought a public safety professional would embrace. It comprises only four evening classes taken over four consecutive weeks. Each class is four hours long, with the last class also including time for the test. We developed an informational flier and, using Matt's connections with the Kansas City Metropolitan Emergency Managers Committee and the Public Safety Communications Committee, got it distributed it to people we thought might be good candidates.

The formula attracted public safety professionals from the entire Kansas City metropolitan region, including fire, police, EMS, emergency managers, and CERT coordinators. This class also drew interest from meteorologists at

our local National Weather Service office in Pleasant Hill, Missouri, including the newly assigned meteorologist in charge. In the first class we had 19 people sign up. We were ecstatic.

The first night, we asked, "What made you decide to take this class?" We were looking toward the future and wanted to be sure we were marketing to the right people in the right way. A large majority indicated they wanted to be ready for any Katrina-like event, and some said they had yearned to get their license for a long time but lacked time to do the self-study. Many indicated the shortness of the class format was a plus. But the most interesting answer came from a firefighter who said, "I am in charge of our communications truck, and we have 24 different radios I can talk on in there. The only one I can't use is the ham radio. I figured I ought to be able to talk on all of them."

That is the first time we even considered the fact that agencies, if given the right resources, could have a pool of their own operators to use when all their other systems fail. In fact, several police, fire, and sheriff departments in the area have installed ham radios within their dispatch center as an additional dispatch position. We immediately thought, "Oh no! They won't need ARES anymore!" But in reality this new model integrates perfectly into the ARES model with the following new and powerful features:

Rapid Response: Hams are already on site at the EOC or dispatch center when a disaster occurs.

Difficult issues involving access to secure areas and the EOC are already handled.

Hams get the request for help early on in the disaster rather than being called in late and having to rush a response or being forgotten altogether.

The format for this ham class is extremely fast paced, teaching to the test, and emphasizes the usage of amateur radio for disaster communications. We started with an excellent PowerPoint created by K3DIO, found online at **www.hamradioinstructor.com/powerpoint.html**, as the basis for our presentation. We added numerous props, a couple of key handouts, and our own website to provide links to study materials and test sites.

The dedicated students spent 14 hours in class and 1 hour taking the test. The formatted repetition and tight focus on the material paid off: 19 of 19 passed on the first try.

Matt and I realized that we needed to integrate these new "insiders" into the ham community and other public service agencies as well. Following the test, we hosted a reception at the Kansas City Missouri Emergency Operations Center and had 30 representatives from the local ARES, RACES, and SKYWARN agencies come out to meet, greet, and congratulate the new hams. This "ham networking" event kickstarted the relationship building.

As more emergency managers and public safety staff get their licenses, the work required to develop these critical relationships gets easier. They will know first hand what hams bring to the table, and you can bet they will be the first to rely on their amateur radio resources during all their communications drills and emergencies. If you are trying to get your foot in the door with the local emergency management agency, we can help. Go to **www.ks0jc.com/hamclass** to learn more.

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!*

Update to 2006 ARES SET Results

Here's an update to the 2006 SET Results article [Jul 207, pp 71-74]. An ARES activity report from Oklahoma should have appeared in the table of results. District Emergency Coordinator David Land, KD5FX, reported 118 points in the North Central Oklahoma SET.

Field Organization Reports

Public Service Honor Roll
August 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.

461 W2LTB
440 KB9KEG
405 KØIBS
383 KD8BGQ
360 KI4GEM
341 WB8RCR
335 NØYR K2DYB
310 KA2ZNZ N2LTC
295 W2MTA
276 N7CM
265 K8MFK
260 K7EAJ
255 KG4TND
250 AK2Z
223 KK1X
210 KB2ETO
205 KJ7NO
197 KD7THV
190 KE5HYW
176 WA2BSS
170 W5XX
166 WB2KNS
160 KGØGG NØUKO
150 WB5ZED KA8ZGY WØLAW
145 WB9JSR
142 K4DND
141 KA2BCE W5PY
140 KK3F K7BFL
138 KA2GJV
135 W3YVQ NIØI N5KWB
130 W3ZQN N2QZ W7EKB WØSJS
125 K2TV K4FQU K3CSX K9LGU NN7H
121 NØZIZ
120 KC5OZT K6JT AG9G KA5KLU KD5TXD N7BEC W8UL N8IO N4ABM K5SFM KW1U W1GMF N1UMJ K1YCQ W7IG K6YR
118 W8CPG
116 K2UL
115 N8QVT WD8Q KD1LE
114 K7BC
110 K4GK WV8RG W7GB KK5GY K9FHI W5ESE N7XG N7YSS N2GJ
109 K2HJ W4ZJY
108 K8ZJU
107 WA4UJC WD9FLJ
106 N7VC
105 KE5DLZ NUØF WD8USA
103 WAØVKC
102 KD1SM K5MC N1LKJ
100 KB2KLH W2DSX W3TWV KM1N KA4FZI WA4EIC NX1Q AA3SB K4SCL KC2LIX N5OUJ W7GHT N7IE N8OD NØMEA K2AN KC8WSE K4SCL KF6SHU WB6UZX N4MEH
99 WA2YL
98 W3CB
97 WB8OIF WU8Y
96 W5GKH
95 WG8Z
92 KS3Z W1PLW W5CU KØBLR
90 WA2CUW N3SW K8GA WB4BIK KA1RMV KA1GWE WD8DHC W8IVF KA8WNO K3IN N3ZOC WE2G NDØN KD7ZLF N8DD WB8SIQ WØCLS WB2IJH N1JX KC2PFV NG1A K8AMR
89 W4CAC W2CC
88 W7VSE
87 NA7G
86 AA4BN WB2LEZ K8RDN WB2LEZ
85 W4TY
83 AB5WF KK7TN
82 WA5OUV KI4JQB KO4OL KBØDTI
80 KE5DKV NØMHJ KC2ANN K8KV AB8SY KA4LRM
79 K6RAU AL7N
77 K1HEJ
75 K4BEH KB5PGY WDØGUF
74 W4DGH
73 WA1JVV KA3UIV
70 N2HQL KA2YKN W9RSX KAØFUI KØDUW WØWSP NØDUX KCØZQC KØNLE KB7ZUP

The following stations qualified for PSHR in previous months but were not recognized in this column: (July) KD1SM 281, K6YR 120, NA9L 110, WB4FDT 100, KF6SHU 100, WB1CHU 81.

Section Traffic Manager Reports
August 2007

The following ARRL Section Traffic Managers reported: AK, AL, AR, CO, EB, EMA, ENY, EPA, EWA, GA, ID, IL, KS, KY, LA, MDC, MI, MN, MO, MS, NC, NFL, NH, NLI, NNJ, NNY, NTX, OK, OR, SBAR, SC, SD, SFL, SNJ, SJV, TN, UT, VA, WCF, WMA, WI, WNY, WV, WY.

Section Emergency Coordinator Reports
August 2007

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

Brass Pounders League
August 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*
KK3F	24	1362	1349	13	2748
KA9EKG	42	679	652	12	1385
W4ZJY	0	654	611	0	1265
W1GMF	0	300	951	0	1251
KA9KLU	0	487	449	1	937
KB9KEG	33	351	33	351	768
WX4H	3	327	401	11	742
WB9JSR	0	333	328	7	668
KW1U	0	302	333	1	636

W3ZZ

THE WORLD ABOVE 50 MHz

Summer Events

All of us look fondly toward working 2 meter E-skip (E_s), one of the kings of all propagation. In fact, Sam, K5SW, says that he has worked 2 m E_s at least once every summer since he started keeping records in 1983, and he still remembers his first 2 m E_s contact — with North Carolina in 1965 when he was W5WAX. Much of this column will be devoted to July 29, when North America experienced one of the most extensive 2 m E_s openings on record. Too close to the deadline to do it justice in last month's column, here is the summary based on my correspondents' reports, which continued to arrive well into mid-August, and culls from the propagation reflectors at **dxworld.com** and DX Summit (**oh2aq.kolumbus.com/dxs/**). My thanks to WA5IYX, K7XC, WØUN, NØAX and W8WN for their summary reports.

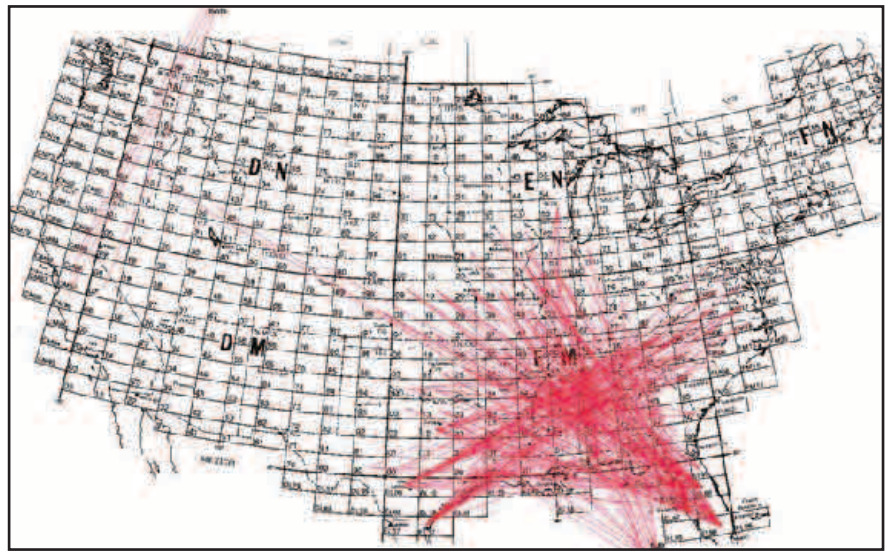

Figure 1 — The opening of July 29, 2007. Note the multiple high MUF centers supporting E/W and N/S contacts to FL, TX and Cuba; Pacific Northwest to DM37 and CA to VE6.

July 29

The entire opening is depicted in Figure 1. Each big E_s opening has its own particular form. This one, like many large 2 m E_s openings, takes the form of a starburst whose major center reflecting area ranges southward from around the EM53/54 area to below the Gulf coast. As is typical of such openings, the first inkling of what is to come can appear earlier than the main opening. In this case it was Jay, KØGU, working EM62 at 1536Z — 9 AM local time. No other E_s activity was reported at that time although there well may have been some not spotted. I was portable in FM03 during the great E_s opening of June 1987 and worked W5VY (EL09) at local noon that day. Several hours later there was a massive E_s opening as far as Colorado and Utah to the west, though I heard nothing more at noon.

The main opening began straightforwardly enough around 1703Z with East/West propagation between south Texas and Florida. Over the next hour it expanded only slightly northward into OK and then by 1915Z it included CO2OJ (see below) and finally expanded northward to IA, WI, IL, MO, KS and eastward mostly after 20Z to OH, KY, MD, PA and VE3. Three other reflecting centers developed during this 5 hour period. At 2033Z, Steve, VE7SL (CN88) worked K7CA (DM37) in Utah. N6KW and K7CW report that no other verified E_s contacts were made from the Pacific Northwest. Sam, K5SW (EM25) worked stations in DN32 and DN13 just before Cuba was heard. Meanwhile a fourth reflecting center appeared farther north and west. Norm, KC6ZWT (CM98) reports and VE6EGN confirms that he, KR7O (DM07), NA6XX (CM97) and WA6LIE (CM96) all worked Egon, VE6EGN (DO23) between 2100-2109Z. A path this far north is quite unusual.

What about 222 MHz? Alas, nothing was heard though not for lack of looking and trying. WB4SLM, K5LLL, W5UWB and KØVXM all reported looking hard but none of them or anyone else spotted ever heard a peep.

This Month

November 4	Good EME conditions*
November 18	Leonids meteor shower peaks @ 0259Z
November 24-25	ARRL International EME Contest 50-1296 MHz

*Moon data from W5LUU

As befits a long opening, there were some pretty decent totals, especially from FL and TX. Among these were Ken, N4TUT (EL98) with 58 QSOs/31 grids; Burch, K4QXX (EL87) with ~50 Qs/24 grids; Lee, N5TIF (EM12) with 48 Qs/15 grids; John, W5UWB (EL17) with 45 Qs/22 grids; Chuck, KØVXM (EL98) with 34 Qs/26 grids; Graham, KE4WBO (EL96) 30 Qs/18 grids; and Al, KG4IRO (EL96) with 20 grids. There was no double hop reported, although there was certainly the possibility during the time that K5SW was working stations in FL and Cuba along with Idaho that such an opening could have happened. Some of the long distance contacts reported included: W5UWB (EL17ax) to K3IB (FM19uu) 2388 km; W5UWB to AB3BK (FN10pd) 2370 km; CO2OJ (EL83td) to WA9ENA (EN42ke) 2262 km; W5UWB to (EN91ql) 2174 km; NØKQY (DM98gk) to N4NDR (EL98fx) 2117 km; and WA5IYX (EL09ql) to NG4C (FM16tj) 2211 km. Many of these were at the limits for a single hop but none appeared to be double hop.

In addition to this data, some of the more interesting things happened at the margins both in terms of the edges of the opening

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and at low power with minimal antennas. Notably, running 5 W to a Halo, Kent, KA2KQM, worked several stations as far as FM17 from three different grids while he was operating mobile returning to EM74 from the Central States VHF Conference. Frank, WB5NDJ (EM13) worked three grids including Cuba with his IC202 running 2 W to stacked halos. Tom, K5VH heard both WA1ZMS/B (FM07) and N4MW/B (FM17) from his mobile in EM00. Dave, N4MW, says this is the first E_s report he has received for this beacon in its 20 years of operation at 10 W to an M^2 SQLoop.

Oscar, CO2OJ (EL83) had a big day in Cuba with 46 QSOs in 18 grids, covering a wide swath of territory from west Texas to MO, IL and IA to the north and northeastern KY to the east. At the other end of the spectrum, as noted, Egon, VE6EGN, worked four CA grids from DO23 as the farthest north station in the opening. At least three stations appear to be the only representatives of their states: AB3BK (FN10) in PA; Randy, K9VHF (EN53) in WI, and Larry, NØLL, both fixed and mobile from EM09 in NE. I received a number of reports from stations around the periphery, including John, AA5JG (EM04); Jay, KA9CFD (EN40); Craig, K9CT (EN50), and Gene, N9TF (EN52).

The opening was strong enough to allow stations nearer the center of ionization to get into the act. Justin, N5BO (EM70) spent much of the time underneath the center but finally broke out as the cloud moved north, to work a number of stations in IL, IA and KS. Most of the others had a fairly narrow footprint. Carl, AA4H (EM86) worked west and south Texas. Bob, WA2EMF (EM94) was limited to all of Texas and Steve, W5KI (EM36) was limited only to FL and Phil, NØPB (EM39) FL and Cuba. Vic, WB4SLM (EM82) worked only into OK but Bill, KF4EHP (EM99) had a much wider opening into MO, IL, OK and KS.

2 Meter E_s in Europe

Speaking of Europe, our friends there had an excellent 2 m E_s season; much better than ours but not as good as last year. Results are compiled by Steffen, DM2SR, at **www.vhf-contest.com/?id=2**. [I wish someone in the US would do likewise for North America.] For the 123 days of May through August, 2 m E_s was observed on 36 days for a total of 40 hours compared to 4 days covering ~8 hours here in the US. See Table 1. Ten of the European openings were short duration — 20 minutes or less — openings that might have been missed had they occurred here where the activity is much lower than in Europe. A few others involved sparsely populated locations equivalent to some of the US mountain states, for example, and surely would have been missed here in the US. Once again there were some very long contacts that could only have been double hop E_s, as Table 1 shows. Either we just don't get that much of that kind of propagation here in the US or we don't have stations in the right places at the right times to exploit it.

Table 1
Two Meter E_s in Europe

ODX includes several double hop contacts.

Month	*Number of Openings*	*Hrs:min open*
May	8	10:30
June	14	8:15
July	11	10:15
August	3	1:00
Totals	36	40:00

ODX:

June 06	2968 km EA6VQ (JM19mp) — 4X1UN (KM72jb)
June 19	3037 km EA4TF (IM89at) — UY5HF (KN66hp)
July 09	3195 km EA8CCG (IL18tm) — DL8EBW (JO31nf)
July 09	3271 km EA8TJ (IL18ri) — DG5YIL (JO32kb)

K5AND

Figure 2 — VP2EDH. Left to right: Jimmy, VP2EDJ; Bob, W4ZST; Dick, K5AND, and Paul, VP2EP.

2007 Summer DXpeditions

Six different DXpeditions enlivened the scene in the summer of 2007.

June 9-24. Antigua, V26HS (FK97), by Howard Sine, WB4WXE, with 350 W to a three element Yagi. Howard made 1529 Qs: 1086 to North America (NA), 428 to Europe (EU), 14 to South America (SA) and 2 to Africa (AF) in 55 countries with Qs as far east as SP and UT; to all US districts and 45 states and 6 VE areas.

June 18-26. Haiti, HH4/W3CMP (FK39), by Chris Patterson, W3CMP, with 200 W to a 6M7JHV seven element Yagi. Chris made ~750 Qs in 38 countries in NA, SA, EU and AF with seven days of propagation to EU/AF. He also made three Qs on 2 m: 2 EME (KB8RQ and RN6BN) and 1 tropo (WP4G).

June 22-July 1. Anguilla, VP2EDH (FK88), by Dick Hanson, K5AND, and Bob Lear, W4ZST, with 1 kW to a long Yagi. They made 1200 Qs in 55 countries east as far as 5B4. See Figure 2.

June 29-July 8. St Vincent, J8/W6JKV (FK93), by Jimmy Treybig, W6JKV, with 1 kW to a long Yagi. Jimmy made 938 Qs: 665 EU/Asia and 273 NA in 57 countries east to 4X, 5B, SP and UT. Long distance Qs to EU in excess of 8000 km existed for many hours on four of the days. All areas of the US except the West Coast were worked. See Figure 3.

June 29-July 4. Nunavut (Canada), VFØX (FO06), by Peter Csanky, VE3IKV, and Bill Brown, W4TAA, using 100 W and an M^2 6M5X Yagi. They made over 500 contacts, all in the US and Canada, and were audible over much of the US at times when no other stations were being heard on E_s and auroral E.

Since late May, Yuri Bodrov, UT1FG/MM, has traveled across the Atlantic into the Caribbean, north to the St. Lawrence Seaway and at the time of this writing has just left Duluth, MN headed east to Spain. Using 100 W to a 2 element quad he has been worked in many water grids from at least the following fields: EL, EN, FK, FL, FM, FN, GJ, GK, GL, GM, GN and HI. Exciting stuff for the field hunters!

ON THE BANDS

The main highlight for August was the appearance of some good tropo openings. On the other hand, after a good summer 6 m slipped mostly into hibernation. I am indebted to my correspondents and the propagation reflectors at DX Summit and **dxworld.com** for the following information. Let's take a look.

Tropospheric Ducting

Enhanced propagation existed from Aug 8-10 in the mid-South, eventually reaching into the Midwest. The opening appeared to go as far as EL17 to the south, EM00 and EM03 to the west, EM66 to the northeast and on the 10th there were a number of contacts from central TN (EM66) to EM29, EN21, 22, 31, 32 and 43 to the north and west. On Aug 8 Craig, K4XR (EM64) worked Al, W5LUA (EM13) on 902 MHz through 10 GHz and Dave, WW2R (EM13) on 902-2304. Lee, N5TIF (EM12) reports 2 m signals from EM29, 36, 42, 43, 48, 51, 55, 56, 64 and 66. He also worked EM43, 54 and 64 on 432 for new grids. Bill, W3XO (EM00) worked into EM25-27, 36, 48, 55-56 and 66 as well as EM48 on 222 and 432. On the 14th, Craig, K4XR, heard WA1ZMS/B very loud but never heard any other stations. On Aug 15, Herb, K2LNS, operating WA2FGK (FN21) worked 20 stations on 2 meters in the W8/9 area, another six on 432, and KB8U (EN71) and N9LR (EN50) on 23 cm. Following a very hot day on Aug 25, Ken, KE2N (FM18) noticed a strong inland coastal opening to New England, which yielded FN31, 42 and 43 on 23 cm and a contact with K1WHS (FN43) on 13 cm. On Aug 28, again from WA2FGK, Herb, K2LNS, worked eight Qs as far west as EN41 on 2 m, four stations including EN41 on 70 cm and W9ZIH (EN51) on 23 cm. The following morning he worked EN53 on 222 MHz. On Aug 29-30 Russ, K4QI (FM06) worked stations NE of FN35

432 MHz Standings

Published 432-MHz standings include call-area leaders as of Sep 1. For a complete listing, check the Standings Boxes on The World Above 50 MHz Web pages at **www.arrl.org/qst/worldabove/**. To ensure that the Standings Boxes reflect current activity, submit reports at least every two years by e-mail to **standings@arrl.org**. Printed forms are available by sending a request with an SASE to Standings, ARRL, 225 Main St, Newington, CT 06111.

Call Sign	State	States Worked	DXCC Entities Worked	Grids Worked	DX (km)
1					
K1TEO	CT	25	3	117	1,948
W1ZC	NH	20	2	71	1,984
W3EP/1	CT	19	2	51	1,760
W1AIM	VT	17	2	52	1,323
AA1YN	NH	11	2	22	821
K1VU	MA	10	1	16	814
WA1FVJ	CT	10	1	14	400
2					
W2CNS	NY	25	3	91	1,582
K2OVS	NY	16	3	41	720
K1JT	NJ	16	2	45	757
WB2AMU	NY	9	1	13	830
3					
W3ZZ	MD	26	2	93	1,526
K1RZ	MD	26	2	96	1,376
WA2FGK	PA	23	2	76	—
N3JNX	PA	10	1	23	786
4					
W4TJ *	VA	43	40	190	—
K4QI *	NC	39	51	261	—
AA4ZZ	NC	31	2	101	1,255
K4RF	GA	28	2	96	1,742
W4WA	GA	25	1	83	—
K4XR	AL	22	3	91	1,550
K4RWP	TN	22	2	50	1,046
KU4WW	AL	21	2	58	1,240
AA4H	TN	21	1	57	1,737
K4RTS	VA	20	2	68	1,078
W4WTA	GA	18	1	54	1,319
KØVXM	FL	14	3	64	1,974
NN4DX	NC	9	2	23	890
W4SW	VA	9	2	22	521
K4MM	FL	8	2	34	1,691
K4MSG	VA	8	1	14	492
5					
W5LUA *	TX	50	—	—	—
W5RCI *	MS	47	22	234	2,992
WD5AGO *	OK	40	23	150	1,740
W5ZN *	AR	35	15	151	1,850
K5YPV	MS	23	3	103	1,327
W5HNK *	TX	20	1	—	1,651
K5LLL *	TX	16	2	98	1,532
W5UWB *	TX	14	3	39	2,167
W3UUM	TX	10	2	58	1,619
AA5AM	TX	9	1	52	1,728
AA5JG	OK	6	1	32	1,855
6					
K6QXY	CA	4	3	36	3,794
KC6ZWT	CA	4	2	50	3,934
KR7O	CA	2	1	39	582
N6ZE	CA	1	2	18	780
7					
K7XC *	NV	9	5	55	945
W7RV	AZ	7	4	56	712
WA7GSK	ID	3	1	12	—
8					
W8PAT *	OH	31	3	76	1,919
K2YAZ	MI	28	2	108	2,167
WA8RJF *	OH	22	3	80	1,287
N8PUM	MI	11	2	44	1,368
K8ZIZ	OH	8	2	23	614
9					
N9LR	IL	33	3	134	1,562
K3SIW/9	IL	32	2	133	1,469
K9SM	IL	30	3	106	1,447
KA9UVY	IL	26	2	74	1,409
AA9MY *	IL	25	3	68	1,567
Ø					
KØRZ *	CO	45	48	267	1,083
KØFF	MO	20	1	74	1,189
KBØPE	MO	17	1	55	1,148
KØCJ	MN	16	2	—	1,375
KØAWU	MN	15	2	65	1,555
Canada					
VE3TMG	ON	23	2	76	1,319
VE3KH	ON	18	—	54	1,174
VE2PIJ	PQ	9	2	37	694
International					
GW3HWR		—	15	36	2,760
F5DE	INT	—	9	58	752
NP3CW	PR	—	1	2	114

*Includes EME contacts
— Not given

on 2 m and K1WHS (FN43) on 1296 MHz.

Meteor Scatter

In recent years the Perseids have been disappointing. Perhaps that is because of declining meteor rates or comparison with the higher rates in the 90s and perhaps because the amount of SSB activity during the Perseids has been declining sharply while the digital activity that has replaced it is less dependent on shower meteors and can provide many contacts on meteor trails from random meteors. Unlike last year, in 2007 I received a number of reports. Doug, K4LY (ex-W2CRS, WØAH), now located in EM85, has operated the Perseids every year since 1963 and reports that this one appeared normal to him. He finds almost no SSB activity, and all his contacts were via FSK441 skeds made on the NØUK Ping Jockey Internet site: **www.pingjockey.net**. He completed 22 of 25 skeds on 2 m (two new states, CO and SD) with 600 W to a 5WL Yagi and three of five on 222 MHz (in TX and NY) with 120 W and an ancient 8/8 J-Beam skeleton slot.

John, W5UWB, noted that the strongest returns appeared to be from 06-08Z on the 13th. Many of his long distance skeds were not successful but he did complete with EM39 and EN61 on 2 m, the latter on SSB, and DM 43 and EM85 on 222 MHz digital. Al, K7ICW (DM62) heard some bursts from CA on 2 m analog. Shelby, W8WN (EM77) reports lots of digital FSK441 activity but generally few longer burns on 2 m with many exchanges being made on weak, underdense pings. Dave, W6OAL (DM79) worked seven states and VE3 on 6 m, including MD, WV, GA and NY on what appeared to be longer burns. He thinks it is possible that the latter may have been very sporadic E_s instead; it is very difficult to tell that kind of E_s from MS on 6 m. Dave, N7DB (CN85) worked or heard a number of long distance contacts in NJ, MD and VE3. Since double hop MS is exceedingly rare (some would say virtually impossible) this may have been E_s or some combination of MS and E_s.

DREW TREYBIG

Figure 3 — The view toward the US from J8/W6JKV on Bequia, St Vincent. It's no wonder Jimmy has such a loud signal.

6 Meters

Six meters became largely quiescent in August, although E-skip was there if you looked hard enough. At least a little E_s was evident every day in the first half of the month and half the days of the second half. The best days were Aug 8-9, which featured numerous double hop contacts. Chip, K7JA (DM03) worked many East Coast stations. Chuck, W6KW (CN87) worked into NC. Leo, KJ6HI (DM03) worked several stations in the Pacific Northwest (PNW) and operating W6DJY (DM03) remotely worked several stations in the Upper Midwest and Colorado. Weak aurora and Au-E contacts in the northern tier of states were seen on both Aug 7 and 27. On the 7th, the PNW worked stations in Alaska. I could find only two days with propagation to Europe: the 15th, when K1TOL was worked/heard in PA, G, DL and I; and the 27th, when Scotland was hearing the VO1ZA beacon. On Aug 11-13 various places in the US had propagation into the Caribbean and the northern edge of South America.

EME

Lance, W7GJ, reports 6 m digital contacts with OM3RCC (DXCC no. 116) on Aug 1, D44TD (no. 117) on Aug 4 and UN8GC (no. 118) on Aug 11. The latter is the first contact between Kazakhstan and the US on 6 m. Meanwhile, we have Ken, K5DNL, working 68 countries since he got on 2 m JT65a EME 2 years ago with only 400 W and 2×17 element 5WL M^2 Yagis. There was a time when that would have been a highly marginal EME station and now Ken is ⅔ of the way to DXCC on 2 m.

HERE AND THERE

Leonids Meteor Shower

The Leonids are predicted to peak on Nov 18 at ~0259Z, with a rate (ZHR) of about 15/hr. The heyday of the Leonids meteor storms seen in 1998-2002 is long past and no storm is expected this year. These are energetic meteors (71 km/s) and even at these lower rates ought to be watched closely.

2007 ARRL International EME Contest

The third and final weekend of the EME contest is 0000Z to 2359Z Nov 24-25 for 50-1296 MHz. Please note that you must be aware of several important rules changes so look at The World Above 50 MHz for September and October and the detailed rules at **www.arrl.org/contests/rules/2007/eme.html**. With the ever increasing amount of digital JT65 activity, relatively small stations can now make EME contacts. QST

K2TQN

OLD RADIO

Tuned-Grid Tuned-Plate 75 Watt Transmitter

I think every collector would want to find something outstanding for their collection. I really like to collect well-made homebrew items. When I passed up going to a local auction in Pennsylvania one day, I knew down deep that I was making a mistake.

Several months later, when I received my monthly *Antique Radio Classified* I read the Auction Report of the Smith Auction of June 17, 1995 by my friend Ray Chase, KA2KQG. Ray is always reporting on interesting radio auctions via the *Antique Radio Classified*, such as the Estes Auctions that I wrote about in my July 2006 column. (You can get a sample issue from their Web site, **www.antiqueradio.com**.)

Page 18 had the listing and photo of a great looking transmitter, one that I could have bid on if only I had not stayed home. I enjoyed kicking myself several times that day, resolving to find the buyer and try to purchase it from him.

A couple of years later I heard a mention of that transmitter in a conversation at a local hamfest. I immediately said that I would like to find it. One collector standing nearby spoke up and said that he owned it and wasn't doing anything with it. I offered to buy it but he said, "I won't sell it, but I will trade it for something interesting." So now the challenge was on. After offering several things in my collection I determined that I would have to trade a high-end receiver to get it.

Another year passes and I found myself at a north Jersey hamfest. One seller brought his father's rack-mounted National HRO receiver in pristine condition. It was expensive, but I thought this might be the one to get my trade. That night I called him on the phone and made the deal. The next weekend I drove to his location and made the trade.

It was disappointing to find the transmitter had been damaged by rough handling. Several knobs and insulators were broken and several pieces of original wood molding had been broken as well. Also the plate lead coming out of the DeForest 52 tube was broken off at the glass line. (The large 52 tubes are rare and hard to find, I was to discover.)

I put the transmitter into my storage area

Transmitter as found with broken knobs, insulators, and 52 tube plate lead and broken trim moldings.

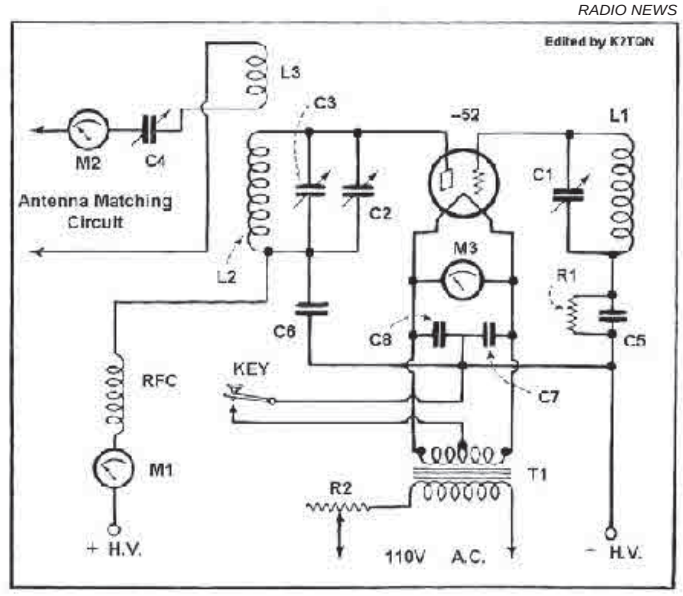
Restored transmitter with new knobs, new 52 tube, tube socket and new trim moldings.

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

K2TQN

K2TQN and transmitter after winning the Blue Ribbon at the 2007 AWA meet.

RADIO NEWS



The transmitter is a classic TGTP design.

and it remained there while I located the necessary parts to restore it to its original condition.

Locating the Parts

One day while reading my older *Radio News* magazines, I discovered the same transmitter was a construction article in the December 1931 and January 1932 issues. Now I had the schematics and parts lists I would need to fully restore it.

The local newspaper reported the day after a large auction of furniture and items from the early Atlantic City High School the city planned to tear down. (Why do they always do this, report after the fact? I would have loved to bid on some of the many oak bookcases from the library.) Anyway, later on my son found out his antique dealer friend had purchased the rights to remove anything that was left inside, which included a considerable amount of quarter-sawn oak used for moldings. He asked and received permission from his friend. This oak was absolutely beautiful. The baseboards were a full 1 inch thick, 8 inches wide and averaged 20 feet long. I helped my son remove quite a few of them that day until my knees gave out. While walking around I noticed the moldings that were attached to the original blackboards. This appeared to be the perfect size for replacing the broken and damaged ones on my transmitter. I removed several pieces to ensure I had enough and added these to my son's pile of lumber. Since I had attended that school I spent the remainder of the day looking for souvenirs. Once we arrived home, I stored the blackboard molding with the transmitter.

eBay provided an affordable 52 tube after several months of watching and bidding. The broken brown beehive insulators were found one at a time from several hamfests. I also needed a new tube socket for the 52 tube. It was a hard-to-find "Air-Gap" brand. Eventually I found several at hamfests.

Putting it All Together

I always say patience pays while collecting. I was able to find what I needed to restore this transmitter without paying too much for the parts. So now it was time to clean it up and make it whole again.

Cleaning it was the first chore. It was covered with dirt, grime and some wax substance. First I removed all the parts. Careful wiping and scraping removed most of the grime from the two wooden breadboard chassis. Murphy's Oil soap did a great job cleaning and restoring the shine to the upper chassis. The lower chassis with the wax and grime mixed in was a little harder. I used a product called "OOPS!" to clean up the wax residue that coated the two large filter capacitors and the wood breadboard near their mountings. It was later I was told the wax residue was the remains of PCB oil that leaked from the two filter capacitors. (Luckily I was outdoors when I did this, so I don't think I breathed any of it in. But be careful if you do anything like this. I always figured PCB contamination was oil, not wax. I was told when the oil evaporates, the wax is left behind. I also should have been wearing plastic gloves.)

I finished the wood with a product my son uses on his antique furniture called "Briwax." It really brings up the wood and makes it look great. My son cut the molding I had saved and attached them using the original nails that held on the broken moldings. The new moldings were a little heavier and should hold up nicely. I finished cleaning and mounting all the parts back in their original places.

Winning the Blue Ribbon

I loaded the transmitter into the car and took it along to the AWA meet in Rochester this past August to enter the Old Equipment Contest. I was lucky enough to win first place in the homemade transmitter category, the "Blue Ribbon." This was a thrill for me. All the hams there came into the contest area to admire it and I received many congratulations from them.

Donating it to ARRL

Now what to do with the transmitter? It is fairly large and heavy. I decided that I would probably never put it on the air because I didn't have room for it afterwards. I wouldn't have a need to finish the restoration and make it operational. I thought it was time to pass it on to another collector, perhaps someone who will finish it and put it on the air. So I'm donating it to ARRL for the ARRL On-Line Auction. This way everyone will have a fair chance to own it, and the money spent will go to further support our hobby.

Included will be the two *Radio News* magazines that contained the original articles and all the removed and defective parts that were replaced.

Due to its construction, I would recommend the winner arrange to have it picked up rather than shipped. I don't think it would stand up to being turned and bounced around on a delivery truck.

Check My Web Site

I will include PDF files of the original magazine articles and photo slide shows of the restoration project and the ham related displays at the 2007 AWA meet on my Web page. Please visit **www.k2tqn.com/**.

— *K2TQN*

W3UR

HOW'S DX?

DX News from around the Globe

3DAO — SWAZILAND

A three man team from South Africa will be operating in the CQ World Wide SSB DX Contest from Swaziland. ZS2DL, ZS6DXB and ZS6JR will be QRV as 3DA0WW on October 27 and 28. They will be operating in the multi-two category. Check out their Web site at **www.zs6dxb.bravehost.com**. QSL via ZS6DXB, Rhynhardt Louw, PO Box 10148, Edleen, 1619, Gauteng, Republic of South Africa.

3X — GUINEA

G3SXW and the Voodoo Contest Group are going to 3X, Guinea, in November for a sizeable operation. Says Roger, "We will move our one ton of equipment overland from Mali where we have been TZ5A for the past two years." The eight-man team this year is AA7A, G3SXW, G4BWP, G4IRN, GM3YTS, K4UEE, K5VT and KC7V. The 3X call signs aren't being reported yet. QSL the contest operation via G3SXW and individual 3X call signs to their home call. The Voodoo group will be multi-multi with mono-band antennas for all six bands and KW amplifiers. "This time we will be immediately beside saltwater, a real luxury!" AA7A and KC7V will do some EME for several days before the CQWW CW contest.

5X — UGANDA

Nick, G3RWF, plans to head to Uganda in late November including participation in the CQ WW CW DX Contest. Look for him to be QRV as 5X1NH from November 21 to 30. First from Kampala between the 21st and 26th and then in Western Uganda for the remaining days. Activity will be mostly on the low bands along with 12, 17 and 30 meters. He'll be doing CW, SSB, RTTY and PSK. QSL via G3RWF.

9Y – TRINIDAD AND TOBAGO

Jim Neiger, N6TJ, will try to add an overall win in yet another decade to his impressive record when he ops from 9Y4AA in the CQWW CW November 24-25, single op all band. Jim was on in contests for many years from ZD8Z. QSL via VE3HO.

A7 — QATAR

Bill, NM7H, will be in Qatar approximately November 1-January 5. He will sign the call A7/GØMKT, operating mostly on CW with some PSK and SSB, on 40-10 meters. He is also available to go to 6 if it opens. Bill also has held the YI9WF call sign. QSL via NM7H, direct or bureau.

C6 — BAHAMAS

C6AKX, the Bahamas, will be in the CQWW CW with KE7X operating low power. He will be single operator single band 20M. His inclusive dates are November 18-26. QSL via WA4WTG.

N6BT also plans to be on from the Bahamas, call sign as yet to be determined, single op single band 160, also low power, inclusive dates November 18-26. QSL via WA4WTG.

C9 — MOZAMBIQUE

W5KDJ, Wayne, plans a trip to Mozambique for late November and early December including the CQ Worldwide CW DX Contest. Wayne says he will be there over two weekends, November 29-December 10, CW only, making 160 and 80 a priority. He will have a 72-foot-tall vertical with 50 or more radials. He says it worked great in Botswana last July. Wayne likes splits of 15 kHz up and listens on the outer edges of that pileup most of the time. Wayne will also have a three-element Yagi or log periodic for higher bands and two or three elements on 30, 17 and 12 meters, and probably a four-square for 40. The Yagis will be 60 feet high. His call sign may be, he says, C91KDJ.

CE — CHILE

Al, K7CA, is expected back in Chile starting the third week of December 2007 through February 2008. Look for him to be QRV as CE1/K7CA. He likes 160 meters.

E7 – BOSNIA AND HERZEGOVINA

During early August the International Telecommunication Union (ITU) changed the call sign series prefix block of Bosnia and Herzegovina (BiH) from T9 to E7. The change has been in the works for many years now. "While it probably will take some time for the BiH administration to implement this change, it should put to an end the use of call signs outside the ITU-allocated call sign block by stations in parts of BiH," says IARU Secretary David Sumner, K1ZZ. The exact dates of when the Amateur Radio operators from BiH will begin to use the new E7 prefix is not known but should be very soon. E7/N4EXA, Danny (ex-T93M) was the first to actually use the new prefix.

FO/C – CLIPPERTON ISLAND

As a reminder FOØ, Clipperton Island, will

be on the air in early March. It will be the 30th anniversary of the 1978 FOØXA-XH expedition. The goal of N6OX and his international team is to break 100,000 QSOs. Heading up organization and management efforts are N7CQQ and K4SV with sponsors ICOM America, Acom, SteppIR and HeilSound lined up. **www.clipperton2008.org**.

HKØ – SAN ANDRES AND PROVIDENCIA

Four ops plan an HKØ, San Andres, operation for the CQWW CW, November 24-25, multi-single. They are K3WT, NØSTL, WØOR and NØAT. They haven't announced their call sign yet.

J2 — DJIBOUTI

J28OO will be on for one year and should have his station set up soon. Operator Darko is also known as T95A, 9A7WW and 4O3AA. Darko is on a work assignment so he says operating time will be limited. He may be able to also go to an IOTA, Moucha Island, AF-053, where he will sign J28OO/p. QSL via K2PF.

JD1 — MINAMI TORISHIMA

Masafumi, JA6GXK (JD1BMM), will be working at various times at the Japan Coast Guard (JCG) loran-C radio navigation station on Marcus Island (Minami-Torishima) until March 2010. His assignments will take him to this semi-rare island for multiple several week stints. Plans are to be QRV as JD1BMM on 10-80 meters on CW, SSB, PSK and RTTY. QSL via JA6GXK.

KG4 – GUANTANAMO BAY

Guy, N5GUY, is now working in Guantanamo Bay until early 2008. He's now QRV on 80 meters as KG4GY and was on the 3905 Century Club Net recently. You can QSL via OMISS Net or direct.

N1UR HEADS TO ASIA

Ed Sawyer, N1UR, reports he "will be heading off to Asia this fall and will be active from a number of areas." First stop was to be from Bhutan as A52UR in late September and early October. QSL A52UR via K2RET. During the CQ World Wide CW DX Contest (November 24/25) Ed will be operating in the Single-op

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All-band category from the Hillview Gardens ARC station in East Malaysia as 9M6A. QSL this operation via N2OO. Ed is also planning an operation from the Spratly Islands in late March 2008. Call sign and other details expected later. QSL this operation via K2RET. He will be staying in Xiamen (BY5), China and plans some activity with local BY ops. Ed operates both CW and SSB.

SU – EGYPT

SU8BHI, Egypt, will be on from Cairo until November 30. Operator Gab, HA3JB, plans to get on the air during many contests during his stay. He will be QRV on CW, RTTY, SSTV, PSK and some SSB. QSL via HA3JB. **www.qsl.net/ha3jb**.

T8 — PALAU

T88WV, Palau, will be in the CQWW CW contest November 24-25 with OH7WV operating. He will be single operator all band. He will operate casually for one or two days before and after the CQWW. QSL via OH7WV direct or bureau.

TI9 – COCOS ISLAND

Organizers are trying to get more operators to go to TI9, Cocos Island, IOTA NA-012. They're looking at six days in February. SSB, CW, and digital mode operators are needed. Go to **www.ti9.eu.com** or **www.qsl.net/ti2hmg/cocos.htm** for more information.

V8 – BRUNEI

Ronald, PA3EWP; Flo, F5CWU, and Tom, GM4FDM, will mount an expedition to Brunei Darussalam November 4-18. They will leave London November 3 returning from Brunei on the 19th. Their call signs and QSL routes are as follows: PA3EWP will sign V8FWP and QSL via PA7FM, F5CWU will use V8FWU and QSL via F5CWU, while GM4FDM will operate V8FDM and QSL via GM4FDM. Operation will take place on all bands from 10 through 160 meters, conditions permitting. They will be QRV on CW, SSB and RTTY. Special attention will be given to the low frequency bands (30-160 meters). Special emphasis will be given to Western Europe and the USA. Plans are to have at least one beam antenna along with verticals and dipoles. Depending on Internet availability they will try to maintain online logs at a Web site yet to be established. The Web master will be Dennis, PA7FM. — **www.pa7fm.nl**.

VK9L – LORD HOWE ISLAND

Tomas, VK2CCC (LY1F), tells us he'll be QRV as VK9CLH from Lord Howe Island November 20-27, including the CQ World Wide CW DX Contest. He'll be focusing on the low bands on CW. Tomas has a Web page at **www.qrz.lt/ly1df**. QSL VK9CLH via LY1F.

VK9N – NORFOLK ISLAND

Ulli, DL2AH, is expected to be QRV from Norfolk Island with the VK9ANH call sign, November 1-14.

VP2M — MONTSERRAT

K3VX, K4NO, K7NM, AK9F, K9NR, and K9CS plan to be active from Montserrat November 20-December 3, 2007. This will include entries in the CQ World Wide CW DX and ARRL 160 Meter CW contests. Call signs and other info to follow. QSL via K9CS.

VP8 – FALKLAND ISLANDS

VP8CXV will be on from East Falkland (SA-002) through January 15. The operator will be Chris, GMØTQJ. He will operate in his spare time, mostly SSB but with some RTTY and PSK31. QSL to his home call sign.

XF4 — REVILLAGIGEDO

Federacion Mexicana de Radio Experimentadores (FMRE) President Carlos Levy, XE1YK, announced he and three other XE ops have obtained permission from the Mexican navy to visit and operate from Socorro Island, Revillagigedo (XF4) by year's end in celebration of FMRE's 75th anniversary. Joining him will be Pepe, XE2MX; Eduardo, XE2YW, and Manuel, XE1VVD, for an expected 30 day operation. The XE Navy will be providing transportation to and from the islands. The expected dates are November 15-December 15. A detailed schedule is expected to be announced soon. Plans are to use the calls 6E4LM and XF4YK.

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*

Feedback

◊ In "Getting to Know Your Radio, The Next Step — 'Sound Card' Modes" [Jun 2007, p 55], the discussion on RTTY mentioned a 750 Hz frequency shift between MARK and SPACE. Current HF practice is to use a shift of 170 Hz.

◊ In "Are You Using the Right-Sized Fuse?" [Oct 2007, p 32], there is a typo in the first column of the sidebar "Calculating Voltage Drop." The text should read: "…the resistance of each conductor is 0.009987…" not 0.0009987. — *tnx Robert Kluck, N4IJS*

◊ Due to a data processing error, the Sponsored Plaque Table included with the 2007 ARRL International DX Phone Contest Results in the October 2007 issue (page 98) was incorrect. This is the corrected table. We have also added four sponsored DX CW sponsored plaques that were omitted from the initial data entry process. We apologize for the error.

DX Phone Sponsored Plaques

Plaque Category	*Winner*	*Plaque Sponsor*
W/VE Single Operator High Power	VY2ZM	Frankford Radio Club
W/VE Single Operator Low Power	N1UR	Dauberville DX Association
W/VE Single Operator QRP	N1TM	Jeffrey Briggs, K1ZM
W/VE Single Operator Assisted	N2NT (W2GD, op)	Pete Carter, K3VW Memorial
W/VE Multioperator Single Transmitter	W3BGN	Steve Adams, K4RF
W/VE Multioperator Unlimited Transmitter	K3LR	Western New York DX Association
W/VE 1.8 MHz	W4SVO	Butch Greve, W9EWC Memorial
W/VE 3.5 MHz	AA1BU	K1ZM Communications, Inc K1ZM
W/VE 14 MHz	W7WA	William F. Beyer Jr., N2WB
W/VE 28 MHz	K4WI	Ralph Fontaine AF7DX
World Single Operator High Power	8P1A (W2SC, op)	North Jersey DX Association
World Single Operator QRP	4M2L (YV5YMA, op)	Southern Arizona DX Association
World Multioperator Single Transmitter	V26H	Carl Cook, AI6V/P49V
World Multioperator Two Transmitters	PJ2T	W6NL and K6BL
World Multioperator Unlimited	OE4A	Stanley Cohen, W8QDQ
World 14 MHz	ZF2AH	Don Wallace, W6AM, Memorial Award
World 21 MHz	ZX5J (PP5JR, op)	Long Island DX Association
World 28 MHz	LU1HF	North Shenandoah DX Association NS4DX
Asia Single Operator High Power	JAØQNJ	Tim Coad, NU6S
Asia Multioperator Single Transmitter	JA8RWU	Yankee Clipper Contest Club
Europe Multioperator Unlimited	OE4A	Operators at K1TTT
North America Multioperator Single Transmitter	V26H	Nick Lash, K9KLR
Oceania Single Operator High Power	KH6GMP	W7EW / W7AT
South America Multioperator Two Transmitter	PJ2T	Operators at K1TTT
New England Division Single Operator Low Power	N1UR	CTRI Contest Group
Canada Single Operator Low Power	VE3AD	Contest Club Ontario
Japan Single Operator Low Power	JH4UYB	Western Washington DX Club
W/VE Single Operator High Combined Score	AA1K	National Contest Journal
W/VE Single Operator Low Combined Score	N1UR	Rochester DX Association K2FR Memorial Plaque
World Single Operator Low Combined Score	VP9/W6PH	C. Sharp, K5DX Memorial by the Texas DX Society
World Multioperator Unlimited Combined	RK2FWA	W2PV Memorial - Schenectady ARA
Rocky Mountain Division Single Operator Combined	NN7ZZ (N5LZ, op)	Albuquerque DX Association
Additional CW Plaques		
W/VE Multioperator Single Transmitter	W3BGN	Northern Illinois DX Association
World 21 MHz	P49V	Caribbean Contesting Consortium
Canada Single Operator Low Power	VE1OP	Contest Club Ontario
Japan Single Operator Low Power	JA2AXB	Western Washington DX Club

W/VE, national, overall, divisional or call area category leaders that are not listed may purchase their plaque by contacting the ARRL Contest Department at 860-594-0232 or by e-mail at **contest@arrl.org**. The cost is $67 (US) and includes shipping.

DX Continental or Country leaders may purchase their un-sponsored plaque by contacting the Contest Department as shown above. Plaques shipped to non-US locations may be charged an additional shipping fee depending on the type of shipping service desired.

W1GHZ

MICROWAVELENGTHS

Frequency Mixers

At microwave frequencies, tunable oscillators are not very stable, and even sharp filters are several MHz wide and not easily tuned. During the First World War, Major E. H. Armstrong developed the superheterodyne receiver, which converts signals at high frequencies to a fixed intermediate frequency (IF) where filters and amplifiers are manageable. At that time, a wavelength of 200 meters was high frequency, but the same techniques apply at microwaves — we convert the microwave frequency down to an IF frequency where tuning and filtering is more manageable. The device that does the conversion is a *mixer*, sometimes called a frequency changer in the UK.

The function of a mixer is to mix two signals together — the desired signal, and a local oscillator (LO) — to produce the sum and difference of the two frequencies. A filter is required to select the desired product, rejecting the undesired one and the two original frequencies. The difference is usually much lower in frequency, so this is typically the desired product for receiving, while the sum is higher and usually used to produce a microwave signal for transmitting. The undesired product is often referred to as the image; if we looked with a spectrum analyzer, its shape would be a mirror image of the desired signal. A common LO can be used for transmitting and receiving, allowing a transceiver at the IF frequency to transmit and receive on the same microwave frequency. Sometimes one mixer is used for both transmit and receive.

A simple multiplier makes an "ideal" mixer. In block diagrams, mixers are represented as shown in Figure 1, a circle with a multiply sign in the middle. The mixer takes two inputs and multiplies them together to form the output signal. As you may remember from high school trigonometry, if we multiply two sine waves together, we get two new waves:

$$A\sin(f_1) \bullet B\sin(f_2) = \frac{AB}{2}[\sin(f_1 + f_2) - \sin(f_1 - f_2)]$$

One of the new waves is at a frequency that is the sum of the two input frequencies, and the other is at the difference of the two input frequencies. Also note that for an ideal mixer, half of the total input power is distributed to each of the new sine saves; in a real mixer, it is somewhat less. The difference is called conversion loss.

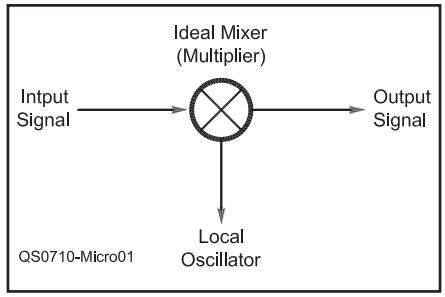

Figure 1 — Symbol for mixer.

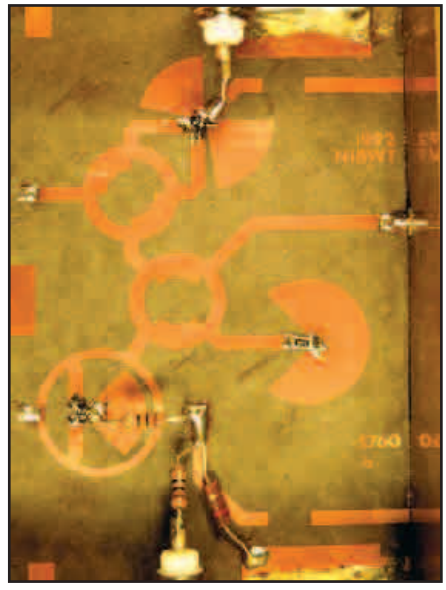

Figure 2 — Balanced mixer for 1296 MHz.

A mixer must be a non-linear device, since a linear device by definition does not change the frequencies of signals, only amplitude and phase. A good mixer must be very nonlinear; transistors, FETs, and even vacuum tubes can be biased to be nonlinear, but diodes are best for mixers. To make them really nonlinear, the LO signal is used to switch the diode on and off — the diode conducts (ON) for the positive half of the sine wave and is reversed-biased (OFF) for the negative half of the sine wave. Since the diode has a barrier voltage (~0.6 V for silicon diodes) before it conducts, the LO amplitude must be larger than the barrier voltage. Schottky diodes, also called hot-carrier diodes, are preferred for microwave mixers since they have lower capacitance and lower barrier voltage, so that less LO power is required. They perform better and are much more consistent than the old point-contact diodes (1N21, 1N23, etc) found in surplus equipment.

Generating enough LO power for good mixer operation has always been the biggest problem in microwave equipment — inadequate LO power to switch the diodes results in much higher conversion loss. Older designs used waveguide or elaborate cavity structures which made it difficult to match the impedance of the diode at all three frequencies for good power transfer. Since Schottky diodes are inexpensive and consistent, most mixers today use multiple diodes in balanced mixers, structures that provide multiple ports for the different signals. Balanced mixers combine two or more non-ideal multipliers so that some

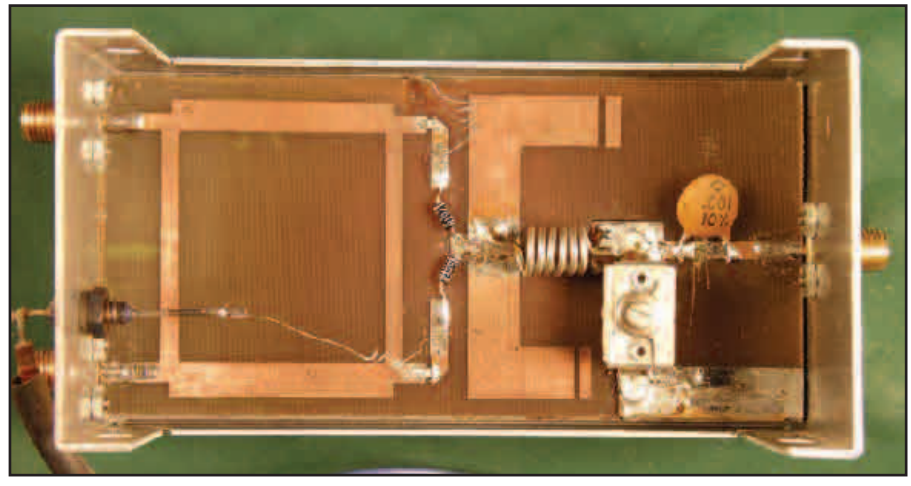

Figure 3 — Dual balanced mixer for 1296 MHz.

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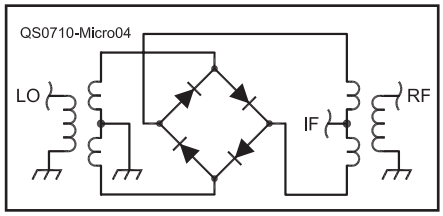

Figure 4 — Schematic of double-balanced mixer.

of the unwanted frequencies are cancelled in the output.

A simple balanced mixer for 1296 MHz from my first *QST* article, in September 1973, is shown in Figure 2. This uses two diodes and a quadrature-hybrid coupler on ordinary printed-circuit board material. The coupler has four legs, each ¼ λ long. The wide legs have 35 Ω characteristic impedance, while the narrow legs are 50 Ω. The LO is applied at one input and the 1296 MHz signal at the other. The lengths and impedances result, with a bit more trigonometry, in the two diodes operating out-of-phase, so one is OFF when the other is ON, for balanced operation. The IF connection is made at the center point of the two diodes, and ¼ λ stubs filter the RF and LO frequencies. Since LO power was still difficult in 1973, a small dc bias through the diodes helps the mixer to operate at reduced LO power.

The quadrature-hybrid balanced mixer makes a very good downconverter, for receiving, but does not work as an upconverter, for transmitting. In my single-board transverter for 5760 MHz, described in *QEX*, November 1997, I used a round quadrature-hybrid balanced mixer for receiving and a "rat-race" balanced mixer for transmitting; both are shown in Figure 3. A Teflon-based printed circuit board is used to reduce losses at the higher frequency. The rat-race coupler at the bottom is a 70 Ω line, ¾ λ in circumference, with ports spaced at ¼ λ intervals. Radial stubs are used as broadband IF filters in both mixers, while pipe-cap filters are used in both RF paths and for the LO. In the center, another quadrature-hybrid coupler is used as a power splitter for the LO; by 1997, cheap MMIC amplifiers made LO power easier.

Commercial mixers are usually double-balanced mixers, using tiny toroid balun transformers for broadband operation. A schematic is shown in Figure 4. These are available at reasonable cost up to a few GHz. They are packaged surface-mount packages for microwave applications and in relay cans for lower frequencies. A good source is Mini-Circuits (**www.minicircuits.com**). Some varieties of these are shown in Figure 5, as well as some mixers with coax connectors. The latter are much more expensive, but occasionally found as surplus. A few of these will work as high as 24 GHz; Figure 6 shows the minuscule components inside one marked "2-18" that has about 14 dB conversion loss at 24 GHz. It appears to use tiny printed baluns instead of toroid transformers. Of course, you could also homebrew a double-balanced mixer using toroids or other baluns.

How much LO power is adequate? Many commercial mixers are specified as needing +7 dBm, or about 5 mW. Curves in the data sheets suggest that having less than about half this power will degrade performance, while having too much can damage the mixer.

The homebrew mixers require similar LO levels. The signal power, for transmitting, should be about 1 mW, or 0 dBm, maximum.

With proper LO drive and good impedance termination on all ports, a good mixer may have conversion loss as low as about 7 dB. Impedance termination is important for good intermod performance as well as loss. Since the mixer is nonlinear, it also generates harmonics of all the frequencies, and mixes these together as well, producing many potential intermod products. Unless signals are very strong, these unwanted products are very small, but their amplitude increases quickly at high signal levels. If mixer loss is not critical — anywhere that gain is cheap — a small attenuator, perhaps 3 dB, makes a good termination without excessive loss.

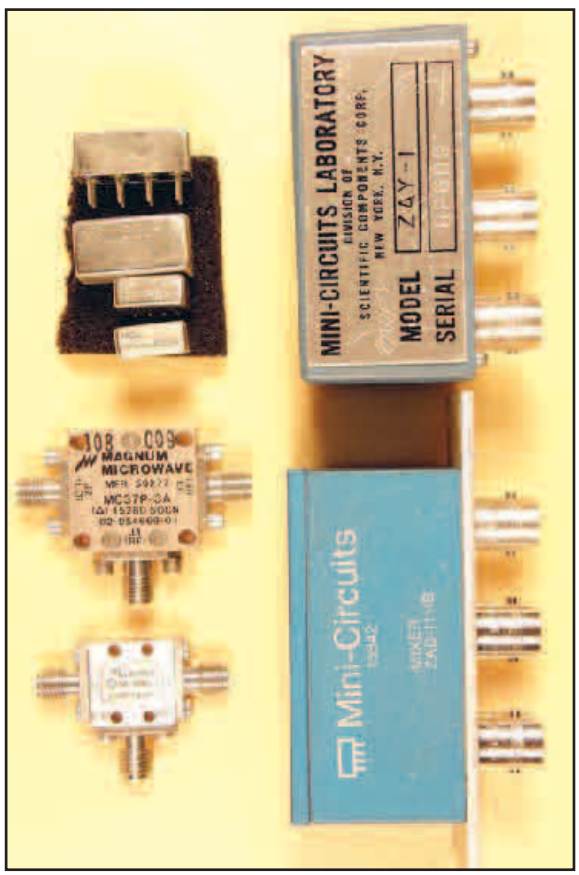

Figure 5 — Some commercial double-balanced mixers.

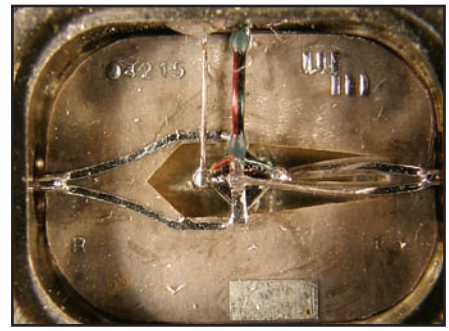

FIgure 6 — Interior of double-balanced mixer usable at 24 GHz.

Filtering is also important. When transmitting, we don't want to radiate unwanted frequencies; even if they are within the ham band, amplifying them wastes power that could go into the desired signal. We also want to keep unwanted signals out of our receiver. The worst unwanted signal is just noise — there is just as much noise power at the image frequency as at the signal frequency. Unless we filter out the image frequency, our noise figure will be greater than 3 dB, no matter how good a preamp we use.

At microwave frequencies, we rarely have to contend with the strong in-band signals that one might find in a contest environment at VHF or lower. High-level mixers are available, requiring +17 dBm or +23 dBm of LO power, to handle proportionately higher signal levels. Since +23 dBm is ¼ W, more than some microwave transmitters, these are overkill for most microwave stations.

At the higher microwave frequencies, harmonic mixers are sometimes used. Two diodes connected anti-parallel (head-to-tail) generate the second harmonic of the LO and act as the mixer. Above 24 GHz, amplifiers are rare, so it is easier to generate more power at half the LO frequency than enough power at the LO frequency. Harmonic mixers are also used at higher (even) harmonics for even higher frequencies, even hundreds of GHz; conversion loss increases at the higher harmonics, but there aren't a lot of other choices.

Another Microwave Beginners Workshop

Another Microwave Beginners Workshop, like the recent one described in the last Microwavelengths, is planned for Microwave Update in Valley Forge, Pennsylvania, in October. See **www.microwaveupdate.org** for details.

WB8IMY

ECLECTIC TECHNOLOGY

Design a Wearable Power Supply and Win $1 Million

Believe it or not, some soldiers on the ground in Iraq or Afghanistan carry as much as 40 pounds worth of batteries to power various electronic devices — radios, computers, night vision equipment, etc. The Department of Defense wants to lighten this load, ideally to less than 9 pounds.

They've decided to open the "wearable power supply" design challenge to the public at large, not just to defense contractors. That means that you, or you and a group of friends, can compete with the big boys. The DoD is offering a $1 million prize for first place, $500,000 for second place and $250,000 for third place.

They will award prizes to the top three teams or individuals in a final competitive demonstration planned for fall 2008. You'll have to demonstrate your wearable power system prototype under "realistic conditions," which I hope doesn't include live fire!

To be in the running for the top prizes, your power system must produce 20 W average power *continuously* for 96 hours while weighing less than 4 kilograms. This is a stiff requirement, but DoD officials believe that someone out there has the inventiveness to meet the challenge.

If you think you have what it takes to enter the competition, you can obtain registration information online at **www.dod.mil/ddre/prize/**. Registration opens October 8 (about the time you receive this issue of *QST*) and closes November 30. Good luck!

Digital Explorations

Amateur Radio will endure as long as we have people willing to ask "what if…?" or "why?" Simple curiosity drives much of what we do.

Ed Sack, W3RNG, was curious to know how well some HF digital modes performed under marginal conditions. He devised a low-power test setup in his condo using a transmitting station comprised of an ICOM IC-706 MkII transceiver set at minimum output and a Hamstick mobile antenna. An ICOM IC-R10 handheld receiver and a laptop functioned as the digital receiver. Ed's condo is constructed with steel studs behind the drywall, so he placed the equipment in separate

rooms, taking advantage of the "built-in" shielding to further degrade the signal.

Using the free *MultiPSK* software (**f6cte.free.fr/index_anglais.htm**) and a long text macro, Ed tested various modes and recorded the resulting S/N ratios (as displayed in *MultiPSK*) and the percentage of text that arrived intact.

The results below represent average performance figures…

Mode	*S/N (dB)*	*Percentage of Text Received Intact*
MFSK 16	–1	95
Domino EX	–7	85
BPSK 31	–9	80
PSKFEC31	–11	75
THROBX	–11	70
Olivia	–19	20
THROB	–11	10
RTTY 45	–5	5

MFSK16 and Domino EX were the clear winners in Ed's tests, although I was somewhat surprised that Olivia didn't turn in a better performance.

Regardless of what you may think of Ed's methodology or the results, I'm impressed by the fact that he devoted time and resources to at least partially satisfy his curiosity (Ed's experiments are continuing). This is the real spirit of Amateur Radio.

Close, but No Cigar

In my column in the August 2007 *QST* I mentioned that a group of companies, which included Microsoft and Google, had delivered a mysterious wireless Internet device to the FCC for testing. The companies want to exploit spectrum that will be vacated as TV stations make the transition from analog to digital. They say the unlicensed and unused TV airwaves, also known as "white spaces," would make wireless Internet service accessible and affordable, especially in rural areas.

Well, it looks like they are going to have to go back to the drawing board. In August the FCC stated that the device failed to perform as expected. According to the FCC announcement, the prototype failed to adequately detect and respond to the presence of other signals to avoid interference on shared frequencies.

Edmond Thomas, who represents the technology coalition, said the companies are convinced the spectrum can be used without causing interference to other users. He said that their prototype was malfunctioning and that they would work with the FCC to resolve the issues.

Xonar D2 Sound Card

If you're following the development of amateur Software Defined Radio, you probably know that a good sound card is critical for good performance. M-Audio's Delta 44 has been the gold standard for a while, but there is a new contender in the high-end sound card market: the ASUS Xonar D2.

The ASUS Xonar D2 sound card.

The Xonar D2 is a 7.1-channel audio card retailing for just under $200. I haven't played with the card yet myself, but ASUS is claiming a signal-to-noise ratio (SNR) of 118 dB for both audio in and out. The Xonar D2 is also packed with multiple sound technologies from Dolby and DTS. This card wasn't available when *QST* did its sound-card Product Review roundup in the May 2007 issue, but we'll likely include it in a future roundup. QST

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

SILENT KEYS

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

WA1F **Reed**, Frank A., Hudson, NH
♦ K1GOX **Highland**, Raymond L., Westerly, RI
KG1S **Joubert**, Ronald A., Springfield, MA
KD2CV **Maxwell**, Donald E., Syracuse, NY
NX2II **Halliday**, James W., Englewood, FL
W2ONV **Salerno**, Sareno "Bill" J., Saddle Brook, NJ
♦ W2OZA **Robinson**, Richard J., Yonkers, NY
WB2SMT **Dimiceli**, Charles Jr, Hackettstown, NJ
W2WB **Sushko**, Sergiy, Morgan Hill, CA
K3CHB **Blouch**, Charles H., Temple, PA
N4BES **Sweatman**, Brian, Largo, FL
W4BZZ **Allen**, John D. Jr, Knoxville, TN
KI4EBP **Lear**, Jimmy W., White Plains, KY
K4EF **Brown**, Everett S., Crestwood, KY
KP4FKO **Escribano**, Jose, Round Rock, TX
KI4GRH **Baker**, William E., Madisonville, KY
N4GTC **Coleman**, Michael C., Alameda, CA
K4HQR **Speier**, Lamar P., Loveland, CO
N4IT **Justice**, Olive C., Pikeville, KY
W4LIT **Young**, Eugene H., Fairfield, OH
K4MIQ **Huffman**, William A., Cave City, KY
W4NME **Harvey**, Bobby D., Decatur, AL
W4RRN **Simms**, June E., Henderson, KY
KJ4SO **Winstead**, William W., Raleigh, NC
W4SVY **Cranford**, William A., Acworth, GA
KA4TSH **Miranda**, Alfonso, Miami Springs, FL
♦ N4UH **Elwell**, Henry G. Jr, Cleveland, NC
K4VTR **Ward**, Lewin C., Glasgow, KY
W4WZA **House**, Donald B., Port Charlotte, FL
KB4YIV **Williams**, Robert L., Valdese, NC
AD4YN **Connelly**, William P., Miami, FL
N4YSI **Roberson**, Daniel C., Glen Allen, VA
KG5GB **Henderson**, Robert D. Sr, Albuquerque, NM
W5LAJ **Battishill**, Dean, Silver City, NM
W5MUK **Nereson**, Norris G., Los Alamos, NM
WB5PZT **Johnson**, Gardner, Las Vegas, NM
W5QLI **Simon**, John R., Houston, TX
W5QPW **Santilli**, Alcide, Albuquerque, NM
K5RWX **Whitman**, Rick D., Edmond, OK
W5USD **Wood**, Gerald E., Trinity, TX
W5VRH **Segrest**, Ralph H., Athens, AL
N5VTE **Coffman**, Ladonna, Fort Smith, AR
N5VXY **Trout**, Jodie L., Las Cruces, NM
KE5XX **Zellers**, Lawrence A., Weatherford, TX
N5YYD **Kennedy**, Jerry D., Albuquerque, NM
W6ALT **Doyel**, Walter J., Porterville, CA
K6BCL **Keller**, Dwain A., Coulterville, CA
KE6CZ **Payne**, Gary R., Fresno, CA
♦ W6ESJ **Walden**, James E., Santa Rosa, CA
KH6GR **Stahl**, Noel C., Gorham, NH
KE6HLT **Farrell**, Joseph L., Anaheim, CA
WA6JPB **Herron**, William E., Lower Lake, CA
WQ6M **Anderson**, Robert C., West Point, CA
W6NCL **Ginn**, Norman R., Albuquerque, NM
WA6NVN **Botimer**, Laurence W., Ooltewah, TN
W6PWQ **Reed**, Frank A. Jr, Langlois, OR
WA6RDX **Womack**, Cecil R., Fresno, CA
W6REZ **Kiramidjian**, Ludwig Jr, San Francisco, CA
W6TVP **Hoffman**, John S., El Dorado, CA
N6ZZ **Goetz**, Philip J., Alto, NM
N7CIF **Gohm**, Virginia A., Olympia, WA
N7GGC **Aries**, Henry L., Everett, WA
AC7HR **Hendrickson**, Samuel L., Lopez Island, WA
♦ W7LCF **McCoy**, James A., Casper, WY
WA7MDL **Hoffart**, Leo N., Bozeman, MT
WB7OHW **Straley**, Charles E., Renton, WA
W7OPF **Carter**, Alan F., Friday Harbor, WA
WX7T **Schumacher**, E. R., Mercer Island, WA
KA7UJA **Pietras**, Edmund S., Bremerton, WA
W7VQQ **Turk**, Frederic L., Mohave Valley, AZ
AA7YJ **Sullivan**, William A., Spokane, WA
N7YQD **Casassa**, Wilfred J., Everett, WA
N8BFA **Kaylor**, Jeanne A., Marcellus, MI
W8BHL **Cooper**, Alden M., Oregon, OH
KA8CBO **Unger**, Maurice C., New Carlisle, OH
KB8LYA **Briggs**, Fred, Royal Oak, MI
♦ W8YIQ **Niedermeier**, Stanley F., Newport, MI
K8ZFD **Vascek**, Louis J., Bedford, OH
K9ALS **Van Dynhoven**, Alan R., Appleton, WI
KB9CIK **Schroll**, Allen A., Springfield, IL
KA9FEL **Selvig**, Walter K., McHenry, IL
KC9IFJ **Templin**, Carl E., Middleton, WI
W9PIL **Spade**, Jacob M., Indianapolis, IN
K9PUJ **Weil**, Louis H., Cincinnati, OH
K9RJN **Hickman**, John E., Belleville, IL
K9RON **Warczynski**, Ronald J., Merriweather, MI
K9SGD **Hall**, Joseph N., Sparta, IL
N9WNT **Eggers**, Conrad C., Little Chute, WI
KA9ZOJ **Knox**, Robert A., Palos Hills, IL
WØBMT **Hoofer**, Fred, Neligh, NE
NØFYT **Ferguson**, Edward C., Gering, NE
ex-KAØHPQ **Roche**, Gregory A., Manhattan, KS
KBØIT **Michael**, Lloyd L., Weston, MO
WØJP **Klehfoth**, Warren G., Cedar Rapids, IA
WØKHG **Ogden**, William A., Saint Paul, MN
♦ WBØRPA **Joybubbles**, Minneapolis, MN
KØSIA **Moe**, Larry R., Marion, IA
WAØTTX **Anderson**, Cecil, Nebraska City, NE
KBØTZO **Smith**, Ronald W., Cortez, CO
WØZKN **Feissle**, Bernard A., Saint Louis, MO
VE1RH **Hann**, Reginald G., Halifax, NS, Canada
VE2IKO **Narbey**, Roger, Laval, QC, Canada

♦ 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

Strays

I would like to get in touch with...

◊other Amateur Radio operators working for Verizon Wireless interested in starting an HF net and expanding our Internet mailing list. Verizon employees can either reach me by e-mail, Richard Garcia out of Charlotte, North Carolina or by going to **finance.groups.yahoo.com/group/vzhams/**. When joining via the list please provide your full name and job location so we can verify via the address book. — *Rich Garcia, K4GPS*

READ ANY GOOD *LETTERS* RECENTLY?

◊If not, you may not be subscribed to *The ARRL Letter*, your weekly source of reliable and up to date news and information. Sign up and it will be e-mailed to you 50 times a year. Best of all, there's no cost to subscribe for ARRL members.

To subscribe, click on the Member Data page under Members Only on the ARRLWeb (**www.arrl.org**), and then click MODIFY MEMBERSHIP DATA. You'll see the box to check for *The ARRL Letter* (and a host of other free membership benefits).

If you'd like to see *The Letter* but prefer not to subscribe, you can find it on our Web site (**www.arrl.org/arrlletter/**). The ARRLWeb also offers archived copies going back to the first electronic edition, distributed in January 1996.

Several other sites also offer *The ARRL Letter*, among them the QTH.net listserver (**mailman.qth.net/mailman/listinfo/letter-list**) and two recently formed newsgroups, **rec.radio.amateur.moderated** and **rec.radio.info**.

New Products

MFJ MOBILE "SHORTY" SCREWDRIVER ANTENNA

◊ MFJ's "Shorty" Automatic Screwdriver Antenna is rated to cover 3.5 to 54 MHz and handle up to 200 W PEP. The MFJ-1672 uses a 16 inch tall base and 32 inch whip and weighs only 1.9 pounds. It can be used with mounts such as the MFJ-336T magnetic mount (shown in the photo but not included with the antenna). The MFJ-1672 comes in black only. A manual control box, 20 feet of control cable, ferrite decoupling core and a ⅜-24 threaded stud for attachment to your mount are included. Price: MFJ-1672 antenna, $399.95; MFJ-336T magnet mount, $34.95. To order or for your nearest dealer, call 800-647-1800 or see **www.mfjenterprises.com**.

STORM-PREP ONLINE WEATHER COURSE

◊ Storm-Prep offers an online self-study course titled "Anticipating, Recognizing, and Preparing For Deadly Weather." This course demonstrates how to recognize the potential for deadly weather using readily available online radar imagery, satellite imagery and other weather data, as well as sky clues. The course focuses on tornadoes, large hail, damaging winds, floods, lightning, hurricanes and tropical storms, winter storms, dense fog and extreme heat and cold. Registration fee for the course is $39. More information can be found at **www.storm-prep.com**.

75, 50, AND 25 YEARS AGO

November 1932

• The cover photo shows a ham soldering a connection on the simple crystal-controlled transmitter described in this issue.

• The editorial reports on the Madrid conference, and the fact that "…the general amateur regulations have been adopted almost identically as they exist at present…."

• George Grammer, W1DF, tells about "Building a Crystal-Controlled Transmitter" that can be replicated by any beginner. The article is complete with information on possible antenna systems.

• R. B. Parmeter, chief operator at HQ station W1MK, describes "An All-Wave Midget Receiver" that covers the 12 to 4500 meter wavelengths.

• Fred Schnell, W9UZ, discusses "Efficiency in the Output Amplifier," telling how to increase your antenna power.

• Howard Anderson, W1BVS, tells us how to build "A Sure-Fire Condenser Microphone."

• Don Mix, W1TS, describes some simple methods of protection for the amateur station, in "A Lesson from the Commercials."

• "The Single-Signal Receiver at Work" praises the S.S. receiver. R. B. Parmeter, W1MK, discusses "Traffic Handling with the S.S. Receiver," and Don Lusk, W3ZF, reports on "The Single-Signal Super in Another Dress."

November 1957

• The cover photo shows a large array of choice DX QSL cards, while red overprint announces "Late Info on Satellite Sputnik!"

• The editorial reports on call-letter automobile tags. At press time, 42 states and provinces, plus the Canal Zone, were issuing ham tags.

• Ray Rinaudo, W6KEV, describes his "Compact AB_1 Kilowatt" that's built around an Eimac 4XC1000A tetrode.

• An item in "Strays" notes that amateur observations of radio propagation are requested during the forthcoming atomic bomb tests at the Nevada Proving Grounds.

• "Project Moonbeam," by W. H. Pickering, tells how hams can help with radio and tracking observations of the US satellite that will be launched during the International Geophysical Year.

• Vern Chambers, W1JEQ, takes a "New Approach to Mobile Converter Construction," changing bands by using plug-in coil assemblies housed in small Miniboxes.

• "Artificial Earth Satellites," by V. Vakhnin (reprinted from the U.S.S.R. publication, *Radio*), is quite timely, in view of the new Soviet satellite *Sputnik I*.

• Confident that Morse code will last forever, Lew McCoy, W1ICP, tells us "How to Adjust a Key — And Send Good Code."

• Gordon Beeman, W9RCS, describes his homebrew tilt-over antenna support, which he calls a "Beam Support for Old Men."

• "Recent Equipment" tells about "The New Drake 1-A Sideband Receiver," a considerable departure from previous commercially built receivers for the ham.

November 1982

• The cover photo shows the tent and tower of a Field Day site on Angel Island, in San Francisco Bay.

• The editorial discusses the growing clamor for a no-code ham license and concludes that "a no-code license is an idea whose time has *not* come."

• Dale Clift, WA3NLO, reports that " 'RFI Bill' Becomes Law; Amateur Radio Benefits!" The photo in the article shows President Ronald Reagan with Senator Barry Goldwater, K7UGA.

• Bob Sutherland, W6PO, and Bill Orr, W6SAI, present "A High-Power Cavity Amplifier for the New 900-MHz Band."

• Doug DeMaw, W1FB, tells about "The 8P6 Special — 'Hamcation' Backup Rig" for 20 meters.

• Herb Ley, Jr, N3CDR, describes his "HR-1680 Receiver Modifications — Try Them!"

• Richard Schellenbach, W1JF, tells how to build "The JF Array," a simple yet effective antenna for 80, 40 and 15 meters.

• Phil Chapman, W6HCS, Paul Chapman and Alvin Lewison present Part 2 of "Amateur Use of Solar Electric Power," a discussion of the required battery systems.

• Fred Brown, W6HPH, tells how to make accurate "Antenna Gain Measurements" without a professional antenna range.

• In a "Strays" story, Elliot Kleiman, WA4YDK, tells how he "Worked All States, Bicycle Mobile."

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

MARYLAND-DC SECTION DIGITAL CONVENTION

November 11, Washington, DC

S

The Maryland-DC Section Digital Convention, sponsored by the Foundation for Amateur Radio, will be held at the Armed Forces Retirement Home, Rock Creek Church Rd at Upshur St NW. Doors are open 10 AM-5 PM. Features include FAR Conference on digital technology and its impact on Amateur Radio practice and policy; digital mode presentations; panel discussion of digital modes and issues with moderated questions from the audience; special guest speaker from ARRL Hq, Steve Ford, WB8IMY, Production and Editorial Manager; Atlantic Division survey results and their implications; selected proceedings and related materials; lunch provided. Talk-in on 146.46. Admission is $15 (advance registration only). Contact Jim Cross, WI3N, 16013 Dorset Rd, Laurel, MD 20707; 301-725-6829; **wi3n@arrl.org**; **www.arrl-mdc.net**.

INDIANA STATE CONVENTION

November 17-18, Fort Wayne

F D V S

The Indiana State Convention (35th Annual Fort Wayne Hamfest and Computer Expo), sponsored by the Allen County AR Technical Society, will be held at the Allen County War Memorial Coliseum, 4000 Parnell Ave. Doors are open for setup on Friday evening and Saturday morning; public Saturday 9 AM-4 PM, Sunday 9 AM-3 PM. Features include 892 commercial and flea market tables; new and used radio, computer, and general electronics items; vendors; several international ham equipment manufacturers; many forums and meetings; VE sessions (Saturday); parking ($4). Talk-in on 146.88. Admission is $6 for both days or $4 for just Sunday (at the door only); under 12 free when accompanied by an adult. Tables are $25 (advance reservations required; no table sales at the door). Send SASE to AC-ARTS/Fort Wayne Hamfest, Box 10342, Fort Wayne, IN 46851-0342; or contact James Boyer, KB9IH, 260-579-2196; **chairman@fortwaynehamfest.com**; **www.fortwaynehamfest.com**.

October 13-14
Florida State, Melbourne*

October 14
Western New York Section, Buffalo*

October 18-20
Microwave Update, King of Prussia, PA*

October 19-21
Pacific Division, San Ramon, CA*

November 3-4
Georgia Section, Lawrenceville*

November 10
Alabama Section, Montgomery*
Midwest Division, Lebanon, MO*

*See October *QST* for details.

WEST CENTRAL FLORIDA SECTION CONVENTION

December 1-2, Palmetto

F D H V S

The West Central Florida Section Convention (32nd Annual Tampa Bay Hamfest), sponsored by the Florida Gulf Coast AR Council, will be held at the Manatee Civic Center, US 301 and Haben Blvd. Doors are open Saturday 8 AM-5 PM, Sunday 9 AM-2 PM. Features include large electronics flea market, paved tailgating ($15 per space for the entire weekend; opens Saturday at 7 AM, Sunday at 8 AM; **tailgate@fgcarc.org**), commercial exhibit booths ($175 each; **commercial_booths@fgcarc.org**), vendors, forums and programs, VE sessions (9-11 AM and 11:30 AM-1:30 PM, both days in the Palma Sola Room, $14 fee; walk-ins accepted but pre-registration is suggested for Sunday sessions; **mfdxa.ve@gmail.com**), ARECC Testing (Saturday only, 3-4 PM in the Palma Sola Room; $10 fee per exam), card checking (DXCC, WAS, VUCC), handicapped accessible, free parking. Talk-in on 145.19, 146.955 (100 Hz). Admission is $6 in advance, $8 at the door (good all weekend). Tables are $20 each for the weekend, plus admission (electricity available for $32 for the weekend; Lou Mallow, AG4OD, **tables@fgcarc.org**). Contact Jim Schilling, KG4JSZ, c/o FGCARC, Box 22042, Tampa, FL 33622-2042; 863-422-0176; **kg4jsz@arrl.net**; **www.tampabayhamfest.org**.

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

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 **November 1** to be listed in the **January** issue. Hamfest information is accurate as of our deadline; contact sponsor for possible late changes. 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.

Alabama (Headland) — Oct 20 F V
8 AM-2 PM. *Spr:* Wiregrass ARC. Headland Town Square, AL Rte 134. Tailgating, VE sessions. *TI:* 145.43. *Adm:* Free. Tables: $5. James Nelson, KE4GWW, 415 Gwaltney Dr, Dothan, AL 36303; 334-685-1642; **ke4gww@arrl.net**; **www.wb4zpi.org**.

Arizona (Mesa) — Dec 1 F H V S

6 AM-2 PM. *Spr:* Superstition ARC. Miracopa Community College, 1833 W Southern (at corner of Dobson Rd). Ham Swap, tailgating, seminars, VE sessions, handicapped accessible, refreshments. *TI:* 147.12 (162.2 Hz). *Adm:* Free. Tables: $10 (per outdoor space). Ron McKee, AJ7T, 773 W Tumbleweed Rd, Gilbert, AZ 85233; 480-539-5596 or 480-510-3025; **aj7t@cox.net**; **wb7tjd.org**.

Connecticut (Waterford) — Oct 27 V
Set up 8:30 AM; auction 10 AM-2:30 PM. *Spr:* Tri City ARC. Oswegatchie School, 470 Boston Post Rd. Amateur Radio Equipment Auction, VE sessions. *TI:* 147.06. *Adm:* $2. Darryl Del Grosso, WA1DD, 13 Linda Ave, Waterford, CT 06385; 860-443-7799; **ddelgrosso@townnorthstonington.com**; or Tom, WA2RYV, 860-464-6555.

DC (Washington) — Nov 11, Maryland-DC Section Digital Convention. See "Coming Conventions."

Florida (Coral Gables) — Nov 17. Bill Moore, WA4TEJ, 305-264-4465; **wa4tej@juno.com**; **www.FlamingoNet.8m.net**.

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

Florida (Ocala) — Dec 8 F D V
8 AM-3 PM. *Spr:* Silver Springs RC. Marion County Extension Complex, 2232 NE Jacksonville Rd. Flea market, commercial vendors, VE sessions. *TI:* 146.61 (123 Hz). *Adm:* advance $2, door $3. Tables: $7. Ron Toller, N4US, 8115 SW 76th Ave, Ocala, FL 34476-6961; 352-861-8769; **rtoller1@cfl.rr.com**; **www.qsl.net/ssrc/**.

Florida (Okeechobee) — Nov 24 F
8 AM-4 PM. *Spr:* Okeechobee ARC. Freedom Ranch, 11655 SR 441/98 SE (**alphaminis-tries.org/citw/freedom_ranch_map**). Tailgating. *TI:* 147.09 (100 Hz). *Adm:* $5. Tables: $5 (inside). Harry Robbins, KF4KDO, Box 368, Okeechobee, FL 34973; 863-467-7454; fax 863-467-0516; **redbirds@strato.net**; **www.k4oke.com**.

Florida (Palmetto) — Dec 1-2, West Central Florida Section Convention. See "Coming Conventions."

Illinois (Carthage) — Dec 8 V
8 AM-noon. *Sprs:* Big Bend ARC and Hancock County ESDA. U of I Extension Center at 4-H Fairgrounds, 600 N Madison (Rte 94 N). On-site VE sessions (10 AM). *TI:* 147.105 (103.5 Hz), 146.52. *Adm:* $4. Tables: advance $10 (by Nov 30), $15 (after Dec 1). Brian Dougherty, N9BLD, 740 Miller St, Carthage, IL 62321; 309-333-1657; fax 217-357-6004; **n9xeg@mchsi.com**; **www.react2u.com/bbarc.htm**.

Illinois (Litchfield) — Nov 11. Scott Millick, K9SM, 217-324-2412; **smillick@wamusa.com** (Banquet/Swap).

Indiana (Evansville) — Nov 24 F V
8 AM-1 PM. *Sprs:* EARS and The Ham Station. Vanderburgh County 4-H Fairgrounds Auditorium, 201 E Boonville-New Harmony Rd. 16th Annual Hamfest, pre-hamfest breakfast, free tailgating (weather permitting), VE sessions, lunch. *TI:* 145.15, 146.925, 443.925, (107.2 Hz on all frequencies); backup 145.11. *Adm:* $7. Tables: advance $10 (if paid by Nov 15), $12 (after Nov 15). Neil Rapp, WB9VPG, 2744 Pinehurst Dr, Bloomington, IN 47403; 812-333-4116; **ears@w9ear.org**; **w9ear.org/hamfest.htm**.

Indiana (Fort Wayne) — Nov 17-18, Indiana State Convention. See "Coming Conventions."

Indiana (Napoleon) — Oct 21, Deb Vierling, N9TMH, 812-934-5853; **dvierlin6@verizon.net**; **www.146805.com**.

Iowa (Davenport) — Nov 4 F H V
8 AM-2 PM. *Spr:* Davenport RAC. Clarion Hotel (formerly the Holiday Inn), 5202 N Brady St (Hwy 61 N). 36th Annual Hamfest/Computer Show, VE sessions, free parking, handicapped accessible, refreshments. *TI:* 146.88. *Adm:* advance $6, door $7. Tables: $12. Bill Bolton, WBØBBM, 28755 Utica Ridge Rd, Long Grove, IA 52756; 563-285-4324; **wb0bbm@arrl.net**; **www.arcsupport.com/drac/hamfest.html**.

Massachusetts (Buzzards Bay) — Nov 10 F
9 AM-1 PM. *Spr:* Falmouth ARA. Upper Cape Cod Regional Vocational Technical School, 220 Sandwich Rd. Electronics flea market, displays, VE sessions. *TI:* 146.655 (88.5 Hz). *Adm:* $5. Tables: $10. Ralph Swenson, N1YHS, PO Box 815, W Falmouth, MA 02574; 508-548-0422 (phone and fax); **depsher911@comcast.net**; **www.falara.org**.

Michigan (Harrison Township) — Dec 2 F V
8 AM-noon. *Spr:* L'Anse Creuse ARC. L'Anse Creuse High School, 38495 L'Anse Creuse Rd. 35th Annual Amateur Radio/Computer Swap and Shop, VE sessions, refreshments. *TI:* 147.08 (100 Hz). *Adm:* $5. Tables: $12. Marty Folz, K8HVI, 40360 Ryan Rd, Sterling Heights, MI 48310; 586-268-0544; **k8hvi@arrl.net**; **www.n8lc.org**.

North Carolina (Benson) — Nov 18 F V
8 AM-4 PM. *Spr:* Johnston ARS. American Legion, 605 N Wall St. 20th Annual "JARSFEST," tailgating, inside tables, VE sessions, refreshments. *TI:* 147.27. *Adm:* advance $4, door $5. Tables: $10. Bill Lambert, AK4H, 8917 NC 50 N, Benson, NC 27504; 919-894-3352; fax 919-894-3219; **blambert1@mindspring.com**; **www.jars.net**.

North Carolina (Gastonia) — Dec 1 F
8 AM-noon. *Spr:* Gastonia Area ARC. Gastonia Farmer's Market, 410 E Long Ave. Swapfest. *TI:* 146.805. *Adm:* $5. Tables: $5. Paul Williams, K4PJW, 703 McAdenville Rd, Lowell, NC 28098-1621; 704-200-0450; fax 704-810-3149; **arrl@k4pjw.net**; **www.gaarc.com**.

Oregon (Rickreall) — Oct 27 F V
9 AM-3 PM. *Spr:* Mid-Valley ARES. Polk County Fairgrounds, 520 S Pacific Hwy W. "Swaptoberfest," ARES meetings, VE sessions (Friday eve, Oct 26). *TI:* 146.86 (186.2 Hz). *Adm:* advance $6, door $8. Tables: $20. Chris Portal, AD7GT, Box 603, Dallas, OR 97338; 503-559-7837; fax 503-623-2395; **ad7gt@arrl.net**; **www.swaptoberfest.net**.

Tennessee (Rockwood) — Nov 17 F V S
7 AM-1 PM. *Spr:* Roane County ARC. National Guard Armory, 111 S Hewitt Ave. 2nd Annual Hamfest, ARES/EOC and other seminars, VE sessions. *TI:* 147.015 (110.9 Hz). *Adm:* $5. Tables: $10. Kati Segar, Box 1104, Kingston, TN 37763; 865-354-4311; fax 865-354-5120; **katisegar@hughes.net**; **www.ke4rx.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**.

Promoting your event is guaranteed to increase attendance. As an approved event sponsor, you are entitled to special discounted rates on *QST* display advertising and *ARRL-Web* banner advertising. Call the ARRL Advertising Desk at 860-594-0207, or e-mail **ads@arrl.org**.

New Products

1500 W AUTOMATIC ANTENNA TUNER FROM MFJ

♢ The MFJ-998 automatic antenna tuner is rated for 1500 W on SSB and CW with a tuning range of 12 to 1600 Ω. Memories store tuner settings at various frequencies. When you key your transmitter, the tuner checks to see if that frequency has been used before and returns to the last stored settings. If not, the '998 measures the impedance and switches in the necessary components and then fine-tunes the SWR. When used with a transceiver interface cable, the MFJ-998 first bypasses any in-line amplifier and initiates a low-power CW tuning carrier from your transceiver while the tuner is finding a match. A protection circuit also disables the amplifier key line if SWR exceeds a preset value. The MFJ-998 has two coax connectors and a binding post for end-fed wire antennas. For balanced line antennas, an external MFJ-912 1.5 kW 4:1 balun is required. Firmware is field upgradeable via a serial port. Automatic bypassing is available when excessive tuning power is applied. Power requirement: 10-15 V dc at 1.3 A. Price: MFJ-998 tuner, $699.95; MFJ-912 balun, $59.95. To order or for your nearest dealer, call 800-647-1800 or see **www.mfjenterprises.com**.

AT THE FOUNDATION

Two New Foundation Scholarships

As the opening of the application period of ARRL Foundation Scholarships nears, the Foundation is pleased to announce the addition of two new scholarships that will be awarded for the first time in 2008.

The David W. Misek, N8NPX Memorial Scholarship, endowed through the generosity of Nancy Makley, administrator of the David W. Misek Estate, honors a resident of Xenia, Ohio, and long-time ARRL Life Member. Misek was a strong advocate of Amateur Radio education as highlighted by his many years of teaching licensing classes, mentoring new hams and actively participating in public service activities. His lifelong dedication to Amateur Radio was dedicated to building awareness of Amateur Radio and introducing the magic to new hams. Beginning in 2008, the Misek Scholarship will award a $1500 scholarship to a current resident of Greene, Montgomery, Champaign, Darke, Preble, Miami, Clark, Butler or Warren County in Ohio.

The Scholarship of the Morris Radio Club of New Jersey is endowed by a $31,671 gift from the Morris Radio Club. Starting in 2008 a $1000 award will be made to a qualified candidate without regard to geographic area or course of study. Led by the efforts of Trustee Ron Levy, K2CD, the Morris Radio Club presented the gift to the ARRL Foundation at the Sussex Hamfest in New Jersey. Attending the presentation were Hudson Division Director and Foundation Trustee Frank Fallon, N2FF; Vice Director Joyce Birmingham, KA2ANF, and Chief Development Officer and Foundation Secretary Mary Hobart, K1MMH.

The Morris Radio Club donated $31,000 to the ARRL Foundation to fund an annual scholarship. MRC members (from left) Bill Loftus, WA2VQF; Henry Patterson, K2DEU; Ron Levy, K2CO, and Noel Scheffen, NO2EL, along with ARRL Hudson Division Director Frank Fallon, N2FF, and Vice Director Joyce Birmingham, KA2ANF, were on hand to present the check to ARRL Chief Development Officer Mary Hobart, K1MMH (third from right).

Important note: the Application period for the 2008 ARRL Foundation Scholarships opens October 1, 2007 and closes promptly on February 1, 2008. Applicants must arrange for current transcripts as part of the application process. All information including application instructions and forms can be found only on the Web at **www.arrl.org/arrlf/scholgen**.

Mary M. Hobart, K1MMH ♦ Secretary, ARRL Foundation Inc ♦ mhobart@arrl.org

SPECIAL EVENTS

Contact these stations and help commemorate history. Many provide a special QSL card or certificate!

Oct 13, 1200Z-2359Z, Fort Wayne, IN. Anthony Wayne Area Council, BSA, K2BSA/9. 90th Anniversary of the Anthony Wayne Area Council. 14.290 7.190. QSL. Joel Pelz, 2699 E 225 S, Warsaw, IN 46580. **kc9atj@arrl.net**

Oct 13, 1330Z-2030Z, Yorktown, VA. Williamsburg Area Amateur Radio Club, K4RC. Special Event related to Yorktown Battlefield, VA. 18.15 14.25 7.261. QSL. Russell Chandler, KU4RP, 132 Druid Dr, Williamsburg, VA 23185. *Certificate for working three WAARC special events, including Jamestown, Colonial Williamsburg and Yorktown*. **www.qsl.net/waarc**

Oct 20, 1400Z-1800Z, Norman, OK. University of Oklahoma Amateur Radio Club, W5TC. 2007 National Weather Festival. 28.350 21.270 14.225 7.175. QSL. OU Amateur Radio Club, c/o Judson Ahern, 100 E Boyd St, Room 810, Norman, OK 73019. **ouarc.ou.edu**

Oct 20-Oct 21, 1600Z-0500Z, Woodland, CA. Yolo District Boy Scouts, W6Y. Jamboree on the Air, 100th Anniversary of World Scouting. 14.290 7.190 IRLP 5750 Echolink 107315. QSL. Bill Ragsdale, K6KN, PO Box 1500, Woodland, CA 95776. **yolobsa.editme.com/JOTA**

Oct 20-Nov 3, 1200Z-2300Z, Honeoye, NY. Ontario County (NY) RACES, K2S. Space Shuttle Mission STS-120 commanded by Col Pam Melroy. 18.155 14.265 7.265. QSL. Norm Schrader, 6009 Pine Haven Ln, Honeoye, NY 14471. **wb2ggm@yahoo.com**

Oct 26-Oct 28, 2300Z-2000Z, Concepcion, Chile. Concepcion Radio Club, XR5JA. Faro Punta Hualpen Chi 070 Activation. 14.240 7.080 3.720. QSL. QSL Manager CE5COX/CE5PZS, Radio Club de Concepción, PO Box 2545, Concepción, Chile. **okean@vtr.net**

Oct 27-Oct 28, 1400Z-2200Z, Duncan, OK. Chisholm Trail Amateur Radio Club and North Texas Weather Group, WD5IYF. 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.ntwg.org** & **www.wd5iyf.org**

Oct 27-Oct 28, 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**

Oct 31-Nov 1, 0500Z-0500Z, Frankenstein, MO. Warrensburg Amateur Radio Club, WØO. Frankenstein FunXpedition 2007. 28.370 21.378 14.65 7.255 3.945. QSL. Dennis Gedeon, KBØNHW, 1811 Hillside Ct, Oak Grove, MO 64075. **www.waarci.org**

Maty Weinberg, KB1EIB ♦ Special Events ♦ events@arrl.org

Oct 31-Nov 1, 1800Z-1400Z, Frankenstein, MO. Mid-MO Amateur Radio Club, WØO. Frankenstein FunXpedition 2007. 21.040 14.040 10.113 7.040 3.540. QSL. (100% direct) Tom Hammond, NØSS, 5417 Scruggs Station Rd, Lohman, MO 65053. **www.mmccs.com/mmarc**

Nov 1-Nov 5, 1700Z-1700Z, Whitefish Point, MI. Stu Rockafellow Amateur Radio Society, N8F & K8F. Remembering the *Edmund Fitzgerald*. 18.160 14.260 7.260 3.860. Certificate. Richard Barker, 264 N East St, Brighton, MI 48116. **www.qsl.net/w8njh**

Nov 2-Nov 5, 2100Z-1900Z, Split Rock, MN. Stillwater Amateur Radio Association, WØJH. Stations operating at Split Rock Lighthouse (ARLHS USA 783). 21.360 14.260 7.260 3.860. Certificate. Shel Mann, NØDRX, 1618 West Pine St, Stillwater, MN 55082. *This event also marks the 32nd anniversary of the sinking of the iron ore tanker ship* The Edmund Fitzgerald *on Lake Superior.* **www.radioham.org**

Nov 3, 1400Z-2359Z, Huntington, WV. Tri-State Amateur Radio Association, W8VA. West Virginia Broadcasting Hall of Fame Second Annual Induction Ceremony at the Museum of Radio and Technology. 28.350 14.240 7.240. Certificate. TARA, PO Box 4120, Huntington, WV 25729-4120. **www.qsl.net/tara**

Nov 3, 1500Z-2000Z, Detroit, MI. Livonia Amateur Radio Club, W8F. Commemorating the loss of the *Edmund Fitzgerald*. 10 15 20 40 m (80 m if conditions allow). Certificate. Livonia Amateur Radio Club, PO Box 51532, Livonia, MI 48151-5532. **livoniaarc.5gbfree.com**

Nov 3-Nov 4, 1300Z-0100Z, Muskegon, MI. Muskegon County Emergency Communication Services, K8WNJ. Celebrating the completion of Muskegon County's new ECOMM Center. 146.820 14.267 7.267. Certificate. Muskegon County Sheriff's Dept, Emergency Services Division (MCECS), 1611 Oak Ave, Muskegon, MI 49442. **www.co.muskegon.mi.us/emergencyservices/index.html**

Nov 3-Nov 4, 1600Z-0000Z, Kansas City, MO. Ararat Shrine Amateur Radio Club, WAØNQA. 72nd Annual Ararat Shrine Circus. 14.250. Certificate. Dave Hinkley, 1221 SE 11th St, Lees Summit, MO 64081. **ka0sog@arrl.net**

Nov 4, 1500Z-2000Z, Rocky Point, NY. Radio Central Amateur Radio Club, W2RC. 86th Anniversary of RCA's Radio Central Transmitter Site. 14.270 14.050 7.270 7.050. QSL. RCARC, PO Box 396, Centereach, NY 11720.

Nov 9-Nov 12, 1400Z-2000Z, Arlington Heights, IL. Armored Force Amateur Radio Net, KA9NLX. Veterans Day SE honoring and remembering all veterans. 28.640 21.375 14.325 7.283 7.030 3.985 possibly 2 m. Certificate. John Paskevicz, 1423 North Ridge Ave, Arlington Heights, IL 60004. **jpaskev@aol.com**

Nov 10, 1400Z-2300Z, Guthrie, OK. Edmond Amateur Radio Society, W5G. Oklahoma Centennial Statehood Day at Territorial Capital Building. 21.260 14.260 7.260. Certificate. EARS, PO Box 48, Edmond, OK 73083. **www.k5eok.org**

Nov 10, 1500Z-2200Z, Waterloo, IA. Five Sullivan Brothers Amateur Radio Club, WØFSB. Marine Corps birthday and honoring Greg (Pappy) Boyington. 14.240 7.240. Certificate. Five Sullivan Brothers ARC, 4015 Independence Ave, Waterloo, IA 50703. **t-mc-nulty@msn.com**

Nov 10, 1600Z-2300Z, San Diego, CA. USS *Midway* CV-41 COMEDTRA, NI6IW. Commemorate Veterans Day and Marine Corps Birthday. 14.325 7.260. QSL. USS *Midway* CV-41 Museum, 910 North Harbor Dr, San Diego, CA 92101. **w9bq@aol.com**

Nov 10-Nov 11, 1300Z-2300Z, Scott, LA. Acadiana Amateur Radio Association, W5S. City of Scott Centennial Celebration. 28.360 21.360 14.265 7.260. Certificate. AARA, PO Box 51174, Lafayette, LA 70505-1174. **www.w5ddl.org**

Nov 10-Nov 11, 1900Z-2300Z daily, Glendale, AZ. Thunderbird Amateur Radio Club, K7R. NASCAR Race at Phoenix International Raceway. 28.360 21.360 14.260. QSL. Johnne Ables, W1YB, 16829 N Orchard Hills Dr, Sun City, AZ 85351. **www.w7tbc.org**

Nov 10-Nov 12, 1300Z-2100Z, Iron Mountain, MI. Mich-A-Con Amateur Radio Club, K8V. UP Veterans Memorial atop Pine Mountain, Veterans' Day. 14.280 14.060 7.230 7.060. Certificate. Thomas Martin, 812 West B St, Iron Mountain, MI 49801. **www.qrz.com/k8v**

Nov 10-Nov 25, 0000Z-0000Z, Paris, France. Association des Radioamateurs de Paris, TM8CRI. 80th Birthday of the Conference Radiotelegraphique Internationale. 21.270 14.270 7.070 3.770. Certificate. ARP, 66 Avenue de la Republique, Paris 75011, France. **arp75.free.fr**

Nov 11, 1200Z-2359Z, Nutley, NJ. Robert D. Grant United Labor Amateur Radio Association, N2UL. CQ Veterans' Day, *Freedom is not Free!* 28.420 14.260 449.975. Certificate. RDGULARA, c/o WA2VJA, 112 Prospect St, Nutley, NJ 07110-0716.

Nov 11, 1500Z-2230Z, Baton Rouge, LA. USS *Kidd* Amateur Radio Club, W5KID. Veterans' 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**

Nov 11, 1500Z-2200Z, Waterloo, IA. Five Sullivan Brothers Amateur Radio Club, WØFSB. Veterans' Day and the 65th anniversary of the loss of the 5 Sullivans. 50.140 21.240 14.240 7.240. Certificate. Five Sullivan Brothers ARC, 4015 Independence Ave, Waterloo, IA 50703. **t-mc-nulty@msn.com**

Nov 11-Nov 12, 1300Z-1930Z, Grand Rapids, MI. Michigan Amateur Radio Alliance, W8USA. Veterans' Day from the Grand Rapids Home for Veterans. SSB 21.280 14.290 7.275 CW 14.045 7.045. Certificate and QSL.* MARA Attn: Larry Dells, PO Box 670, Comstock Park, MI 49321-0670. **www.w8usa.org**

Nov 11-Nov 12, 1600Z-0100Z, Santa Cruz, CA. United Veterans' Council of Santa Cruz, K6V. Veterans Day 2007, from the Veterans' Memorial Building. 14.280 7.250. QSL. United Veterans Council, 846 Front St, Santa Cruz, CA 95060.

Nov 16, 1400Z-1700Z, Luther, OK. Luther Amateur Radio Club and Oklahoma City AutoPatch Association, KB2AW. Dedication of Luther Veterans Memorial and Oklahoma's Centennial Day. 14.250. QSL. Dolph H. Grolock Jr, PO Box 305, Luther, OK 73054-0305.

Nov 17, 1400Z-2000Z, Guthrie, OK. Edmond Amateur Radio Society, W5G. Oklahoma Centennial Statehood Day at Territorial Capital Building. 21.260 14.260 7.260. Certificate. EARS, PO Box 48, Edmond, OK 73083. **www.k5eok.org**

Nov 17, 1500Z-2359Z, Paulden, AZ. Yavapai Amateur Radio Club, W7YRC. NRA's birthday, operating as K7NRA from Gunsite Academy. 28.450 21.335 14.250 7.250 147.220+ 162.2 PL. Certificate. Michael Campbell, K7NRA, 404 Lampliter Village, Clarkdale, AZ 86324. **www.w7yrc.org**

Nov 23, 1400Z-2100Z, Provincetown, MA. Marconi Radio Club, W1P. The 109th Anniversary of the sinking of the SS *Portland*. 18.160 14.260 7.260 3.997. QSL. Henry Brown, 19 Sao Paulo Dr, E Falmouth, MA 02536. **k1wcc@arrl.net**

Nov 23-Nov 24, 1500Z-0300Z, Peoria, IL. Peoria Area Amateur Radio Club, W9UVI. 120th Santa Claus Parade, Longest Running Santa Parade in US. 14.260 14.060 7.260 7.040. Certificate. Dave Pearsall, PO Box 3508, Peoria, IL 61612-3508. **www.W9UVI.org**

Nov 24-Nov 25, 0000Z-2359Z, All US call areas. Ten-Ten International, W6OI. Celebrating 45 years and 75,000 members. 28.340 to 28.400 PSK 28.120. QSL. Jack Moore, K5CC, 371 Ridge Creek Ln, Bulverde, TX 78163. *Certificate for working all call areas.* **www.10-10.org**

Nov 24-Nov 25, 1400Z-2300Z, Carnegie, PA. Steel City Amateur Radio Club, W3KWH. Celebrating 50 years in our *new* clubhouse. 21.350 14.250 7.250 3.850. Certificate. Steel City Amateur Radio Club, PO Box 281, Carnegie, PA 15106. *No SASE required.* **www.w3kwh.com**

Nov 24-Dec 9, 0000Z-0000Z, Paris, France. Association des Radioamateurs de Paris, TM8IRC. 80th Birthday of the International Radiotelegraph Convention. 21.270 14.270 7.070 3.770. Certificate. ARP, 66 Avenue de la Republique, Paris 75011, France. **arp75.free.fr**

Nov 24-Nov 25, 1500Z-2000Z daily, The Villages, FL. The Villages Amateur Radio Club, K4VRC. Annual Special Event Station. 146.925 14.280 7.230 3.960. Certificate. Edwin A. Crowell, 1570 St James Cr, The Villages, FL 32162. **www.tvarc.net**

Certificates and QSL cards: To obtain a certificate from any of the special-event stations offering them, send your QSO information along with a 9×12 inch self-addressed, stamped envelope to the address listed in the announcement. To receive a special event QSL card (when offered), be sure to include a self-addressed, stamped business envelope along with your QSL card and QSO information.

***Note:** Some clubs may ask for a nominal fee to cover the cost of the certificate or QSL. Request will be made on air during the event or on the club's Web site.

Special Events Announcements: For items to be listed in this column, 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 **Jan** *QST* would have to be received by **Nov 1**. In addition to being listed in *QST*, your event will be listed on the *ARRLWeb* Special Event page. QST

CONTEST CORRAL

courtesy of the *National Contest Journal*

W1AW Qualifying Runs are 9 AM EST Wednesday, November 7 (1400Z November 7) (35-10 WPM), and 7 PM EST Tuesday, November 20 (0000Z). The K6YR West Coast Qualifying Run will be at 9 PM PST Wednesday, November 14 (0500Z November 15) (10-40 WPM). K9JM serves as alternate. 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 — Multiop, MS — Multiop, Single Transmitter, MM — Multiop, 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**.

Nov 3-4

Can you work all 80 ARRL/RAC sections? A "Clean Sweep" coffee mug looks great on the operating desk! 100 contest QSOs (it's easier than you might think) makes you eligible for the participation pin, too!

ARRL November Sweepstakes — CW, from 2100Z Nov 3-0300Z Nov 5. (Phone from 2100Z Nov 17 to 0300Z Nov 19; see October *QST*, p 102, or **www.arrl.org/contests**.)

North American Collegiate ARC Championship — CW (Phone, Nov 17-19). This is a competition based on Sweepstakes results between club stations at institutions of higher education beyond the high school level. Clubs enter Sweepstakes in any of the valid entry categories. Separate champions will be determined for CW, Phone and Combined scores. For more information: **www.collegiatechampionship.org**.

High Speed Club CW Contest, sponsored by the Radio Telegraphy High Speed Club (HSC) from 0900Z-1100Z and 1500Z-1700Z Nov 4. Frequencies: 80-10 meters, 10-30 kHz above band edge. Categories: SOAB-LP (<150W), SOAB-QRP (<5W), SWL. Exchange: RST + HSC member number or NM. QSO points: HSC member — 5 pts, nonmember — 1 pt. Score: QSO points. For more information: **www.dl3bzz.de**. Logs due 6 weeks after the contest to **hsc-contest@dl3bzz.de** or Lutz Schröer, DL3BZZ, HSC Contest-Manager, Am Niederfeld 6, 35066 Frankenberg/Eder, Germany.

IPA Contest — Phone/CW, sponsored by The International Police Association Radio Club. CW from 0600Z-1000Z and 1400Z-1800Z Nov 3, Phone from 0600Z-1000Z and 1400Z-1800Z Nov 4. Frequencies: 80-10 meters with 15-minute band change rule. Categories: SOAB, MO (includes club and special event stations) and SWL. Exchange RST + serial number (IPARC members send "IPA" + state if US). QSO points: IPARC members — 5 pts, nonmember — 1 pt. Score: QSO points × DXCC entities + US states counted once per band. Multipliers are only counted for QSOs with IPARC members. For more information: **www.ipa-rc.de**. Logs due Dec 31 to **dl8kcg@darc.de** or Uwe Greggersen, DL8KCG, Hurststr 9, D-51645 Gummersbach, Germany.

Ukrainian DX Contest — CW/SSB, sponsored by the Ukrainian Amateur Radio League and the Ukrainian Contest Club from 1200Z Nov 3-1200Z Nov 4. Frequencies: 160-10 meters, with 10-minute band change rule. Categories: SOAB, SOAB-QRP (<5 W), SOSB, MS, SWL. Exchange: RST + serial number or Ukraine oblast). QSO points: same country — 1 pt, same continent — 2 pts, different cont — 3 pts, Ukrainian station — 10 pts. Score: QSO points × DXCC entities + WAE countries + oblasts. For more information: **www.ucc.zp.ua**. Logs due 30 days after the contest to **urdx@ham.kiev.ua** or to Ukrainian Contest Club HQ, PO Box 4850, Zaporizhzhe, 69118, Ukraine.

DARC 10 Meter Digital "Corona" — RTTY/AMTOR/PACTOR/PSK31/Clover, sponsored by Deutscher Amateur Radio Club from 1100Z-1700Z Nov 4. Frequencies (MHz): 28.050-28.150, work stations once per mode. Categories: SO, SWL. Exchange: RST + serial number. QSO points: 1pt/QSO. Score: QSO points × DXCC entities + WAE countries + JA/VE/W call districts (all counted only once). For more information: **www.darc.de/referate/dx/fed.htm**. Logs due 4 weeks after the contest to **dl9gs@darc.de** or A. Schlendermann DL9GS, Postfach 102201, D-44807 Bochum, Germany.

Radio Club of America QSO Party, SSB/AM, from 1700Z Nov 3-0500Z Nov 4. See Web site for frequency schedule. Exchange: RST, QTH, name, equipment used. RCA members sign their calls "/RCA". For more information: **www.radioclubofamerica.org**. Logs and questions to **rlraide@roadrunner.net** or Bob Raide, W2ZM, 2514 E Sherman Hollow Rd, Penn Yan, NY 14527.

Nov 10-11

If Kentucky is missing from your Worked All States or 5-Band WAS totals, this is your chance. County hunters will be on the prowl for contacts with the rare counties mobile stations will activate!

Kentucky QSO Party — CW/Phone, sponsored by the Western KY DX Association from 1400Z Nov 10-0600Z Nov 11. Frequencies: 160-10 meters. Exchange: RS(T) and KY county or S/P/C. QSO points: 160 meters — 2 pts, CW — 2 pts, SSB — 1 pt. Score: QSO points × KY counties (KY stations add states and provinces) counted only once. KY mobiles and portables add 1000 points for each activated county, min 10 QSOs (incl home county). 100 bonus points for a QSO with KY4DXA (once only). For more information: **wkdxa.com/page2.html**. Logs due Dec 31 to Western Kentucky DX Association, PO Box 73, Alvaton, KY 42122.

Japan International DX Contest — Phone, from 0700Z Nov 10-1300Z Nov 11 (see April *QST*, p 97, or **jidx.org)**.

Worked All Europe DX Contest (WAEDC) — RTTY, from 0000Z Nov 10-2359Z Nov 11. Same rules as WAEDC Phone and CW, except everyone works everyone. QTC may only be exchanged between continents (see August *QST*, p 96, or **www.waedc.de**).

OK-OM DX Contest — CW, sponsored by the Czech Radio Club (CRC) from 1200Z Nov 10-1200Z Nov 11. Frequencies: 160-10-meters. Categories: SOAB-HP (>100W), SOSB-HP, SOAB-LP, SOSB-LP, SOAB-QRP (<5W), MS, SWL, packet spotting allowed for all categories. Exchange: RST plus serial number or OK/OM district. QSO points: EU to OK/OM — 1 pt, non-EU to OK/OM — 3 pts. Score: QSO points × OK/OM districts (OK/OM stations use WPX prefixes) counted once per band. For more information: **okomdx.crk.cz**. Logs due Dec 1 to **okomdx@crk.cz** or OK-OM DX Contest, CRK, PO Box 69, 113 27 Praha 1, Czech Republic.

CQ WE (Western Electric) — CW/Phone/Digital, from 1900Z Nov 10-0500Z Nov 12. Frequencies: 160 meters-70 cm (no repeater contacts). Contact as many hams as possible who currently work for, did work for, or are retired from any part of the pre-divestiture "Bell System" or any company created from it. Categories: SOAB (Bell and non-Bell). Exchange: Call, name, Bell location, years of Bell service (non-Bell send ZZ and 1). QSO points: equal to years of service. Score: sum of QSO points × unique location codes worked on each mode. For more information: **cqwe.cboh.org**. Logs due Dec 1 to **cqwe-2007@cboh.org** or Robert Stampfli, KD8WK, 9951 Alliston Dr, Pickerington, OH 43147.

Nov 17-18

Phone Sweepstakes is great for contest Elmering. The multi-operator class (M) lends itself very well to a group of enthusiastic newcomers working together!

ARRL November Sweepstakes — Phone, from 2100Z Nov 17-0300Z Nov 19 (see Nov 3-4).

North American Collegiate ARC Championship — Phone (see Nov 3-4).

LZ DX Contest — CW/SSB, sponsored by the Bulgarian Federation of Radio Amateurs from 1200Z Nov 17-1200Z Nov 18. Frequencies: 80-10-meters with 10 minute mode change rule. Categories: SOAB (CW, Phone, Mixed), SOAB-QRP Mixed, SOSB-Mixed, MS-Mixed, SWL. Exchange: RST + ITU zone or 2-letter LZ district. QSO points: same continent — 1 pt, different cont — 3 pts, LZ station — 10 pts. Score: QSO points × ITU zones + LZ districts counted once per band. For more information: **www.qsl.net/lz1fw/contest**. Logs due 30 days after the contest to **lzdxc@yahoo.com** or BFRA, PO Box 830, 1000 Sofia, Bulgaria.

RSGB 1.8 MHz Contest — CW, from 2100 Nov 17-0100Z Nov 18 (see Feb *QST*, p 101). For more information: **www.rsgbhfcc.org**. Logs due 16 days after the contest to **2nd160.logs@rsgbhfcc.org** or RSGB — G3UFY, 77 Bensham Manor Rd, Thornton Heath, Surrey CR7 7AF, England.

PSK63 QSO Party — sponsored by the European PSK Club from 0000Z to 2400Z Nov 18. Frequencies: 160-10 meters, near PSK calling frequencies. Categories: SOAB, 100 watts max, spotting assistance allowed. Exchange: EPC member number or signal report plus serial number. QSO points: EPC members — 5 pts, otherwise 1 pt. Score: QSO points × EPC numbers from all bands. For more information: **www.eu.srars.org**. Logs due 30 days after the contest to **eudx@scotham.net**.

Nov 24-25

The CW subbands will be filled with Morse from all 40 CQ Zones this weekend. Exchange a signal report and zone to participate in this biggest CW contest of all.

CQ WW DX Contest — CW, from 0000Z Nov 24 to 2400Z Nov 25 (see October *QST*, p 91, or **cqww.com**).

ARRL EME Contest, from 0000Z Nov 24-2400Z Nov 25. Frequencies: 50-1296 MHz (see August *QST*, p 96 or **www.arrl.org/contests**).

H. Ward Silver, NØAX ♦ PO Box 927, Vashon, WA 98070 ♦ n0ax@arrl.org

2007 ARRL 160 Meter Contest Announcement

2200Z November 30 (Friday evening) – 1600Z Dec 2 (Sunday afternoon)

How to participate: An all-CW contest, W/VE stations work any station on 160 meters with activity concentrated below 1875 kHz. DX stations may only work W/VE stations. There are both Single Operator and Multioperator classes. Single-op stations can enter as QRP, Low Power or High Power. If you make use of any packet spotting assistance, you are a Multioperator station.

What to send: W/VE stations, including KL7 and US Pacific or Caribbean islands, give a signal report and their ARRL/RAC section. DX stations give only a signal report. If you are maritime or aeronautical mobile, give your ITU region.

Special interest: Entries are almost always received from all 50 states, which makes it possible to work a 160 meter WAS with some effort and luck. In addition, an average of 20-30 DXCC entities are active, providing a great start to chasing DX on the band.

Quirks: The frequencies 1830 to 1835 kHz (the "DX window") should be used only for long-distance intercontinental QSOs such as W/VE to Europe or South America. JA stations can only operate from 1810 to 1825 kHz and 1907.5 to 1.912.5 kHz.

For Gene Gabry, N9TF, of Mundelein, Illinois the 160 Meter Contest is "the most enjoyable contest of the year."

Rule changes this year: None.

Best reason to participate: "Top Band" is one of the biggest challenges around, but it also provides some of the most satisfying contacts. In the period of declining sunspots, conditions and propagation on 160 meters will continue to improve, making for interesting openings and opportunities.

Relative challenge: Hearing and being heard is a real test for many participants. Good antennas are a strong plus for contacts on 160 meters, but with all the activity, even a small antenna will give surprising results.

Scoring: Contacts with W/VE QSOs count 2 points. W/VE stations count 5 points for each DX QSO. Each ARRL/RAC Section worked is a multiplier. In addition, W/VE stations each DXCC entity worked as an additional multiplier.

How to report your score: You must send in your entry by January 2, 2008. E-mail Cabrillo format logs to **160meters@arrl.org** or send paper logs to 160 Meter Contest, ARRL, 225 Main St, Newington, CT 06111. You may also submit your score via the Web 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)* and other forms and operating aids, 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 envelope with 2 units of postage to 160 Meter Contest Rules, ARRL, 225 Main St, Newington, CT 06111.

For more information: E-mail **contests@arrl.org** or phone 860-594-0232. QST

2007 ARRL 10 Meter Contest Announcement

0000Z Dec 8 – 2359Z Dec 9

How to participate: Any amateur station on 10 meters can be worked and you may contact the same station on both Phone and CW (all phone modes are equivalent). There are both Single Operator and Multioperator classes. As a single-op, you can enter as QRP, Low Power or High Power. Single-ops also choose to operate Phone Only, CW Only, or Both Modes (mixed).

What to say: W/VE stations should give a signal report and your state or, province. DX stations give a signal report and sequential number for the contact. Since everyone can work everyone, even smaller stations can try calling CQ Contest. On phone, be sure to give your full call and use standard phonetics.

Special interest: There are usually a good number of expeditions to DX countries just for the contest. This is also a great time to work on your 5-band Worked All States (**www.arrl.org/awards/#was**), 10 meter specialty awards and DXCC.

Quirks: The District of Columbia counts separately from Maryland in this contest with those stations sending DC. KH6 and KL7 participate as states entities rather than DX entities. Novices and Technicians signing /N or /T count double on CW QSOs. Remember: All stations may only operate 36 out of the 48 hour contest period.

Rule changes this year: None

Best reason to participate: With all US amateurs now having some HF privileges on 10 meters, this is an excellent introduction for newly licensed amateurs to the HF experience. Since we are at the bottom of the sunspot cycle, the band openings will be shorter, limiting available time on the air for many. But this will be a good time to "get your feet wet" and experience some of the fun of HF contesting! Be sure to check the bands frequently — getting on when the band is open in your area may lead to your winning at least your section, even with a modest score. Also, by spending a lot of time on the band, you may experience all the unusual propagation that this nearly-VHF band has to offer; sporadic-E, skew, F-hop or skip, ground-wave, tropospheric — it's all there! Listen for propagation beacons before the contest to get an idea of where the band is open (**www.ten-ten.org/beacons.html**).

At his N Charleston, South Carolina, station, Mel Seyle, W4MEL, operated CW during the 2006 contest.

Relative challenge: This contest at this point in the sunspot cycle requires determination and patience, especially in the higher latitudes. Be sure to listen towards the equator following the sun. There are generally lots of mobile and portable stations, as well. While code speeds will be high at the low end of the band, listen around 28.090 MHz and above for slower CW contacts.

Scoring: CW contacts count four points each. Phone contacts count two points each. Multipliers are US states (and DC), Canadian provinces (and territories), and DXCC entities. Multipliers count once per mode. Your final score equals QSO points times your multiplier total. You count eight points for each Novice or Technician signing /N or /T on CW.

How to report your score: You must send in your entry by January 9, 2008. E-mail Cabrillo format log to **10meter@arrl.org** while paper logs are submitted to 10 Meter Contest, ARRL, 225 Main St, Newington, CT 06111. You may also use the Web applet at **www.b4h.net/cabforms** to report your score.

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, 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 envelope with 2 units of postage to 10 Meter Contest Rules, ARRL, 225 Main St, Newington, CT 06111.

For more information: E-mail **contests@arrl.org** or phone 860-594-0232. QST

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 Comparison of HF Mobile Antenna Designs

1:1 match — Impedance match between an antenna and a transmission line in which the standing wave ratio is 1:1. That condition results in no reflected power at the interface.

Bandwidth — The difference between the highest and lowest frequencies passed in a system.

Q — Measure of quality of a capacitor or inductor. A dimensionless unit that can be calculated by dividing the reactance at a frequency by the resistance, or other loss quantity. Higher Q results in sharper tuning of resonant circuits.

SWR — Standing wave ratio. The ratio of maximum to minimum voltage along a transmission line. A 1:1 SWR means that the load is matched to the line characteristic impedance and there are no standing waves. See **www.arrl.org/tis/info/reflections.html**.

SWR protection circuitry — Many transmitters are designed to drive an antenna system that is matched to 50 Ω. A mismatch will manifest itself as a higher than 1:1 SWR at the transmitter output and can result in higher voltage or current than the transmitter is designed for. To prevent this, many transmitters measure the SWR and reduce power if it is found to be above, typically, 2:1.

Microwavelengths

Balanced mixer — Mixer (or modulator) in which the carrier, also known as local oscillator or LO, signal is cancelled at the output.

dBm — Decibels with respect to a milliwatt. Logarithmic power measure referenced to a milliwatt. 0 dBm is 1 mW, 30 dBm is 1 W and –30 dBm is 1 µW, for example.

Microwaves — Radio signals starting at 1000 MHz (1 GHz, 0.3 meters or 30 cm wavelength), generally considered to extend to the beginning of the millimeter wave region at 30 GHz (10 millimeter wavelength).

Quadrature hybrid — Passive device that provides two versions of a signal with 90° phase difference.

Motorola VHF Micor Radio Modifications — *Part 2*

Amplified microphone — Mic with built in amplifier that can be used to boost the audio level or to drive a low impedance load.

APRS — Automatic position reporting system. System that accepts position data, such as from a GPS receiver, formats special messages for packet radio transmission and forwards them to special nodes.

Base — Element of standard bipolar transistor. A change in the current in the base will result in a larger change in *collector* to *emitter* current. Often (but not always) the input point of a transistor amplifier.

Collector — Element of standard bipolar transistor. Often (but not always) the output point of a transistor amplifier.

DIN type connector — Family of low-level miniature multi-pin audio and control connectors defined by German national standards organization (Deutsches Institut für Normung).

Emitter — Element of standard bipolar transistor. Often (but not always) the common point, between input and output of a transistor amplifier.

Hamfest — A gathering of Amateur Radio operators at an event generally sponsored by a local or regional club. A hamfest often includes a flea market, vendor booths and presentations on topics of interest to amateurs..

Node — A network element with interconnection to multiple other network destinations. In an APRS network, position data are processed at special nodes and made available to interested parties.

Packet radio — Type of data networking system that stores and forwards specially formatted (AX.25 protocol) messages via ad hoc networking.

TNC — Terminal node controller. Dedicated hardware device under firmware control that translates packet digital communication to and from a computer type terminal.

Transmit deviation — Level of transmit frequency change resulting from the audio input to an FM transmitter.

Old Radio

AWA — Antique Wireless Association. An organization dedicated to the preservation of the history of early radio including amateur and commercial radio equipment. They are headquartered near Rochester, New York. They offer a museum open to the public and have an annex with a wonderful collection of early equipment, including some early amateur stations that are on the air. See **www.antiquewireless.org** for more information.

Beehive insulator — Kind of usually ceramic insulator stand-off insulator with a ribbed cross section designed to increase the path length. This resulting in a shape reminiscent of a beehive.

Cathode — Element of a vacuum tube. The cathode is the emitter of electrons that are attracted to the (usually) positive plate or anode element. The cathode is often (but not always) a common point between the input and output of an amplifier.

Grid — Control element of a vacuum tube. The voltage on the grid controls the amount of current that flows from plate (anode) to cathode. The grid is often (but not always) part of the input circuit of an amplifier.

Hamfest — See previous entry.

National HRO — Line of MF and HF receivers developed by the now defunct National Company of Malden, Massachusetts in the early 1930s.

PCB oil — Insulating oil with added polychlorinated biphenyl, a highly toxic persistent organic compound that is a known carcinogenic material. Power line transformers and oil filled capacitors made before PCB was banned in the 1970s should be considered a health hazard unless they can be positively identified as not containing PCBs. These should not be used and should be disposed of in a proper hazardous waste facility.

Plate — Anode of a vacuum tube. The plate is often (but not always) part of the output circuit of an amplifier.

Tuned Grid Tuned Plate — Also TPTG, or TGTP. Vacuum tube variable frequency oscillator circuit in which there are resonant tuned circuits at both grid and plate of the oscillator tube. This was a popular configuration for single tube transmitters before the FCC imposed stability requirements on amateurs in 1929.

Simple Sideband, Another Approach

Analog multiplexer — Device that has a single output and allows electronic selection of one of many inputs.

Balanced modulator — Device that accepts RF carrier wave and audio inputs. The two are multiplied to produce upper and lower sidebands surrounding the RF carrier frequency with the carrier eliminated. Can also be used in opposite direction to recover the audio from an SSB signal in a receiver. It is then called a *product detector*.

BFO/carrier oscillator — Beat frequency or carrier oscillator. Generator of RF signal applied to a balanced modulator or product detector. This oscillator selects the nominal (suppressed) frequency of the transmitted signal.

BJT — Bipolar junction transistor. Three terminal transistor with base, collector and emitter.

Filter method SSB transceiver — Single sideband transceiver that uses a balanced modulator to generate upper and lower sideband signals. One is eliminated by a band pass filter to result in single sideband transmission. The same elements are used to receive and detect a similar signal.

Gilbert Cell IC — A type of mixer consisting of cross coupled differential amplifiers. It provides gain as well as conversion. See **michaelgellis.tripod.com/gilbert.html**.

Negative-positive-zero (NP0) capacitor — Capacitor designed to maintain a stable value in the presence of temperature change. See **en.wikipedia.org/wiki/Capacitor_(component)**.

Product detector — See BALANCED MODULATOR.

PTO — Permeability tuned oscillator. Variable frequency oscillator in which the frequency is changed by moving a tuning slug.

Switching-mode transistor — Transistor designed to operate as an electronically controlled switch — either in on or off state.

Q-dope — Kind of adhesive designed to be applied to coil wound inductors to provide additional insulation and keep turns in place.

Wire-wrap sockets — Socket using a connection method in which a square cross section terminal is tightly wrapped with bare wire to result in a solid, but easily removable connection. QST

[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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*816-901.995 MHz blocked; unblocked versions available to FCC approved users. FM video range for the IC-R3 is 900-1300 MHz & 2250-2450 MHz

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Handles 10 sq.ft. at 50mph
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TWO-IN-ONE CONTROLLER

1 Noise Canceling Controller

- Reduce overload or interference by nulling a strong local signal or noise before it gets to your receiver
- Better and more stable nulling than any other noise canceller on the market
- Peak weak signals hidden under a strong signal on the same frequency
- Null out local AM broadcast stations
- Null out noise from power line arcing, lamp dimmers, motors and consumer electronics

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
- Use for direction finding

Special Features

- Exceptional dynamic range, nearly 1000 times better than nearest competitor
- Phasing is voltage controlled allowing precise resetting of phase
- Phasing rotates more than 360 degrees with smooth control
- Built-in two channel, voltage controlled attenuator system
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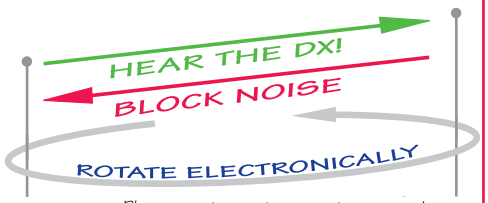
- Works on all modes, 300 kHz to 30 MHz
- Provides power for external active antennas
- Input for mute on transmit

DXE-NCC-1 Noise Canceling/Phasing Controller **$495.00**



Phase any two antennas at any spacing. For optimal results, use identical antennas.

HAM-SWL

Active Receive Antenna

- Now available with relay protection from transmitter overload when used with TVSU-1
- Weak signal sensitivity rivals full size antenna
- Operates from 100 kHz to 30 MHz
- Excellent strong signal handling with +30 dBm output third order intercept
- Easy installation
- Available in vertical or dipole configuration

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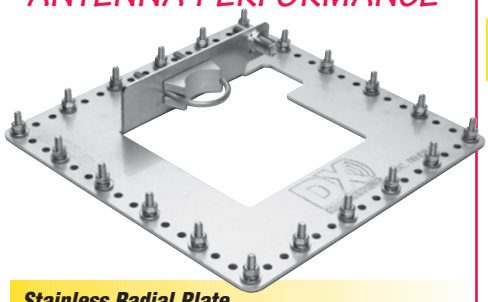

Stainless Radial Plate with Coax Attachment

Makes radial attachment a snap!
- Fits 2" pipe, 4x4 and 6x6 posts
- 0.125" thick 304 stainless steel
- Accommodates up to 120 radials
- Patented high current coax connection to radials

Shown with optional DXE-363-SST and DXE-SAD-200A

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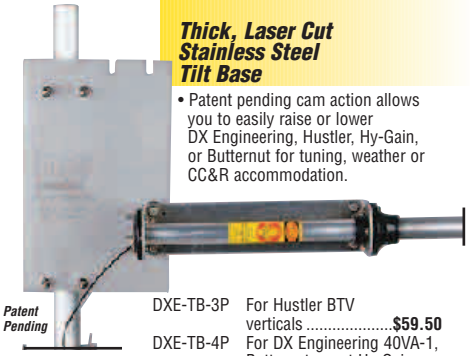
DXE-SAD-200A Saddle Clamp for 2.0" O.D. **$9.30**

ONE MAN TILT OVER



Patent Pending

Thick, Laser Cut Stainless Steel Tilt Base

- Patent pending cam action allows you to easily raise or lower DX Engineering, Hustler, Hy-Gain, or Butternut for tuning, weather or CC&R accommodation.

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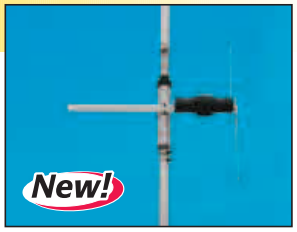

- Full band under 1.5:1 SWR
- Minor adjustments for other bands
- Simple installation
- 500W SSB/CW power rating

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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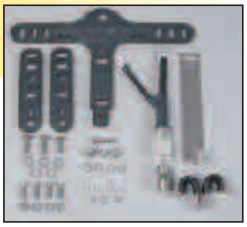
Universal Wire Antenna Hardware Kit



- 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
- Works with DX Engineering's 300 Ω ladder line for both the feed and elements
- 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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- Weatherproof, welded stainless steel housing for best RF shielding
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- Better than 70 dB of port-to-port isolation

RR8-HP-P.....**$375.00**

10 KW Key-Down RF Switch

- Better than 60 dB of port-to-port isolation

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☐ Charge to: ☐ VISA ☐ MasterCard ☐ Amex ☐ Discover

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Our customers have known we were #1 all along. LDG was the first company with the "no questions asked" two-year warranty on our autotuners and all other products, the first company to include all of the cables with our autotuners, and the first company with 3-D memory in our autotuners. LDG autotuners also have the highest resale value of any autotuner on the market today.

To thank you for making ldg the #1 autotuner we are now offering you a FREE balun with the purchase of any LDG Electronics autotuner through January 31st, 2008. What are you waiting for? We have worked hard to offer you the best products in the industry and with a FREE balun you can't go wrong. Call or visit your favorite distributor today!

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

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.

All cables included.

Suggested Price $169

Z-100

"I really like it, its fast and will tune almost anything."

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!

The Z-100 will tune with 0.1 to 125 watts (50 watts on 6 meters), making it an excellent choice for almost any radio or operating style. Backpackers and QRP operators will appreciate the latching relays. Power can be removed from the tuner once you have tuned. Additionally, when the tuner is not tuning, it draws nearly zero amps.

Suggested Price $149

LDG ELECTRONICS Two-Year Warranty

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Visit www.ldgelectronics.com for a list of distributors.

LDG Electronics, Inc.
1445 Parran Road,
St. Leonard, MD 20685
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Fax: 410-586-8475

FREE Balun with Any Autotuner Purchase

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
- Calibration adjustment on the back of the unit; no need to take apart to calibrate
- Backlight brightness adjustment on the back so you can set the backlight to your desired level

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!

RCA-14 is a breakout box for the accessory jacks on most popular transceivers. It comes with cables with the right DIN plugs, and all the outputs are RCA jacks. You simply plug the RCA-14 into your radio's accessory jacks, and all your ports are right there at your fingertips; just plug and play, one function or all of them, makes no difference.

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.

Suggested Price $59

"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**

LDG ELECTRONICS Two-Year Warranty

IC-7800 Owners – Your Eye-Strain Problems Solved

Your beautiful IC-7800 deserves the best; add LDG's new DM-7800 dual meter system, and you're in the picture like never before. The DM-7800 is made exclusively for the IC-7800; order yours today. **List Price $179.**

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Purchase any LDG Electronics autotuner between September 1st, 2007 and January 31st, 2008 and you will receive a free LDG Balun ($30 value) through the mail.

Visit www.ldgelectronics.com for your rebate form or write to: 1445 Parran Rd. St. Leonard, MD 20685 USA. Limit one rebate per address.

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Multi-DC 12 Volt DC Distribution Box **$49**

IC-V82 2M HT

- TX: 144-148 • RX: 136-174 • Power: 7W
- Memories: 200 • D-Star upgradable with optional UT-118

$119.99 after mail in Rebate

IC-U82 440 MHz HT

- TX: 420-450 • RX: 400-479 MHz • Power: 5W
- Memories: 200 • D-Star upgradable with optional UT-118

$119.99 after mail in Rebate

IC-2820H 2M/440 FM Dual Bander

- TX: 144-148, 430-450 MHz • RX: 118-549.95, 810-990.990 MHz (cell blkd)
- Power: 50/15/5W • Memories: 522 • Supports diversity reception in the 127, 136, 146, 375, 440 and 500 MHz bands (two antennas required)
- Packet ready (9600 BPS – 6-pin DIN) • Upgradable D-Star DV (digital voice) & GPS capabilities with the optional UT-123

$649.99

CONTROL HEAD

ID-1 1.2 GHz D-Star Data/Voice & FM Mobile

- TX: 1240-1300 MHz • RX: 1240-1300 MHz • Power: 10/1W
- Memories: 105 • D-Star 128 kbps Data & 4.8 kbps Voice

$979.99 after mail in Rebate

IC-7000

Multi Band Multimode Mobile

- TX: HF/6M/2M/440 MHz
- RX: 0.03-199, 400-470 MHz
- Power: 100W (HF/6M), 50W (2M), 35W (440 MHz)
- Memories: 503 • 2.5 inch color screen • 41 bandwidths with sharp or soft filter shape

$1299.99 after instant Coupon, free RMK-7000

IC-91A Dual Band HT

- TX: 144-148, 420-450 MHz • RX: 0.495-999 MHz (cell blkd)
- Power: 5/0.5W • Memories: 1304
- D-Star upgradable with optional UT-121

$329.99

IC-91AD D-Star Ready Dual Band HT

- IC-91A with UT-121 D-Star Unit installed

$449.99

IC-2200H 2M FM Mobile

- TX: 144-148 MHz • RX: 118-174 MHz • Power: 65/25/10/5W
- Memories: 207 • D-Star upgradable with optional UT-118

$139.99 after mail in Rebate

ID-800 2M/440 Analog/Digital Dual Bander

- TX: 144-148, 440-450 • RX: 118-173, 230-549, 810-999 MHz
- Power: 55/15/5W (2M), 50/15/5W (440 MHz) • Memories: 512
- D-Star Digital Ready • Includes Seperation kit hardware

$559.99 after instant Coupon & mail in Rebate

D-Star Repeater Modules:

ID-RP2C - Repeater Controller (control up to 4 modules) **$1459.99**

ID-RP2D - 1.2 GHz Data • RX & TX 1240-1300 MHz • Output 9-12W (high)/0.5-1.2W (low) • Communication speed: 128 kbps **$1112.99**

ID-RP2V - 1.2 GHz Voice • RX & TX 1240-1300 MHz • Output 6-12W (high)/0.5-1.2W (low) • Communication speed: 4.8 kbps **$1559.99**

ID-RP2000V - 2M Voice • RX & TX 144-148 MHz • Output 23-30W (high)/2-3W (low) • TX speed: 4.8 kbps (voice 2400 bps, FEC 1200 bps, data 952 bps) **$1399.99**

ID-RP4000V - 440 MHz Voice • 440-450 MHz • Output 23-30W (high)/2-3W (low) • TX speed: 4.8 kbps (voice 2400 bps, FEC 1200 bps, data 952 bps) **$1399.99**

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VX-170 2M HT

• TX: 144-148 • RX: 136-174 • Power: 5W
• Memories: 200

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VX-170

VX-3R

VX-3R Ultra Compact Dual Band HT

• TX: 144-148, 430-450 • RX: 0.5-999 (cell blkd) • Power: 1.5W (2M), 1W (440 MHz) • Memories: 1286 • Sub-RX feature allows listening to AM or FM radio stations while monitoring a HAM frequency and talk on instantly by pressing the PTT button.

$179.99

VX-6R Dual Band HT

• TX: 144-148, 222-225, 430-450 • RX: 0.5-999 (cell blkd)
• Power: 5/2.5/1/0.3W (1.5/1/0.5/0.2W on 220)
• Memories: 900 • Submersible 3 feet for 30 minutes

$249.99

VX-6R

FT-2800M 2M FM Mobile

• TX: 144-148 • RX: 137-174
• Power: 65/25/10/5W • Memories: 221

$139.99 after instant ©oupon

FT-7800R 2M/440 FM Mobile

• TX: 144-148, 430-450 MHz • RX: 108-520, 700-999 MHz (cell blkd) • Power: 50/20/10/5W (2M), 40/20/10/5W (440 MHz) • Memories: 1055

$249.99 after instant ©oupon, free YSK-7800

(FT-8900R shown)

FT-8800R 2M/440 FM Mobile

• TX: 144-148, 430-450 MHz • RX: 108-520, 700-999 MHz (cell blkd)
• Power: 50/20/10/5W (2M), 35/20/10/5W (440 MHz)
• Memories: 1000 • Crossband repeat

$374.99 free YSK-8900

FT-8900R 10/6/2M/440 Quad Band FM Mobile

• TX: 28-29.7, 50-54, 144-148, 430-450 MHz • RX: 28-29.7, 50-54, 108-180, 320-480, 700-999 MHz (cell blkd) • Power: 50/20/10/5W (10/6/2M), 35/20/10/5W (440 MHz) • Memories: 800 • Crossband repeat

$424.99 free YSK-8900

FTM-10R 2M/440 FM Dual Bander

• TX: 144-148, 430-450
• RX: 0.5-1.8, 76-222, 300-999 (cell blkd) • Power: 50/20/5W (2M), 40/20/5W (440 MHz)
• Memories: 500 • Sub-RX feature allows listening to AM or FM radio stations while monitoring a HAM frequency and talk on instantly by pressing the PTT button • Microphone & PTT button are built-into the waterproof front panel • Bluetooth capable

$379.99

FTM-10SR Smaller & Lower Power FM Dual Bander

• Sames as FTM-10R except RF output is 10W (2M), 7W (440 MHz) • Body and Front Panel are waterproof • Body is smaller

$379.99

FT-450 100W HF/6M Portable/Base

• TX: HF/6M • RX: 0.03-56 MHz • Power: 10-100W • Memories: 500
• IF DSP Technology • Selectable AGC, IF width & shift, contour, digital noise reduction, manual notch filter and clarifier • Optional internal Auto Antenna Tuner (ATU-450)

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FT-450AT

• Sames as FT-450 except ATU-450 Auto Antenna Tuner is installed

$969.99 after instant ©oupon

FT-2000 100W HF/6M Base

• TX: HF/6M • RX: 0.03-60 MHz • Power: 10-100W • Memories: 99
• Auto Antenna Tuner • 32-bit Floating Point DSP • Dual In-Band Receive
• External display port with optional DMU-2000 unit for viewing RF, Audio and Oscilloscopes • Internal Power Supply

$2469.99 after instant ©oupon

FT-2000D 200W HF/6M Base

• Sames as FT-2000 except RF output is 200W and power supply is external

$3099.99 after instant ©oupon

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- **DJ-V17T** 144 MHz HT
- **DJ-V27T** 222 MHz HT
- **DJ-V47T** 440 MHz HT

These powerful HTs make perfect companions for outdoor activities like fishing, camping or snow-sports.

The rugged polycarbonate materials are compatible to IPX7 so these HTs are submersible 1m/3ft. for 30 minutes! And unlike water-resistant radios you may have looked at before, the DJ-V17, DJ-V27 and DJ-V47 all have a large 40mm internal speaker so the audio is clean and crisp, not muffled. You can enjoy 500mW max audio-output, new two-touch repeater access, and over 200 memories. A special battery-drain function helps avoid battery memory-effect. Other features include an ergonomic design, ultra-flexible antenna with SMA connector, 39 CTCSS settings, split function, two-level attenuator and more. Whatever your idea of outdoor fun, Alinco's DJ-V17, DJ-V27 and DJ-V47 are ready to take on the challenges of rain, dirt and dust and come back for more.

Actual Size

- New, two-touch repeater access
- High grade waterproof materials compatible to IPX7 (submersible 1m/3ft. for 30 min.)
- Rugged polycarbonate body resists dirt, dust and moisture
- Large 40mm internal speaker for great audio!
- Highly visible backlit alphanumeric display
- Direct frequency input through illuminated keypad
- 200 Memories, plus one call channel and one repeater access parameter memory
- VFO, Memory and Scan modes
- Ultra-flexible antenna with SMA connector avoids breakage
- 39 CTCSS tone squelch (encode+decode) settings
- Tone burst function (1,000, 1450, 1750 and 2100Hz)
- Battery-drain function avoids memory-effect
- Cloning feature
- Ni-MH standard also uses optional Lithium-ion and NiMH battery packs or AA dry cell case
- SMA antenna port
- 2-level attenuator
- Waterproof single mic/speaker jack

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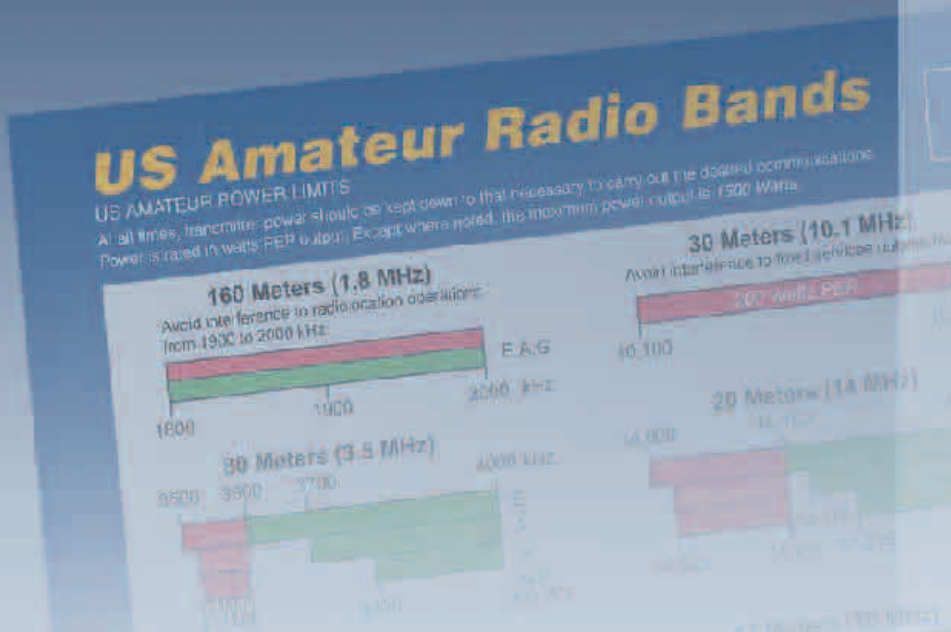

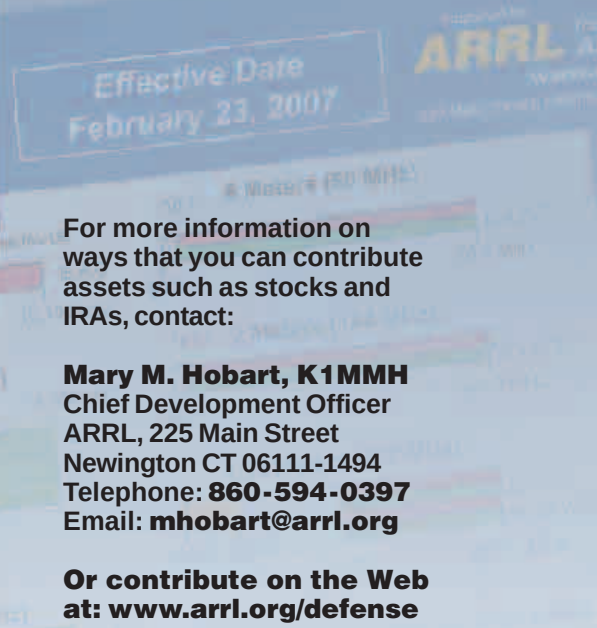

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EDC21 *Wall charger for EBP10N*	4.95
EDC22 *Wall charger for EBP12N*	4.95
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EJ12U *Tone Squelch unit for F1/F4*	9.95
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Yaesu Discontinued Items

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XF117CN *300hz CW filter for FT100*	69.95
XF455C *CW Filter for FT102*	59.00

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VX3R

The new ultra-compact VX-3R 2m/70cm FM HT Transceiver is loaded with convenience features. In addition to top quality performance on 2m and 70cm, you will also be able to enjoy stereo FM and improved AM broadcast band reception with our new Internal Bar Antenna. And *"When All Else Fails"* and local power service is not available to power your charger, you can now operate using "AA" batteries with our optional battery case 1.9" X 3.2" X .9" 4.6 ounces. Tough where it counts - Aluminum Die-Cast Chassis. Supplied with Tiny Super-thin, Lithium-ion High-Capacity Battery and Charger. Internal Bar Antenna for AM Broadcast Band Reception. Listen to AM or FM Broadcast while Monitoring an Amateur Frequency .

FTM10R

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FT450

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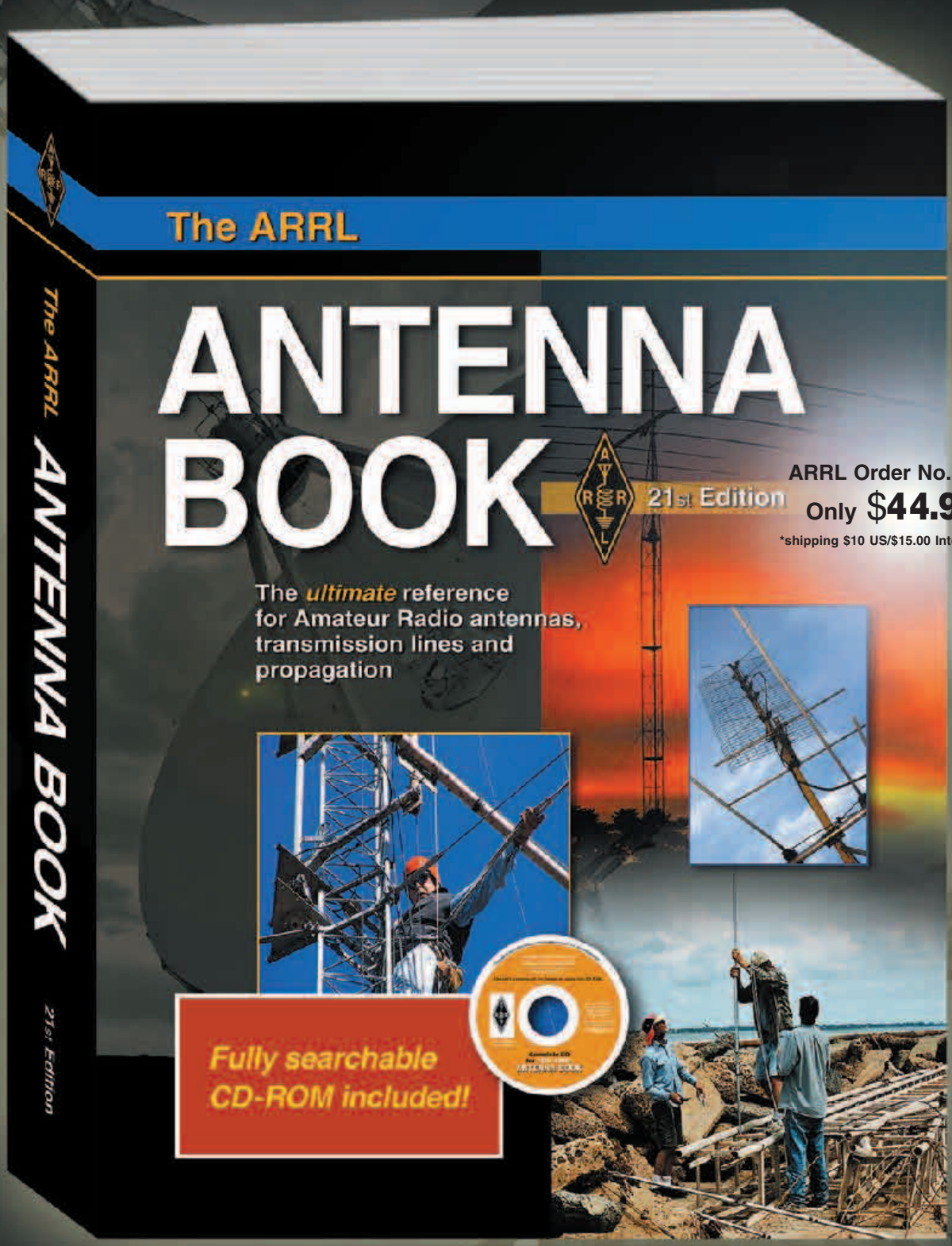

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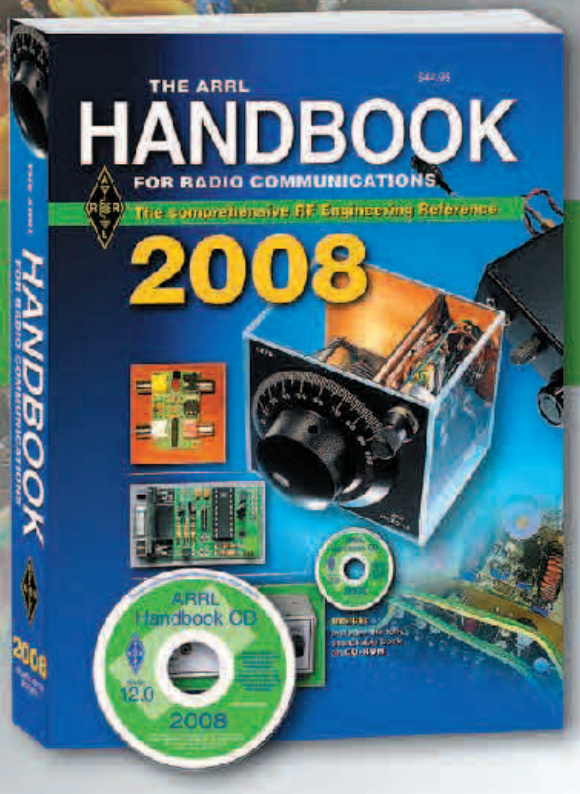

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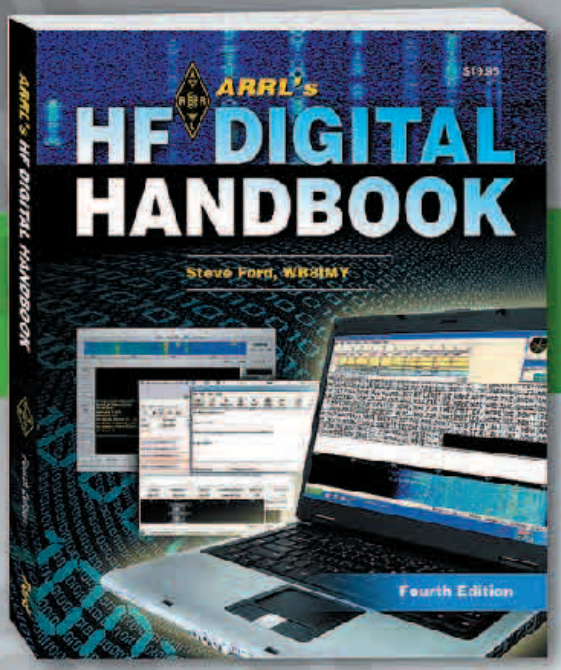

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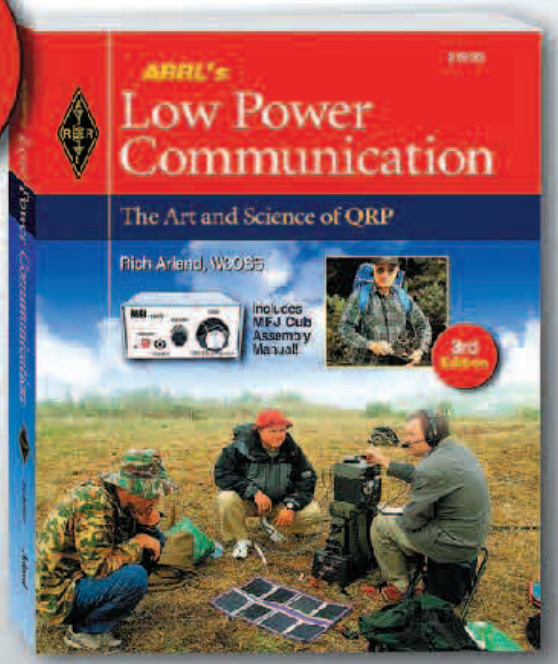

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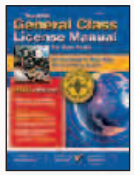

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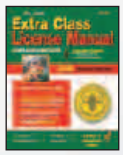

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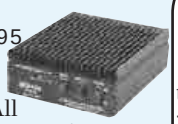

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New, Improved MFJ-989D 1500 Watt *legal limit* Antenna Tuner

World's most popular 1500 Watt Legal Limit Tuner just got better -- much better -- gives you more for your money!

New, improved MFJ-989D *legal limit* antenna tuner gives you better efficiency, lower losses and a new *true* peak reading meter. It easily handles *full* 1500 Watts SSB/CW, 1.8 to 30 MHz, including MARS/WARC bands.

New dual 500 pF *air variable capacitors* give you twice the capacitance for more efficient operation on 160 and 80 Meters.

New, improved *AirCore*™ *Roller Inductor* gives you lower losses, higher Q and handles more power more efficiently.

New *TrueActive*™ peak reading Cross-Needle *SWR/Wattmeter* lets you read *true* peak power on all modes.

MFJ-989D $389.95

New high voltage *current balun* lets you tune balanced lines at high power with no worries.

New *crank knob* lets you reset your roller inductor quickly, smoothly and accurately.

New larger 2-inch diameter *capacitor knobs* with easy-to-see dials make tuning much easier.

New cabinet maintains components' high-Q. Generous air vents keep components cool. $12^{7}/_{8}$Wx6Hx$11^{5}/_{8}$D inches.

Includes six position ceramic antenna switch, 50 Ohm dummy load, indestructible multi-color Lexan front panel with detailed logging scales and legends.

The MFJ-989D uses the superb time-tested T-Network. It has the widest matching range and is the easiest to use of all matching networks. Now with MFJ's new 500 pF air variable capacitors and new low loss roller inductor, it easily handles higher power much more efficiently.

***No Matter What*™ Warranty**

Every MFJ tuner is protected by MFJ's famous one year *No Matter What*™ limited warranty. We will repair or replace your MFJ tuner (at our option) for a full year.

More hams use MFJ tuners than all other tuners in the world!

MFJ-986 Two knob *Differential-T*™

MFJ-986 $349.95

Two knob tuning (differential capacitor and *AirCore*™ roller inductor) makes tuning foolproof and easier than ever. Gives minimum SWR at only one setting. Handles 3 KW PEP SSB amplifier input power (1.5 KW output). Gear-driven turns counter, lighted peak/average Cross-Needle SWR/Wattmeter, antenna switch, balun. 1.8 to 30 MHz. $10^{3}/_{4}$Wx$4^{1}/_{2}$Hx15 in.

MFJ-962D *compact* kW Tuner

MFJ-962D $299.95

A few more dollars steps you up to a KW tuner for an amp later. Handles 1.5 KW PEP SSB amplifier input power (800W output). Ideal for Ameritron's AL-811H! *AirCore*™ roller inductor, gear-driven turns counter, pk/avg lighted Cross-Needle SWR/Wattmeter, antenna switch, balun, Lexan front, 1.8-30MHz. $10^{3}/_{4}$x$4^{1}/_{2}$x$10^{7}/_{8}$ in.

MFJ-969 300W *Roller Inductor* Tuner

MFJ-969 $219.95

Superb *AirCore*™ Roller Inductor tuning. Covers *6 Meters* thru 160 Meters! 300 Watts PEP SSB. *Active* true peak reading lighted Cross-Needle SWR Wattmeter, *QRM-Free PreTune*™, antenna switch, dummy load, 4:1 balun, Lexan front panel. $3^{1}/_{2}$Hx$10^{1}/_{2}$Wx$9^{1}/_{2}$D inches.

MFJ-949E *deluxe* 300 Watt Tuner

MFJ-949E $179.95

More *hams use MFJ-949s than any other antenna tuner in the world!* Handles 300 Watts. Full 1.8 to 30 MHz coverage, custom inductor switch, 1000 Volt tuning capacitors, *full size* peak/average lighted Cross-Needle SWR/Wattmeter, 8 position antenna switch, dummy load, *QRM-Free PreTune*™, scratch proof Lexan front panel. $3^{1}/_{2}$Hx$10^{5}/_{8}$Wx7D inches. **MFJ-948, $139.95.** Economy version of MFJ-949E, less dummy load, Lexan front panel.

MFJ-941E *super value* Tuner

MFJ-941E $139.95

The *most for your money!* Handles 300 Watts PEP, covers 1.8-30 MHz, *lighted* Cross-Needle SWR/Wattmeter, 8 position antenna switch, 4:1 balun, 1000 volt capacitors, Lexan front panel. Sleek $10^{1}/_{2}$Wx$2^{1}/_{2}$Hx7D in.

MFJ-945E HF/6M *mobile* Tuner

MFJ-945E $129.95

Extends your mobile antenna bandwidth so you don't have to stop, go outside and adjust your antenna. Tiny 8x2x6 in. *Lighted* Cross-Needle SWR/Wattmeter. Lamp and bypass switches. Covers 1.8-30 MHz *and* 6 Meters. 300 Watts PEP. **MFJ-20, $6.95,** mobile mount.

MFJ-971 *portable/QRP* Tuner

MFJ-971 $119.95

Tunes coax, balanced lines, random wire 1.8-30 MHz. Cross-Needle Meter. SWR, 30/300 or 6 Watt QRP ranges. Matches popular MFJ transceivers. Tiny 6x$6^{1}/_{2}$x$2^{1}/_{2}$ in.

MFJ-901B *smallest* Versa Tuner

MFJ-901B $99.95

MFJ's smallest (5x2x6 in.) and most affordable wide range 200 Watt PEP Versa tuner. Covers 1.8 to 30 MHz. Great for matching solid state rigs to linear amps.

MFJ-902 *Tiny Travel* Tuner

MFJ-902 $99.95

Tiny $4^{1}/_{2}$x$2^{1}/_{4}$x3 inches, full 150 Watts, 80-10 Meters, has tuner bypass switch, for coax/random wire.

MFJ-904H, $149.95. Same but adds Cross-needle SWR/Wattmeter and 4:1 balun for balanced lines. $7^{1}/_{4}$x$2^{1}/_{4}$x$2^{3}/_{4}$ inches.

MFJ-16010 *random wire* Tuner

MFJ-16010 $69.95

Operate all bands anywhere with MFJ's reversible L-network. Turns random wire into powerful transmitting antenna. 1.8-30 MHz. 200 Watts PEP. Tiny 2x3x4 in.

MFJ-906/903 *6 Meter* Tuners

MFJ-906 $99.95

MFJ-906 has lighted Cross-Needle SWR/Wattmeter, bypass switch. Handles 100 W FM, 200W SSB. **MFJ-903, $69.95**, Like MFJ-906, less SWR/Wattmeter, bypass switch.

MFJ-921/924 *VHF/UHF* Tuners

MFJ-921/924 $89.95

MFJ-921 covers 2 Meters/220 MHz. **MFJ-924** covers 440 MHz. SWR/Wattmeter. 8x$2^{1}/_{2}$x3 in.

MFJ-931 *artificial* RF Ground

MFJ-931 $109.95

Eliminates RF hot spots, RF feedback, TVI/RFI, weak signals caused by poor RF grounding. Creates artificial RF ground or electrically places far away RF ground directly at rig. **MFJ-934, $209.95**, Artificial ground/300 Watt Tuner/Cross-Needle SWR/Wattmeter.

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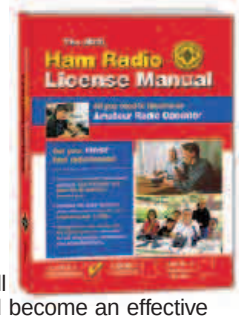

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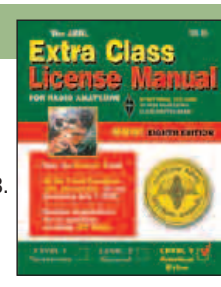

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QST 6/2007

MFJ 2500 Watts *ContinuousCarrier*™ Tuner

Silver plated Edge-Wound Roller Inductor . . .1000/500 pF Variable Capacitors . . . Antenna Switch . . . 4-Core Balun . . . true Peak Cross-Needle SWR/Wattmeter . . . Dummy Load . . . Extremely Wide Matching Range . . . Patent Pending . . .

New!

MFJ-9982

$699.95

The MFJ-9982 ContinuousCarrier™ antenna tuner handles 2500 Watts continuous carrier output on all modes and all HF bands into most unbalanced antennas -- even on 160 Meters where even the best antenna tuners fail!

The MFJ-9982 gives you every feature you'll ever want in a high power tuner -- wide matching range, 1.8 to 30 MHz coverage, 6-position antenna switch, 4-core balun, dummy load, true peak/average lighted SWR/Wattmeter, 6:1 reduction drives with detailed logging scales, 3-digit turns counter, extra large knobs.

New Components, New Technologies

The *Heart and Soul* of the MFJ-9982 is its roller inductor and variable capacitors.

MFJ's high power, high-Q *continuous current AirCore*™ roller inductor is no ordinary roller inductor! It's edge wound from thick .06-inch *silver-plated* solid copper strap.

It can carry huge circulating RF currents and withstand tremendous heat that'll melt or burn up ordinary roller inductors.

Self-insulating construction reduces stray capacitance -- keeps self-resonant frequencies high and out-of-the-way. Dual, *silver-plated* compression wheels give ultra low-resistance contacts. New fast-tune crank knob.

High-current, *high-capacitance* 1000 pF and 500 pF air variable capacitors have low minimum capacitance and are self-insulating.

These newly developed air variable capacitors give you *very high efficiency* on 160/80 Meters *and* MFJ's patent pending innovation gives you *extremely wide matching range* on 10/12/15 Meters at 2500 Watts -- a feat *only* the MFJ-9982 has achieved.

Hi-Voltage/Current Antenna Switch

The antenna switch is completely isolated to handle high-voltage, high impedance antennas. High-current, low impedance antennas are handled by parallel sets of high-current contacts of *two* ceramic switches.

New 4-Core Balun

Powerful balun -- Four 2½ inch cores, 12-gauge *Teflon*™ wire. Run balanced lines at full 2500 Watts SSB/CW continuous, 24/7.

New Balanced Line Feed-Thru Insulator

Allows massive transmitter currents to flow directly to the antenna without passing through lossy screws or bolts.

TrueActive™ Peak Reading Circuit

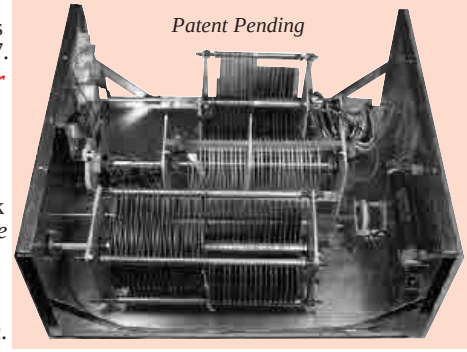
New *TrueActive*™ circuit reads *true* peak or average power on all modes. *Cross-Needle* meter reads SWR/forward/reflected power.

1500 Watt Dummy Load

1500 Watt air-cooled non-inductive 50 Ohm resistor. 100W/10 min., 1.5kW/10 sec.

New Cabinet maintains high Q

New roomy cabinet maintains high Q. Vent holes. Heavy gauge, .08 inch aluminum braced chassis. Vinyl cover, non-stripping PEM nuts, heavy 10-gauge and copper strap wiring throughout. 13¾Wx7Dx16¼D inches. 15 pounds.



MFJ 1500 Watt *Fully Balanced* Antenna Tuner

Fully balanced MFJ-976 handles 1500 Watts legal limit . . . Extra-wide 12-2000 Ohms matching range . . . continuous 1.8 to 30 MHz coverage including all WARC bands . . . Four separate 500 pF in two gangs gives you a total of 2000 pF capacitance . . . Heavy duty 1:1 current balun . . . more!

New!

MFJ-976

$499.95

The MFJ-976 is a 1500Watt full Legal Limit *fully balanced* antenna tuner.

You get *superb* current balance, very wide matching range (12-2000 Ohms) and *continuous* 1.8-30 MHz coverage including all WARC bands. Handles *full* 1500 Watts SSB *and* CW.

You can tune *any* balanced lines including 600 Ohm open wire line, 450/ 300 Ohm ladder lines, 300/72 Ohm twin lead -- shielded or unshielded. Also tunes random wires and coax fed antennas.

MFJ's *fully balanced* extremely wide-range T-network gives you simple, fast three knob tuning. No complicated switching between high and low impedance and switching in additional capacitance of L-networks.

Four separate 500 pF in two gangs gives you a total of 2000 pF for highly efficient low loss operation on 160 Meters.

You get excellent 10 Meter performance because of MFJ's low minimum capacitance and exclusive *Self-Resonance Killer*™ high-Q *AirCore*™ roller inductor with silver plated contacts.

Heavy duty 1:1 current balun gives you *superb balance* and stays cool even at 1.5kW.

True *active* peak reading lighted Cross-Needle SWR/Wattmeter lets you read SWR, *true peak* or average forward and reflected power all at a glance on 300/ 3000 Watt ranges. 12Wx6Hx15¾D inches.

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★ NEW GEAR ★ VINTAGE ITEMS ★ TRIPS ★
★ ONE-OF-A-KIND FINDS ★ AND SO MUCH MORE! ★

MFJ tiny Travel Tuner

Tiny 4½x2¼x3 inch tuner handles full 150 Watts! Covers 80-10 Meters, has tuner bypass switch, tunes nearly anything!

MFJ brings you the *world's smallest* full power 150 Watt 80-10 Meter Antenna Tuner. Extra wide matching range lets you tune nearly any antenna.

It's no toy, its got guts! Built with real *air* variable capacitors (600 Volt, 322 pF) and *three* stacked powder iron toroids to handle real power -- not just QRP. Bypass switch lets you bypass tuner when you don't need it.

You can use nearly any transceiver at full power with nearly any coax fed or random wire antenna for portable, home or mobile operation.

It's perfect for compact rigs like Icom IC-706MKIIG, Yaesu FT-100D, Kenwood TS-50, QRP rigs and others with a built-in SWR meter.

Operate anywhere, anytime with a quick easy set-up! Tune out SWR on your mobile whip from inside your car. Operate in your apartment with a wall-to-wall antenna or from a motel room with a wire dropped from a window or from a mountain top with a wire over a tree limb. Great for DXpeditions or field day. Be prepared for emergencies.

MFJ-902 is so small and handy, you'll rely on it wherever you go! It's easy to pack away in your briefcase, suitcase, backpack, glove compartment or desk drawer. It's tiny enough to slide in your back hip pocket! 4½Wx2¼Hx3D inches.

MFJ-902
$99.95

Tiny Travel Tuner with 4:1 Balun

MFJ-902H, same as MFJ-902 *Tiny Travel Tuner* but has *4:1 balun* for balanced lines and 5-way binding posts for balanced lines and random wire. 5¾Wx2¼Hx 2¾D in.

MFJ-902H
$119.95

Tiny Travel Tuner with Cross-Needle SWR/Wattmeter

MFJ-904, same as MFJ-902 *Tiny Travel Tuner* but has *Cross-Needle SWR/Wattmeter.* Read SWR, forward and re-flected power all at a glance in 300/60 and 30/6 Watt ranges. 7¼Hx2¼Hx2¾D inches.

MFJ-904
$129.95

ALL-in-one *Tiny Travel Tuner* with 4:1 Balun *and* SWR/Wattmeter

ALL-in-one! MFJ-904H, same as MFJ-902 *Tiny Travel Tuner* but has *4:1 balun for balanced lines* and Cross-Needle SWR Wattmeter. Read SWR, forward and reflected power all at a glance in 300/60 and 30/6 Watt ranges. Has 5-way binding posts for balanced lines and random wire. 7¼Hx2¼Hx2¾D inches.

MFJ-904H
$149.95

Long 10/12 foot Telescoping Whips

MFJ-1954
$29.95
10 Feet

10 foot extended, 19 inches collapsed, MFJ-1954, $29.95. 12 foot extended, 22.5 inches collapsed. MFJ-1956, $34.95. Standard 3/8 inch by 24 threaded stud for use with all standard mounts. Durable 1/2 inch diameter plated brass. Telescopes for full 1/4 wave operation 2 to 12/15 Meters. Cover 17, 20, 30, 40, 60, 80, 160 Meters with loading coil. Use two for multi-band dipoles. Replace screwdriver antenna whip for highly efficient *fixed* mobile operation.

MFJ-1956
$34.95
12 Feet

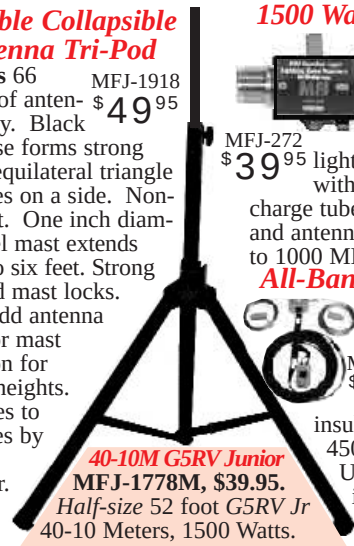
MFJ RF Isolator

MFJ-915 *RF Isolator*

MFJ-915
$29.95

prevents unwanted RF from traveling on the outside of your coax shield into your transceiver. This unwanted stray RF can cause painful RF "bites" when you touch your microphone or volume control, cause your display or settings to go crazy, lock up your transceiver or turn off your power supply. In mobile installations, stray RF could cause your car to do funny things even blow your car computer. Clear up these problems, plug an MFJ-915 between your antenna and transceiver. *Don't operate without one!* 5x1½ inches. For 1.8 to 30 MHz.

Portable Collapsible Antenna Tri-Pod



Holds 66 pounds of antenna steady. Black *steel* base forms strong braced equilateral triangle 40 inches on a side. Non-skid feet. One inch diameter steel mast extends height to six feet. Strong base and mast locks. Easily add antenna mount or mast extension for greater heights. Collapses to 38 inches by 4 inch diameter. 6¾ pounds.

MFJ-1918
$49.95

40-10M G5RV Junior
MFJ-1778M, $39.95.
Half-size 52 foot *G5RV Jr*
40-10 Meters, 1500 Watts.

1500 Watt Lightning Surge Protector

Protect your expensive transceiver from static electricity and lightning induced surges with an ultra-fast gas discharge tube. Plug between rig and antenna, attach ground. DC to 1000 MHz. SO-239s.

MFJ-272
$39.95

All-Band G5RV Antenna

Cover all bands, 160-10M with tuner. 102 ft. long, 1.5kW. Custom fiberglass insulator stress relieves 450 Ohm ladder line. Use horizontally, as inverted vee or sloper. Marconi on 160M.

MFJ-1778
$44.95

Glazed Ceramic Antenna Insulator

MFJ-16C06
6-Pack
$4.56
(79 cents each)

Authentic *glazed ceramic* antenna insulator. Extra-strong -- will not break with long antennas and will not arc over or melt even under full legal power. Molded ridges give extra-long high voltage path to prevent high-voltage breakdown. Smooth wire holes prevent wire damage. Use as center or end insulator for dipoles, doublets, G5RVs, guy wires and others.

Current Balun/Center Insulator

True *1:1 Current Balun/Center Insulator* forces equal currents into dipole halves to reduce coax feedline radiation and field pattern distortion. Reduces TVI, RFI and RF hot spots in your shack. 50 ferrite beads on *Teflon*(R) coax. 1.5kW, 1.8-30 MHz. Stainless steel hardware. *Direct* antenna connection. 5x1½ in.

MFJ-918
$24.95

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- Triband (144/220/440 MHz)
- Receives 2 frequencies simultaneously even on the same band
- 0.1-1300MHz high-frequency range RX (B band)[1]
- FM/FM-W/FM-N/AM plus SSB/CW receive
- Bar antenna for receiving AM broadcasts
- Special weather channel RX mode
- 435 memory channels, multiple scan functions
- 7.4V 1550mAh lithium-ion battery (std.) for high output[2] and extended operation
- 16-key pad plus multi-scroll key for easy operation
- Built-in charging circuitry for battery recharge while the unit operates from a DC supply
- Tough construction: meets MIL-STD 810 C/D/E standards for resistance to vibration, shock, humidity and light rain
- Large frequency display for single-band use
- Automatic simplex checker
- Wireless remote control function
- Battery indicator • Internal VOX • MCP software

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

TH-F6A

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MFJ Compact 200 Watt *IntelliTuners*™

Automatically tunes any unbalanced antenna . . . Ultra fast . . . 20,000 VirtualAntenna™ Memories . . . Antenna Switch . . . Efficient L-network . . . Matches 6-1600 Ohms at 200 Watts . . . 1.8-30 MHz . . . Digital SWR/Wattmeter . . . Audio SWR meter . . . Radio interface . . .

The MFJ-929 *IntelliTuner-Compact*™ lets you *automatically* tune any coax fed or random wire antenna 1.8-30 MHz at full 200 Watts SSB/CW. It can match 6-1600 Ohms (SWR up to 32:1) - - that's a 50% wider matching range at a higher power level than lesser competing products.

You get a *digital* SWR/Wattmeter with backlit LCD, antenna switch for 2 antennas, built-in radio interface and built-in internal BiasTee for remote tuner operation.

MFJ's exclusive *IntelliTune*™, *Adaptive Search*™ and *InstantRecall*™ algorithms give you ultra-fast automatic tuning with over 20,000 *VirtualAntenna*™ Memories.

MFJ VirtualAntenna™ Memory

MFJ new *VirtualAntenna*™ Memory system gives you 4 antenna memory banks for *each* of 2 antenna connectors. You can select up to 4 antennas on each antenna connector. Each antenna has 2500 memories.

New!
MFJ-929
$219.95

4 Times the Solutions!

MFJ-929 gives you 256 values each of capacitance and inductances for 131,072 matching solutions. That's *4 times* the 32,768 matching solutions of competing products with only 128 L/C values each!

Highly intelligent, ultra-fast tuning!

Don't be fooled by competing products claiming fast search times -- if you have a *quarter* of the matching solutions, of course, it takes less time to search but it's *not* faster.

MFJ's much faster speed comes from advanced technology and software algorithms *not* from fewer matching solutions.

MFJ's *IntelliTuner-Compact*™ actually *measures* complex impedance -- *R* and *X* -- of your antenna, computes the L-network values needed and snaps in those components to give you an *instant* match.

If the load is out of measurement range, *AdaptiveSearch*™ determines the *smaller* subset from all solutions that can match a safe load -- and then searches *only* that subset -- others search through far more solutions.

Digital LCD SWR/Wattmeter

An easy-to-read, two-line, 16-character backlit LCD displays SWR, peak or average forward/reflected power, frequency, antenna 1 or 2, L/C tuner values, on/off indicators and other info. They are selected from easy-to-understand menus -- *not* complex combinations of buttons you can't remember.

A fast-response, high-resolution bargraph gives you an auto-ranging 20/200 Watt power meter. You get 60 segments each for forward and reflected power and 36 segments for SWR -- *try that with an 8 segment bargraph that makes you change power ranges and doesn't even give you reflected power!*

You can read inductance and capacitance *directly* in uH and pF. This turns you into an expert *L-network designer!* Match your load, read the resulting L/C values, then use them to build your fixed L-network.

Or, knowing the L/C values you can determine R and X of the load impedance.

Plus Much More!

***StickyTune*™** mode gives you one-hand tuning by locking the TUNE button -- just transmit to tune regardless of SWR.

Has audio SWR meter and audio feed back. Competing products don't.

Built-in 50 MHz frequency counter.

Its built-in radio interface lets you use a simple wire cable to compatible rigs. Others require a cable with expensive electronics.

Binding post for random wire. Self-test.

Highly efficient L-network. 10 Amp/1000V relays, RF duty silver mica capacitors. 6½ Wx2¾Hx7½D in. 2.4 lbs. 12-15 VDC/1Amp or 110 VAC with MFJ-1316, $21.95.

MFJ-928, $199.95. **Like** MFJ-929, less LCD, manual tune buttons.

MFJ-927, $259.95. **Weather** protected *remote* auto tuner for coax/wire ant., includes MFJ-4116 Power Injector. Most MFJ-929 features, no LCD/buttons.

MFJ-5114 K/Y/I/A, $19.95. Prewired Radio Interface cable for MFJ-929/928.

MFJ-4116, $24.95. Power Injector for remote MFJ-929/928 use. Sends DC/RF down coax.

Desktop/Remote Antenna and Antenna/Transceiver Switches

MFJ-4716
$89.95
6-position *Antenna* Switch

New!

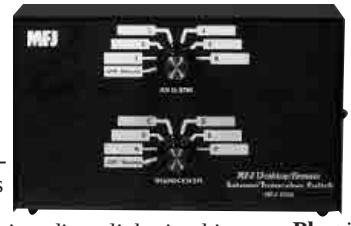
Place these MFJ antenna or antenna/transceiver switches on your *desk* or use them *remotely*. You can place them out-of-the-way under your desk, in your garage or closet -- saves cable, eliminates cable mess.

Super easy-to-use rotary switches -- no complicated computer buttons to learn or microprocessors to fail or generate RFI that covers up rare DX.

Select 1 of 6 antennas and/or 1 of 6 transceivers in any combination. All unused inputs are grounded. Automatically grounds all inputs when you turn off your transceiver -- simply connect a sense line to your transceiver. When rotary switches are in OFF position, all inputs are grounded or control is transferred to the optional remote control.

Ultra-fast gas discharge tube *lightning surge protector* protects transceiver and safely shunts static electricity and lightning induced surges safely to ground. Does not protect against direct lightning hit.

MFJ-4726
$159.95
6-position *Antenna/Transceiver* Switch



SO-239 connectors. 1500 Watts/50-75 Ohm load, 1-60 MHz. Useable to 150 MHz. Connects to remote control with common CAT 5 cable, not included (available from WalMart, etc.). Use 12 VDC or 110 VAC with MFJ-1312D, $14.95. For indoor use, not weather protected.

Antenna Switches - - 6 and 4 positions

• MFJ-4716, $89.95, *6-positions*; **• MFJ-4714, $79.95,** *4-positions*. 8Wx2¾Hx4¼D in.

Remote Controls:
• MFJ-4716RC, $39.95, *6-positions*;
• MFJ-4714RC, $39.95, *4-positions*.
2¾Wx3¾Hx1D inches.

Antenna/Transceiver Switches - - 6 and 4 positions

Select one of 6 antennas *and* one of 6 transceivers in any combination with just two easy-to-use rotary switches.

Plug in antenna tuner, SWR/Wattmeter or other into its common ports, so it's always connected to the antenna and radio selected.

• MFJ-4726, $159.95, *6-positions*; **• MFJ-4724, $139.95,** *4-positions*. 8Wx5Hx4¼D"

Remote Controls: • MFJ-4726RC, $59.95, *6-positions*; **• MFJ-4724RC, $59.95,** *4-positions*. 2¾Wx3¾Hx1D"

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MFJ-259B *1.8-170 MHz* SWR Analyzer

World's most popular SWR analyzer is super easy-to-use

Reads SWR . . . Complex RF Impedance: Resistance(R) and Reactance(X) or Magnitude(Z) and Phase(degrees) . . . Coax cable loss(dB) . . . Coax cable length and Distance to fault . . . Return Loss . . . Reflection Coefficient . . . Inductance . . . Capacitance . . . Battery Voltage. LCD digital readout . . . frequency counter . . . side-by-side meters . . . Battery charger . . . battery saver . . . low battery warning . . . smooth reduction drive tuning . . .

World's most popular SWR analyzer! ***The famous MFJ-259B gives you a complete picture of your antenna's performance. You can read your antenna's SWR and Complex Impedance from 1.8 to 170 MHz.***

You can read Complex Impedance as series resistance and reactance (R+jX) or as magnitude (Z) and phase (degrees).

You can determine velocity factor, coax cable loss in dB, length of coax and distance to a short or open.

You can read SWR, return loss and reflection coefficient at any frequency simultaneously.

You can read inductance in uH and capacitance in pF at RF frequencies.

Large easy-to-read two line LCD screen and side-by-side meters clearly display your information.

It has built-in frequency counter, Ni-MH/Ni-CD charger circuit, battery saver, low battery warning and smooth reduction drive tuning.

Super easy to use! Just set the bandswitch and tune the dial -- just like your transceiver. SWR and Complex Impedance are displayed instantly!

Here's what you can do

Find your antenna's true resonant frequency. Trim dipoles and verticals.

Adjust your Yagi, quad, loop and other antennas, change antenna spacing and height and watch SWR, resistance and reactance change instantly. You'll know exactly what to do by simply watching the display.

Perfectly tune critical HF mobile antennas in seconds for super DX -- without subjecting your transceiver to high SWR.

Measure your antenna's 2:1 SWR bandwidth on one band, or analyze multiband performance from HF to VHF -- 1.8-170 MHz!

Check SWR outside the ham bands without violating FCC rules.

Take the guesswork out of building and adjusting matching networks and baluns.

Accurately measure distance to a short or open in a failed coax. Measure length of a roll of coax, coax loss, velocity factor and impedance.

Measure inductance and capacitance. Troubleshoot and measure resonant frequency and Q of traps, stubs, transmission lines, RF chokes, tuned circuits and baluns.

Call your favorite dealer for your best price!

MFJ-259B $289.95

Adjust your antenna tuner for a perfect 1:1 match without creating QRM.

And this is only the beginning! The MFJ-259B is a complete ham radio test station including -- frequency counter, RF signal generator, *SWR Analyzer*™, RF Resistance and Reactance Analyzer, Coax Analyzer, Capacitance and Inductance Meter and more!

Free Manual: call, write or download

MFJ's comprehensive instruction manual is packed with useful applications -- all explained in simple language you can understand.

Take it anywhere

Fully portable, take it anywhere -- remote sites, up towers, on DX-peditions. It uses 10 AA or Ni-Cad batteries (not included) or 110 VAC with MFJ-1312D, $15.95. Its rugged all metal cabinet is a compact 4x2x6¾ in.

How good is the MFJ-259B?

MFJ *SWR Analyzers*™ work so good, many antenna manufacturers use them in their lab and on the production line -- saving thousands of dollars in instrumentation costs! Used worldwide by professionals everywhere.

More MFJ SWR Analyzers™

MFJ-249B, $259.95. Like MFJ-259B, but reads SWR, true impedance magnitude and frequency only on LCD. No meters.

MFJ-209, $159.95. Like MFJ-249B but SWR meter only. No LCD/frequency counter.

MFJ-219B, $119.95. UHF *SWR Analyzer* covers 420-450 MHz. External frequency counter jack. 7½x2½x2¼ in. *Free* "N" to SO-239 adapter.

SWR Analyzer Accessories

Dip Meter Adapter

MFJ-66, $24.95. Plug a dip meter coupling coil into your MFJ *SWR Analyzer*™ and turn it into a sensitive and accurate bandswitched dip meter. Takes guesswork out of winding coils and determining resonant frequency of tuned circuits and Q of coils. Set of two coils cover 1.8-170 MHz depending on your *SWR Analyzer*.

Genuine MFJ Carrying Case

MFJ-29C, $24.95. Tote your MFJ-259B anywhere with this MFJ custom carrying case. Has back pocket with security cover for carrying dip coils, adaptors and accessories. Made of special foam-filled fabric -- cushions blows, deflects scrapes, and protects knobs, meters and displays from harm. Wear it around your waist, over your shoulder, or clip it onto the tower while you work -- the fully-adjustable webbed-fabric carrying strap has snap hooks on both ends. Has clear protective window for frequency display and cutouts for knobs and connectors so you can use your MFJ *SWR Analyzer*™ without taking it out of your case.

MFJ-99, $60.85. Accessory Package for MFJ-259/B/249/B/209. Includes MFJ-29C carrying case, MFJ-66 dip meter adapter, MFJ-1312D 110VAC adapter. ***Save $5!***

Tunable Measurement Filter

MFJ-731, $99.95. *Exclusive* MFJ tunable RF filter allows accurate SWR and impedance measurements 1.8-30 MHz in presence of strong RF fields. Virtually no effect on measurements. Works with *all* SWR Analyzers.

MFJ *No Matter What*™ warranty

MFJ will repair or replace (at our option) your MFJ *SWR Analyzer*™ for one full year.

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Visit: http://www.mfjenterprises.com or call toll-free 800-647-1800

1.8-170 MHz *plus* 415-470 MHz SWR Analyzer

All-in-one handheld antenna test lab lets you quickly check/tune HF, VHF, ***UHF*** antennas anywhere. Measures: SWR, Return Loss, Reflection Coefficient, R, X, Z, Phase Angle, Coax cable loss, Coax cable length, Distance to short/open in coax, Inductance, Capacitance, Resonant Frequency, Bandwidth, Q, Velocity Factor, Attenuation, more!

MFJ-269 $389.95

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More hams use MFJ SWR Analyzers™ than any others in the world!

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DX Hilltop for sale **WWW.LITTLEFAMILYFARM.COM**

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Oriental, NC. Waterfront with dock. Almost 2 acres. No CC&Rs. 3900 sq. ft. 4br/2ba. Great ham radio, sailing, boating, fishing, hunting area. AG7C. pzawasky@pzef.net 252-249-3391

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BROADCAST MICROPHONES and accessories (call letter plates, stands) wanted: early carbon, condenser, ribbon, dynamic models. Cash or trade. James Steele, Box 610, Kingsland, GA 31548. 912-729-6106. jsteele@k-bay106.com; http://www.k-bay106.com/mics.htm

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COLLINS 75A4 $650., Hallicrafter SX-110 $150., Swan 350D $250., Dentron Clipperton L Amp $300., J-36 Military Bug $135. All in working condition. W5UGI, 865-977-9024

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TELEGRAPH KEYS wanted by collector. Bugs and unusual or unique straight keys or sounders, and tube electronic keyers. Also pre-1950 callbooks. Vince Thompson, K5VT, 3410 N. 4th Ave., Phoenix, AZ 85013. 602-840-2653.

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Visit THE SOUTHERN APPALACHIAN RADIO MUSEUM! - www.saradiomuseum.org 828-299-1276. Asheville, NC.

MFJ *giant* SWR/Wattmeter

World's *largest HF SWR/Wattmeter has* ***giant*** ***6½ inch meter!***

This one you can SEE! Extra-long scales gives you highly accurate SWR and power measurements. Huge numbers makes reading easy across your shack.

Like your analog watch, one glance at the meter needle gives you fast and accurate readings without actually examining the scale. New!

MFJ's exclusive *TrueActive*™ peak reading circuit captures *true* peak or average forward and reflected power readings.

MFJ-868 $149.95

Has 20/200/2000 Watt ranges for accurate QRP or QRO operation.

Exclusive MFJ Wattmeter *Power Saver*™ circuit turns on meter only when RF power is being measured.

Covers 1.8-30 MHz. Use 9 volt battery or 12 VDC or 110 VAC with MFJ-1312D, $15.95. 7Wx5¹/2Hx5D in. SO-239 connectors.

New!
Giant 144/220/440 MHz SWR/Wattmeter
MFJ-867, $159.95. Similar to MFJ-868 giant SWR/Wattmeter, but for 144/220/440 MHz.

MFJ *Weather-Proof* Antenna *Feedthrough* Panel

New! ***Bring three coax-fed HF/VHF/UHF antennas, balanced line, random wire and ground into your hamshack without drilling through walls . . .*** MFJ-4602 $69.95

MFJ's Weather-proof *Antenna Feedthrough Panel* mounts in your window sill. Lets you feed three coax-fed antennas, balanced line, random wire and ground without drilling through walls.

Simply place in window sill and close window. One cut customizes it for any window up to 48 inches. Use horizontally or vertically. High-quality pressure-treated wood with excellent 3/4 inch thick insulating properties is painted with heavy coat of white outdoor enamel paint. Edges sealed by weather-stripping. Seals and insulates against all weather conditions. Gives years of trouble-free service. ³/4Dx3¹/2Hx48W in.

Inside/outside stainless steel plates bond all coax shields to ground. Stainless steel ground post brings outside ground connection inside. Three *Teflon*® SO-239 coax connectors, *ceramic* balanced line/randomwire feedthru insulators.


Stainless Steel Bonding Plate


Indoor View


Outdoor View

6-Band ***Rotatable*** mini-Dipole for 40,20,15,10,6,2 M

Low profile 14 ft . . . 7 ft. turning radius . . . 1.5 kW . . . Directivity focuses signal, reduces QRM/noise . . .

You can hardly see this mini 14 foot rotatable dipole from across the street!

Tiny 7-foot turning radius fits the smallest roof -- perfect for houses, apartments/condos.

The low-profile MFJ-1775 is not much bigger than a TV antenna and nicely blends into the sky. It's easily turned by a lightweight TV rotator.

It's no Wimp! Its *directivity* reduces QRM/noise and lets you *focus* your signal in the direction that you want -- so you can work some *real* DX.

Operate 6 bands -- 40, 20, 15, 10, 6 and 2 meters. Run *full 1500 Watts* SSB/CW on all HF bands!

Its entire length radiates. Each HF band uses a separate, highly-efficient end-loading coil wound on fiberglass forms with *Teflon*™ wire with capacitance hats at each end (no lossy traps). 6 and 2 meters are *full-length* halfwave dipoles.

Built-to-last -- incredibly strong solid rod fiberglass center insulator and 6063 T-6 aircraft strength aluminum tubing radiator. Assembles in an afternoon. Adjusting one band has little effect on other bands.

MFJ-1775W, $249.95. WARC band version for 12, 17, 30, 60 Meters only.

80/40/20 Meter Rotatable Dipole

MFJ-1785, $369.95. DX the *low bands* on 80, 40, and 20 Meters with an efficient full 33 foot *rotatable* dipole! Handles a full 1500 Watts. Balun included. 6063 T-6 aircraft strength aluminum tubing with a solid center fiberglass insulator. Requires a medium-duty rotator such as Hy-gain's AR-40.

Compact SWR/Wattmeter

MFJ-822
MFJ-842
$59.95
New!

Compact SWR/Wattmeter has huge 3 inch *lighted* Cross-Needle Meter, easily viewable from across shack. Read forward/reflected power, SWR *simultaneously*. 3¹/4Wx3¹/4Hx3¹/4D in.

MFJ-822 for 1.8-200 MHz, 30/300 Watts.
MFJ-842 for 140-525 MHz, 15/150 Watts.

2-Position *Remote* Ant. Switch

MFJ-4712 $79.95

Switch any two antennas remotely! *Single* coax feeds two antennas, DC power, control signals -- *no extra cable needed.* Use 1.8-150 MHz antennas. 1500 Watts. 50-75 Ohms. 4W x2⁵/8Hx1¹/2D in. fully enclosed, *weather protected* outside switch box has stainless steel bracket for 1¹/2 in. mast. 3 *Teflon*® SO-239s.

16-Element 2.4 GHz WiFi Yagi

MFJ-1800 $29.95

16-element WiFi Yagi antenna greatly extends range of 2.4 GHz, 802.11b/g WiFi signals. Turns slow/no connection into fast, solid connection. Highly directional -- minimizes interference. N-female connector. Tripod screw-mount. Wall/desk/shelf mounts. Use vertically or horizontally. 18Wx2³/4Hx 1¹/4D in. 2.9 oz.

MFJ-5606SR, $24.95. Cable connects MFJ-1800/WiFi antennas to computer. Reverse-SMA male to N-male, 6 ft. RG-174.

MFJ-5606TR, $24.95. Same as MFJ-5606SR but Reverse-TNC male to N-male.

Glazed *Ceramic* Insulators

MFJ-16C06, $4.56, package of 6 authentic glazed *ceramic* antenna insulators. Extra-strong -- long antennas will not break, will not arc over or melt under full legal power. Extra-long ridges prevent high-voltage breakdown. Smooth wire holes prevent wire damage.

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General

10 Bands -- 1 MFJ Antenna!

Full size performance . . . No ground or radials

Operate 10 bands: 75/80, 40, 30, 20, 17, 15, 12, 10, 6 and 2 Meters with one antenna Separate full size radiators . . . End loading . . . Elevated top feed . . . Low Radiation Angle . . . Very wide bandwidth . . . Highest performance no ground vertical ever . . .

Operate 10 bands -- 75/80, 40, 30, 20, 17, 15, 12, 10, 6 and 2 Meters with this MFJ-1798 vertical antenna and get *full size performance* with no ground or radials!

Full size performance gives high efficiency for more power radiated. Results? Stronger signals and more Q-5 QSOs.

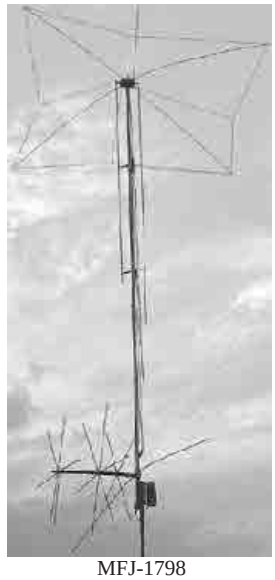
Full size performance also gives you exceptionally wide bandwidths so you can use more of your hard earned frequencies.

Full size performance is achieved using separate full size radiators for 2-20 Meters and highly efficient end loading for 30, 40, 75/80 Meters.

Get very low radiation angle for exciting DX, automatic bandswitching, omni-directional coverage, low SWR. Handles 1500 Watts PEP SSB.

MFJ's unique *Elevated Top Feed*™ elevates the feedpoint *all the way to the top* of the antenna. It puts the maximum radiation point high up in the clear where it does the most good -- your signal gets out even if you're ground mounted.

It's easy to tune because adjusting one band has minimum effect on the resonant frequencies of other bands.



MFJ-1798
$299.95
Ship Code F

Self-supporting and just 20 feet tall, the MFJ-1798 mounts easily from ground level to tower top -- small lots, backyards, apartments, condos, roofs, tower mounts.

Separate Full Size Radiators

Separate *full size* quarter wave radiators are used on 20, 17, 15, 12, 10 and 2 Meters. On 6 Meters, the 17 Meter radiator becomes a 3/4 wave radiator.

The active radiator works as a stub to decouple everything beyond it. *In phase* antenna current flows in all parallel radiators.

This forms a very large equivalent radiator and gives you incredible bandwidths.

Radiator stubs provide automatic bandswitching -- absolutely *no loss* due to loading coils or traps.

End Loading

On 30, 40, 75/80 Meters, end loading -- the most efficient form of loading -- gives you highly efficient performance, excellent bandwidth, low angle radiation and automatic bandswitching.

MFJ's unique *Frequency Adaptive L-Network*™ provides automatic impedance matching for lowest SWR on these low bands.

Tuning to your favorite part of these bands is simple and is done at the *bottom* of the antenna.

No Ground or Radials Needed

You don't need a ground or radials because an effective counterpoise that's 12 feet across gives you *excellent* ground isolation.

You can mount it from ground level to roof top and get awesome performance.

No Feedline Radiation to Waste Power

The feedline is decoupled and isolated from the antenna with MFJ's exclusive *AirCore*™ high power current balun. It's wound with *Teflon*® coax and can't saturate, no matter how high your power.

Built to Last

Incredibly strong solid fiberglass rod and large diameter 6061 T-6 aircraft strength aluminum tubing is in the main structure.

Efficient high-Q coils are wound on tough *low loss* fiberglass forms using highly weather resistant *Teflon*® covered wire.

MFJ's Super High-Q Loop™ Antennas

MFJ-1786
$419.95

MFJ's *tiny* 36 inch diameter loop antenna lets you operate 10 through 30 MHz *continuously* -- including the WARC bands!

Ideal for limited space -- apartments, small lots, motor homes, attics, or mobile homes.

Enjoy both DX and local contacts mounted vertically. Get both low angle radiation for excellent DX and high angle radiation for local, close-in contacts. Handles 150 watts.

Super easy-to-use! Only MFJ's super remote control has *Auto Band Selection*™. It auto-tunes to desired band, then beeps to let you know. No control cable is needed.

Fast/slow tune buttons and built-in two range Cross-Needle SWR/Wattmeter lets you quickly tune to your exact frequency.

All welded construction, no mechanical joints, welded butterfly capacitor with no rotating contacts, large 1.050 inch diameter round radiator -- not a lossy thin flat-strip -- *gives you highest possible efficiency*.

Each plate in MFJ's tuning capacitor is welded for low loss and polished to prevent high voltage arcing, welded to the radiator, has nylon bearing, anti-backlash mechanism, limit switches, continuous no-step DC motor -- gives smooth precision tuning.

Heavy duty thick ABS plastic housing has ultraviolet inhibitor protection.

MFJ-1788, $469.95. Same as MFJ-1786 but covers 40 Meters-15 Meters continuous. Includes super remote control.

MFJ-1782, $379.95. Like MFJ-1786 but control has only fast/slow tune buttons.

MFJ-1780, $299.95. *Box Fan* Portable Loop is about the same size (2x2 foot) as a box fan, complete with handle. Covers 14-30 MHz. Control has fast/slow tunes.

MFJ Apartment Antenna

MFJ-1622 $99.95

Covers 40 thru 2 Meters. Mounts outdoor to windows, balconies, railings. Works great indoors mounted to desks, tables, bookshelves. Highly efficient air wound *bug catcher* loading coil and telescoping 5½ foot radiator lets you really get out! Radiator collapses to 2½ feet for easy storage/carrying. Includes coax RF choke balun, coax feed line, counterpoise wire, safety rope. 200 Watts PEP.

MFJ's G5RV Antenna

MFJ-1778
$44.95

Covers all bands, 160-10 Meters with antenna tuner. 102 feet long, shorter than 80 Meter dipole. Use as inverted vee or sloper to be more compact. Use on 160 Meters as Marconi with tuner and ground. Handles full legal limit power. Add coax feedline and some rope or other nonconductor and you're *on the air!*

MFJ halfwave vertical

6 bands: 40, 20, 15, 10, 6, 2 Meters . . . No radials or ground needed

MFJ-1796
$229.95

Only 12 feet high and has a tiny 24 inch footprint! Mount anywhere -- ground level to tower top -- apartments,small lots, trailers. Perfect for vacations, field day, DXpedition, camping.

Efficient end-loading, no lossy traps. Entire length is always radiating. Full size halfwave on 2/6 Meters. High power *air-wound* choke balun eliminates feedline radiation. Adjusting 1 band has minimum effect on others.

MFJ-1792, $189.95. Full size 1/4 wave radiator for 40 Meters. 33 feet, handles 1500 Watts PEP. Requires guying and radials.

MFJ-1793, $209.95. Like MFJ-1792 but has full size 20 Meter ¼ wave also.

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You won't burn up our power supplies!

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MFJ-4245MV
45 Amp
$199.95 plus s&h

No RF Hash!

They are fully protected with Over Voltage and Over Current protection circuits.

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MFJ *MightyLites*™ can be used anywhere in the world! They have switchable AC input voltage and work from 85 to 135 VAC or 170 to 260 VAC. Replaceable fuse.

MightyLites™ . . . Mighty Features

Front-panel control lets you vary output from 9 to 15 Volts DC.

Front-panel has easy access five-way binding posts for heavy duty use and cigarette lighter socket for mobile accessories. MFJ-4245MV has two sets of quick-connects on the rear for accessories.

Brightly illuminated 3 inch meters let you monitor load voltage and current.

A whisper quiet internal fan efficiently cools your power supply for long life.

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25 Amp
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Massive 19.2 pound transformer . . . No RF hash . . . Adjustable 1 to 14 VDC . . .

MFJ's heavy duty conventional power supply is excellent for powering HF or 2 Meter/440 MHz transceiver/accessories.

A massive 19.2 pound transformer makes this power supply super heavy duty! It delivers 35 amps maximum and 30 amps continuous without even flexing its muscles. Plugs into any 110 VAC wall outlet.

It's highly regulated with load regulation better than 1%. Ripple voltage is less than 30 mV. *No RF hash* -- it's super clean!

Fully protected -- has over voltage protection, fold back short circuit protection and over-temperature protection.

MFJ-4035MV
$149.95

You get front panel adjustable voltage from 1 to 14 VDC with a convenient detent set at 13.8 VDC. A pair of front-panel meters let you monitor voltage and current.

Three sets of output terminals include a pair of heavy duty five-way binding posts for HF/VHF radios, two pairs of quick-connects for accessories and a covered cigarette lighter socket for mobile accessories.

A front-panel fuse holder makes fuse replacement easy. Whisper quiet fan speed increases as load current increases -- keeps components cool. 9½Wx6Hx9¾D inches.

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Power two HF/VHF transceivers and six or more accessories from your 12 VDC power supply

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MFJ-1116
$54.95 plus s&h

MFJ-1112
$39.95 plus s&h

MFJ-1117
$59.95 plus s&h

MFJ-1118, $79.95. This is MFJ's most versatile and highest current *Deluxe Multiple DC Power Outlet*. Lets you power two HF and/or VHF transceivers and six or more accessories from your transceiver's main 12 VDC supply.

Two pairs of super heavy duty 30 amp 5-way binding posts connect your transceivers. Each pair is fused and RF bypassed. Handles 35 Amps total.Six pairs of heavy duty, RF bypassed 5-way binding posts let you power your accessories. They handle 15 Amps total, are protected by a master fuse and have an ON/OFF switch with "ON" LED indicator.

Built-in 0-25 VDC voltmeter. Six feet super heavy duty eight gauge color-coded cable with ring tongue terminals. Binding posts are spaced for standard dual banana plugs. Heavy duty aluminum construction. 12½x2¾x2½ in.

MFJ-1116, $54.95. Similar to MFJ-1118. No 30 amp posts. Has "ON" LED and 0-25 VDC voltmeter. 15 amps total.

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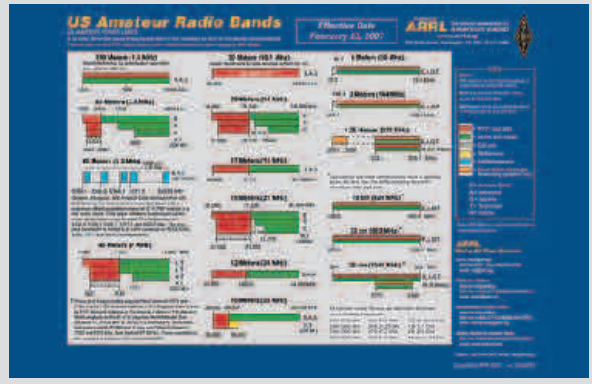

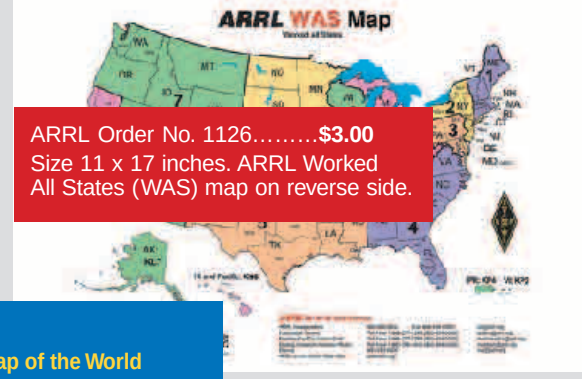

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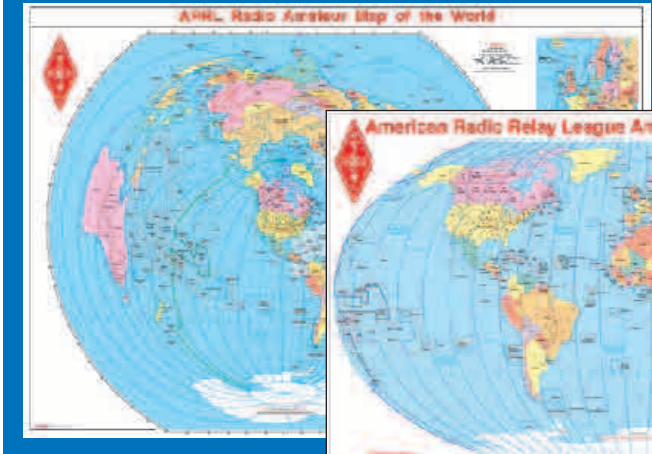

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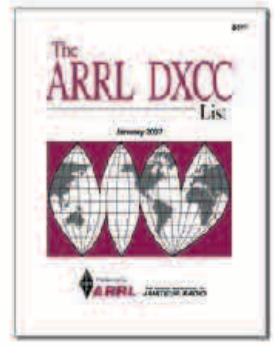

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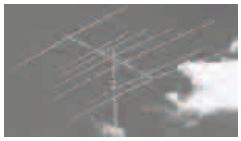

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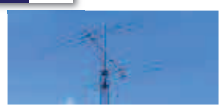

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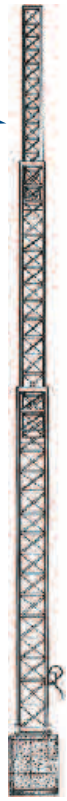

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- Five Voice Message memories, with the optional DVS-6 unit
- Large Multi-color VFD (Vacuum Fluorescent Display)
- Optional Data Management Unit (DMU-2000) permits display of various operating conditions, transceiver status and station logging.
- Optional RF μ -Tune Units for 160 m, 80/40 m and 30/20 m Bands

Optional, YAESU Exclusive, Fully-Automatic μ -Tuning Preselector System!

Fully automatic, Ultra-sharp, External μ -Tuning Preselector (optional) features a 1.1" (28 mm) Coil for High Q

On the lower Amateur bands, strong signal voltages impinge on a receiver and create noise and intermod that can cover up the weak signals you're trying to pull through. YAESU engineers developed the μ (Mu) Tuning system for the FT DX 9000/FT-2000, and it is now available as an option for the FT-950. Three modules are available (MTU-160, MTU-80/40, MTU-30/20); these may be connected externally with no internal modification required! When μ -Tuning is engaged, the VRF system is bypassed, but the fixed Bandpass Filters are still in the received signal path.

Optional External Data Management Unit (DMU-2000) Provides Many Display Capabilities

Enjoy the ultimate in operating ease by adding the DMU-2000! Enjoy the same displays available with the FT DX 9000 and FT-2000: Band Scope, Audio Scope, X-Y Oscilloscope, World Clock, Rotator Control, Extensive Transceiver Status Displays, and Station Logging Capability. These extensive functions are displayed on your user-supplied computer monitor.

Shown with after-market keyer paddle, keyboard, and monitor (not supplied).

DMU-2000
Data Management Unit (option)

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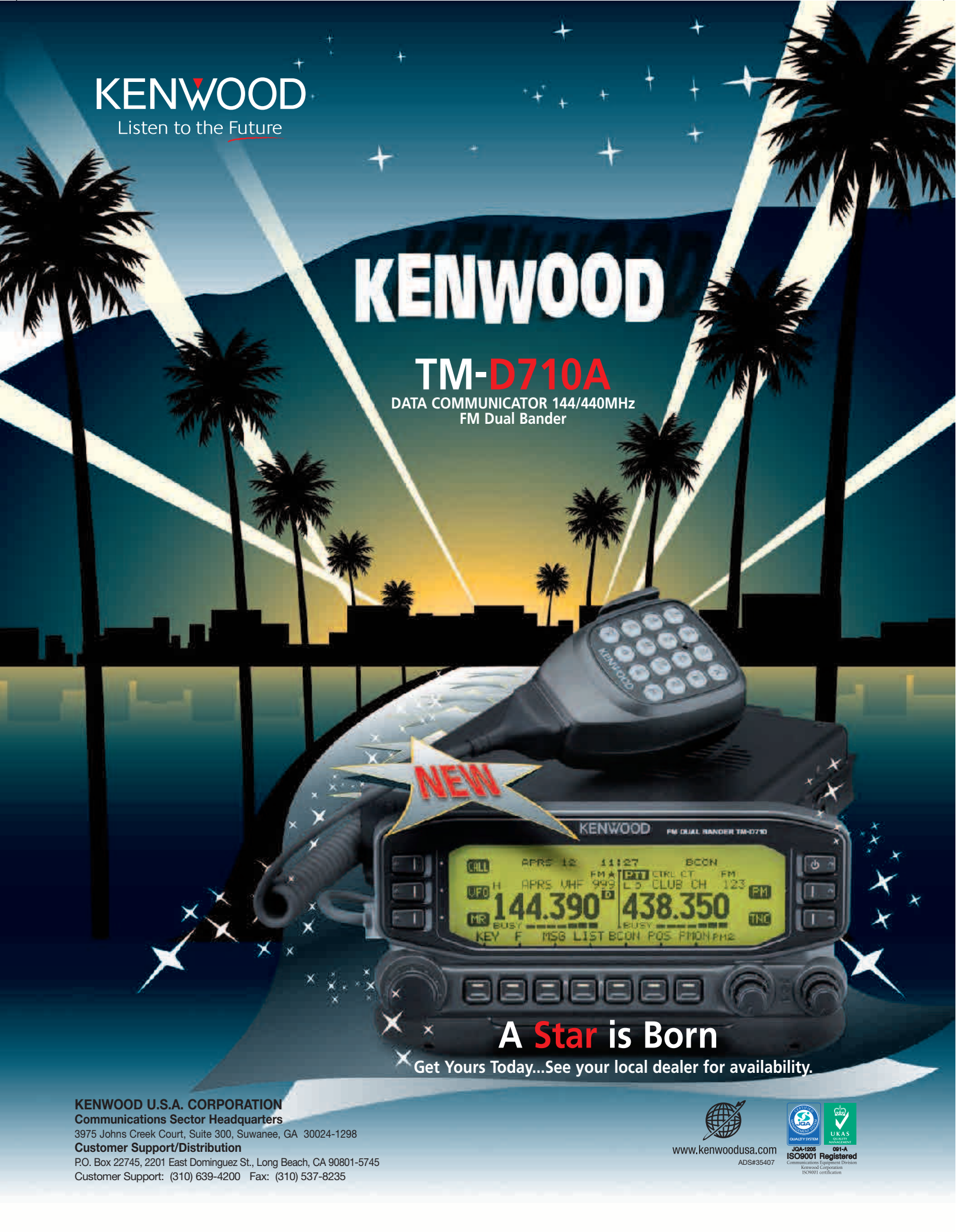

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