ARRL Centennial — Advancing the Art and Science of Radio Since 1914

QST

DEVOTED ENTIRELY TO AMATEUR RADIO

September 2014 WWW.ARRL.ORG

DIGITAL EDITION

Amateur Radio and Public Service

QST reviews:

- **Yaesu FTM-400DR** VHF/UHF Transceiver
- **Yaesu FT1DR** VHF/UHF Handheld Transceiver
- **Hy Power Antenna Company** Shortened 80 Meter Dipole

SPECIAL
8-Page Advertising Insert—Page 129

DIGITAL FEATURE

ARRL 100 YEARS

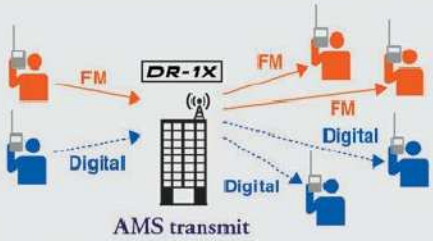
System Fusion

The Best Solution for the Future

System Fusion provides Total Integration of Digital and Conventional FM

FM Friendly Digital & Auto Mode Select (AMS)

System Fusion is designed to enable seamless intercommunication between conventional FM and C4FM Digital using a single unified platform, without manually switching between the communication modes.



This is made possible in System Fusion by the Auto Mode Select (AMS) function. With AMS, the modulation mode of your station is automatically selected according to the received signal. If a member transmits the conventional FM, the other System Fusion radios automatically select their modulation to conventional FM and permit communication between all members.

The Choice of C4FM Digital & New Attractive Digital Functions

System Fusion - C4FM Digital makes possible **9600 bps data speed** utilizing **12.5 kHz bandwidth**. **9600 bps data transmission speed** enables the high speed data communication and provide the new attractive digital functions to expand your enjoyment of the amateur radio communication.

Digital Group Monitor (GM)

Automatically checks whether members registered to a group are within the communication range, and displays the distance and the direction with each call sign on the screen.

Smart Navigation

Real-time navigation function enables location checking at any time. With the simple touch of a button, you can start navigating to your departure point or any location previously saved. (Backtrack Function)

Snapshot (Image Data Transmission)

Simply connect an optional speaker microphone with camera (MH-85A11U), you can take snapshots and easily send them to other System Fusion radios.

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

System Fusion Lineup

C4FM Clear and Crisp Voice Technology

144/430 MHz DUAL BAND
C4FM/FM DIGITAL REPEATER

DR-1X

- Three digital modes and a Conventional FM mode
- Emergency Operation: Supports operation on an emergency battery

Exciting New Amateur Digital Transceiver

C4FM Clear and Crisp Voice Technology

C4FM FDMA 144/430 MHz DUAL BAND
5W DIGITAL/FM TRANSCEIVER

FT1DR Heavy Duty Package

(1800 mAh Li-Ion Battery FNB-102LI included)

- Three digital modes and a Conventional FM mode
- Automatic Mode Select (AMS) Function
- Snapshot Picture Taking Capability
- Digital Group Monitor Function
- Smart Navigation Function

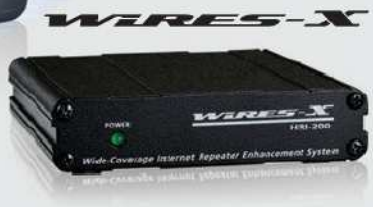
Equipped with advanced touch panel operation and full-color TFT large-scale display

C4FM Clear and Crisp Voice Technology

C4FM FDMA 144/430 MHz DUAL BAND
50W DIGITAL/FM TRANSCEIVER

FTM-400DR

- Three digital modes and a Conventional FM mode
- Automatic Mode Select (AMS) Function
- 3.5-inch Full Color Touch Panel Operation
- Snapshot Picture Taking Capability
- Digital Group Monitor Function
- Smart Navigation Function



Advanced VoIP wireless WIRES-X

C4FM Clear and Crisp Voice Technology

Amateur Radio Internet Linking Kit

HRI-200

- Advanced Internet VoIP radio communication is available with C4FM.
- Easy access to Node/Room stations by a simple operation.
- The NEWS Function enables exchanging messages, Images and Voice in the new communications method.

YAESU
The radio

YAESU USA
6125 Phyllis Drive, Cypress, CA 90630 (714) 827-7600

Cushcraft . . . Keeping you in touch around the globe!

Cushcraft

R9

80-6 Meters!

No Radials!

Cushcraft's world famous R8 now has a big brother!

Big Brother R9 now includes 75/80 Meters for local ragchewing and worldwide low band DX *without radials*!

It's omni-directional low angle radiation gives you exciting and easy DX on all 9 bands: 75/80, 40, 30, 20, 17, 15, 12, 10 and 6 Meters with low SWR. QSY instantly -- no antenna tuner needed.

Use full *1500 Watts* SSB/CW when the going gets tough to break through pileups and poor band conditions.

The R9 is super easy to assemble, installs just about anywhere, and its low profile blends inconspicuously into the background in urban and country settings alike.

Compact Footprint: Installs in an area about the size of a child's sandbox -- no ground radials to bury with all RF-energized surfaces safely out of reach.

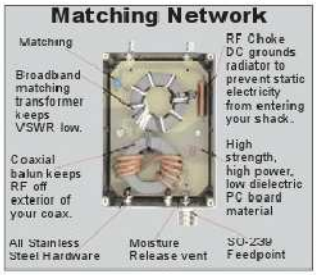
Rugged Construction: Thick fiberglass insulators, all-stainless steel hardware and 6063 aircraft-aluminum tubing is double or triple walled at key stress points to handle anything Mother Nature can dish out.

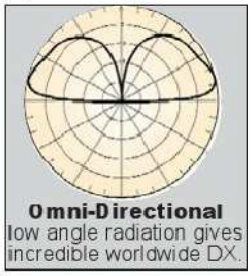
31.5 feet tall, 25 lbs. Mounting mast 1.25 to 2 inches. Wind surface area is 4 square feet.

R8, $539.95. Like R9 antenna but less 75/80 Meters.

R-8TB, $79.95. Tilt-base lets you tilt your antenna up/down easily by yourself to work on.

R-8GK, $59.95. Three-point guy kit for high winds.



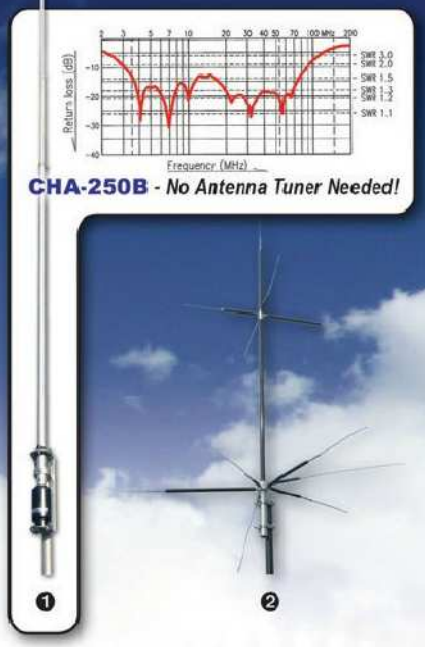


Free Catalog/Nearest Dealer . . . 662-323-5803
Call your dealer for your best price!

Cushcraft
Amateur Radio Antennas
308 Industrial Pk. Rd., Starkville, MS 39759 • 8-4:30 CST, M-F
http://www.cushcraftamateur.com

C★MET®

Life is a JOURNEY. Enjoy the ride!



CHA-250B - *No Antenna Tuner Needed!*

❶ ❷ ❸ ❹ ❺ ❻ ❼

Base Antennas

❶ C★MET CHA-250B BROADBAND 80M THROUGH 6M VERTICAL ANTENNA
A newly designed broadband vertical with NO GROUND RADIALS. EXTREMELY easy to assemble, requires no tuning or adjustments and VSWR is under 1.5:1 from 3.5-57MHz! • TX: 3.5MHz – 57MHz • RX: 2.0– 90MHz • VSWR is 1.5:1 or less, continuous • Max Power: 250W SSB/125W FM• Impedance: 50 Ohm • Length: 23' 5" • Weight: 7 lbs. 1 oz. • Conn: SO-239 • Mast Req'd: 1" – 2" dia. • Max wind speed: 67MPH

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

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

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

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

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

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

CAA-500
1.8-500MHz SWR/Impedance analyzer
Simple to use and accurate, the CAA-500 displays antenna system SWR and total impedance while turning the thumb wheel to sweep though the selected frequency range.

SO-239 connector for the low range.

N-female provides stable impedance in the high range

Install 6 AA batteries or use the 12VDC jack.

The primary tool for any antenna adjustment, trouble-shooting or installation project!

CAA-5SC
Protect your CAA-500 from moisture, shock, dents and dings!

Shoulder strap included.

Call or visit your local dealer today!
www.natcommgroup.com | 800-962-2611

C★MET®

Our mission: To promote and advance the art, science and enjoyment of Amateur Radio.

Includes video
Includes audio
Additional content

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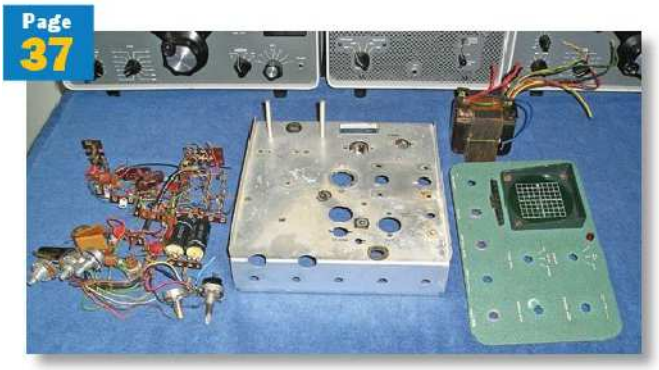
News and Features

Our Cover
This month's cover celebrates Amateur Radio in public service. For decades, hams like Tammy Scheirman, VA6TSS, have volunteered their skills to assist in everything from storm spotting to disaster relief. In the inset photo, taken by Jerry Clement, VE6AB, Tammy is participating with her club, the Foothills Amateur Radio Society of southern Alberta, Canada, during a mock disaster exercise conducted by Canada Task Force 2. Besides FM voice communication, APRS-IS messaging was also used during the exercise.

Radiosport



Columns

Departments

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www.arrl.org/qst-author-guide
e-mail: **qst@arrl.org**

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The radio... YAESU

HF/50 MHz 100 W Transceiver

FTDX3000

New Crystal Roofing Filters provide ultimate weak signal receiver performance in crowded, strong signal environments

The amazing Crystal Roofing Filter performance

The Down conversion 9 MHz 1st IF frequency receiver construction, can realize narrow 300 Hz (optional), 600 Hz and 3 kHz bandwidth roofing filters.

Outstanding receiver performance, the heritage of the FTDX5000!

The high dynamic range IP3 performance that was realized and proven in the FTDX5000.

IF DSP provides effective and optimized QRM rejection

Independent Frequency display

The newly developed LCD has a wider viewing angle and higher contrast.

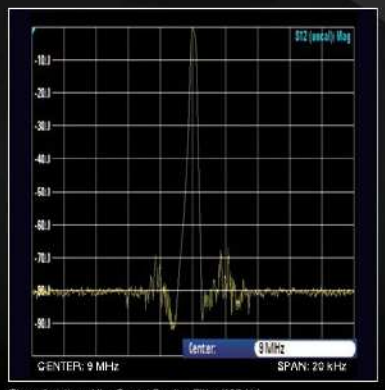
4.3-inch Large and wide color LCD display with high resolution

High Speed Spectrum Scope built-in

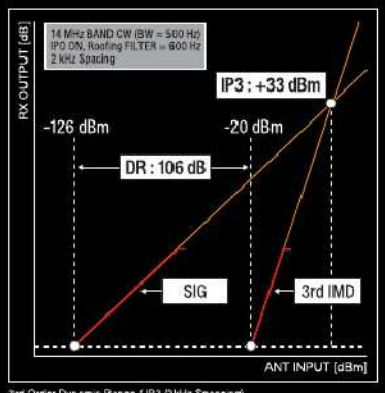
AF SCOPE display and RTTY/PSK encoder/decoder

Other features

The specialized Receiver amplifier for 50 MHz is built in / Three antenna connectors are provided / The "ANT-3" terminal may be assigned to "RX-only" / Signal output for an external receiver and the 9 MHz IF output are furnished / High speed Automatic antenna tuner built in / Optional μ-tune unit available / USB interface equipped



Characteristics of the Crystal Roofing Filter (300 Hz)



3rd Order Dynamic Range / IP3 (2 kHz Spacing)

YAESU The radio

YAESU USA
6125 Phyllis Drive, Cypress, CA 90630 (714) 827-7600

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

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

The radio... YAESU

HF/50MHz 100W Transceiver

FT DX 1200

This medium-price HF Transceiver Excels on all fronts. The High Frequency Design Technology it has inherited, ensures "Best in Class Performance". The Outstanding Operability is Perfect for the DX Scene.

Superior triple conversion receiver, and optimum gain distribution at each IF stage will eliminate out of band unwanted signals.

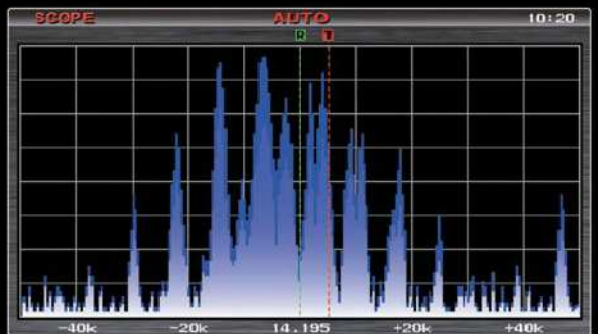
The 1st IF frequency is set at 40 MHz and is protected by selectable 3 kHz, 6 kHz and 15 kHz roofing filters, which effectively attenuate interfering signals.

Similar to the high end series Yaesu transceivers, it uses the 32-bit high speed floating point DSP, TMS320C6727B by Texas Instruments, for its IF DSP.
The acclaimed superior Yaesu DSP algorithm is highly effective in weak signal processing and enhancement.

The Full Color, 4.3 inch TFT display on the left side of the front panel, has a wide viewing angle and provides excellent visibility. It beautifully displays the various functions unique to this high class HF transceiver.

An optional built-in FFT-UNIT supports advanced functionality, including the AF-FFT Scope, RTTY/PSK31 Encode/Decode, CW Decode and CW Auto Zero-in.

The Full Color 4.3 inch TFT display



Spectrum-Scope (Full Screen display)

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YAESU
The radio

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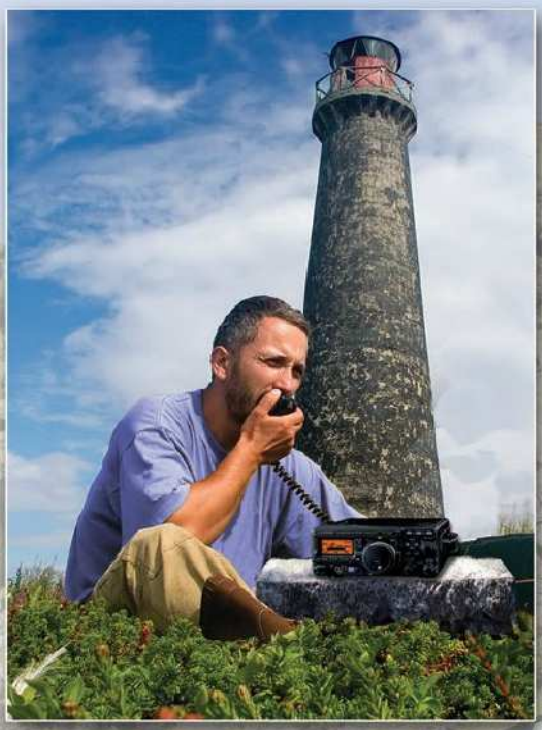

Field Gear That Goes The Distance!

FT-897D

HF/VHF/UHF Portable Operation Powerful Transceiver

- The Ultimate Emergency Communications Radio
- Rugged, Innovative Multi-Band
- Operates on the SSB, CW, AM, FM, and Digital Modes
- Wide Frequency Coverage
- 20-Watt Portable Operation Using Internal Batteries
- 100 Watts When Using an External 13.8-Volt DC Power Source

FT-817ND

The Ultimate Backpack, Multi-Mode Portable Transceiver

- Self-Contained
- Battery-Powered
- Covering the HF, VHF, and UHF Bands
- Provides up to Five Watts of Power Output
- SSB, CW, AM, FM, Packet, or SSB-based Digital Modes like PSK31

FT-857D

The World's Smallest HF/VHF/UHF Mobile Transceiver

- Ultra-Compact Package
- Ideal for Mobile or External Battery Portable Work
- Wide Frequency Coverage
- Optional Remote-Head
- High-Performance Mobile Operation

FT-450D

HF/50 MHz 100 W Easy to Operate All Mode Transceiver

- Illuminated Key Buttons
- 300Hz / 500Hz / 2.4 kHz CW IF Filter
- Foot Stand
- Classically Designed Main Dial and Knobs
- Dynamic Microphone MH-31 A8J Included

YAESU

The radio

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It Seems to Us

David Sumner, K1ZZ — dsumner@arrl.org
ARRL Chief Executive Officer

H.R. 4969: Cosponsors Needed!

"A bill has been introduced in the US House of Representatives to extend the principle of reasonable accommodation of Amateur Radio antennas to all types of land use regulations. Our challenge now is to find enough cosponsors that the bill will be taken seriously in the remaining days of the 113th Congress."

Without an effective antenna, a radio station — amateur or otherwise — is just a collection of equipment. It was almost 30 years ago that the FCC, in response to the ARRL's argument that there was a strong federal interest in effective Amateur Radio communication, adopted a policy of limited preemption of state and local land use regulations governing amateur station antennas. The policy is known as PRB-1, which refers to the Private Radio Bureau, the component of the FCC that at the time was responsible for Amateur Radio. PRB-1 established a three-part test for such regulations: they must not preclude Amateur Service communications, they must reasonably accommodate such communications, and they must constitute the minimum practicable regulation to accomplish the state or local authority's legitimate purpose.

At the time the FCC was not persuaded to extend this policy to property that is subject to private land use regulations, usually called "covenants, conditions, and restrictions" (CC&Rs). Since then, CC&Rs have spread and now cover more than 25 million housing units — about five times as many as when PRB-1 was adopted. In parts of the country with rapid population growth, it is virtually impossible to find housing that is not subject to CC&Rs.

PRB-1 is a powerful tool that amateurs can use in dealing with local zoning boards. It does not guarantee that a particular antenna system will be deemed reasonable, but it does ensure that municipalities cannot act arbitrarily. Using the authority given to it by Congress, the FCC has said that public policy requires a good-faith effort to minimize the impact of local land use regulations on amateur communications, and that in any event the regulations may not have the effect of precluding amateur communications. Amateurs and would-be amateurs living under CC&Rs have no such protection. It's time they did.

On June 25, Rep. Adam Kinzinger of Illinois (IL-16), with Rep. Joe Courtney of Connecticut (CT-2) as the original cosponsor, introduced "The Amateur Radio Parity Act of 2014" in the House of Representatives. If signed into law, the bill, H.R. 4969, would require the FCC to extend its PRB-1 policy to private land use restrictions. As a matter of public policy, this extension is both reasonable and necessary. At one time amateurs had alternatives to living under restrictive covenants; in many parts of the country that is no longer the case. The federal interest in effective amateur communications is just as strong in such areas as elsewhere. While amateurs sometimes can negotiate an acceptable arrangement with their homeowners' association, that is the exception; arbitrary rules and decisions are all too common.

H.R. 4969 is bipartisan legislation, with a Republican sponsor and a Democratic cosponsor. That's a good start, but for the bill to be taken seriously there must be a much broader base of support in Congress — in short, more cosponsors. How do we go about building that base in the few remaining months of the 113th Congress?

The most promising approach, and one that we ask all ARRL members who are in a position to do so to pursue, is to use an established relationship with your Congressman to ask for his or her cosponsorship. Asking him or her to support the legislation isn't enough. Unless he or she is a member of the Committee on Energy and Commerce, even a promise that they will vote for the bill if it comes to the House floor isn't enough. Cosponsors are what we need, and right now! At the very least, call your Congressman's district or Washington office. Your request is simple: "Please cosponsor H.R. 4969. It's very important to me as a constituent and an Amateur Radio operator." The staff keeps a tally of incoming calls. It's a small thing that could make a big difference.

Congressmen Kinzinger and Courtney have given us a window of opportunity. We are grateful to both of them and to their staffs. The next step, to demonstrate that Amateur Radio has broad support in Congress, is up to us.

If you are fortunate enough to live where there are no CC&Rs you may think this is not your fight. It is. Someday you may want to, or have to, move — and the odds are that if you then want to avoid CC&Rs your housing choices will at best be severely limited.

And then it will be too late.

David Sumner, K1ZZ

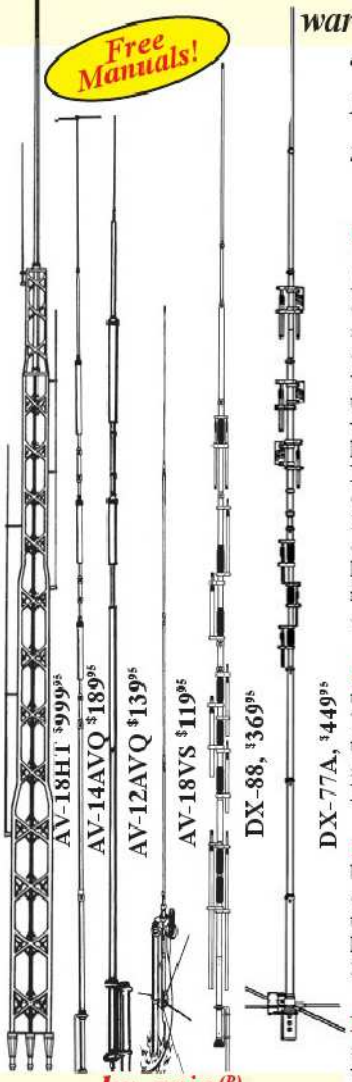
If you could protect the future of Amateur Radio with a phone call, would you pick up the phone? If your signature could end the encroaching prohibition of home-based Amateur Radio operations, would you sign? We are engaged in a battle for the future of Amateur Radio, and our weapons of necessity are phones and e-mail. Contact your congressperson and request that he or she cosponsor H.R. 4969. For more information about H.R. 4969, visit **www.arrl.org/hr-4969**.

Click here to watch a special video message from ARRL President Kay Craigie, N3KN, concerning H.R. 4969.

hy-gain® HF VERTICALS

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

Free Manuals!



hy-gain® Classics

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

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

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

Heavy duty, slotted, tapered swaged, aircraft quality aluminum tubing with full circumference compression clamps are used for radiators.

Includes all stainless steel hardware.

Recessed SO-239 prevents moisture damage.

Hy-gain verticals go up easily with just hand tools and their cost is surprisingly low.

Two year limited warranty.

AV-18HT, $999.95. (10,12,15,20,40,80 M, 160, 17 Meters optional). 53 ft., 114 lbs.

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

AV-14AVQ, $189.95. (10,15,20,40 Meters). 18 ft., 9 lbs. **The** Hy-Gain AV-14AVQ uses the same trap design as the famous Hy-Gain Thunderbird beams. Three separate air dielectric Hy-Q traps with oversize coils give superb stability and 1/4 wave resonance on all bands. Roof mount with Hy-Gain AV-14RMQ kit, $89.95.

AV-12AVQ, $139.95. (10, 15, 20 Meters). 13 ft., 9 lbs. **AV-12AVQ** also uses Thunderbird beam design air dielectric traps for extremely Hy-Q performance. This is the way to go for inexpensive tri-band performance in limited space. Roof mount with AV-14RMQ kit, $89.95.

AV-18VS, $119.95 (10,12,15,17,20,30,40,80 Meters). 18 ft., 4 lbs. **High** quality construction and low cost make the AV-18VS an exceptional value. Easily tuned to any band by adjusting feed point at the base loading coil. Roof mount with Hy-Gain AV-14RMQ kit, $89.95.

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

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

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

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Model #	Price	Bands	Max Power	Height	Weight	Wind Surv.	Rec. Mast
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AV-14AVQ	**$189.95**	**10,15,20,40**	**1500 W PEP**	**18 feet**	**9 pounds**	**80 MPH**	**1.5-1.625"**
AV-12AVQ	$139.95	10/15/20 M	1500 W PEP	13 feet	9 pounds	80 MPH	1.5-1.625"
AV-18VS	**$119.95**	**10 - 80 M**	**1500 W PEP**	**18 feet**	**4 pounds**	**80 MPH**	**1.5-1.625"**
DX-88	$369.95	10 - 80 M	1500 W PEP	25 feet	18 pounds	75 mph no guy	1.5-1.625"
DX-77A	**$449.95**	**10 - 40 M**	**1500 W PEP**	**29 feet**	**25 pounds**	**60 mph** no guy	**1.5-1.625"**

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- Connecotr: SO239 female UHF

W735 Specifications

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- Connecotr: SO239 female UHF

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SD330 Specifications:

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HFV-5

HFV-5 Specifications:

- Bands: 40m/20m/15m/10m/6m
- Max Power Rating: 150W (SSB, 7/14MHz)
- 200W (SSB, 21/28/50MHz)
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- Type: Trapped Dipole
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CP62 is identical, just without 10m Counterpoise.

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Inside HQ

Harold Kramer, WJ1B – hkramer@arrl.org, ARRL Chief Operating Officer/*QST* Publisher

Public Service Programs and Services

Welcome to the Public Service issue of *QST*. Along with some helpful feature articles about Amateur Radio public service activities, in this column I will review some of the programs and services managed by the ARRL's Emergency Preparedness (EP) and Field Organization teams.

Mike Corey, KI1U, Emergency Preparedness Manager, leads the Emergency Preparedness team and is assisted by Ken Bailey, K1FUG, Emergency Preparedness Assistant. The Field Organization Support staff is led by Steve Ewald, WV1X, Supervisor, assisted by Leona Adams, W1LGA, Membership and Volunteer Programs Assistant, and Chuck Skolaut, K0BOG, Field and Regulatory Correspondent.

The EP team manages the Ham Aid program, which supplies equipment that temporarily replaces or adds capacity to Amateur Radio responders after a disaster. Ham Aid equipment includes base HF transceivers, mobile and hand-held VHF/UHF transceivers, and accessories that are packed in rugged shipping cases for quick transport.

Ham Aid equipment has been deployed to Haiti, to Mississippi and Louisiana for Hurricane Gustav, and to multiple states for Hurricane Sandy. Ham Aid equipment has been pre-deployed in Texas, Oklahoma, and Washington, or wherever it is needed the most. Ham Aid equipment is not only deployed for disaster response. Kits can be provided for education, exhibitions, and training purposes. To learn more, visit **www.arrl.org/ham-aid**.

Another important function of the EP team is to act as the liaison with ARRL's national disaster and emergency response partners, including organizations such as the Federal Emergency Management Agency (FEMA), the American Red Cross, the National Weather Service; the National Hurricane Center; and Salvation Army Team Emergency Radio Network. They also work with the many organizations that make up the National Voluntary Organizations Active in Disaster (VOAD) and assure that the ARRL complies with the MoUs (Memos of Understanding) that we have with these organizations.

The EP team also administers our online and field-based Public Service courses including Emergency Communications EC-001 — Emergency Introduction to Emergency Communication, and EC-016 — Public Service and Emergency Communications Management for Radio Amateurs.

The ARRL field organization support staff provides administrative support and guidance to the approximately 7800 ARRL Field Organization leaders and appointees. They work closely with the ARRL's 71 Section Managers and their respective appointees to maintain a comprehensive database of Field Organization appointees. They also manage Section Manager elections four times a year, coordinate the ARRL Simulated Emergency Tests (SET), and work with the National Traffic System (NTS). This group also manages the ARRL Official Observer program and is the liaison for the Amateur Auxiliary to the FCC.

Penny Harts, N1NAG, Retires

Penny Harts, N1NAG, the welcoming face in the ARRL Headquarters lobby and the friendly voice who answers our phones, is retiring — at least from full-time work. Penny began working at the ARRL clerk/typist in the Communications Department 46 years ago, making her the employee with the longest tenure here at Headquarters. She has greeted tens of thousands of visitors to ARRL HQ with a friendly smile and manner, and she has answered hundreds of thousands of phone calls from ARRL members. She has also unselfishly helped many new ARRL employees learn the ropes about the ARRL and Amateur Radio.

Penny Harts, N1NAG

She claims that her distinctive call, N1NAG, was assigned and is not a vanity call sign. Sometimes mysterious events occur, even at the FCC! Along with her official duties as receptionist and member service representative, she has been our lead in-house Volunteer Examiner. Penny became a Volunteer Examiner after upgrading to Amateur Extra class in April 2005. She has participated in over 100 exam sessions, acting as team leader for the majority of them. Her friendly manner has made many an anxiety-ridden applicant feel at ease. She was also part of the special VE Team that tested candidates from the remote areas of Antarctica and Kalaupapa, Hawaii using video conference exam sessions.

A woman of many talents, I can personally attest that she is the best baker (as in banana bread) at Headquarters. Penny and I also built our 40-40 QRP transceiver kits together in the ARRL Lab. She is highly skilled at winding small toroids and soldering tiny components. In fact, the 40-40 that she meticulously constructed had the best performance of any of the kits that were built by ARRL staff.

Although she is retiring from her full-time position, Penny assures us that she still intends to work some part-time hours, particularly when additional help is needed. She will be missed by all of us here at Headquarters, as well as our members, and the Amateur Radio community.

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- **Customized ARRL.org home page**
  Customize your home page to see local ham radio events, clubs and news.
- **ARRL Member Directory**
  Connect with other ARRL members via a searchable online Member Directory. Share profiles, photos and more with members who have similar interests.

ARRL Technical Information Service — www.arrl.org/tis

Get answers on a variety of technical and operating topics through ARRL's Technical Information Service. ARRL Lab experts and technical volunteers can help you overcome hurdles and answer all your questions.

ARRL as an Advocate — www.arrl.org/regulatory-advocacy

ARRL supports legislation and regulatory measures that preserve and protect access to Amateur Radio Service frequencies. Members may contact the **ARRL Regulatory Information Branch** for information on FCC rules; problems with antenna, tower and zoning restrictions, and reciprocal licensing procedures for international travelers.

ARRL Group Benefit Programs* — www.arrl.org/benefits

- **ARRL "Special Risk" Ham Radio Equipment Insurance Plan**
  Insurance is available to protect you from loss or damage to your station, antennas and mobile equipment by lightning, theft, accident, fire, flood, tornado, and other natural disasters.
- **The ARRL Visa Signature® Card**
  Every purchase supports ARRL programs and services.
- **MetLife® Auto, Home, Renters, Boaters, Fire Insurance and Banking Products**
  ARRL members may qualify for up to a 10% discount on home or auto insurance.

* ARRL Group Benefit Programs are offered by third parties through contractual arrangements with ARRL. The programs and coverage are available in the US only. Other restrictions may apply.

Programs

★ ARRL Centennial 2014

Second Century Campaign for the ARRL Endowment – **www.arrl.org/scc**
Centennial QSO Party – **www.arrl.org/centennial-qso-party**

Public Service — www.arrl.org/public-service

Amateur Radio Emergency Service® – **www.arrl.org/ares**
Emergency Communications Training – **www.arrl.org/emcomm-training**

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Contests – **www.arrl.org/contests**
QSL Service – **www.arrl.org/qsl**
Logbook of The World – **www.arrl.org/lotw**

Community

Radio Clubs (ARRL-affiliated clubs) – **www.arrl.org/clubs**
Hamfests and Conventions – **www.arrl.org/hamfests**
ARRL Field Organization – **www.arrl.org/field-organization**

Licensing, Education, and Training

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Find a Licensing Class – **www.arrl.org/class**
ARRL Continuing Education Program – **www.arrl.org/courses-training**
Books, Software and Operating Resources – **www.arrl.org/shop**

Quick Links and Resources

QST – ARRL members' journal – **www.arrl.org/qst**
QEX – *A Forum for Communications Experimenters* – **www.arrl.org/qex**
NCJ – *National Contest Journal* – **www.arrl.org/ncj**
Support for Instructors – **www.arrl.org/instructors**
Support for Teachers – **www.arrl.org/teachers**
ARRL Volunteer Examiner Coordinator (ARRL VEC) – **www.arrl.org/vec**
Public and Media Relations – **www.arrl.org/media**
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The American Radio Relay League, Inc.

The American Radio Relay League, Inc. is a noncommercial association of radio amateurs, organized for the promotion of interest in Amateur Radio communication and experimentation, for the establishment of networks to provide communication in the event of disasters or other emergencies, for the advancement of the radio art and of the public welfare, for the representation of the radio amateur in legislative matters, and for the maintenance of fraternalism and a high standard of conduct.

ARRL is an incorporated association without capital stock chartered under the laws of the State of Connecticut, and is an exempt organization under Section 501(c)(3) of the Internal Revenue Code of 1986. Its affairs are governed by a Board of Directors, whose voting members are elected every three years by the general membership. The officers are elected or appointed by the directors. The League is noncommercial, and no one with a pervasive and continuing conflict of interest 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: ARRL, 225 Main Street, Newington, Connecticut 06111-1494.

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ARRL Section Managers

www.arrl.org/sections

The 15 divisions of ARRL are arranged into 71 administrative *sections*, each headed by an elected *Section Manager* (SM). Your Section Manager is the person to contact when you have news about your activities, or those of your club. If you need assistance with a local problem, your Section Manager is your first point of contact. He or she can put you in touch with various ARRL volunteers who can help (such as Technical Specialists). Your Section Manager is also the person to see if you'd like to become a section volunteer. Whatever your license class, your SM has an appointment available. Visit your section page on the web at **www.arrl.org/sections/**.

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From QST Magazine, March, 2005

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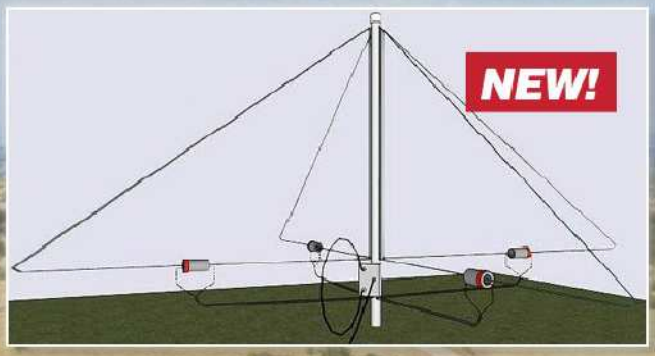

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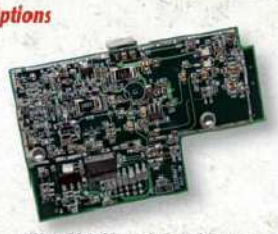

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KXPA 100 Amplifier Specifications

- 100 W output on 160-6 m with 5 W input typical
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Amateur Radio in Service to Communities

Keeping Track of More than "Turkeys"

The Mesilla Valley Radio Club of Las Cruces, New Mexico provides radio communications for the annual Turkey Trot races each November. Radio director George Kopp, KD5OHA (right), assigns the course section to be covered to Richard Johnson, KC5EVR, and Charlotta Johnson, KC5KWI. The Johnsons have radio-equipped bicycles, which allow them to keep the race director fully informed about the conditions on the race route and the locations of the runners. [Alex Burr, K5XY, photo]

Honoring Service in the Wake of Devastation

The township of Babylon, New York, erected a monument at a town park in the village of Copiague to honor first responders and others who assisted in the aftermath of Superstorm Sandy in 2012, and the Nor'easter that followed. The park is situated directly on the Great South Bay on the South Shore of Long Island and was seriously damaged during the storms.

The plaque affixed to the monument reads: "When the Town of Babylon was struck by Superstorm Sandy in the Fall of 2012, many residents were exposed to dangerous storm conditions; some of whom were rescued from their homes. These brave men and women were the first to answer the call when their neighbors needed them the most. We thank them for their service and dedicate this plaque to them."

Included in the listing on the plaque is the Great South Bay Amateur Radio Club who, along with many other Amateur Radio groups in the Northeast, responded to provide communications during and after the storms.

The monument honoring those who assisted in the aftermath of the 2012 storms.

A close-up view of the plaque, which includes the Great South Bay Amateur Radio Club among the list of those who served.

March of Dimes and DMR in Tavares, Florida

The Lake County, Florida, Amateur Radio Emergency Service (ARES) provided communication in support of the March of Dimes Walkathon in Tavares, Florida on May 10. Fifteen volunteer ham radio operators donated their time, vehicles, and equipment for the event. The walkathon course was approximately 5 miles long and had 250 participants.

An Amateur Radio operator was stationed at each rest area with a handheld radio. This enabled the rest area to be in contact with the net control station, N4FLA, in the communications trailer.

What made this public service operation unusual was the fact the Lake County ARES used Digital Mobile Radio (DMR) for the first time. Lake County Emergency Management loaned the ARES operators Motorola XPR 7550 handheld transceivers to stay in contact with the net control station, which was using a Motorola XPR 5550 base station. These radios were programmed to operate in the amateur 70 centimeter band through two repeaters linked together in Groveland and Paisley, Florida.

Strait Hollis, KT4YA, provided one of the mobile support vehicles. [Ted Luebbers, K1AYZ, photo]

Jay Boehme, N4KXO, ran the DMR net control station from the communications trailer. [Ted Luebbers, K1AYZ, photo]

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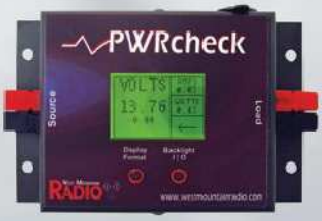

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Letters from Our Members

During 2014, in honor of the ARRL Centennial year, each "Letters from Our Members" column will feature a letter from a past issue of QST.

Off the Air, 1940

In January 1940, Europe was at war and Amateur Radio in the United Kingdom had been shut down. This letter gives a poignant glimpse of conditions in England at the time. — Ed.

Popular opinion amongst hams your side of the duck-pond pictures the average English ham a couple of hundred feet underground, flooding his air raid shelter with tears of despair at being off the air. Well, we may be off the ether, but we're certainly not under it. So here's some dope on things over here.

Inspectors were sent to our shacks to put our rigs off the air. This consisted of confiscating coils and crystals and in my own case one or two connections were opened. I was away at the time and returned to find that the r.f. chokes in my modulator, and the socket for the HK354 final had been disconnected. Since neither were actually in operation and I still had the exciter unit and a 100-watt modulator complete with power supply, plus a couple of other power supplied for the sub-amplifier running, I didn't know whether to shoot myself or give myself up at the nearest jail. The problem was solved by the arrival of two more inspectors who announced their intention of removing the entire rig. The main H.T. transformer weighs 150 pounds, then there is a 350-watt modulator complete with power supply, plus a couple of other power supplies for the sub-amplifiers, all bolted firmly to a fairly weighty W.E. rack. An SOS was sent out to local hams and with their aid the rig was eventually removed...

And so we're off the air, but we're still carrying on. We've still got our receivers to work on, and many of the gang are doing some really good work on u.h.f. suppers, so your crowd had better look to your laurels or we'll have you licked in that field.

The South London-Croydon hams are still sticking together. Some of us have been called, some are away, but those left are still keeping the ball rolling.

We're still keeping our local club on the map...The R.S.B.G. Bulletin is still running, but commercial radio mags are feeling the pinch and are publishing small monthly editions at three times the price of their old weekly ones. I have seen *QST* for October, but don't know if I'll see anymore — it's very hard to get dollars owing to the exchange restrictions, and I doubt whether magazine importers will be able to get us copies either for the same reason.

Maybe you'd like to know how we are getting on with the present bother running. I can only speak for London as I work in that burg. As a precaution we had sent most of our staff about 150 miles away around August 25th. And just a few of us were left to run things at my office. Ten-thirty on the Friday morning after, news came through of the invasion of Poland. Some said London would be bombed that very day, others said ridiculous, and offered to lay bets against it. As I left my office about ten that night, and was crossing by the Bank of England, all the street lights suddenly went out. That was the last we've seen of them.

Well, I think that's just about all, except that although I can't talk to you lads over the air, I'd appreciate hearing from you once in awhile.

Keep on the air, U.S.A. We like hearing you.

Basil Wardman, G5GQ
London, England

More Praise for Centennial Operations

Just a note to say how much I am enjoying the Centennial portable operations of W1AW. I only operate CW and the initial pileups are tougher to break than the most rare DX! Listening to the calling frequencies, my S meter sometimes doesn't move off of a steady S-9 +40! It's a challenge to work the adjacent states on the higher bands where the propagation is longer than the short distance: a real test of skill and patience. I'm a DXer and my wife doesn't understand when I exclaim "I JUST WORKED WISCONSIN!"

The W1AW operators are absolutely fantastic to make sense out of it. I hope they're having as much fun as I am having while chasing them down.

What a great way to celebrate 100 years. Thank you for finding yet another way to have fun with Amateur Radio.

Fred Glenn, K9SO
Castlewood, Connecticut

Ham Radio's First Handheld

Thanks to Bob Allison, WB1GCM, for preparing an excellent article on the Gonset Communicator, which appeared in the July 2014 issue of *QST*. The subtitle of the article caught my eye: "The 'Gooney Box' was ham radio's first 'handheld.'"

The Gooney Bird (as the Communicator was also affectionately known) was indeed a "handheld," but not quite in the way we think of handhelds today. It was helpful to have a friend carry a Die Hard-type battery in a backpack to power the vacuum tubes. Using this arrangement, you could walk and talk as long as the Communicator-carrier and the battery-carrier remained side-by-side. You could even go mobile from a roller coaster, and some hams did just that!

One small point of clarification: the Gonset Company was family owned and operated until about the time the Communicator IV was introduced. Then the company was sold, and my father started other successful businesses, including Minitron, which made printed circuit boards for the manned space program, and Sideband Engineers, which manufactured the first low-cost widely-accepted largely-transistorized HF transceiver — the SBE-33. But those are great stories for another day.

Bob Gonsett, W6VR
Fallbrook, California

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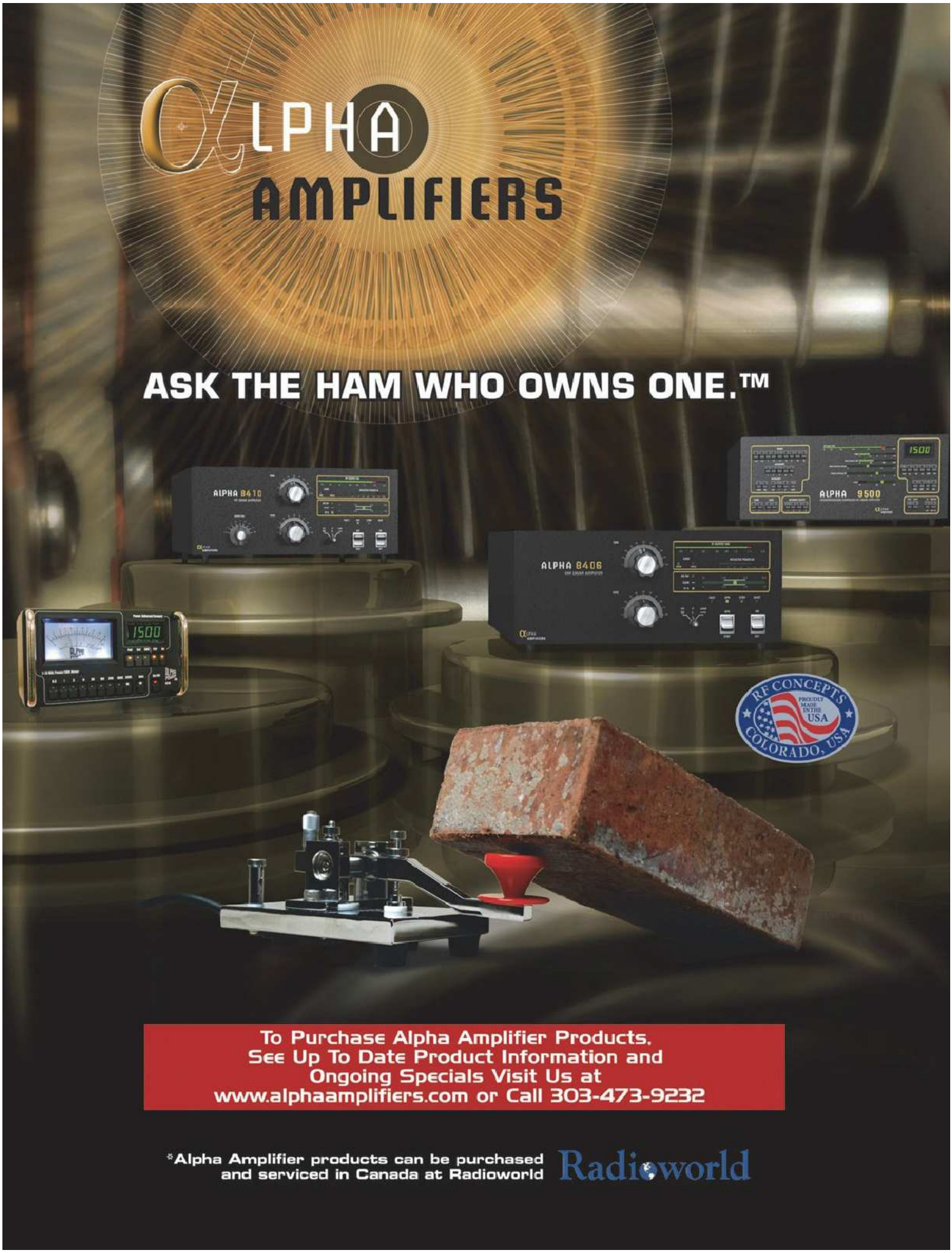
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Antenna Masts: Safety and Selection

Whether you are using a mast in a permanent installation or a temporary public service application, this valuable advice from a tower professional can help you avoid disaster.

Don Daso, K4ZA

Nearly every amateur who contemplates a tower will need to include a mast to support his or her antenna — or antennas. While some hams simply mount their beams on the side rails (the vertical legs) and rotate the whole tower, most of us rely on masts installed within the tower. Masts also come into play for temporary installations, such as those at public service events.

Either way, choosing the proper mast isn't a decision to take lightly. Your personal safety, not to mention the safety of your antenna, depends in large part on the type of mast you select.

Figure 1 — A water pipe mast failure. [Thomas Cox, KT9OM, photo]

Mast Material

Consider the mast material itself. I've encountered almost every mast material during my years as a ham tower professional, from wood to fiberglass, conduit to fence rail, water pipe to aluminum, and various steel alloys. However, the fact remains there's neither a single nor simple solution for every situation. In all cases, though, a basic understanding of some physics, along with the inherent strength of the materials, will help you choose wisely and stay within your budget.

Years ago, hams thought nothing of using water pipe as mast material. The common pipe available locally and cheaply is known as ASTM 120. It is heavy, which led users to think it must be strong enough for the task. This was often true, but at other times these masts failed spectacularly, as shown in Figure 1.

A few minutes with the *ASM International Handbook* demonstrates that for common water pipe, no minimum yield strength is specified at all![1] Water pipe is intended to convey fluids from point A to point B and is not rated for structural uses, although it is often pressed into service for light loads.

Water pipe is also measured by its inside diameter (ID), so a smaller size (1.5-inch ID) is required in order to mate with our common 2-inch diameter U-bolts, clamps, and rotators. The actual outer diameter (OD) will still be under-sized — about 1.9 inches, in fact. If you were considering water pipe for your project, proceed with great caution. For all but the lightest jobs, you should use mast material that is designed for *structural applications* and rated accordingly.

Calculating Stresses and Strengths

When selecting a mast, you must ensure it will be strong enough. That means the mast's strength must be greater than the stress of the loads you will place upon it, with an additional margin for safety.

The *bending stress* on your antenna mast depends upon:

- The wind load area presented by the antennas specified in square feet
- The antenna position on the mast above the top bearing
- The mast's cross-sectional area
- The peak wind velocity

The *strength* of your mast is determined by:

- The yield strength of the mast material in psi (pounds per square inch)
- The cross-sectional dimensions of the mast (wall thickness and diameter)

Obtaining the data for calculating the bending stress is easy enough. You can obtain the information you need from manufacturer's data, your own measurements, and your local county wind speed ratings (along with additional information that your nearest National Weather Service office can provide).[2] The data for yield strength is obtained from the mast vendor.

Consult Chapter 26 of the *ARRL Antenna Book* for the fundamental formulas to calculate stress on masts.[3] You can also use commercial mast selection software. DX Engineering (**www.dxengineering.com**) and Champion Radio (**www.championradio.com**) both sell software that allows you to simply "plug in" your values to de-

[1]Notes appear on page 32.

termine the strength of materials required in your installation. Once you've done that, choose a mast that meets the requirements.

You may find that a simple antenna system can be supported easily. For example, if a single small tribander is going to be mounted only a couple of inches above a tower-top thrust bearing, water pipe *may* work because the bending stress will be very low. But if a "Christmas tree" array of 10 through 20 meter monobanders is going on that mast, you must use very high-strength mast material such as 4130 steel, which is strengthened with chromium and molybdenum.

Mast Installation

Once you have obtained a mast, the next challenge is to install it safely. The most common problem encountered during mast installation is maneuvering that long, heavy mast up the tower and into position. Here are some helpful suggestions.

If you are building a new tower, install the mast as soon as it is practical. For instance, if you are using a 24-foot length of tubing, install the mast inside the tower as soon as you have the first 30 feet of tower erected. It is much easier to install the mast inside the tower sections and pull it up, rather than attempting to lower it into the relatively small diameter sleeve or thrust bearing, from above the tower.

Simply lower the mast into the tower sections and let it rest on the tower foundation as you build the rest of the tower. (The longer the mast, the less likely it will fit into the tower between the rungs of regular lattice tower, so take advantage of the opportunity!) It is then an easy task to raise it once the tower is complete, pulling it up and through the bearing. Use muffler clamps as safety stops above the bearing, and slings to lift it into place.

If you are replacing a mast and must lower the new mast through the bearing from above, you will likely find the following technique helpful. Any long mast, no matter its material or how light, will exert some serious bending forces (torque or moment) on the person climbing the tower. It's very hard to hold such a thing in position, guiding it down and through a hole only slightly larger than the mast's own diameter. Add some wind and some wobble, and any climber will begin to worry. Such work is dangerous and not trivial.

Figure 2 — A basketball hoop can be used with a gin pole to control movement as a mast goes into place. [Don Daso, K4ZA, photo]

Figure 3 — Two Slipp-Nott mast clamps and hardware. [Photo courtesy of Tennadyne]

It's critical that the mast remain as vertical as possible, yet secure. While I've read of various methods to guarantee this, the simplest way is not allowing the mast to move away from vertical. A loop or ring, secured to the top end of the gin pole will provide that stability. I use an inexpensive basketball hoop as shown in Figure 2. It can be easily attached and removed.

Mast Alignment and Realignment

Despite torquing things down as tightly as you can, you may one day look up and notice your antenna(s) have turned from their normal position. At the top of the tower, you find one of two things: either the antenna has slipped on the mast, or the mast has slipped in the rotator. Such slipping is quite common on chrome-moly masts, for example, because of the steel's hardness.

I do not recommend pinning masts to antennas or rotators with a bolt through the mast. In worst-case scenarios, rotators and antennas are then more likely to break, which is always more troublesome and costly compared to a simple readjustment. Slipping arises from the typical U-bolts used to hold the mast in place. They simply do not have sufficient surface contact area. Some extra "clamping power" is called for to prevent such slippage. A commercial product, the aptly named "Slipp-Nott," available from Tennadyne (**www.tennadyne.com/slipp_nott.htm**) and shown in Figure 3, works great if you use the common 2-inch mast material. The Slipp-Nott provides nearly 90% surface contact area, producing greater holding force.

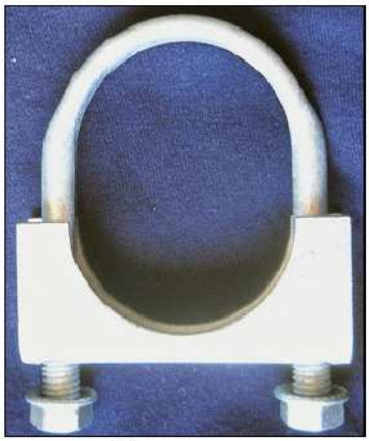
Another option is using U-bolts with "flattened" clamping areas, such as those developed by Cycle 24 (now sold by DX Engineering). Shown in Figure 4A, those bolts have more contact area between the mast and the bolt, increasing the clamping force. Photo 4B is of my homebrew version that adds a second U-bolt with short straps to clamp the mast above the rotator clamp. Although the Cycle 24 clamp is shown, a standard U-bolt can also be added and will add to the overall holding ability.

Conditions Beyond Your Control

If you do a simple search for wind tables, charts or wind zone diagrams, you'll encounter confusing and sometimes conflicting data. While measuring wind velocity is easy enough, the charts usually provide *averages* of wind speed over long periods of time. Unfortunately, it is the gusts or peak wind speeds that wreak havoc with antenna systems.

Because we can't predict when gusts will occur, it becomes necessary to gather all the relevant data, make some educated calculations, and proceed accordingly. But modeling, figuring, and software-driven conclusions will only take us so far. At some point we have to let experience guide our choices. If you don't have that experience, or are unwilling to take the risk, consult a professional engineer familiar with conditions in your area.

Besides wind, which we can design for, there is ice to consider in some regions. Again, we can design for ice loads, but here is a significant point to remember: we cannot design for what will happen to structures when the ice comes off. Ice *never* sheds in a predictable fashion. Ice tumbles off in bits and pieces. The load changes dramatically as the ice departs. Add some



(A)

(B)

Figure 4 — A U-bolt with a flattened clamping area (A) for greater clamping force. [Photo courtesy of DX Engineering] A homebrew version is shown at (B) using a pair of straps to add a second clamp for extra clamping. [Don Daso, K4ZA, photo]

wind and you've potentially set the stage for disaster.

One of my clients recently suffered a broken boom on his C-19XR Yagi antenna during a fairly uncommon North Carolina ice storm. Compiling some simple figures, I reasoned that once the beam was loaded with ice, it likely weighed more than 200 pounds. When the wind began whipping up, the strength of the boom was quickly exceeded and it failed.

Despite your best efforts, it isn't always possible to build in a sufficient safety margin for every scenario and still remain within a reasonable budget. If that is the case, consider purchasing insurance to protect you. Insurance should cover the cost of removing damaged antennas, masts, and tower hardware — a job best left to professionals with the proper equipment and years of experience.

Be Safe and Wise; Prepare and Plan

Here is a truth that should be universally acknowledged: an antenna system is first in a ham's hierarchy of hardware and if there is a tower in your plans, the mast should be near the top (pun intended) of the items on which to concentrate your attention. Start by choosing mast material that is strong enough for the loads you expect it to support. Prepare yourself for the job of installation before you start up the tower. And be sure to leave yourself plenty of margin both in material selection and safety (always use a body harness) when working aloft.

Notes

[1] *ASM Handbook Volume 1: Properties and Selection: Irons, Steels, and High-Performance Alloys* and *ASM Handbook Volume 2: Properties and Selection: Nonferrous Alloys and Special-Purpose Materials*, ASM International (Formerly the American Society for Metals); **products.asminternational.org/hbk/index.jsp**.

[2] *Structural Standards for Steel Antenna Towers and Antenna Supporting Structures*, TIA Standard TIA-222-G, Telecommunications Industry Association, Aug 2005; **www.tiaonline.org**.

[3] *ARRL Antenna Book, 22nd Edition*, ARRL, 2012; **www.arrl.org/shop**.

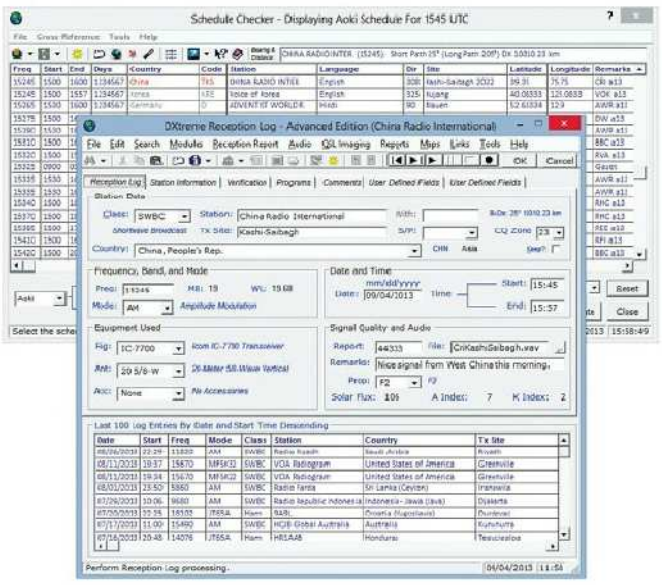
Don Daso, K4ZA, is the author of *Antenna Towers for Radio Amateurs* (**www.arrl.org/shop**). You can contact Don at **k4za@juno.com**.

For updates to this article, see the *QST* Feedback page at www.arrl.org/feedback.

New Products

DXtreme Reception Log Software

DXtreme Reception Log — Advanced Edition Version 9.0 is a *Windows* logging program for radio and TV monitoring enthusiasts. In addition to the usual logging functions, an embedded audio feature lets users create and maintain an audio archive of stations heard. A Schedule Checker imports schedules from the FCC, Aoki, and EiBi websites and displays schedule data according to user specified filter criteria. A Last Log Entries Grid shows up to 5000 of the most recent log entries added. The records can be sorted, and double-clicking them displays their detailed data in the Reception Log window. The program also features an integrated QSL imaging facility that that allows users to scan physical QSL cards and capture electronic QSLs received over the Internet. *Reception Log* saves both types of QSLs as digital images to view at any time. The software includes a customized paper and e-mail reception report generator and integrates with Afreet *Omni-Rig* and *DX Atlas* programs. Price: $89.95 for new users; upgrade pricing available. For more information, or to order, visit **www.dxtreme.com**.



XP to *Linux*: The "Why" for Hams

With Microsoft no longer supporting *Windows XP*, is it time to consider *Linux*?

Bill Kibler, WA6SAZ

I am a retired Senior Software Engineer from HP who has seen more than his fair share of *Windows'* "blue screen of death." I managed a software build factory where we spent 95% of our time fixing *Windows* issues and 5% of our time making sure the *Unix/Linux* systems hadn't run out of disk space. You can see from that why all my personal and business systems are running *Linux*.

With Microsoft dropping support for *XP*, now would be a good time for hams to convert their systems to *Linux*, like I have. The questions for many hams will be — why? What will I get by converting to *Linux*? How do I convert? What will I lose when I convert?

I will start with what it means to lose Microsoft support.

The End of *XP* Support

If you have been getting Microsoft updates on a regular basis, your *XP* machine should have patches for fixing bugs, virus problems, changes in any standards, and so forth. But all of those "updates" have now come to an end.

As a result, over time your system will become more vulnerable to virus and malware infections, to the point where it may eventually become unusable. Many of the programs you enjoy will become outdated and may fail if a needed patch is not applied.

One answer to the infection threat is to simply take your system off the Internet, but then how would you download software updates to that new rig that only came with *Windows* tools? The answer is to run *Linux* alongside *Windows XP* on the same hard drive, through a technique known as *dual booting*.

Reasons to Consider *Linux*

There is a solid economic reason why whole countries, large corporations, schools, and small businesses have made the transition to *Linux*. Typically, they see their overall IT expenses drop by 40%, and in some cases to 20% of previous yearly costs.

In contrast, consider the cost factors of remaining with *Windows*. In the past, you had the option to upgrade *Windows* for a cost of about $100. You'd purchase the upgrade CD, install it on your computer, and you were ready to go.

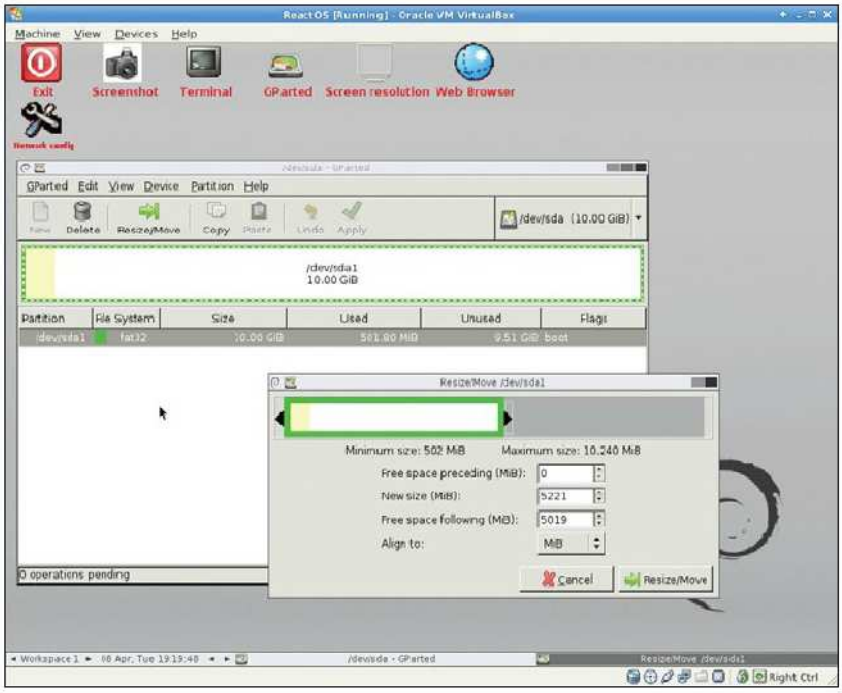
But even if you had $100 in your pocket today, that upgrade path no longer exists. Instead, you must install a completely new version of *Windows* that will utterly erase your hard drive in the process. That means you will have to re-install all of your software and totally reconfigure the computer.

Worse yet, you will likely discover serious compatibility issues with your software and hardware. Some programs simply will not run at all. And for internal hardware issues, the only cure will be buying a completely new PC!

Compare that scenario to the *Linux* alternative. To install *Linux*, you can download everything you need and perform the operation for the cost of a few blank CD-ROMs or DVDs. Because there is basically no cost associated with *Linux*, this also means you can try various versions until you find something you like. If you find you don't like *Linux* at all, you've lost nothing but your time. You can go ahead and purchase that new desktop computer, laptop, or tablet with the peace of mind of knowing that you explored the alternatives.

Of course, cost isn't the only reason to try *Linux*. Consider the following:

- There are no licensing entanglements, which means that you can install *Linux* on more than one system.
- If your hardware is antiquated, there are special versions of *Linux* that will add new life to an old system.
- *Linux* uses open standards like ODF (Open Document Format). which fixes the *Word* version compatibility problem.
- *Linux* is finding its way into more embedded and special systems, and therefore



In this view, *GParted* has configured the 10 GB "virtual box" hard drive *Windows* partition into two 5 GB partitions. Notice the RESIZE command boxes with proper values. The next step is to access the "Partition" pull-down menu and select NEW to create the *Linux* and Swap partitions.

knowing *Linux* allows you to understand and use exciting technologies, such as the Raspberry Pi microcomputer.

For many *Linux* users, *Linux* is all about choice. Every ham has different work habits and requirements. Some may also need special support for issues like blindness. As your skill set changes with *Linux*, you can adjust every aspect of your environment to match the way you work.

Try a Dual Boot

The advantage of dual booting for *XP* converts is that you get to keep what you already have. You are just adding *Linux* to your toolbox.

Dual booting allows for a more gradual migration, but I must warn you that it will take longer to fully understand and adjust to how *Linux* can work for you. The *Linux* install tools will typically mount your *XP* hard drive partition, so when running from *Linux* you will have full access to read and write your old *XP* data. For those wanting to take *XP* "offline," you can download data using *Linux* and save it on the *XP* partition for later use. There are even advanced tools that will run virtual *XP* environments using the *XP* partition.

The first step in the dual boot process is to prepare the old *XP* partition. For normal *XP* users, your hard drive will have one or two partitions. In the early days, PC vendors shipped disks with units; later they just added an extra hard drive partition to contain a "restore" file system for when the normal hard drive partition became corrupted or infected. In both cases, your hard drive will be fully used and will have no extra room to install another operating system. Your choices are getting a new hard drive, which is probably not possible for very old systems as that style of drive is no longer made, or shrinking your main partition to make room for *Linux*. If, by chance, you can afford and find a new drive, adding it to the mix is probably the best option.

If You Need to Shrink...

If you find that you must shrink your hard drive partition, there are a number of steps to do first, the main one being to back up your hard drive. Keep in mind that any number of things could go wrong at any time, so you need a backup of your data even if you don't convert to *Linux*. The next step is using the *Windows* tools to check for disk errors and defragment the hard drive. Defragging is important as we want all the data moved to the beginning of the hard drive. Do the defragging even if *Windows* says it is not needed.

This would also be a good time to remove any junk on your hard drive (old software you no longer use, documents you don't want to keep, etc). The more room you make, the larger the *Linux* partition can be.

Some users will find that they have problems that *Windows* tools cannot fix. This illustrates the importance of making a backup copy of your hard drive. You may need to completely restore the hard drive before you can proceed.

When you're ready to start shrinking, the best tool I have found is the *GParted.iso* CD-ROM. This *Live Linux* utility disk comes as an ISO image and can be found by searching the Internet or ordering from any of the *Linux* disk suppliers; a Google search will return many featured and free sites to use. Once you have downloaded the latest version of *GParted.iso* and burned it to a disk, start by inserting the CD and rebooting your computer.

I suspect a lot of systems out there will have the Basic Input/Output System, or BIOS, configured in such a way that it skips anything in the CD-ROM/DVD drive and goes right to the hard drive when powering up. You will need to change that by going into the BIOS menus and changing the boot order to use the CD-ROM or DVD drive first.

Watch your monitor closely as your computer boots up. You will see a brief text message telling you that if you press and hold a certain key, such as F12, you can access the BIOS menus. Follow that instruction — you'll have to restart again if you are slow to reach the key!

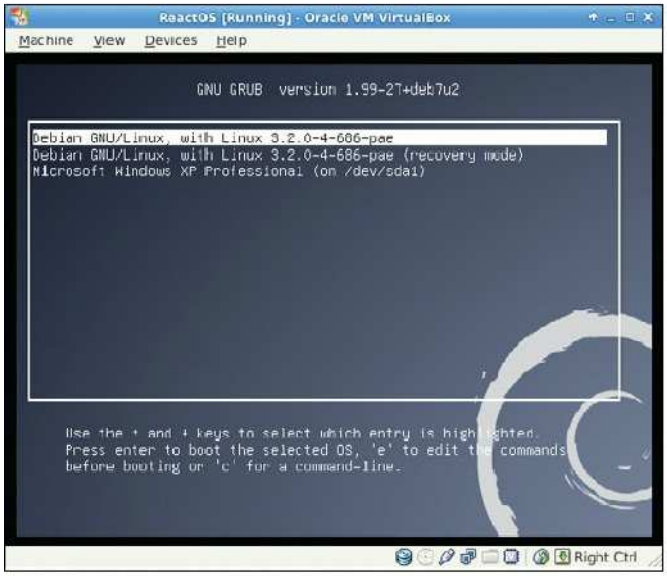
Once you have access, search through the menus until you find a reference to "boot order." Change the order to make the CD/DVD drive the first device the computer checks. Save your changes and reboot the system with the *GParted.iso* CD in the drive.

If all goes well, *GParted* should start. Select the "C" drive or main partition and click on the RESIZE box to see the options. You can use the mouse to move the right side end toward the left side, but be careful not to move the left end point. I find it is safer to change the values in the AFTER box, which is the size of the new free space you want for *Linux*. I recommend about 10 GB, although if you are going to do more than just test *Linux*, 30 to 50 GB seems better.

Once you have the new size entered, make sure the BEFORE box hasn't changed — typically it should be "0." This controls the beginning point of the *Windows* partition, and it is best not to change it.

Linux Links

- Learn more about Debian, or about *Linux* in general: **https://www.debian.org/intro/about**.
- For information about getting or buying Debian disks or images: **https://www.debian.org/distrib/**.
- An excellent support page for *Unbuntu Linux* Amateur Radio software: **https://wiki.ubuntu.com/UbuntuHams**.
- For that old *Windows 95* system collecting dust, learn about Puppy *Linux* here: **puppyLinux.org/main/Overview and Getting Started.htm**.
- A version of Puppy for very old PCs: **puppyLinux.org/main/Long-Term-Supported WaryPuppy.htm**.
- *Fldigi* is an excellent Amateur Radio multimode program for everything from PSK31, to RTTY and much more: **www.w1hkj.com**. There is even a "how-to" for using Puppy *Linux* and *Fldigi* at **www.w1hkj.com/flpuppy.html**.
- Andy's Ham Radio *Linux Live* DVD (1.6GB), contains a lot of Amateur Radio software including *Fldigi*, *Gpredict*, *earthtrack*, *XLog* and *cqrlog*, *flrig* and *grig*, *xnec2c*, *gEDA*, and much more: **sourceforge.net/projects/kb1oiq-andysham/**.
- *Virtual Box* is a PC emulator that can boot ISO images downloaded from the Internet without burning DVDs. Many *Linux* releases can install *Virtual Box* by using their package manager. *Windows* and *OS X* users wanting to try *Linux* in *Virtual Box* can download it from: **https://www.virtualbox.org/wiki/Downloads**.
- The *Linux* Australia website provides links to hundreds of ham projects, both very old and very new: **radio.Linux.org.au/?sectpat=All**.



The dual boot menu showing options for *Linux* and *Windows*. This is what you will see when you restart or turn on your computer after completing the dual-boot installation. *Linux* is the default option and will boot in 30 seconds if no action is taken.

An old HP laptop using *Linux Wine*, a *Windows* emulator that is being used to run *Windows Yaesu PCC-450* software, which in turn is communicating serially with an FT-450 transceiver and a SignaLink USB interface. All units are powered by two solar collectors and three solar batteries.

If everything looks correct (you did back up your hard drive, right?), use the APPLY tab and *GParted* will start shrinking the partition. This can take a very long time if you have lots of data to move. There may be a second partition that contains a RESTORE file system and it can be ignored or removed if you never want to re-install the original *Windows* operating system.

Installing Linux

Insert your *Linux* installation CD or DVD and reboot your computer. If you didn't need to shrink your *Windows* partition, you will need to change the boot order as described in the previous section so that your BIOS will "look" for the CD/DVD drive during the rebooting process.

As the *Linux* installation routine begins, it will present you with a menu. Follow the instructions; they are straightforward. Just be careful when it comes to the part of the installation concerning hard drive partitioning and formatting.

Selecting USE WHOLE DISK will generally mean that *Linux* will completely overwrite the *Windows* partition, which you obviously don't want to do! It will be safer to select MANUAL PARTITIONING, because you want to be sure to only change the new space (or drive). Some installs will be clear that they are partitioning and formatting the unused space and selecting that option will also work.

The objective is to provide a *Linux* partition using ext4, containing all the data in one partition, mounted on "/" or root, with a swap space of at least the same size as your available RAM, although I generally use at least 1 GB to keep it simple. When you are happy with your selections, you will be asked to confirm that you understand that the next step will alter your hard drive's partition table and that there will be no restoration possible should it be wrong.

This is the moment of truth. You must feel confident that what you are doing is correct before you allow the software to proceed. Keep in mind that you can abort the install any time up until the moment the software re-partitions the hard drive.

There are several places in the install where things can go wrong, especially with older *XP* systems. They may have bad hardware, buggy motherboards, or unsupported components. For those cases try the "fail safe options" and if those fail, you will need to check the Internet for solutions.

If the installation is a success, and most will be, you can reboot your computer and you will see a menu asking you to choose *Windows* or *Linux*. You will see this menu each time you restart or turn on your machine.

Conclusion

One topic I didn't mention is the use of *Live Linux* DVDs and CD-ROMs. This is a great way to get a taste of *Linux* without modifying your hard drive at all.

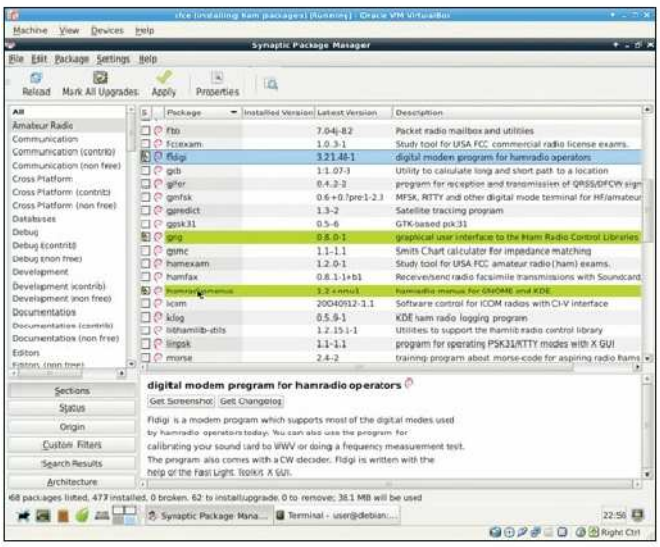
The *Live* disks boot from the CD/DVD drive (there's that BIOS boot order issue again!) and the software runs entirely from RAM. If you want to make a *Linux* presen-

What is a *Linux* "Distro?"

A "Distro" is short for a Distribution, as *Linux* is a collection of programs or modules that represent a selected functional design. That design can be used as a general purpose desktop workstation or a specific embedded use, such as powering Android phones.

By being modular, *Linux* can be customized to provide various sets of features or functions within size constraints. Distros range in size from 45 MB to over a gigabyte. They can be command-line only, or use one of many desktop packages to provide point and click functionality. You can add or manage the packages or functions the Distro performs by using one of the many "package managers."

The website **distrowatch.com** rates Distros by how many were downloaded from their site each week. You can search their database by several criteria to help select a Distro for a specific need, such as "Old Computers," which returns 19 to choose from.



The *Linux* package manager *Synaptic* with three of the most common Amateur Radio programs selected for installation. Note the descriptions, both on the highlighted display and below in the details box. The status line shows 68 packages in the Amateur Radio section alone!

Grig Linux software controlling a Yaesu FT-450 transceiver.

tation at your local ham club, *Live* CDs are ideal for giving members a safe, noncommittal way to try *Linux* themselves.

It is important to emphasize that *Linux* is free and thus your expenses for testing and trying *Linux* are as close to zero as you are likely to find. Should you find it is not for you, you can format the *Linux* partition in NTFS and *Windows* will use it for data. However, I'm willing to bet that you will be pleased to discover that *Linux* has increased systems performance, provided new tools for old jobs, and returned "fun" to the terms you use for describing your computing experience!

New Products

Pan/Tilt Positioner from J-Systems

The JPTH-13M pan/tilt joystick controlled positioner from J-Systems operates from any 12 V dc power source and is intended for remote, solar power, and mobile applications. It can be used to position loads up to 13 pounds, including cameras, IR or white light illuminators, speakers, or wireless antennas. The unit is made from powder coated aluminum and uses stainless steel hardware. Multiple IP based controllers are available. The advanced PWM controller offers precise closed loop dc servo control with a virtual joystick web interface. For more information, visit **www.j-systems.com**.

Bill Kibler, WA6SAZ, has been a ham since the early 1960s. He has a Masters degree in Computers and Education, worked in broadcasting, geophysics, ran *TCJ* magazine, and worked for major computer companies doing software and hardware engineering. His website at **kiblerelectronics.com** has the *TCJ* back issues and new articles on using *Forth*, *Linux*, BeagleBones, and many ARM platforms. You can contact Bill at **kibler@psyber.com**.

For updates to this article, see the *QST* Feedback page at www.arrl.org/feedback.

Strays

QST Congratulates...

■ARRL Life Member James M. Roop, K9SE (ex-WA9QFL, K0BI), on his retirement from the Federal Communications Commission after 37 years of service. James retired on May 30, 2014 as the District Director of the Chicago District Office. Additionally James was stationed at the Allegan (Michigan) Monitoring Station until its closure in 1996 where he administered the monitoring training program, as well as training foreign engineers in the United States Telecommunications Training Institute (USTTI) program.

■Dr Kevin Kloesel, KE5NFJ, who was appointed to newly-created position of University Meteorologist under the Emergency Preparedness office of the University of Oklahoma.

I would like to get in touch with...

■Anyone who has QSL cards from the former holders of the call W4TI: Arthur Seager, Robert Sommerville, and James Pullman. Please contact Chase Turner at **w4ti@arrl.net**.

■Anyone who might be interested in participating in an expedition to the island of Peleliu in 2019 to commemorate the 75th anniversary of the Battle of Peleliu. Contact me, James Fayard, KE5JDJ, at **rastus@igottahaveajob.com**, or **ke5jdj@arrl.net**.

A New Life for an SB-610 Monitor Scope

Convert a derelict monitor scope to a solid state ham shack oscilloscope and add an analog clock display.

Dave Cook, WA0TTN

I have a Heathkit SB-610 monitor scope in my shack. Though it is tube based and was designed in the 1960s, it still performs its intended primary task well, which is to display a transmitted signal pattern, RF envelope, RF trapezoid, or radioteletype (RTTY) cross pattern.[1] Its classic design blends in with my Collins S-Line equipment.

I received a rare disappointment from the '610 when I tried to attach an accessory analog/digital clock display card (designed by Jan de Rie) to its X and Y input terminals (HOR. and VERT. respectively on the back panel).[2, 3] Instead of a sharp analog clock face with an auxiliary digital time display (see Figure 1), I was presented with an image that looked like a heap of limp spaghetti. I had pushed my '610 too far — it lacked the bandwidth to produce the display.

It occurred to me that if a solid state CRT driver circuit were provided for an SB-610, there would be adequate bandwidth for the clock display. In my research I came across the website of Jon Stanley (not to be confused with John Stanley, K4ERO), which has a wealth of information pertaining to solid state conversion of tube based oscilloscopes.[4] Jon has designed a new CRT driver board, which is available on his website.[5]

I consider my SB-610 to be a collectors' item and I would no sooner hack into this vintage piece than I would into one of my S-Line radios. Fortunately, there were many produced and quite a few have become derelict over the years and ended up on Internet auction sites advertised as "For parts or repair." I obtained such a unit, which had a front panel and CRT that were in good shape. The transformer had a bad winding, which made it undesirable for someone doing a full restoration because functional transformers are so hard to find.

[1]Notes appear on page 43.

Figure 1 — Oscilloscope clock display generated by Jan de Rie's AVR Oscilloscope Clock available from SparkFun Electronics at **www.SparkFun.com**.

Tear-Down

The first step in the conversion was the "tear-down." The key here is to tear *down*, not tear *up* — try to do as little damage as possible, especially to the front panel, CRT, and its socket. Rather than laboriously clipping or unsoldering component leads, I left everything connected and simply unfastened nuts and screws. I threw away the leaky electrolytic capacitors and set the tangle aside in my junk box in case I need original components in the future for my functional SB-610.

With all the parts removed, the chassis was accessible for cleaning. Because this was not a restoration project, I scrubbed and then sanded the chassis with fine sandpaper until it was shiny. I removed the tarnish from the CRT magnetic shield and painted it flat black. The front panel was cleaned with glass cleaner, taking care not to rub off the labels, which I decided not to modify. A series of photos detailing the tear-down and construction is available at my Picasa web account.[6] Before getting into the construction, we'll look at the circuitry.

Circuitry

The block diagram of the modified SB-610 is shown in Figure 2. In addition to the CRT and the power transformer, there are three functional blocks — the CRT driver board, the clock display module, and the sweep generator. Each is discussed in detail in a separate subsection below with the exception of the CRT driver board, which is divided into a subsection describing the power supply and a subsection describing the X, Y, and Z axis drivers for the CRT.

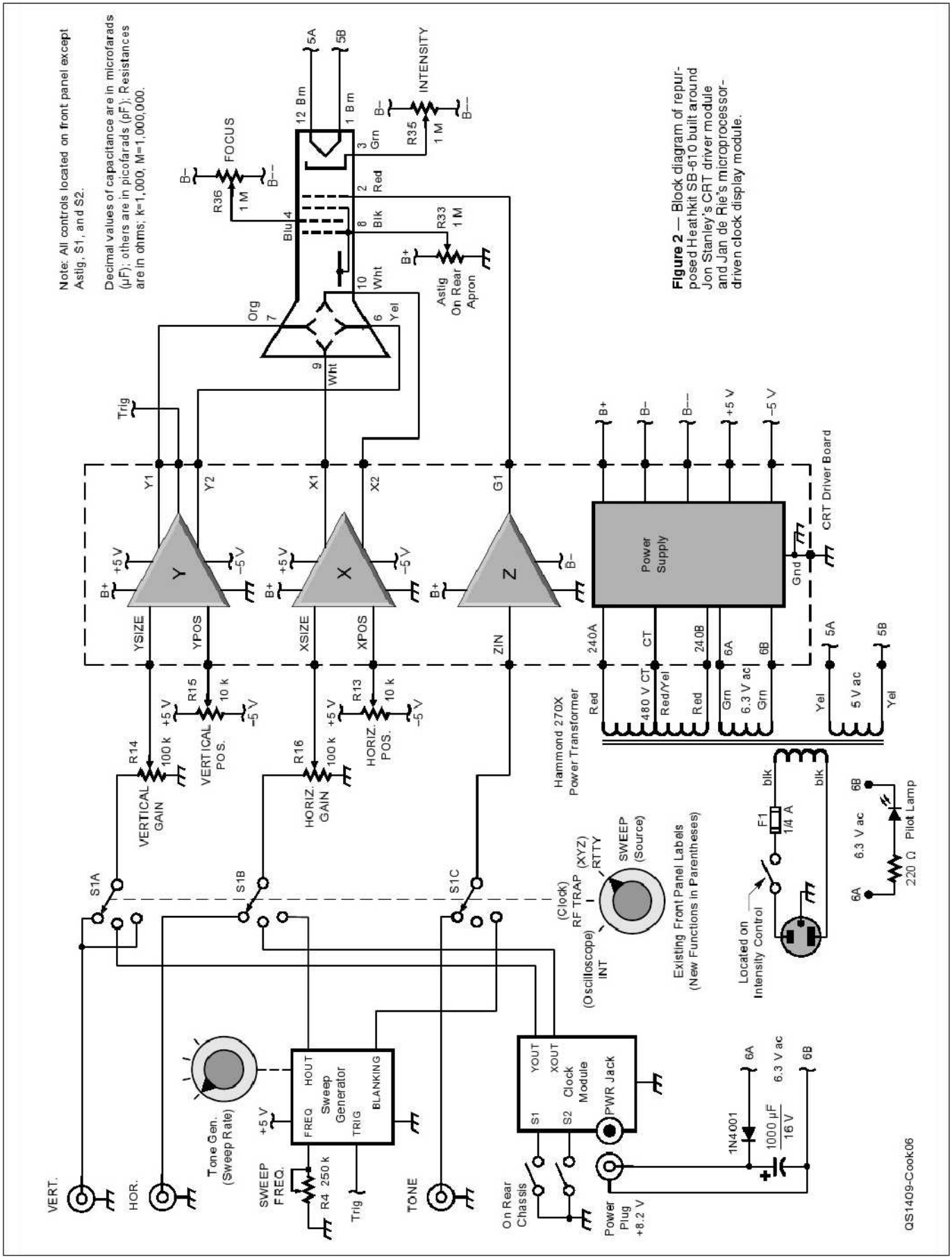
I chose to leave the front panel labels unchanged. For the most part this did not present a problem — controls such as INTENSITY and FOCUS retained their indicated functions. The two controls where the function has changed from the panel label were SWEEP and TONE GEN.

The new purpose of the SWEEP control is to select the source signal for the CRT driver board. The left position marked INT. selects the oscilloscope function where the VERT. input from the rear chassis jack is routed to the VERTICAL GAIN control, the ramp output HOUT of the sweep generator is routed to the HORIZ. GAIN control, and the sweep generator BLANKING output is routed to the Z axis amplifier through ZIN on the CRT driver board.

The center position of the SWEEP switch, labeled RF TRAP, selects the clock display where YOUT and XOUT are routed to the VERTICAL GAIN and HORIZ. GAIN controls respectively. There is no connection to the Z axis amplifier for this mode.

The right position of the SWEEP switch marked RTTY selects XYZ mode where direct inputs from rear chassis jacks HOR. (X input), VERT. (Y input), and TONE (Z input) are connected to the HORIZ. GAIN control, VERTICAL GAIN control, and CRT driver board ZIN respectively. There is a fourth, unused switch position reserved for future expansion.

The purpose of the TONE GEN. switch is now to select different sweep speeds for the oscilloscope display mode. While there are only three marked positions on the front panel (OFF, 1.5 KC, 2-TONE), the switch has


Note: All controls located on front panel except Astig, S1, and S2.
Decimal values of capacitance are in microfarads (µF); others are in picofarads (pF); Resistances are in ohms; k=1,000; M=1,000,000.
Figure 2 — Block diagram of repurposed Heathkit SB-610 built around Jon Stanley's CRT driver module and Jan de Rie's microprocessor-driven clock display module.
CRT Driver Board
Power Supply
Hammond 270X Power Transformer
Sweep Generator
Clock Module
Tone Gen. (Sweep Rate)
Existing Front Panel Labels (New Functions in Parentheses)
Located on Intensity Control
Pilot Lamp
QS1409-Cook06

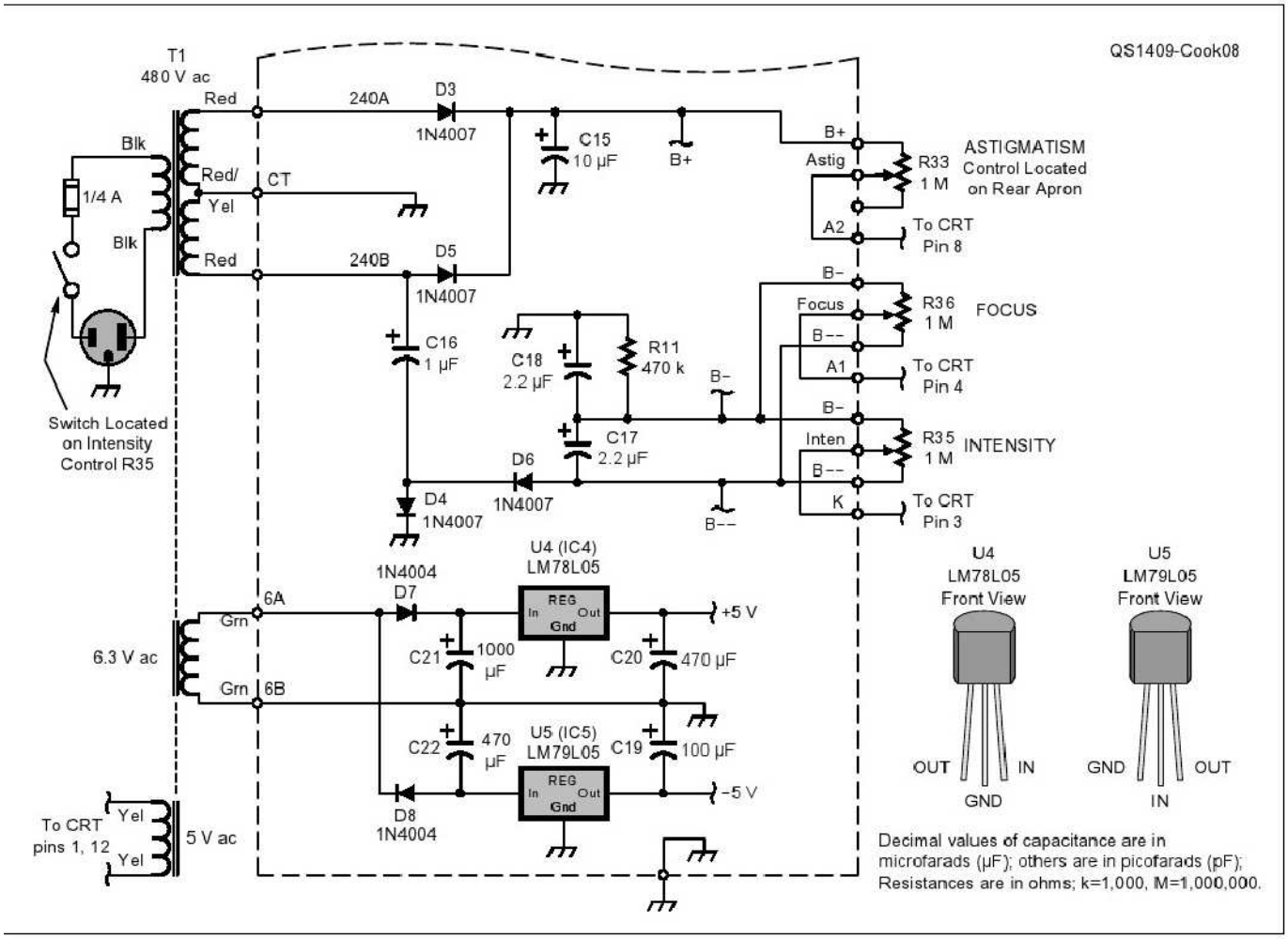


Figure 3 — Schematic diagram for the power supply section of the CRT driver board. Note that part IDs are not necessarily sequential and parts with critical form factors to fit the PC board have suggested Mouser (**www.mouser.com/**) part numbers. Where different, part IDs marked on the PC board are shown in parentheses.

C15 — 10 µF 450 V electrolytic capacitor (647-UVZW1000MHD).
C16 — 1 µF 450 V electrolytic capacitor (667-ECA-2WM010).
C17, C18 — 2.2 µF 450 V electrolytic capacitor (667-ECA-2WM2R2).
C19 — 100 µF 16 V electrolytic capacitor (667-ECA-1CM101).
C20, C22 — 470 µF 450 V electrolytic capacitor (667-ECA-1CM471).
C21 — 1000 µF 16 V electrolytic capacitor (667-ECA-1CM102).
D3 – D6 — 1N4007 1 kV 1 A Si diode.
D7, D8 — 1N4004 50 V 1 A Si diode.
R11 — 470 kΩ ¼ W resistor.
R33, R36 — 1 MΩ ½ W linear potentiometer (31VC601-F).
R35 — 1 MΩ ½ W linear potentiometer w switch (31VM601-F3).
T1 — Hammond 270X power transformer 480 V CT, 6.3 V, 5 V (546-270X).
U4 (IC4) — LM78L05 +5 V low power voltage regulator (512-MC78L05ACP).
U5 (IC5) — LM79L05 –5 V low power voltage regulator (512-MC79L05ACP).

four positions, with the slowest at the left and each position to the right 10× faster than the one before it. The SWEEP FREQ. control varies the selected sweep speed. The PULL FOR CLAMP function is currently unused.

CRT Driver Board — Power Supply

The CRT driver board was designed by Jon Stanley.[7] Connections to the board are made via solder pads around the periphery. The nomenclature used on the schematics and block diagram is the same as that used on the board.

The schematic for the power supply section of the board is shown in Figure 3. The power supply provides five voltages to the CRT controls and the amplifier section of the board: B+, B–, B– –, +5, and –5.

The B+ supply (nominally +335 V unloaded) is derived from a full wave rectifier comprised of the center-tapped 480 V secondary of power transformer T1 and rectifier diodes D3, D4, and filter capacitor C15.

The B– – and B– voltages (nominally –670 V and –335 V unloaded) are provided by the tapped voltage doubler circuit comprised of C16, D4, D6, C17, C18, and R11. The circuit is fed by one end of the 240 V (referenced to the grounded center tap) power transformer secondary.

A regulated positive 5 V +5 is provided by ½-wave rectifier D7, three-terminal positive voltage regulator U4, and electrolytic filter capacitors C20, C21. Voltage is supplied to the ½-wave rectifier by one end of the 6.3 V secondary of the power transformer T1. The other end of the 6.3 V secondary is grounded.

Similarly, a regulated negative 5 V –5 is provided by ½-wave rectifier D8, three-terminal negative voltage regulator U5, and

electrolytic filter capacitors C19, C22. Note the pin assignment differences between U4 and U5.

At this point, before proceeding with further construction, it's a good idea to verify proper operation of the power supply by temporarily connecting the 480 V secondary and center tap along with the 6.3 V secondary. Double check the polarities of all capacitors and diodes and make sure that U4 and U5 are not swapped before applying ac power. Measure voltages with a meter that has a 10 MΩ input impedance and use the old-time ham's method of keeping one hand behind you when probing. After verifying the voltages, be sure to discharge all capacitors before proceeding with construction.

CRT Driver Board — X, Y, and Z Amplifiers

The x axis and y axis beam deflection amplifiers as well as the z axis beam blanking amplifier are shown in the Figure 4 schematic.

Because the amplifiers for the X and Y axes are similar, we'll only consider the operation of the Y axis amplifier. The vertical signal from the wiper arm of switch S1-A is connected to top of the voltage divider potentiometer R14 (VERTICAL GAIN), which will provide between 0 and 100% of the signal to the non-inverting amplifier comprised of operational amplifier U1A, and feedback network R10 and R47. The amplifier gain is 5.7 as determined by the ratio (R47 + R10) / R10. The amplifier power supply is ±5 V, so, given the gain of 5.7, the maximum signal that can appear on the potentiometer wiper arm before amplifier saturates is 5.0 / 5.7 or approximately ±0.88 V.

The amplifier output is connected to one input of a differential amplifier consisting of: collector resistors R2 and R3; transistors Q4 and Q5; and emitter resistors R8, R9, and R5. The CRT vertical deflection plates are driven by outputs Y1 and Y2. The

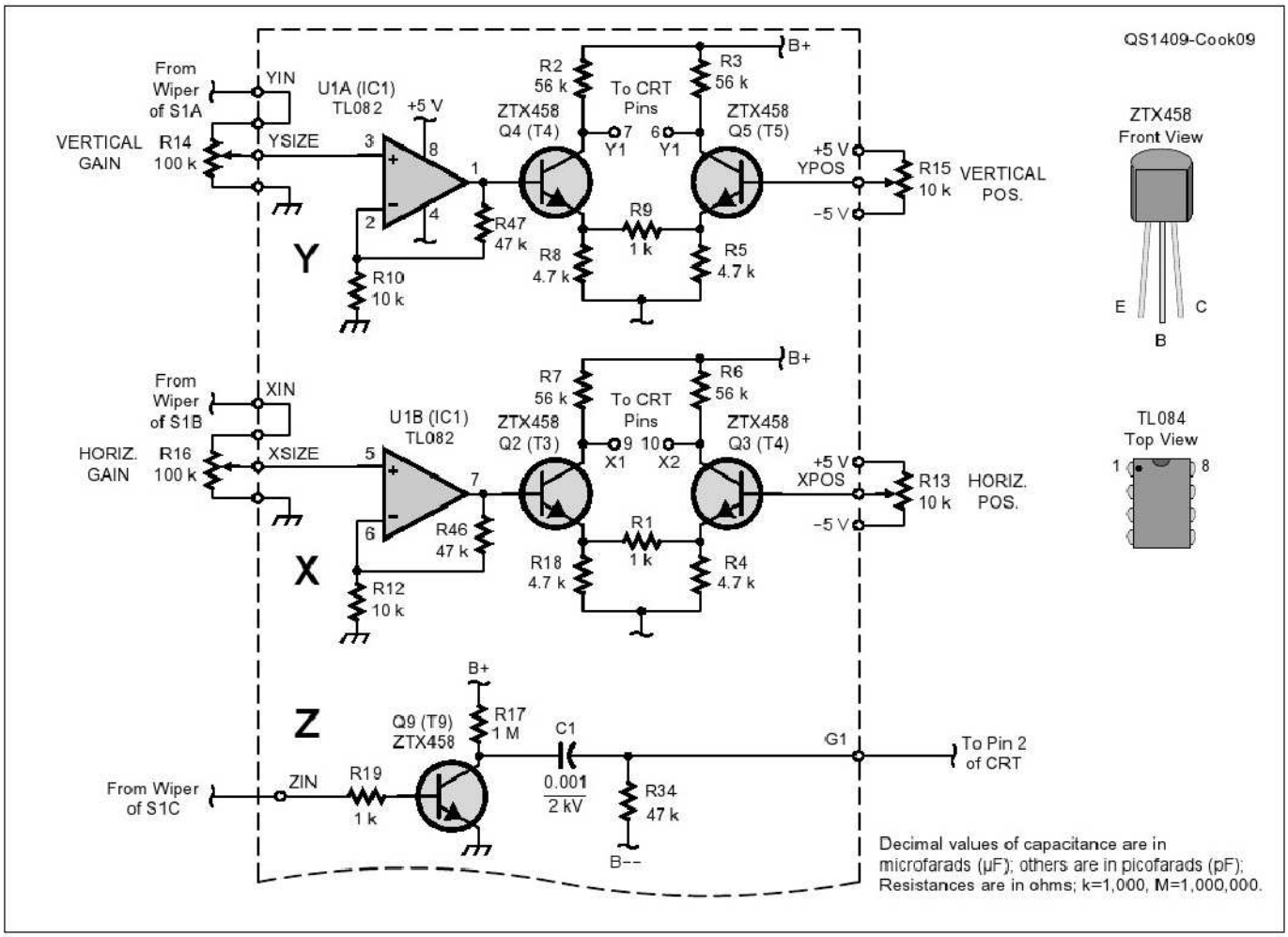


Figure 4 — Schematic diagram for the amplifier section of the CRT driver board. Note that part IDs are not necessarily sequential and parts with critical form factors to fit the PC board have suggested Mouser (**www.mouser.com/**) part numbers. Where different, part IDs marked on the PC board are shown in parentheses.

C1 — 0.001 µF ceramic disc capacitor 2 kV (140-202P6-102K-RC).
R1, R9, R19 — 1 kΩ ¼ W resistor.
R2, R3, R6, R7 — 56 kΩ ¼ W resistor.
R4, R5, R8, R18 — 4.7 kΩ ¼ W resistor.
R10, R12 — 10 kΩ ¼ W resistor.
R13, R15 — 10 kΩ ⅛ W linear potentiometer (313-1000F-10K).
R14, R16 — 100 kΩ ⅛ W linear potentiometer (313-1000F-100K).
R17 — 1 MΩ ¼ W resistor.
R34, R46, R47 — 47 kΩ ¼ W resistor.
S1 — 3POL 4POS rotary switch (105-SR2511F-34NS).
Q1 – Q4, Q9 (T1 – T4, T9) — ZTX458 400 V NPN transistor (522-ZTX458).
U1 (IC1) — TL082 dual JFET wide bandwidth operational amplifier (511-TL082IP).

other input to the differential amplifier is supplied by voltage divider potentiometer R15 (VERTICAL POS.). Its output (YPOS) will vary between +5 V and –5 V according to the setting of the VERTICAL POS. control, which matches the approximate dynamic range of the non-inverting amplifier. When both inputs to the differential amplifier are the same voltage, the differential voltage between the outputs Y1 and Y2 should be essentially zero (ignoring component variations).

If we consider just the left half of the amplifier, the voltage drop across the collector resistor R2 is determined by the voltage on the base of Q4 and the resistance of emitter resistor R8. Assuming a quiescent state with 0 V on the base of Q4 and a 0.6 V drop from base to emitter, we would have 4.4 V across the emitter resistor R8 with a resultant current flow of 0.94 mA. Essentially the same current will flow through collector resistor R2 with a resultant voltage drop across the resistor of about 52.4 V. Again, with 0 V on the base of Q5, the right side of the amplifier would have the same state with 52.4 V across collector resistor R3. Even though there are voltage drops across both collector resistors, the net difference is zero, so there is no vertical deflection of the CRT's electron beam.

As the voltage on the base of Q4 increases, the current flow through emitter resistor R8 also increases, causing the voltage drop across collector resistor R2 to increase. As the voltage across R8 increases, current will flow through R9, which will cause the voltage across Q5's emitter resistor to increase. However, the base voltage of Q5 is fixed and forcing its emitter voltage higher will act to "turn off" Q5, which in turn will cause less current to flow through Q5's collector resistor R3. The net effect is that the voltage drop across Q5's collector resistor will be less while the voltage drop across Q4's collector resistor will be more compared to the quiescent state. The resultant differential will cause the CRT's electron beam to deflect. Decreasing the voltage at the base of Q4 will have a contra effect with a resultant beam deflection in the opposite direction.

The Z axis amplifier is really a switch designed to deliver a negative-voltage beam blanking pulse to the CRT. In the quiescent state when transistor switch Q9 is off, one end of capacitor C1, which is charged through the 1 MΩ resistor R17, will be at

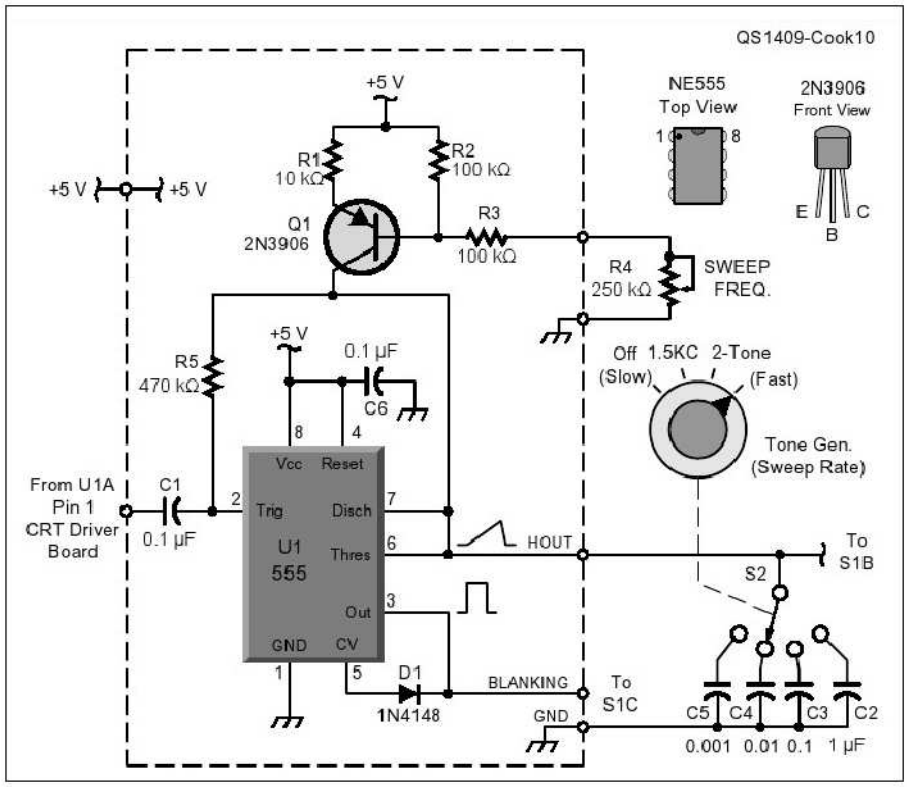


Figure 5 — Schematic diagram of the sweep generator designed by Jon Stanley.

C1, C3, C6 — 0.1 µF ceramic disc capacitor.
C2 — 1 µF ceramic disc capacitor.
C4 — 0.01 µF ceramic disc capacitor.
C5 — 0.001 µF ceramic disc capacitor.
D1 — 1N4148 Si diode.
R1 — 10 kΩ ¼ W resistor.
R2, R3 — 100 kΩ ¼ W resistor.
R4 — 250 kΩ linear potentiometer.
R5 — 470 kΩ ¼ W resistor.
S2 — 3POL 4POS rotary switch, only one pole used (105-SR2511F-34NS).
Q1 — 2N3906 NPN transistor.
U1 — NE555 timer IC.

a potential of B+ V with respect to ground. The other end of C1, which comprises the Z axis output G1, will be at a potential of B– – V with respect to ground because it is connected to B– – through resistor R34. When a positive pulse is applied to the base of Q9 through resistor R19 (ZIN), Q9 will turn on. This will place the B+ end of the capacitor at ground potential. Because the voltage across a capacitor cannot change instantaneously, this will cause the B– – end, and hence the G1 output, to shift more negative by the magnitude of B+.

Sweep Generator

Figure 5 shows the sweep generator schematic. The NE555 timer circuit U1 is wired as a free running oscillator, which controls the charging and discharging of timing capacitors C2 – C5. A current source comprised of R1 – R4 and Q1, which is connected to the selected capacitor by switch S2, insures that the capacitor's charging rate is constant, producing a linear sweep. Potentiometer R4 (front panel SWEEP FREQ.) varies the magnitude of the current and provides a variable sweep rate. A periodic signal to the TRIG input will synchronize the oscillator and produce a steady waveform display. U1's discharge pulse is directly connected to the BLANKING output, which is used to blank the CRT during the retrace interval. The sweep generator is constructed on a separate circuit board and is powered by +5 V from the CRT driver PC board.

Clock Display Module

A small dc power supply comprised of a 1N4001 diode and 1000 µF 16 V electrolytic filter capacitor is mounted on a tie strip salvaged from the original unit. The power supply tie strip is mounted next to the clock module and provides approximately 8.2 V dc through a power plug to the module. The center of the plug is positive and the shell is ground. Take care when connecting the 6.3 V ac from the power transformer to the diode because one end of the 6.3 V secondary is grounded: terminal

6A on the CRT driver card is connected to the diode and terminal 6B is connected to the negative side of the filter capacitor (see Figure 2).

The clock module has many features that are too numerous to describe here. However, complete documentation is supplied with the module.[8]

Construction

After the tear-down and cleaning, reattach the front panel to the chassis and mount the new switches, potentiometers, and input jacks. Next, add fresh rubber grommets where wires will pass through the chassis. Large grommets can be trimmed to fit smaller holes if need be. Because the power transformer is heavy and the CRT is fragile, mount them last, after the bulk of the wiring has been completed. A rear view of the chassis is shown in Figure 6.

Figure 6 — Rear view of assembled unit.

If you have an oscilloscope, it's not a bad idea to verify the operation of the clock module before mounting it to the chassis and wiring it in. As mentioned earlier, it's also not a bad idea to check the power supply portion of the CRT driver board before completing its assembly. After completing the CRT driver board construction, check it carefully for solder bridges. I recommend cleaning off any solder rosin with solvent.

There is a fair amount of wiring between the boards and controls, so it is best to be methodical and check each connection as you go. Switches can be tricky, so take your time and double-check your work. After the boards and switches have been mounted, much of the wiring can be confirmed by only hooking up the low voltage (6.3 V ac) power, which will energize the ±5 V circuitry. With only a voltmeter you can verify the signal paths from the input jacks to the bases of transistors Q2 and Q4. Similarly, the connections from the VERTICAL POS. and HORIZ POS. controls can be verified with a voltmeter by checking the bases of Q5 and Q3. When using the power transformer at this stage, make sure the ends of the high voltage secondary are well insulated.

After the board and control wiring has been checked, mount the power transformer and make its connections. Lastly, mount the CRT in the magnetic shield and carefully push its socket onto the pins at the base with a gentle rocking motion.

At this point, after checking and verifying the wiring, you should be able to power on with confidence. Be patient; it can take anywhere from 15 seconds to a minute for the beam to appear. If the beam does not appear, rotate the INTENSITY control to its extremes in case the wiring to the control is reversed.

Operation

Most of the controls retain their functions labeled on the front panel. The exceptions are the SWEEP and TONE GEN. switches. The SWEEP switch now selects the units function: left (INT) is oscilloscope mode (see Figure 7); center (RF TRAP) is clock mode (see Figure 8); and right (RTTY) is XYZ mode. The new switch has one unmarked position for expansion. The TONE GEN. switch now selects one of four decade sweep rates with the slowest at the right. Sweep rates are varied within the

Figure 7 — Repurposed SB-610 with solid state CRT drive — oscilloscope mode.

Figure 8 — Repurposed SB-610 with solid state CRT drive — clock display mode.

decade by the SWEEP FREQ. control.

Jon's board provides an astigmatism control (ASTIG), which was not available in the original SB-610. The control is mounted on the rear skirt panel in the hole originally used for the transmitter attenuation control (XMTR. ATTEN.). Adjustment of the CRT beam is a bit critical and depends upon the interactive adjustment of INTENSITY, FOCUS, and ASTIG. Getting an acceptable focus in both the center and edge of the 3RP1 CRT is somewhat of a compromise and requires iterative adjustment of all three controls.

Conclusion

Thanks to the impetus of this project, a derelict SB-610 monitor was saved from oblivion and repurposed into a useful ham shack accessory. While this was not a restoration project and the unit no longer functions as a monitor scope, it retains its original look and feel and now provides my station with a novel clock display and an oscilloscope with both triggered sweep and direct X, Y, and Z axis inputs.

The oscilloscope has 4 decades of sweep speeds and a bandwidth of roughly 400 kHz. At full vertical gain the maximum input voltage is approximately ±0.88 V. The input impedance to both the vertical and horizontal amplifiers is 100 kΩ and both are direct coupled.

Construction was greatly simplified by the availability of Jan's clock board as an assembled module from SparkFun Electronics and Jon's redesigned CRT driver PC board available from his website **www.catahoulatech.com**. Components for the board are widely available and inexpensive. Both boards are compact and there is still plenty of room "under the hood" for future functional expansion.

Acknowledgments

Thanks to Jan de Rie for the brilliant design and programming of the Dutchtronix digital clock board and for the gracious invitation to visit his home laboratory. His sage construction tips were especially helpful. Special thanks is due to Jon Stanley for the brilliant CRT driver board design and agreeing to produce and sell a new CRT driver printed circuit board for this project. The intriguing project and circuit ideas of both Jon and Jan have been a great inspiration to me.

Notes

[1]Heathkit Assembly Manual, Monitor Scope Model SB-610, 1966, p 2. **www.vmarsmanuals.co.uk/archive/1310_SB-610_User_Manual.pdf**.
[2]Original clock card: **dutchtronix.com/ScopeClockH3-1-Enhanced.htm**.
[3]New AVR Oscilloscope Clock card now available from SparkFun Electronics: **https://www.sparkfun.com/products/9306**.
[4]Solid state oscilloscope background: **electronixandmore.com/projects/simplescope/index.html**, **www213.pair.com/jandr/binaries/CRTScopeDocs.pdf**.
[5]Solid state CRT driver board: **catahoulatech.com/**.
[6]Commented photo series (note that construction photos reflect an earlier version of this project): **picasaweb.google.com/wa0ttn/SolidStateScopeConversion**.
[7]ibid. 5.
[8]ibid. 3.

Photos by the author.

Amateur Extra class license holder and ARRL member Dave Cook was first licensed in 1968. Dave also holds a First Class Radiotelephone Operator License and has a BS degree in Electrical Engineering Technology from the University of Southern Colorado. He is active in local Amateur Radio activities, currently serving as chairman of the Mercer Island Radio Operators emergency communications organization. Dave is also a member of the Communications Team for the American Red Cross, serving King and Kitsap Counties. Dave operates a consulting firm specializing in software development. You can contact him at **davepc2@netdave.com**.

For updates to this article, see the *QST* Feedback page at www.arrl.org/feedback.

New Products

SigTrax Signal Tracking App

SigTrax, designed by Jim McCullers, WA4CWI, is a signal tracking app for iOS and Android mobile devices. It combines the power, visual capability, and mapping services of mobile devices to reduce the time required to triangulate and locate a signal source. *SigTrax* eliminates the manual handling of maps, intersection point plotting, and route determination to reach an intersection point. Designed for the individual or group involved in locating RF signals, it can be used for applications such as foxhunting, searching for interfering signals, tracking near-space balloon flights, tagged wildlife tracking, or search and rescue. With *SigTrax*, bearings are created using the current location or a remote location. Where bearing lines intersect, *SigTrax* creates a Crosspoint that identifies a potential signal location. Tapping on a Crosspoint repositions the map to the Crosspoint and optionally provides visual and turn-by-turn directions to the Crosspoint. Price: $3.99 from Google Play for Android devices and the iTunes App Store for iOS devices. For more information, visit **www.sigtrax.com**.

Cable Entry Wall Plates from KF7P Metalwerks

Cable through-the-wall entry plates from KF7P Metalwerks are available in four different styles. They can accommodate from one to 12 cables, and optional cable hangers allow for neat routing of cables along walls indoors or outdoors. The Single Entry Scoop ($8.95) mounts horizontally and allows passage of up to eight RG-8 sized cables. The Double Entry Scoop ($9.95) allows passage of up to four RG8 sized cables per side for a total of eight, while the Triple Entry Scoop ($15.95) allows passage of up to four RG8 sized cables per side for a total of 12. Each version includes black mounting bracket, cable scoops, wall cover plate, and all necessary hardware. The Slotted Cover Entry Plate ($9.95) is similar to a single gang electrical wall plate, only larger, and the slotted cover allows for a cable bundle of up to 10 RG-8 size cables to pass through. Cable hangers are $2 each. For more information, or to order, visit **www.kf7p.com**.

A CTCSS Generator and 12/24 Hour Clock

Add CTCSS to your vintage VHF/UHF radio for public service and volunteer activities.

Billy Dollarhide, W5ET

After acquiring an older 2 meter radio, I needed to add a CTCSS tone generator for accessing local repeaters, especially for public service events. I opted to build my own tone generator that includes a digital display, and generates pure sine wave tones of constant but adjustable amplitude. Here are the details of my solutions for three different LCD versions. They are based on a PIC16F628 peripheral interface controller (PIC). The device has enough memory to include an accurate time-of-day-clock, and a 10 minute ID timer.

PIC Details

The PIC16F628 has 16 I/O pins with high current sink/source capability, so it can drive display segments directly. It also has internal EEPROM to store the CTCSS frequency to local at power-up. The PIC internal 4 MHz clock is accurate to just ±1%, which is below the accuracy that I wanted, so I elected to use an external 4 MHz oscillator module with an accuracy of 50 ppm (±0.005%). Because the PIC processor divides the external clock by four, the instruction cycle time is 1 µs. All tones are generated as even multiples of 1 µs.

The PIC16F628 has two 8-bit timers (T0 and T2) and one 16-bit timer (T1), each capable of generating interrupts. I used the 16-bit T1 timer for the tone generator. Timer T1 advances one count (1 µs) for each clock cycle. When T1 overflows (transitions from 0xFFFF to 0x0000) it generates an interrupt. This interrupt defines each half cycle of the desired tone frequency.

Tone Frequencies

To calculate the load value for T1, I found the period of each half cycle by dividing 1 by twice the desired output frequency (F Hz). I multiplied the period of each half cycle by one million (1/1 µs) to get the needed number of processor clock cycles. When T1 generates an interrupt, there are a number of instructions (clock cycles) executed before T1 is reloaded and the clock starts advancing again. For this reason, and with my software, the number of calculated clock cycles must be reduced by 28. Because T1 counts up, a starting value must be calculated so that it will give the required number of clock cycles before T1 overflows. Subtract the adjusted clock value above from 65,536 (0x10,000) to calculate the starting value. All of this simplifies to 65,564 – (500,000/F), where F is the desired tone frequency in Hz. That, rounded to the nearest integer, is the starting value loaded into T1. Because T1 is a 16-bit timer and the PIC16F628 is an 8-bit processor, you will need to convert the starting value into a hexadecimal number. Load the two least significant digits into the low byte of T1 and the next two digits into the high byte of T1. If you have a way to measure frequency accurately, this value can be adjusted up or down a few counts to account for any inaccuracy of the clock oscillator.

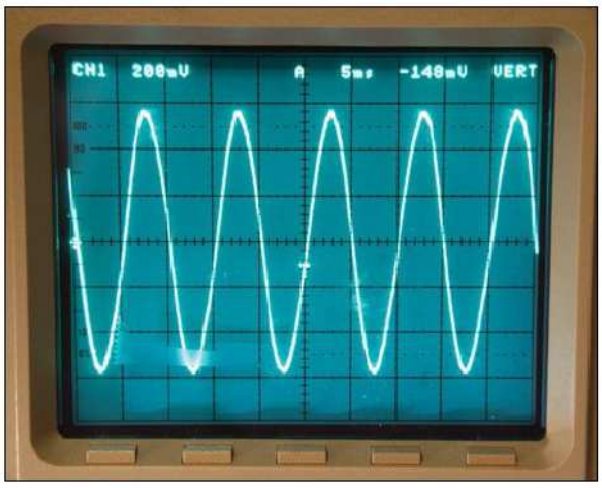


Figure 1 — Sine wave output of the generator at 100.0 Hz. [Billy Dollarhide, W5ET, photo]

Converting Square Waves to Sine Waves

Once the PIC was generating the desired tones, I started looking at methods of converting the square wave output to a sine wave. I settled on a switched capacitor filter using the MAX7480. The MAX7480 filter clock frequency must be adjusted for each tone frequency by the PIC processor. I use the PWM function of timer T2 to generate the clock needed for the MAX7480. Because the PWM function in the PIC processor is implemented in hardware it does not interfere with the T1 interrupts that generate the tone. Adjusting the filter clock frequency in software for each tone results in a nice sine wave output. Figure 1 shows the trace of a 100.0 Hz output from the tone generator. It is typical of that which is seen across the entire tone frequency range. I set the filter clock to 100 times the tone frequency. Use 10,000/F rounded to the nearest even integer to calculate the PWM clock load value. This value is divided by two in the software to set the PWM duty cycle to 50%.

I added an emitter follower amplifier (Q1 in Figure 2) to buffer the output of the MAX7480 filter. The output level can be adjusted using the potentiometer (R6), which I also used for the emitter resistor.

Adding Time

It seemed wasteful for the display to show just the tone frequency. With plenty of unused memory in the PIC, and an accurate system clock source, I added a time of day clock function to the generator.

The Hardware

My latest version of the tone generator drives LCD modules

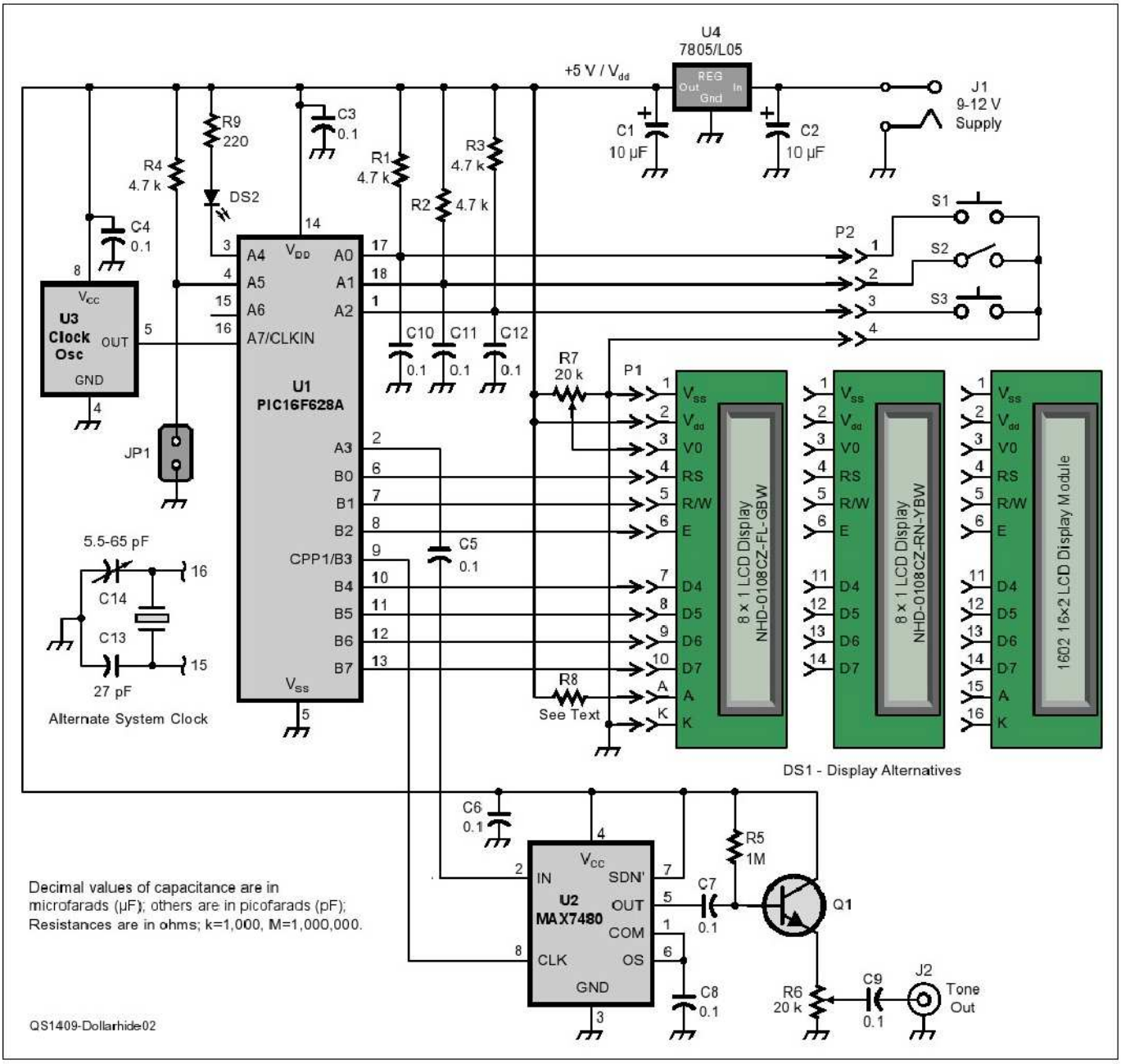


Figure 2 — The schematic shows connections for all three alternative LCD displays. Digi-Key parts from **www.digi-key.com**.

C1, C2 – Tantalum capacitor, 10 µF, 25 V 20% radial, (Digi-Key P2049-ND).
C3 – C12 – Ceramic capacitor, 0.1 µF, 50 V 5% NP0.
C13 – 27 pf, 50 V, 5% NPO.
C14 – 5.5-65 pf, trimmer GYC65000 (Digi-Key SG3009-ND).
DS1 – LCD display, see text, (NHD-0108CZ-FL-GBW or NHD-0108F-RN-YBW, New Haven Display **www.mouser.com**; or 1602A (16x2) **www.ebay.com**).
J1 – Connector, 2.1 mm PCB power jack (Digi-Key CP-102A-ND).
J2 – Connector, R/A BLU PCB RCA metal jack, (Digi-Key CP-1404-ND).
P1 – Wired directly to display with short jumpers.
P2 – Connector, header vert. 4-pos 0.1 tin (Digi-Key A19431-ND).
Q1 – NPN Transistor, 40 V 600 mA, TO-18 2N2222A (Digi-Key 497-2598-ND).
R1-R4 – Resistor 4.7 kΩ ¼ W 5%.
R5 – Resistor, 1 MΩ ¼ W 5%.
R6, R7 – Trimmer 20 kΩ ½ W PC PIN (Digi-Key 3296W-203LF).
R8 – Resistor, see text.
R9 – Resistor, 220 Ω ¼ W 5%.
S1, S3 – Push SPST switch, 1 A 120 V (Digi-Key CKN1729-ND).
S2 – Toggle switch, SPST.
U1 – IC, PIC16F628A MCU Flash 2Kx14 EEPROM, 18 DIP (Digi-Key PIC16F628A-I/P-ND).
U2 – IC low-pass filter, 8th order 8-DIP (Digi-Key MAX7480EPA+-ND).
U3 – Oscillator, 4.0000 MHz, half size (Digi-Key CTX742-ND).
U4 – IC Regulator 5 V, 1.5 A, TO220-3 (Digi-Key UA7805CKCT-ND).
8-pin solder tail DIP socket (Digi-Key A400-ND).
18-pin solder tail DIP socket (Digi-Key A403AE-ND).

directly. I found three different LCD modules that use the same 7-bit interface. As seen in Figure 3, two of these modules display eight characters by one line. One has no backlight and the other has a backlight. The third displays 16 characters by two lines, with a backlight.

As seen in Figure 2, the interfaces for all three LCD modules are identical with the exception of the circuit needed to power the backlight. I elected to connect the dropping resistor R8 for the backlight directly to the 5 V power source. You will need to size your resistor for the voltage and current needed by your display choice. My LCD backlight draws about 50 mA, but it depends on the brightness you want. Connecting the backlight directly to the power source (J1) allows you to use a low power version of the 5 V regulator. Be sure to use resistors with a power rating to handle the voltage drop and current that your display requires.

My first version of this generator uses a four-digit, seven-segment, common anode LED display. You can download the schematic and software for this first generator from the *QST* in Depth web page.[1]

Controlling the Generator

Three switches control operation of the generator. S1 and S3 are momentary contact pushbutton switches and S2 is a toggle switch, which makes time easier to synchronize with WWV. On the single-line display version, momentarily toggling S2 ON then OFF will switch the display between modes. Regardless of which mode the display is in, both the tone generator and clock will continue to operate.

When the display is in tone mode, the tone frequency can be moved down one value by momentarily pressing S1, and moved up 1 value by momentarily pressing S3. Pressing S1 and S3 at the same time will save the currently displayed frequency to EEPROM so it will be reloaded when the device powers up next time.

In the clock display mode S2 must be toggled ON in order to change the time. I did this to keep the time from being inadvertently changed. With S2 ON, pressing S1 will advance minutes by one and pressing S3 will advance hours by one. After a time change, the clock will not start until S2 is toggled OFF. Toggling S2 ON without changing the time will result in a display mode change when the switch is turned back OFF.

Figure 3 — Three different LCD modules display options are available. [Billy Dollarhide, W5ET, photo]

For the two-line display, toggle S2 ON to adjust the time. The clock starts when S2 is toggled OFF. With S2 OFF, S1 and S3 will adjust frequency the same way as the single-line display version. As before, pressing both will store the tone frequency that loads when the generator is powered ON.

Adding an ID Timer

You can add an LED (D1) and implement a 10-minute ID timer on the single-line display versions. The switching logic on the dual-line display will not allow implementation of the timer without adding an additional switch. The 10-minute timer can be activated with the display showing time as long as S2 is OFF. Pressing S1 will activate the timer. At the end of 9 minutes, the LED will start flashing. At the end of 10 minutes, the LED will stay on solid. Pressing S1 at any time will restart the timer. Pressing S3 will cancel the timer.

Jumper JP1 selects 12 hour (jumper out) or 24 hour (jumper in) format for the clock. This selection occurs at power-up.

Clock Accuracy

The 50 ppm clock generator is good enough to accurately generate the PL tones. Driving the time of day clock, however, is different because errors accumulate. Being a few cycles off the required 4 MHz makes a big difference over time. I used two different methods to solve this problem. The first method is a software fix. The second requires replacing the clock generator module with a crystal resonator.

The Microchip application note AN590 is a reference for writing the clock software.[2] AN590 explains the use of a counter and adjustments made at different intervals to correct time errors. Measure the frequency of your clock oscillator and substitute that for the 4,000,000 used in my calculations below to get the correct adjustment for your clock. The software adds the adjustment values so subtractions need to be a negative number. These adjustments are implemented as constants located in the software's included file.

The 4 MHz clock is divided by 4 internally, which gives a processor clock of 1 MHz. That signal goes through a prescaler that divides it by 16 before it is applied to timer T2 that is used for the time of day clock (1 MHz/16 = 62500 Hz). T2 is 8 bits wide and rolls over every 256 counts or 62500/256 = 244.140625 times a second. The clock counter increments each time T2 rolls over. T2 is preloaded with 12 so it rolls over once per second with an error of 0.140625 counts. The first software adjustment is made when the minutes counter updates. The error at this point is 60 times the error coming out of the clock counter or $60 \times 0.140625 = 8.4375$ counts. Adjust the clock counter by adding a negative 9 counts every minute, which leaves an error of negative 0.56250 counts. At the end of each hour the counter is adjusted again.

[1]Notes appear on page 47.

This time by 60 times the error left over from the minutes adjustment (–0.56250 × 60 = –33.750) or by adding negative 34. This leaves an error of negative 0.250 counts each hour. The final adjustment is done every 12 hours and is –0.0250 × 12 = –3 or adding negative 3 counts.

Clock Options

The connections for the crystal resonator are shown on the schematic as an alternate system clock. If you chose this option, you must adjust C8 to get 4 MHz exactly. This may be tricky as any probe used to measure frequency will add capacitance to the crystal circuit, which will pull the frequency a bit. I worked around this by setting the tone frequency to 100 Hz which sets the PWM generator clock frequency to 10 kHz. The clock-only software generates 100 kHz on Pin 9 of processor U1. My frequency counter reads 100 kHz down to 0.01 Hz which allowed me to adjust C8 for an output of almost exactly 100 kHz. Be sure to set the processor configuration bits for the processor clock type you use. The files on the *QST* in Depth web page contain information detailing how to set the configuration bits.

The Board

I built several versions of the tone generator on prototype board using point-to-point wiring with both surface mount and through-hole components. On the crystal resonator versions I place the crystal and the associated components as close to the processor as possible to eliminate stray capacitance. The other wiring is less critical, but it is wise to keep the wire runs as short as possible to avoid picking up stray RF in the shack.

The circuit requires 9 to 12 V dc at a little less than 100 mA. I used a voltage regulator rated for up to 25 V input, but anything over about 12 V input might generate too much heat. You can use your station 12 V supply, or the accessory plug on your transceiver, but you will need to reset the clock any time the power is turned off.

Software

I wrote the software in assembly language using the Micro Chip MPLAB IDE development system. MPLAB IDE is available free from the Micro Chip website. There are a number of devices available on the web that can be used to program the PIC controller. The files for the software for all three LCD display modules can be found on the *QST* in Depth web page.

Final Notes

This was a fun and educational project. There is a lot of satisfaction in building something useful from scratch. You should be able to complete this project in a couple of evenings and have a useful accessory for the shack. I would like to hear about your experience and welcome questions or comments.

Notes

[1]**www.arrl.org/qst-in-depth**

[2]**www.microchip.com/stellent/idcplg?IdcService=SS_GET_PAGE&nodeId=1824&appnote=en011031**

ARRL Life Member Billy Dollarhide, W5ET, was first licensed in 1973 as WN5JYF. Billy became WB5JYF in 1975 after passing the Advanced class exams on Christmas Eve 1974. He upgraded to Amateur Extra in 1992 as AB5KL, then obtained his current call in 1996. Billy graduated from Southeastern State College, Durant, Oklahoma in 1969 with a BS in Physics. He retired in 2006 from Texas Instruments after 28 years of service. At TI, Billy held various positions in the design, fabrication, and implementation of semiconductor process equipment and factory automation. Billy was elected a member of the TI Group Technical Staff in 1991. He enjoys homebrewing, traffic handling, and portable operation from the family RV. He also holds a private pilot license and is an active member of the local EAA Chapter. You can reach Billy at 409 High Country Rd, Sherman, TX 75092, or **w5et@cableone.net**.

For updates to this article, see the *QST* Feedback page at www.arrl.org/feedback.

Radio Tips

Picking a Microphone

The physical package of a microphone may be the driving factor for many hams. You want a mic that fits your station or your hand and looks like it's part of what you're doing. There are many choices, and it's largely a matter of personal preference.

Perhaps the most basic mic arrangement, and the one most likely to be supplied with a radio, is the clamshell type hand mic. These are quite functional, generally include a PTT thumb switch, and often other controls and indicators. While they are perfect for many portable and mobile applications, they often end up being chased around the operating desk in a home station, although with a bit of thought they can be adapted to many, especially compact, stations.

Headsets are a combination of headphones and a boom mic that allow for effective communications while keeping the hands free for other activities.

Mics on desk stands are probably the most popular in the home station environment. They come in many different shapes and forms, some with PTT capability, and some without.

Boom mics are a variation on the desk-mounted mic in which the boom is mounted to an edge of the desk and thus does not take up valuable desk space. They can be acoustically isolated so they don't pick up any of the vibrations or noise of dropped objects on the desk top. They can also be pushed out of the way for CW or digital modes, and can be quickly swung into position as needed. One disadvantage of the boom mic is that it is not readily equipped with a PTT switch, so either VOX or some kind of additional switch is required.

Headsets are headphones with a boom mic attached to one side of the headphones. The boom is generally adjustable so it can be moved to be at the optimum position from your mouth. The position stays constant as you move your head to operate other equipment, making it particularly beneficial for VOX use. As with other types of boom mics, plan on using VOX, or a separate hand or foot switch to do your transmit/receive switching. — *Joel R. Hallas, W1ZR, Contributing Editor,* QST, **w1zr@arrl.org**

Feedback

In the article "Improving S-Meter Linearity for Collins S-Line Receivers" by Don Jackson, W5QN, published in the July 2014 issue of *QST*, there are two errors in the schematic diagram shown in Figure 2. The value for R3 in the parts list (5.1 kΩ) is correct, but in the schematic it is incorrectly shown as 1.5 kΩ. Also, the chassis ground and –12 V connections at the ends of R1 and R3 were swapped. The ground connection should be at R3 and the –12 V connection should be at R1.

Steve Ford, WB8IMY, wb8imy@arrl.org

Communication Without Infrastructure

My 20-year-old daughter and her friends are not at all impressed with Amateur Radio. When I tout the fact that I can communicate with people throughout the world, they roll their eyes, pull out their smartphones and tell me how they can enjoy FaceTime *video* conversations with people worldwide.

"But I can call CQ and talk to perfect strangers…"

More eye rolling. "Dad, there are about a dozen apps that set up random video chats, and you can even specify the country you want." This is followed by the classic smirk that says, "Is that all you got, Pops?"

"But what happens when the Internet or cell network goes offline, hon? What then?"

Silence. I allow the awkward pause to linger, and then say, "That's the power of Amateur Radio. Our communication doesn't depend on a multi-billion-dollar infrastructure. We can toss wires into trees and talk around the world with our bare hands."

"But you still need electricity," a friend chirps.

"Batteries, generators, solar panels — we have lots of power options that don't depend on the local utility company."

"Yeah, but how often does the Internet ever go down, Dad?" my daughter says. "I mean, I know it can happen, but how realistic is that? If you're talking about a huge asteroid slamming into the Earth, maybe, but *really!*"

Before I can respond, she grabs my car keys and bolts out of the house.

It's true that the cell and Internet networks are becoming increasingly robust. Providers are "hardening" their systems, putting backup power options in place and much more. Still, we've yet to find a way to completely thwart Mother Nature with our technology. That's why hams have long invested in various ways to provide communication when infrastructures crumble. You could even say it is central to our "mission."

The Last Mile

In the age of the Internet, amateurs have pioneered several approaches to what is commonly called "last-mile" communication. It is based on the idea that even if the Internet is disrupted over a wide area, it remains available just outside the disaster zone. The amateur Winlink 2000 network is such a last-mile system. Using packet radio, PACTOR and Winmor modes, Winlink operators can set up RF links on HF or VHF to bridge long gaps to the nearest Internet portals. These links won't function at Internet speeds, of course, but they are fast enough to relay vital text communications.

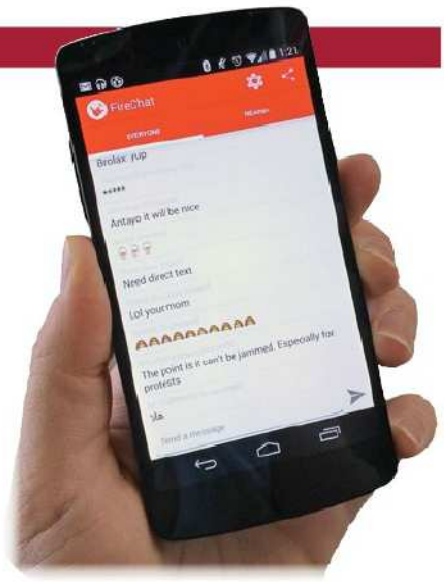
The same can be achieved at somewhat higher speeds with D-STAR and the new Yaesu "Fusion" systems.

A few "Eclectic" columns ago we also discussed advances amateur High Speed Multimedia (HSMM) enthusiasts have made turning consumer Wi-Fi routers into highly robust Mesh networks. With gain antennas and RF power amplifiers, hams can set up Mesh networks over large areas, providing high-speed digital communication to support everything from images to live video. They can also create high-speed last-mile links to the Internet.

FireChat

Amateur Radio techniques can gradually make their way into the public sphere. A few months ago, Open Garden announced an app for Apple smartphones called *FireChat*. (The app has since been released for Android devices as well.) I haven't yet had a chance to play with it, but the concept is intriguing — and awfully familiar.

In its *iOS* version, the app takes advantage of the Multipeer Connectivity Framework that was part of the *iOS 7* upgrade. In a nutshell, if you want to send a text but can't connect to the Internet, *FireChat* will relay your text directly to another iPhone whenever a *FireChat*-equipped iPhone comes into range. That iPhone will then relay to the next nearest iPhone and so on. *FireChat* accomplishes this using Wi-Fi, peer-to-peer connections, and Bluetooth. Because it relies on these direct links, the range is around 100 feet from phone to phone.



The *FireChat* app running on an Android smartphone. [Photo courtesy of Phandroid]

FireChat is intended for *hyperlocal* communication (you and a bunch of friends communicating in a stadium during a football game, for instance). In theory, however, *FireChat* could relay to the nearest Internet connection several miles distant, assuming there are enough *FireChat* users and perhaps a Wi-Fi network or two along the way.

There are already Amateur Radio implementations of the same idea. You could imagine a mobile station, for example, connecting, disconnecting and then reconnecting to an HSMM Mesh network as the station moves from place to place within a disaster area. If the operator sends, say, a written damage assessment, his transceiver would automatically hold that file until the vehicle came into range of a Mesh node. At that point it would instantly upload to the network without the driver even being aware that the upload had taken place — the Amateur Radio version of the military's "fire and forget" weapons concept.

However you approach it, the idea is the same — communications without a permanent infrastructure. Hams have quite a bit of experience in that field!

Mark J. Wilson, K1RO, k1ro@arrl.org

Yaesu FTM-400DR and FT1DR Dual Band Analog/Digital Transceivers

Yaesu's comprehensive entry into the VHF/UHF digital voice arena.

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Yaesu has entered the Amateur Radio VHF/UHF digital voice fray in a big way, beginning with the FT1DR dual band, dual mode handheld, followed by the FTM-400DR dual band, dual mode mobile, and most recently the DR-1 dual band, dual mode repeater introduced at the 2013 ARRL and TAPR Digital Communications Conference.[1] At press time, the handheld and mobile were on the market, the repeater was undergoing beta testing at several sites, and one final piece — the *WIRES-X* Internet linking controller — hadn't yet been released. Yaesu is headlining the new products as *System Fusion*, emphasizing that they aim to maintain compatibility between conventional FM and Yaesu's choice of digital voice modulation, C4FM. The mobile and handheld radios also have built-in Automatic Packet Reporting System (APRS) capabilities with an integrated GPS receiver.

In this article, I'll review the FT1DR and FTM-400DR radios. Even though digital voice has been with us for over a decade, it's still unfamiliar territory for many hams, so I'll also weave in some commentary on how digital voice is evolving in Amateur Radio, and where Yaesu's System Fusion fits into the puzzle. Other puzzle pieces include D-STAR, APCO-25, and DMR (Digital Mobile Radio, commonly called MOTOTRBO, a Motorola tradename).

So we now have four *incompatible* digital voice modes heading into common use in Amateur Radio. Common? Compared to analog FM, the digital voice modes are still pretty small, but D-STAR, APCO-25 and DMR have a significant number of users and repeaters. D-STAR and DMR have extensive, worldwide networks in operation. Digital voice is here to stay, but which mode? Or could it be *all* of them, and more?

The FTM-400DR Mobile

Even without the C4FM digital mode, the FTM-400DR mobile and FT1DR handheld radios compete at the top of the heap. They are full-featured and well-designed *analog* FM radios that include APRS packet. The FTM-400DR mobile in particular is a striking departure from typical FM mobiles with a large, *color* touchscreen display. As it replaces the FTM-350, it loses the low-power 222 MHz transmit capability, but gains a built-in GPS. The control head has only four knobs (two volume controls, two multifunction "tuning" dials) and five buttons. That simplicity belies a depth of features and settings accessed by a series of on-screen menus.

The control head is taller and narrower than usual. The radio is a full V/V-U/U dual bander, displaying and receiving two frequencies at once. The alphanumeric characters are large and stacked vertically instead of the usual side-by-side (hence the narrower control head). They are easy to see, even in daylight in a vehicle, as long as the display isn't in direct sunlight.

The operating band can be selected either by pressing its corresponding dial knob, or by touching the display directly. After discovering that the display is a touchscreen, I intuitively touched the top and bottom band rows to select them without even thinking about it. The selected band is highlighted by brighter characters. Compared to a modern smartphone, the resistive touchscreen takes a pretty good poke to get it to register. All the buttons, including the on-screen items, respond with a variety of beeps. Different pitches or doubled beeps can aid in operation for visually impaired hams, or for drivers who want to keep their eyes on the road.

The menu system begins with four main on-screen, touch-accessed menu buttons across the bottom of the display. You can select your own "most-used" function for

Bottom Line

The FTM-400DR and FT1DR are full feature, high-end transceivers that showcase Yaesu's comprehensive entry in the Amateur Radio digital voice arena. Coupled with the DR-1 repeater, System Fusion offers something for both digital radio enthusiasts and traditional FM users.

[1]Video of the RP-1 introduction is at **arvideo news.com/hrn/HRN_Episode_0099.html.**

Key Measurements Summary

FTM-400DR

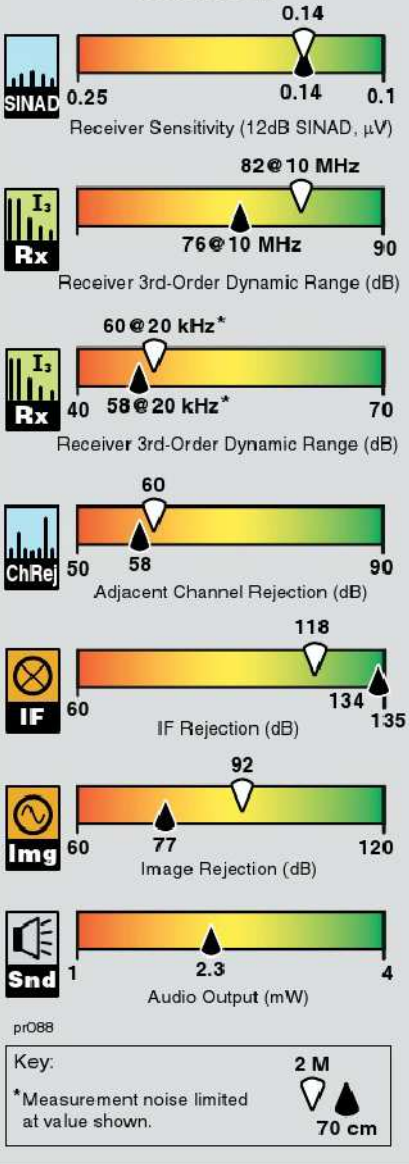


Figure 1 — The FTM-400DR control head with its mounting bracket inserted into the CD player slot in the author's dashboard. The display is showing the bearing and distance to an APRS station.

each of them. Additional menus open by pressing the F button, or holding the DISP/SETUP button. The display fills with the second layer of menus and options, most accessed by a direct touch on the screen (or turning and pressing the top dial), with some leading to another layer or two of options and menus. With more room to display real words, there are fewer cryptic abbreviations, though some options require deeper knowledge of the function being accessed.

The control head cannot be attached to the radio body, and connects with a 9.8 foot cable using RJ-10 4p4c plugs. The microphone plugs into the radio body using an RJ-12 6p6c connector. You'll need an extension if the radio body is going to be fairly remote. My Yaesu FT-8900 mic plugged into that radio's control head, and I thought I wouldn't like the FTM-400DR's configuration until I put it in my car temporarily. Turns out it would have been inconvenient for the mic cord to be coming from the head, at least in that case.

The FTM-400DR's control head comes with a stand that holds it upright. Yaesu and third parties have other mounting options, or it would be easy to build yourself one. When I did my temporary mobile installation, I hunted around for a spot to put it. Right on the dash was the most visible, but even the mid-April North Carolina sun made it too hot. Then I tried sliding the thin, flat flange on the bottom of the mount into the slot of my car radio's CD player, and voilà! Figure 1 shows my installation.

The radio body is a little smaller than most, with heat-sink ribs along the bottom, small fins and a quiet fan on the back. Also on the body are the SO-239 antenna connector (no pigtail), a ⅛ inch speaker jack, a slot for a micro-SD card, a 10-pin mini-DIN for a packet TNC (more on that later), and what looks like a mini-USB jack, but isn't. It's for "data," and more on that later, too. The big, top-facing speaker sounds good, and it's plenty loud. After previously reviewing two mobiles with volume control issues, I paid careful attention to the Yaesu. The steps taper down to zero smoothly with plenty of resolution to set it just where you want.

Back on the display (Figure 2), the upper band (Band A) and the lower band (Band B) have completely independent sets of 500 memories. Only Band A does C4FM digital, and only Band B does APRS. APRS can run in the background while you operate FM or C4FM on Band A, but of course if you use 144.39 for APRS, any 2 meter transmitting you do on Band A will temporarily mute the Band B receiver. If you have the radio set to beacon your position, that short burst from Band B will mute Band A. Band A can operate on UHF at will, and APRS will have no effect. Band B will mute Band A when in VHF.

The display can show frequency or your own eight-character alphanumeric label. If you use alphanumerics, the frequency still shows up in small numbers. The remainder of the main display feels uncluttered, and it uses color to good effect to separate the information it imparts. A large vertical bar on the left is green for receive, red for transmit. A thin horizontal line below the alphanumeric label shows the relative volume setting — useful because you may be a few button-pushes away from opening the squelch to set volume on a quiet channel. Below that is a meter bar for relative receive and transmit levels. It has an uncalibrated ruler above it (no S-9 indication), but the first ⅓ of the meter bar

is white, and the right ⅓ is red. Finally, the display shows the operating mode (FM, DIGITAL, and AUTOMATIC, more later), and a few more little icons for other features. Missing: any indication of the tone mode (CTCSS or DCS).

One of the default bottom-row MENU items is SCOPE, which turns the bottom of the display into a band scope, showing either a slice of spectrum in VFO mode, or a range of memory channels in memory mode.

The physical DISP button toggles the whole display through up to four other views, including a compass rose (see Figure 1), an altitude graph, a clock/stopwatch/timer, and a GPS satellite display. Each deserves more description than I have space for, but two points stand out. Both C4FM digital and APRS use the built-in GPS to determine your position (and send it to other stations), and the compass rose will display that for the selected A or B band, pointing to the received station and showing your distance to them.

The satellite display page told me that the GPS receiver often had trouble acquiring enough satellites for a location fix in my shack on the top floor of a typical wood-frame and shingle-roofed house, and when sitting inside my car under the metal roof. It worked fine right by a window, or directly under the car windshield. GPS receivers in consumer electronics such as smartphones haven't needed "a clear view of the sky" for some time now.

The memory system takes good advantage of the big display. Enter a frequency in VFO mode using either the microphone buttons or the on-screen keypad you can bring up, hold the F/MW (memory write) button, and the memory list pops up as a scrollable display, with four memory channels in view at once. Dial "over" the memory channel you want to enter. If it's already got something in it, your new information replaces that temporarily until you commit it. Then you can enter an alphanumeric label with an on-screen keyboard. I found the small "typewriter" buttons a little hard to hit reliably, but editing is easy.

Band A and Band B each have 500 *independent* memory channels and there is no "copy and paste" function to share them without using computer software. Also, I was disappointed to find that there is no memory bank feature. Individual memory

Table 1
Yaesu FTM-400DR, serial number 3J020450

Manufacturer's Specifications	Measured in ARRL Lab
Frequency coverage: Receive, 108-137 MHz (AM), 137-300 MHz (FM), 300-336 MHz (AM), 336-999.99 MHz (FM, cellular blocked). Transmit, 144 – 148, 430-450 MHz.	Receive, 108-136.995 MHz (AM), 137 – 299.995 MHz (FM), 300 – 335.995 MHz (AM), 336 – 823.990, 849.010 – 868.990, 894.040 – 911.990, 943.510 – 956.990, 988.510 – 999.990 MHz (FM); transmit, as specified.
Modes: FM, digital voice, data.	As specified.
Power requirements: Nominal 13.8 V dc. Receive: 500 mA. Transmit, at 50 W RF output: 11 A at 144 MHz, 12 A at 430 MHz.	At 13.8 V dc: Receive, 1 A (max volume, max lights, no signal, one receiver), 1.1 A (max volume, max lights, both receivers), 423 mA (standby, min lights). Transmit (hi/med/low): 146 MHz, 8.2/4.5/2.6 A; 440 MHz, 9.6/5.8/3.3 A.
Minimum operating voltage: Not specified.	Operation confirmed at 11.7 V dc. RF output at 144 MHz, 41/19/4.9 W.
Receiver	**Receiver Dynamic Testing†**
FM sensitivity: (12 dB SINAD), 0.2 µV (137 – 150 MHz), 0.25 µV (150 – 174 MHz), 0.3 µV (174 – 222 MHz), 0.25 µV (222 – 300, 336 – 420 MHz), 0.2 µV (420 – 520 MHz), 0.4 µV (800 – 900 MHz), 0.8 µV (900 – 999.99 MHz).	FM (12 dB SINAD), 0.14 µV (144 and 440 MHz), 0.14 µV (WX), 0.85 µV (223 MHz), 0.65 µV (902 MHz).
AM sensitivity: 10 dB S/N, 0.8 µV (108 – 137, 300 – 336 MHz).	AM (10 dB S+N/N), 0.46 µV.
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz offset, 146 MHz, 60 dB*, 440 MHz, 58 dB*; 10 MHz offset, 146 MHz, 82 dB, 440 MHz, 76 dB.
FM two-tone, second-order IMD dynamic range: Not specified.	146 MHz, 91 dB, 440 MHz, 109 dB.
Adjacent-channel rejection: Not specified.	20 kHz offset, 146 MHz, 60 dB, 440 MHz, 58 dB.
Spurious response: Not specified.	IF rejection: 146 MHz, 118 dB; 440 MHz, >134 dB. Image rejection: 146 MHz, 92 dB, 440 MHz, 77 dB.
Squelch sensitivity: 0.16 µV (144/430 MHz).	At threshold, 146 MHz, 0.13 µV, 0.28 µV (max), 440 MHz, 0.12 µV, 0.32 µV (max).
S meter sensitivity: Not specified.	S-9, receiver A, 2.3 µV (144 MHz), 2.48 µV (440 MHz); receiver B, 2.11 µV (144 MHz), 3.12 µV (440 MHz).
Audio output: 3 W at 10% THD into 8 Ω.	2.3 W at 7.5% THD into 8 Ω (max output). THD at 1 V rms, 2.2%.
Transmitter	**Transmitter Dynamic Testing**
Power output: 50, 20, 5 W (hi, med, low).	146 MHz and 440 MHz, as specified.
Spurious signal and harmonic suppression: >60 dB.	≥70 dB. Meets FCC requirements.
Transmit-receive turnaround time (PTT release to 50% of full audio output): Not specified.	Squelch on, S-9 signal, 146 MHz, 60 ms; 440 MHz, 80 ms.
Receive-transmit turnaround time ("tx delay"): Not specified.	146 MHz, 60 ms; 440 MHz, 80 ms.
Size (height, width, depth): Control panel, 2.8 × 5.4 × 1.2 inches (including protrusions); main chassis, 1.7 x 5.5 x 5.9 inches. Weight, 2.7 lbs (panel, rear chassis, cable).	
Price: FTM-400DR, $695; BH-2A Bluetooth mono headset, $80; BU-2 Bluetooth adapter, $80; CD-40 charger cradle for BH-2, $25; PA-46B power supply for CD-40, $20.	

†Receiver A and B measured identically, unless noted. DV not tested; C4FM FDMA signal generator was not available.
*Measurement was noise limited at the value indicated.

channels can be selected for scanning or skipping, but I like being able to group otherwise disparate memories together in banks such as "Local Repeaters" or "Bike Event." Other Yaesu radios, including the FT1DR handheld, *do* have memory banks.

Also unusual: the memory system doesn't remember mode (FM, AM receive, and a couple of versions of digital that I'll detail later). That's because Yaesu emphasizes System Fusion, or the accommodation between analog and digital. They recommend using their *automatic* mode system that will select whatever mode is being received, and set the transmitter for that mode (except for AM, which is receive-only). That works well if someone else is talking first. But if you've been listening to a digital signal (so the mode is set to digital), and then dial in a *quiet* analog repeater in memory, you have to remember to change the mode yourself. If you don't, you'll give the repeater a blast of digital. (Like most digital systems, the C4FM digital transmission sounds like a buzzy noise on an analog receiver.) If the repeater uses just carrier squelch, all the listeners will be treated to your buzz. If the repeater uses tone squelch, it will remain quiet.

Tone frequency and tone mode are also not as "memorized" as in other radios, including other Yaesu radios. Memory channels *will* retain those parameters as you switch from one memory to another, but if you change a tone mode or frequency on the fly, the memory holds the change without being re-stored. Ditto the repeater offset. That's not a complaint! It's just a different way of doing things. But note that the FT1DR handheld *does* require re-storing a memory to learn a new CTCSS tone or offset. So if you adopt C4FM and acquire both radios, you'll have to keep the differences in mind. The '400 includes the usual CTCSS and DCS. Setting the mode (encode, encode/decode, DCS, and so on) and the parameters (CTCSS frequency, DCS code) are done in different menus.

There is a tone mode unique to some Yaesu radios. They call it Pager Mode, and it lets you be more selective in who will be alerted to your call. You can have the radio set off a bell when its code is received, and numerical codes can choose who the receiver is and identify the sender. Clever, but other brand radios can't join the fun, nor can my older Yaesu FT-8900.

Table 2
Yaesu FT1DR, serial number 3F030471

Manufacturer's Specifications	Measured in ARRL Lab
Frequency coverage: Receiver A, 0.5 – 30, 108 – 137 MHz (AM), 30 – 76, 137 – 999 MHz (FM, cellular blocked); 76 – 108 MHz (WFM); Receiver B, 108 – 137 MHz (AM), 137 – 580 MHz (FM); transmit, 144 – 148, 430 – 450 MHz.	Receive and transmit, as specified (774 – 803 MHz blocked).
Modes: FM, digital voice, data; AM and WFM (receive only).	As specified.
Power requirements: Receive, 150 mA (mono band receive), 220 mA (dual band receive), 45 mA, standby (battery saver on). GPS on, additional 30 mA. Digital mode, additional 60 mA. Transmit, 1.7 A (5 W, 144 MHz), 2.0 A (5 W, 430 MHz) at 7.4 V dc.†	Battery power, 8.4 V dc (full charge): Receive, 379 mA (max volume, backlight on, mono band receive); 272 mA (max vol, backlight off, mono band receive); 456 mA (max vol, backlight on, dual band receive); 48 mA standby. GPS on, additional 24 mA. Digital mode, additional 60 mA. Transmit, Hi/L3/L2/L1: 146 MHz, 1.68/1.06/0.73/0.44 A. 440 MHz, 2.0/1.29/0.84/0.42 A. External power, 13.8 V dc: Receive, 225 mA (max vol, backlight on mono band receive), 350 mA (max vol, backlight on, dual band receive).Transmit, Hi/L3/L2/L1: 146 MHz, 0.98/0.76/0.55/0.32 A 440 MHz, 1.26/0.92/0.61/0.3 A. Charging with external 13.8 V dc, 217 mA with power off.
Receiver	**Receiver Dynamic Testing‡**
Sensitivity, AM, 10 dB SN: 3 µV (0.5 – 30 MHz), 1.5 µV (108 – 137 MHz). WFM, 1.5 µV (76 – 108 MHz). FM, 0.35 µV (30 – 54 MHz), 1 µV (54 – 76 MHz), 0.2 µV (137 – 140 MHz), 0.16 µV (140 – 150 MHz), 0.2 µV (150 – 174 MHz), 1 µV (174 – 222 MHz), 0.5 µV (300 – 350 MHz), 0.2 µV (350 – 400 MHz, 0.16 µV 400 – 470 MHz), 1.5 µV (470 – 540 MHz), 3 µV (540 – 800 MHz), 1.5 µV (800 – 999 MHz).	Receiver A, AM, 10 dB S+N/N: 0.71 µV (1 MHz), 0.66 µV (15 MHz), 0.59 µV (29 MHz), 0.56 µV (120 MHz). WFM, 12 dB SINAD: 0.8 µV (100 MHz). FM, 12 dB SINAD :0.18 µV (52 MHz), 0.17 µV (146 MHz), 2.75 µV (222 MHz), 0.17 µV (440 MHz), 1.4 µV (902 MHz). Receiver B, AM 10 dB S+N/N: 0.6 µV (120 MHz). FM, 12 dB SINAD: 0.18 µV (146 MHz), 3.1 µV (223 MHz), 0.18 µV (440 MHz).
FM two-tone, third-order IMD dynamic range: Not specified.	Receiver A, 20 kHz offset, 61 dB (146 MHz), 59 dB (440 MHz). 10 MHz offset, 79 dB (146 MHz), 61 dB (440 MHz). Receiver B, 20 kHz offset, 58 dB (146 MHz), 63 dB (440 MHz). 10 MHz offset, 73 dB (146 MHz), 61 dB (440 MHz).
FM two-tone, second-order IMD dynamic range: Not specified.	Receiver A, 91 dB (146 MHz), 101 dB (440 MHz). Receiver B, 91 dB (146 MHz), 100 dB (440 MHz).

Figure 2 — The FTM-400DR set up for full rate data communication on Band A (top) and analog FM voice on Band B. There are independent volume controls and dial knobs for each band. The functions of the buttons along the bottom of the touchscreen can be changed by the user.

Manufacturer's Specifications	Measured in ARRL Lab
Adjacent-channel rejection: Not specified.	20 kHz offset: Receiver A, 67 dB (146 MHz), 63 dB (440 MHz). Receiver B, 67 dB (146 MHz), 55 dB (440 MHz).
Spurious response: Not specified.	IF rejection: Receiver A, 98 dB (146 MHz), 102 dB; (440 MHz). Receiver B, 107 dB (146 MHz), 128 dB (440 MHz). Image rejection: Receiver A, 94 dB (146 MHz), 53 dB (440 MHz). Receiver B, 101 dB (146 MHz), 74 dB (440 MHz).
Squelch sensitivity: Not specified.	At threshold, Receiver A, 146 MHz and 440 MHz, 0.13 µV (min), 0.31 µV (max). Receiver B, 146 MHz, 0.14 µV (min), 0.26 µV (max), 440 MHz, 0.15 µV (min), 0.28 µV (max).
S-meter sensitivity: Not specified.	S-9 indication, Receiver A, 4.67 µV (146 MHz), 5.75 µV (440 MHz). Receiver B, 5.75 µV (146 MHz), 5.55 µV (440 MHz).
Audio output: at 10% THD, 200 mW with 8 Ω load at 7.4 V dc; 400 mW at 13.8 V dc.	10% THD with 8 Ω load: 382 mW at 8.2 V dc, 419 mW at 13.8 V dc. THD at 1 V rms, 1.9%.
Power output: 5.0 W (Hi), 2.5 W (L3), 1.0 W (L2), 0.1 W (L1).	Battery power, 8.4 V dc Hi/L3/L2/L1: 146 MHz, 4.5/2.5/1.0/0.12 W 440 MHz, 3.9/2.3/0.8/0.08 W. External 13.8 V dc input, Hi/L3/L2/L1: 146 MHz, 5.2/2.5/1.0/0.1 W 440 MHz, 5.0/2.3/0.8/0.08 W.
Spurious signal and harmonic suppression: ≥60 dB (Hi/L3 L2), ≥50 dB (L1).	As specified. Meets FCC requirements.
Transmit-receive turnaround time (PTT release to 50% of full audio output): Not specified.	Squelch on, S-9 signal, 146 and 440 MHz, 80 ms (Receiver A and B).
Receive-transmit turnaround time ("tx delay"): Not specified.	146 MHz, 25 ms, 440 MHz, 30 ms. (Receiver A and B).

Size (height, width, depth): 4.2 x 2.6 x 1.2 inches (including protrusions); antenna, 6.9 inches. Weight: 9.0 ounces (with battery and antenna).

Price: $430. MH-85 hand microphone with camera, $135.

†FNB-102LI 7.4 V, 1800 mAh Li-ion battery and PA-48B wall charger supplied. Available options: extra FNB-102LI battery, $75; FNB-101LI 7.4 V, 1100 mAh Li-ion battery, $60; CD-41 drop-in charger cradle, $40; FBA-39 battery case for 3 AA cells, $35; SDD-13 cigarette lighter dc power cable with filter, $25.
*DV not tested; C4FM FDMA signal generator was not available.

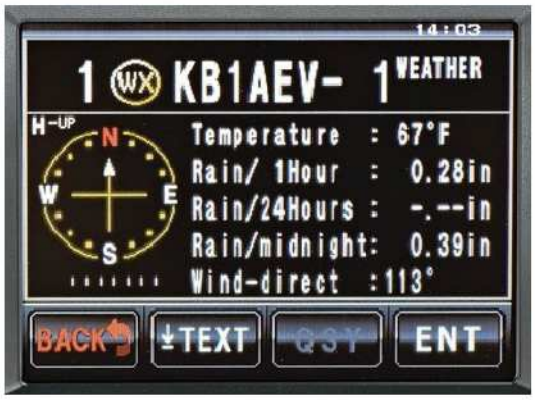


Figure 3 — The FTM-400DR receiving weather information via APRS.

The microphone that ships with the '400 is Yaesu's old standby, the MH-48. In addition to the usual 16-button array for DTMF in transmit and frequency entry in receive, the A-B-C-D buttons are assigned to select the operating band (A and B), take the dial to the squelch-level function (C), and toggle through the four main display options (D). Four more P buttons can be programmed by you to get to specific settings or options faster than stepping through menus. The '400 also has five levels of transmit audio gain.

Wrapping up this radio's take on conventional features, the '400 has the usual range of scanning options for hold and resume times, lockouts, and so on. The *resume* time (how long it waits to begin scanning after it stops on an active channel) can be set to 1, 3, or 5 seconds. The *hold* time (how long it waits after the signal drops) is fixed at 2 seconds. I'd like to see more (longer) options. There are nine upper/lower limits for VFO scanning, and the HOME channel can be checked every 3 seconds for activity (called DW, or Dual Watch). If the HOME channel is quiet, doing this briefly flashes the display to the HOME channel and takes a little hole out of the audio. Finally, the minimum setting of the time-out timer is 5 minutes, but could be shorter because many repeater timers are 3 minutes.

APRS on the FTM-400DR

The FTM-400DR includes a packet modem and firmware for APRS operation, and a built-in GPS receiver (with a jack for an external GPS receiver but no provision for using just an external antenna). The settings and menus for APRS are extensive, letting you send a beacon after you've made a turn, and sending beacons more often when you're moving quickly than when you're moving slowly. But like the FTM-350 it replaces, the '400's packet capability begins and ends with APRS. If you want to do more, the mini-DIN on the back is designed to interface with an external modem/TNC.

APRS operation is fun. The display can be set to show a screen whenever a new or updated APRS signal is received. That screen includes the call sign, distance, direction, speed, altitude, and message or weather info being sent by the transmitting station (see Figure 3). Or you can watch the compass rose to see the call sign, direction, and distance for every signal as it's received.

The on-screen keyboard lets you compose a message, and the radio logs incoming and outgoing messages and the most recent 100 call signs received. APRS can run in the background (though it does tie up the B Band) with minimal disruption while you play FM or C4FM on the A Band.

C4FM Digital Voice

Yaesu's digital voice mode, C4FM, isn't compatible with any of the other digital voice systems in common use in Amateur Radio. Okay, you probably knew that. Well, it isn't *proprietary*, either. Yaesu uses a newer version of the AMBE vocoder chip that Icom used for D-STAR (the most recent Icom models do their vocoding in software without the chip, but still licensed through DVSI). As with D-STAR, anyone can buy them, and Yaesu says the protocol will be published, so anyone can be compatible.

Yaesu says they chose C4FM because it is newer and better. I can't debate that (other, more technical hams do). I've been listening to it for a while now, and I can say, "It sounds digital." All of the digital voice modes, including C4FM, offer high clarity and near zero background noise down to the threshold. All sound a little different.

I rounded up some hams to do a very *un*-scientific test between handhelds at low signal levels, and the performance was also similar. The biggest difference I hear is at the margins, when signals are weak, the bit error rate gets high, and the voice garbles. D-STAR and C4FM can sound pretty rough. APCO-25 and DMR handle it a little more gently.

But mostly C4FM works fine. I think it's more important to focus on what Yaesu is *doing* with their digital system, and compare as much of that as I can to D-STAR (I'm not familiar enough with DMR to do it justice). And the first thing to repeat is that Yaesu is trying very hard to attract analog FM users. That's the essence of System Fusion.

The DR-1 Repeater

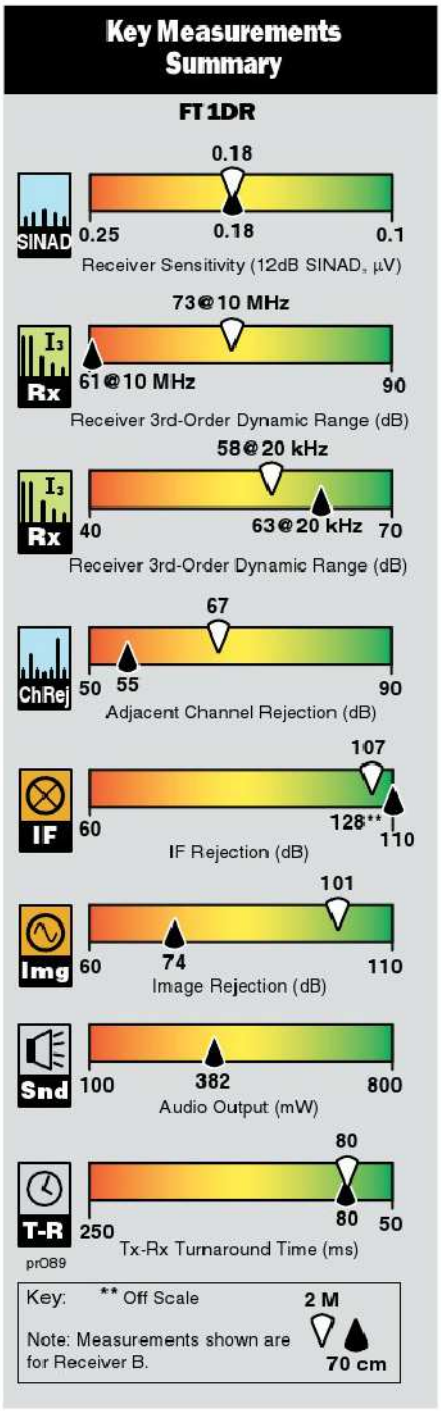
Repeaters are vital to VHF/UHF FM and to digital voice. Alinco introduced a ham radio digital voice handheld about 15 years ago, but with no repeaters to provide area-wide coverage, it was pretty much a novelty. Icom's D-STAR launch came complete with repeaters and an Internet linking system. While the user radios were also high-end analog FM radios, the D-STAR repeaters were digital-only. The system occupied only 6.25 kHz of spectrum, compared to about 16 kHz for FM, and 12.5 kHz for the other digital modes, including Yaesu's C4FM. That allowed frequency coordinators to squeeze D-STAR repeaters into geographic areas without available spectrum for another analog or wider digital mode repeater.

During my review period, Yaesu released some of its DR-1 repeaters to volunteers for a beta test, and one of them went on the air in my area. While the hams who received the repeater agreed not to release their results until the trial was over, I could at least see how the radios and repeaters performed together.

Yaesu designed the DR-1 to be a drop-in replacement for an existing VHF or UHF repeater. It will interface to existing controllers and run analog FM, and then there are some options for integrating C4FM. The first option is that users who have a C4FM radio can transmit to the repeater in digital, while the repeater continues to output analog FM — it simply demodulates the digital signal and the applies the decoded voice to the FM modulator. Analog and digital users can talk to each other in the same conversation.

There's no huge advantage to this technically. The digital signal is noise-free *to* the repeater, but the digital user is still listening in analog, and that analog output still lacks the crispness of a fully digital signal. The digital radios don't currently have a mode that locks transmit to digital and receive to analog. In "automatic" mode, when the radio receives an analog signal, the transmitter switches to analog, too. The local guy's workaround was to *transmit* in digital on Band A, while *receiving* in analog on Band B. The analog-digital hybrid avoids the social stigma of being exclusionary, while introducing the concept of digital to the analog users. At least, that's the plan.

The second option is to repeat analog signals as analog, and digital signals as digital. They occupy the same frequency, and it's one-at-a-time, or first-come, first-served. The repeater can't do both analog and digital at the same time. In this beta test, the users didn't have control over which mode the repeater would be in, but I'm guessing it could eventually be a user option. APCO-25 repeaters have been dual-mode since their beginning, though I'm not aware of any that ran digital-in, analog-out.



The dual mode repeater gave me a good chance to compare analog and digital performance. I was far enough from the repeater that a 100 mW signal was pretty noisy in analog. At "pretty noisy," I could switch to digital and have a good, mostly garble-free signal. Taking advantage of multipath, I could move a few inches and go from "pretty noisy" to "very noisy."

At that point, the digital signal was either mostly garbled, or not there at all. Now this wasn't in a lab, and multipath can affect analog and digital signals differently. But my results match what just about everyone reports — that a well-modulated analog signal can be copied a little below the point that a digital signal drops out. I wonder how much longer that will be the case? The ARRL Lab is working on tests that will hopefully answer that question.

When the DR-1 is used in fully-digital mode, though the analog-only users will not be able to listen to the conversation. On an analog receiver, the audio will be just that buzzy rush of noise. To avoid listening to the noise while still being able to monitor the repeater for analog use, every user will need to use tone-decode, either CTCSS or DCS depending on what the repeater tech set up for the repeater output. Technically and operationally, this is not a big deal.

Yaesu has announced, but at press time had not begun shipping, an updated version of their *WIRES* Internet linking system called *WIRES-X*. There are menus for using it in the FTM-400DR and FT1DR, but the radio's manual points the user to a downloadable *WIRES-X* manual, not yet released as I complete this review. The *WIRES* system is popular in Japan, but in the rest of the world IRLP and Echolink are the VoIP repeater networking systems of choice.

Other Digital Capabilities

Yaesu's digital signal is 12.5 kHz wide, and the data rate is also double D-STAR's at 9600 bits per second. From the user's perspective at least, Yaesu allocates it a little differently. D-STAR users sometimes complain that the 1200 bits of ASCII is wasted when they're not sending any data (which is most of the time in a voice conversation). If they have a GPS connected, they're sending that in the ASCII stream (and the newest Icom radios have built-in GPS, so they'll be doing more of that). But their point is they would have liked the option to dedicate *all* of their signal to voice to sound better, or all to data if they wanted to make *D-RATS* as efficient as possible.

Note that D-STAR does have an all-data version, but it's not part of Icom VHF/UHF radios. Yaesu caught that, and offers users the DN and VW modes. The manual never really expands the initials into words, but I think of them as "Digital Narrow" and "Voice Wide" although in both modes the RF signal is still 12.5 kHz wide. (The manual refers to DN as simultaneous voice/data communication mode, and VW as voice full-rate mode.) In DN mode, the voice audio isn't as full fidelity as VW because it's sharing the bits with error correction and a data field. VW uses the whole pie for voice. And yes, it sounds noticeably better.

In DN, the Yaesu radios send the user's call sign and its GPS position. The '400 mobile displays the call sign and the distance to the received station, if everybody's GPS is getting a fix. The FT1DR makes you hop to another display to get the distance. The mobile uses the S meter's space to display that information, so there's no signal-strength reading when copying a digital signal — just when you need it because you can't "hear" how strong a signal is. In VW, you get the call sign, but no distance info. On both mobile and handheld, you can switch to a compass rose display to see the direction and distance. You can store that info, or your own location, and use it to track your way to that location. Same for APRS stations. Lots to play with.

Send a Message...

How about that ASCII data? Icom makes you hook up an external device (a computer, maybe a tablet or phone today) into their serial port to tap that D-STAR stream and send to or read from it. Yaesu lets you blip in a message (80 characters max) with their on-screen keyboard. On the FT1DR you either twist the knob to scroll through the alphabet one letter at a time, or use the keypad like you did for text messages on an older cell phone.

The receiving station reads the text message right on their screen. I believe you need to stick in a micro-SD card for this to work. The manual wasn't specific about that, but that was the missing ingredient when I tried to do it. Words are broken at the end of a line with nary a hyphen to enhance readability, but it works. The messages stack up on the micro-SD card.

So far, so good on data use. But when I went looking for a way to use Yaesu's data stream from my *computer*, I couldn't find it. There are ports and plugs for cloning and programming and stuff, but nothing leads to that data. At least not yet. I wouldn't be surprised if Yaesu introduces an update to add it.

Both radios can be updated with software in the field. I performed an update on the FT1DR, and it was pretty easy. Hint: Heed Yaesu's warning to install their driver before connecting the data cable to your computer. Hint #2: Read the update instructions all the way to the end to find out how to check what the current version of firmware is in the radio because you may not need the update. Hint #3: The instructions say to use an external power supply, not the battery, during the update. If the battery dies mid-update, you could brick the radio.

One more thing about that messaging. On the FT1DR, you have to join a group to do it using Group Monitor (GM). Turn it on (it forces digital mode, doesn't work in analog) and the radio starts pinging to let anyone in receiving range (who also has their GM turned on) know you're there. On the receiving end, you see a list of everyone you hear, and you can "register" stations into groups. The radios continue to ping about every 20 seconds, and all this chatter serves to let you know who's still in range. If the '400 has heard from you lately, your call sign is lit up green (Figure 4). On the FT1DR, it's highlighted in black. Fall out, and you turn gray.

Figure 4 — In the Group Monitor mode, call signs of stations in range (W1AW) are highlighted in green.

... And Get the Picture

The optional MH-85 camera-mic (Figure 5) plugs into that little DATA jack on either radio. It works just like a speaker-mic, and it has a camera built in. There's no viewfinder. The '400 mobile can show you what you've just snapped (Figure 6), and if it wasn't quite right you can try again. On the FT1DR you're flying blind. There are no adjustments beyond image size and quality (not that great compared to a typical cell phone camera). File sizes are correspondingly small, and when you're sending this across the very limited bandwidth of the C4FM signal, size = time. The larger (320 × 240 pixels), better quality image takes about 30 seconds to send in DW mode. On the SD card, they are standard JPEGs.

Wait, DW Mode? Didn't I mention that earlier, as Dual Watch? This DW mode, which the manual refers to as "data full rate" is automatically selected when you send a photo. If you're in VW, a picture will go out as DW (I'm dubbing it Digital Wide...still unofficial). The manual's a little skimpy here, but I believe that when I sent a picture in DN, the picture seemed to take longer to transfer. Maybe. Again, I wouldn't be too surprised if full user access to the fastest (9600 bps) data stream became available some day.

And oh, yes, using Group Monitor, you can direct a text or picture to one specific radio.

Figure 5 — The MH-85 microphone includes a camera that can be used to snap and send photos with the FTM-400DR or FT1DR. The lens is in the top.

Figure 6 — A photo snapped with the MH-85 camera/mic, transmitted with the FT1DR, and received by the FTM-400DR.

About that Handheld...

The FT1DR (Figure 7) is fairly bristling with buttons on its face, and ports and more buttons on its sides, but only one knob. There are no connectors on top — the GPS antenna occupies the space between the rubber antenna (SMA male on the radio body) and knob. The left edge has PTT, MONItor (opens the squelch), VOL (hold and turn the knob to adjust the volume, or one quick press to mute), and ON-OFF/LOCK. The right edge has ports for a speaker mic, dc/charging, and a data connector that the camera-mic plugs into (and where I plugged in the included data cable when I updated the firmware). Below that is the slot for the micro-SD card.

On the front are the display (plenty readable, but not color or touch screen), busy lights for the A and B sides, and 18 more buttons, including the 16-button DTMF pad that doubles, triples, and maybe even quadruples for other functions. And a speaker. And yet the whole thing is tiny.

The bottom of the radio has rubber feet. Set it down and it grabs the table. You can still knock it over easily (top-heavy with the rubber antenna sticking up), but it won't slide.

Here are the important differences in the FT1DR. I already mentioned that its memory system hangs on to tone and offset a little tighter than the FTM-400 (you have to re-store a memory to get them to stick). There are 900 memory channels (*shared* between A and B sides, but digital only on A, and APRS only on B), and a bunch of other memory options, including 24 banks that hold 100 memories each.

It does have tone scan and a tone mode icon on the display. Alphanumeric names appear in small type below the frequency readout, and only when the radio is in mono-band mode (you can make the second band go away). You can't make the radio show *only* the alpha label. Too bad, because the alpha label holds an awesome *15 characters!*

The radio receives AM, FM and SW broadcast, almost dc to daylight (no SSB, and you'll need a little more than the rubber antenna for HF shortwave). The options for scan-resume are more generous (up to 10 seconds). Time-out timer options start at

Figure 7 — The FT1DR is tiny considering its extensive list of capabilities and features.

30 seconds. The noise-squelch level adjustment is buried deep in menus. The feature list is nearly endless, but I don't think I've missed any of the go-no-go stuff. The rest is just nice candy in a sweet radio.

The LOCK button locks the volume control, along with everything else. The knob does nothing when the radio is locked (and LOCK is a quick press of the power button on the side — nice!). It would be convenient if, when the radio is locked, the knob became a volume control, turning the nearly two-handed volume adjustment into an easy one-hander.

Editorial (A New Hope)

Not long ago I was a little unhappy at the thought of splintering Amateur Radio digital voice into a bunch of incompatible formats. Now I realize that this is the way of things. There is no question that digital moves fast and develops in many different ways. The big, plasma digital TV in the living room that I bought in 2007 is obsolete compared to what's available today.

Ham radio moves a lot slower. We are 99% analog in a 98% digital world. We won't change overnight, but at least some of our future will be tied to digital, and we can't get there with radios that do only one form of digital and never anything else. Yaesu says their C4FM is better, newer. How long until someone else introduces the next best thing? I am very glad they embraced digital — it sends a message to the ham radio world that we have a future, not just a glorious past. I do hope, though, that the manufacturers are looking into designing radios that will do multiple digital formats, easily upgradable when new ones are invented (and they will be).[2]

Each of the digital systems has a fan base that will adopt their systems. They may all thrive, or maybe one will "win." I hope, though, that hams will take a longer view, and look closely at the kinds of technology that will be fun today, fun tomorrow, and help us reach our future.

Manufacturer: Yaesu USA, 6125 Phyllis Dr, Cypress, CA 90630; tel 714-827-7600; **www.yaesu.com**.

[2]At press time, Connect Systems, Inc. (**www.connectsystems.com**) is working on a handheld that will operate with as many digital systems as they can license, including D-STAR, DMR, and possibly P25. And Whitebox, under development by Bruce Perens, K6BP, and Chris Testa, KD2BMH, is envisioned as a software defined radio that will do any digital mode they can license, but featuring a VHF/UHF version of *FreeDV* using CODEC2.

Click here for a video overview of the Yaesu FTM-400DR mobile transceiver and FT1DR handheld.

Hy Power Antenna Company LD8073

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

On my tiny lot I have just enough room to erect a "tilted" delta loop antenna that works well on 40 through 10 meters. I wanted to add something for 80 meters, but at more than 130 feet in length, a full-sized dipole was out of the question. I noticed that the Hy Power Antenna Company offers a shortened 80 meter dipole only 73 feet long. If I hung that antenna as an inverted V from my one remaining tree, it might finally give me access to 80 meters.

The LD8073

The model LD8073 is an 80 meter dipole made shorter (a little more than half the length of a traditional dipole) through the use of loading coils — one in each leg. The antenna is rated for 1.5 kW and requires a standard 50 Ω coaxial feed line.

The LD8073 arrives completely assembled. The wire is #12 AWG and insulated with a tough, UV-resistant jacket. The insulation is light gray, which helps the antenna blend into the background.

The loading coils (Figure 8) are fully weatherproofed and feature stainless steel hardware. The center insulator (Figure 9) also includes stainless steel hardware and offers a standard SO-239 coaxial connector for the station feed line. Like the durable end insulators and wire, the center insulator is light gray.

Bottom Line

The Hy Power LD8073 is half the length of a conventional 80 meter dipole. Rated for legal-limit operation, it offers space-challenged amateurs a way to operate on a segment of the 80 meter band.

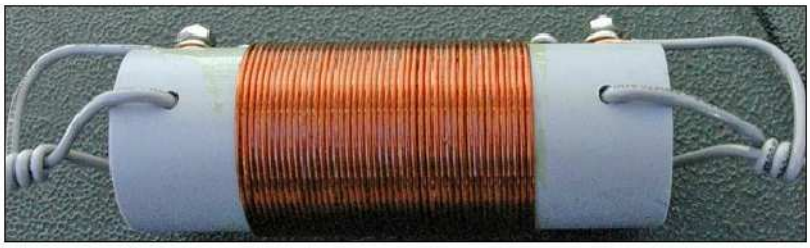


Figure 8 — One of the LD8073 loading coils.

Installation and Tuning

In an ideal world we'd all hang our dipole antennas a ½-wavelength or more above ground (about 130 feet on 80 meters). That clearly was not going to happen on my property. The best I could hope for was a thick branch that would support the apex of an inverted V configuration at a height of 20 feet. The legs of the LD8073 would be threaded through branches and brush to end up about 7 feet above ground.

I wasn't expecting to hunt DX with an w80 meter antenna installed in this fashion. I knew such a low-altitude installation would most likely result in much of my signal going straight up, suitable for local communication.

In addition, I understood that a shortened dipole antenna represents a compromise. In exchange for an antenna that would squeeze within a very limited space, I would have to sacrifice a certain amount of efficiency and bandwidth. Even so, *something* on 80 meters was better than *nothing* on 80 meters. If I could communicate within, say, a 500 mile radius, I would be happy.

The Hy Power LD8073 is cut for the bottom end of the 80 meter band. This allows the user to trim a bit of length to move the resonant frequency higher in the band if necessary. You don't need to trim the legs physically, though. Just pull the desired length of wire through the insulators and wrap it around itself at the ends.

Figure 9 — The center insulator is essentially a PVC cylinder with a stainless steel eye bolt. An optional 1:1 balun is available.

After hauling the antenna into the tree, I secured the drooping legs and then swept the LD8073 with an antenna analyzer. The 1.2:1 SWR point occurred right at 3500 kHz. The 2:1 SWR bandwidth was only about 80 kHz, not surprising with a shortened dipole. That placed the upper 2:1 SWR point at about 3540 kHz.

In addition to enjoying CW, I also operate digital modes, so I really wanted to shift the upper 2:1 SWR point to about 3600 kHz. I pulled 10 inches of wire through each end insulator and wrapped the surplus wire accordingly. Now the 2:1 SWR bandwidth ranged from 3520 to 3600 kHz. Perfect!

The LD8073's SWR bandwidth is quite sharp. Sweeping the analyzer up the band into the 75 meter phone portion, the SWR skyrocketed beyond 10:1.

On the Air

Because of the less-than-optimum installation, I had low expectations. To my surprise, however, I found myself working the west coast and Europe on the first evening during late winter. Regional coverage was solid, with most of my radiated energy at high angles and "spraying" down over New England and the Mid-Atlantic states. Still, the LD8073 was radiating enough RF at lower angles to give me some distance coverage as well.

The Hy Power LD8073 is ruggedly built, so I expect it to withstand whatever New England weather can throw at it. If I can ever manage to raise it higher, I will no doubt enjoy even better DX performance.

Manufacturer: Hy Power Antenna Company, 2028 Riverside Dr, Bethlehem, PA 18015; tel 610-317-9779; **www.hypowerantenna.com**. $60 plus $12.50 shipping and handling.

Radio Tips

Power Supplies

A typical 100 W transceiver requires a power supply that can deliver about 25 A of current at 13.8 V when you are operating the radio at full output. Low power QRP transceivers, on the other hand, have far lower power requirements. A 3 A 13.8 V supply should be more than sufficient.

Don't worry about buying a power supply with too much current capacity. Your equipment will only draw the current it needs. In fact, it is probably safe to say that you can never have too much current capacity. It may seem economically foolish to invest in a 25 A supply when all you want to power is a 5 W QRP rig. However, if you think you'll be upgrading to a larger radio in the near future, you may want to get the big power supply today (especially if you find a great deal on a high-current supply).

When shopping for a power supply, beware of one potential stumbling block. Power supplies are often rated by their *continuous* and *intermittent* (ICS) current capacities. The figure you want to look for is the *continuous* rating — the amount of current the power supply can provide continuously. Don't be misled by what appears to be a fantastic deal on, say, a 25 A supply. Can it supply 25 A intermittently — only for short periods — or continuously? You may need 25 A of continuous current, so check and be sure.

It is also worth mentioning that you'll find two types of ham-grade power supplies for sale. The *linear* design uses a hefty transformer to shift the 120 V ac line voltage from your wall outlet to a lower voltage for later conversion to 13.8 V dc. These power supplies tend to be large and heavy, especially the high-current models.

Another approach to power supply design is the *switching* configuration. In the switching power supply, the ac line voltage is converted directly to dc and filtered. This high-voltage dc is then fed to a power oscillator that "switches" on and off at a rate somewhere between about 20 and 500 kHz. The result is pulsating dc that can be applied to a transformer for conversation to 13.8 V or whatever is needed. The reason for doing this is that rapidly pulsating dc can be transformed to lower voltages without the need for large transformers. It is the transformer that accounts for most of the weight, size, and cost of traditional linear power supplies. A switching power supply is much smaller and lighter, and usually less expensive.

Switching power supplies are the same type found in your computer and they are becoming more popular in Amateur Radio. The disadvantage of the switching supply is that some designs generate interfering signals that you can hear in your radio. If you're considering a switching power supply, look for models that boast low "RFI" (radio frequency interference). *QST* magazine occasionally reviews and tests switching power supplies. — *Steve Ford, WB8IMY*

Joel R. Hallas, W1ZR, w1zr@arrl.org

If Top Loading Works on 80 Meter Verticals, How About on 160 Meters?

Q Charles, K0AYS, asks: In the June 2014 column, I found your treatment of ¼-wave and top-loaded verticals on 75 meters interesting and informative. For most hams, a 120-foot high vertical ¼-wave monopole for 160 meters is out of the question, so how do shortened ones stack up? I have often wondered what kind of efficiency could be had on 160 meters with top-loaded verticals that equaled the height of a ¼-wave on 75 meters.

Could you continue the loaded vertical-top hat story by plugging in a popular 160 meter SSB frequency, and model the same vertical heights and top hat dimensions in your June column? It would be interesting to compare base loaded 43-foot and 64-foot base loaded monopoles with a top hat loaded quarter wave. How would I calculate the length of the top hat radiators?

A I did as you asked, with the results as shown in Figures 1 – 3. I used the same buried radials as were used in the June column's models and added sufficient base loading to resonate the 43- and 64-foot monopoles on 1.85 MHz. In each case, I assumed an inductor Q of 100. The additional resistive loss in the inductance for the shorter antenna was a major contributor to its lower field intensity.

For longer monopoles, the inductance needed for base loading, with the resulting lower coil resistance will improve performance, as expected. For the top loaded case, I used four horizontal wires of equal length adjusted to provide resonance. With my 64-foot monopole and top hat wires all #14 AWG, the top hat wires were each 24.5 feet long. For the often easier to install inverted L configuration — a single top hat wire — a length of 67.5 feet was required, which is a bit longer than the 64-foot, 80 meter monopole height. The gain and pattern were similar to the four-wire top hat, except that it was about 1 dB out of being omnidirectional, with a peak gain of –0.7 dB, with the peak in the direction opposite from the top wire. To allow operation on both 160 and 80 meters without an antenna tuner, a trap could be installed at the top of the 80 meter vertical. The two sections would likely require a bit of shortening to make the antenna resonant on both bands.

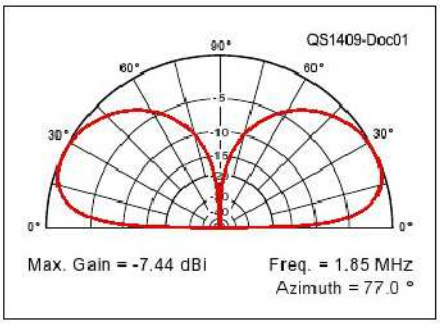


Figure 1 — The *EZNEC* elevation pattern of a 43-foot monopole with base loading to be resonant on 1.85 MHz (80 µH, Q of 100) above typical ground (conductivity 0.005 S/m, dielectric constant 13). The antenna and eight buried 66-foot radials are all of #14 AWG wire.[1]

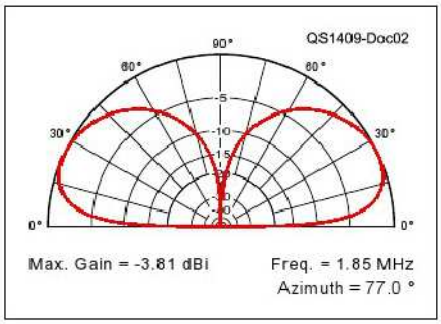


Figure 2 — Similar pattern to Figure 1, except that the monopole is 64 feet long and resonant on 3.7 MHz without loading. This pattern is with base loading sufficient to resonate on 1.85 MHz (48.7 µH).

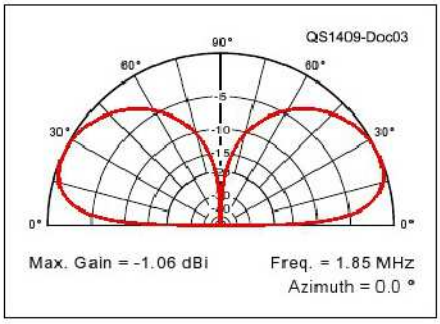


Figure 3 — Similar pattern to Figure 2, except that the 64 foot long monopole is resonant on 1.85 MHz by four horizontal "top hat" wires, each 24.5 feet long.

Q Ed, W4TPN, asks: I needed to change the plug on an old (and comfortable) headset. After cutting off the old, damaged plug, I discovered that the cord is the old type with fine metal foil conductors wrapped around cloth threads. I remember trying to work with this kind of wire about 50 years ago and having trouble soldering. I am unable to tin the wire and cannot get a good bond. Can you offer any hints as to how to solder the wires to the new plug?

A That is tough — I've been there and done that. The easiest way may be to start over and just make a new cable arrangement. Next, if it's an old World War II vintage set, as some of mine are, you may be lucky enough to find a new cable set in an original wrapper at a hamfest flea market — but you are probably more likely to win the lottery!

I suggest tightly wrapping the terminal end with a strand of fine wire removed from some stranded copper wire. Then, heat that with your iron and liberally apply solder, until it runs into the inner area. Often it will make contact with the "tinsel" wire strands, even though it doesn't look like a solid connection. Solder a ring terminal, or other connection device, to the new termi-

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

nation, and tie it to the plug. With luck, it will last as long as we will.

I haven't tried this myself, but if you can find a suitable crimp terminal that is a snug fit, or even better, a snug fit on a double-width folded end, it might also be worth a try.

Q Jim, W6JHB, asks: I built two W2FMI-designed 1 kW, 1:1 baluns, based on Jerry Sevick's book on baluns and ununs.[2] They use a 2.4 inch diameter, mix 31 ferrite core and are wrapped with 10 turns of #12 AWG coated high temperature wire with insulating tape on one wire. I put each of those baluns on my antenna analyzer to see how they came out, electrically. Both showed a fairly flat response from 1.8 up through 30 MHz, at very close to 50 Ω while driving a matched load. I connected one to a friend's medium power linear amplifier via a short length of coax and then about 75 feet of 600 Ω open wire line to a 56-foot long doublet at a height of 35 feet. He ran this configuration (without the amplifier) at 100 W and appeared to have no problems.

About 30 minutes after turning on the amplifier to about 425 W output on CW, the balun's ferrite core totally overheated and broke into several pieces. Subsequent SWR measurements on that antenna with the other, identical homebrew balun showed an SWR on 40 meters of about 15:1. Yikes! His automatic antenna tuner was able to get a match, although it was about 1.7:1 or so.

My question is — how does one determine whether the power level a balun is capable of handling if presented with other than the design SWR?

I'm also concerned about my own station, although circumstances are a little different. At my station, I have an 88 foot long doublet at 45 feet, fed with 115 feet of 450 Ω window line, a 4:1, 3 kW rated balun in the shack and about 6 feet of RG-8X coax running to my 100 W transceiver. My antenna analyzer assessment of the SWR on all the bands shows it to be under 7:1 on 40, 30, 20, 17, and 10 meters. On 15 meters it is the worst, approaching 11:1, and 12 meters sitting right at 8:1. I plan on "finger testing" the balun on all the bands with my transceiver to see how that balun holds up to a few short minutes of key-down. I am somewhat concerned as to how this will work after I fire up my new 500 W amplifier and tuner!

A In the special case of a matched (SWR equal 1:1) transmission line, the voltage and current will be almost the same at any point along the line, with the exception of the usually small line loss. For your case, in which the SWR is higher than 1:1, instead of the current (and voltage) being roughly constant along the line, the current (and voltage) will vary with distance along the line. The places with maximum current will be the places with minimum voltage and vice versa. The problem comes up because ferrite, while having great electrical properties, is not particularly good at dissipating heat. The heat is a function of the wire loss in the balun times the current there. It sounds like you had the misfortune of having a high current location that happened to be where the balun was. Note that the high voltage regions can also cause problems with arcing, since the maximum voltage will also be the square root of the SWR times the matched voltage.

So the issue is not just what the SWR is on each band, but what the maximum voltage and current are at the location of the balun on each band. Your antenna analyzer can measure the actual impedance at the balun point on each band and you can then calculate the current and voltage at that location. Because of all the bands that such a multiband antenna can be used on, however, it seems likely that at least one band will be close to a maximum voltage point and another near a maximum current point.

It is pretty easy to calculate the maximum current based on SWR, it is just the square root of the SWR times the matched current. At 50 Ω, the 1:1 balun's design impedance, the matched current at 100 W would be 1.4 A, at 15:1, it could be as high as 5.5 A, the same current that you would have with 1500 W in a matched situation.

Your new "500 W" amplifier can actually output about 600 W, or a current of 3.5 A to a matched 50 Ω load. Your 4:1 balun is designed to feed a 200 Ω load, so the numbers on the antenna side will be somewhat different, but we can still analyze what's happening on the 50 Ω side, where the current will be highest. For a matched load, your 3 kW balun should be able to handle 7.75 A. At 600 W into a matched load, your amplifier will be delivering about 3.5 A. You will be within that rating if your SWR is less 5:1. At 400 W output, you will be within the matched current rating for a 7:1 SWR, 350 W for 8:1 and 250 W for an 11:1 SWR.

Going to a 5 kW balun should allow you to handle your current without problems. But be sure to check your balun specifications carefully. If your manufacturer, for example, says that it can handle 3 kW with a 2:1 SWR, than your safe current limit would increase to 11 A, indicating that you could have a safe SWR of 9.8:1 at your power level.

Of course this all assumes that the manufacturers (and Sevick) designed their baluns to just do what they were rated to do. I would hope that they left some headroom.

Just for fun, after you get your amplifier and have it running on your lossiest band for a while, (gently) put your hand on that piece of RG-8X that is going to the balun. I once burned my hand at the same power level by accidently touching my RG-8X when I went to check if my balun was warm — it wasn't, but I ordered some RG-213 the next day! I had a brick on the paddle sending dots for a while on a dead band to get it heated up.

Q Greg, KB8NU, asks: Is there any advantage to matching an antenna to a receiver's antenna input? The prevailing opinion, from the Internet and elsewhere, appears to be *no*. The reasoning is usually something like, "If your antenna is delivering a certain signal-to-noise ratio, then everything is fine." But it is well known that receivers typically present a complex impedance looking into the antenna input; rarely is it actually 50 Ω as advertised.

It seems to me that, because the directionality and gain of any antenna depends on the tuning and resonances of its elements, then placing an odd impedance across the antenna terminals will change the tuning and alter the antenna's performance. Also, especially for weak signal reception, a better

[2]J. Sevick, W2FMI, "Building and Using Baluns and Ununs: Practical Designs for the Experimenter," *CQ Communications*, 1995.

match into the receiver would logically seem desirable.

A First, if the receiver doesn't have an input impedance that is exactly matched to 50 Ω, it is probably much closer to a match than the typical mismatch at an antenna, especially at the band edges. Thus I would expect that any change in the antenna pattern resulting from a mismatch would be small, but certainly not "none."

Particularly for frequencies at which the antenna is not quite matched, the best performance might occur at an impedance other than 50 Ω, typically whatever impedance presents a load back at the antenna that the antenna wants to see. All of this is somewhat masked by any transmission line loss between the antenna and receiver.

Regarding the change in S/N, that tends to be limited by atmospheric noise below perhaps 10 to 14 MHz, depending on season and receiver. In that case, unless the receiver is very noisy, improving the match won't help the S/N, but it will bring up both the signal and noise together. Thus the S meter will read higher (assuming the improvement exceeds any losses in the matching network) but the S/N will remain about the same.

On frequencies at which the internal receiver noise is higher than perhaps 10% of the atmospheric level, providing a better match will indeed increase the signal as well as the S/N, again under the condition that it is not offset by the matching network loss, which will often make it a wash. In the days of separate receivers and transmitters, most receivers did have an antenna trimmer that could be used to peak up the receive input. It would do so by providing a match to typically the reactive part of the impedance presented to the receiver. Interestingly, the still popular 1950s vintage E.F. Johnson Matchbox series of link-coupled antenna tuners that were designed to match balanced antennas to a 50 Ω transmitter, also had a separate link winding that matched a connected receiver to 300 Ω at the same setting. Until the 1980s, many receivers were really designed for a 200 – 300 Ω antenna load impedance.

At VHF, the situation can be a bit different. The receiver input network should be tuned for best S/N (best *noise figure*). This adjustment is somewhat critical, and the best performance is generally close to, but not at quite the same settings as a match — even though that might result in the strongest signal.

Q **Ron, WQ6X, asks: Over the years I have acquired a number of audio digital signal processing (DSP) filters. I have recently added a 15-band (per channel) audio equalizer that I use with one channel for my transmit audio, the other for receive audio. I often run these three devices in series with the goal being to obtain the best processed receive audio to the speaker or headset. My question is, what is the optimum sequence of these devices? Should the amplified equalizer come before the filters or after? In other words, would shaping the frequency response (via the equalizer) make for better DSP results if the filters come afterwards? Or, does it make more sense to shape the frequency response after the DSP filtering has done its job?**

A In a perfect world with perfectly linear devices, it would make absolutely no difference what the sequence is. For many cases there will, in fact, be no noticeable difference. On the other hand, we don't live in a perfectly linear world, so we have to consider the effects of possible non-linearities.

Passive inductor-capacitor (L-C) or resistor-capacitor (R-C) filters are generally quite linear, at least until the levels get high enough to saturate inductors, or break down capacitors. DSP devices, or any active or semiconductor devices including amplifiers, however, can generally be driven into non-linearity at generally much lower levels. With DSP devices, it is often the analog-to-digital (A/D) converter that forms the first step. Each A/D converter has a defined dynamic range, essentially defining the maximum input before there is distortion.

By putting passive filter elements before active ones, and the ones with the highest dynamic range (assuming they have unity gain) early, you may eliminate portions of signals that you don't need anyway and that could cause the A/Ds to overload and distort.

Equally important is to have as low a gain as possible before the DSP and higher gain afterward. Your DSP devices should have an input level specification, and it might be possible to set your receiver AGC and output level so that signals are always below the maximum input of your filters, and then use audio amplifiers following the filters to obtain the desired listening level.

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; for fastest response, e-mail **doctor@arrl.org**.

New Products

Firmware for Icom IC-7800

Icom's latest IC-7800 upgrade adds new and improved features. A spectrum waterfall display allows review of RF and AF characteristics on the IC-7800's 7-inch color LCD and includes a wide screen setting. A PC mouse may be connected via USB to select operating frequency and control the spectrum scope. An audio scope function offers waterfall and oscilloscope views and can be used to observe mic compressor level and other attributes. Direct remote control operation allows direct connection to an IP network using Icom's optional RS-BA1 software and the IC-7800's internal base station function. (A user operation PC is still required; a base station PC is not.) A digital voice recorder automatically captures incoming/outgoing signals onto an external memory card or flash drive. Other updates include an APF function said to increase volume up to 6 dB (adjustable by 1 dB step), a transmit delay function to control a connected external linear amplifier, USB flash drive compatibility, and added RIT and transmit offset commands for CI-V remote control. For more information, visit **www.icomamerica.com**.

Larry D. Wolfgang, WR1B, tc@arrl.org

Wideband Digital Quadrature LO Generator

Generating Quadrature Local Oscillator Signals

Here is an innovative digital technique to generate quadrature local oscillator (LO) signals. This new circuit begins with a signal at twice the LO frequency and not four times the LO frequency, as other published designs require.

Basic Amateur Radio Software Defined Radio Application

The band of interest is linearly down converted to base-band (0 to 20 kHz) with a single mixing stage. The linear mixing process implies that all the information of the signals in the passband is retained and that only the frequency of operation is changed.

The computer sound card is used as an analog-to-digital converter. It is possible to apply many different DSP processes and techniques on the digitized information. Figure 1 illustrates the basic configuration of this simple software defined radio application. The ability to "see" all the signals in the down converted band is very powerful. This is achieved by performing a Fast Fourier Transform (FFT) on the data. The result is a plot of frequency versus amplitude for the down converted frequency band. The calculated FFT spectrum, displayed over time is known as a waterfall or a sonogram. Figure 2 is a screenshot from the HDSDR program, showing some lower sideband activity on 40 meters.

SDR RF Front Ends

The most basic front end simply consists of a local oscillator and a mixer. This functionality is available in a single IC. Typical examples include the NE602 family as well as the TDA7000 family.

For signals in the range of 7.060 to 7.100 MHz, a 7.080 MHz local oscillator (LO) is used. A 7.070 MHz signal mixed with the 7.080 MHz LO produces two output signals; the sum at 14.150 MHz, which is filtered out, and the signal of interest at 10 kHz, referred to as the base band frequency. This frequency is acceptable to the sound card, and the digital demodulation process is then performed.

A higher performance front end makes use of two mixers and two LOs on the same frequency, but with a 90° phase difference. The two base band outputs are thus also 90° out of phase. This is known as a complex mixer, or an I-Q (In phase-Quadrature) mixer. Figure 3 illustrates the basic configuration of such an I-Q SDR.

The two mixer outputs are fed to the left and the right stereo inputs of the sound card. A complex FFT can now be performed and more information can be extracted. In this way it is possible to display a spectrum with a bandwidth of 40 kHz, although the sound card maximum input bandwidth is only 20 kHz.

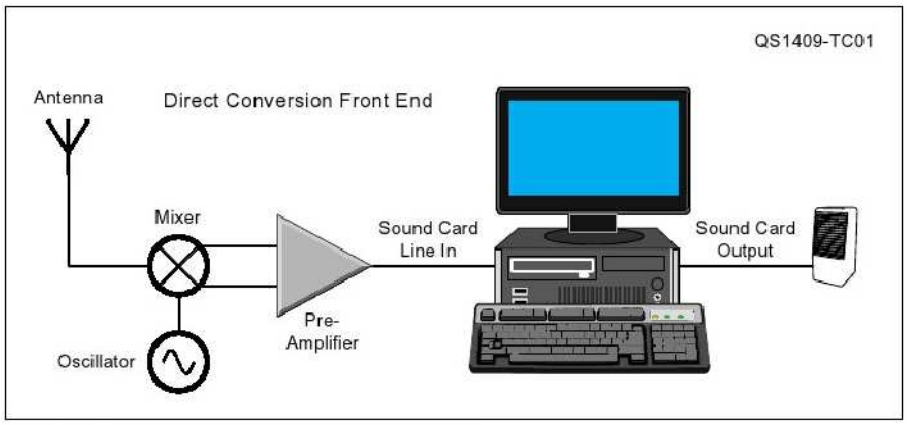


Figure 1 — A basic Amateur Radio SDR application.

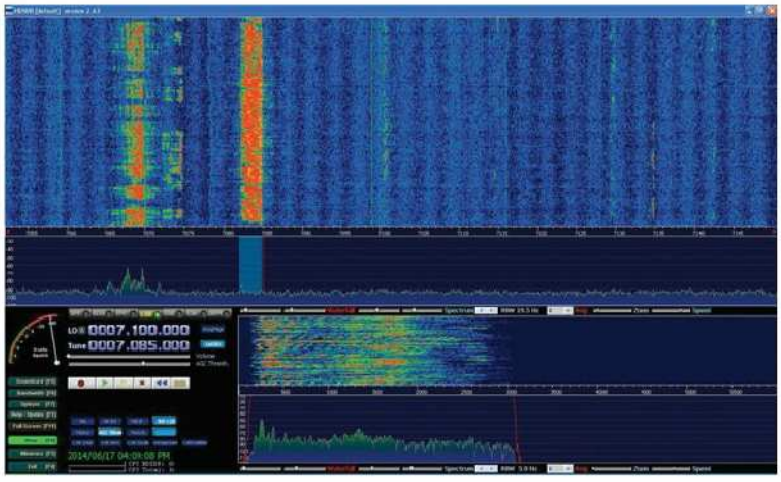


Figure 2 — A screenshot of the HDSDR program, showing the spectrum and waterfall display.

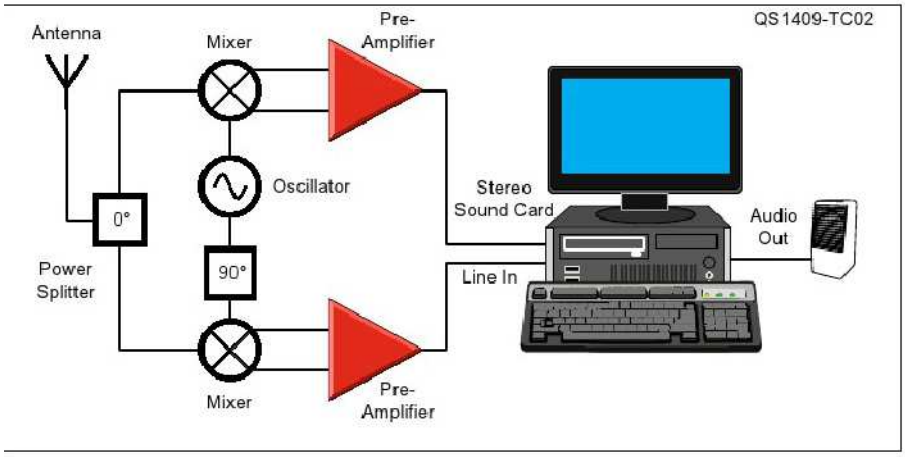


Figure 3 — Diagram of a basic I-Q SDR system.

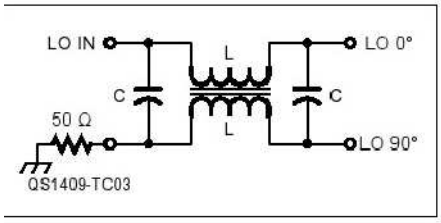


Figure 4 — Schematic of a basic L-C phase shifter.

Quadrature LO Generation

If coverage of only a single band is required, the 90° phase shift for the two mixers can be obtained with the help of an L-C phase shifter. Excellent amplitude and phase balance can be achieved over a narrow frequency range. This technique is not suitable, however, to cover an entire HF band. Figure 4 is the schematic of a simple L-C phase shift network.

The classic way to generate quadrature signals over a wide band is to make use of D-type flip-flops in a ring configuration. Very accurate quadrature signals can be generated over many octaves with this technique. The input signal must be four times higher in frequency than the required output frequency, however. If operation at 10 meters (30 MHz) is required, a stable LO input signal of 120 MHz must be generated. This is obviously very challenging. Figure 5 shows the schematic diagram of such a quadrature generator. Suitable D-type flip-flops include the 74AC74 C-MOS family.

It is also possible to generate quadrature signals over a wide band by making use of D-type latches. The advantage of this configuration is that the input frequency only needs to be twice the required quadrature output frequency. For operation on 10 meters (30 MHz) an input frequency of only 60 MHz is required. This requirement can be met considerably more easily with low cost, readily available DDS solutions. Figure 6 illustrates the quadrature generator formed using D-type latches. Note that the LO input signal is only two times the desired LO frequency. Suitable D-type latches include the 74AC75 and the 74AC373 C-MOS family.

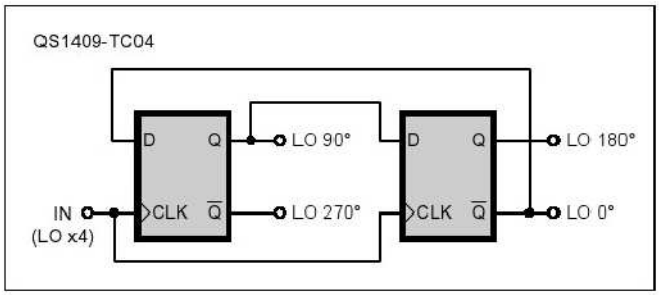


Figure 5 — Basic diagram of a digital quadrature generator (Input = 4 × LO).

It is also possible to implement the improved digital quadrature generator with D-type flip-flops. Figure 7 illustrates this circuit.

Unfortunately, an input signal with a 50% duty cycle is required, and the accuracy of the output 90° phase shift will deteriorate progressively as the input duty cycle deviates from the required 50%. This is not a major problem, however, because a well-filtered DDS output normally easily complies with this requirement. — *73, Hannes Coetzee, ZS6BZP, 134 Goshawk St, Rooihuiskraal-North, 0157, South Africa*; **hcoetzee@gew.co.za**

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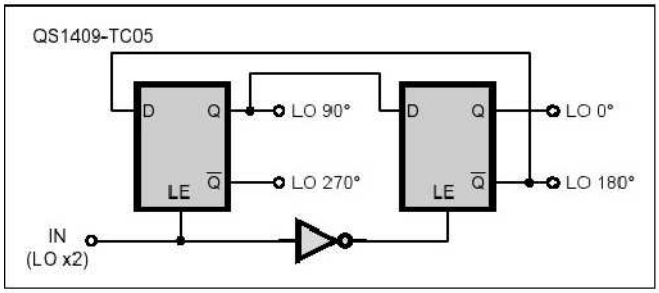

Figure 6 — Schematic of the improved digital quadrature generator (Input = 2 × LO).

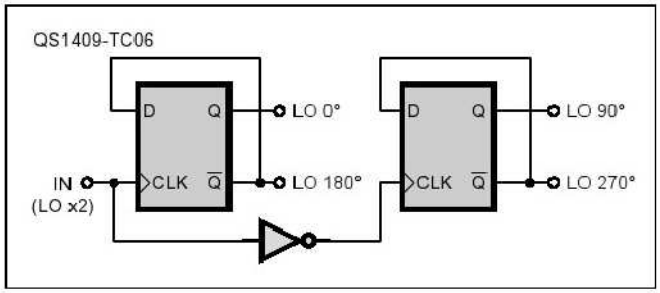

Figure 7 — Here is the Improved Digital Quadrature Generator (Input = 2 × LO) with D-type flip-flops.

H. Ward Silver, N0AX, n0ax@arrl.org

Experiment #140

RF Measuring Tools

This column presents several simple circuits you can build yourself to satisfy a common ham radio need — detecting and measuring RF voltages and currents. We'll start by figuring out how to get access to those RF signals, then measure the value of the voltage or current, and finally turn it into a value measured in decibels. All of the tools are described further in the articles listed in the references at the end of this article.

RF Samplers

How do you tap into a feed line carrying RF without disturbing it (much)? Simple — just get a T connector and hook up your test instrument with a jumper, right? Well, no. If that little bit of cable becomes more than a few percent of an electrical wavelength long, the combination of the terminating impedance and transmission line effects can seriously disturb signals in the main feed line.

The solution is to use a sampler that extracts a very small amount of RF power while not affecting the main feed line very much. Two common methods are used to do this, as shown in Figure 1; the toroidal transformer and the capacitive coupler.[1, 2, 3]

For the toroidal transformer, pick the desired attenuation, A, in dB and the turns ratio, N. Then solve for R_{SHUNT} and R_{SERIES}. Assuming the sampler's main line is connected to a 50 Ω load with V_S across it, and R_{SAMPLE} in Figure 1A is 50 Ω, the output voltage, V_{SAMPLE}, across R_{SAMPLE} will be A dB below V_S.

The capacitive sampler, known as the *Isotee*, is not designed to have a specific attenuation, but rather to simply pick off a small amount of RF from a main feed line. The Isotee is used to provide a signal for a spectrum analyzer or frequency counter. Be sure to label the coupler clearly to avoid using it as a regular T connector and then wondering why you have a bad connection!

For both the toroidal and capacitive samplers, remember to take into account their frequency response when making comparisons between signals of different frequencies. For example, if you are interested in determining harmonic content of a signal relative to the fundamental, the sampler's response should be consistent well beyond the frequency of the harmonic. You can determine the sampler's frequency response by measuring the sampler's response with a lab-quality instrument.

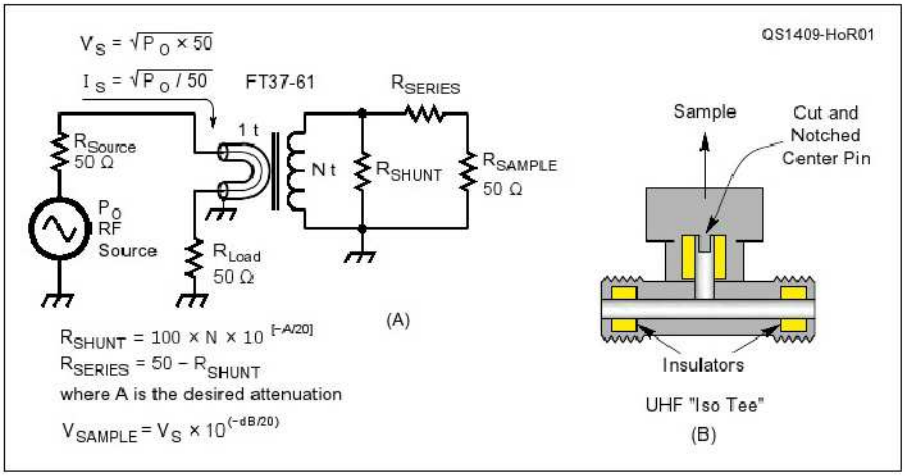

Figure 1 — Two common RF samplers. A one-turn primary toroidal transformer senses RF current at (A). The sampler at (B) senses RF voltages by using the capacitance of a modified T coaxial adaptor.

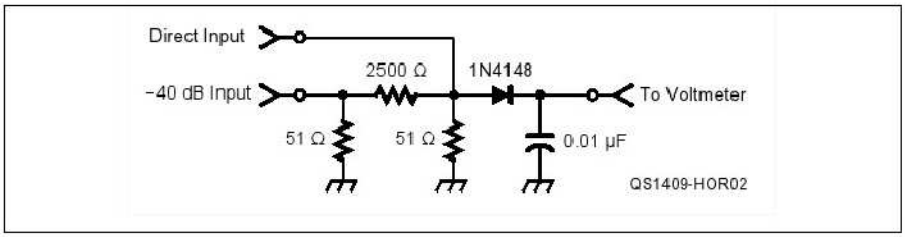

Figure 2 — This peak detector is useful for measuring RF power levels by creating a dc voltage that can be measured with a DVM or other voltmeter. Be sure the 51 Ω resistors are sufficiently rated for the power level to be used.

RF Peak Detector

Without an oscilloscope handy or a true-RMS RF voltmeter, the most useful RF signal amplitude measuring tool is a peak detector. Experiment #53 presented both envelope detector (for receiving AM signals) and peak detector circuits. Figure 2 shows an RF peak detector with both a direct 50 Ω input and an input with 40 dB of attenuation.

The meter's response can be calibrated by measuring the input voltage with an oscil-

[1] T. Thompson, W0IVJ, "Technical Correspondence — A High-Power RF Sampler," *QST*, June 2011, p. 52.

[2] **urgentcomm.com/test-and-measurement/every-toolbox-needs-one-these**

[3] The Isotee was described in Experiment #103. All previous Hands-On Radio experiments are available to ARRL members at **www.arrl.org/hands-on-radio**.

loscope or a lab-quality voltmeter. The input power can be calculated as:

$$P_{watts} = \frac{(V_{dc} + 0.6)^2}{2 \times R}$$

Where R is the value of the resistors connected to the inputs (51 Ω in the figure), V_{dc} is the dc voltage measured by the voltmeter, and 0.6 represents the diode's forward voltage drop with 1 mA of current. (This equation is from section 7.3 of *Experimental Methods in RF Design*.[4]) At lower power and diode current, the voltage drop will be lower, causing a non-linear calibration curve!

A 1N4152 diode can be substituted with a faster response time to extend frequency response. A 1N5711 Schottky diode will have still faster response and a lower voltage drop. And a 1N34A germanium diode will have a lower forward voltage drop (approximately 0.3 V), making the meter even more sensitive. To use the meter for measuring power, be sure the 51 Ω resistor power and diode reverse voltage ratings are adequate for the power level to be used. For a power level of 25 W, the value of V_{dc} will be about 50 V.

[4]Hayward, Campbell, and Larkin, *Experimental Methods in RF Design*, available from your local ARRL dealer or the ARRL Bookstore at **www.arrl.org/shop** or 888-277-5289.

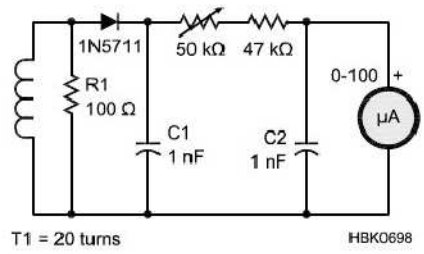

Figure 3 — A toroidal transformer (Mix 2 powdered-iron — T157-2 core) samples RF current, which is then rectified and displayed on a sensitive current meter.

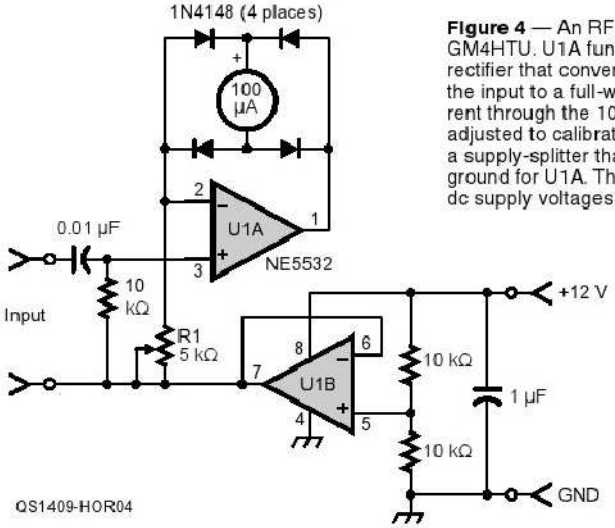

Figure 4 — An RF voltmeter circuit by GM4HTU. U1A functions as a full-wave rectifier that converts the voltage at the input to a full-wave rectified current through the 100 µA meter. R1 is adjusted to calibrate the meter. U1B is a supply-splitter that provides a virtual ground for U1A. The circuit will work at dc supply voltages from 9 to 15 V.

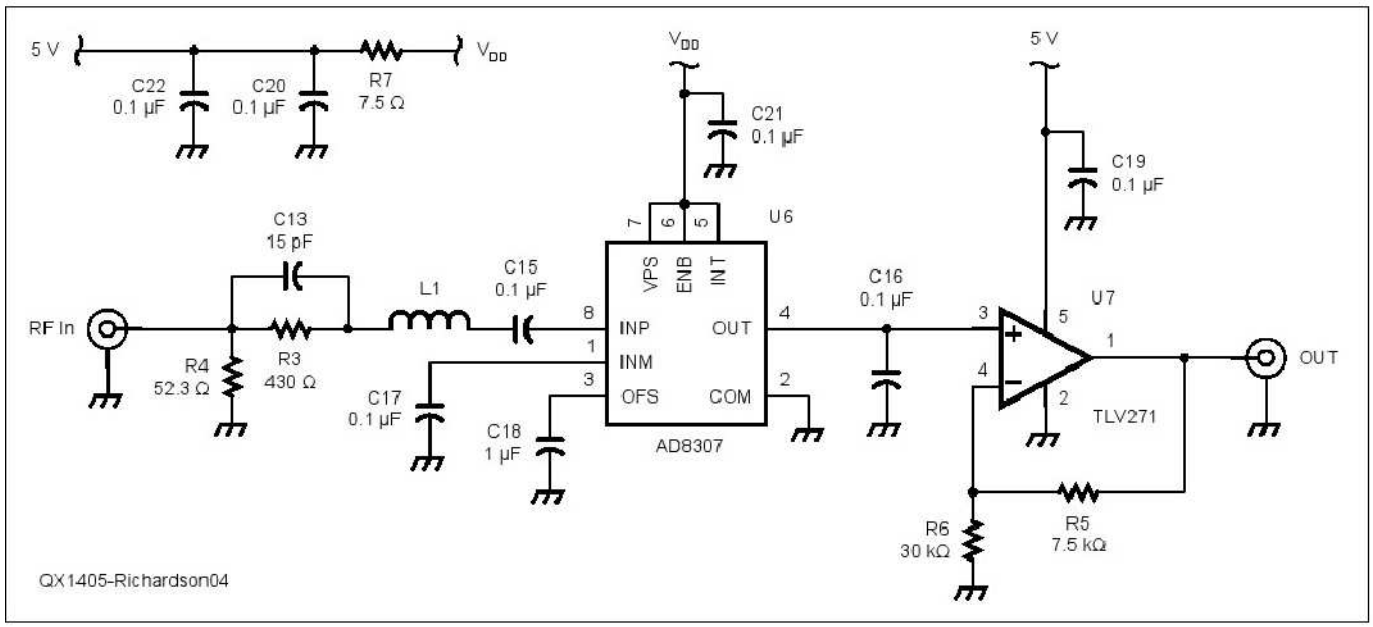

Figure 5 — This wide-range RF detector from AA7VM's July/August *QEX* article outputs a dc voltage based on the input absolute RF power level. The circuit works over a range of 1 to 100 MHz and from –70 to +10 dBm.

RF Current Sniffer

A common reason to go "RF hunting" is to find RF current flowing on feed lines or other conductors. Or perhaps you would like to make some relative measurements of RF current to test antenna or ground radial system performance. Tom Rauch, W8JI, developed the handy RF current meter shown in Figure 3 for this purpose.[5] RF current is measured just as described for the toroidal transformer method in Figure 1. To keep leads short, the entire assembly is glued to the back of the 100 µA meter. If a clamp-on transformer is required, try K0LR's design at **lowfer.us/k0lr/currprob/currprob.htm**.

RF Voltmeters

The circuit of Figure 4 was designed by GM4HTU and published in the Summer 2014 issue of the G QRP Club's magazine, *SPRAT*. This interesting circuit uses ½ of an op-amp (U1A) and bridge circuit to convert the input voltage at Pin 3 to a full-wave rectified current through the 100 µA meter. Meter current is equal to the input voltage divided by the value of VR1. The meter responds to the average value of the current and can be calibrated for either RMS or peak value. The op-amp should have a gain-bandwidth (GBW) product of several times the maximum frequency signal to be measured. (The NE5532 GBW is 10 MHz.) With these values, the maximum input voltage is about 1 V. The remaining section of the op-amp (U1B) acts as a dc power splitter to provide a virtual ground at its output for the rectifying circuit. The circuit will work fine with a 9 V battery or 12 V power supply.

RF Logarithmic Detector

Finally, we often want to measure RF levels in terms of dB. We can use a linear meter and convert the readings to dB mathematically but a circuit that does that conversion for us is much more convenient. Figure 5 shows a circuit that uses the popular AD8307 logarithmic amplifier to provide a linear dc voltage output representing an input voltage of –70 to +10 dBm over a range of 1 to 100 MHz.[6] The circuit is described both in a July/August 2014 *QEX* article by Gary Richardson, AA7VM, and in section 7.3 of *Experimental Methods in RF Design*, mentioned earlier.[7]

Summary

This collection of circuits ranges from simple, passive diode detectors that can be quickly wired together from a junk box and used with an inexpensive DVM, to sophisticated ICs developed for high-performance commercial RF applications. You can build just the one you need or create a whole stable of valuable tools for your RF toolbox!

[5] **www.w8ji.com/building_a_current_meter.htm**

[6] **www.analog.com/en/rflif-components/detectors/ad8307/products/product.htm**

[7] G. Richardson, AA7VM, "An RF Filter Evaluation Tool," *QEX*, July/August 2014, pp. 3-6.

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The ARRL VEC Honor Roll recognizes the top five Volunteer Examiners in each ARRL Division according to the total number of ARRL exam sessions in which they have participated since their accreditations. Considering each session requires an average time commitment of 2 to 4 hours or more, the thousands of hours these VEs have invested represent extraordinary dedication! Whether you are one of our VE Teams that tests once a week, once a month, or once a year, we want to express our warmest appreciation to all volunteers for your generous contribution to the ARRL VEC program.

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Examiner	Sessions	Accreditation Date
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Edward Genoino, WA2NDA	246	10-Jul-85
William Effland, K2GVI	228	06-Sep-84
James McCloskey, NS3K	223	14-Nov-94
George Brechmann, N3HBT	213	01-Apr-91
Donald Wright, Jr, AA2F	186	26-Oct-84
Central		
Eldon Boehm, NK9U	237	21-Nov-86
Allan Bukowski, N9ZD	236	01-Jun-92
Donald Hlinsky, N9IZU	231	01-Mar-91
George Greene, NE9ET	227	13-Nov-00
Timothy Pechtold, AA9BV	225	01-Nov-92
Dakota		
John Schwarz, Jr, AE0AL	226	26-Oct-94
Jeffrey Goodnuff, W0KF	208	17-Jun-03
Daniel Royer, KE0OR	194	01-Jul-91
Dennis Ackerman, KB0OQQ	193	15-Jul-96
Thomas Wilson, NI0I	181	30-Jul-86
Delta		
Arthur Parry, Jr, WB4BGX	226	01-May-91
Edward Scheufele, AB5RS	219	19-Jan-94
William Easterday, KB8FU	209	01-Mar-91
Joan Thorne, KN4PM	172	01-Jan-91
Bobby Livingston, N5YLE	165	01-Apr-93
Great Lakes		
David Schmidt, KI4QH	250	15-Feb-85
Herbert Blasberg, WA8PBW	216	06-Sep-84
Charles Hall, W8HF	207	01-Jun-92
Theodore Wilson, K8TCR	201	19-Jan-90
Claybourne Mitchell, W8JNZ	201	01-Sep-90

Examiner	Sessions	Accreditation Date
Hudson		
Paul Maytan, AC2T	452	06-Sep-84
E. Drew Moore, W2OU	339	01-Aug-90
Gerald Miller, Jr, AA2ZJ	313	05-Dec-95
Daniel Calabrese, AA2HX	305	01-Nov-91
Stanley Rothman, WA2NRV	280	01-Mar-85
Midwest		
Harry Nordman, AB0SX	614	09-Jan-02
David Bartholomew, AB0TO	504	22-Mar-02
Kevin Naumann, N0WDG	471	17-Nov-02
Jeanette Nordman, AB0YX	431	21-Aug-03
Roland Kramer, W0RL	348	21-Jun-01
New England		
Lawrence Polowy, KU1L	289	02-Jan-85
James Mullen, KK1W	271	01-Mar-91
Robert Beaudet, W1YRC	268	01-Aug-90
Stefan Rodowicz, N1SR	268	20-Nov-84
Bruce Anderson, W1LUS	268	11-Feb-88
Northwestern		
Richard Morgan, KD7GIE	391	11-Aug-00
John Mackey, Jr, KS0F	368	01-Oct-90
Loren Hole, KK7M	311	06-Sep-84
George Ftikas, N7TQZ	250	01-Dec-92
Duane Anderson, NA7DA	241	26-Oct-94
Pacific		
Royal Metzger, K6VIP	368	29-Apr-85
Morris Jones, AD6ZH	327	27-Nov-01
Dorothy Hays, N6UDH	242	01-Sep-91
Kenneth Hall, WO6J	230	18-Mar-86
Rodney Gibson, KC6NYR	198	01-Aug-92

Examiner	Sessions	Accreditation Date
Roanoke		
Judy Friel, AC4RG	228	01-Feb-91
Alan Moeck, WA2RPX	202	27-Sep-94
Thomas Hill, KJ4IV	201	01-Jun-91
David Snyder, W4SAR	180	01-May-93
Sheila Frank, KT4YW	179	30-Oct-96
Rocky Mountain		
Karen Schultz, KA0CDN	402	06-Sep-84
Robert Hamilton, N0RN	314	19-May-87
Frank Goddard, W0AJY	266	01-Feb-92
Henry Luthe, Jr, W0ZU	250	01-Jan-92
David Avery, N0HEQ	238	13-Jan-88
Southeastern		
Victor Madera, KP4PQ	366	01-Mar-92
Pablo Soto, KP4SJ	297	01-May-92
Joseph Patti, N4UMB	270	01-Sep-90
Harold Prosser, III, KK1B	263	22-Jan-86
Robert Cumming, Sr, W2BZY	253	29-Jan-97
Southwestern		
Bill Martin, AI0D	534	01-Nov-84
Fred Bollinger, AB7JF	311	17-Apr-95
Gary Mangels, AD6CD	286	30-Jul-97
Steve Gurley, KY7W	285	19-Apr-96
Frankie Mangels, AD6DC	282	14-Oct-97
West Gulf		
Sammy Neal, N5AF	531	20-Nov-84
Franz Laugermann, K3FL	530	01-Dec-91
John Moore, III, KK5NU	423	21-May-95
Gerald Grant, WB5R	366	04-Jan-85
David Fanelli, KB5PGY	344	01-Oct-91

Steve Sant Andrea, AG1YK, hk@arrl.org

Android APRS, a Good Fit, and Weight Control

APRSdroid

We all know that personal computers have played an increasing role in the ham shack. PCs have now given way to smartphones, which I believe are going to be seen increasingly as the choice for operations in the field.

APRS

APRS is the Automatic Packet Reporting System founded by Bob Bruninga, WB4APR (**www.aprs.org**), which is used to transmit GPS location data and text information over radio. One of the most low-cost ways to implement APRS involves using a VHF handheld transceiver, an APRS tracker, a GPS unit, battery, and some cables. The *APRSdroid* app simplifies these requirements.

APRSdroid

APRSdroid is a $4.95 app that installs on any Android smartphone or tablet running *Android 1.5* or later. Installed on an Android smartphone, *APRSdroid* is a complete implementation of APRS for sending and receiving tactical information, including messages. *APRSdroid* includes not only the map software; it also serves as an APRS tracker. Using the smartphone's GPS, display, and keyboard, it becomes a complete APRS implementation, lacking only the radio.

There is one hitch. Because earphone/microphone jacks for smartphones don't have a push-to-talk connection, a radio with voice-operated transmitting (VOX) capability is needed. While external VOX devices exist, I learned that the Baofeng UV-3R and -5R handheld transceivers have VOX capability. This VOX capability allows the APRS data stream to trigger transmit automatically.

Connecting to the Radio

APRSdroid has an "AFSK via Speaker/Mic" feature (in PREFERENCES) that will send and receive data over the smartphone's speaker and microphone or with a cable, over the smartphone's four-conductor earphone/microphone jack. I happen to have the first version Samsung Galaxy Tab Wi-Fi, a 7-inch tablet running *Android 2.2.1* and the Baofeng UV-5R (see Figure 1).

Figure 1 — The Baofeng UV-5R radio and Samsung Galaxy Tab Wi-Fi connected by cable with *APRSdroid* in action. [Daniel Yang, K6DPY, photo]

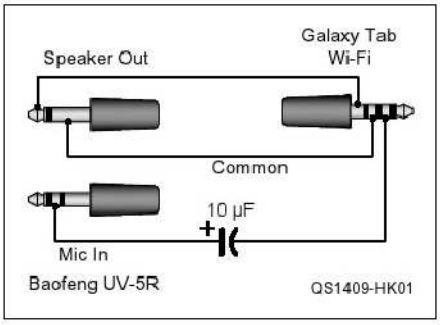

Figure 2 — Schematic of the UV-5R to Galaxy interface cable.

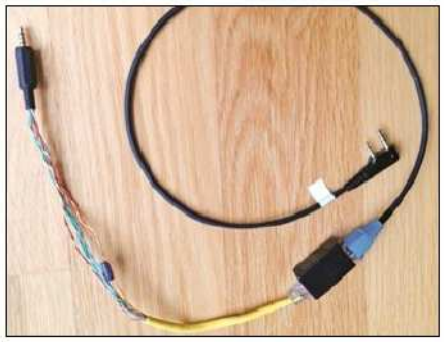

Figure 3 — The completed interface cable.

Audio Cable

The pinouts for the UV-5R are the same as the pinouts for some Kenwood handhelds. Note that the UV-3R has different pinouts.

I have a cable for my Kenwood TH-G71A that was suitable for the UV-5R. Because it terminated in an RJ45 connector, I decided to use that format for the cable to the Galaxy Tab (see Figures 2 and 3). Note that only three of the eight wires of the RJ-45 connector are used. The volume controls on the smartphone and the UV-5R are used to match the output levels, so the diagram for the cable turned out to be simple.[1]

The trick to making this work is in matching the output levels to the microphone input levels on both the UV-5R and the Galaxy. These are both low-level inputs. The output on the Galaxy is a low-level output (match-

[1]These pinouts are different for different models of Android smartphones.

ing the low-level microphone input on the UV-5R), *but* the output on the UV-5R is a *high*-level output. Normally this would require a matching circuit, but because both output levels are controlled by the volume controls on the devices, in the interest of keeping costs low, I decided to forgo the matching circuit. This makes it a bit tricky to set up the levels.

So with only an inexpensive handheld transceiver and my smartphone, I have the ability to use APRS to broadcast my GPS position and short text messages to others via either ham radio or the Internet. In an emergency, such flexibility can be valuable. — *73, Daniel Yang, K6DPY, PO Box 2812, Palos Verdes Peninsula, CA 90274*, **k6dpy@arrl.net**.

Does the Case Fit?

I was about to give up on my handheld transceiver after many complaints that my signal was strong but my audio was "mushy." I take good care of my radio and even keep it in a protective leather case to prevent damage and keep debris out of all those little holes. One day, while admiring this little marvel, I noticed the protective vinyl window over the display was blocking more than dirt. Although the window had holes over the speaker, the pinhole for the microphone was behind the vinyl, which was sure to muffle my voice.

The solution was easy. Using a marking pen, I put a dot over the MIC pinhole. Next, I removed the cover and used a handheld paper punch to make a 3⁄16 inch diameter hole centered on the dot. It took a little effort to wiggle the punch in position, but once in place, it worked great. Craft stores sell leather punches that would probably do an even better job.

I've had clear audio reports ever since. One other thing — check the pinhole's position from time to time. As Figure 4 shows, even with normal handling of the radio, the case will shift around. Rather than enlarge the hole, I just give the case a tug. One thing's for certain, I'm no longer heard shouting, "Can you hear me now?!" — *73, Hal Rogers, K8CMD, 7811 Dogwood Ln, Parma, Ohio 44130*, **k8cmd.hal@arrl.net**.

Tensioner Weight Control

Whether they are used for emergency communications or just a fun day of hamming, our wire antennas need to stay up. Trees will sway in the wind and no wire will stop your green supports from swinging in opposite directions. So, we use pulleys; running the support rope or cable through a pulley and down to a weight has been the solution for many years. However, this solution has its own problem. I once saw two cement blocks that were being used to tension an antenna. The blocks were hanging at the end of a rope and doing a good imitation of a wrecking ball as they swung against the tree. It seemed to me a better solution was needed.

After considering the issue, I came up with a simple solution — plastic pipe. I took a piece of pipe about twice the diameter of the antenna support mast. I cut two 1-inch collars off one end and sealed the other end.

Next, I cut the collars in half. I mounted two of the half-moon pieces to the tube using pipe cement and screws, and then I positioned the support mast in the half-moon and roped it in place. I glued the other half-moon pieces to those mounted on the pipe, waited for the glue to harden, and removed the rope. Finally, I added enough weight to the inside of the pipe to provide the correct amount of tension to the antenna wire.

Figure 5 shows the tensioner at one end of my 630 meter inverted L antenna. The tree at the other end will swing a few feet in a storm, but (so far) not so much that it pulls the pipe up to the guy ring at 10 feet. The wind drag is minimal.

If you have a house, fence, or something else on the end of the antenna you want to protect, this method will keep those weights under control. — *73, Patrick Hamel, W5THT and WD2XSH/6, 1157 East Old Pass Rd, Long Beach, MS 39560*, **w5tht@arrl.net**.

See That SMD

SMD parts are so tiny I have trouble seeing the connections to solder them to the circuit board. I have a headband magnifier that helps, but even that is not enough magnification for some tiny SMD parts. I have found that wearing drugstore reading glasses under the headband magnifier solves this problem. You get the magnification of the lenses in the headband magnifier, plus the magnification of the reading glasses. You can also select reading glasses of different powers to get more or less magnification to suit various jobs. — *73, Bob Sumption, W9RAS, 61250 Cass Rd, Diamond Lake, Cassopolis, MI 49031-9406*, **w9ras@arrl.net**.

Figure 4 — Punching a "mic hole" in your handheld transceiver's protective vinyl cover may solve that low audio problem. [Hal Rogers, K8CMD, photo]

Figure 5 — A section of plastic pipe can be cut and glued to form an antenna counterweight, which is then attached to a section of mast to keep it under control. [Patrick Hamel, W5THT, photo]

"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 **hk@arrl.org**. Please include your name, call sign, complete mailing address, daytime telephone number and e-mail address on all correspondence. Whether you are praising or criticizing an item, please send the author(s) a copy of your comments.

TN2MS — Care and Contacts from the Congo

A DXpedition to the Congo helps support the Mercy Ships charitable activities.

The hospital ship *Africa Mercy* docked in Pointe-Noire, Republic of the Congo.

Arie Kleingeld, PA3A

October 2013 was the fourth time that a team of Dutch radio amateurs traveled into Africa with a mission to support the charity organization Mercy Ships (**www.mercyships.org**) in combination with a DXpedition (**www.tn2ms.nl**). This time the trip was to the Republic of the Congo. Republic of the Congo is sometimes known as Congo Brazzaville to avoid confusion with the Democratic Republic of the Congo, which is known as Congo Kinshasa. The Republic of the Congo is much more stable than the Democratic Republic, which allows for safer travel.

The plan was for the team to support the activities of the hospital ship *Africa Mercy* (see lead photo) as volunteers for a week and afterwards to spend 2 weeks on a DXpedition. Starting on October 4, 2013, Ad, PA8AD; Marian, PD1AEG; Angelina, PA8AN, and myself, Arie, PA3A, traveled from Rotterdam to Pointe-Noire in Congo. After approximately 20 hours of traveling, we finally reached the ship.

The *Africa Mercy* has six operating theaters and 78 beds. It offers free medical care to people within developing countries who otherwise have no access to it. The *Africa Mercy* is fully self-contained with a crew of about 450 volunteers. Besides doctors and nurses, the ship needs other skilled workers. As a hospital, the *Africa Mercy* needs a clean environment, which requires clean water, electricity, food, drinks, security, transportation, a school for the children, working lavatories and showers, etc. Some of our team has skills in these areas and used their knowledge and experience to support the hospital's operation.

The GPS Project

One task where the ham radio team's expertise was helpful was for the GPS project. The *Africa Mercy* is equipped with about 30 cars used for travelling over land to bring medical help to those inland. Our team took on the task of equipping all 30 cars with a GPS. The GPS was tied into a VHF transceiver so that the position of each car would be passed on to the ship automatically, working similar to an APRS system. For the *Africa Mercy*, this serves to ensure the safety of the crew. If something unexpected happens, it is vital to know where the cars and crew are so that they can be guided back to the ship safely. Because of the limited technological infrastructure in many of the countries it visits, the *Africa Mercy* must have its own reliable communications system.

Ad and Arie started this project on the day after our arrival onboard. Immediately we ran into a problem with the GPS units the team had brought. The units were only equipped with a PS2 style circular

Figure 1 — Marian, PD1AEG (left), and Ad, PA8AD, setting up one of the beams.

Figure 2 — Arie, PA3A, connects the radials for the 40 meter vertical.

Figure 3 — One part of the TN2MS antenna farm.

connector, which did not fit the radio. We needed a 15-pin D-connector. One of the Congolese day workers was sent to find an electrical store in the city and obtain the connectors.

Once we had the GPS and the radio connected, there were difficulties in passing the GPS location data to the mobile radio. We discovered later that the GPS units and transceivers were not configured for the proper baud rate and communications protocol. We set about correcting this by programming the GPS units with an African-style interface that used a D-9 connector to the serial port of the PC for loading the software to the GPS unit by RS-232 and a D-15 connector to the transceiver to provide a 5 V power source, all connected by some simple wiring. We then installed all the GPS units onto the cars and also modified the older mobile transceivers for GPS use.

Our last difficulty was discovered while monitoring the radio traffic. We found that on several of the radios the data carrier, which transmitted the position data to the ship, was set to a very low level. Once we corrected the data carrier level, the entire fleet of cars was able to be fitted with a working system.

Other Duties on the *Africa Mercy*

Other members of the team (Marian and Angelina) who were not trained in electronics set about volunteering for the various day-to-day duties both on board and in the areas surrounding the ship. This included helping out in the local café, working as members of the security team for an eye screening, which assessed potential eye patients, and, as care workers, visiting vulnerable elderly people who were abandoned by their children, or disabled people who lived far from their relatives.

Next Project: a DXpedition

After a week on board it was time to start the DXpedition. About 10 miles south of Pointe-Noire, we found a suitable location with electric power that was on almost 24 hours a day. We rented two cabins in a resort that were about 150 feet apart and about 1000 feet from the beach. Behind the cabins we were offered a nearly flat and virtually open field of 200 × 150 feet.

For the preparations, we used the experience of the TN2T team who had visited Congo 2 years earlier. We also had a good impression of the site through aerial photographs we found on the Google Earth and Bing Maps websites.

After a brief exploration, we immediately started building the antenna farm and unpacked all the equipment. The antennas were erected according to plan. When both beams (a five-bander and a three-bander) were heading north, they stood side by side about 150 feet apart (see Figure 1). In this way they were never pointed directly at one another when working Asia, North America, or Europe. The various verticals (five in total) were put in between and around the beams (see Figure 2).

Each cabin had one station consisting of a transceiver and linear. Both cabins could connect to the 20 – 10 meter antennas. The 30 and 40 meter verticals were placed between the two cabins so that they could be connected as needed. The combined 80/160 meter vertical and the corresponding K9AY loop were located as far apart as possible to minimize the impact of the vertical on the directivity of the loop. The 80/160 vertical antenna was a tunable monobander that was used on 80 meters the first week and 160 the second (see Figure 3).

Once everything was set up and working properly, the team was divided into groups of two per cabin to share operational duties. A day in the life of the team members was as follows: In the morning in each cabin one

member of the team would start operating. The other would go to the resort restaurant for breakfast. After breakfast, operators were relieved on a regular basis but without a tight schedule. Change of operators usually happened after 1½ to 2 hours. Every day at about 1800 local we stopped all activities for a team dinner and to share the experiences of the day. Operations commenced again about 2030 and continued until sometime after midnight, mostly in a "silent" mode like CW so that the other person could sleep. In this way, the two stations were on the air for more than 16 hours per day.

The objective of the DXpedition was to give as many different stations enough opportunities to work Congo and also give the weaker ones a fair chance. Lots of hams e-mailed us about propagation paths to nearly every corner of the globe. Most of the time we were able to receive those e-mails over the Internet, which is not always reliable in this part of Africa.

We followed up on almost every suggestion for working the distant continents. To actually hear stations from such areas, we often had to ask a pileup from another continent to stand by (see Figure 4). For the most part the calling stations were courteous and stood by while we worked these difficult locations. Of course we missed stations; we know that we were not perfect. Some stations tried to speak to us through the DX Cluster in *talk* mode in order to get around the pileup, but we didn't feel it was appropriate to accommodate them.

Low Band Operations

The lower bands proved to be very difficult, and sometimes nearly impossible, due to the huge static levels generated by the thunderstorms around us. On 40 meters, we could work reasonably well with CW but 80 meters was extremely difficult and 160 meters almost impossible. Signals of S-6 were buried under S-9++ static that made copy very hard, even with the automatic gain control off. These high static levels prevented us from hearing the reported pileups on 80 and 160 meters.

Good Propagation on Higher Bands

The propagation on the higher bands from 17 – 10 meters was generally good. In particular the 15 and 12 meter bands were open to the whole world. At any time of day pileups were heavy on every band in CW, SSB, and RTTY. A significant phenomenon we noticed was that many hams are now using a bandscope or panadapter.

With a panadapter, it is easy to see which station in the pileup is answering the DX station. When they complete their contact, those with panadapters jump to that frequency and start calling. Many stations moved quickly along with the frequency of the station last worked. The only way to keep up the contact rate up was to change frequency after almost every contact.

Figure 4 — Angelina, PA8AN, running one of the many pileups.

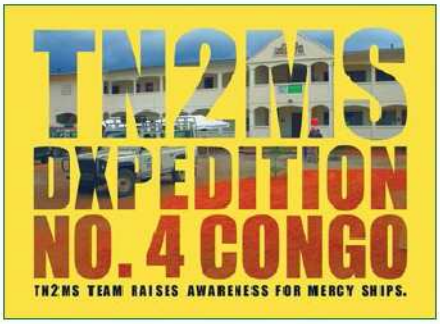

Figure 5 — The TN2MS QSL card.

Figure 6 — The TN2MS team in front of the Mercy Ships HOPE Center, from the left: Ad, PA8AD; Angelina, PA8AN; Arie, PA3A, and Marian, PD1AEG.

The Magic Band

In the second week we used a lightweight two-element beam from Nuxcom (**nuxcom.com**) for the 50 MHz band. This setup worked well for 3 nights when we experienced openings to the Middle East (including Oman), South and Central Europe, North Africa, the Caribbean, and South America. The experts call this type of propagation TEP (Transequatorial Propagation). This band proved a lot more efficient than 160 meters.

Packing Up

After almost 2 weeks of intensive radio work and volunteering, it was time to pack up. The nice environment, the climate, the entire entourage, relaxed atmosphere, and the still ongoing pileups made it difficult for us to leave. After 11 days of operating we had more than 30,000 contacts in the log and lots of good memories. Before we knew it, we were saying goodbye to the *Africa Mercy*'s crew and had arrived back in the Netherlands. We immediately started working on the QSLs (see Figure 5) along with Henk, PA3AWW, our QSL manager.

We managed to ship all direct cards in December 2013. We also transferred the donations from hams, given via our website, to Mercy Ships, which will benefit the HOPE Center in Pointe-Noire, a clinic that is set up near the ship for recovering patients and their caregivers (see Figure 6). We are delighted that we can sponsor this Mercy Ships project via ham radio because we were able to experience and witness the good work this organization performs for those in need.

All photos by the author.

Arie Kleingeld, PA3A, an ARRL® international member, has been a licensed radio operator since 1977 and was a member of the 5L2MS, 9L5MS, and TN2MS DXpedition teams. He is an active CW and SSB contester and an Elmer to many radio amateurs in the southwest Netherlands. Arie holds a master's degree in Telecommunications and works as a freelance consultant. He and his wife Marian, PD1AEG, can be reached by e-mail at **pa3a@xs4all.nl**.

MS Society Challenge Walk

A public service activity is often repaid with personal satisfaction.

Mark Richards, K1MGY

The Amateur Radio license affords many opportunities to experiment, learn, and advance the "radio art." It is also our passport to public service. Many hams participate in this aspect of our hobby by, for example, assisting the Red Cross with vital communications at the Boston Marathon or providing communications support for a community parade. In doing so, we fulfill our charter and become a vital part of our communities. I consider this public service activity to be significant.

The Challenge Walk

Of the many events I've participated in as a volunteer, none came close to my remarkable experience at the Multiple Sclerosis (MS) Society Challenge Walk on Cape Cod in September 2013. Designed to raise funds for the Multiple Sclerosis Society, increase public awareness, and offer encouragement to MS patients, the event is held over the span of 3 days and involves 750 participants and 200 volunteers, including scores of Amateur Radio operators. Its 50-mile course traverses public roads and the Cape Cod Rail Trail, and is a challenge to participants and volunteers alike. Amateur Radio communications support is critical for a safe and successful walk, particularly as large sections of the course are isolated. I was one of two bicycle-mobile hams supporting the effort. During the event I managed to rack up 150 miles, a few sore muscles, and memories to last a lifetime.

The bicycle team assembling at Hyannis Green prior to the start of the event.

Multiple Sclerosis

Multiple Sclerosis is a disease that affects the brain and spinal cord with a wide range of symptoms and impacts. Many people have MS and live without paralysis and pain, while others are walking one day and wheelchair-bound the next. MS patients live with what some call a "ticking time bomb," because symptoms can manifest quickly and severely. When a dear friend succumbed to MS a few years ago, I witnessed the devastation first hand, and so began my service as a communications volunteer prepared to offer encouragement to those in similar circumstances. Little did I know at the time that the encouragement and inspiration I gave would be returned one hundred fold.

The MS Society consists of a national organization with various state and re-

Jim, KB1JKJ, and Donna Bradley taking a break from sweeping the course on their tandem bicycle equipped with a radio, first aid kit, and other supplies.

Motor Crew members David Odess, KB1MVN (left), and Ross Chapman, KB1MGD.

The author's mountain bike was equipped with a 2 meter APRS transmitter mounted on the frame.

gional chapters. Their primary goal, to achieve "a world free of MS," is being pursued by funding research for improved MS treatments and, hopefully, a cure. The Society also does a great deal for patients and families through advocacy, information, referral, and events such as the MS Challenge Walk, where those affected by MS gather to support one another.

This event is as demanding in its organizational complexity as it is challenging for participants and volunteers to complete. The MS Society of Greater New England, supported by a team of Amateur Radio volunteers, accomplishes a remarkable feat of planning and operations for this event every year.

I consider safety to be the prime directive in any public service event, more so at the Challenge Walk where 750 participants; some wheelchair-bound, others with leg braces; faced not just a test of stamina, but sudden weather changes, 50 miles of roads and trails with uneven surfaces, busy intersections, and clogged bikeways. Our reflective vests bore the title "Safety Team," which served to bring all of the volunteers together with this singular focus.

A Geek and His Gear

My assignment turned out to be a real gift; I was the lead support cyclist on each day of the walk. Another ham, Jim Bradley, KB1JKJ, and his spouse, Donna, followed the last walkers, acting as the course sweepers (volunteers who follow behind the walkers to "sweep up" the last participants and make sure no one is lost along the route). Jim and Donna were on a tandem bicycle equipped with a solidly-mounted mobile rig, APRS, batteries, first aid supplies, water, snacks, and tools — around 400 pounds in total.

My mountain bike was also equipped with 2 meter APRS, enabling me to provide instant and accurate locations to event managers. A rear mast supported GPS and 2 meter antennas; the APRS transmitter was attached to the bike frame. I wore a small backpack, similar to that used by bicycle messengers, and on its strap I clipped a Yaesu FT-60 (backed up by a Wouxun portable) with a gain antenna. As a backup I also used *APRS Droid*, a mobile phone application that sends GPS position data to the APRS network.

All this was powered by a sealed lead-acid battery. (Note to self: get something lighter next time!) With a modified Plantronics commercial wired headset (**www.plantronics.com/us**) in one ear and a mobile phone Bluetooth headset in the other, mine was a geek's fashion statement. It did prove to be excessive, because the setup required 20 minutes to assemble each morning.

Especially helpful was the use of a moving map display rendered by OpenStreetMap (**www.openstreetmap.org**), which ran on a spare mobile phone. Mounted in a clear pouch within a handlebar bag, it helped to answer the frequent question, "How far to the next rest stop?" As a backup, I carried a printed map and daily queue sheet that described every point on each day's route. As the event progressed, I decided to promote the paper from its backup role. It was convenient and enforced the discipline of location awareness. In summary, my setup consisted of 100 pounds of gear, 30 pounds of bike, and 150 pounds of me.

Meeting the Challenges

My participation in the Challenge Walk went far beyond public service communications. Although a technical and logistical exercise, the experience was one of human courage and hope. While each participant raised money for the Society, the whole idea was to walk while pushing through pain and disability.

William Brouillon (left) of the bicycle team assists a participant at the finish who was determined to walk the final distance.

Lori Goode and Marv Winter, part of the motor crew. They were on constant patrol, ready to deal with any issue that might compromise the event.

Celebrating a successful finish are (from left) Brenda Barbour, KB1MVJ (Director of Volunteer Development, MS Society); Kathy Savage, KB1LYJ (medical/ham); Rick Savage, KB1LPW (SAG/ham), and Brittany Collins, KB1ZPS (medical/ham).

On the second day, I had the privilege of accompanying the lead participant along her last 5 miles. Alternating between jogging and walking, she was clearly tired. I offered water and encouragement. Despite being by herself, she took the lead. All of those behind her served as an inspiration.

Included in the plentiful support matrix for participants were SAGs (Amateur Radio-equipped vehicles providing transportation or other assistance), a motorcycle crew, rest stop personnel, ham-equipped emergency medical teams (stationary and mobile), and participant team SAG vans. I must single out the 20-unit bicycle team, mobile phone equipped and coordinated by Alan Loiselle. They were ubiquitous and, along with the crew (motorcycles and SAG vehicles), appeared where they were needed, and at the right time.

Smoothing the Course

A key part of my job was scouting ahead of the lead walker to locate and report safety concerns such as debris along the path or a difficult road crossing. As these issues became apparent, my call to net control brought Marv Winter and Lori Goode of the motor crew to handle them within minutes. Later I learned that each of these issues had been assessed beforehand, and planned for. In the future, I still won't assume something's covered, but will approach issues with the knowledge that the planning is more comprehensive than I might initially believe. This is a tribute to the extraordinary effort and experience that goes into the extensive event preparation.

At our Net Control Station (NCS) for the 3 days, John Mahon, N1PYN, was the voice that glued everything together. More than offering essential orchestration and coordination, John's every transmission sent a message of confidence to all of us in the field. His relaxed style was imbued with competence. John offered a tireless performance that was inspiring and served up some goals for my own operating.

Support did not end upon our arrival at "base camp" (the Brewster Sea Camps facility). Here the participants and volunteers were provided food, housing, and even a massage for sore muscles — and boy, did I have a few! My assignment required a considerable amount of patrolling, which resulted in average travel of 50 miles a day.

I will remember, and hold with respect in my heart, the special core of Amateur Radio and medical volunteers into whose community I was so graciously welcomed. The bonds that formed are ongoing and leave me very much looking forward to supporting the Challenge Walk again.

An Emphasis on Service

Amateur Radio public service can be far more than talking on the radio. It can be your passport to the life-enriching experience of serving others. In this event all the technology went to the sidelines. Instead, I discovered the heart of the matter is what you bring in your personal kit, and the welcoming and supportive team of which you become a member. It's waiting to be experienced.

My license allows me this chance to utilize my communication skills and techniques to support others through their challenges. It has opened doors and brought enjoyment and personal fulfillment to my life.

The MS Challenge Walk is one of many events that welcome Amateur Radio and medical volunteers. Visit **www.nationalmssociety.org** for details or contact me and I'll send you in the proper direction.

Photos courtesy National Multiple Sclerosis Society and Mark Richards.

Mark Richards, K1MGY, an ARRL member, has been a licensed radio amateur since 1968 when the sounds of Morse code beckoned from a neighbor's window. He currently holds a General class license. He works in the solar energy and instrumentation field and is currently involved in ultrasonic flow and heat metering technology. He can be reached at 29 Juniper Rd, Littleton, MA 01460, **k1mgy@arrl.net**.

2014 ARRL Simulated Emergency Test

Test your preparedness in this nationwide event, held October 4 – 5.

Steve Ewald, WV1X

ARRL's Simulated Emergency Test (SET) is scheduled for October 4 and 5, 2014. This nationwide exercise is the chance to test your emergency operating skills and the readiness of your communications equipment and accessories in a deployment that simulates an emergency. ARRL Field Organization Leaders at the section and local levels, and many other volunteers who are active in public service and emergency communications, are developing emergency-like scenarios in consultation with a variety of agencies for which radio amateurs are known to provide service during emergencies.

To find out how you can step up and be a part of the local or section-level activities, your Section Manager's contact information is found on page 16 of *QST*. Additional contact information may also be found on the Section web pages at **www.arrl.org/groups/sections**.

The Amateur Radio Emergency Service® (ARES®), the National Traffic System (NTS), the Radio Amateur Civil Emergency Service (RACES), and members of the ARRL Field Organization, among other allied groups, will participate in and practice emergency operation plans, nets, and procedures.

More information on working with national served agencies may be found at **www.arrl.org/served-agencies-and-partners**.

Metro Atlanta District ARES Tested Ice Storm Scenario

In the October 2013 SET, ARES members, among others, of the 14-county Metro Atlanta District ARES group established emergency communications to various locations throughout metro Atlanta, Georgia Emergency Management Agency Headquarters in Atlanta, Emergency Operation Centers, and shelters and hospitals across the state. Metro Atlanta District Emergency Coordinator Jim Millsap, WB4NWS, lead this group and was supported by Assistant DECs Randy Kerr, KD4KHO, and Guy McDonald, K4GTM, and 13 Emergency Coordinators.

Figure 1 — Coweta County, Georgia, Emergency Coordinator Randy Mercer, WN4TLP, is shown operating as net control from his home station in Newnan during the Metro Atlanta District ARES 2013 SET. Contact was established with the County Emergency Operations Center and the National Weather Service during the test. [Randy Mercer, WN4TLP, Photo]

"What is ironic is that we practiced this in October 2013, and the exact scenario took place in January 2014 with the Atlanta 'Snow Jam 2014,' but it was an ice storm event," Millsap noted.

Various forms of voice and data communications were used by the ARES members with their radios and laptops on battery power. This annual exercise confirms the ability for ham radio operators to provide emergency communications to the EOC, State Operations Center, and across the counties and state during any disaster. The ARES members are highly trained emergency communicators, trained in the Incident Command System (ICS) and volunteer their time, skills, and equipment to support the citizens of Metro Atlanta and beyond. This exercise scenario is, in essence, what the Simulated Emergency Test is all about. What steps can you take to get ready as an individual licensed radio amateur or as part of the larger community?

SET to Go!

In consideration of local and section-wide schedules with agencies and many others, ARRL Field Organization Leaders have the option of conducting their local or section-wide SET on another weekend in the fall season. Check with your local ARRL Field Organization leadership for the exact date in your area. Your help is needed, and the ARRL SET is a great way to get involved in emergency communications.

Information about specific SET guidelines and reporting forms for ARRL Field Organization Leaders are posted at **www.arrl.org/public-service-field-services-forms**.

SET Bonus Points for Centennial QSO Party

During this year's Simulated Emergency Test, participating ARES/NTS members can earn SET bonus points by participating in the ARRL Centennial QSO Party (**www.arrl.org/centennial-qso-party**). This applies to all involved in the ARES and NTS programs. All participating stations should review the ARRL Centennial QSO Party rules, which can be found at the link above.

During the SET weekend, October 4 – 5, ARES and NTS field members and appointees are encouraged to get on the air and call "CQ Centennial." The contact exchange is RST, name, location, and your designator. You can also search for stations calling "CQ Centennial."

There will be a special bonus for groups that include participation in the Centennial QSO Party. Each participating station that makes at least five contacts is worth an additional three points to your group's 2014 SET score. See page 78 in the July issue of *QST* for further information.

Additional 2013 SET Results

The following 2013 SET Results were submitted properly, but did not appear in the results article in the July issue of *QST*, pages 71 – 73.

ARES Activity

Area	*Reporter*	*Points*
Georgia		
Metro Atlanta	WB4NWS	1061
Maine		
Piscataquis Co	WA1JMM	577

Rick Lindquist, WW1ME, ww1me@arrl.org

"Amateur Radio Parity Act of 2014"

Bill would require FCC to extend PRB-1 coverage to restrictive covenants.

A bill with bipartisan support introduced in the US House at the ARRL's request on June 25 would require the FCC to extend PRB-1 to private land use policies. The "Amateur Radio Parity Act of 2014" — H.R. 4969 — calls on the FCC to apply the "reasonable accommodation" three-part test of the PRB-1 federal pre-emption policy to private land use restrictions regarding antennas. The bill's primary sponsor is Rep Adam Kinzinger (R-IL). It had initial co-sponsorship from Rep Joe Courtney (D-CT). The League worked with House staffers to draft the legislation.

An H.R. 4969 page on the ARRL website at **www.arrl.org/hr-4969**, supports a grassroots campaign to promote co-sponsorship of the bill. It contains information and resources for clubs and individuals wishing to boost efforts to gain co-sponsors for the measure by contacting their members of Congress.

If the bill passes the 113th Congress, it would require the FCC to amend the Part 97 Amateur Service rules to apply PRB-1 coverage to include homeowners' association regulations and deed restrictions, often referred to as "covenants, conditions, and restrictions" (CC&Rs). At present, PRB-1 only applies to state and local zoning laws and ordinances.

"There is a strong federal interest in the effective performance of Amateur Radio stations established at the residences of licensees," the bill states. "Such stations have been shown to be frequently and increasingly precluded by unreasonable private land-use restrictions, including restrictive covenants."

The 11-page PRB-1 FCC *Memorandum Opinion and Order* is codified at § 97.15(b) in the FCC Amateur Service rules, giving the regulation the same effect as a federal statute. In short, PRB-1 states that local governments cannot preclude Amateur Radio communications; they must "reasonably accommodate" amateur operations, and the state and local regulations must be the minimum practicable regulation to accomplish a legitimate governmental interest. Subject to those guidelines, municipalities may still establish regulations with respect to height, safety, and aesthetic concerns. Since PRB-1 was enacted 28 years ago, the FCC has said several times that it would prefer to have some guidance from Congress before extending the policy to private land-use regulations.

H.R. 4969 was been referred to the House Energy and Commerce Committee. Rep Greg Walden, W7EQI (R-OR), chairs that panel's Communications and Technology Subcommittee, which will consider the measure.

N6MJ and KL9A Take WRTC-2014 Gold

The US team of Dan Craig, N6MJ, and Chris Hurlbut, KL9A, operating as K1A, took home the gold for their winning team effort in the 2014 World Radiosport Team Championship (WRTC-2014). Craig and Hurlbut led the international pack of 59 competing teams literally from the start. Craig, 33, comes from a ham radio family and got his license when he was just 8. He had competed in three prior WRTCs, finishing fourth in 2002, second in 2006 (with N2NL), and third in 2010 with KL9A. Licensed since he was 10, Hurlbut, now 31, began contesting 4 years later.

Walking away with the silver was the Slovak team of Rastislav Hrnko, OM3BH, and Jozef Lang, OM3GI, who operated as W1L. Both had competed in WRTC-2000 and WRTC-2010.

Determining third place was not so simple, but in the final analysis, the W1P team of Manfred Wolf, DJ5MW, and Stefan von Baltz, DL1IAO, from Germany won the bronze. Wolf took part in WRTC-2000, while von Baltz competed in WRTC-1996 and WRTC-2000.

Chief Judge David Sumner, K1ZZ, said the judges had to carefully scrutinize the logs of those placing third, fourth, and fifth in the closely bunched claimed scores.

A full summary of WRTC-2014 will appear in the October issue of *QST*.

ARRL Great Lakes Division Leadership Changes

The new ARRL Great Lakes Division Director is former Vice Director Dale Williams, WA8EFK, of Dundee, Michigan. He succeeded former Director Jim Weaver, K8JE, of Mason Ohio, who retired on July 7 after serving since 2003. Williams, who became Great Lakes Division Vice Director in 2012, previously served two stints as ARRL Michigan Section Manager. The Great Lakes Division is made up of Ohio, Michigan, and Kentucky.

Great Lakes Director Dale Williams, WA8EFK. [Photo courtesy of Dale Williams, WA8EFK]

ARRL President Kay Craigie, N3KN, appointed W. Thomas "Tom" Delaney, W8WTD, of Cincinnati, Ohio, to fill the resulting Vice Director vacancy. Delaney was a Public Information Officer for about a decade. He chairs the Communications Committee for Disaster Services at the Cincinnati Area Chapter of the American Red Cross.

FCC News

Vanity Call Sign Fee Poised to Rise

The FCC has proposed raising the Amateur Service vanity call sign regulatory fee from its current $16.10 to $21.60 for the 10-year license term. The $5.50 increase would be the largest vanity fee hike in many years. The FCC reported there were 11,500 "payment units" in FY 2014. The Commission said the vanity program generated $230,000 in FY 2013 revenue, and it estimated that it would collect nearly $248,000 in FY 2014. Vanity call sign fees typically take effect in late August or early September, and sometimes the fee proposed differs from the one adopted.

FCC Invokes "Red Light Rule"

The FCC in June invoked its "Red Light Rule" in dismissing the long-standing license renewal application of Glenn Baxter, now ex-K1MAN, of Belgrade Lakes, Maine. The Red Light Rule gives the Commission authority to turn down a pending application, if the applicant has an unpaid fine on the books. Baxter was liable for a $10,000 FCC forfeiture stemming from violations over a period extending back several years. His Amateur Extra class license now appears as "canceled" in the Universal Licensing System. Baxter's license expired in October 2005, but FCC rules gave him the authority to continue operating while his renewal application was pending. That privilege ended on June 23.

In 2011, the FCC set a hearing to determine, among other things, if Baxter's Amateur Radio license should be renewed. In 2012, the US District Court for the State of Maine ruled in the FCC's lawsuit to collect Baxter's fine, initially $21,000. The court agreed with the FCC on the first two counts — willful or repeated failure to respond to FCC requests for information, and willful or malicious interference — and granted summary judgments to the FCC in the amounts of $3000 and $7000, respectively. The Court declined to rule on the third issue —communications in which an amateur station licensee or control operator has a pecuniary interest — asserting that issues of material fact remained to be litigated.

FCC Alleges Oregon Radio Amateur Interfered with Others, Aired Music, and Failed to Identify

In a *Notice of Violation* (*NoV*) released June 5, the FCC has alleged that Thomas Ryan Price, W7WL, of Sweet Home, Oregon, caused malicious interference to other radio communications on 3908 kHz, transmitted music on the same frequency, and failed to properly identify. The FCC said agents from its Portland, Oregon, office on May 13, 2014, used radio direction-finding techniques to pinpoint the source of the interfering signal to Price's residence and further observed that Price was transmitting music and did not identify at the end of each communication, as required. The Commission noted that issuance of the *NoV* "does not preclude the Enforcement Bureau from further action if warranted, including issuing a *Notice of Apparent Liability for Forfeiture* for the violations cited."

FCC Substantially Reduces Radio Amateur's Fine for CB Violation

The FCC has significantly reduced the fine it imposed earlier this year on an Oklahoma Amateur Extra class radio amateur licensee for operating his Citizens Band radio in May 2013 to interfere with other CBers' transmissions. Orloff Haines, KF5IXX, had been facing a $12,000 fine. In a June 17 *Forfeiture Order*, the Commission dropped Haines's liability to $1750. "Although we do not cancel the fine, we reduce the monetary penalty based on Mr. Haines's documented inability to pay," the FCC said. Prior to May 2013, Haines had received two written warnings from the FCC regarding interfering with other CB communications. The FCC had added $5000 to Haines's initial $7000 fine, because of "his deliberate disregard for the Commission's requirements and authority" by ignoring the earlier warnings.

ISS Contacts Put Smiles on Field Day Faces

Some lucky — and happy — ARRL Field Day participants managed to snag a contact with NASA Astronaut Reid Wiseman, KF5LKT, operating from NA1SS on the International Space Station. Wiseman, who arrived at the ISS this past spring, seemed to have fun working the pileup.

"Enjoyed ARRL FD 14," Wiseman tweeted. "I operated from the ESA *Columbus* module. So many calls!" Wiseman used NA1SS on the standard VHF frequencies of 144.49 MHz up and 145.80 MHz down.

The Goddard Amateur Radio Club's WA3NAN Field Day station in Maryland was among those that succeeded in contacting NA1SS during Field Day. "When I mentioned Goddard, he came back with 'Goddard! That's just down the road from where I grew up! Good to hear from you,'" Bob McCown, N3IYI, told ARISS International Chair Frank Bauer, KA3HDO, and others in a post-Field Day e-mail. Wiseman is from Baltimore.

Patrick Stoddard, WD9EWK/VA7EWK, in Arizona worked NA1SS as the station passed over the western US. "First time working NA1SS during Field Day!" he said in an ISS Fan Club forum post.

"Me too!" rejoined Umesh Ghodke, K6VUG, who operated Field Day from the South Bay Amateur Radio Association KU6S site, "It was such an out-of-the-world experience having a voice contact with Wiseman, surrounded by many club members," Ghodke posted. "This is a once-in-a-lifetime contact."

Reid Wiseman, KF5LKT, at the controls of NA1SS for Field Day 2014. [Photo courtesy of Reid Wiseman, KF5LKT, via Twitter]

Stoddard said Wiseman was having occasional difficulty copying call signs. "I could hear times during the two North American passes where he was picking up a different call each time he was transmitting," he said. "He was going very quickly, knowing the limited time he had over the continent on each pass."

In Nevada, Shane Wiggins, NV7SW, operating as W7V at the Elko Amateur Radio Club's Field Day operation, managed to work NA1SS on a less-than-ideal pass. "[W]e all went crazy when we heard him come back to me," Wiggins told ARRL. "In particular, there was a young father and son visiting our Field Day location, [and] the little boy was jumping around."

Another fortunate Field Day group that connected with the ISS was Boy Scout Troop 32 in Raymore, Missouri. "I bet the boys could be heard up in orbit even without a radio when Reid answered our call!" Scout Leader Jim Reicher, W0HV, said afterward.

Stoddard expressed gratitude to Wiseman and to NASA and ARISS "for encouraging him to try the ham station in the ISS *Columbus* module during Field Day!"

HAARP Closing Delayed, But Facility Being Dismantled Piece by Piece

The US Air Force has given Alaska's High Frequency Active Auroral Research Program (HAARP) facility a death row reprieve of sorts. The Secretary of the Air Force told Sen Lisa Murkowski (R-AK) on July 2 that it is "willing to slow the closure process and defer irreversible dismantling of the transmitter site" until next May. Those pushing for HAARP to remain open as a scientific research facility include several radio amateurs. The delay notwithstanding, HAARP proponents claim, the Air Force has been picking the plant apart piece by piece, and that critical research instruments already have been taken off-site.

University of Alaska Fairbanks (UAF) Professor Chris Fallen, KL3WX, who has conducted research at HAARP, told ARRL in July that it was his "unofficial understanding" that the Air Force has already has removed or relocated critical diagnostic instruments, instrument shelters, office furniture, and even tubes for the multiple transmitters. HAARP's transmitters are capable of generating more than 3 gigawatts of RF in the HF spectrum, which its 180 antennas can direct upward to modify the ionosphere.

Secretary of the Air Force Deborah Lee James told Murkowski that the Air Force "will proceed with removal of government property not essential to operations," but "will retain critical hardware to maximize the potential to reactivate the site, should it be transferred to another federal government agency or a private entity next year."

Murkowski had questioned her congressional colleagues whether it was "fiscally sound to destroy an approximately $300 million facility when it costs less than one percent of that amount to operate it each year," according to a news release from her office. She supports handing control of HAARP over to the University of Alaska or another research entity to "keep the world-class facility open and running." UAF has been engaged in discussions with the Air Force with an eye toward taking over HAARP, although it's not clear that these have gained any serious traction.

The Air Force, the US Navy, and the Defense Advanced research Projects Agency have determined they no longer need HAARP, and the military would like to get the sprawling facility off its books — if not by finding another entity to run it, then by razing it altogether.

"UAF or any organization that wants to sustain HAARP through external funding is essentially in a situation where it's trying to sell the Brooklyn Bridge, or least passes to it," Fallen quipped. "In a way it's worse, since it's like the asphalt from the bridge is being removed by the state in the process."

An aerial view of the HAARP facility near Gakona, Alaska.

Matt Wilhelm, W1MSW, Takes the Reins at ARRL Contest Branch

Matt Wilhelm, W1MSW, of Williamsburg, Massachusetts, is the new ARRL Contest Branch Manager. He joined the ARRL Headquarters staff on July 3. An active contester and a member of the Yankee Clipper Contest Club and the Hampden County Amateur Radio Association, Wilhelm has been licensed since 2009 and holds an Amateur Extra class ticket. He became hooked on contesting after the first ARRL Rookie Roundup in April 2010. His expertise — and his contest scores — have been rising ever since.

A native of Dallas, Texas, Wilhelm has an IT background in help desk operations and network security systems management. When not making contest contacts, Wilhelm enjoys mountain biking, home projects, and spending time with his family — his wife, Elizabeth, and his 2-year-old daughter Ruby.

Silent Keys

Past Wyoming Section Manager Robert W. Williams, N7LKH

Past Wyoming SM Bob Williams, N7LKH (ex-WB6ZAK), of Wapiti, Wyoming, died June 8. He was 89. Williams served as Wyoming's Section Manager from April 1997 until March 2003, when he decided not to seek another term. Williams was among the longest-licensed hams — and perhaps *the* longest-licensed — in Wyoming.

Rick Palm, K1CE, k1ce@arrl.org

Memoranda of Understanding

The MOU is a catalyst for cooperation between organizations.

Al Taylor, KN3U
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If you've been working in the Public Service arena, you've probably heard the term Memoranda of Understanding (MOU). The ARRL maintains Memoranda of Understanding with a number of different organizations. You can view these MOUs at **www.arrl.org/served-agencies-and-partners**. If you thought these documents were just for the use of ARRL® Headquarters staff, think again! They are full of ideas that you might be able to use in your own community. More important, they can be used as templates for creating your own MOUs at the local, regional, or state level.

What is an MOU?

An MOU is a formal, written agreement between two parties that expresses their desire to work together toward a common purpose. It is not designed to be a binding legal contract, but serves to document the intentions of the parties, which is one of the elements needed to establish a formal working relationship.

We in the Amateur Radio community often refer to government agencies that have a role in disaster response and recovery as "served agencies" and our fellow nongovernment organizations (NGOs) as "partners." Examples of served agencies include the Federal Emergency Management Agency (FEMA) and the National Weather Service (NWS). Examples of NGO partners are the American Red Cross and the Civil Air Patrol. Not surprisingly, the ARRL has MOUs with all of these organizations, and more.[1] Each of these national organizations has counterparts at the state, regional, and/or local level.

The distinction between the roles of government agencies and NGOs has become blurred over time. In fact, the most recent edition of the National Response Framework notes that NGOs routinely work side by side with government organizations to serve the needs of people whose lives are disrupted by incidents ranging from local events to major disasters — basically, any time that normal public services are overwhelmed.[2] It is not uncommon for an NGO to be assigned a formal operational role in a response plan at the national, state, regional, or local level. In reality, we all are (or should be) partners in service to the public.

Black Boxes

Getting to that point has its challenges, however. In the view of our prospective partners, Amateur Radio often appears as a mysterious "black box." The value of Amateur Radio is well documented in the emergency preparedness literature, but it is often unclear to our partners what roles we should play in the plans they have already developed.

Our understanding of our partners' roles may be equally murky. We may know something of what they do, but perhaps not the full breadth of their activities and we almost certainly are unfamiliar with their inner workings.

FEMA's Independent Study Program, covering the incident management system, the National Response Framework, and related topics, provides a lot of insight into how various emergency response organizations work together.[3] That is a good start, but it is only the beginning. It takes time to discover how the framework has been implemented in any given community. In addition, understanding and respecting the constraints faced by your potential partners is essential to building relationships where everyone benefits.

For example, the motivation of government agencies is clear — they exist to serve the public. However, government officials must establish a legal authority for each activity they engage in. To the extent that you express an interest in understanding the agency's mission, structure, and governing laws, and can connect those to the capabilities of your own organization, you are demonstrating why it is in the agency's interest to have you on their team.

NGOs, by contrast, may be for-profit companies who are paid for their services or voluntary organizations that are driven by a religious or charitable mission. People in these organizations are no less committed than their government counterparts, but like their government counterparts may face limits on what they are able or willing to accomplish. If you seek to partner with a not-for-profit organization, you must understand how the capabilities of your organization will advance their mission (and vice versa), and capitalize on that "sweet spot" when writing the MOU.

This is where the MOU comes into the picture. Because the MOU makes a compelling argument for why you and your partners should work together, it can be a valuable step in building a productive relationship. It can help you to reach that ideal state in which your ARES®, RACES, or Auxiliary Communications Service group is accepted as a partner and assigned a formal operational role in the response plans of your community.

In fact, the process of writing the document may be as important as what the document says. Building relationships is all about de-

[1] MOUs don't have to be limited to organizations active in emergency preparedness. ARRL also maintains MOUs with organizations that share in fulfilling other aspects of ARRL's mission, such as the Boy Scouts of America and the National Frequency Coordinators Council.

[2] **www.fema.gov/media-library/assets/documents/32230?id=7371**

[3] **training.fema.gov/is**

veloping trust, and learning how your partner functions is a great way to show your commitment.

Anatomy of an MOU

The MOU is typically a short (one or two page) document. If you look through several of the ARRL's MOUs, you will notice that certain elements are fairly standard in each of them. ARRL's MOU with FEMA (see Figure 1 for a copy of the FEMA MOU or download the PDF version from the ARRL website) is a good example of this basic structure.

- The first paragraph is a brief description of each party's organization and purpose, highlighting shared goals and values.
- The second and third paragraphs give concise descriptions of both the organizations involved in the agreement.
- The fourth paragraph states that the parties intend to work together.
- This is followed by a series of bullet points describing how each party will contribute to the shared mission.
- The final paragraph discusses the mechanics of the agreement — a definition of the agreement's duration, defining a review period, provisions for amendment or termination, etc — if any are needed. In the FEMA MOU, no such specifics are included.

The document closes with the signatures of the officials who have the authority to speak for both organizations.

A Diplomatic Endeavor

While the MOU might be only a page or two in length, the preparation that precedes the actual writing of the document is worth volumes.

Typically, you will start with a casual conversation, which can result from a chance encounter or an organized campaign of contacting prospective partners to introduce yourself and Amateur Radio. In that initial contact with an organization, you should simply express your desire to work together toward a common cause. As this initial contact evolves, try to identify within the organization one or more influential persons who show some interest in cooperation. It isn't necessary to start at the top of the organization, but it will be helpful to find members who have the ear of a decision-maker.

Then the real work begins. You might request an informal meeting, which you should prepare for by researching available information about the organization and brainstorming ways in which a relationship might prove mutually beneficial. Bring along some information about Amateur Radio and the history, makeup, organization, and aspirations of your ARES team (but don't overwhelm them or promise more than you can deliver). Be sure to prepare and ask lots of questions about your potential partner's organization rather than assuming that you know the answers. Before the meeting ends, discuss possible next steps, such as a demonstration of your group's capabilities. Follow up that initial meeting with an e-mail summarizing what was discussed and expressing a desire to build the relationship.

From this point on, you will need to follow your instincts. It might be love at first sight, but most relationships take some time and patience to develop. When the time comes to cement the relationship, you will probably want to take the initiative to write the first draft of the MOU and offer it to your counterpart in an exploratory way. There will undoubtedly be some back-and-forth as the document is developed. Whether this is done in a series of meetings or via e-mail, look at each issue that arises as an opportunity for improving mutual understanding and building a strong foundation.

It is best to avoid trying to specify the minute details of how the relationship will work in the MOU. These details will evolve as the relationship matures and can be codified in supporting documents as the need arises.

One the other hand, if a difficult issue arises during negotiations, document the resolution in the MOU. For example, the ARRL's MOU with the American Red Cross (ARC) is a bit more detailed and legalistic than most, but this reflects the long history of the relationship. Some concerns have arisen in the past, such as the ARC's requirement that all volunteers be subject to background checks. Lengthy negotiations resulted in guidelines that were incorporated into the MOU to resolve this and other issues.

A Long-term Commitment

When it comes to signing the MOU, it is nice if the persons who hammered out the agreement are afforded the honor of affixing their signatures to the document. But the goal should be to have the document signed by a high-level official in the partnering organization. There is no limit to how many signatures can appear on the document, but it is sometimes strategic for the staff-level folks who did the legwork to fade into the background at the signing ceremony. Use your judgment in this regard.

Here is the reason for that advice. While relationships are built between individuals, your goal should be to establish an organizational relationship that survives the individuals who created it. The day may come when that relationship is tested. For example, imagine that your ARES team has flourished under the patronage of a forward-thinking emergency manager who enthusiastically promotes your involvement in emergency preparedness activities. At some point, that person is going to move on and his or her replacement may question the need for Amateur Radio involvement.

The existence of a well-written MOU that documents a sound legal or mission-driven basis for the relationship may be what it takes to convince that new manger to take a second look. And as a practical matter, the more persons who signed the original MOU, and the higher their rank, the better off you (or your successor) will be. This is partly a matter of bridge-building, which after all, is one of the more important things we do. But it is also a defensive tactic, taking advantage of the fact that many organizations are bound and guided by hierarchy and precedent to a very large extent.

The MOU is a valuable tool — don't hesitate to use it when you need it. Last but not least, keep in mind that once the MOU is signed, the real work begins — living up to the expectations that the MOU creates. Be sure your members are committed to the relationship before starting work on an MOU.

Al Taylor, KN3U, has served as ARRL Emergency Coordinator and Section Emergency Coordinator. He has devoted most of his professional career to the design of mission-critical electronic systems, including several years with the office that administered the National Disaster Medical System.

STATEMENT OF AFFILIATION
BETWEEN
THE FEDERAL EMERGENCY MANAGEMENT AGENCY
AND THE AMERICAN RADIO RELAY LEAGUE

The ***Department of Homeland Security (DHS)*** and the ***American Radio Relay League (ARRL)*** view community disaster preparedness and response as top priorities for their respective organizations and for the American people. As such, our organizations have come together to provide mutual support for ***Citizen Corps.***

Under the direction of ***DHS, Citizen Corps*** is a community-based initiative to engage all citizens in homeland security and community and family preparedness through public education and outreach, training opportunities, and volunteer programs. Programs under the Citizen Corps umbrella include federally sponsored programs and other activities that share the goal of helping communities prevent, prepare for, and respond to terrorism, public health issues, and disasters of all kinds. It encourages all Americans to take an active role in building safer, stronger, and better-prepared communities.

ARRL is a non-commercial membership association of radio amateurs organized for the promotion of interest in Amateur Radio communication and experimentation, for the establishment of networks to provide communications in the event of disasters or other emergencies, for the advancement of the public welfare, and for the representation of the Radio Amateur in legislative and regulatory matters. ***ARRL*** is the principal organization representing the interests of the more than 650,000 U.S. Radio Amateurs. Because of its organized emergency communications capability, ***ARRL's Amateur Radio Emergency Service (ARES)*** can be of valuable assistance in providing critical and essential communications during emergencies and disasters when normal lines of communication are disrupted. ***ARRL*** conducts emergency communications training and certifies proficiency in emergency communications skills.

Together ***DHS*** and the ***ARRL*** agree to work collaboratively to:

- Raise public awareness about the use of Amateur Radio as a public safety resource;
- Provide training and accreditation for Amateur Radio Emergency Communications;
- Promote the formation of local ***Citizen Corps Councils*** and assist these Councils with providing public education, training and volunteer service opportunities that support first responders, disaster relief organizations, and community safety efforts;
- Publicly acknowledge the affiliation of ***Citizen Corps*** and the ***ARRL,*** which may include website links, co-logos on publications, and references in printed materials, including articles and news releases;
- Coordinate their respective activities to further their shared mission; and
- Keep each other informed of activities conducted in support of ***Citizen Corps*** and to provide an annual report summarizing those activities.

On this 21st day of June 2003, both parties enter into this agreement in good faith and agree to pursue the shared mission as stated.

citizen corps

MICHAEL D. BROWN
UNDER SECRETARY
DEPARTMENT OF HOMELAND SECURITY
EMERGENCY PREPAREDNESS AND RESPONSE

JIM HAYNIE
PRESIDENT
AMERICAN RADIO RELAY LEAGUE, INCORPORATED

Figure 1 — This one-page MOU between the ARRL and FEMA contains all the basic elements needed to construct an effective MOU.

Be Prepared for the Next Blackout!

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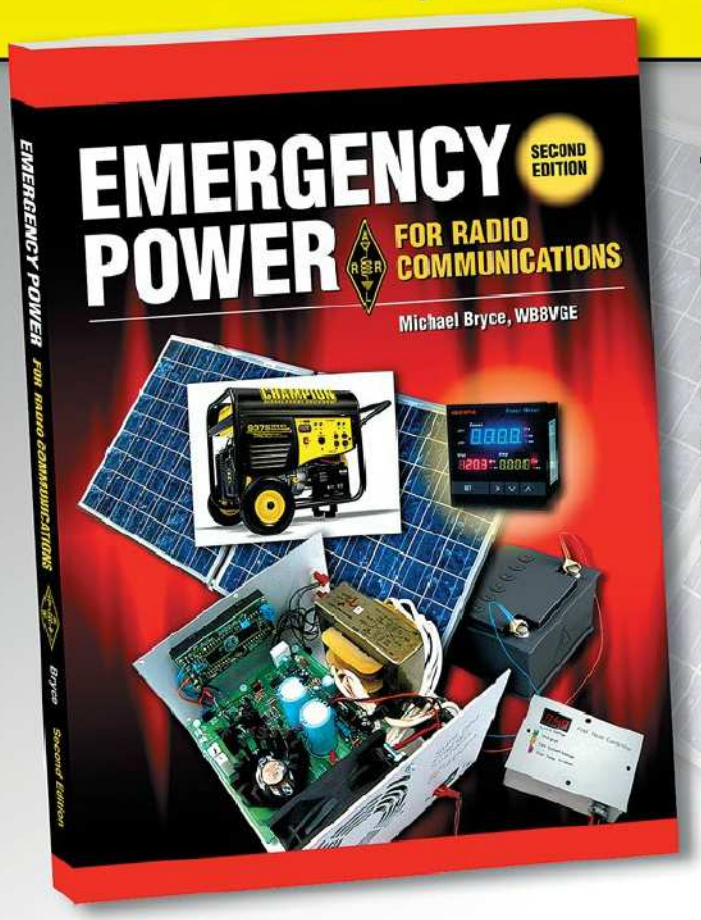

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By Michael Bryce, WB8VGE

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Contest Corral — September 2014

Check for updates and a downloadable PDF version online at www.arrl.org/contests.

Refer to the contest websites for full rules, scoring information, operating periods or time limits, and log submission information.

Start - Finish Date-Time		Date-Time		Bands HF / VHF+	Contest Title	Mode	Exchange	Sponsor's Website
1	1630Z	4	1730Z	3.5, 7 / -	OK1WC Memorial Contest	Ph CW	RS(T) and serial	www.memorial-ok1wc.cz
1	2300Z	2	0300Z	1.8-28 / 50	Labor Day Sprint	CW	RST, S/P/C, MI QRP nr or power	miqrp.org
2	0100Z	3	0300Z	3.5-28 / -	ARS Spartan Sprint	CW	RST, S/P/C, and power	www.arsqrp.blogspot.com
3	0000Z	3	0300Z	3.5-14 / -	NAQCC/FISTS WZ8C Honor Sprint	CW	Call sign, "NANCY", S/P/C, mbr id – see website	naqcc.info, www.fists.org
3	1300Z	7	See website	1.8-28 / -	CWOps Weekly Mini-CWT Tests	CW	Name and member number or S/P/C	www.cwops.org/cwt.html
5	0230Z	6	0300Z	1.8-14 / -	NS Weekly Sprint	CW	Serial, name, and S/P/C	www.ncccsprint.com
6	8 PM	6	2 AM	3.5 / -	070 Club KA3X Memorial Sprint	Dig	Call sign, RST, and S/P/C	www.podxs070.com
6	0000Z	7	See website	1.8-28 / -	CWops CW Open	CW	Serial and name	www.cwops.org/cwopen.html
6	0000Z	6	2400Z	3.5-28 / -	All-Asian DX Contest	Ph	RS, operator age (YL may send 00)	www.jarl.org/English
6	0000Z	6	2400Z	3.5-28 / -	Russian Radio RTTY WW	Dig	RST and oblast or WAZ zone	www.radio.ru/cq/contest/rule-results/index2.shtml
6	1100Z	6	1700Z	28 / -	DARC 10 Meter Digital "Corona"	Dig	RST and serial	www.darc.de/referate/ukw-funksport
6	1300Z	6	1600Z	7 / -	Straight Key Party	CW	RST, serial, category, name, age	www.agcw.de
6	1600Z	6	2400Z	3.5-28 / 50	Indiana Parks on the Air	Ph CW Dig	Category and Park ID or S/P/C	inpota.com
6	1600Z	6	2359Z	3.5-21 / 50	Ohio State Parks On the Air	Ph CW	"Ohio" or S/P/DX and Park ID	parks.portcars.org
6	1300Z	7	1300Z	1.8-28 / -	IARU Region I Field Day	Ph	RS and serial	See IARU Society web pages
7	**0000Z**	**7**	**0359Z**	**3.5-14 / -**	**North American Sprint**	**CW**	**Call signs, serial, name, and state**	**www.ncjweb.com**
7	1500Z	14	See website	1.8-28 / -	QRP ARCI Two Sidebands Sprint	Ph	S/P/C and ARCI member nr or power	www.qrparci.org/contests
7	1800Z	14	0300Z	1.8-28 / 50+	Tennessee QSO Party	Ph CW Dig	RS(T) and county or S/P/C	www.tnqp.org
13	0000Z	15	2400Z	3.5-28 / -	Worked All Europe DX Contest	Ph	RS and serial	waedc.de
13	0000Z	14	2359Z	1.8-28 / -	FOC QSO Party	CW	RST, name, FOC nr if member	www.g4foc.org
13	1200Z	15	2359Z	1.8-28 / 50	Straight Key Weekend Sprintathon	CW	RST, QTH, name, member nr if member	www.skccgroup.com
13	1400Z	15	0200Z	3.5-28 / 144	Arkansas QSO Party	Ph CW Dig	RS(T), county or S/P or "DX"	www.arkqsoparty.com
13	**1800Z**	**18**	**0259Z**	**- / 50+**	**ARRL September VHF Contest**	**Ph CW Dig**	**4-char grid square**	**www.arrl.org/contests**
14	**0000Z**	**14**	**0359Z**	**3.5-14 / -**	**North American Sprint**	**Ph**	**Call signs, serial, name, and state**	**www.ncjweb.com**
14	1300Z	21	0700Z	1.8-28 / 50,144	Classic Exchange	Ph	Name, RS, S/P/C, type of equipment	www.classicexchange.org
18	0030Z	18	0230Z	3.5-14 / -	NAQCC Monthly QRP Sprint	CW	RST, S/P/C, and NAQCC mbr nr or power	naqcc.info
20	**6 AM**	**21**	**12 mid**	**- / 10G+**	**ARRL 10 GHz Cumulative Contest**	**Ph CW Dig**	**6-char grid locator**	**www.arrl.org/contests**
20	1200Z	21	1159Z	3.5-28 / -	Scandinavian Activity Contest	CW	RST and serial	www.sactest.net
20	1400Z	21	0300Z	3.5-28 / 50+	South Carolina QSO Party	Ph CW Dig	RS(T) and county or S/P/C	scqso.com
20	1600Z	20	1800Z	1.8-28 / -	Feld-Hell Hell on Wheels Sprint	Dig	RST, S/P/C, Feld-Hell member nr	www.feldhellclub.org
20	1600Z	21	2400Z	1.8-28 / 50,144	Washington State Salmon Run	Ph CW Dig	RS(T) and county or S/P/C	www.wwdxc.org
21	0100Z	21	0300Z	1.8-28 / -	Run For the Bacon	CW	RST, S/P/C, Flying Pig nr or power	www.fpqrp.org
21	1300Z	28	0700Z	1.8-28 / 50,144	Classic Exchange	CW	Name, RS, S/P/C, type of equipment	www.classicexchange.org
21	1700Z	21	2100Z	3.5-28 / -	BARTG Sprint 75	Dig	Serial	www.bartg.org.uk
22	7 PM	22	11 PM	- / 144	144 MHz Fall VHF Sprint	Ph CW Dig	4-char grid square	www.svhfs.org
24	0000Z	28	0200Z	1.8-28 / 50	SKCC Straight Key Sprint	CW	RST, QTH, name, SKCC nr or power	www.skccgroup.com/sprint/sks
27	0000Z	30	2359Z	3.5-28 / -	CQ WW RTTY Contest	Dig	RST, CQ zone and State/VE area (US/VE)	www.cqwwrtty.com
27	1200Z	28	1200Z	1.8-28 / -	Maine QSO Party	Ph CW	RS(T), county or "DX"	www.maineqsoparty.com
27	1400Z	28	See website	1.8-28 / 50,144	Texas QSO Party	Ph CW Dig	RS(T), county or S/P/C	www.txqp.net
28	2000Z	28	2200Z	7-21 / -	Peanut Power Sprint	Ph CW	RST, S/P/C, and Peanut nr or power	www.nogaqrp.org
30	7 PM	30	11 PM	- / 222	222 MHz Fall VHF Sprint	Ph CW Dig	4-char grid square	www.svhfs.org

All dates refer to UTC and may be different from calendar dates in North America. Times given as AM or PM are local times and dates. No contest activity occurs on the 60, 30, 17, and 12 meter bands. Serial = Sequential number of the contact. S/P/C = State, Province, DXCC Entity. XE = Mexican state. Publication deadline for Contest Corral listings is the first day of the second month prior to publication date (December 1 for February *QST*) — send information to contests@arrl.org. Listings in blue indicate contests sponsored by ARRL or *NCJ*. The latest time to make a valid contest QSO is the minute listed in the "Finish Time" column.

2014 ARRL International DX Phone Contest Results

Solar mini-max? There's nothing "mini" about this year's results!

Drew Vonada-Smith, K3PA, drew@whisperingwoods.org

After the marginal conditions in ARRL DX Phone last year, hopes were high that Sol would come through on March 1st and 2nd, providing good 10 and 15 meter openings for those of us at higher latitudes. Even given the infamously low "mini-max" sunspot peak of Solar Cycle 24, our fusioning friend did not disappoint. Solar flux was in the 160s, coinciding almost exactly with this cycle's peak. Participants were blessed with a wonderfully calm A index of 7 on Saturday and an even better 5 on Sunday.

This KL7RA guest operator (M0OSE?) seemed to agree that 10 meter conditions were great — and hung around the 10 meter tower in the background for most of the weekend! [David Case, KA1NCN, photo]

Deserving DXers around the world consistently reported excellent high band conditions. KC8IMB reported that 10 meters "was wall-to-wall all weekend." On the other hand, what is gained on 10 meters is sometimes lost on the low bands. KM1R asked, "Did someone turn off the 160 meter band on the first night?" Nevertheless, a few stations reported increasing their country total on 160 meters.

Such good conditions provided a lot of fun. Who wouldn't enjoy 2 days of six-band DX? The Soapbox comments were filled with words like "fantastic," "exciting," "super," "hot," and many instances of the phrase "first time for..."

2014 also smashed the participation record with a new record of 4131 logs — 586 more than last year! (There was an increase of 10% in both groups: 2053 W/VE logs, and 2078 DX logs.) 1,136,632 QSOs were reported by DX stations for an increase of almost 261,000 over 2013. That's up by an amazing 29%! W/VE logs contained 898,279 (691,336) QSOs for a similarly impressive increase. Be part of it all; claim your 15 minutes of fame and send in that log!

High Band Hullabaloo

This year was a sunspot peak, so the big topic has to be 10 meters. Master contester W3BGN took W/VE Single Op, Single Band honors on 10 meters last year with 247k. This year, an amazing 22 entries bettered Steve's score, peaking at 825k. Some fun, eh?

For DX, the top three Single Op, Single Band 10 meter scores, starting at 718k, beat last year's winner of 557k. More significantly, the top four 10 meter scores last year were all in South America. This year, the top four, respectively, were from South America, Europe, North America, and Europe. Now that's a solid indicator of good propagation!

How about new 10 meter overall records? Sorry, not for W/VE. Even at this sunspot maximum, top stations could not quite compete with overall 2000/2002 records. But things were great in the northeast, with new district highs set in W1, W2, and W3. An aging record from Solar Cycle 21 was broken this year, with K2SSS smashing the 2nd district Single-Band 10 meter record, set in 1982. In DX land, only the top European entrant set a continental record on 10 meters. Let's look forward to improving more of these figures in Solar Cycle 25.

But let us not forget 15 meters. The winning W/VE 15 meter score of 811k and the next three competitors easily beat last year's 527k. For DX entrants, 15 meter scores were very similar to last year with the winner at 665k, down slightly from last year's 673k. Clearly, 15 meter scores are not as sensitive to the magnitude of the sunspot peak.

Record New Records

This was a record year for records! Forty-four new records were set in 2014, 17 of which were in either in SOULP or MSL. Thirty-four were set in W/VE and 10 by DX stations. Particularly noteworthy are the seven all-time records set this year:

- VY2ZM — W/VE SOHP
- N1UR — W/VE SOLP
- W4AAA (KK9A, op) — W/VE SOSB-40
- K4XS — W/VE SOUHP
- W6AAN — W/VE SOULP
- N1BA — W/VE MSLP
- PJ6A — DX MSLP

Category Abbreviations
SOHP/LP/QRP — Single Op, All Band
SOUHP/LP — Single Op Unlimited
SOSB — Single Op, Single Band
MSH/L — Multiop, Single Transmitter
M2 — Multiop, Two Transmitter
MM — Multiop, Multi-Transmitter

Accuracy Leaders

Bold indicates a new record

W/VE

Single Op

Call	Category	QSOs	Error %	Index
K1TO	SOHP	4037	0.4	13.566
VY2ZM	SOHP	4762	1.3	13.548
N1UR	SOHP	3590	0.7	13.485
K3CR (LZ4AX, op)	SOHP	3292	0.7	13.447
XL3A (VE3AT, op)	SOHP	3086	0.6	13.429

Single Op Unlimited

K4XS	SOUHP	4607	0.6	13.603
VY2TT	SOUHP	3769	0.6	13.516
AA3B	SOUHP	3409	0.6	13.473
K3WW	SOUHP	3952	1.6	13.437
KN2M	SOUHP	3138	1.0	13.397

Multiop

K3LR	MM	9430	0.0	13.822
W3LPL	MM	8464	1.0	13.776
WE3C	MM	8092	0.9	13.621
W2PV	MM	6505	1.0	13.567
W4RM	MM	5473	1.5	13.518

DX

Single Op

8P5A (W2SC, op)	SOHP	8969	0.3	13.923
KP2M (N2TK, op)	SOHP	7136	0.3	13.823
YN5Z (K7ZO, op)	SOHP	6722	0.3	13.797
V26M (N3AD, op)	SOHP	6336	0.7	13.732
KH7M (NA2U, op)	SOHP	5727	0.6	13.698

Single Op Unlimited

P40P (W5AJ, op)	SOULP	5472	0.5	13.688
OK7K (OK1BN, op)	SOUHP	4658	0.5	13.618
IR4M (IK4MGP, op)	SOUHP	4466	0.4	13.610
EC2DX	SOUHP	4752	1.2	13.557
SP8R (SP8BRQ, op)	SOUHP	3943	0.7	13.526

Multiop

P40L	M2	13236	0.3	14.092
PJ4G	M2	11533	0.4	14.022
CN2AA	M2	11575	0.7	13.994
KH7XX	M2	9310	0.0	13.969
VP5H	MSHP	8957	0.5	13.902

Low band aficionado VY2ZM set a new record in the prestigious SOHP category. Jeff broke his own VE record from 2004, and the overall W/VE record, with a score only 3% less than the Single Op Unlimited category winner. His multiplier of 49 on 160 meters certainly helped. If you think you need a DX spotting network to make big points, think again!

Low power champion N1UR also set a new SOLP mark, breaking his own 2013 1st district record, and the overall W/VE record set by K4XS in 2001. He noted, "Most amazing ARRL DX SSB conditions experienced here for 12 years here. It was a thrill to be part of it." Ed, if I made 3590 QSOs without an amplifier, I'd be thrilled too!

W4AAA, with contest veteran KK9A operating, smashed the 40 meter single band record. John topped it by 40%, moreover, during a part of the sunspot cycle not usually associated with 40 meter excellence.

Super-scoring regular K4XS apparently did not take the loss of his SOLP record lying down. Bill took the big SOUHP crown this year with a record-setting 7.16M. Bill broke a record standing since 2000 by an impressive 24%! In fact, Single Op Unlimited veteran K3WW also broke the previous record with 6.06M. It's great to see such strong efforts being made in the SOU categories.

Joining the surge of big SOU scores is W6AAN, who obliterated the SOULP record set in 2011. Also joining Vasily in breaking the previous mark were KT4ZB with 2.07M, N2WKS with 1.76M, and N2SQW with 1.74M.

N1BA rounds out the trifecta of stations breaking their own district records and the all-time figure. Lee and his team's 2.6M edged out the score set last year by NR4M in the Multi-Single, Low Power category. In this very close race, VE9ML and team also beat the previous record with their 2.57M.

Last but certainly not least is the PJ6A team, who topped the 2011 DX Multi-Single, Low Power record set by P40V. It certainly will not be easy to top their 6.08M, but the Caribbean is never short of strong efforts. Who wouldn't want to go there in March?

All of the ARRL contest records are available online at **arrl.org/contest-records**. More than 400,000 scores are included in the K5TR Contest database, too (**kkn.net/~k5tr/scoredb**). The best way for you to show your admiration for a record is to break it. Give it a try!

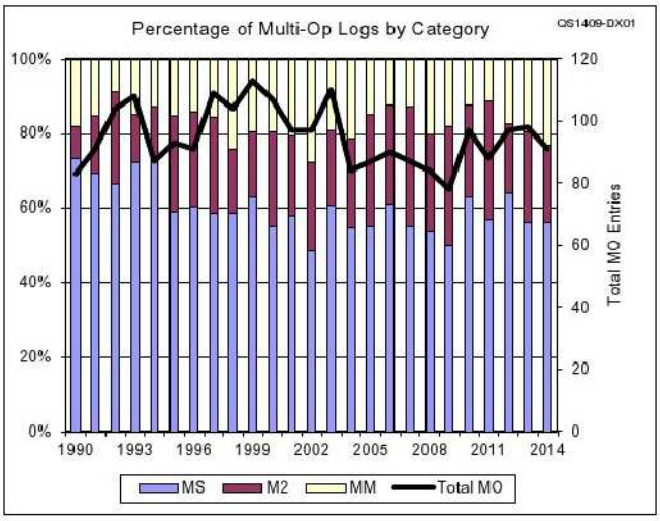
Accurate Operating

Hams are communicators and few of us would deny that accuracy is key. Getting the call and exchange right is important. Make the extra effort and ask for a fill when you need it. Penalties are assessed for errors to reward good operating habits. So boost your score by getting the call sign right!

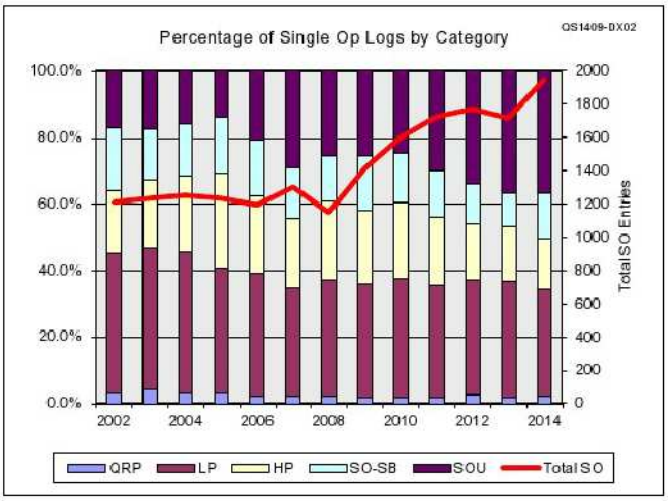
The table lists the top five Accuracy Indexes achieved by HP and LP single- and multi-op stations this year along with the corresponding all-time records. (For more information about the Accuracy Index and all-time accuracy records, see the full results at **www.arrl.org/contest-results-articles**.)

DXing Trophies

There are even more achievements to celebrate. The top multiplier totals keep growing



The relative levels of activity among W/VE single op categories along with the trend of increasing number of submitted logs since 2008.



This chart shows the relative levels of activity among W/VE single-op categories along with the trend of increasing number of submitted logs since 2008.

Top Ten

W/VE

Single Operator High Power

VY2ZM	6,949,614
K1TO	5,253,930
K3CR (LZ4AX, op)	4,445,289
XL3A (VE3AT, op)	3,648,348
NR5M	3,629,304
AA1K	3,476,400
K4AB	3,272,904
K3ZJ	2,985,285
K3ZO	2,798,640
K0TT	2,281,686

Single Operator Low Power

N1UR	4,708,275
W9RE	2,502,984
NA5NN (N5BO, op)	2,502,927
N5AW	2,453,802
NA8V	2,355,240
N4TZ	2,069,613
N8II	2,057,544
W4IX	2,021,370
VA3SWG	898,776
W2TF	887,364

Single Operator QRP

W1MR	654,678
NDOC	443,466
N1TM	437,760
W6QU (W8QZA, op)	295,086
NT4TS	256,620
KA8SMA	203,634
KK0Q	175,050
N4IJ	172,845
N8HP	107,352
N8XA	96,558

Single Operator Unlimited, High Power

K4XS	7,160,103
K3WW	6,066,816
VY2TT	5,221,392
AA3B	4,930,992
N2NT (W2GD, op)	4,704,768
KN2M	4,444,575
N2MM	3,872,451
W1UE	3,590,028
K3PP	3,195,360
K3MD	3,138,585

Single Operator Unlimited, Low Power

W6AAN	2,291,769
KT4ZB	2,069,949
N2WKS	1,759,914
N2SQW	1,743,948
KS1J	1,238,541
WE9R	1,193,976
W3KB	1,154,340
AA4R	1,136,364
KA2KON	1,116,297
NA4EA	844,560

Single Operator 160 Meters

W2MF	11,868
W3LL	10,212
KM1R	6,552
W2VO	3,960
K3UL	3,420
WB4WXE	3,306
WD5COV	2,349
K1HAP	2,175
N1SZ	918
K7CW	390

Single Operator 80 Meters

K1KNQ	23,607
W4QNW	20,355
W4DD	16,380
WA4TII	14,040
K4CC	10,212
K9IDQ	3,510
WD8E	429
N0TA	390
N6DZR	330

Single Operator 40 Meters

W4AAA (KK9A, op)	398,718
W1XX	176,880
W1FQ	85,878
AG4W	66,597
VE3FU	48,762
K8DJC	41,412
W6RKC	39,015
KE3X	35,376
WD0BGZ	24,660
W8FR	20,736

Single Operator 20 Meters

KB3WD	610,854
W8TA	537,810
W7WA	475,068
VE9HF	363,852
WA8UEG	339,066
W1AVK	102,120
K6HNZ	83,853
VE3CR	65,016
K4TRH	59,778
W4RRE	59,049

Single Operator 15 Meters

VE3EJ	811,422
K1DG	774,360
KU2M	749,322
K5RX	580,116
AB4B	320,832
WA7LT	226,596
K1JB	199,320
N9TGR	195,738
N2UN	193,011
W8JGU	166,161

Single Operator 10 Meters

K1LZ (K3JO, op)	825,084
N4PN	707,616
K1ZR	651,309
K2SSS	629,391
K5TR (K5OT, op)	594,720
N3OC	592,710
VE9AA	553,446
VE3DZ	520,866
K9BGL	516,660
W3EP	457,065

Multi-Single Transmitter High Power

WW4LL	5,589,657
N1RR	5,085,762
W1TJL	4,531,563
W3MF	3,318,975
AD4ES	2,729,610
W8PR	2,569,560
K5UA	1,838,025
VA2EN	1,687,359
WN2O	1,440,000
K7ZS	1,287,072

Multi-Single Transmitter Low Power

N1BA	2,598,174
VE9ML	2,574,936
N4XL	1,577,616
N5DO	1,473,120
W3ZGD	892,038
K9LA	596,700
KC8IMB	190,629
AJ4DT	188,784
W3WN	142,809
W3KWH	110,625

Multi-Two Transmitters

KB1H	6,657,732
W6WB	4,573,050
K2AX	4,034,880
WA3EKL	3,873,936
W2YC	3,707,721
KU2C	3,187,002
N0IJ	3,132,576
W4ML	2,436,822
W1QK	2,090,943
N0MA	2,071,380

Multi-Multi Transmitters

K3LR	19,435,230
W3LPL	16,890,030
WE3C	15,637,536
W2PV	11,310,783
W4RM	8,731,800
N6RO	5,196,030
K0TV	5,185,440
K1KP	4,475,310
W0AIH	3,747,810
NE3F	3,360,168

DX

Single Operator High Power

8P5A (W2SC, op)	9,338,580
KP2M (N2TK, op)	7,046,820
V26M (N3AD, op)	6,156,510
YN5Z (K7ZO, op)	5,933,040
KH7M (NA2U, op)	5,027,400
TO5A (F5VHJ, op)	4,344,084
OA4SS	3,557,952
S54ZZ	2,883,072
3V8BB (KF5EYY, op)	2,795,118
EA5DFV	2,783,991

Single Operator Low Power

VP2MLL (K1XX, op)	4,844,301
VP9/W6PH	4,792,560
J75Y (K1LI, op)	4,107,996
V31MA	1,598,544
PJ7AA	1,268,703
KH6CJJ	1,241,625
KP2DX (KP2BH, op)	1,065,213
PY2NY	1,059,060
XE1XOE	921,015
8P6EX	798,252

Single Operator QRP

F5BEG	168,504
IK6FWJ	103,320
SP6JOE	86,670
CT1BXT	81,432
IK1BBC	55,335
JH1APZ	46,968
F4GVZ	46,899
IV3DDN	46,452
JR4DAH	45,576
JH1OGC	44,712

Single Operator Unlimited, High Power

P40P (W5AJ, op)	5,210,865
OK7K (OK1BN, op)	4,033,320
EC2DX	3,900,708
IR4M (IK4MGP, op)	3,763,854
ED7W (EA7OT, op)	3,429,540
EA5KA	3,295,596
NP2X (K9VV, op)	3,064,068
SP8R (SP8BRQ, op)	3,020,778
EI1Y (EI3KG, op)	2,993,250
EA6FQ (EA3AIR, op)	2,957,172

Single Operator Unlimited, Low Power

8P2K (8P6SH, op)	1,042,320
YV8AD	988,380
DF2SD	826,233
EF1A (EA1XT, op)	724,845
UR5AS	588,468
DF7ZS	460,824
3G1D (XQ1FM, op)	404,016
GI4SJQ	391,524
NP4RA	386,409
OM5XX	279,705

Single Operator 160 Meters

KV4FZ	59,976
XE2X	31,878
CU2CE	30,240
SP3GTS	3,363
SQ8L (SQ8JLU, op)	720
DL2SAX	189

Single Operator 80 Meters

CR2A	236,619
FM5DN	110,055
CO6CAC	85,350
YT4A (YT1AA, op)	31,635
ED7P	22,560
SN7V (SP7VC, op)	12,948
OM7RU	4,221
UT7E (UV5EOZ, op)	3,960
7Z1SJ	1,224
IT9EWR	630

Single Operator 40 Meters

TM9R (F5FLN, op)	280,545
9A2NA	238,056
US1I (UX2IO, op)	128,232
OA4/XQ3SA	116,232
CE3EEA	113,796
KP4BD	110,880
9A9R	102,300
EA3CI	94,446
XE1OGG	54,927
SQ9HZM	47,799

Single Operator 20 Meters

6Y3M (VE3NZ, op)	621,285
OZ7X	468,348
PJ4D	459,846
EB3CW	425,292
HK3C	404,064
FM5FJ	402,120
ZY5M (IV3NVN, op)	351,912
TM4L (F8ARK, op)	288,408
PX2F (PY2PT, op)	260,898
YT1A	245,892

Single Operator 15 Meters

FY5FY	664,578
EE8T (EA8MT, op)	635,004
LX7I (LX2A, op)	490,806
CR6T (CT1ESV, op)	483,852
CQ8X (OH8NJ, op)	448,899
PX2B (PY2LED, op)	443,520
CE3/OZ1AA (OZ1AA, op)	433,161
PW5G (PP5WG, op)	428,172
9A1UN	395,829
EF7X	387,228

Single Operator 10 Meters

PX5E	717,960
CR2X (OH2BH, op)	667,401
NP2P (N2TTA, op)	575,820
MW0ZZK	557,418
CE3CT	519,903
ZV2K (PY2SHF, op)	491,580
PJ4DX	475,434
TM0T	464,628
9A9A	409,320
9A8WW (S55M, op)	378,180

Multioperator Single Transmitter High Power

VP5H	9,417,408
PJ2T	9,357,327
HK1NA	8,793,675
C6ANA	7,597,395
TM6M	6,937,245
XE7S	6,535,230
CS2C	5,921,676
T48K	5,862,672
TQ22C	5,240,550
PI4DX	4,101,300

Multioperator Single Transmitter Low Power

PJ6A	6,083,181
PY1GQ	1,856,475
HI3K	1,672,668
T42R	1,630,950
WP3DX	1,601,760
ZW8T	1,177,416
ZR9C	771,630
PY5FO	538,005
PY2ZR	281,952
RT4S	114,345

Multioperator Two Transmitters

P40L	13,938,144
PJ4G	12,264,912
CN2AA	11,667,084
TI8M	8,798,973
KH7XX	8,602,440
KL7RA	7,244,517
KH6LC	6,338,736
S57UN	3,716,979
YU5R	2,909,808
LU8YE	2,554,911

Multioperator Multi Transmitters

II9P	7,466,391
LP1H	6,049,953
HG1S	5,431,968
JA3YBK	3,454,908
C6ANM	3,015,699
KL2R	1,439,955
JE1ZWT	1,091,196
LI5O	581,544
9A5BWW	339,465

Continental Leaders

Continent	Call	Score
Africa		
Single Operator High Power	3V8BB (KF5EYY, op)	2,795,118
Single Operator Low Power	7X5QB	387,918
Single Operator Unlimited, High Power	CN8WW	9,000
Single Operator Unlimited, Low Power	EA8BZH	43,803
Single Operator 15 Meters	EE8T (EA8MT, op)	635,004
Single Operator 10 Meters	EA8TX	221,154
Multi-Single Transmitter, Low Power	ZR9C	771,630
Multi-Two Transmitters	CN2AA	11,667,084
Asia		
Single Operator High Power	JA0JHA	2,354,400
Single Operator Low Power	JH4UYB	410,733
Single Operator QRP	JH1APZ	46,968
Single Operator Unlimited, High Power	JS3CTQ	1,319,025
Single Operator Unlimited, Low Power	BG2AUE	161,568
Single Operator 80 Meters	7Z1SJ	1,224
Single Operator 40 Meters	JH9URT	43,215
Single Operator 20 Meters	RK9QWM	86,130
Single Operator 15 Meters	JR1CBC	261,873
Single Operator 10 Meters	JI1LET	168,777
Multi-Single Transmitter, High Power	RT0F	2,053,278
Multi-Single Transmitter, Low Power	BY1CQ	756
Multi-Two Transmitters	JK1YMM	1,995,480
Multi-Multi Transmitters	JA3YBK	3,454,908
Europe		
Single Operator High Power	S54ZZ	2,883,072
Single Operator Low Power	CT1ETK	418,110
Single Operator QRP	F5BEG	168,504
Single Operator Unlimited, High Power	OK7K (OK1BN, op)	4,033,320
Single Operator Unlimited, Low Power	DF2SD	826,233
Single Operator 160 Meters	CU2CE	30,240
Single Operator 80 Meters	CR2A	236,619
Single Operator 40 Meters	TM9R (F5FLN, op)	280,545
Single Operator 20 Meters	OZ7X	468,348
Single Operator 15 Meters	LX7I (LX2A, op)	490,806
Single Operator 10 Meters	CR2X (OH2BH, op)	667,401
Multi-Single Transmitter, High Power	TM6M	6,937,245
Multi-Single Transmitter, Low Power	RT4S	114,345
Multi-Two Transmitters	S57UN	3,716,979
Multi-Multi Transmitters	II9P	7,466,391

Continent	Call	Score
North America		
Single Operator High Power	8P5A (W2SC, op)	9,338,580
Single Operator Low Power	VP2MLL (K1XX, op)	4,844,301
Single Operator QRP	KP3BR	270
Single Operator Unlimited, High Power	NP2X (K9VV, op)	3,064,068
Single Operator Unlimited, Low Power	8P2K (8P6SH, op)	1,042,320
Single Operator 160 Meters	KV4FZ	59,976
Single Operator 80 Meters	FM5DN	110,055
Single Operator 40 Meters	KP4BD	110,880
Single Operator 20 Meters	6Y3M (VE3NZ, op)	621,285
Single Operator 15 Meters	KP4RV	212,580
Single Operator 10 Meters	NP2P (N2TTA, op)	575,820
Multi-Single Transmitter, High Power	VP5H	9,417,408
Multi-Single Transmitter, Low Power	PJ6A	6,083,181
Multi-Two Transmitters	TI8M	8,798,973
Multi-Multi Transmitters	C6ANM	3,015,699
Oceania		
Single Operator High Power	KH7M (NA2U, op)	5,027,400
Single Operator Low Power	KH6CJJ	1,241,625
Single Operator QRP	ZM2IO	3,330
Single Operator Unlimited, High Power	VK4QH	757,701
Single Operator Unlimited, Low Power	YE1NZ (W7NZ, op)	75,621
Single Operator 40 Meters	YD9RWY	744
Single Operator 20 Meters	VK7GN	21,720
Single Operator 15 Meters	NH2DX (KG6DX, op)	199,578
Single Operator 10 Meters	YC9WIC	46,011
Multi-Single Transmitter, High Power	VK2BD	15,624
Multi-Single Transmitter, Low Power	DX1PUP	2,400
Multi-Two Transmitters	KH7XX	8,602,440
South America		
Single Operator High Power	OA4SS	3,557,952
Single Operator Low Power	PY2NY	1,059,060
Single Operator QRP	PY2BN	4,680
Single Operator Unlimited, High Power	P40P (W5AJ, op)	5,210,865
Single Operator Unlimited, Low Power	3G1D (XQ1FM, op)	404,016
Single Operator 40 Meters	OA4/XQ3SA	116,232
Single Operator 20 Meters	PJ4D	459,846
Single Operator 15 Meters	FY5FY	664,578
Single Operator 10 Meters	PX5E	717,960
Multi-Single Transmitter, High Power	PJ2T	9,357,327
Multi-Single Transmitter, Low Power	PY1GQ	1,856,475
Multi-Two Transmitters	P40L	13,938,144
Multi-Multi Transmitters	LP1H	6,049,953

with lots of activity from around the world from difficult DXCC entities on the air. And of course, 10 meter operators were especially happy this year.

The top four DX multiplier champions were a repeat from last year, with P40L joining the list: HK1NA (363), PJ2T (357), PJ4G (356), VP5H (352), P40L (352). That's a lot of states and provinces!

The best DXCC entity totals acquired by a Multiop and Single Op entry are listed below. Can Five-Band DXCC in a weekend be far off? Just a little more 80 meter activity and this dream will come true.

160:K3LR — 60 (MM);
VY2ZM — 49 (SOHP)

80: W3LPL — 90 (MM);
K4XS — 68 (SOUHP)

40: K3LR — 116 (MM);
W4AAA (KK9A, op) — 102 (SOSB-40)

20: K3LR — 147 (MM);
W8TA — 130 (SOSB-20)

15: K3LR — 139 (MM);
VE3EJ — 122 (SOSB-15)

10: K3LR — 136 (MM);
K1LZ (K3JO, op) &
W6YI — 123 (SOSB-10 & SOUHP)

The Top Tens

The tables tell the story, of course, and we note the winners of several popular categories here, W/VE and DX. More discussion and coverage is available in the full version of the results at **www.arrl.org/contest-results-articles**.

Single-Op, All-Band

From the US-Canadian side, VY2ZM set a new all-time SOHP record and took the category for the 11th year out of the past 12. He comfortably passed frequent high-flyer K1TO, who in turn prevailed over K3CR (LZ4AX, op). XL3A (VE3AT, op) and NR5M made a close showing for fourth and fifth place, respectively. The domination of the northeast is just a bit less apparent this year, thanks to excellent conditions.

From the DX side, 8P5A (W2SC, op) is our repeat SOHP winner, surpassing his 2013 score. This is Tom's fifth win in a row and seventh out of the past 13 years. 8P5A managed 9.3M, 2.3M greater than the 2nd place finisher. KP2M (N2TK, op). Tony is a Frankford RC contesting veteran and repeats his Top Ten placement of last year. As does #3, V26M (N3AD, op), another FRC DXpedition veteran. YN5Z (K7ZO, op) places #4 and is another repeat placer. KH7M made the #5 mark, still surpassing the 5M mark.

As we saw in the record listings, N1UR (VT) continues to dominate W/VE SOLP with a sixth straight win; the longest in the contest. Ed's score would have placed 3rd in the SOHP Top Ten. That is truly an amazing achievement! The next four spots were placed quite closely, representing IN (W9RE), MS (NA5NN — N5BO, op), STX (N5AW), and MI (NA8V), all of whom would have made the SOHP Top Ten box this year!

In the DX SOLP competition, VP2MLL (K1XX, op) takes the gold in this category with VP9/W6PH only 1% behind to claim silver. Being close to the East Coast, VP9/W6PH dominated 40 and 20 meters, but the better 15 and 10 meter scores at VP2MLL ultimately won the day. J75Y (K1LI, op) was not far behind and earned the bronze. While North America dominated SOLP as usual, KH6JJ and PY2NY were able to bring Oceania and South America onto the board. Good propagation rewarded the low power competitors with scores up about 1M from last year.

In SOQRP it is clear that a New England location doesn't hurt, and indeed W1MR placed 1st in the US and Canada. But trust me, being in NH does not make 1000 QSOs at 5 W easy — congratulations, Chris! Second place comes from the rather inland location of ND0C in Minnesota. Back to New England with N1TM placing 3rd, and off to the West Coast with W6QU (W8QZA, op) placing 4th. To the south was NT4TS placing 5th from SFL.

On the DX end of the pileups, F5BEG, last year's 2nd-place SOQRP finisher, came out on top this year, driven by good 10 meter totals. Gerard has been in the Top Ten for the past 13 years. IK6FWJ also focused on 10 meters to place 2nd. SP6JOE made nearly the same QSO count, but fell behind in multipliers to place 3rd. In a great show of skill and good propagation, three QRP stations from Japan made the Top Ten this year.

Single Op Unlimited

From well outside of the usual DC, Philadelphia, and Boston circles comes an interloper from North Florida, K4XS, this year's SOUHP winner and holder of the new SOUHP W/VE record. Wow, way to go, Bill! Following K4XS, it is easy to identify the "usual suspects." In 2nd place is contest Hall-Of-Fame member K3WW. Chas has been 1st or 2nd for eight times out of the past 13 and in the Top Ten for the category 12 out of the past 13 years. And 13 years is as far back as your author can easily check! Another very familiar call, VY2TT, shifted from SOHP last year and placed 3rd from MAR.

Just as competitive as SOUHP, SOULP saw seven district records broken plus the all-time record. Congratulations to PVRC's W6AAN for placing first, and setting a new all-time bar for others to follow. Not very far behind, KT4ZB placed 2nd and set the fourth district record. N2WKS placed 3rd for the second district record, barely sneaking by N2SQW who placed 4th. KS1J managed the #5 spot from RI and set a first district record.

The SOU categories are popular outside the US and Canada, too. The top score this year was again from South America, with a dominating effort from P40P (W5AJ, op). But OK7K (OK1BN, op) placed 2nd, and set a new EU SOUHP record! Europeans also placed 3rd-4th-5th as EC2DX, IR4M (IK4MGP, op), and ED7W (EA7OT, op). From 2nd to 10th, this was indeed a tight race.

DX SOULP brought the medal back to North America, with a win by 8P2K (8P6SH, op). YV8AD managed nearly 200 more Qs but fell short on multipliers to take 2nd place. DF2SD placed 3rd, with 4th through 6th place also coming from Europe. Not placing in the Top Ten, but worthy of mention, were two new SOULP records; BG2AUE in Asia, and YE1NS (W7NZ, op) in Oceania.

Multioperator Categories

We have some new faces in W/VE MSHP for 2014. On top of our chart is WW4LL placing #1 from GA, setting a new 4th district record in the process. N1RR (WMA) tied in multipliers but fell just a bit short in QSOs to place 2nd. MSLP was topped only by SOULP in number of new records set. Ultimately, N1BA prevailed from NH by a slim margin over VE9ML in MAR. Both topped the previous all-time record set last year, with N1BA now holding that honor, and VE9ML holding the VE record.

After the electrons cleared, KB1H (CT), last year's #2 participant, came out on top in M2. W6WB (EB), also in last year's Top Ten, placed 2nd to represent the west. The bar set by K1AR in 2000 (11.4M) is going to take quite some time to top! This is a mature category and there were no big records set this year. In MM, the intense yearly competition between the teams at W3LPL (MDC) and K3LR (WPA) leads to ever-growing scores, and this year is no exception. This year, K3LR prevailed and took the top spot while setting a 3rd district record at 19.4M. But team LPL was hardly lying down. Their #2 score of 16.9 M would have been the winner last year.

Multioperator is less popular for DX stations but there was lots of activity just the same. The epic MSHP struggle between PJ2T and VP5H of last year reversed itself, with VP5H prevailing for the win this year. PJ2T came in 2nd, topping VP5H on multipliers. In MSLP, PJ6A absolutely ran away with the category this year, placing first, and setting a new all-time MSLP record. PY1GQ placed 2nd. The outstanding PJ6A score would have placed 7th in the MSHP category!

In M2, PJ4G had a super score and repeated their Top Ten finish from last year but was bumped for the #1 spot by P40L, setting a new South American record in the process. Number two station PJ4G still made an amazing 12.3M. The M2 category was packed with superb scores, with #10 still making almost 4000 QSOs. The big MM category was won this year by II9P, moving up from last year's M2 and scoring 7.5M. LP1H brought 2nd place to South America, repeating last year's Top Ten showing. Asian calls are rare in the DX MM Top Ten, but

Affiliated Club Competition

Unlimited Category

	Score	Entries
Yankee Clipper Contest Club	309,313,344	225
Frankford Radio Club	274,550,130	145
Potomac Valley Radio Club	211,298,259	194
Minnesota Wireless Assn	73,479,519	119
Florida Contest Group	61,845,312	100
Society of Midwest Contesters	48,590,538	108
Contest Club Ontario	43,355,826	69
Northern California Contest Club	40,386,816	99
Tennessee Contest Group	27,241,215	53
Arizona Outlaws Contest Club	25,992,876	68

Medium Category

North Coast Contesters	83,227,824	31
Radio Club of Redmond	761,619	7
Oklahoma DX Assn	668,532	3
South Jersey Radio Assn	407,493	3
Nacogdoches ARC	158,733	3
Hudson Valley Contesters and DXers	32,621,709	36
Central Texas DX and Contest Club	30,367,659	25
Carolina DX Association	30,100,296	50
DFW Contest Club	28,626,342	40
Southern California Contest Club	25,347,537	46
Mad River Radio Club	25,247,256	25
Alabama Contest Group	20,103,351	28
South East Contest Club	17,647,536	28
Maritime Contest Club	16,692,306	20
Order of Boiled Owls of New York	16,062,111	16
CTRI Contest Group	15,819,768	11
Willamette Valley DX Club	12,518,019	26
Contest Group Du Quebec	12,449,646	18
ORCA DX And Contest Club	11,395,245	31
Georgia Contest Group	10,857,801	15
Louisiana Contest Club	10,293,270	9
Grand Mesa Contesters of Colorado	8,901,399	27
North Texas Contest Club	7,250,163	10
Western Washington DX Club	7,222,296	33
Kansas City Contest Club	6,776,478	11
Rochester (NY) DX Assn	6,048,792	21
Niagara Frontier Radiosport	5,989,530	11
Northern Rockies DX Association	5,621,709	5
Mother Lode DX/Contest Club	4,943,211	23
Mississippi Valley DX/Contest Club	4,767,492	12
Bergen ARA	3,365,940	17
Spokane DX Association	3,060,033	20
Bristol (TN) ARC	3,021,285	10
Kentucky Contest Group	2,497,506	7
Utah DX Assn	2,445,000	16
Allegheny Valley Radio Association	1,871,583	3
Saskatchewan Contest Club	1,763,442	6
Metro DX Club	1,626,945	12
West Park Radiops	1,258,434	14
Texas DX Society	896,310	7

Local Category

Iowa DX and Contest Club	11,005,815	3
Delara Contest Team	6,222,639	10
Central Virginia Contest Club	5,815,893	5
599 DX Association	3,669,753	6
Kansas City DX Club	2,315,898	8
Paducah Amateur Radio Association	2,139,354	3
Meriden ARC	1,570,572	6
Hilltop Transmitting Assn	1,263,252	3
Portage County Amateur Radio Service	853,491	7
St Louis ARC	780,294	4
Salt City DX Assn	766,716	3
Loudoun ARG	739,290	3
Blue Ridge ARC	700,449	5
New Mexico Big River Contesters	687,735	4
Fort Wayne Radio Club	683,184	5
All Amateur Radio Club	629,580	3
Fort Smith Area ARC	573,096	3
Sterling Park ARC	552,057	7
Lincoln ARC	532,494	5
Laird Campbell Memorial HQ	498,351	3
Wireless Association of South Hills	477,507	3
Badger Contesters	423,816	5
Brazos Valley ARC	403,473	8
Great South Bay ARC	391,293	7
Milford (OH) ARC	342,144	5
Northern Illinois DX Assn	299,250	3
Skyview Radio Society	270,870	4
Northeast Maryland Amateur Radio	270,525	4
Boeing Employees ARS — St Louis	221,622	4
Ventura County Amateur Radio Society	169,692	3
South Texas DX and Contest Club	160,314	3
Southern California DX Club	153,066	4
Nanaimo Amateur Radio Association	88,446	3
Pueblo West Amateur Radio Club	84,300	3

W/VE Single Operator Region Leaders

Boxes list call sign, score, and power (Q = QRP, LP = Low Power, HP = High Power, U = Unlimited).

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

VY2ZM	6,949,614	HP
K3CR (LZ4AX, op)	4,445,289	HP
AA1K	3,476,400	HP
K3ZO	2,798,640	HP
W2XL	2,030,625	HP
N1UR	4,708,275	LP
W2TF	887,364	LP
WX1S	849,024	LP
W1JQ	772,632	LP
WA2JQK	771,120	LP
W1MR	654,678	Q
N1TM	437,760	Q
K2QO	46,458	Q
W1CEK	46,350	Q
W2IX	45,582	Q
K3WW	6,066,816	UHP
VY2TT	5,221,392	UHP
AA3B	4,930,992	UHP
N2NT (W2GD, op)	4,704,768	UHP
KN2M	4,444,575	UHP
W6AAN	2,291,769	ULP
N2WKS	1,759,914	ULP
N2SQW	1,743,948	ULP
KS1J	1,238,541	ULP
W3KB	1,154,340	ULP

Southeast Region
(Delta, Roanoke and Southeastern Divisions)

K1TO	5,253,930	HP
K4AB	3,272,904	HP
K3ZJ	2,985,285	HP
NR3X (N4YDU, op)	2,232,048	HP
WA2VYA	1,115,856	HP
NA5NN (N5BO, op)	2,502,927	LP
N8II	2,057,544	LP
W4IX	2,021,370	LP
AC4G	762,852	LP
W6DVS	693,600	LP
NT4TS	256,620	Q
K3TW	74,100	Q
N4ZAK	42,588	Q
K8MR	37,392	Q
W1IS	24,174	Q
K4XS	7,160,103	UHP
N4ZC	3,123,861	UHP
KOLUZ	2,188,809	UHP
K3IE	2,187,408	UHP
K5EK	2,035,125	UHP
KT4ZB	2,069,949	ULP
AA4R	1,136,364	ULP
NA4EA	844,560	ULP
W0PV	738,720	ULP
W4ZAO	595,080	ULP

Central Region
(Central and Great Lakes Divisions; Ontario East, Ontario North, Ontario South and Greater Toronto)

XL3A (VE3AT, op)	3,648,348	HP
K8AO	1,222,326	HP
K8GL	1,217,430	HP
K9ZO	916,575	HP
VE3OI	721,926	HP
W9RE	2,502,984	LP
NA8V	2,355,240	LP
N4TZ	2,069,613	LP
VA3SWG	898,776	LP
W8KTQ	871,332	LP
KA8SMA	203,634	Q
N8HP	107,352	Q
N8XA	96,558	Q
AI9K	11,520	Q
AF9J	9,588	Q
N8TR	2,559,738	UHP
W8MJ	2,153,334	UHP
K9IMM	1,842,675	UHP
N2BJ	1,744,512	UHP
WO9Z	1,265,481	UHP
WE9R	1,193,976	ULP
VE3TW	821,526	ULP
N9UA	789,342	ULP
K8LY	645,621	ULP
N4LR (@ K9XD)	613,035	ULP

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

NR5M	3,629,304	HP
K0TT	2,281,686	HP
WD5K	1,921,995	HP
VE4VT (VE4EAR, op)	1,530,009	HP
KM5VI	1,260,936	HP
N5AW	2,453,802	LP
W5GFI	784,680	LP
N1CC	755,595	LP
N7WY	637,488	LP
AA0MZ	518,817	LP
ND0C	443,466	Q
KK0Q	175,050	Q
N4IJ	172,845	Q
KIF0F	62,217	Q
WB0IWG	17,442	Q
AB5K	3,082,134	UHP
K5LLA	2,200,626	UHP
W0GJ (N0KK, op)	2,200,608	UHP
K0MD	1,699,716	UHP
K3PA	1,588,980	UHP
WA8ZBT	723,330	ULP
N0HJZ	713,775	ULP
AA0AI	705,942	ULP
K0AD	565,245	ULP
VE4EA	505,890	ULP

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

N9RV	2,059,668	HP
K5RR	1,123,440	HP
N6AA	686,106	HP
N6NF	661,710	HP
VA7ST	436,260	HP
N7IR	800,745	LP
N6RV	747,486	LP
K7ACZ	472,230	LP
K6GHA	331,296	LP
WB7QXU	258,456	LP
W6QU (W8QZA, op)	295,086	Q
K2GMY	34,632	Q
KG7RZ	32,832	Q
N6HI	14,691	Q
KK7VL	8,307	Q
KA6BIM	1,755,549	UHP
KG7H	1,583,469	UHP
N6QQ	1,262,751	UHP
N6JV	1,135,440	UHP
W6TK	913,920	UHP
VA7BEC	532,014	ULP
N7FLT	442,818	ULP
K3WYC	194,922	ULP
NG2Q	183,768	ULP
WN6K	134,640	ULP

consistent powerhouse JA3YBK is again the exception, placing 4th.

Bang the Gavel — Club Competition

Another great way to have fun is to complete as part of a club. Whether you are part of one of the powerhouse Unlimited clubs or a casual operator in your own Local club, there is no better way to compete, share the experience, and perhaps tell a few tall tales. For beginners, joining a club is a great way to get started. If there are none in your area, why not start one?

ARRL Affiliated Club activity continues to grow, with 2071 club logs submitted from 84 clubs this year. Note that CW and SSB contests are combined in the overall club totals.

Starting in the Local Club category, the Iowa DX and Contest Club ran away with the title, making 11 Meg and propelled by the huge 9M+CW score at N0NI. The Delara Contest Team earned a very respectable 6.2M for the silver, followed by the Central Virginia Contest Club reaching 5.8M for the bronze.

Next up the scale are the Medium Clubs where the North Coast Contesters achieved 83.2M, and repeated for the win over the Hudson Valley Contesters at 32.6M. The Central Texas DX and Contest Club captured 3rd at 30.4M, just squeaking past the Carolina DX Association at 30.1M. This category has quite a race for 2nd place, so expect to see some fights next year.

But what about the major league pennant? Predictably, it was a giant struggle between the Yankee Clipper Contest Club, Frankford Radio Club, and the Potomac Valley Radio Club. Final results look a lot like last year, scaled up a bit due to the excellent conditions. The New England champs at YCCC prevailed for the third year in a row, with an amazing 309M over 225 logs. The Philadelphia powerhouses at Frankford Radio Club managed second place with 275M and 145 logs. You might note the outstanding points-per-log figure for FRC. (Disclosure: your author is an FRC member.) Placing 3rd is the high voltage DC effort of Potomac Valley Radio Club, with 211M over 194 logs. But watch out for the Minnesota Wireless Association and others, they are growing fast!

Signing Off and Clear

The 2014 ARRL DX Contest was a real thrill, a perfect storm of good conditions and lots of activity. I hope this encourages others to give the contest a try. It really is a lot of fun and is a terrific way to enjoy ham radio. Tell your friends!

It now seems clear that the 2014 contest season represented the peak of Solar Cycle 24. However, what is not known is how quickly the cycle will decline. It is entirely possible that next year will also feature excellent 10 and 15 meter conditions. The only way to tell is to turn on your radio during the weekends of 21 – 22 February and 7 – 8 March.

The ARRL Soapbox web pages (**www.arrl.org/soapbox**) feature more photos and stories, too. Please send your contest stories and photos next year so that I can use more of them. Your suggestions for what to put in next year's article are always welcome.

I'd like to thank Ward, N0AX, for an entire solar cycle of superb results article authorship. Ward, my sincere appreciation for such good material to borrow from! And thanks to the ARRL for this opportunity to talk contesting with you all.

Full Results Online

Read K3PA's complete inaugural article online at **www.arrl.org/contest-results-articles**. Each category is scrutinized, records are sorted, band-by-band results swept, and QSO-multiplier breakdowns studied.

Jon Jones, N0JK, n0jk@arrl.org

2 Meter Sporadic E Lights Up June

A rare sporadic E event put many new grids in many logs.

One of the rarest forms of ionospheric propagation in North America is 2 meter sporadic E (E_s). Catching a 2 meter E_s opening is like chasing a will-o'-the-wisp. Many dedicated operators search for years without working one. Other times, you turn on the radio and there it is. One of the best 2 meter E_s openings in 2014 popped out of nowhere Sunday evening, June 22. After a lackluster day on 6 meters, strong E_s appeared Sunday evening between the East Coast and Midwest. Signals got very loud on 6; K1HTV (FM18) was 40 dB over S-9 for N0JK (EM28) at 2330Z. About 20 minutes later John Lock, KF0M (EM17), in Wichita, Kansas worked NZ3M (FN10), followed by KB2AYU (FM29) on 2 meters.

The 2 meter E_s opening continued for over an hour. John logged K4RTS (FM08), AK3E (FM19), K1HTV (FM18), K3WHG (FN10), KD4AA (FM17), K1RZ (FM19), WA2ONK (FN20), and W4TJ (FM08) at 0143Z. John observed, "Signals would be in strong for 2 – 3 minutes then drop out. One station could be strong and another weak, then swap. I tried with K1RZ on 222 MHz when he was 60 over on 2 meters but no joy." Signals were so strong that KN4SM (FM16) using an indoor ⅝ wave whip and 10 W was able to work JD, N0IRS (EM29)! N0IRS made 13 E_s contacts in three states covering six grids.

How do you find a 2 meter E_s opening? The old-school way was to watch how 6 meters behaved. Consider a 50 MHz contact between stations in Memphis and Indianapolis, about 600 kilometers apart (see Figure 1). What is the possible Maximum Usable Frequency (MUF) of the cloud that is supporting that path?

Years ago you would have used a chart to estimate the MUF. Now **dxmaps.com** calculates the MUF on spots posted. In this case, the MUF is over 144 MHz — around 160 MHz. The process can be taken one step further to estimate the likely distance that could be spanned on 144 MHz using the same E cloud as a reflecting point. This analysis suggests that a 144 MHz path from Minneapolis to Tallahassee or any other 1800 kilometer path with the same center point would be possible. When you hear or see others spotting short E_s off a cloud farther away from where you are, 2 meters may be open for you.

Emil Pocock, W3EP, suggests,

> This classical analysis works well in many practical applications and it has enabled many alert operators to anticipate 144 and 220 MHz sporadic E. It may also be helpful to keep in mind that the sporadic E MUF often climbs very rapidly, but reaches 144 MHz only one-tenth as often as 50 MHz. The sporadic E MUF exceeds 200 MHz on very rare occasions. Because the VHF Amateur Radio bands are widely spaced in the radio spectrum, monitoring between the amateur bands such as TV Channels 2 to 13, FM broadcast or aircraft navigation aids, may provide more precise indications of actual conditions.[1]

[1]Pocock, Emil, W3EP, "Sporadic-E Propagation at VHF: A Review of Progress and Prospects," *QST*, Apr 1988, pp 33 – 39.

John, KF0M, used this strategy:

> I noticed E-skip to the east on 6 meters; I turned the beam and fired up the 2 meter rig based on K5SW's reminder of historical data showing 2 meter E-skip peaks around the solstice. **dxmaps.com** showed 6 meters strong with short contacts spotted around 0040Z. I heard NZ3M call a CQ on 2 meters at 0045Z.

Todd, KC9BQA, has this tip:

> When 6 shortens up, you need to really pay attention to 2 meters. The shortening up means that the MUF is rising. When you're getting stations from 300 – 500 miles away on 6 meters with big signals, it's time to call CQ on or near 144.200 MHz, SSB/CW. I've only caught E_s on 144 MHz twice (in six summer seasons).

Some new "high tech" ways to find 2 meter E_s openings include the APRS VHF map at **aprs.mountainlake.k12.mn.us** and an e-mail alert subscription service, **amunters.home.xs4all.nl/monitor.html**. Sam, K5SW, found the e-mail alert "right on."

> I was at a church function until 0110Z, June 23. When I got home 0110Z 6/23, I heard W5VTM and K5CM in my grid,

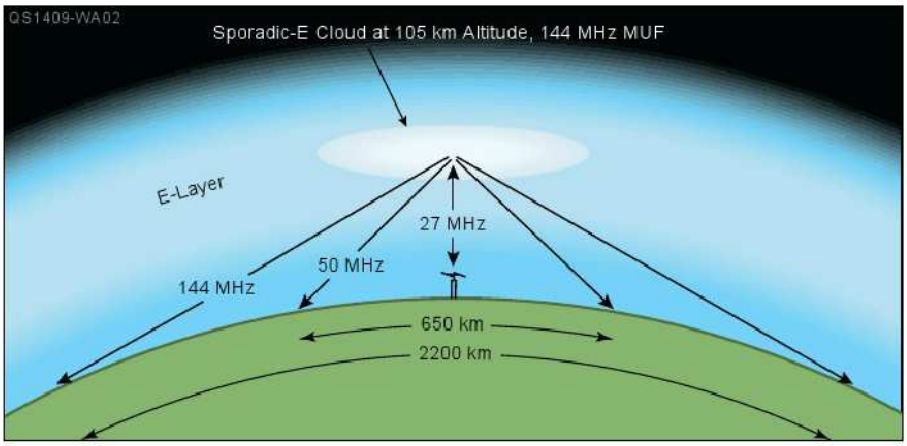


Figure 1 — This diagram shows the relationship between a sporadic E's MUF and the path distance. For an E cloud with an MUF of 144 MHz, the single-hop path distance will be about 2200 kilometers. As the transmitter frequency is reduced below the MUF, the path distance decreases also, that is — at 50 MHz the path distance will only be about 650 kilometers.

EM25, working the opening. At 0115Z I worked KB2AYU (FM29) NJ, 0120Z and K1RZ (FM19) MD as my only contacts. My e-mail from the warning group at 0029Z for high MUF over EM88 was *right* on, as I spoke with W5VTM (EM25) and he said he had been working the opening for about 30 minutes prior to my 0110Z QSO.

As a historical note, Sam says the first North American 2 meter E_s contact was made by Al, K5WXZ, TX with W8WXV OH in the 1950s. Sam has made 2 meter E_s contacts in almost every month of the year, including January.

So, are 2 meter E_s link to TEP contacts possible? As you read this, the fall TEP season will be starting. Six meter TEP will occur nightly and even a few E_s-TEP contacts will be made. Two meter TEP contacts are made regularly between the Caribbean and Uruguay, Brazil, and Argentina around the equinoxes. While 2 meters E_s are exceedingly rare in North America during the fall, a 2 meter E_s opening with the right geometry could form a link using TEP to South America.

On the Bands

50 MHz. Lance, GJ (DN27), worked ZA/PA2CHR via EME on June 3. This is Lance's DXCC #193 on 6 meters. Jay, K0GU (DN70), made a remarkable E_s contact on June 4. He worked JY9FC at 1542Z.

> I happened to see a small blip on the bandscope at 50.102 MHz and it turned out to be JY9FC. He was the only signal on the band. Beam heading from here is about the same as southern Sweden. He is running 100 W to a two-element wire Yagi that is about halfway between horizontal and vertical made of broomsticks. That is just crazy.

JY9FC is 10,993 kilometers from K0GU. Also on the 4th, WA3IEM worked YV4NN, 9Y4VU, KP4EIT, and FM5WD.

On June 5, YO9HP (KN35) appeared in many logs, including K1HTV. "At 1457Z, from my FM18ap QTH in VA, I worked YO9HP in KN35ba, a new grid square for me on 6 meters." Rich noted:

> Starting around 1340Z and lasting until around 1500Z June 5, a number of stations in SW Texas and NE Mexico reported hearing and/or working European stations. The DX stations were located in YO, LZ, S5, DL, HA, PA, ON, and F.

Mike, AB5EB, says

> It was the best opening I have experienced into Europe. The run started at 1416Z with 9A8A on CW. Signals were around S-1 to S-2 but very solid copy. 9A8A was followed by HA8FK, LZ2FU, HA6NL, 9A4K, S53K, and YO3APJ. The whole opening lasted less than 20 minutes for me.

Dave, N9HF (EL99), was pleased to work YO9HP for his country 97.

K1HTV worked W1AW/5 LA on the 6th. The morning of June 12 Tim, NW0W (EM47), heard the VE2KYT and VE2RCS beacons early at 1210Z and found S55DX at 1322Z. June 13 W7GJ (DN27) worked KH6HI (BL01) via E_s.

Sunday afternoon of the June VHF Contest, Don, AA5AU, worked EA8CQS.

> Yes, I tell you it was really a special feeling working EA8CQS. I had two or three stations calling me and I was having a fit getting his call sign. It took a couple minutes (or so it seemed) and I was afraid he was going to fade. But I finally got it. Being #1 Mixed Honor Roll and only needed one more on CW and RTTY each, I've seen some strange DX. But this one has to take the cake.

On the 15th, Dan, K1TO, heard FP8FD (GN17). A rare opening from the Midwest to the Pacific Northwest took place June 17. From 0130Z to 0230Z N0JK (EM28) worked K7CW (CN85), KE7V (CN88), N7AOK (DN62), AH6LE (CN85), W7EW (CN84), W2JVN (CN83), and VA7FC (CN79). The path is rare as it is between single and double hop E_s. Dan, K1TO, worked five stations in Oregon during this opening.

June 18 was a great day for many. For Rich, K1HTV (FM18), it

> included EA6SX, CT1IUA, old faithful CT1HZE, ZB2B, EA5WU, EA7KW, YV5IUA (that makes two 'IUA' suffixes in the same day), ZY14RR (PV8ADI op), CN8KD, YV4NN, CT1FFU, 9Y4VU, CT1FJC, FS/K9EL, FM5AN, 8P6AN, YS1AG, XE1FAA, XE3DX, TG9AJR, and KP2/K3TEJ.

XE3DX (EK36) was also in to EM28 for N0JK. Andy, YS1AG, "was in for hours" to Dan, KF6A (EN73). He said Andy worked many. Also on the 18th, Dave, N9HF (EL99), worked 9H1XT at 1713Z for country number 98 on 6 meters!

The next day was the first extensive Hawaii to stateside E_s opening of the season. Jim, KH6/K6MIO (BK29), reports

> Dave, N3DB, came up out of the noise calling CQ on CW about 1915Z (0915 HST). I called and we completed on SSB. Over the next 30 minutes or so I worked 18 stations on SSB. Signals were not very strong. Whether working 6s, 7s, 0s or working 2s, 3s, 8s, or 9s, they were all about the same. The 'searchlight effect' was very prominent. The signal footprints jumped back and forth across the country from minute to minute.

Unfortunately for Fred, KH7Y, his 6 meter Yagi was stuck due north. "I did work K6QXY, and was copied by KF6A, a W9, and a W2. So it was a good opening considering where my antennas were pointing." Jay, W9RM, did well from his new home in DM58:

> I was pointed east and heard a bunch of Midwest callers on 50.110. I figured they were after some Carib station, but I checked ON4KST and saw it was KH6/K6MIO. After I did a 180 with the antenna, Jim was 59+. He quickly QSYed to 50.120 MHz and I worked him over the top of the 8/9/0 horde with one call. I have to admit that felt good. I also worked KH6HI on CW, 579. KH6U was never audible here, even though the guys back in the Midwest were reporting him louder than KH6HI.

Juan, TG9AJR (EK44), had strong E_s to the East Coast and Midwest on both the 18th and 19th working many. On June 23 Lance, W7GJ, handed out W1AW/7 MT contacts. June 24 was one of the better JA – NA openings of the season. W9RM (DM58) worked JL8GFB (QN03), JA0MVW (PM97), and JE1BMJ (QM05) around 2200Z.

2 Meter E_s!

Rich, K1HTV (FM18), explains using **dxmaps.com** to help find the E_s opening June 22:

> Hi Jon, thanks for the 6 meter CW QSO. I heard you calling JL8GFB about 20 minutes later and stuck around 50.083 for another 15 minutes or so in hopes that I could hear him. I glanced over at the video monitor displaying the 50 MHz map screen of the DXMAPS website. It looked like there was very short 6 meter E_s with the midpoint being over southern IL. A click on the 'MUF ES' tab indicated a Maximum Usable Frequency was over 150 MHz, meaning there should be E_s on 2 meters. I quickly switched from 6 meters to 144.200 MHz and heard K4RTS in Luray, VA about 30 miles west of me calling 'CQ E-skip.' I asked him if he had worked anyone and he said that he had just worked KF0M (EM17) in KS a few min-

utes earlier. While we were chatting, at 8:10 PM, N0IRS called me for my first 2M Es QSO of the 2014 season.

During the opening Rich worked N0IRS (EM29), KF0M (EM17), W5VTM (EM25), AA0KM (EM39), and KD0HY (EM26).

From EM04, Dan, WB5AFY, worked 10 stations including K1TEO, W1COT, and WZ1V (FN31). From EN10, KA0JGH worked W0LD (FM05), K7BV (FM04), K4SAN (FM05), and WF4R (FM16). Larry, AE0G (EM10), logged KD4AA (FM17), W0LD (FM05), and NG4C (FM16). N0JK (EM28) heard K1HTV (FM18) on an indoor antenna. Dennis, K7BV (FM05), says

> I am a total newbie to the band and love the excitement of not having a clue what to expect and what to do! Just like the wonderful Novice years. These were my first ever 2 meter E_s QSO since licensed in '62. I worked N0IRS (EM29), W0WOI (EN22), KA0JGH (EN10), KC0CF (EN32), W0KT (EN21), and WB0YWW (EN22), between 0030 – 0120Z." W0LD (FM05) caught N0IRS, AE0G, W0WOI, and KA0JGH.

On the 19th, Lauren, W0LD (FM05), worked Dan, WB5AFY (EM04), on E_s. Dan, KF6A (EN73), worked KD4ESV (EL87) via E_s at 2135Z on the 19th. Dan was running 20 W to a small Yagi on a 15-foot mast. He said the APRS map helped. Dan saw "a big red splotch from Florida to Michigan."

During the June VHF Contest, Oleh, KD7WPJ (CN80), worked K6AAW (DM05) using a FT-817 transceiver and a three-element Yagi over a 400 mile path.

First Time 2 Meter EME with USVI

Between May 22 and 27, 2014, Bill Dzurilla, NZ5N, and Pete Rimmel, N8PR, journeyed to the island of St Croix in the US Virgin Islands to activate the USVI for the first time on EME (see Figure 2). They took an Icom IC-7000 transceiver, I0JXX Solid-state 2 meter kW amplifier, two nine-element M^2 2 meter antennas, with an az-el rotator. They worked 210 stations, 42 DXCC countries and 152 grid squares in 4 days of operation. We credit the host station owner, George Oster, NP2N.

Figure 2 — Pete Rimmel, N8PR (left), and Bill Dzurilla, NZ5N, standing beside their two nine-element M^2 2 meter antennas mounted on an az-el rotator. [Mark Wohlschlegel, WC3W, photo]

222 MHz. No 222 MHz E_s contacts reported.

432 MHz. There were many participants June 22 in N4PZ's 432.105 MHz Monday night net: "AB9QH, N9IYV, and KC9VHD in Chicago. Gene, K6DV, in EN43. JD, N0IRS (EM29), as usual put a 20/9 signal into EN52. Dave, KC9CLM, in Elkhorn, WI had a loud signal. KB8GUE in EM89 with a 250 W brick supplied by KB9YSJ — Steve, N4PZ. I have my 4 × 32 foot homebrew 40-element Yagis working well thanks to Jeff, KB9YSJ, who helped me sort out a few glitches."

902 MHz. Herb, WA2FGK, reports a "one way" EME contact with PY2BS on June 21 at 0605Z. PY2BS received "PY2BS WA2FGK FN21" at −26 dB. Local cell tower interference prevented Herb from completing the contact. Herb runs 400 W to a 4 × 45 element Directive System loop Yagi array.

Here and There

Gabriel, EA6VQ, says **dxmaps.com** "needs your support." For more information, please visit **www.dxmaps.com/supporter.html**.

VC1T is attempting a transatlantic terrestrial contact with Europe on 2 meters in their quest for the Brendan trophy. They are running 750 W into a rope-supported 43-element, 100 foot long Yagi directed at Europe. It has a gain of more than 23 dBd. At 750 W input, the group estimates the effective radiated power (ERP) in the center of the major lobe should be about 150 kW. Information and an operating schedule can be found at **www.brendanquest.org**.

On July 6, 2014 at 1341Z, John, G4SWX, was able to completely decode an FSK-441 transmission from VC1T on 144.155 MHz.

Bernie McClenny, W3UR, w3ur@arrl.org

Tromelin Island

The ninth most wanted DXCC entity is to be activated by a French DXpedition.

The uninhabited Tromelin Island is located at 15° 53′ 32″ South and 54° 31′ 29″ East, which is about 462 kilometers (287 miles) east of Madagascar (5R8) and about 563 kilometers (350 miles) north of Reunion Island (FR). The tiny, flat, almond-shaped island is approximately 1.7 kilometers (1 mile) long by some 700 meters (2297 feet) wide, with the highest point on the island just over 7 meters (23 feet) above sea level. The island is surrounded by a coral reef, which makes landings by sea very difficult.

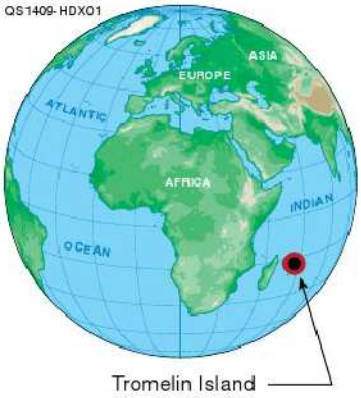
History of Tromelin Island

The first official recording of the island was in August 1722 by Captain Jean Marie Briand de la Feuillée, aboard *La Diane*. On July 31, 1761 a French ship named *L'Utile* illegally carrying slaves from Madagascar to Mauritius ran aground on the coral reef on what was then called Ile de Sable (Sand Island). The crew was able to escape and get back to Madagascar; however, they abandoned about 60 slaves on the island with few supplies.

Eventually the French warship *La Dauphine*, captained by le Chevalier de Tromelin (the knight of Tromelin), arrived to rescue the remaining slaves on November 29, 1776. The French continued to call it Sable Island until 1875, before eventually embracing the name "Tromelin."

In 1953 the decision was made to build a weather station and 1000-meter runway on Tromelin, which were completed the following year. The weather station provides information on cyclone activity in the southern Indian Ocean that is important to maritime traffic.

Tromelin Island is part of the Eparses Islands. These islands were originally under the administration of the island of Reunion. The islands were later entrusted to the Terres Australes et Antarctiques Francaises (TAAF), one of five districts under the French Southern and Antarctic Lands, on January 3, 2005 and eventually were incorporated in the TAAF by the Act of February 21, 2007.



DXCC History of Tromelin Island

Tromelin Island was not on the original DXCC list of November 15, 1945. The announcement of its addition appeared in the March 1956 issue of *QST*: "DXCC credit will be given starting May 1, 1956, for creditable confirmations dated on or after November 15, 1945."[1]

The first Amateur Radio operation to take place from Tromelin was by Marc Jouanny operating as FB8BK/T shortly after the weather station was built. Other operations that reportedly took place were FR7ZC/T (by W4BPD) in 1963; FR5ZL/T in 1967, 1969, 1974, 1977, and other times; FR7AI/T in 1970 and 1974; FR7AE/T in 1971; FR5ZU/T in 1971, 1992, 1996, 1999, and 2001; FR0FLO/T and FR7BP/T in 1980 (with around 11,000 contacts); FR7CG/T in 1982; FR5ES/T in 1987; FR5ZQ/T in 1993, 1996, 1998, and 1999; FR5AI/T in 1991, and the last DXpedition in 2000 as FR/F6KDF/T by operators F5PXT, P5PYI, F6JJX, and F5NOD making around 50,000 contacts.

[1]"DXCC NOTES," *QST*, Mar 1956, p 74.

Up until about 2000, the weather station was visited by technicians, some of whom were Amateur Radio operators who got on the air in their spare time. Now, the weather station is automated and there is little need for personnel to visit. Today there are typically two or three TAAF workers on the island who stay for some 45 days at a time. None of them are licensed Amateur Radio operators.

Effective from 2005, the Eparses Islands changed from the FR prefix to the FT prefix, under the authorization of the TAAF. FT5GA was the first of the Eparses Island DXpeditions to use the new prefix for the 2009 Glorioso Island (ex FR/G) operation. Europa Island, which used to be FR/E, is now FT#E. Juan de Nova counts as the same DXCC and entity as Europa, and both use the FT#J prefix. No DXpeditions have taken place from either since the change. So FT4TA will be the first DXpedition from Tromelin using the new FT#T prefix. There were no changes to the FT#W (Crozet Island), FT#Y (Terre Adelie, Antarctica), FT#X (Kerguelen Island) or FT#Z (St Paul and Amsterdam Islands) prefixes.

October/November FT4TA DXpedition

In mid-2013, members of the Radio Club de Provins, F6KOP, and the Lyon DX Gang, F6KDF, announced they were teaming up for a 2014 DXpedition to Tromelin Island as FT4TA. Tromelin ranks number

nine on the Club Log Most Wanted list. Six French operators are expecting to be QRV from October 30 to November 10 of this year. The team will consist of Sib, F5UFX (team leader); Michel, FM5CD; Vincent, F4BKV; Flo, F5CWU; Fred, F5ROP, and Franck, F4AJQ. The pilot stations for this one will be Col, MM0NDX (chief pilot); Harumi, JR4OZR (JA/AS pilot); Bjorn, ON9CFG (EU pilot); Don, N1DG (NA East Coast and SA pilot); John, K6MM (NA West Coast pilot), and Lee, ZL2AL (OC pilot).

The FT4TA team plans to be QRV on 1.8 – 28 MHz on SSB, CW, and RTTY. They will have three OM2000 amplifiers. For antennas, they will be using an 18-meter Spiderbeam pole vertical on Top Band, two phased 18-meter high Spiderbeam poles for verticals and a DX Engineering DVA-80 on 80 meters, four square antennas on 40 and 30 meters, and a two-element vertical dipole array on 20 – 10 meters.

The team's website is **www.tromelin2014.com/en**, which includes the latest news, a history of the island, details about their goals, operator biographies, equipment list, a great propagation tool thanks to K6TU, complete QSL details, their sponsors, and contact information. The FT4TA team plans to post their logs on Club Log (**secure.clublog.org**) and will be using OQRS (Online QSL Request Service) for QSLing afterwards.

W9DXCC

Mark your calendars for the 62nd W9DXCC DX Convention and Banquet, which will be held on Friday September 19 and Saturday September 20. They'll also be running DX University (**www.dxuniversity.com**) on Friday. Complete details about your editor's favorite DX Convention can be found at **w9dxcc.com**.

DX News via Twitter

For those of you who are not acquainted with Twitter, it is "an online social networking and microblogging service that enables users to send and read short 140-character text messages, called 'tweets.'" For DXers, IOTA chasers and contesters, it's a great tool for keeping up with the latest news by taking you directly to interesting news stories. Some of the more popular accounts to follow are **@DXInformation**, **@dxcoffee**, **@DX_World** and, of course, **@DAILYDX**.

DX and IOTA News From Around the Globe

5V — Togo. Czech DXpedition team members OK6DJ, OK1FPS, and OK1FCJ plan to be QRV from Togo for approximately 12 days at the end of September, including the CQ WW RTTY Contest. They will be operating as 5V7DB, 5V7PS, and 5V7ST respectively on 1.8 – 28 MHz. They will have two K3 transceivers and one KX3 transceiver along with two amplifiers. For antennas they will be using two Spiderbeams that include the 12, 17, and 30 meter bands, one vertical for 40 – 10 meters, and one vertical on 160 and 80 meters. They will also have "special RX antennas" for the low bands. Activity will be on SSB, CW, and the digital modes. QSL via OK6DJ either direct (OQRS), via the bureau, LoTW or eQSL. They have a website at **www.cdxp.cz**.

CY0 — Sable Island. A 1-day DXpedition is in the works for Murray, WA4DAN, and Randy, N0TG, to Sable Island possibly as CY0C on September 8. The two will be using the station they left during their last adventure as CY0P during their October 2013 DXpedition and one other rig. One rig will be high power with Murray operating phone while Randy will be on CW. They plan on using Yagis on 20 and 17 meters. Plans are to be QRV between 1300 – 2100Z. Due to renovations taking place on Sable Island, overnight stays are not being granted by Parks Canada, hence the 1-day operation. QSL via VE1RGB.

FK — New Caledonia. Bob, KD1CT, will be joining up with Cezar, VE3LYC, for an IOTA DXpedition to Matthew Island (OC-218) as TX4A for 4 days sometime in the September 1 – 9 time frame. This one has not been QRV since FK5M in 1997. Activity will be on 7 – 28 MHz on CW and SSB with plans to have "one station on the air around the clock." Check out their website (**tx4a.yolasite.com**) and watch your favorite DX news outlet for the latest news. Dan, W4DKS, (**dan.sullivan@verizon.net**) is the pilot station for this one.

P2 — Papua New Guinea. Derek, G3KHZ, has announced plans for a multi-island IOTA DXpedition through Papua New Guinea in September. Joining him will be Hans, SM6CVX, and Eddy, K5WQG. They will be meeting in Singapore on September 10 and then flying together to PNG. Plans are to activate P29VCX from New Britain (OC-008) from September 11 – 14. Following that operation will be an operation from September 15-20 as P29NI on Kranket (OC-258) followed by P29VCX on Kiriwina (OC-115) from September 21 – 25. Their final activity will be as P29NI from Loloata (OC-240) from September 25 – 30. "The operation will be mainly CW but there will be a station daily on SSB (mainly on 20 and 15 meters) and there will be some RTTY." QSL P29VCX via SM6CVX and P29NI via G3KHZ. They have a website at **p29ni.weebly.com**.

VK — Australia. IOTA DXpeditioner Craig, VK5CE, has announced he will be QRV as VK5CE/8 from Bathurst Island (OC-173) planned for August 26 – 29. The last activation for this one was in 1999. It's currently #2 of the most wanted VK IOTAs. He has a blog at **oc173.blogspot.com**.

After KD1CT's and VE3LYC's TX4A IOTA DXpedition to Matthew Island (OC-218) as TX4A and after VK5CE's IOTA operation from OC-173 the three will be teaming up, along with Johan, PA3EXX, to put VK6ISL on the air from Sandy Islet (OC-294) for 4 days sometime between September 14 and 21. They have a website at **vk6isl.weebly.com**.

VK9X — Christmas Island. Rob, N7QT, has announced he is going to Christmas Island where he will be QRV as VK9X/N7QT on 3.5 – 28 MHz on CW, SSB, and digital modes from September 3 – 13.

Wrap Up

That's it for this month with thanks to F5CWU, N1DG, KE3Q, and *The Daily DX* for helping to make this month's column possible. Don't forget to send your DX news, photos, and club newsletters to **w3ur@arrl.org**. Until next month, see you in the pileups! — *Bernie, W3UR*

Special Event Stations

Maty Weinberg, KB1EIB, events@arrl.org; www.arrl.org/special-event-stations

Working special event stations is an enjoyable way to help commemorate history. Many provide a special QSL card or certificate!

Aug 15 – Aug 24, 1600Z – 0059Z daily, NN1MF, Marshfield, MA. Whitman Amateur Radio Club. **147th Annual Marshfield Fair**. 18.160 14.260 7.260 3.860; EchoLink WA1NPO-R IRLP: 8691. Certificate & QSL. Whitman ARC, PO Box 48, Whitman, MA 02382. **www.wa1npo.org**

Aug 16 – Aug 17, 1600Z-2200Z, W5BMC, Franklin, LA. Bayouland Emergency Amateur Radio Service. **Southwest Reef Lighthouse**. 14.260 7.260; Echo Link 5070.0 IRLP 3670. QSL. Jackie Price, 708 Front St, Morgan City, LA 70380. *This is the first time this lighthouse has been activated on the air. Station will be located on the bank of the Atchafalaya River in Berwick, LA.*

Aug 23 – Aug 24, 1700Z – 0200Z, K4T, Huntsville, AL. **"Damn The Torpedos!" — 150 years since the Battle of Mobile Bay.** 18.140 14.250 7.200. QSL. Dennis Pesca, 11220 Suncrest Dr, Huntsville, AL 35803. **www.qrz.com/db/nn1mf**

Aug 26 – Sep 26, 0000Z – 0400Z, CG3C, Mississauga, ON. Robert Emerson. **150th Anniversary of the Charlottetown Conference**. 28.525 24.940 21.295 14.270. QSL. Via bureau or direct to Robert Emerson, VE3OKA, 6950 Summer Heights Dr, Mississauga, ON L5N 7E9, Canada. **canada-150th.ca**

Aug 29 – Aug 31, 1400Z – 2000Z, KD8KWV, Bellevue, OH. Harold R. Wolfe. **20th Anniversary of *The Shawshank Redemption* Movie**. 14.250 7.250 3.850 146.940. QSL. Harold R. Wolfe, KD8KWV, 358 High St, Bellevue, OH 44811. *Celebrating the filming locations of* The Shawshank Redemption. *Historical sites include the Ohio State Reformatory, as well other locations on the historical Shawshank Trail located in Mansfield, Ohio.*

Aug 29 – Aug 31, 1200Z – 1600Z, W8WE, Mansfield, OH. InterCity Amateur Radio Club. ***The Shawshank Redemption* 20th Anniversary.** 14.250. QSL. IARC, PO Box 713, Bellville, OH 44813. *Times and frequency may change. Check out the club website for up-to-date information.* **www.w8we.org**

Aug 29 – Aug 31, 1800Z – 0100Z, W3A, Gilbert, PA. Eastern PA Amateur Radio Association/Pocono Amateur Radio Klub. **West End Fair of Monroe County Pennsylvania**. 14.280. QSL. EPARA/PARK, PO Box 1163, Stroudsburg, PA 18360.

Aug 29 – Sep 1, 1900Z – 1900Z, K7RDG, Sierra Vista, AZ. Cochise Amateur Radio Association. **CARA's 35th Annual Trek to the Ghost Town of Paradise, AZ**. 28.315 21.215 14.315 7.230. Certificate & QSL. Cochise ARA, PO Box 1855, Sierra Vista, AZ 85636. **www.k7rdg.org**

Aug 30 – Sep 1, 1317Z – 1317Z, K1R, Northfield, MA. 72 Rag Chew Group. **Labor Day Special Event**. 7.272. Certificate. Robert Lobenstein, WA2AXZ, 1936 East 36th St, Brooklyn, NY 11234. *Join us Labor Day weekend to help celebrate all the US workers that make this country the best in the world.* **k1lrb@arrl.com**

Sep 1 – Sep 2, 1600Z – 1600Z, W7ZA, Aberdeen, WA. Grays Harbor Amateur Radio Club. **Aberdeens of the World**. 28.600 14.310 7.180 3.910. QSL. Grays Harbor Amateur Radio Club, PO Box 2250, Aberdeen, WA 98520. *QSL for contacting special event station; contest beginning September 1 — work 20 Aberdeens, including Aberdeen WA GHARC members, for certificate. Details at* **www.gharc.org**

Sep 4 – Sep 15, 1900Z – 0500Z, N4F, Fairview, NC. The Road Show Amateur Radio Club, Inc. **North Carolina Mountain State Fair**. 40 20 15 10 Meters; 7.245. Certificate & QSL.* The Road Show Amateur Radio Club, Inc, 57 Echo Lake Dr, Fairview, NC 28730. *Check website throughout the event for live video feed and current operating frequency.* **www.theroadshowarc.com**

Sep 5-Sep 7, 2300Z – 1800Z, K5E, Pottsboro, TX. WeatherBunch. **Treasure Island ExPedition**. CW 28.170 14.130 7.100 3.550; SSB 50.150 28.450 21.250; PSK31 50.290 18.100 14.070; FM 146.550. QSL. James Hunt, 1026 Valentine Dr, Sherman, TX 75090. **www.tailgatersnet.com/weather-bunch.html** *or* **www.qrz.com/db/K5E**

Sep 6, 1500Z – 1900Z, W1KVI, Cape Elizabeth, ME. Portland Amateur Wireless Association. PAWA Centennial. 28.400 21.350 14.250 146.730; 100.0 CTCSS. QSL. PAWA, PO Box 1605, Portland, ME 04104. **www.qsl.net/pawa**

Sep 6 – Sep 7, 1400Z – 0200Z, K3IEC, Carlisle, PA. Cumberland Amateur Radio Club. **50th Anniversary Celebration**. 21.360 14.260 7.260 3.860; CW & SSB 2 through 80 meters; 146.490 FM. Certificate & QSL. CARC, 1367 Kiner Rd, Carlisle, PA 17013. **home.comcast.net/~carc-k3iec**

Sep 6 – Sep 14, 0000Z – 2359Z, W6J, Elk City, OK. Route 66 Amateur Radio Association. **Route 66 On The Air**. 14.266 7.266 3.866. QSL. Marvin Gorden, PO Box 2222, Elk City, OK 73648. *W6J is one of 18 or more W6 stations operating during same date and time.* **www.w6j.org**

Sep 6 – Sep 14, 0001Z – 2359Z, W6O, Lebanon, MO. Lebanon Amateur Radio Club. *Route 66 on the Air.* 14.266 7.266. QSL. Bill J. Wheeler, 272 Donna Lee, Lebanon, MO 65536.

Sep 6 – Sep 15, 0000Z – 2359Z, W6K, Oklahoma City, OK. Central Oklahoma Radio Amateurs, Inc. **Route 66 On The Air**. 14.266 14.033 7.266 7.033. QSL. D. C. Macdonald Jr, PO Box 15462, Oklahoma City, OK 73155.

Sep 7 – Sep 8, 1800Z – 2300Z, W6LY, Laguna Woods, CA. Laguna Woods Amateur Radio Club. **50th Anniversary Laguna Woods Village Retirement Community**. 14.240 28.380; 14.070 PSK. Certificate & QSL. Ernie Senser W6ETS, 3031 Calle Sonora Unit B, Laguna Woods, CA 92637. *For QSL, use USPS or e-mail.* **www.qsl.net/w6ly**

Sep 8, 1500Z – 2000Z, WX0KR, Hutchinson, KS. Kansas State RACES Team. **Kansas Preparedness Day**. 21.240 14.240; 147.12 Talk in. QSL. Elk County KS Amatuer Radio Society, PO Box 70, Elk Falls, KS 67345. *The Kansas State RACES team will be operating the special event station in conjunction with Kansas Department of Emergency Management to showcase Amateur Radio & preparedness during the Kansas State Fair.* **wx0kr@yahoo.com**

Sep 11 – Sep 22, 0000Z – 2359Z, K0T, Boone, IA. Boone Amateur Radio Klub. **Day Out with Thomas 2014**. 14.275 7.275 3.875 28.375. QSL. Ron Yates, 2244 120th St, Story City, IA 50248. **www.qsl.net/kb0tlm**

Sep 12 – Sep 13, 1600Z – 2359Z, W2W, Plattsburgh, NY. Champlain Valley Amateur Radio Club, W2UXC. **Battle of Plattsburgh**. SSB 28.390 21.360 14.290 7.910; CW 28.190 21.140 14.060 7.030. QSL. John Jerdo, KA2WQK, 18 Sandy Pines Tr Prk, Keeseville, NY 12944. *The 200th anniversary of the historic Battle of Plattsburgh, Aug 31 through Sep 14 in and around Plattsburgh, NY. Info at* **www.cvarc.us**

Sep 12 – Sep 14, 1400Z – 2200Z, KK4NC, Spivey's Corner, NC. Sampson County Amateur Radio Services. **46th Annual National Hollerin' Contest**. SSB 14.264 7.264; CW 14.030; PSK31 14.070. Certificate. Cliff Ireland, 170 Pinecroft Dr, Dunn, NC 28334. KK4NC. **cliff@gmail.com**

Sep 12 – Sep 14, 1300Z – 0459Z, K4Y, Tompkinsville, KY. Monroe County Amateur Radio Group. **Old Mulkey Meetinghouse Special Event**. 28.450 14.260 7.225. Certificate & QSL. Mark D. Warren, 400 Martin Subdivision, Tompkinsville, KY 42167. *Burial site of Hannah Boone Pennington and the Old Mulkey Meetinghouse. Fri, Sep 12 is Kids Day. Local school kids will be learning the math and science of Amateur Radio. They will also experience talking on the radio. Please be patient with the children if you make a contact with them.*

Sep 13, 1400Z – 1800Z, K2R, Roseland, NJ. Roseland Amateur Radio Club. **Celebrating 69 Years of Operating**. 146.550. Certificate. Roseland Amateur Radio Club, 300 Eagle Rock Ave, Roseland, NJ 07068. *We will be operating a 2 meter simplex station at the Eagle Rock Reservation near the 911 monuments at West Orange, NJ. We will try to contact as many zip codes as possible.* **www.qsl.net/k2gq**

Sep 13, 1400Z – 2000Z, W3A, Holtwood, PA. State Line Radio Club. **Annual Picnic**. 21.280 14.240 7.240. QSL. Ted Reichenbach, 108 Park Cir, Elkton, MD 21921. **www.w3rei.com**

Sep 13, 1600Z – 2300Z, NI6IW, San Diego, CA. USS *Midway* (CV-41) Museum Ship. **USS *Midway* Commissioning Special Event**. 14.320 7.250; PSK31 14.070 D-STAR REF001C. QSL. USS *Midway* (CV-41) Museum Radio Room, 910 N Harbor Dr, San Diego, CA 92101.

Sep 13 – Sep 14, 0000Z – 2359Z, N3P, Middle River, MD. Aero Amateur Radio Club. **Battle of North Point Bicentennial War of 1812**. 21.250 14.250 7.250 3.850. Certificate.* Frank Stone, AC3P, 2228 Southorn Rd, Middle River, MD 21220. *Hard copy or electronic certificate.* **ac3p@arrl.net**

Sep 13 – Sep 14, 1600Z-1600Z, W8SAT, Grand Rapids, MI. The Salvation Army/West Michigan Northern Indiana Division Emergency Disaster Services. **SATERN's First International Response — Hurricane Gilbert 1988**. 14.265

7.265 3.977. Certificate & QSL. WMNI SATERN, 1215 Fulton St E, c/o WMNI DHQ, Grand Rapids, MI 49503. **eds-satern.sawmni.org**

Sep 13 – Sep 15, 0000Z – 0200Z, W3B, Reisterstown, MD. Baltimore Amateur Radio Club. **Bicentennial of the Writing of *The Star-Spangled Banner* During the Battle of Baltimore**. 21.290 14.190 7.225 3.815. QSL. Baltimore Amateur Radio Club, PO Box 120, Reisterstown, MD 21136. **www.w3ft.com**

Sep 14, 0900Z – 1800Z, KE2EH, Pocono Lake, PA. RAFARS. **Battle of Britain, July – Sept 1940, Commemorative Station**. 14.285 14.055 7.145 7.026. QSL. Michael Goodwin, 136 Ski Tr, Pocono Lake, PA 18347. **ke2eh@mail.com**

Sep 14 – Sep 15, 1900Z – 0100Z, N3APS, Orinda, CA. Expatriate Marylanders Radio Club. **200th Anniversary of The Writing of the Star-Spangled Banner.** 14.340 7.280. QSL. N3APS, PO Box 617, Orinda, CA 94563.

Sep 16, 1400Z – 2100Z, N9EF, Sandwich, IL. Sandwich Public Library. **Grand Opening**. 28.260 21.260 14.260 7.260. Certificate. Robert Mitilieri, N9EF, 1174 Cindy Ln, Sandwich, IL 60548.

Sep 20, 1400Z – 2200Z, K4CPO, Nashville, TN. Nashville Amateur Radio Club. **80th Anniversary.** 28.480 14.280 14.070 7.280. QSL. Nashville ARC, PO Box 290672, Nashville, TN 37229.**www.k4cpo.org**

Sep 20, 1400Z – 2100Z, K5GCC, Sherman, TX. Grayson County Amateur Radio Club. **20th Anniversary**. PSK31 14.070 7.070; SSB 14.250 7.250. QSL. K5GCC, 718 E Hwy 82 #198, Sherman, TX 75090. *We will be operating PSK31 and SSB on both 20 and 40 meters depending on band conditions.* **www.k5gcc.org**

Sep 26 – Sep 28, 1600Z – 0900Z, NW0AA, Angle Inlet, MN. Northwest Angle Radio Club. **Northwest Angle Station Activation**. 21.070 14.250 7.250 3.550. Certificate & QSL. Dan Whipple, 11726 Norway St NW, Minneapolis, MN 55448. *Northernmost radio club in the 48 contiguous states.*

Sep 27 – Sep 28, 1200Z – 2200Z, N1D, Auburn, ME. Androscoggin Amateur Radio Club. **Dempsey Challenge Bicycle Race**. 28.400 14.260 7.195. Certificate & QSL. Androscoggin ARC N1D/W1NPP, PO Box 1, Auburn, ME 04212. **www.w1npp.org**

Sep 27 – Oct 11, 0000Z – 2359Z, K0H, Smith Center, KS. M&M Amateur Radio Club. **Home on the Range Cabin Rededication and Anniversary of the Writing of the Song.** 14.250. QSL. Michael G. Saft, 220 E Kansas Ave, Smith Center, KS 66967. **kb0qgt@ruraltel.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 website.

Special Events Announcements: For items to be listed in this column, use the ARRL Special Events Listing Form at **www.arrl.org/special-events-application**. A plain text version of the form is available at that site. You may also request a copy by mail or e-mail. Offline completed forms can be mailed, faxed (Attn: Special Events) or e-mailed.

Submissions must be received by ARRL HQ no later than the 1st of the second month preceding the publication date; a special event listing for **Nov** *QST* would have to be received by **Sep 1**. In addition to being listed in *QST*, your event will be listed on the ARRL Web Special Event page. Note: All received events are acknowledged. If you do not receive an acknowledgment within a few days, please contact us. ARRL reserves the right to exclude events of a commercial or political nature.

Special Events listed in this issue include current events received through July 10. You can view all received Special Events at **www.arrl.org/special-event-stations**.

September 2014 W1AW Qualifying Runs

Earn your Code Proficiency certificate or endorsements by listening to W1AW Qualifying Runs. Legibly copy at least one minute of text by hand and mail the sheet to:

W1AW Qualifying Run, 225 Main St, Newington, CT USA 06111

Include $10 (check or money order) if this is a submission for your initial Code Proficiency certificate; $7.50 if you are applying for an endorsement (available for speeds up to 40 WPM). Your text will be checked against the actual transmissions to determine if you have qualified.

September Qualifying Runs will be transmitted by W1AW in Newington, Connecticut at 10 PM EDST on Friday, September 5 (0200 UTC, September 6) and at 7 PM EDST on Wednesday, September 17, (2300 UTC) at 1.8025, 3.5815, 7.0475, 14.0475, 18.0975, 21.0675, 28.0675 and 147.555 MHz. The West Coast Qualifying Runs will be transmitted by K6KPH on Saturday, September 13, at 2 PM PDST (2100 UTC) at 3581.5, 7047.5, 14047.5, 18097.5 and 21067.5 kHz. Unless indicated otherwise, sending speeds are from 10 to 35 WPM.

Listen for W1AW Portable Centennial QSO Party Operations in September!

September 3 – September 9	W1AW/4	Tennessee
	W1AW/7	Oregon
September 10 – September 16	W1AW/1	New Hampshire
	W1AW/5	Texas
	W1AW/0	Colorado
September 17 – September 23	W1AW/1	Connecticut
	W1AW/4	North Carolina
September 24 – September 30	W1AW/5	New Mexico
	W1AW/7	Idaho

Strays

QST Congratulates...

Parker Mitchell, KI4YAV, of Boy Scout Troop 313 in Clearwater, Florida who recently completed his Eagle Scout project. His project consisted of getting equipment and labor donated to build an Amateur Radio station in Fire Rescue Station 65 of Palm Harbor Fire Rescue as a backup means of communications in case of an emergency such as a hurricane. The completed station was tested with the Pinellas County EOC and then Parker organized training for the firemen to earn their Technician licenses and arranged for the Clearwater Amateur Radio Society (CARS) VE team to conduct a special testing session. Eight members of the fire department earned their Technician licenses. Pictured from left to right: Dan Hawthorne, AI4ET (CARS VE); Eric Mitchell, AI4WY (CARS VE); Parker Mitchell, KI4YAV; Lt Keith Maciuba, KM4BDU; FF Paramedic Ashley White, KM4BDV; Fire Chief Craig Maciuba, KM4BDX; Deputy Chief Bob Markford, KM4BDY; Deputy Chief Chad Pittman, KM4BDT; Training Chief Tim Pilson, KM4BFO; District Chief Scott Sanford, KM4BDW; Mike Branda (CARS VE) K4HN. Not pictured: District Chief Thomas Fritz, KM4BFM.

The Dawn of Single Sideband and the Story of the Drake 1-A

Amateurs embraced an exciting new voice transmission technology in the aftermath of World War II.

Ron Pollack, K2RP
k2rp@arrl.net

The decade between the mid 1950s to the mid 1960s was marked by great technological changes, especially in the Amateur Radio community. Among the most significant changes was the rise of SSB — single sideband. In a remarkably short time, SSB utterly eclipsed AM to become the most dominant form of voice communication on the amateur HF bands — a position it holds to this day.

Although SSB had been explored before World War II, it attracted the attention of amateurs in the late '40s when *QST* began to publish a column called "On the Air with Single Sideband." Much of the column welcomed individual stations to the mode, with brief descriptions of the homebrew SSB transmitters of the day.

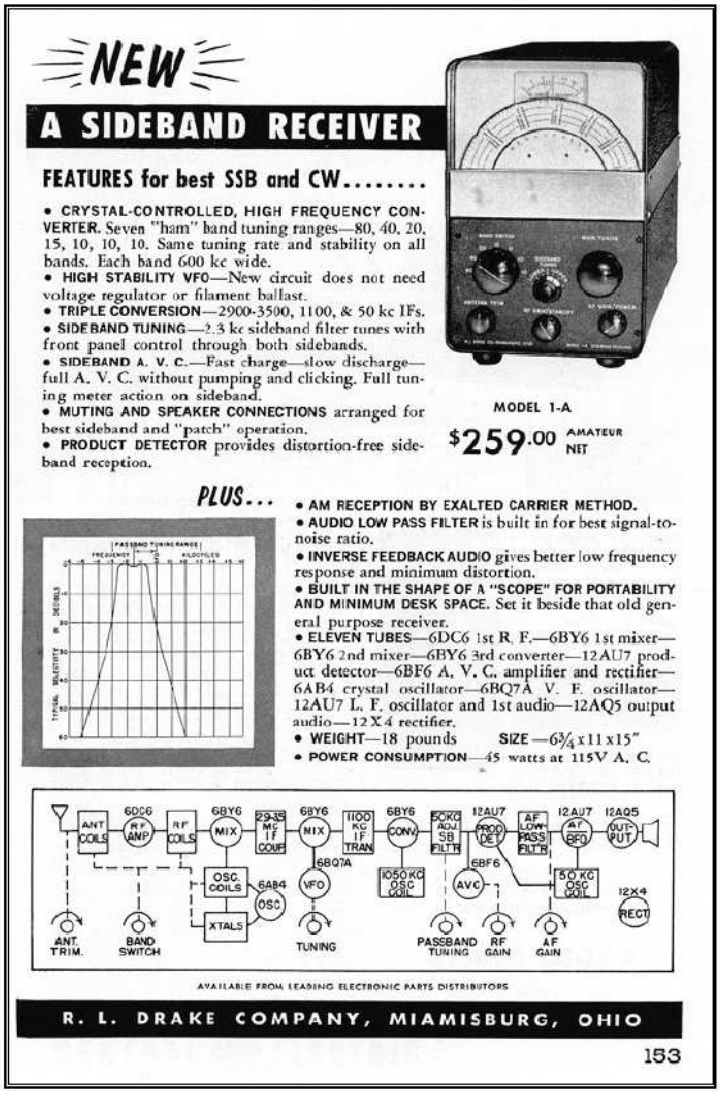
SSB transmitter technology was more complex than AM, with design requirements to match. Even so, the new mode offered irresistible advantages. As the bands became more crowded in the post-war years, the 6 kHz-wide AM signals with steady carriers caused intolerable heterodyne interference. Because an SSB signal had no carrier, there were no heterodynes, not to mention the fact that the SSB signals occupied about ⅓ the bandwidth of typical AM signals.

With the transmit power concentrated in only one sideband, an SSB transmission was far more energy efficient. As a result, an SSB transmitter required less power to operate. SSB transmitters also did not require the heavy modulation transformers needed for AM. Thus, sideband transmitters quickly became lighter and smaller than the "boat anchors" that were the order of the day.

Changing Receiver Technology

The adoption of SSB not only brought about changes in transmitter design, receivers needed to change as well. While it was possible to tune an SSB signal on one of the older radios designed for AM and CW, serious sideband work required improvements in several areas. Remember that this was a time when most amateur stations were equipped with separate receivers and transmitters.

Stability and selectivity became more important than ever before. To demodulate the SSB signal, the receiver's Beat Frequency Oscillator (BFO) needed to re-insert the "missing" carrier. In that environment, even a small amount of drift was enough to make the SSB signal unreadable. In addition, most of the existing receivers did not allow the Automatic Gain Control (AGC) to function when the BFO was enabled. This tended to cause reception problems as well.



One of the few advertisements for the Drake 1-A receiver appeared in the December 1957 issue of *QST*.

From a mechanical standpoint, SSB receivers also required a more precise tuning mechanism. With narrower SSB signals, you needed controls that allowed you to tune the signal slowly and make it comprehensible without flying right past it. The hardware in older AM receivers was often too clumsy for the job.

Manufacturers Respond

Commercial manufacturers soon produced SSB-compatible transmitters and receivers to meet the demand. Among the first was Central Electronics with its model 10A, 10B, and 20A transmitters. Later, Hallicrafters introduced their own SSB transmitters, with the HT-32 and HT-37 models becoming quite popular.

Collins was another pioneer, introducing the KWM-1 and KWM-2 models. These were milestones not only for their SSB capability, but also for introducing the idea of combining the transmitter and receiver into a single device: the *transceiver*.

Along with the successes by Collins, Hallicrafters, Hammarlund, and National to name a few, there were a number of other remarkable designs that came to market during this period. While these radios didn't become commercially successful, they did much to shape designs of the future.

The Drake 1-A

As mentioned previously, receivers of the day could make SSB signals intelligible, but they fell short of what was really needed. The new mode required receivers that were not only stable, but included features such as selectable sidebands, product detectors, AGC with fast attack and slow release time constants, and more.

Some of the early receivers incorporating these features were the Collins 75A4 (1955), Hallicrafters SX-100 (1955) and SX-101 (1956), and the Hammarlund HQ-170 (1958). They were all great performers, and were well accepted in the marketplace. In addition to SSB, they were also excellent for CW and AM.

Conventional wisdom dictated that stability was only possible with robust physical construction. This meant heavy mechanical design. Hallicrafters even advertised the SX-101 as "The New Heavyweight Champion! Heaviest Chassis in the industry!" At 70 pounds, I'm sure it was!

Robert L. Drake, owner of the RL Drake Company in Ohio, had manufactured electronic parts and accessories for the military during the war and had built some amateur accessories and consumer products afterward. He had been experimenting with SSB reception and came to believe that a new approach was necessary.

The result of his work was the Drake 1-A receiver. He was unsure whether he could build and market it profitably, so he offered the concept to National, Hammarlund, and Hallicrafters. No deal was ever made, but the owner of Universal Service in Columbus, a large Amateur Radio dealer, agreed to take the first 100 units. (Universal Service was to later become Universal Amateur Radio and finally Universal Radio.) Srepco, in Dayton, later agreed to take another 100 receivers.

According to Fred Osterman, N8EKU, co-owner of Universal Radio, "Bob Drake's idea for the 1-A was so radical at the time that he could not get any traditional manufacturer such as National, Hallicrafters, or Hammarlund to get involved with the project. He then realized if the receiver was to see the light of day, he would have to build it himself.

"Bob Drake's idea for the 1-A was so radical at the time that he could not get any traditional manufacturer...to get involved with the project. He then realized if the receiver was to see the light of day, he would have to build it himself."

Because the required tooling investment was significant, he remained hesitant to move forward. It was Gibby's (of Universal Service) offer to buy the first 100 units that gave Drake the confidence to proceed. And so RL Drake *Amateur* Radio equipment began."

The most significant milestone of the 1-A was the fact that it was the first receiver designed exclusively for SSB. Indeed, the labeling on the panel is "Model 1-A Sideband Receiver."

All the attributes important to sideband were included. Stability was accomplished by employing a crystal controlled first oscillator, with tuning provided in the second (of three) conversion stages. Front end tuning was accomplished with a preselector control, so only one stage was tuned. The oscillator tube was segregated from the rest of the heat-generating tubes to minimize drift. There was an efficient product detector, a two-speed dial, and the AGC was active continuously, with attack and release times optimized for sideband. Sideband selection was provided by variable bandpass tuning.

Another innovation was the relatively compact size of the 1-A, which was a mere 18 pounds, a sharp contrast to the heavyweight competition. Many receivers of the time also had desktop footprints in the neighborhood of 300 square inches, but the 1-A occupied only 75. The 1-A excelled in ergonomics as well. The Drake had only six knobs and switches, while the Hallicrafters SX-101 had 16! Price was important, too. The Drake was priced to sell for $100 less than the 101.

However, the total production run of this innovative radio has been estimated at only approximately 1000. That is why 1-As are in such high demand today by collectors. In contrast, the SX101 was produced for about 7 years, encompassing several minor changes. The total production is unknown, but it is certainly many times that of the Drake. At the same time, there were other competing receivers, such as the Hammarlund HQ-170 and the famous Collins 75A4 that boasted the same "sideband friendly" features, all at higher prices than the Drake. Like the Hallicrafters, these also outsold the 1-A by a large margin.

One possible reason for the sluggish sales is that there was practically no advertising. I could find only one full-page ad in *QST*. A number of hams also characterized the 1-A as "funny looking," with its resemblance to a rural mailbox. It has been suggested that the shape was chosen so that it would be the same height as the popular transmitters of the day.

Drake learned quickly. The 1-A was soon followed by the 2-A, and then the 2-B. While still small and even lighter, these receivers added AM and CW capability, and were more conventional in appearance.

These radios, especially the 2B, were great sales successes, with long production runs and many thousands produced. There is a strong collector demand for these as well. Due to the greater numbers made, however, they do not command high prices.

The legacy of these early sideband radios is present in all of our modern gear. The stability, size, and performance of our sideband equipment is often taken for granted, but it all started with the Drake.

Lauren B. Clarke, KB1YDD, lclarke@arrl.org

ARRL Foundation Presents the 2014 Scholarship Recipients

The ARRL Foundation is pleased to present the students selected to receive scholarship awards for 2014. Scholarships are made possible through the generosity of individuals and clubs. This year, 79 scholarships totaling $107,250 were awarded. Padraig Lysandrou, KC9UUS, of Bloomington, Indiana was presented with the 2014 Goldfarb Scholarship award earlier this year. The ARRL Foundation Board of Directors offers these hams their best wishes for continued success as they pursue their college degrees. The 2015 application period opens October 1, 2014; for more information please go to **www.arrl.org/scholarship-program**.

Jessica L. Abrolat, KK6IIB
Charles N. Fisher Memorial Scholarship

Michael Almeter, W4MJA
Southeastern DX Club Scholarship

Eli J. Barton, KF5MYN
Betty Weatherford, KQ6RE, Memorial Scholarship

Christopher Baxley, KK4VVT
Orlando Hamcation® Scholarship

Bryant M. Beck, KF7OSG
William Bennett, W7PHO, Memorial Scholarship

Caleb R. Begly, KD0IGQ
Irving W. Cook, WA0CGS, Scholarship

Anthony R. Bisulco, KD2BBR
Henry Broughton, K2AE, Memorial Scholarship

Jeremy Breef-Pilz, KB1REQ
Dr. James L. Lawson Memorial Scholarship

Taylor M. Brock-Fisher, KB1NOW
New England F.E.M.A.R.A. Scholarship

James E. Brooks, KJ4FZX
Richard W. Bendicksen, N7ZL, Memorial Scholarship

Morgan Burcham, KE5VFK
K2TEO Martin J. Green Sr Memorial Scholarship
Mississippi Scholarship

Tim Choldas, KC9WCJ
Six Meter Club of Chicago Scholarship

Hunter D. Clark, KC9LGG
David Knaus Memorial Scholarship

Kyle H. Clever, KC2RQO
Henry Broughton, K2AE, Memorial Scholarship

Ashley A. Coleman, KD0YTX
Paul and Helen L. Grauer Scholarship

John A. Crooke, KD0STX
Dayton Amateur Radio Association Scholarship

Marian Deacutis, KB1YLJ
Yankee Clipper Contest Club Youth Scholarship

Adam J. Donaldson, KC9VIV
Edmond A. Metzger Scholarship

Krzysztof A. Drewniak, KF5SOQ
Tom and Judith Comstock Scholarship

Dakota R. Dumont, KB1YYC
Androscoggin Amateur Radio Club Scholarship

Joshua Feng, KG6JNP
Donald Riebhoff Memorial Scholarship

Ryan Garbe, KB1ZAK
New England F.E.M.A.R.A. Scholarship

Robert J. Giuliani, K1RJG
Byron Blanchard, N1EKV, Memorial Scholarship

Mack Goodstein, K2MGG
Henry Broughton, K2AE, Memorial Scholarship

Elliott M. Gordon, AF5HH
YASME Foundation Scholarship

Philip D. Gresham, KD5IPH
Ray, N0RP, and Katie, W0KTE, Pautz Scholarship

Cortez N. Hadley, KC9MLB
Chicago FM Club Scholarship

Jason S. Harris, KJ4IWX
Victor Poor, W5SMM, Memorial Scholarship

Catherine R. Hartnek, KJ6QKY
Charles N. Fisher Memorial Scholarship

John C. Herrick, KK4BSM
Ernest L. Baulch, W2TX, and Marcia E. Baulch, WA2AKJ, Scholarship Fund

Austin R. Holden, KF5ZTW
Allen and Bertha Watson Memorial Scholarship

Christopher Howard, WA4YG
Charles Clarke Cordle Memorial Scholarship

Don P. Hull, KF7BVF
ARRL Foundation General Fund Scholarship

Andrew D. Hutchman, KD8JRZ
Robert D., W8ST, and Donna J., W9DJS, Streeter Scholarship

Alexander F. Jacobs, KB1QJJ
New England F.E.M.A.R.A. Scholarship

Levi J. Jones, K5FFA
Jackson County Amateur Radio Association Scholarship

Nicholas D. Kelley, KK4OMQ
Jake McClain Driver Scholarship

William (Liam) C. Kelly, KD0HDF
ARRL Rocky Mountain Division Scholarship

Joseph E. Landavaso, KE7DHY
YASME Foundation Scholarship

Tyler J. Lehman, KC9FKE
Ted, W4VHF, and Itice, K4LVV, Goldthorpe Scholarship

Colin T. Lieberman, KC2ZPM
Henry Broughton, K2AE, Memorial Scholarship

Jessica E. Lipa, KX8A
Dayton Amateur Radio Association Scholarship

J. Richard Lithgow, KC9LXT
Indianapolis Amatuer Radio Scholarship

Alexander M. Lozada, KK4THC
Outdoor Hams Scholarship

Helena P. Lysandrou, KC9VIM
ARRL Foundation General Fund Scholarship

Duncan MacLachlan, KU0DM
Alfred Friend Jr, W4CF, Memorial Scholarship

Alex M. Massenzio, KC2USF
Scholarship of the Morris County Radio Club of New Jersey

Johnathan D. Mayo, AB3FX
K3OMI Gary Wagner Scholarship

Carey M. McCachern, N5RM
L. B. Cebik, W4RNL, and Jean Cebik, N4TZP, Memorial Scholarship

Andrew McLuckie, K3AWM
You've Got a Friend in Pennsylvania Scholarship

Matthew R. Meredith, KB3RHD
ARRL Foundation General Fund Scholarship

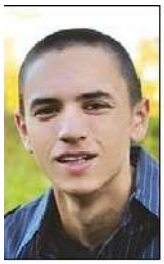
Aaron D. Morrill, NA7AM
Wilse Morgan, WX7P, Memorial ARRL Northwestern Division Scholarship

Natalie J. Nash, KC3ARZ
You've Got a Friend in Pennsylvania Scholarship

Christina L. Packard, KE4FEJ
Gwinnett Amateur Radio Society Scholarship

John T. Peters, KC9HLM
L. B. Cebik, W4RNL, and Jean Cebik, N4TZP, Memorial Scholarship

Matthew D. Preisser, KK4NSS
Dayton Amateur Radio Association Scholarship



Patrick R. Prescott, KC1AJT
New England F.E.M.A.R.A. Scholarship

Ryan B. Ruenholl, KD0FJQ
PhD ARA Scholarship

Robert M. Saylor, KK4VFR
IRARC Memorial, Joseph P. Rubino, WA4MMD, Memorial Scholarship

Jerod Schmidt, KC8TUL
Carole J. Streeter, KB9JBR, Scholarship

Kevin P. Schulz, KF7YBE
Central Arizona DX Association Scholarship

Jessica Sherrill, K0SHE
Paul and Helen L. Grauer Scholarship

Kiran A. Shila, KJ4EYN
Dayton Amateur Radio Association Scholarship

Logan M. Simpson, KF5ZUH
Louisiana Memorial Scholarship
Magnolia DX Association Scholarship

Bernard J. Socha, KB3YWW
ARRL Foundation General Fund Scholarship

Jacob Tavenner, KB3SLL
Bill Salerno, W2ONV, and Ann Salerno Memorial Scholarship

Andrew Z. Tennenbaum, KD2DYD
"Challenge Met" Scholarship

Katelyn N. VanderClute, KB1MGK
New England F.E.M.A.R.A. Scholarship

Gary W. Vicars, AB4GV
Wayne Nelson, KB4UT, Memorial Scholarship

Nicholas R. Wattendorf, N1NRW
New England F.E.M.A.R.A. Scholarship

Jesse J. Werle, KJ4CCH
IRARC Memorial, Joseph P. Rubino, WA4MMD, Memorial Scholarship

Matthew A. West, WM7MW
Mary Lou Brown Scholarship

Clifford White, W5CNW
Fred R. McDaniel Memorial Scholarship

Hamilton A. White, KD2DVJ
Norman E. Strohmeier, W2VRS, Memorial Scholarship

Joseph M. Williamitis, KD8MEP
Thomas W. Porter, W8KYZ, Scholarship Honoring Michael Daugherty, W8LSE

Zachary Yarashus, KJ4BXT
L. Phil and Alice J. Wicker Scholarship

Steven Young, KC9ENO
Bill Salerno, W2ONV, and Ann Salerno Memorial Scholarship

Rick Lindquist, WW1ME, ww1me@arrl.org

Attendance Up at 39th Annual International "Ham Radio" Exhibition

Attendance at the 39th annual international "Ham Radio" exhibition in Friedrichshafen, Germany, on June 27 – 29 was 17,100 visitors — up from 15,300 last year. "Creative Amateur Radio — Build It Yourself" was the theme for this year's show, for which Ham Radio teamed with the Maker World exhibition. Ham Radio 2014 emphasized youth-oriented themes and activities.

"A ham youth camp had participation from 100 young people up to the age of 27," said ARRL Marketing Manager Bob Inderbitzen, NQ1R, who was on the League's delegation to the show. "The young hams spent 3 nights meeting with one another and having fun." Activities included building projects, getting on the air, and taking part in a hidden transmitter hunt.

The third International Youth Meeting took place at Friedrichshafen on June 28, sponsored by the International Amateur Radio Union Region 1 and the Deutscher Amateur Radio Club (DARC). Among the presenters were 16-year-old ARRL member Alex Banbury, KE7WUD, and Gerrit Herzig, DH8GHH. Herzig, who organizes activities for youth in Braunschweig, Germany, discussed ways to interest young people in Amateur Radio — in particular, students interested in science and technology. Herzig also was on the team of students and youth leaders who launched a tropospheric balloon carrying student-built ham radio payloads from the convention grounds.

Alex Banbury, KE7WUD (left), and Gerrit Herzig, DH8GHH. [Bob Inderbitzen, NQ1R, photo]

Banbury, who earned his ham radio ticket at age 10, told one forum how he started a radio club at his high school on Washington's Mercer Island. He explained that promoting the public service aspect of Amateur Radio has been particularly successful for recruiting other students, but because the island's infrastructure is uniquely susceptible to natural or manmade disaster.

The German DX Foundation presented the K9W Wake Atoll Commemorative DXpedition with its 2013 DXpedition of the Year Award at Friedrichshafen. The DXpedition last November received an ARRL Colvin Award grant.

SP5FM, VK3ADW, Receive Michael J. Owen, VK3KI, Memorial Award

Wojciech Nietyksza, SP5FM, and Dr David Wardlaw, VK3ADW, are the inaugural recipients of the Michael Owen, VK3KI, Award, in recognition of decades of exceptional service to the International Amateur Radio Union (IARU). Owen, the award's namesake, served as IARU Region 3 chairman and Wireless Institute of Australia (WIA) president; he died in 2012. IARU Vice President Ole Garpestad, LA2RR, conferred the honor on Nietyksza at a Polish IARU member-society PZK gathering on May 17 in Warsaw. Nietyksza got involved with the IARU as a member of the team attending the 1974 Maritime Mobile World Administrative Radio Conference (WARC) in Geneva. Through WARC-2003 he was the most consistent face of the IARU at ITU and CEPT meetings and conferences. Nietyksza served as IARU Region 1 Vice Chairman from 1975 until 1999 and stayed on as member of the IARU Region 1 Executive Committee and chair of the External Relations Committee until 2002.

IARU President Tim Ellam, VE6SH/G4HUA, presented the award to Wardlaw, a former IARU Vice President, at Wireless Institute of Australia headquarters. Ellam called Wardlaw "an effective representative of both Amateur Radio and the Australian administration at the ITU." With Owen, Wardlaw was part of Australia's delegation to World Administrative Radio Conference 1979 (WARC-79), in which Amateur Radio gained 30, 17, and 12 meters. In the 1980s and 1990s Wardlaw served as an IARU Region 3 director before becoming Vice President. Ironically, it was Wardlaw who, years earlier, had interested a young Michael Owen in ham radio.

Voice of America Makes More Cuts to International Shortwave Broadcast Schedule

With no public announcement, the Voice of America on July 1 phased out some 14 hours per day of international shortwave broadcast transmissions and ceased broadcasting on some of its customary frequencies. Another 10 hours of daily cuts were made to Radio Free Europe/Radio Liberty (RFE/RL) and Radio Free Asia (RFA) broadcasts. The Broadcasting Board of Governors (BBG) oversees the VOA, RFE/RL, and RFA. Tom Witherspoon, K4SWL, who maintains The SWLing Post Internet site, said he contacted BBG spokesperson Letitia King for details on the cuts. According to information she provided, the cuts, okayed by Congress, will save taxpayers some $1.6 million annually.

"US international media must optimize program delivery by market," said the statement King provided. "We are ending some shortwave transmissions. We continue shortwave to those countries where these transmissions are still reaching significant audiences or where there are no reasonable alternative platforms at a lower cost to the BBG." King said the cuts were to "transmission platforms only," and that there would be no staff reductions. "Programming continues to be available through other media," her statement pointed out.

Embracing Change

While some aspects of Amateur Radio will certainly change, our core values will remain the same.

Jim Cluett, W1PID
jim@w1pid.com

A few months ago I hiked to Knox Mountain in the remote foothills of the White Mountains of New Hampshire. I enjoyed the timeless sights and sounds of a perfect spring day along an exquisite brook. And in my backpack, I had a complete radio station...the latest gear that our technology has to offer. I'd brought the Elecraft KX3, a software defined radio with some of the best specs around. I worked Italy, Spain, and Portugal in just a few minutes while sitting in front of a mountain pond.

I'd also brought a D-STAR handheld transceiver, the Icom ID-51. With a push of my thumb I could chat with New Zealand just as easily as I could talk with a commuter in the next town over.

What a far cry from the "boat anchors" I used as a kid more than 55 years ago! Back then I had 100 pounds of vacuum tube gear sitting on the desk. There was nothing portable about my ham radio setup. Technology has changed by quantum leaps in the last 50 years...and it's going to change even more in the next 50 years. But strangely, I think the coming years will be defined as much by the things that don't change as by the things that do change.

More Than Technology

Ham radio isn't just technology. It's the spirit of fun and adventure, of invention, the fascination with the magic of radio, the passion for experimenting and a dedication to courtesy and public service. These principles guided the radio pioneers, and must be a part of our future. I think ham radio for the coming generations depends as much upon these qualities as it does on technology.

Whatever happens with technology in the next 50 years, ham radio is going to be fun.

Throughout the ARRL Centennial Year, *QST* is sharing the thoughts of selected members as they consider the current state of Amateur Radio and the future of our avocation at the dawn of its second century.

It has to be. What we enjoy today, the coming generations will enjoy 50 years from now, although perhaps with some modification. Working DX will be fun, building will be fun, QRP, satellites, and experimenting with new gadgets, antennas, and new pieces of gear will all be fun. That's one of the reasons we're drawn to the hobby. The sheer pleasure of experimenting with magic attracted new hams 50 years ago, and it will do so 50 years from now. Fun is a cornerstone of what we do. That won't change.

The Willingness to Share Knowledge

Amateur Radio has endured and grown over the last 50 years because hams have been willing to share their knowledge and nurture newcomers to the hobby. This not only ensures the future of the hobby but the advancement of the technologies of amateur radio. The ham we guide today will be the ham who develops a new mode or technique.

My QRP hiking friend, Dick Christopher, N1LT, has been teaching classes for new hams for almost 40 years in New Hampshire. He's been responsible for training and licensing nearly 500 new hams. He's dedicated a lot of time to ensuring the future of ham radio. Of course, the content of his classes has changed over the years, but his dedication to teaching and introducing newcomers to ham radio has stayed the same. The spirit of mentoring that our grandfathers embraced will be a part of ham radio during the next century.

The Importance of Courtesy

Courtesy is a pillar of ham radio. We share a limited spectrum. Sharing requires respect, patience, and a gentlemanly spirit toward our fellow amateurs. This is not an empty platitude. We've all seen egregious examples of what happens on the bands when we transgress this simple hallmark of the hobby. No matter what aspects of Amateur Radio you enjoy, courtesy is an absolute requirement for the future of ham radio.

The Belief in Magic

Ham radio, if nothing else, is an adventure into the realms of pure magic. My friend Mike Rainey, AA1TJ, has made experimenting his sole pursuit. Years ago he vowed to use only homemade equipment. He builds a piece of gear on a breadboard, tries it out on the air for a few days and then tears it apart to begin designing his next project. He once made a voice-powered CW transmitter with a single output transistor. It generated 15 mW. I was fortunate to work him with this setup. I'm 118 miles away. He also worked W4FOA in Georgia for a distance of 923 miles. The power for this setup was created by shouting into a tin can with a speaker taped to the back of it. The speaker coil generated a tiny current. This kind of experimentation inspires the inventor hidden within us all.

Technology in the coming years will no doubt change in ways we cannot yet imagine, but the core values we bring to ham radio won't change. Embrace the core values, and the future of the best hobby in the world is assured.

Convention and Hamfest Calendar

Gail Iannone, giannone@arrl.org; www.arrl.org/hamfests-and-conventions-calendar

Abbreviations

Spr = Sponsor
Tl = Talk-in frequency
Adm = Admission

Alabama (Attalla) — Sep 13 D F H R T V
8 AM–noon. *Spr:* Gadsden ARC. Etowah County Fairgrounds, 301 Griffin St. *Tl:* 147.16 (100 Hz). *Adm:* Free. Dave Waits, K4VMV, 256-492-9562; **k4vmv1@charter.net**; **www.garc.org**.

Arkansas (Little Rock) — Sep 20
D F H R S T V
8 AM – 3 PM. *Spr:* Central Arkansas Radio Emergency Net (CAREN). Catholic High School, 6300 Father Tribou St. All-Arkansas Hamfest. *Tl:* 146.94. *Adm:* $5. Mark Barnhard, KD5AIV, 501-221-3909; **mbarnhard@aristotle.net**; **www.carenclub.com**.

SOUTHWESTERN DIVISION CONVENTION

September 12 – 14, San Diego, CA
D F H Q R S V
Friday 3 PM – Sunday noon. *Spr:* San Diego County AR Council (SANDARC). Four Points Sheraton Hotel, 8110 Aero Dr. *Tl:* 145.32 (107.2 Hz). *Adm:* advance $15, door $20. Michael Maston, N6OPH, 619-972-1148; **mastroleo@mindspring.com**; **sandarc.net/convention2014.php**.

Regional ARRL Centennial Event

PACIFIC DIVISION CONVENTION

October 10 – 12, Santa Clara, CA
D F H Q R S T V
Friday 8 AM – Sunday 1 PM. *Spr:* Mount Diablo ARC. (Pacificon 2014). Marriott Santa Clara, 2700 Mission College Blvd. Youth activities, Wouff Hong ceremony, 1-day license class, satellite demonstrations, QRP, kit building, banquet. *Tl:* 147.06 (100 Hz). *Adm:* advance $23, door $28. Misa Siemons, KJ6BUE, 925-945-8007; **pacificoninfo@pacificon.org**; **www.pacificon.org**.

Colorado (Longmont) — Sep 28
D F H R T V
8 AM – 1 PM. *Spr:* Boulder ARC. Boulder County Fairgrounds, 9595 Nelson Rd. *Tl:* 146.7. *Adm:* $5, under 13 free with paid adult. Michael Derr, W3DIF, 303-404-2161; **barc70@arrl.net**; **www.qsl.net/w0dk**.

Colorado (Pueblo) — Sep 13 F H R T
8 AM – 1 PM. *Spr:* Pueblo Ham Club. First United Methodist South Building, 325 West 10th St. *Tl:* 146.79. *Adm:* Donation. Steve Worley, KD0QCF, 719-250-5152; **sworley.sw@gmail.com**.

Connecticut (Newtown) — Sep 14
D F H R S T
8:30 AM – 12:30 PM. *Spr:* Candlewood ARA. Edmond Town Hall, 45 Main St. *Tl:* 147.3 (100 Hz). *Adm:* $6. Ron Cabral, AB1RJ, 203-938-7007; **RonCabral@optonline.net**; **www.CARARadioClub.org**.

DELAWARE STATE CONVENTION

October 4, Georgetown, DE
D H Q R S T V
6:30 AM (tailgating), 7:30 AM – 3 PM (indoor venue). *Spr:* Sussex ARA. Sussex Technical High School, 17099 County Seat Hwy (Rte 9). *Tl:* 147.09 (156.7 Hz). *Adm:* $5. Paul Ross, NR3P, 410-896-4222; **paulyross@yahoo.com**; **www.radioelectronicsexpo.com**.

Regional ARRL Centennial Events

August 16 – 17
Huntsville Hamfest, Huntsville, AL

October 10 – 12
Pacificon, Santa Clara, CA

Coming ARRL Conventions

August 16 – 17
Southeastern Division Convention, Huntsville, AL*

August 17
Kansas State Convention, Salina, KS*

August 23
West Virginia State Convention, Weston, WV*

August 24
Western Pennsylvania Section Convention, New Kensington, PA*

August 30 – 31
North Carolina State Convention, Shelby, NC*

September 5 – 7
ARRL/TAPR Digital Communications Conference, Austin, TX

September 6
Kentucky State Convention, Shepherdsville, KY*

September 6
Virginia Section Convention, Virginia Beach, VA*

September 12 – 14
Southwestern Division Convention, San Diego, CA

September 19 – 20
W9DXCC Convention, Schaumburg, IL

September 26 – 27
W4DXCC/SEDCO Convention, Pigeon Forge, TN

September 26 – 28
Mid-Atlantic States VHF Conference, Bensalem, PA

September 27
North Dakota State Convention, West Fargo, ND
Washington State Convention, Spokane Valley, WA

October 4
Delaware State Convention, Georgetown, DE

October 5
Iowa Section Convention, West Liberty, IA

October 10 – 11
Florida State Convention, Melbourne, FL

October 10 – 12
Pacific Division Convention, Santa Clara, CA

October 11
Pacific Northwest VHF Conference, Seaside, OR

October 12
Connecticut State Convention, Meriden, CT

October 18
Arkansas State Convention, Batesville, AR
Wisconsin ARES/RACES Conference, Wisconsin Rapids, WI

October 24 – 25
Oklahoma Section Convention, Ardmore, OK

November 1
TechFest Convention, Lakewood, CO

November 1 – 2
Georgia State Convention, Lawrenceville, GA

November 8
Alabama State Convention, Montgomery, AL

*See August *QST* for details.

Florida (Jacksonville) — Oct 4 R T
7 AM – 1 PM. *Spr:* Orange Park ARC. Jacksonville Dog Fanciers' Assn, 6932 Morse Ave. *Tl:* 146.67. *Adm:* Free. Greg Fitcher, N4RVD, 904-716-0187; **gfitcher@icloud.com**; **oparc.net/hamfest**.

FLORIDA STATE CONVENTION

October 10 – 11, Melbourne, FL
D F H Q R S T V
Friday 3 – 7 PM, Saturday 9 AM – 4 PM. *Spr:* Platinum Coast ARS. Melbourne Auditorium, 625 E Hibiscus Blvd. *Tl:* 146.85. *Adm:* advance $6, door $7. Don Winn, AF4Z, 321-254-9495; **hamfest2014@cfl.rr.com**; **www.pcars.org**.

Illinois (Belvidere) — Sep 13 D F H R S T V
6 AM – 3 PM. *Spr:* Chicago FM Club. Boone County Fairgrounds, 8791 IL Rte 76. *Tl:* 146.76 (107.2 Hz), 147.255 (114.8 Hz), 444.725 (107.2 Hz). *Adm:* advance $8, door $10. Steve Bosnyak, K9VO, 773-817-2744; **k9vo@arrl.net**; **www.chicagofmclub.org.**

Illinois (Peoria) — Sep 20-21 D F H Q R S V
Saturday 6 AM – 4 PM, Sunday 6 AM – 1 PM. *Spr:* Peoria Area ARC. Exposition Gardens, 1601 W Northmoor Rd. Peoria Superfest, weather balloon launch, go-kit competition. *Tl:* 147.075 (103.5 Hz). *Adm:* advance $7, door $10. Deb Suhs, KA4DEB, 309-453-9331; **ka4deb@arrl.net**; **www.w9uvi.org.**

W9DXCC CONVENTION

September 19 – 20, Schaumburg, IL
H Q S
Friday 4 PM, Saturday 9 AM – 5 PM. *Spr:* Northern Illinois DX Assn. Hyatt-Regency Schaumburg, 1800 E Golf Rd. Friday DX University Program ($30), Saturday night banquet ($45/$55). *Adm:* $45 (convention only). Coley Casey, W9LP, 847-304-8797; **casey@w9lp.com**; **w9dxcc.com**.

Indiana (Greenfield) — Sep 20 F H R T V
8 AM – 1 PM. *Spr:* Hancock ARC. First Church of God, 700 N Broadway St. *Tl:* 145.33. *Adm:* Free. Joe White, KC9UKE, 317-908-4664; **joewhite@hrtc.net**.

Indiana (Mitchell) — Oct 4 D F H R S T V
8 AM – 2 PM. *Spr:* Hoosier Hills Ham Club. Lawrence County 4-H Fairgrounds, 11265 US Hwy 50 W. Foxhunt. *Tl:* 146.73 (107.2 Hz). *Adm:* $5. William Warren, KB9TMP, 812-675-2450; **kb9tmp@arrl.net**; **www.w9qyq.org/hamfest**.

IOWA SECTION CONVENTION

October 5, West Liberty, IA
D F H R S T V
7 AM – 1 PM. *Sprs:* Muscatine and Washington Area ARCs. Muscatine County Fairgrounds, 101 N Clay St. *Tl:* 146.76. *Adm:* $7. Tom Brehmer, N0LOH, 563-263-3097; **n0loh@live.com**; **www.kc0aqs.org/hamfest.html**.

Kansas (Gardner) — Sep 13 D F H R S V
8 AM – 1 PM. *Spr:* Santa Fe Trail ARC. Johnson County Fairgrounds, 136 E Washington St. *Tl:* 147.24 (151.4 Hz). *Adm:* $5. Jim Cessna,

D = DEALERS / VENDORS
F = FLEA MARKET
H = HANDICAP ACCESS
Q = FIELD CHECKING OF QSL CARDS
R = REFRESHMENTS
S = SEMINARS / PRESENTATIONS
T = TAILGATING
V = VE SESSIONS

AC0KN, 913-782-4107; **AC0KN@arrl.net**; **www.sftarc.org**.

Kansas (Wichita) — Oct 4 D F H R V
8 AM – 1 PM. *Spr:* Valley Center ARC. River Walk Church of Christ, 225 N Waco. *Tl:* 146.94. *Adm:* $4. Steve Periman, N0YYI, 316-617-1658; **wichitaareahamfest2014@gmail.com**; **www.vcarc.org.**

Kentucky (Bowling Green) — Oct 4
D H Q S V
7:30 AM – 2 PM. *Spr:* Kentucky Colonels ARC. Sloan Convention Center, 1021 Wilkenson Trace. Vette City Hamfest. *Tl:* 147.33 (107.2 Hz). *Adm:* $6. Ed Gann, N4HID, 270-843-8911; **edwardgann@twc.com**; **vettecityhamfest.com**.

Kentucky (Richmond) — Sep 13
D F H R S T V
8 AM – 3 PM. *Spr:* Central Kentucky ARS. Madison County Fairgrounds, 3237 Old KY Rte 52. *Tl:* 145.37 (192.8 Hz). *Adm:* advance $5, door $6. Michael Rogers, KE4ISW, 859-575-2199; **gedeckt@roadrunner.com**; **www.qsl.net/ckars/**.

Maine (Alexander) — Sep 20 F H R T V
8 AM – noon. *Spr:* St Croix Valley ARC. Alexander Elementary School, 1430 Airline Rd. *Tl:* 147.33 (118.8 Hz). *Adm:* $5. Roger Holst, W1LH, 207-454-2174; **holst@midmaine.com**; **stcroixvalleyamateurradioclub.org**.

Massachusetts (Cambridge) — Sep 21. Mitch Berger, N2YIC, 617-253-3776 (9 AM – 5 PM); **w1gsl@mit.edu**; **www.swapfest.us**.

Michigan (Adrian) — Sep 14 D F H R T V
8 AM – 2 PM. *Spr:* Adrian ARC. Lenawee County Fairgrounds, 602 N Dean St. *Tl:* 145.37 (85.4 Hz). *Adm:* $5. Mark Hinkleman, NU8Z, 517-423-5906; **cqnu8z@comcast.net**; **www.w8tqe.com**.

Michigan (Wyoming) — Sep 13
D F H Q R T V
8 – 1 PM. *Spr:* Grand Rapids ARA. Home School Building, 5625 Burlingame Ave SW. *Tl:* 147.26 (94.8 Hz). *Adm:* $6. Rich Douglas, KC8NKA, 616-531-6218; **kc8nka@sbcglobal.net**; **www.w8dc.org**.

Minnesota (East Grand Forks) — Sep 13
D F H R S V
8 AM – 1 PM. *Spr:* FORX ARC. Heritage Village, 219 20th St NE. *Tl:* 146.94. *Adm:* $5. Donna Schaffer, KC0SKD, 701-739-2957; **kc0skd@arrl.net**; **www.wa0jxt.org/**.

Minnesota (Henderson) — Sep 20 D H V
8 AM – noon. *Sprs:* SMARTS Club and Sibley Emergency Radio Team. Henderson RoadHaus, 514 Main St. *Tl:* 146.61 (136.5 Hz). *Adm:* $5. Don Burgess, KC0QNA, 612-578-7561; **kc0qna@yahoo.com**.

Mississippi (Grenada) — Oct 4 F H R T V
8 AM-1 PM. *Sprs:* ARRL Mississippi Section and Grenada Lake ARC. Grenada Dam North Abutment Public Use Area (Pavillion 550), Hwy 333 Scenic Loop. "ARRL Day in the Park." *Tl:* 146.7. *Adm:* Free. Malcolm Keown, W5XX, 601-636-0827; **w5xx@vicksburg.com**; **www.arrlmiss.org**.

Nebraska (Bellevue) — Sep 27
D F H R S T V
8 AM – 2 PM. *Spr:* 3900 Club. Bellevue Volunteer Fire Department Hall, 2108 Franklin St. *Tl:* 147.06 (131.8 Hz). *Adm:* $5. Tom Huber, WD0BFO, 402-990-5135; **wd0bfo@cox.net**; **www.wd0bfo.com/hamboree-2014.html**.

New Jersey (Haledon) — Aug 23 F H R T
8 AM. *Spr:* Ramapo Mountain ARC. Camp Veritans, 225 Pompton Rd. *Tl:* 146.49 up 1 (107.2 Hz). *Adm:* $7. David Schwartz, W2DIS, 201-891-8060 ext 101; **dischwartz@apexres.com**; **qsl.net/rmarc**.

New Jersey (Mullica Hill) — Sep 14
D F H Q R T V
8 AM. *Spr:* Gloucester County ARC. Gloucester County 4-H Fairgrounds, 240 Bridgeton Pike (Rte 77). *Tl:* 147.18 (131.8 Hz). *Adm:* $8. Cory Sickles, 856-582-9146; **wa3uvv@arrl.net**; **w2mmd.org**.

New Jersey (Tinton Falls) — Sep 20
D F H R T V
8 AM – 1 PM. *Spr:* Garden State ARA. MOESC Building, 100 Tornillo Way. *Tl:* 147.045 (67 Hz). *Adm:* $5. John King, KA2F, 732-542-1822; **ka2fwb2hdj@gmail.com**; **gardenstateara.org**.

New Jersey (Wall Township) — Sep 27
D F H R T V
6 AM. *Spr:* Ocean-Monmouth ARC. InfoAge Learning Center, Project Diana Site, 2300 Marconi Rd. *Tl:* 145.11 (127.3 Hz). *Adm:* $5. Matthew Capozzoli, N2UG, 732-312-8066; **crashc79@yahoo.com**; **www.n2mo.org**.

New Jersey (West Windsor) — Sep 20
D F H R T
8 AM – 1 PM. *Spr:* Delaware Valley Radio Assn. West Windsor Community Park, Rte 571. *Tl:* 146.67 (131 Hz). *Adm:* $7. Frank Palecek, KC2TKD, 609-306-5038; **frankpal@comcast.net**; **w2zq.com**.

New York (Lancaster) — Sep 14 D F H R T
7 AM. *Spr:* Lancaster ARC. Bowen Road Grove, 3845 Bowen Rd. *Tl:* 147.255 (107.2 Hz). *Adm:* $7. Luke Calianno, N2GDU, 716-481-5747; **luke48@gmail.com**; **gbhamfest.hamgate.net.**

NORTH DAKOTA STATE CONVENTION

September 27, West Fargo, ND
D F H R S V
8 AM – 2 PM. *Spr:* Red River Radio Amateurs. Red River Valley Fairgrounds (Hartel Ag Bldg), 1805 W Main Ave. *Tl:* 145.35 (123 Hz). *Adm:* $8. Bob Kirkeby, WB0DSF, 701-541-3411; **wb0dsf@gmail.com**; **www.rrra.org**.

Ohio (Berea) — Sep 28 D F H Q R S T V
8 AM – 2 PM. *Spr:* Hamfest Assn of Cleveland. Cuyahoga County Fairgrounds, 164 Eastland Rd. *Tl:* 146.73 (110.9 Hz). *Adm:* $6. Glenn Williams, AF8C, 440-835-4897; **af8c@arrl.net**; **www.hac.org**.

Ohio (Cincinnati) — Sep 21 D F H Q R T V
8 AM – 2 PM. *Spr:* OH-KY-IN ARS. Aiken High School, 5641 Belmont Ave. *Tl:* 146.67 (123 Hz). *Adm:* advance $5, door $6. Gary Coffey, KB8MYC, 513-347-6396; **kb8myc@arrl.net**; **www.ohkyin.org**.

Oklahoma (Ada) — Sep 13 D F H R S V
8 AM – 1 PM. *Sprs:* Ada and Durant ARCs. Chickasaw Community Center, 700 N Mississippi Ave. *Tl:* 147.285 (114.8 Hz). *Adm:* $5. Chris Faulkner, KD5NQA, 580-332-1435; **kd5nqa@yahoo.com**.

Oregon (La Grande) — Sep 13 F
9 AM – 4 PM. *Spr:* W7GRA Grande Ronde RAA. La Grande Fairgrounds, 3604 N 2nd St. *Tl:* 146.98 (100 Hz), 146.55. *Adm:* Free. Mike Orcutt, KF7STP, 541-200-4872; **KF7STP@gmail.com**; **w7gra.org/**.

MID-ATLANTIC STATES VHF CONFERENCE

September 26 – 28, Bensalem, PA
D F H R S T
Friday 6:30-10:30 PM (Hospitality Suite, Registration and Table-top Flea Market), Saturday 8 AM-5 PM (Conference), Sunday 8 – 11 AM (Outdoor Tailgate). *Spr:* Mt Airy VHF Radio Club (Pack Rats). InnPlace Hotel, 3327 Street Rd. Conference Registration: advance $40, door $50; banquet advance $40, door $45. Rick Rosen, K1DS, 610-270-8884; **rick1ds@hotmail.com**; **packratvhf.com**.

Pennsylvania (Brownstown) — Oct 4
D H R T V
8 AM – 1 PM. *Spr:* Red Rose Repeater Assn. West Earl Community Park, S State St (Rte 772). *Tl:* 147.015 (118.8 Hz). *Adm:* $5, under 12 free. Allen Showalter, AB3NE, 717-397-3429; **allens011@verizon.net**; **www.w3rrr.org/**.

Pennsylvania (Sinking Spring) — Aug 16
D F H R T V
8 AM – 1 PM. *Spr:* Reading RC. Heritage Park of the Sinking Spring Area Historical Society, 992 Clematis St. *Tl:* 146.91 (131.8 Hz). *Adm:* $1 (nonham spouses and under 18 free). Harry Hoffman, W3VBY, 610-678-8976; **harryhoffmanjr@juno.com**; **www.qsl.net/w3bn/**.

W4DXCC/SEDCO CONVENTION

September 26 – 27, Pigeon Forge, TN
D H Q R S
Friday 2 – 11 PM, Saturday 9:30 AM – 11 PM. *Spr:* SouthEastern DX and Contesting Organization. MainStay Suites, 410 Pine Mountain Rd. Saturday evening banquet. *Adm:* advance $25, door $30. Layfield Lamb, W4NL, 865-898-2279; **w4nl@roslynn.net**; **www.W4DXCC.com**.

ARRL/TAPR DIGITAL COMMUNICATIONS CONFERENCE

September 5 – 7, Austin, TX
H S
Friday 8:15 AM – 6 PM, Saturday 8 AM – 6 PM, Sunday 8 AM – noon. *Sprs:* ARRL and Tucson Amateur Packet Radio. Austin Marriott South, 4415 South IH-35, Austin, Texas; **www.marriott.com/hotels/travel/ausap-austin-marriott-south/**. Friday evening Social and Saturday evening banquet. The Sunday seminar is a 4-hour presentation by an expert in the field. Register by contacting TAPR at 972-671-8277; **www.tapr.org/dcc**.

Texas (Belton) — Oct 4 D F H R T V
7 AM – noon. *Spr:* Temple ARC. Bell County EXPO Center, 301 Loop 121. *Tl:* 164.82 (123 Hz). *Adm:* $5. John Hobson, WD5BFS, 254-338-8620; **expo@tarc.org**; **www.tarc.org/hamexpo/**.

Texas (Gainesville) — Sep 27 D F H R T V
7 AM – 1 PM. *Spr:* Cooke County ARC. Gainesville Civic Center, 311 S Weaver St. *Tl:* 147.34, 442.775 (both 100 Hz). *Adm:* advance $8, door $10. Barbara Henderson, KF5TVC, 940-727-8342; **bmranch2000@gmail.com**; **www.gainesvillehamfest.org**.

Washington (Des Moines) — Aug 23 F H T
9 AM – 1 PM. *Spr:* Highline ARC. Des Moines Activity Center, 2045 S 216th St. *Tl:* 146.66 (103.5 Hz). *Adm:* $3. Dennis Reanier, W7UBA, 206-241-6812; **swapfest@highlinearc.org**; **highlinearc.org**.

WASHINGTON STATE CONVENTION

September 27, Spokane Valley, WA
D F H Q R S T V
9 AM – 4 PM. *Sprs:* Kamiak Butte Amateur Repeater Assn, NW Tri-State ARO, Palouse Hills ARC, Inland Empire VHF Radio Amateurs, Spokane DX Assn, University High School ARC, and Panoramaland ARC. University High School, 12420 E 32nd Ave. Open-cry Auction. *Tl:* 147.38. *Adm:* $5. Betsey Ashleman, N7WRQ, 509-448-5821; **n7wrq@aol.com**; **kbara.org**.

Wisconsin (Cedarburg) — Sep 27 D F R T
6 AM – 1 PM. *Spr:* Ozaukee RC. Fireman's Park, 796 Washington Ave. *Tl:* 146.97 (127.3 Hz). *Adm:* $5. Tom Ruhlmann, W9IPR, 262-377-6945; **teruhlmann@wi.rr.com**; **www.ozaukeeradioclub.org**.

75, 50, and 25 Years Ago

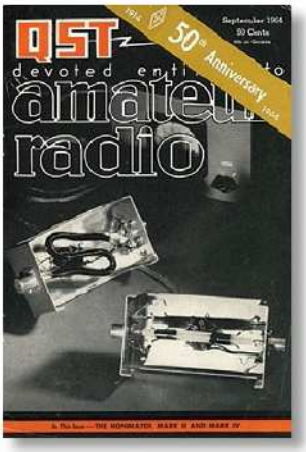
Al Brogdon, W1AB

September 1939

- The cover photo shows a compact portable and emergency station, mounted in a car trunk.
- The editorial beats the drums for the upcoming UHF Transcon tests that will relay messages on UHF — an echo of the early work of the ARRL.
- Ray Woodward, W1EAO, reports on "Hetrofil — An Aid to Selectivity," an audio phasing system to eliminate heterodynes.
- Charles Perrine, W6CUH, gives us "An Answer to the E.C.O. Problem," by designing and building an ECO that has crystal stability.
- In "High-Q Tank Circuit for Ultra-High Frequencies," Arnold Peterson reports on his high-stability oscillators for 5, 2½, and 1¼ meters.
- Don Wallace, W6AM, tells us how ham radio played an important role in the Treasure Island to Honolulu Race, in which "The Yacht 'Contender' Comes in First."
- Louis Leuck, W8ANZ, tells about building "A Portable-Emergency Utility Transmitter" for phone and CW operation.

September 1964

- The cover photo shows W1ICP's two recent remodels of the Monimatch antenna-matching indicator.
- The editorial notes, with pride, that a radio amateur — Senator Barry Goldwater, K7UGA/K3UIG — has been nominated for President of the United States, and gives us a quick look at his ham history.
- Ralph Burhans, W8FKC, describes "An I.F. Tracking Filter for Weak-Signal Reception" that uses phase-locked reception.
- National Emergency Coordinator George Hart, W1NJM, suggests ways to go about "Organizing Your Local Emergency Corps."
- Harry Gensler, K8OCO, tells about what must be the simplest electronic keyer ever, "The Neon-Bulb Keyer." The circuit uses one neon bulb, one battery, and one resistor.
- Gary Garriott, WA9FMQ, wins the *QST* Article Contest with "You and Emergency Power."



September 1989

- The cover photo montage looks at "The '70s."
- The editorial reports that the ARRL Board of Directors has voted (9-6) to petition FCC to establish a new class of amateur license with no Morse code requirement.
- Pat West, W7EA, tells about the Boeing Employees Amateur Radio Society's collaboration to put China's first repeater on the air, in "Squelch Tails from China's Great Wall."
- John Hennessee, KJ4KB, reports in words and photos on "W1AW — Rededicated."
- Doug DeMaw, W1FB, describes his work on "A 1.25- to 25-V, 2.5-A Regulated Power Supply."
- "Tales of Triumph" is a collection of three tales of Novices who learned by doing and are now heartily enjoying Amateur Radio — David Cope, KC4HMK; Steve Davidson, KC4GYD; and Janice Harding, KA3SZR.
- In "How's DX?" Ellen White, W1YL/4, discusses "Pitcairn Island's Bicentenary."

Field Organization Reports

June 2014

Public Service Honor Roll

This listing recognizes radio amateurs whose public service performance during the month indicated 70 or more points in six categories. Details on the program can be found at **www.arrl.org/public-service-honor-roll**.

625 W5DY
569 WA7PTM
413 KI6LNB
400 W4DNA
390 KE6WEZ
384 KT2D
365 KK5NU
361 K7RDB
349 KC5ZGG
340 WM2C
330 W8QAS
325 KB8QKC
305 K9LGU
285 K0IBS
282 W5KAV
280 W7PAT
267 WB9FHP
259 W8TBC
251 KF4DVF KJ4JPE
249 N8OSL
245 VE7GN
244 WB8R
235 N7EIE KJ6PCC
230 W9BGJ N7YRT K2HAT
221 AE5VY
220 W7GB N1UMJ
215 KD5RQB
210 WB9WKO
200 W4VX KK4BVR
195 KB2RTZ
190 W7FQQ K7OAH KC8YVF
185 WB8YSS
180 N8SY WA3EZN WE2G K4IWW
175 K8RDN
172 KB8VXE
170 WA5LOU WB4ZIQ
168 W4SEE
167 WB8RCR
165 KE5HYW N8FVM
160 KE4CB WB9QPM KG0GG WK4WC WD8USA
159 KF7PDV
157 W1INC
155 WBDJG
150 N8IBR WV8CH KK3F W0PZD
146 KD8AAD
145 KB2BAA WA4STO
141 KC8QWH
140 WS6P K0VTT K1PJS K7BDU
138 KJ7NO
135 WA1STU W3YVQ
134 N2DW
131 KD8HPG
130 N9VC K6JT WB2FTX W7EKB W8MAL K7BFL AK4RJ KW1U
125 AG9G W0LAW
124 KA9QWC
122 KA8ZGY
120 KA4FZI KF5IOU K4GK WB6UZX NM1K NA7G AF7FT KK7DEB KB8RCR
115 KB3LNM N7CM K7EAJ K0PTK W4TTO
114 W9EEU N1IQI
113 NA9L
112 W7JSW
110 K6HTN KJ6IJJ W1KX NX9K NC3F W9WXN NN7H KC5OZT KF5TTN KB2QQ N1JX KA1G WA2NDA KB5KKT N9MN K1HEJ WB6OTS
N7XG WS4P W2EAG
109 W4OTN
108 N3RB
107 K9DUR
106 N2RTF
105 KC9UJP KD8TTE KF7GC KK7TN N1TF
101 KJ4G
100 K8FRG K0PTK N0DUX WA0VKC WA4BAM K9JM N9EXM WA1MXT K5KV KA2HZP KA2GQQ WB8SIQ WD8Q KC8WH WA0CGZ N3SW KC2EMW NU8K KB1NMO AA3SB AJ4TH N1LKJ WB8WKQ
99 K4VWK
98 N9WLW K6JGL AB1ST WB9JSR
95 KC0ZDA
94 KR6LH
91 AB9ZA
90 KU6J W6KJ WA6IAF WC0W N3KB KA5AZK WG8Z KB8HJJ WB4BIK
WB3FTQ KZ8Q KC7ASA N4RNM
89 W2CC
88 AL7N KE5YTA
87 AB1AV
86 KT5SR W8CPG KA0DBK
85 KD0NJK AC7RB
83 WB8QLT W8IM KC8BW
82 KB9KEG KM7N
81 W0RJA WD0GUF N5MBQ
80 VE3GNA AJ7B K0DEU N0MHJ WA9QIB WB4RJW N2YJZ NS7K KF4OCU KB1WXC K8ED K8KV
79 KJ4HGH W7MIN WB8WJV
78 W4CPG W3CB KB0DTI
74 N2VC
71 K3KH KC9ZDA NF8I
70 K6RAU KJ6CNO K0RXC KD0AYN KD0USN KD7ZUP N0DUW W0FUI N0YOL

The following stations qualified for PSHR in previous months but have not been recognized in this column yet: (May) W8QAS 215, N1UMJ 210, KW1U 130, W7EKB 130, N1IQI 114, K1YCQ 110, WS4P 110, N1TF 105, AJ4TH 100, N4RNM 90, N1LKJ 80, KB1WXC 80, AC7RB 80. (Apr) W8QAS 335, K9JM 100, KU6J 90. (Mar) W8QAS 249.

Section Traffic Manager Reports

The following Section Traffic Managers reported: AK, AL, AR, AZ, CT, EMA, ENY, EPA, EWA, GA, IA, ID, IL, IN, KS, KY, LA, LAX, MDC, ME, MI, MN, MS, NC, NE, NFL, NH, NNJ, NTX, OH, OK, OR, SC, SD, SFL, SJV, SNJ, STX, SV, TN, UT, WMA, WCF, WI, WPA, WV, WY.

Section Emergency Coordinator Reports

The following ARRL Section Emergency Coordinators reported: GA, ENY, EWA, IA, ID, IN, KY, MDC, ME, MI, MN, MO, NC, ND, NLI, NM, NTX, OH, SV, WV, WWA.

Brass Pounders League

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

KK3F 2554, K6HTN 1771, WB9FHP 1620, WB6OTS 1404, K6FRG 1030, N1IQI 1012, K7BDU 670, W4VX 600, KW1U 587, WA1STU 584, KZ8Q 584, WA3EZN 541, VE3GNA 511.

BPL with Originations + Deliveries: NM1K 117, K8LJG 105.

The following stations earned BPL in May but were not listed previously in this column: VE3GNA 857, N1IQI 567.

Silent Keys

Silent Keys Administrator, sk@arrl.org

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

NG1A **Butts**, Frederick J., Quincy, MA
N1AD **Nytch**, Alexander J., Durham, CT
WA1BFA **Mallett**, David C., Waltham, MA
N1DHW **Murphy**, Frank, Cambridge, MA
KM1E **Wiseman**, Kenneth W., Arrowsic, ME
AB1ER **Abery**, Harry H. Jr, Newington, CT
KB1ESQ **Mitchell**, Vernon, Nashua, NH
KA1FSP **Whitney**, Allen F., Waterford, CT
KA1HEH **Davis**, James B., Belfast, ME
♦K1ISJ **Coggins**, Bruce I., Vineyard Haven, MA
W1JLK **French**, William A., Sebring, FL
N1LMT **Buckley**, James, Walpole, MA
KB1LPU **Quiray**, Joseph W. Jr, Harrisville, RI
AA1NP **Powers**, William P. Jr, Sutton, MA
W1NRE **Cyr**, Lyn H., North Haven, CT
K1PYJ **Godek**, Laurence J., Lincoln, RI
KA1SFH **Hill**, Robert B., Stuart, FL
W1TPK **Hall**, George E., Riverside, CT
W1VTU **Reno**, John P., Farmington, CT
WQ1X **Chartier**, Ronald L., Holyoke, MA
W1ZSG **Calkins**, David W., Westford MA
KD2ACY **Snell**, Christian S., Rochester, NY
N2AMS **Haddad**, Albert, Elmira, NY
N2BHV **Poli**, Oscar A., New Milford, NJ
W2BNJ **Wagner**, Elmer E., Lebanon, NJ
NN2C **Nusbaum**, Edwin J., Skillman, NJ
WB2CKB **Kazanowski**, Richard P., Clark, NJ
WA2CUW **Wagner**, Thomas G. Sr, Cherry Hill, NJ
KC2DOX **Fischetti**, Robert D., Hyde Park, NY
KC2DRA **Searles**, Robert W., Olean, NY
N2DWR **Bozarth**, Marla, Wenonah, NJ
ND2E **Aurelio**, Joseph A., Gray, TN
♦WB2EPR **Budinger**, Mark L. Sr, Budd Lake, NJ
K2GQH **Moore**, Stewart F., Queensbury, NY
K2IOE **Woodruff**, Thomas A., Pulaski, NY
AJ2J **Canup**, Robert E., Salisbury, NC
KA2JJW **Asselta**, Anthony, Vineland, NJ
WE2K **Snitchler**, Melvin D., Binghamton, NY
♦KE2L **Brostek**, Ronald W., Hubbardton, VT
♦W2LW **Kostenbauder**, Scott I., Poughquag, NY
♦WA2NVG **Luke**, Wallace W., Englewood, NJ
W2PJW **Patterson**, Edward A., Pleasantville, NJ
K2PRD **Sargent**, John C. Jr, King of Prussia, PA
KB2RGC **Davie**, Kevin S., Montgomery, NY
♦W2UB **Weir**, Frederick V., Clarence, NY
K2WIB **Burke**, William I., Herkimer, NY
KA2ZPX **Short**, Stephen J., Schenectady, NY
W2ZZE **Niemczyk**, Henry J., Melville, NY
KA3FNH **Ness**, Kenneth L., Red Lion, PA
WB3G **Moore**, Brian J., Saxonburg, PA
W3HPG **Curley**, Robert F., Gibson, PA
ex-W3IRR **Elliott**, Dorothy H., Rehoboth Beach, DE
W3JON **Buzzard**, Elwood, Bangor, PA
♦W3KCM **Spitzkopf**, Harry E., Mims, FL
K3KGF **McCraw**, Tommy F., Gettysburg, PA
N3MCE **Boyer**, Richard J., Waymart, PA
K3MPZ **Hairsine**, Ralph L., Wilmington, DE
W3NBK **Courty**, Charles H., Penn Hills, PA
KB3OUZ **Nelson**, William, Meshoppen, PA
W3RGH **Duffy**, Erik H., Catonsville, MD
KA3SVF **Wiles**, Dale S., Princess Anne, MD
KB3UUF **Dunkle**, Robert L., Sunbury, PA
KA3VOM **Frankenbery**, Fay N., Eighty Four, PA
KE3VU **Blank**, Mark, Finksburg, MD
KA3WDK **Longstreth**, William H., Erie, PA
K3WTZ **Smith**, Robert L., East Springfield, PA
AA3YR **Devoe**, William B., Oxford, PA
W3ZMR **Harris**, Robert D., Indian Trail, NC
KB4AES **Sasseen**, Dewey E., Paducah, KY
N4AKD **Touw**, T. K., Saint Simons Island, GA
W4EBZ **Francis**, Gerald R., Madisonville, KY
KE4FGF **Brown**, Michael F., Coolidge, GA
W4FPW **Brewer**, Grover Jr, Norfolk, VA

KB4FZT **Coolidge**, Marie G., Hypoluxo, FL
KF4GZJ **Anderson**, Ralph E., Asheville, NC
KF4HHK **Vesser**, Bobby L., New Market, TN
K4HKO **Waddell**, James A., Tarpon Springs, FL
KJ4HMI **Rickard**, James S., Fayetteville, GA
K4KEU **Fowler**, Robert E., Clemmons, NC
W4LQU **Bates**, Ross M. Sr, Nashville, TN
KB4MUV **Stutts**, Kenneth L. Jr, Salisbury, NC
KD4PH **Patton**, Kenneth N., Greenville, SC
KE4QJV **Richards**, Harry E., Palm Bay, FL
KJ4RPJ **Metcalf**, Robert J., Lexington, TN
WA4TQI **Seaberg**, Walter F. Jr, Nokesville, VA
N4TRI **German**, Fred J., Woodville, AL
KJ4UKR **Williams**, Stephen E., Cairo, GA
W4UMA **Demory**, Floyd A., Taylorstown, VA
KI4USD **Hurt**, John C., Shelbyville, KY
W4UXE **Oney**, Earnest, Winchester, VA
WB4VRP **Pollock**, Helen M., Louisville, KY
KA4WGN **Davis**, George W., Saint Charles, KY
N4YMO **Linker**, Christopher M., Concord, NC
KD4YJJ **LeBlanc**, Alfred J., Pensacola, FL
WA4ZPX **Stracuzzi**, Alice R., Ocala, FL
K4ZVQ **Aimar**, Charles E. Sr, Sullivan's Island, SC
KA5BHY **Guffey**, Robert J., Cooper, TX
W5BRA **Woodard**, George, McKinney, TX
KA5BUU **Franklin**, Glenda F., Buna, TX
K5CK **O'Malley**, John J. Jr, Fredericksburg, TX
♦K5CX **Townsend**, Howard O., Naples, TX
K5GEN **Mangum**, Gene P., Tupelo, MS
KD5HCI **Hoover**, Bennie, Linden, TX
KD5JJJ **Kessell**, R. K., Beaumont, TX
K5JJS **Thaxton**, Fred, Springhill, LA
♦K5KR **Wondergem**, John M., Metairie, LA
N5KRP **Collins**, Billy R., Combine, TX
W5MRT **Miller**, John D. Sr, West Monroe, LA
W5PLH **DeLong**, Jim H., Alamogordo, NM
N5PO **Ward**, Marion L., Weatherford, TX
WB5REB **Clarkson**, Annabeth I., Walnut Springs, TX
N5RQO **Grimes**, Sharon, Richmond, TX
KC5TES **Taliaferro**, Timothy F., Caney, KS
W5TFH **Jobe**, Sammie J., Princeton, TX
♦AK5V **Dickey**, Robert R., Benbrook, TX
N5VOA **Weaver**, David W. Sr, San Antonio, TX
N5WNL **Massey**, Glynn, Oklahoma City, OK
KK5XJ **Floyd**, William Wayne, Baird, TX
KC5YQF **Hall**, Beverly, Mountain Home, AR
N5ZCB **Moller**, Alan R., Benbrook, TX
KD6GHC **Wells**, Solomon, Fresno, CA
ex-W6GZK **Andrews**, Calvin J., Klamath Falls, OR
WA6HAN **Bailey**, Dean C., Prescott, AZ
W6LFC **Baucke**, Cyril G. Jr, Fullerton, CA
W6LIU **Woltz**, Robert L., Laguna Beach, CA
WA6NQZ **Strickland**, Marlin D., Santa Rosa, CA
K6RP **Shipman**, Wendell R., Woodland, CA
KA6UFK **Faulkner**, Christopher Y., San Diego, CA
KC6UGI **Staley**, Doris M., Lake Elsinore, CA
WA6UDR **Myers**, Arlo K. Jr, Riverside, CA
WH6UG **Inouye**, Melvin F., Honolulu, HI
WA6UTD **Sharrow**, Bruce, Novato, CA
♦KC6UTF **Burns**, Judy A., Ridgecrest, CA
W6WZM **Sumida**, Roy Y., Visalia, CA
WY6Y **Strongman**, Mildred, Lake Isabella, CA
WU7A **Beyer**, Edward H., Phoenix, AZ
KL7AI **Zeglen**, Michael P., Anchorage, AK
KT7C **Amos**, Douglas L., Queen Creek, AZ
KC7CQZ **Osterman**, John III, Kingman, AZ
K7CZ **Parfitt**, William N., Springfield, IL
♦W7KRB **Yarnall**, Wayne H., Portland, OR
N7LKH **Williams**, Robert, Wapiti, WY
W7PO **Guy**, Arthur W., Kenmore, WA
WA7QJL **Arrington**, Alden C., Ogden, UT
K7RCR **Bledden**, Kenneth C., Phoenix, AZ

N7REH **Hoban**, Robert E., Las Vegas, NV
KF7UNO **Zimmerman**, Randal J., Henderson, NV
W7WBU **Malkin**, Millard I., Vancouver, WA
WB7WFZ **Woodcock**, Donald W., Spokane, WA
KB7ZXT **Kenck**, Paul H., Chelan, WA
K8AEM **Wilson**, Walter J., Marshall, MI
K8BXW **Ayers**, Carroll W., Parkersburg, WV
N8CUN **Stuben**, Donna S., Richmond, MI
N8DTR **Clark**, Michael C., Hamilton, OH
K8EGU **Burton**, Phillip L., Grand Rapids, MI
N8FJS **Patton**, Edna, Hillsboro, OH
K8HBT **Gorman**, Bobby L., Cincinnati, OH
W8HEC **Camp**, Howard E., Muskegon, MI
ex-K8IWP **Alarie**, Albert J. Jr, Flint, MI
♦WQ8LH **Harshbarger**, B. Leon, Greenville, OH
KD8QQ **Wonders**, Stephen L. Sr, Comstock Park, MI
KC8SXG **Mertz**, Barry B., Columbus, OH
KD8SY **Pressman**, Harold B., Mason, OH
W8VAN **Chambers**, Erlin K. Sr, The Villages, FL
W8VXH **Monsion**, James W., Pinconning, MI
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Continued on page 112

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DX ENGINEERING

New!

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Protect your sensitive receiver against high levels of RF from strong or nearby signals. DX Engineering's Receiver Guard 5000 is perfect if you have a receive antenna saturated with high RF levels. It is also useful for Field Day, SWL or if your neighbor generates a lot of RF.

The RG-5000's advanced design limits strong signals with minimal harmonic noise and is RF transparent at normal receiver signal levels. Designed for the world-class multi-transmitter contest station K3LR, it offers 100% protection to expensive transceiver front-ends. The RG-5000 provides performance and frequency coverage superior to other devices. At a continuous input of 10 W maximum, output is only +10 dBm (83dB over S-9), and insertion loss is under 0.15 dBm 0.5 to 50 MHz.

DXE-RG-5000 Receiver Guard 5000 ..... **$69.95**

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Copper Ground Rod Clamp

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DXE-UCGC Copper Ground Rod Clamp..... **$48.95**

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This unit has eight individual terminals that will automatically shunt to ground when voltage spikes above 82 Vdc, in either polarity. It features a gasketed, weatherproof metal enclosure with an integrated stud for easy mounting.

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The DX Engineering Dual Vertical Array systems are available for the 160, 80 and 40 meter bands. More bands are coming soon.

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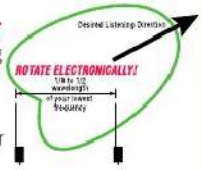

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NCC-1 Optional Receive Filters

New!

These filters are an upgrade to your NCC-1 Receive Array Phasing Unit, offering enhanced, frequency-specific directional noise and signal nulling performance. They're an excellent addition to your NCC-1 if you enjoy AM DXing, HF operation and SWL. By reducing or excluding frequency-specific signals that normally cause interference, these filters lower the noise floor of the desired pass-band to dramatically improve reception.

They have a nominal insertion loss of 1 dB. Purchase your filters in pairs, so you can match each receive antenna input to its corresponding pass-band slot on the NCC-1.

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DXE-RXFL-LP15M	Low Pass	15M & below
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DXE-RXFL-HP15M	High Pass	15M & above
DXE-RXFL-HP10M	High Pass	10M & above
DXE-RXFL-BPF160M	Band Pass	160M
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Bulk Cable	Impedance	Length	Price
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DXE-8X	50 Ω	per foot	**$0.38**
DXE-8X-1000	50 Ω	1,000'	**$299.99**
Low-Loss Cable			
DXE-213U	50 Ω	per foot	**$0.89**
DXE-213U-500	50 Ω	500'	**$389.95**
DXE-11U	75 Ω	per foot	**$0.52**
Premium Low-Loss Cable			
DXE-400MAX	50 Ω	per foot	**$0.92**
DXE-400MAX-500	50 Ω	500'	**$399.95**
Low-Loss Foam Cable			
DXE-8U	50 Ω	per foot	**$0.84**
DXE-8U-500	50 Ω	500'	**$369.95**
Highly Flexible Cable			
DXE-58AU	50 Ω	per foot	**$0.29**
Flooded Jacket Cable			
DXE-F6-CTL	75 Ω	per foot	**$0.19**
DXE-F6-1000	75 Ω	1,000'	**$149.95**

New!

*DX Engineering's Revolutionary PL-259 Connector**

A "Better Mousetrap" Approach to Your Cable.

This brand new PL-259 design has a full-diameter, full-length soldered center pin, which means it will fit snugly into a well-worn SO-239. The large center pin also makes it easier to flow solder inside, further securing the conductor. The silver plated and deeply knurled shell has precise threads to promote a solid connection with the SO-239. Each of these PL-259 connectors is insulated with a PTFE dielectric for exceptional RF characteristics. You can only get this new connector design at DX Engineering.

***Patent Pending**

The New PL-259 is Used Exclusively on DX Engineering Cable Assemblies.

DX Engineering starts with the highest-performance, low-loss 8U, 213U and 400MAX coaxial cable, and then finishes each assembly with its revolutionary new PL-259 connectors. The connectors feature a machine-crimped shield that provides a 360° electro-mechanical connection. Every weather-shielded, hand-soldered assembly is hi-pot and continuity tested in the USA. They come in multiple lengths; custom lengths are also available.

Made in USA

DX Engineering is the Best Place to Get Coax, Here's Why:

- 100% High Voltage (Hi-Pot) Tested
- Weatherproof: Adhesive Shrink Tubing Seals Connections
- Silver-plated PTFE-insulated Connectors
- Hand Crafted by Top Techs
- See DXEngineering.com for more connector options

Black PVC Jacket

DXE-8U 50 Ω Low-Loss Foam Dielectric Cable

- .405" high-flex PVC jacket

Attenuation per 100 feet	Power Rating	Efficiency
0.3 dB @ 5 MHz	5.4 kW	93%
0.5 dB @ 10 MHz	4.1 kW	90%
0.9 dB @ 30 MHZ	2.2 kW	81%
1.2 dB @ 50 MHz	1.8 kW	77%
2.2 dB @ 150 MHz	1.0 kW	60%

UV-Resistant, Non-Contaminating, Black PVC Jacket

DXE-213U 50 Ω MIL-Spec Cable

- .405" Type II UV-resistant jacket is non-contaminating and suitable for outdoor use

Attenuation per 100 feet	Power Rating	Efficiency
0.4 dB @ 5 MHz	4.9 kW	90%
0.6 dB @ 10 MHz	3.4 kW	87%
1.0 dB @ 30 MHz	2.0 kW	79%
1.3 dB @ 50 MHz	1.5 kW	73%
2.4 dB @ 150 MHz	0.9 kW	57%

UV-Resistant, Non-Contaminating, Black PE Jacket

DXE-400MAX 50 Ω Premium Low-Loss Cable

- Gas-injected foam, polyethylene dielectric bonded tape foil covered by a braided copper shield
- .405" low-density UV-resistant polyethylene jacket is ideal for outdoors
- Direct-bury

Attenuation per 100 feet	Power Rating	Efficiency
0.3 dB @ 5 MHz	6.9 kW	93%
0.5 dB @ 10 MHz	4.8 kW	90%
0.8 dB @ 30 MHz	2.8 kW	83%
1.1 dB @ 50 MHz	2.1 kW	79%
1.8 dB @ 150 MHz	1.2 kW	65%
3.3 dB @ 450 MHz	0.7kW	47%

UV-Resistant, Black PE Jacket

DXE-8X Low-Loss Foam Dielectric Cable

Known as RG-8X or Mini-8

- Very flexible; ideal for short, in-shack jumper cables
- .242" Type II jacket is non-contaminating and UV-resistant
- Direct-bury

Attenuation per 100 feet	Power Rating	Efficiency
0.6 dB @ 5 MHz	3.0 kW	86%
0.9 dB @ 10 MHz	2.2 kW	81%
1.4 dB @ 30 MHz	1.2 kW	69%
2.0 dB @ 50 MHz	0.9 kW	62%
3.8 dB @ 150 MHz	0.4 kW	42%

DX Engineering Cable is Available in Pre-Cut Assemblies with Connectors.

DX Engineering Cable Assemblies are built by our techs, right here in Ohio. They're fully tested and are ready for installation in your shack. For all lengths and connector options, visit DXEngineering.com.

Pre-cut Cable, PL-259 Connectors		
Part Number	Length	Price
DXE-8UDX002	2'	**19.95**
DXE-8UDX003	3'	**$20.95**
DXE-8UDX006	6'	**$23.95**
DXE-8UDX025	25'	**$43.95**
DXE-8UDX050	50'	**$68.95**
DXE-8UDX100	100'	**$118.95**

Pre-cut Cable, PL-259 Connectors		
Part Number	Length	Price
DXE-213UDX003	3'	**$20.45**
DXE-213UDX006	6'	**$22.45**
DXE-213UDX012	12'	**$26.45**
DXE-213UDX025	25'	**$43.45**
DXE-213UDX050	50'	**$68.45**
DXE-213UDX075	75'	**$96.45**
DXE-213UDX100	100'	**$118.45**
DXE-213UDX150	150'	**$178.45**

Pre-cut Cable, PL-259 Connectors		
Part Number	Length	Price
DXE-400MAXDX003	3'	**$21.45**
DXE-400MAXDX006	6'	**$24.45**
DXE-400MAXDX018	18'	**$31.45**
DXE-400MAXDX025	25'	**$44.45**
DXE-400MAXDX050	50'	**$69.45**
DXE-400MAXDX075	75'	**$97.45**
DXE-400MAXDX100	100'	**$119.45**
DXE-400MAXDX150	150'	**$179.45**

Pre-cut Cable, PL-259 Connectors		
Part Number	Length	Price
DXE-8XDU003	3'	**$18.45**
DXE-8XDU006	6'	**$19.45**
DXE-8XDU012	12'	**$24.45**
DXE-8XDU025	25'	**$29.45**
DXE-8XDU050	50'	**$37.45**
DXE-8XDU075	75'	**$44.45**
DXE-8XDU100	100'	**$54.45**
DXE-8XDU150	150'	**$79.45**

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Source Code: QST 2/2014

Specified by Commercial and Amateur Designers

DX® ENGINEERING

Only $109 Freight to Lower 48 United States

Heavy-Duty 4130 Chromoly Steel Masts

Start stacking some serious antennas. These 2" and 3" O.D., 22' masts feature a 0.250" wall thickness and meet ASTM A-513 Type 5 ratings. The cold-drawn, electric-weld carbon-steel masts have a galvanized surface that creates an almost polished appearance.

- Certified yield stress rating over 100,000 psi
- Tensile strength minimum above 110,000 psi
- Stress-relieved for consistent mechanical strength
- Minimum Rockwell B hardness is 96

Use DXEngineering.com's exclusive online Mast Load Estimator to find the perfect mast for your setup.

DXE-ST200CM-22 2" O.D. Heavy Duty Mast, 22' **$399.95**

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Exclusively from DX Engineering

160M Preamplifier

New! KD9SV Products

This preamp could make the difference between barely hearing distant stations and actually working that rare DX. It features a BF981 FET ultra low-noise design. Gain is adjustable from 10 to 28 dB. The preamp is specifically tailored for monoband 160M operation. Visit DXEngineering.com for more options from KD9SV Products.

SVP-SV-160 160 Meter Preamp with Band Pass Filter **$91.95**

Hustler Verticals with DX Engineering Performance and the Lowest Prices!

Add Bands to Your BTV!

The easiest assembly and tuning of any multi-band vertical. DX Engineering stocks replacement parts for all BTV antennas.

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HSR-6BTV	10, 15, 20, 30, 40, 75-80M	**$209.95**
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DXE-AOK-80M	80M Add-On Kit for BTV	**$64.95**

TX38 Tri-Band Yagi

2X Arrays

Get on the 20/15/10 meter bands with an antenna that can withstand 100 mph winds. Its durability makes it ideal for permanent installations, but it's compact and light enough to be used during Field Day. The TX38 was also selected as the official tri-band antenna of WRTC 2014.

TXA-3B-8L-WRTC TX38 Yagi Antenna ..... was ~~$1,199.00~~
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DX Engineering Clamps are Specified by Scientific, Military & Government Designers, & Used by Antenna Builders: Both Commercial & Amateur.

Highest Quality—Lasting Performance!

Whether you are building a Yagi from scratch, refurbishing a well-used "old friend," or experimenting with a new antenna project, DX Engineering can supply the best hardware for your application. You can find useful tips and complete dimensions for each clamp and bracket type at DXEngineering.com.

SignaLink™ USB Unit from Tigertronics

PSK-31, RTTY and more! Powered by your computer's USB port, this unit is compatible with both PCs and Macs, and works with virtually every radio. The SignaLink supports all sound card digital and voice modes. It's easy to install and set up, and software is included.

TGR-SL-USB SignaLink™ **$85.00**

You'll need the right radio cable to get started. Right now, any interface cable is only **$14.95** when you buy a SignaLink.

Coaxial Cable Grounding Brackets

These stainless steel brackets have two holes for chassis- or bulkhead-mount connectors (not included). Each bracket comes with a stainless steel V-bolt and hardware.

DXE-CGB-150 Bracket for 0.50" to 1.50" O.D. Tube..... **$15.95**

DXE-CGB-200 Bracket for 1.00" to 2.00" O.D. Tube **$15.95**

Guy Rings

Use DX Engineering's Guy Rings to secure your rope guys and stabilize your aluminum vertical antenna. They work with three- and four-way guying systems and are a great complement to our tubing kits. These guy rings are super strong, virtually impervious to the elements and fit 0.75", 1.0", 1.25", 1.50" and 2.0" O.D. tubing.

DXE-GR-5P Set of 5 Guy Rings..... **$8.95**

Telescoping Fiberglass Antenna Tubing Kits

These kits contain seven sections of high quality smoothly telescoping tubing from 2" to 1/2" O.D. and new DX Engineering Compression Clamps for maximum tubing grip and strength. Perfect for portable operation, camping, Field Day or experimenting, these kits are an excellent way to get your antenna wire in the air quickly.

DXE-FTK50A Fiberglass Antenna Tubing Kit, 50' Max. Length..... **$198.95**

The Best Aluminum Tubing Available

Just Add Clamps and Slide It Together for a Complete Antenna Element!

6063-T832 Aluminum Tubing

- Better than the other guys, at same price
- Order from us and the competition—We're sure that you'll send theirs back
- Smoothly telescoping pre-slit or un-slit lengths
- Custom made just for DX Engineering

3' lengths .058" wall - 3/8" to 2 1/8" O.D.

6' lengths .058" wall - 3/8" to 2 1/8" O.D.

Perfect for Most Elements

6061-T8 .120" wall - 1.5" to 3" O.D. un-slit

For Booms and HD Element Designs

DXE-ATK65 Aluminum Antenna Tubing Kit, 65' Max. Length..... **$229.95**

See DXEngineering.com for specs and additional tubing. DX Engineering has All-Stainless Steel Element Clamps to fit exact tubing sizes.

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Z-11ProII

Designed for battery operation. Handles 0.1 to 125 watts, great for both QRP and standard 100 watt transceivers from 160 - 6 meters. It will match dipoles, verticals, inverted-Vs or virtually any coax-fed antenna.

Suggested Price $179.99

Z-100Plus

Runs on any voltage source from 7 to 18 volts; six AA batteries will run it for a year of normal use. Includes an internal frequency counter so the operating frequency is stored with tuning parameters.

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ALL TUNERS 2000 MEMORIES

Z-817H

Powered by four AA internal Alkaline batteries. Covers 160 through 6 meters. The ultimate autotuner for QRP radios including the Yaesu FT-817(D) with addition of the Tokyo High Power HL-45B.

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radio not included

Z-817

Powered by four AA internal Alkaline batteries. Covers 160 through 6 meters. The ultimate autotuner for QRP radios including the Yaesu FT-817(D).Tuning is simple; one button push - the Z-817 takes care of the rest.

Suggested Price $129.99

radio not included

AT-897Plus

Mounts on the side of your FT-897 just like the original and takes power directly from the CAT port of the FT-897 and provides a second CAT port on the back of the tuner so hooking up another CAT device couldn't be easier.

Suggested Price $199.99

AL-100

Compatible with all Alinco radios including the new DX-SR8T (includes Alinco interface cable). The AL-100 is the definitive low cost automatic antenna tuner for the definitive low cost Amateur transceiver!

Suggested Price $149.99

IT-100

Matched in size to the IC-7000 and IC-706. Control the IT-100 and its 2000 memories from either its own button or the Tune button on your IC-7000 or other Icom rigs. For your Icom radio that is AH-3 or AH-4 compatible.

Suggested Price $179.99

YT-100

For Yaesu FT-857, FT-897 and FT-100 (and all D models) an integrated tuner, powered by the interface. Press the tune button on the tuner, and everything else happens automatically.

Suggested Price $199.99

YT-847

YT-847 Autotuner is an integrated tuner for the Yaesu FT-847. An included CAT/Power cable interfaces with your FT-847. Just press the tune button on the tuner and everything else happens automatically!

Suggested Price $249.99

KT-100

For AT-300 compatible Kenwood transceivers (except TS-480HX). The KT-100 allows you to use the Tune button on the radio. 2,000 memories for instant recall of tuning parameters for favorite bands and frequencies.

Suggested Price $199.99

YT-450

Interfaces directly with the Yaesu FT-450 and FT-950 radios. Press the tune button on the tuner and the rest happens automatically. It will quickly match nearly any kind of coax fed antenna with an SWR of up to 10:1.

Suggested Price $249.99

Your Favorite Dealer has these tuners in stock NOW! Don't Miss Out - Call or visit them TODAY!

hy-gain® Rotators

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

HAM-IV

HAM-IV **$649.95**

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

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

TAILTWISTER SERIES II

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

T-2X **$799.95**

T-2XD **$1229.95** with DCU-1

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

CD-45II

CD-45II **$449.95**

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

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

HAM-V

HAM-V **$1099.95** with DCU-1

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

AR-40

AR-40 **$349.95**

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

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

HDR-300A

HDR-300A **$1499.95**

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

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

ROTATOR OPTIONS

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

Digital Automatic Controller

DCU-1 **$749.95**

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

AR-303 Rotator/Controller

AR-303 **$99.95**

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

RBD-5 **$29.95**

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

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FT-1DRBHD 2M/440 FM HT

• TX: 2M/70cm • Wideband RX: 500kHz-999MHz (less cellular with AM/FM broadcast) • Power: 5W • Analog and Digital (12.5kHz C4FM FDMA) • Integrated GPS • CTCSS/DCS Encode & Decode • WX Receiving with WX Alert • Digital Group Monitor Function • GSM (Group Short Message) • Snapshot Function with optional Speaker Mic

$40 MAIL-IN REBATE

FTM-400DR 2M/440FM Transceiver

$40 MAIL-IN REBATE

TX: 2M/70cm RX: 108-470/800-999MHz (cell blkd) • Power: 50W FM • C4FM FDMA w/GPS for APRS (1200/9600bps) • Packet Ready Color display • Spectrum scope • ARTS • Bluetooth • Twin RX• MicroSD slot • 12/30kHz filters • 500 memories/band

$60 MAIL-IN REBATE

FT-270R 2M FM HT

• TX: 144-148 • RX: 136-174 • Power: 5/2/0.5W • 200 Memories • Extra large LCD display & speaker

VX-6R 2M/440 FM HT

•TX: 144-148, 222-225, 430-450 • RX: 0.5-999 (cell blkd) • Power: 5/2.5/1/0.3W (1.5W on 220) • 900 Memories

VX-8DR 6M/2M/440 FM HT

• TX: 50-54, 144-148, 222-225, 430-450 MHz • RX: 0.5-999 MHz (cell blocked) • 1200+ Memories • Power: 5/2.5/1/0.05W (1.5W on 220 MHz) • Optional GPS Unit FGPS-2 with either CT-136 adapter or MH-74A7A hand microphone provides APRS® data

$30 MAIL-IN REBATE

FT-2900R Heavy Duty Wide/Narrow, Deviation Section 2M FM Mobile

• TX: 144-148 MHz • RX: 136-174 MHz • Power: 75/30/10/5W • 3W of Audio for for Noisy Environments • Massive Heat Sink (No Cooling Fan Needed) • 221 Memories • Dual Watch • Versatile Scanning Capability • WX Channels with "Severe Weather" Alert • CTCSS and DCS Encode/Decode Built-in • Transmit Time-Out timer • Automatic Power Off

$80 MAIL-IN REBATE

FT-450D HF/6M Transceiver

• TX: HF/6M • RX: 0.03-56 MHz • Power: 10-100W • Memories: 500 • Built-in Automatic Antenna Tuner • IF DSP • Same as the original FT-450AT with new features: Key illumination, Foot stand, Selectable 300 Hz/500 Hz/2.4 kHz CW IF Filters • Classically designed main dial and knobs • dynamic microphone

FTDX-1200 HF/6M Transceiver

• TX: HF/6M • RX: 0.03-56 MHz • Triple Conversion with 32-bit floating point DSP • Power: 100W • Built-in Automatic Antenna Tuner • 40 MHz IF with selectable 3 kHz, 6kHz & 15 kHz Roofing Filters • FM & AM Wide and Narrow modes included • Optional built-in FFT UNIT supports advanced functionality including AF-FFT Scope • RTTY/PSK31 Encode/Decode • CW Decode and CW Auto Zero-in • Full Color 4.3 in. TFT Color Display • USB port

FTDX-3000D HF/6M Transceiver

• TX: HF/6M • RX: 0.03-56 MHz • Power: 5-100W • Large TFT color display • High-speed spectrum scope • High end receiver based off of the FTDX-5000 • IPO • Built-in USB interface • Remote Control Capability • High-speed auto antenna tuner • RTTY/PSK31encode/decode included • 5 Digital voice messages

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IC-V80HD 2M FM Handheld

• TX: 144-148 • RX: 136-174 MHz • Power: 5.5/2.5/0.5W • Memories: 207 • Comes with Li-Ion Battery and Rapid Charger

IC-V80 SPORT 2M FM Handheld

• No NiMH Battery or Charger • Has AA Battery Case which accepts standard or alkaline batteries

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• TX: 144-148 MHz • RX: 118-174 MHz • Tested to the latest MIL-STD 810G Specifications • Heavy Duty Power: 65/25/10/5W • 4.5W Audio Output • 207 Memories • CTCSS and CTCSS encoder/decoder

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HF/VHF/UHF All Mode Transceiver

• TX: HF/6M/2M/440MHz • RX: 0.03-199.999, 400-470 MHz MHz • Power: 2-100W/2-50W (2M)/2-35W (440) • Memories: 495, 900 D-Star Repeater Channels • Remote Head • Intuitive Touch Screen Interface • D-Star DV Mode • Detachable Angled Screen • SD Memory Card Slot • USB Port • Optional RS-BA1 Remote Control Software • Optional RC-28 USB Remote Encoder

$100 INSTANT COUPON

IC-7200 HF/6M Portable Transceiver

• TX: HF/6M • RX: 0.03-60 MHz • Power: 2-100W • Memories: 201 • Rugged design for outdoor use • 32-bit IF-DSPs + 24-bit AD/DA Converters • USB Port for CI-V Format PC Control and Audio In/Out

$75 INSTANT COUPON

IC-7410 HF/6M Transceiver

• TX: HF/6M • RX: 0.03-60 MHz • Power: 2-100W • 15kHz 1st IF Filter and optional 3kHz & 6kHz filters to protect against strong unwanted adjacent signals • Much faster DSP unit compared to the IC-746PRO • Automatic antenna tuner • USB connector for PC control

$100 INSTANT COUPON

IC-7600 HF/6M Transceiver

• TX: HF/6M • RX: 0.03-60 MHz • Power: 2-100W • Memories: 101 • 5.8 inch color screen • High-resolution real spectrum scope • Automatic antenna tuner

$100 INSTANT COUPON

IC-9100 HF/6/2M/440 MHz All Mode

• TX: HF/6/2M/440 MHz • RX: 0.03-60, 136-174, 420-480 MHz • Optional 1.2 GHz, 1-10W Operation • Power: 2-100W HF/6/2M & 2-75W 440 MHz • Memories: 297 • Optional D-Star Board • Auto Tuner • +30dBm class third-order intercept point • Optional 3 kHz & 6 kHz Roofing Filters (first IF) • USB Port for PC Control • Optional Remote Control Software • Optional RC-28 USB Remote Encoder • Much More!

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You can read Complex Impedance as series resistance and reactance (R+jX) or as magnitude (Z) and phase (degrees).

Determine velocity factor, coax cable loss in dB, length of coax and distance to short/open.

You can read SWR, return loss and reflection coefficient at any frequency simultaneously.

Read inductance (uH) and capacitance (pF) at RF frequencies.

Large easy-to-read two line LCD screen and side-by-side meters clearly display your information.

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MFJ-266C 1.5-65, 105-230 300-490 MHz -- *all* Ham Bands

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MFJ-269C*PRO™* Analyzer

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New high voltage *current balun* lets you tune balanced lines at high power with no worries.

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Two knob tuning (differential capacitor and *AirCore™* roller inductor) makes tuning foolproof and easier than ever. Gives minimum SWR at only one setting. Handles 3 KW PEP SSB amplifier input power (1.5 KW output). Gear-driven turns counter, lighted peak/average Cross-Needle SWR/Wattmeter, antenna switch, balun. 1.8 to 30 MHz. 10¾Wx4½Hx15 in.

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MFJ-969 **$229.95**

Superb *AirCore™* Roller Inductor tuning. Covers *6 Meters* thru 160 Meters! 300 Watts PEP SSB. *Active* true peak reading lighted Cross-Needle SWR Wattmeter, *QRM-Free PreTune™*, antenna switch, dummy load, 4:1 balun, Lexan front panel. 3½Hx10½Wx9½D inches.

MFJ-949E *deluxe* 300 Watt Tuner

MFJ-949E **$179.95**

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MFJ-941E **$139.95**

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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.

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MFJ-16010 **$69.95**

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MFJ-921 covers 2 Meters/220 MHz. **MFJ-924** covers 440 MHz. SWR/Wattmeter. 8x2½x3 in.

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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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Small, Ant Switch, 20K VA Memories

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200 Watt *MightyMite*™

Matches IC-706, FT-857D, TS-50S

No *extra space needed!* Just set your IC-706/7000, FT-857D, TS-50S on top of this matching low-profile automatic tuner -- it's all you need for a completely automated station using *any* antenna! Just tune and talk!

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G5RV Antenna

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Covers all bands, 160-10 Meters with antenna tuner. 102 ft. long. Can use as inverted vee or sloper. Use on 160 Meters as Marconi.1500 Watts. Super-strong fiberglass center/feedpoint insulators. *Glazed ceramic* end insulators. All hand-soldered connections. Add coax, some rope and you're *on the air!*

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for Remote/Outdoor/Marine

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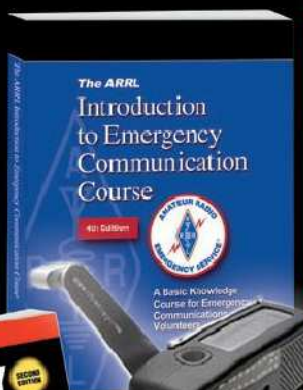

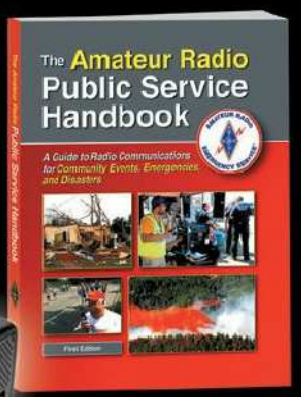


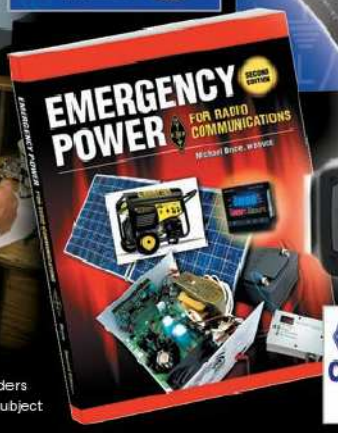


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QST 9/2014

TIMEWAVE TECHNOLOGY INC.

Available at:
- Universal Radio
- AES
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- R&L Electronics

The *Navigator* Sound Card Modem

See QST Short Takes Review - May 2014-P. 62

- **Single USB connection to computer**
- **USB Sound Card built-in**
- **USB Powered**
- **Universal Rig Control built-in - logic level +/-, CI-V, CAT, & RS-232!**
- **Software Configuration - *No jumpers!***
- **FSK Controller for Precise RTTY**
- **K1EL Paddle & Keyboard Precise CW**
- **Separate COM ports for PTT, FSK, CW, CI-V/CAT & RS-232 - *no port splitters!***

- ***Quiet - hear what others miss!***
- ***Convenient - No annoying jumpers!***
- ***Precise - FSK & CW controllers on board***
- ***Complete - Six COM ports***

The *Navigator* is a complete USB sound card modem featuring a proven USB audio sound card chip, six FTDI USB serial COM ports, a K1EL WinKeyer, True FSK and rig control connections for every radio. It has a built-in USB sound card with isolated audio I/O to your radio to prevent ground loops. A second audio input lets you use both receivers in a dual receiver radio. The logic level and RS-232 rig control ports support your Icom CI-V, Yaesu CAT, Kenwood and other radios. Front panel controls set both RX audio levels, TX audio ouput level, audio monitor level and the CW speed. There are no annoying internal configuration jumpers - just conveniently set the software-controlled configuration settings from your PC.

Need Software? Check the Ham Radio Deluxe & Radio Operating Center bundle!
Optimized for the Navigator, PK-232SC+ and other Timewave/AEA TNCs www.ham-radio-deluxe.com

PK-232SC+ with New Dual Port Option!

PK-232SC+ Multimode Data Controller*

Sound Card, Rig Control, USB, Pactor, RTTY, CW Packet, Dual Port Option & more!

100,000 sold - All-time top selling data controller!

- **Dual Port - two radios at same time!**
- **Single USB connection to computer**
- **USB Sound Card built-in**
- **3-Way Rig Control built-in - logic level, RS-232 & USB!**
- **Computer isolated from radio**
- **Real FSK and high-speed keyboard CW**

For the first time in 23 years, we tweaked the PK-232's main PC board! Now with a dual port option, the incredible PK-232SC+ again expands its role in your radio station. The new PK-232SC+ can operate legacy modes on one port and sound card modes on the other - simultaneously! The SC+ connects to your computer with a single USB cable - no audio cables, no RS-232 cables! It has a built-in USB sound card with isolated audio I/O to your radio to prevent ground loops. The logic level and RS-232 rig control is optically isolated for your Icom CI-V, Yaesu CAT, Kenwood and other radios. A new optically isolated DTR PTT option works with legacy sound card software and radios. We even added a pair of USB ports for that new radio with USB rig control and other accessories.

**Upgrade any PK-232 to the PK-232SC with New Lower SC & DSP Upgrade Combo Pricing!*

Customize your PK-232 installation with our complete line of upgrades, accessories and cables.

- **HamLinkUSB™ Rig Control +**
  CI-IV, CAT, RTS (PTT, FSK or CW) for sound card software
  Perfect for HRD owners with simple sound card adapters
- **HamLinkUSB™ USB-to-RS-232 Adapter**
  Proven FTDI Chip. 9 and 25 pins for all radios and TNCs!

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MFJ G5RV Antennas

Operate all bands 10 thru 160 Meters with a single wire antenna!

MFJ-1778
$44.95

The *famous G5RV antenna is the most popular ham radio antenna in the world!* You will transmit and receive strong signals day and night.

And it's no wonder . . . it's an efficient, *all band* antenna that's only 102 feet long -- shorter than an 80 Meter dipole. Has 32.5 foot ladder line matching section ending in SO-239 connector for your coax feedline.

Use as Inverted Vee or Sloper and it's even more compact and needs just one support.

With an antenna tuner, you can operate all bands 80 Meters through 10 Meters and even 160 Meters with a ground.

MFJ's fully assembled G5RV handles 1500 Watts. *Ceramic* end and fiberglass center insulators. *Hang and Play™* -- add coax, some rope to hang and you're on air!

MFJ-1778M, $39.95. *Half-size*, 52 foot *G5RV JUNIOR* covers 40-10 Meters with tuner. Handles full 1500 Watts.

MFJ All Band Doublet

MFJ-1777
$59.95

MFJ-1777 is a 102 foot *all band* doublet antenna that covers 160 through 6 Meters with a balanced line tuner. Super strong custom fiberglass center insulator provides stress relief for ladder line (100 ft. included). Authentic *glazed ceramic* end insulators. Handles full 1500 Watts.

MFJ *Dual Band* 80/40 *or* 40/20M Dipoles

MFJ-17758
$89.95
80/40 Meters

MFJ-17758 is a short *dual band* 80/40 Meter dipole antenna that is only 85 feet. *Full-size* on 40 Meters with ultra-efficient end-loading on 80 Meters. Full 1500 Watts. Super-strong injection-molded center insulator with *built-in* SO-239 connector and hang hole. Solderless, crimped construction. 7-strand, #14 gauge hard copper wire. Connect your coax feedline directly, *no tuner needed.*

MFJ-17754, $59.95. Short *dual band* 40/20 Meter dipole antenna is only 42 feet. *Full-size* on 20 Meters, ultra-efficient end-loading on 40 Meters. 1500 Watts. Center insulator with SO-239 connector and hang hole.

MFJ *Single Band* Dipole Antennas

Ultra high quality center fed dipoles will give you trouble-free operation for years. Custom injection-molded UV-resistant center insulator has built-in coax connector and hanging hole. Heavy duty 7-strand, 14-gauge hard copper antenna wire. Extremely strong solderless crimped construction. Authentic *glazed ceramic* end insulators. Use as horizontal or sloping dipole or inverted vee. Handles full 1500 Watts. Simply cut to length for your favorite frequency with cutting chart provided.

MFJ-1779A **$69.95** 160M, 265 ft.
MFJ-1779B **$49.95** 80-40M, 135 ft.
MFJ-1779C **$29.95** 20-6M, 35 ft.

True 1:1 Current *Balun & Center Insulator*

MFJ-918
$24.95

True *1:1 Current Balun/ Center Insulator* forces equal antenna currents in dipoles for superior performance. Reduces coax feedline radiation and field pattern distortion -- your signal goes where *you* want it. Reduces TVI, RFI and RF hot spots in your shack. *Don't build a dipole without one!* 50 hi-permeability ferrite beads on high quality RG-303 *Teflon*(R) coax and *Teflon*(R) coax connector. Handles full 1.5kW 1.8-30 MHz. Stainless steel hardware with *direct* 14 gauge stranded copper wire connection to antenna. 5x2 inches. Heavy duty weather housing.

RF Isolator

MFJ-915
$29.95

MFJ-915 *RF Isolator* prevents unwanted RF from traveling on the outside of your coax shield into your transceiver. This unwanted stray RF can cause painful RF "bites" when you touch your microphone or volume control, cause your display or settings to go crazy, lock up your transceiver or turn off your power supply. In mobile installations, stray RF could cause your car to do funny things even blow your car computer. Clear up these problems, plug an MFJ-915 between your antenna and transceiver. 5x2 in. Handles full 1500 Watts. Covers 1.8-30 MHz. **MFJ-919, $59.95.** 4:1 current balun,1.5 kW. **MFJ-913, $29.95.** 4:1 balun, 300 Watts.

Antenna Switches

MFJ-1704
$79.95
4-Positions

MFJ-1704 heavy duty *antenna switch* lets you select 4 antennas or ground them for static and lightning protection. Unused antennas automatically grounded. Replaceable lightning surge protection. Good to 500 MHz. 60 dB isolation at 30 MHz. 2.5 kW PEP. Less than .2 dB insertion loss, SWR below 1.2:1. SO-239 connectors. Handy mounting holes. 6¼Wx4¼Hx1¼D in.

MFJ-1702C
$39.95
2-Positions

MFJ-1702C Like MFJ-1704, but for 2 antennas. 3Wx2Hx2D"

MFJ-1700C
$119.95

MFJ-1700C *Antenna/ Transceiver Switch* lets you select one of six antennas and one of six transceivers in any combination. Plug in an antenna tuner or SWR wattmeter and it's always in-line for any antenna/transceiver combination. Has lightning surge protection. Handles 2 kW PEP SSB, 1 kW CW, 50-75 Ohm loads. Unused terminals are automatically grounded. 1.8 to 30 MHz. SO-239 connectors. 4¾W6½Hx3D inches.

MFJ-1701
$79.95

MFJ-1701 *Antenna Switch* like MFJ-1700C but lets you select one of six antennas only. 10Wx3Hx1½D inches.

33 ft. Telescoping fiberglass Mast

3.8 feet collapsed, 3.3 lbs.

MFJ-1910
$79.95

Super strong fiberglass mast has huge 1¾ inch bottom section. Flexes to resist breaking. Resists UV. Put up *full size* inverted Vee dipole/vertical antenna in minutes and get *full size performance!*

Make your own antennas

Dipoles, G5RV, Random Wire, Doublets, Beverage Antennas, etc.

MFJ-16C06, $4.56. 6-pack authentic *glazed ceramic* end/center antenna insulators.

MFJ-16B01, $19.95. Custom injection-molded UV-resistant center insulator has built-in coax connector and hanging hole.

MFJ-18G100, $24.95. 100 ft. of flexible, 7-strand, 14-gauge solid copper antenna wire.

MFJ-58100X, $49.95. 100 ft. 50-Ohm RG-8X with PL-259s on each end.

MFJ-18H100, $34.95. 100 feet, 450 Ohm ladder line, 18 gauge copper covered steel.

Lightning Surge Protectors

Ultra-fast gas discharge tube shunts 5000 amps peak. Less than 0.1 dB loss. Up to 1000 MHz. SO-239s. **MFJ-270, $29.95.** 400W PEP. **MFJ-272, $39.95.** 1500W PEP.

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FAX:(662)323-6551 8-4:30 CST, Mon.-Fri. ***Add shipping.***

http://www.mfjenterprises.com for instruction manuals, catalog, info

Celebrating 30 Years of the ARRL VEC

In addition to the ARRL Centennial, 2014 marks a special milestone for the ARRL VEC. On July 21, 2014, the ARRL VEC will celebrate 30 years of outstanding service to the Amateur Radio Community.

ARRL VEC Program

The ARRL's VEC program has a long standing tradition of serving the Amateur Radio community and the FCC with integrity and expertise. As the largest VEC in the nation, we operate as a knowledgeable information source for a wide-range of licensing issues. The ARRL VEC has had a positive effect on our community's growth and has truly made a difference in the future of Amateur Radio.

Serving the Amateur Radio Community

ARRL accredited Volunteer Examiners (VEs) give so generously of their time, energy and skill. They support us around the country by offering exam opportunities in their local communities and helping exam candidates fulfill their Amateur Radio aspirations.

Become an ARRL VE

If you haven't already, we hope you will embark on this rewarding journey and become an ARRL Volunteer Examiner. If you are interested in becoming an ARRL VE, it's easy! Visit www.arrl.org/VE for more information today.

ARRL VE's, Thank You for 30 Years of Service!

www.arrl.org/VE

30 Years of Serving the Amateur Radio Community

MFJ Weather-Proof *Window Feedthrough Panels*

Weather-proof window feedthrough panels bring coax, balanced lines, HF/VHF/UHF antennas, random wire antennas, ground, rotator/antenna switch cables and DC/AC power into your hamshack without drilling through walls!

MFJ Weather-Proof *Window Feedthrough Panels* mount in your window sill. Lets you bring all your antenna connections into your hamshack *without* drilling holes through walls.

Simply place in window sill and close window. One cut customizes it for any window up to 48 inches. Use horizontally or vertically. Connectors are mounted on inside/outside stainless steel plates and attached to a 4 foot long, 3½ inch high, ¾ inch thick *pressure-treated* wood panel. Has excellent insulating properties. Weather-sealed with a heavy coat of long-lasting white outdoor enamel paint. Edges sealed by weather-stripping. Seals and insulates against all weather conditions. Includes window locking rod.

Inside/outside stainless steel plates ground all coax shields. Stainless steel ground post brings ground in.

MFJ-4603 Universal Window Feedthru Panel

MFJ-4603 **$89.95**

Four 50 Ohm *Teflon*® SO-239 coax connectors lets you feed HF/VHF/UHF antennas at full legal power limit.

A 50 Ohm *Teflon*® coax *N-connector* lets you use any antenna up to 11 GHz, including 450 MHz, UHF, satellite, moon bounce and 2.4/5.8 GHz Wi-Fi antennas.

A 75 Ohm, 1 GHz *F-connector* makes it easy to bring in television, Satellite, HD, cable TV and FM radio signals.

A pair of high-voltage *ceramic feedthru insulators* lets you bring in 450/300 Ohm balanced lines directly to your antenna tuner.

Has random/longwire antenna *ceramic feedthru insulator.*

***5-way** binding posts* lets you supply 50 Volts/15 Amps DC/AC power to your outside antenna tuners/relays/switches.

Stainless ground post brings in ground connection, bonds inside/outside stainless steel panels together and drains away static charges.

MFJ's exclusive *Adaptive Cable Feedthru*™ lets you bring in rotator/antenna switch cable, etc. without removing connectors (up to 1¼X1⅝ in). Adapts to virtually *any* cable size. Seals out rain, snow, adverse weather.

3 Coax, Balanced Line, Random Wire

Best Seller! 3 *Teflon*® coax connectors for HF/VHF/UHF antennas. Separate high voltage *ceramic* feed-thru insulators for balanced lines and longwire/random wire, Stainless steel ground post.

MFJ-4602 **$69.95**

6 Coax

6 high quality *Teflon*® coax connectors for HF/VHF/UHF antennas. Stainless steel ground post. Full 1500 Watt legal limit.

MFJ-4601 **$59.95**

4 Balanced Line, 2 Coax

4 pairs of high-voltage *ceramic* feed-thru insulators for balanced lines and 2 coax connectors.

New! MFJ-4600 **$79.95**

5 Cables, any-size

5 *Adaptive Cable Feedthrus*™. Pass any cable with connector: 2 cables with large connectors up to 1¼x1⅝ inches and 3 cables with UHF/N size coax connectors. Seals out weather.

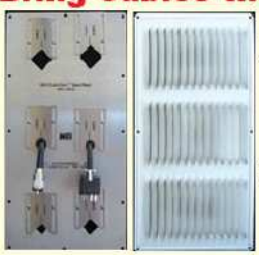
MFJ-4604 **$99.95**

All-Purpose FeedThru/CableThru™

***Stacks** MFJ-4603 **and** MFJ-4604!* Gives you every possible cable connection you'll ever need through your window without drilling holes in wall -- including UHF, N and F coax connectors, balanced lines, random wire, ground, DC/AC power and cables of any size for rotators, antenna switches, etc.

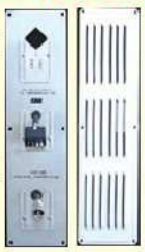
MFJ-4605 **$159.95** **New!**

Bring cables thru eave of your house



MFJ-4616
shown with standard full-size vent (not included) it replaces. For *6 Cables*
$26.95

MFJ-4613
shown with standard half-size vent (not included) it replaces. For *3 Cables*
$14.95



Replace your standard air vents on the eave/sofitt of your house with these *MFJ AdaptiveCable*™ *Air Vent Plates* and...

Bring in coax, rotator, antenna switch, power cables, etc. *with connectors* up to 1¼x1⅝ inches!

Sliding plates and rubber grommets adjust for virtually any cable size to seal out adverse weather, insects and varmints. Use existing vent hole, mounting screws and screw holes.

AdaptiveCable™ Wall Plates

MFJ-4614
For 4 Cables
$34.95

Bring nearly any cable -- rotator, antenna switch, coax, DC/AC power, etc. -- through walls *without removing connectors* (up to 1¼x1⅝ inches). Sliding plates and rubber grommets adjust hole size to weather-seal virtually any size cable.

Includes *stainless steel* plates for each side of wall, sliding plates, rubber grommets, weather stripping and screws.

MFJ-4612
For 2 Cables
$24.95

MFJ-4611
For 1 Cable
$14.95

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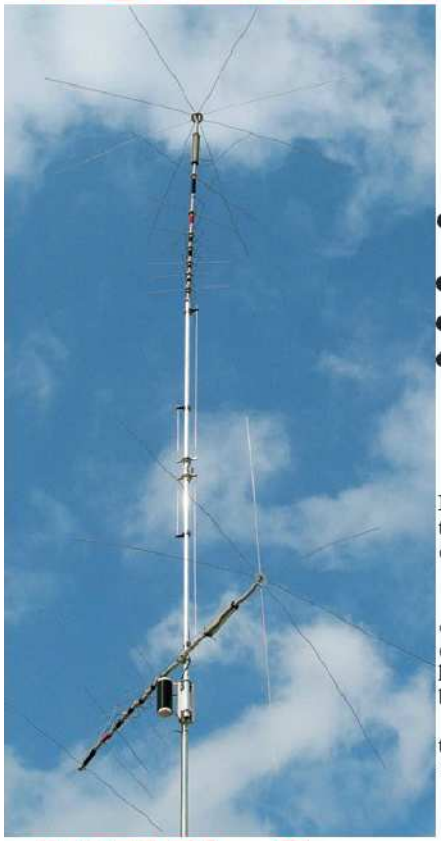
10 Bands: 80-2 Meters



$399.95
MFJ-1799

- *10 Bands: 75/80, 40, 30, 20, 17, 15, 12, 10, 6, 2 Meters including 75/80M*
- *Handles 1500 Watts PEP SSB/CW*
- *No ground or ground radials needed!*
- *Low radiation angle for great DX, omni-directional, automatic bandswitching*

Only 20 feet tall! Mounts anywhere!

Self-supporting and just 20 feet tall. Mounts easily from ground level to tower top -- small lots, backyards, apartments, condos, mobile homes, roofs, tower mounts.

Highly Efficient End-Loading

No lossy traps! *End-loading*, the most efficient loading known -- gives you highly efficient performance, excellent bandwidth, low angle radiation and automatic bandswitching.

High-Q loading coils are wound on tough, low loss fiberglass forms with *Teflon*® wire where needed.

Entire Length Radiates

End-loading results in uniform current distribution and the *entire length radiates*. This puts the radiating elements up high giving you more QSOs.

No Feedline Radiation/Distorted Pattern

MFJ's center-fed *balanced* halfwave vertical dipole design is decoupled and isolated from the feedline with MFJ's *AirCore*™ high power balun. It can't saturate, no matter how high your power.

This gives you consistently high performance by killing feedline radiation, pattern distortion, SWR shifts, RFI, noise pickups.

Easy to Tune!

Tuning to your favorite part of one band does not affect other bands and is done at the *bottom* of the antenna by simply adjusting a length of the capacitive hat.

Built-to-Last!

Incredibly strong *solid* 1¼ inch diameter fiberglass center insulator and 1⅜ inch diameter 6061 T6 aircraft strength aluminum tubing will make it the only antenna you will ever need.

MFJ 6-Band Halfwave Vertical Antenna

MFJ-1796 **$229.95**

MFJ-1796, like MFJ-1799, but for 6 bands: 40, 20, 15, 10, 6 and 2 Meters. 12 foot high, 24 inch foot print, mounts anywhere. No ground, no radials, self-supporting.

MFJ's Super High-Q Loop™ Antennas

MFJ's *tiny* 36 inch diameter loop antenna lets you operate 10 through 30 MHz *continuously* -- including the WARC bands!

Ideal for limited space -- apartments, small lots, motor homes, attics, or mobile homes. Enjoy DX and local contacts mounted vertically. Get both low angle radiation for excellent DX and high angle radiation for local, close-in contacts. Handles 150 watts.

Super easy-to-use! Only MFJ's super remote control has *Auto Band Selection*™. It auto tunes to desired band, then beeps to let you know. No control cable is needed. Fast/slow tune buttons and built-in two range Cross-Needle SWR/Wattmeter lets you quickly tune to your exact frequency.

All welded construction, welded butterfly capacitor with no rotating contacts, large 1.050 inch diameter round radiator -- *gives you highest possible efficiency.*

Each plate in MFJ's tuning capacitor is welded for low loss and polished to prevent high voltage arcing, welded to the radiator, has nylon bearing, anti-backlash mechanism, limit switches, continuous no-step DC motor -- smooth precision tuning. Heavy duty thick ABS plastic housing has ultraviolet inhibitor protection.

Cover 40-15 Meters. MFJ-1788, $499.95. Like MFJ-1786 but covers 40 - 15 Meters continuous. Includes remote control.

6-Band, 40-2 Meters *Rotatable* Mini-Dipole

Low profile 14 feet . . . 7 ft. turning radius . . . 40, 20, 15, 10, 6, 2 Meters . . . 1500 Watts . . .

MFJ-1775 is inconspicuous and low profile -- not much bigger than a TV antenna and is easily tuned by a lightweight rotator like Hy-Gain's *AR-35*.

It's no Wimp! Its directivity reduces QRM/noise and lets you *focus* your signal in the direction you want -- work some real DX.

You can operate 6 bands -- 40, 20, 15, 10, 6 and 2 Meters -- and run *full 1500 Watts* SSB/CW on all HF bands!

Features automatic band switching and uses highly efficient end-loading with its *entire length* always radiating. With 6 and 2 Meters thrown in, you have ham radio's most versatile *rotatable* dipole!

Each HF band uses a separate, efficient end-loading coil wound on fiberglass forms with *Teflon*™ wire, and capacitance hats at each end (no lossy traps). 6 and 2 meters are *full-length* halfwave dipoles.

Built-to-last -- incredibly strong solid rod fiberglass center insulator and 6063 T6 aircraft strength aluminum tubing radiator. Assembles in an afternoon. Adjusting one band has little effect on other bands.

MFJ-1775W, $249.95. WARC band version for 12, 17, 30, 60 Meters only.

MFJ *G5RV Antenna*

MFJ-1778 **$44.95**

Covers all bands, 160-10 Meters with antenna tuner. 102 feet long. Can use as inverted vee or sloper. Use on 160 M as Marconi. 1500 Watts. Super-strong fiberglass center/feedpoint insulators. *Glazed ceramic* end insulators. All hand-soldered connections. Add coax, some rope and you're *on the air!*

MFJ-1778M, $39.95. G5RV Junior. Half-size, 52 ft. 40-10M with tuner, 1500 Watts.

***Free* MFJ Catalog**

Visit: http://www.mfjenterprises.com or call toll-free 800-647-1800

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Prices and specifications subject to change.

MFJ . . . the world leader in ham radio accessories!

MFJ Big Stick™

18 Foot *Portable* Telescoping Antenna

Only 28 inches collapsed . . . Covers 40-6 Meters -- No gaps!

MFJ-2286
$99.95

The MFJ BigStick™ antenna is for the on-the-go Ham who is hungry for the next great QSO anywhere or anytime!

Full Size Performance

For top portable performance, carry a *Big Stick* for the loudest, strongest on-the-go signal on the band!

MFJ's extra long 17 foot stainless-steel telescoping whip gives you *full-size antenna* for full size performance 20 to 6 Meters but collapses to just 28 inches.

An ultra low loss, high-Q adjustable *air-wound* loading coil gives you highly efficient operation 30 and 40 Meters.

This extra long radiator and ultra low loss loading coil is a winning combination that stands head and shoulders above shorter backpack antennas.

True Backpack Portability

Antenna is over 18 feet long fully extended, but disassembles and collapses to 28 inches in seconds. Fits into most backpacks or suitcases! And at just over 2 pounds you'll hardly know you are packing it!

True General Coverage

Tapped loading coil covers 7.0-55.0 MHz without gaps. Great for Ham Bands and outstanding for image-free shortwave broadcast!

Everything you need

Everything is included for instant operation. Pipe/Mast mount quickly and easily mounts to any pipe or mast up to 1/2 inch. SO-239 for coax. 3/8-24 antenna connector.

Counterpoise kit included: Ensures low SWR, high efficiency.

Rugged Construction

All aluminum, stainless steel construction ensures years of excellent performance. *One Killowatt rated* components guarantee electrical safety.

40-2 Meters Apartment Antenna

MFJ-1622
$99.95

MFJ-1622 universal mount/clamp lets you attach it to window frames, balconies and railings. Works great indoors mounted to table/bookshelf. It's not a 5-element yagi, but you'll work your share of exciting DX! Highly efficient air wound *"bug catcher"* coil, telescoping 4½ foot radiator. Collapses to 2½ feet for easy storage and carrying. Includes coax, choke balun, counterpoise wire, safety rope. Operating frequency adjusted by moving "wander lead" on coil and adjusting the counterpoise for best SWR. ***Optional DX-Getter,*** MFJ-1977, $44.95. Stainless-steel 12-ft whip, 26 inches collapsed.

MFJ *BigEAR*™

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34 feet Radiators, 7-55 MHz

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34-Feet stainless steel radiator gives you *full-size dipole* performance on 20-6 Meters and highly efficient ultra *low loss* loaded dipole performance on 30/40 Meters. Collapses to 27 inches to fit into any suitcase or backpack. No ground or counterpoise needed.

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Ultra low loss high-Q *air-wound* loading coil. Built-in Guanella current balun kills feedline radiation, pattern distortion, RF shifts, RFI and noise pickup.

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MFJ-1919EX, $159.95.

***Put your antennas anywhere and get them up high with this super-strong* 18 foot telescoping fiberglass mast and heavy-duty steel MFJ-1919 tripod.**

QuickClamps™ easily collapses mast to 5 feet. Mast has thick 1/8 inch wall, .75 inch diameter top, 1.5 inch bottom. 15 lbs.

All tripods are black heavy-duty steel with braced triangle base, non-skid feet and mast lock.

MFJ-1918EX, $89.95. MFJ-1918 *tripod with super strong 9.5 foot telescoping fiberglass mast.* Collapses to 3.8 feet. *QuickClamps™.* Mast has thick 1/8" wall, ¾ inch top, 1 inch bottom. Weighs 6.5 lbs.

Tripods Only

MFJ-1919, $89.95, *Large tripod.* Supports 100 lb. antenna. Built-in 1.4 inch diameter mast extends 7.8 feet. Collapses to 4.5Hx.5D feet. Triangle base spreads to 4.8 feet on a side. Weighs 9.75 lbs.

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Use these inexpensive, lightweight, *isolated* mini-dipoles when space is limited for temporary or permanent installations. Rotate to null QRM/noise and to focus your signal. Coax choke balun, mast not included. For 40/30/20/17/15/12/10/6 Meters. Order **MFJ-22XX** (insert band in "XX") **$44.95.** 75/60 Meters, $49.95 each. Total length 14 feet. For mounting masts up to 1.25" OD.

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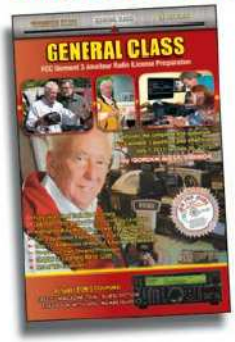

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MFJ-461 **$89.95**

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The MFJ-461's serial port lets you display CW text full screen on a bright computer monitor -- just use your computer serial port and terminal program.

When it's too noisy for its microphone pickup, you can connect the MFJ-461 to your receiver with a cable. A battery saving feature puts the MFJ-461 to sleep during periods of inactivity. It wakes up and decodes when it hears CW.

Uses 9 Volt battery. Fits in your shirt pocket with room to spare - smaller than a pack of cigarettes. Tiny 2¼x3¼x1 inches. 5½ ounces.

Super easy-to-use! Just turn it on -- it starts copying instantly!

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Soft leather protective pouch. Clear plastic overlay for display, push button opening, strong, pocket/belt clip secures MFJ-461.

MFJ-5161, $16.95. MFJ-461 to computer serial port cable (DB-9).

MFJ-5162, $7.95. Receiver cable connects MFJ-461 to your radio's external speaker 3.5 mm jack.

MFJ-5163, $10.95. Cable lets you use external speaker when MFJ-461 is plugged into radio speaker jack. 3.5 mm.

MFJ Morse Code *Reader and Keyer* Combination

Plug MFJ's CW Reader with Keyer into your transceiver's phone jack and key jack.

Now you're ready to compete with the world's best hi-speed CW operators -- and *they won't even know you're still learning the code!* Sends and reads 5-99 WPM.

Automatic speed tracking. Large 2-line LCD shows send/receive messages. Use paddle or computer keyboard.

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MFJ-551, $39.95. RFI suppressed keyboard, a must to avoid RFI problems.

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MFJ-561, $24.95. 1¾Wx1¾D x¾H inches. *Formed* phosphorous bronze spring paddle, stainless steel base. 4 ft. cord, 3.5 mm plug.

MFJ Code Oscillator

MFJ-557 **$39.95**

MFJ-557 Deluxe Code Practice Oscillator has a Morse key and oscillator unit mounted together on a heavy steel base -- stays put on your table! Portable. 9-Volt battery or 110 VAC with MFJ-1312D, $15.95. Earphone jack, tone and volume controls, speaker. Adjustable key. Sturdy. 8½x2¼x3¾ inches.

MFJ-550, $14.95. Telegraph Key Only with adjustable contacts. Handsome black.

MFJ Deluxe CW Keyer

Deluxe MFJ Keyer has all controls on front panel for easy access -- speed, weight, tone, volume knobs, and tune, semi/auto, on/off push-buttons. You get all keyer modes, dot-dash memories, self completing dots/dashes, jam- proof spacing, sidetone, built-in speaker, type A /B keying. RF proof. Solid state keying. 7x2x6 inches.

MFJ-407D **$79.95**

MFJ-401D, $69.95. Econo Keyer II has front-panel volume/speed controls (8-50 wpm), tune switch. Internal adjust weight, tone. Solid state keying. Tiny 4x2x3½ inches.

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Best of all CW worlds -- a *deluxe MFJ Curtis*™ *keyer* that fits right on *Bencher paddle!* Adjustable weight and tone, front panel volume and speed controls (8-50 WPM), built-in dot-dash memories, speaker, sidetone, semi-automatic/tune or automatic modes. Use 9V battery or 110 VAC with MFJ-1312D, $15.95. 4⅛x2⅝x5¼ in.

MFJ-422DX, $99.95.

MFJ *Curtis*™ Keyer only, fits on your Bencher paddle or MFJ-564 (chrome) or MFJ-564B (black) paddles above.

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Learn Morse code anywhere with this tiny *MFJ Pocket-sized Morse Code Tutor*™! Practice copying letters, numbers, prosigns, punctuations or any combination or words or QSOs. Follows ARRL/VEC format. Start at zero code speed and end up as a high speed *CW Pro!* LCD, built-in speaker.

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IC-9100
HF + 6m + 2m + 70cm + 23cm[1] All-Around Transceiver

D-STAR optional

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- RX: 0.030–60.000[2], 136.000–174.000[2], 420.000–480.000[2], 1240.000–1320.000[2,3]MHz*
- AM[3], FM, SSB, RTTY, CW, & DV[1]
- Satellite (Mode B/J/L[1])
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ID-880H
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- 50/15/5 Watt VHF/UHF
- FM, AM (Receive only), DV
- RX: 118–999.99MHz*
- 1052 Alphanumeric Memory Channels
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[†]*www.icomamerica.com/amateur/DSTAR for details about free software*

ID-1
GO DIGITAL ON 23cm

D-STAR ready

- 10 Watt on 23cm (FM, DV, DD)
- RX: 1240–1300MHz*
- 100 Alphanumeric Memory Channels
- USB Rig Control, Ethernet Plug for DD
- Black Box Operation
- Remote Control Head, Remote Speaker and Cables Included
- PC Software Included

*Frequency specs may vary. Refer to owner's manual for exact frequency specs. [1]Optional UX-9100 required. [2]HF (14MHz) [3]See manual for AM output power.

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D-STAR ready

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D-STAR ready

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- 1304 Alphanumeric Memory Channels
- Optional GPS Speaker Mic (HM-175GPS)
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QST QuickStats

sta·tis·tics (st-tstks) n.
1. (used with a sing. verb) The mathematics of the collection, organization, and interpretation of numerical data, especially the analysis of population characteristics by inference from sampling.
2. (used with a pl. verb) Numerical data.

www.arrl.org/QuickStats

Online QuickStats Poll Results for June 1, 2014 through July 1, 2014.
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Have you ever converted a wireless network router into an Amateur Radio Mesh transceiver?

Yes **10%**
No **68%**
I've never heard of this **22%**

Among the WARC bands, which is your favorite?

30 meters **22%**
17 meters **48%**
12 meters **7%**
I never operate on the WARC bands **23%**

Have you ever used Amateur Radio digital communications in a public service application?

Yes **30%**
No **55%**
I don't participate in public service activities **15%**

Have you ever heard a Long Delayed Echo (LDE)?

Yes **37%**
No **50%**
I don't know what an LDE is **13%**

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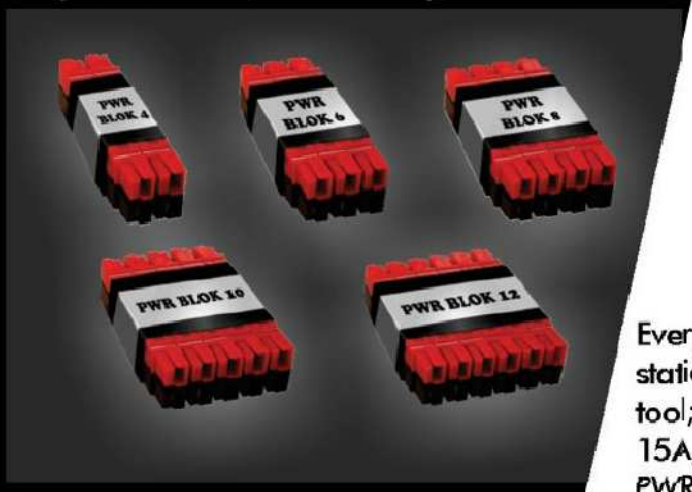

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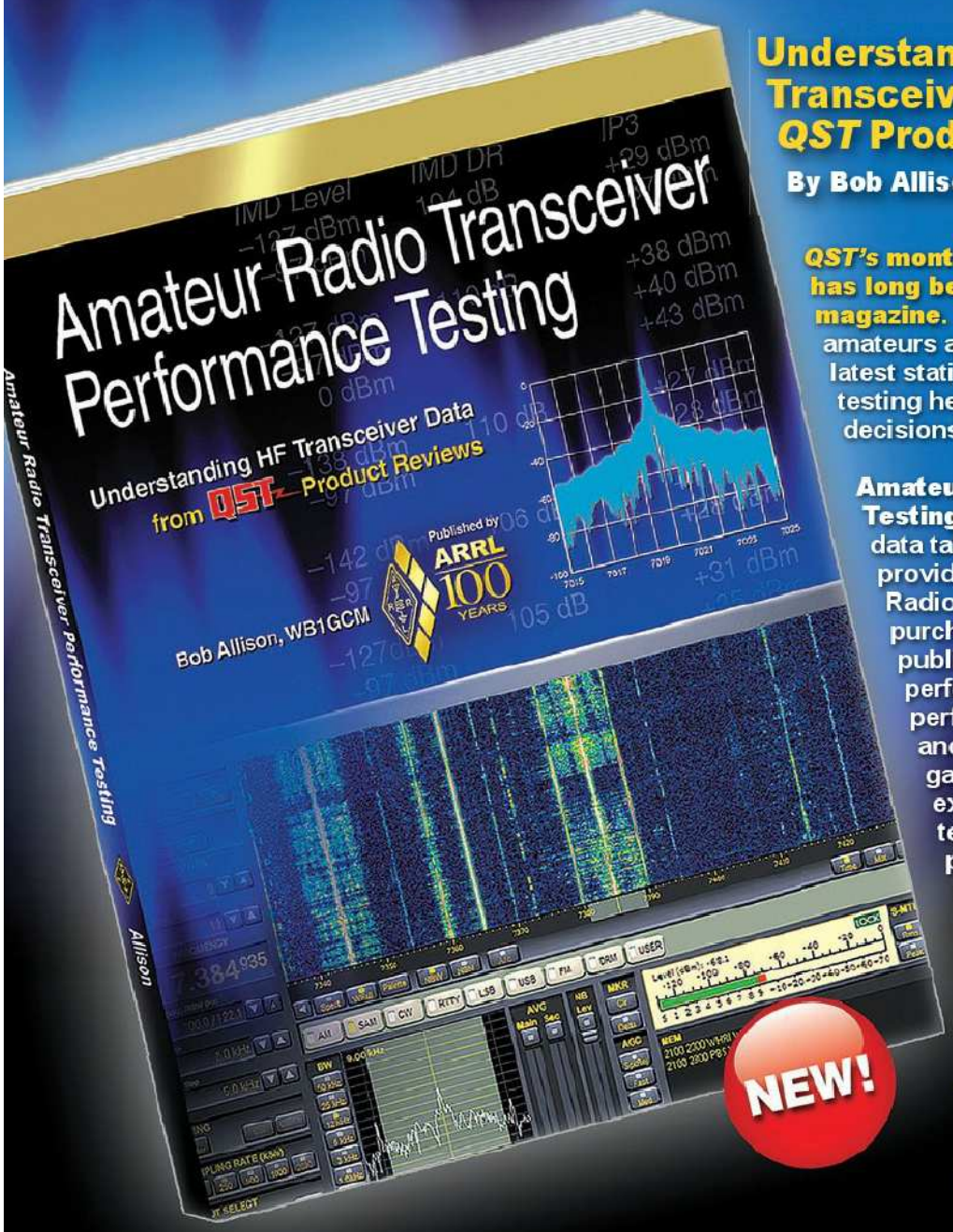

Understanding HF Transceiver Data from *QST* Product Reviews

By Bob Allison, WB1GCM

***QST*'s monthly "Product Review" column has long been the most-read section of the magazine.** That's not surprising as most radio amateurs are interested in reading about the latest station equipment — and product review testing helps operators make informed decisions based on their needs.

Amateur Radio Transceiver Performance Testing explains in detail the performance data tables from *QST* Product Reviews, providing a valuable resource for Amateur Radio operators who are looking to purchase a transceiver. It discusses how published laboratory data relates to actual performance, how each major test is performed, the significance of each test, and what the numbers mean. You'll gain a better understanding of the extensive testing ARRL performs, technical terms and parameters presented in Product Review, and develop the capability to reach your own conclusion about which HF transceiver is best for you.

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2. The Ham-Ad rate for commercial firms offering products or services for sale is $2.25 per word. Individuals selling or buying personal equipment: ARRL member 1.00 per word. Non-ARRL member $1.50 per word. **Bolding** is available for $2.50 a word. Prices subject to change without notice. You may pay by check payable to the ARRL and sent to: Ham-Ads, ARRL, 225 Main St., Newington, CT 06111. Or, you may pay by credit card sending the information by fax to 860-594-4285 or via e-mail to hamads@arrl.org. The credit card information we need is: the type of credit card, the exact name that appears on the credit card, the credit card number, the expiration date and the credit card billing address.

3. Remittance in full must accompany copy since Ham-Ads are not carried on our books. Each word, abbreviation, model number and group of numbers counts as one word. Entire telephone numbers count as one word. No charge for postal Zip code. No cash or contract discounts or agency commission will be allowed. Tear sheets or proofs of Ham-Ads cannot be supplied. Ads submitted in writing should be typed or printed clearly on an 8 1/2" X 11" sheet of paper.

4. Closing date for Ham-Ads is the 15th of the second month preceding publication date. No cancellations or changes will be accepted after this closing date. Example: Ads received July 16th through August 15th will appear in October *QST*. If the 15th falls on a weekend or holiday, the Ham-Ad deadline is the previous working day. Please contact the Advertising Department at 860-594-0209 or hamads@arrl.org for further information or to submit your ad.

5. No Ham-Ad may use more than 200 words. No advertiser may use more than two ads in one issue. A list name or call must appear in each ad. Mention of lotteries, prize drawings, games of chance etc is not permitted in *QST* advertising.

6. New firms or individuals offering products or services for sale must check with us to determine if a production sample (which will be returned) should be submitted for examination. Dealers are exempted, unless the product is unknown to us. Check with us if you are in doubt. You must stand by and support all claims and specifications mentioned in your advertising.

The publisher of *QST* will vouch for the integrity of advertisers who are obviously commercial in character and for the grade or character of their products and services. Individual advertisers are not subject to scrutiny.

The American Radio Relay League does not discriminate in its advertising on the basis of race, color, religion, age, sex, sexual orientation, marital status or national origin. The League reserves the right to decline or discontinue advertising for any other reason.

7. AN IMPORTANT NOTICE TO ALL HAM AD POSTERS AND RESPONDERS, FROM THE ARRL ADVERTISING DEPARTMENT Greetings from ARRL HQ! Please note that we have received reports from many ARRL members who have placed classified ads in these listings, and have received responses from individuals proposing "creative" payment schemes. These particular instances involved offers of overpayments for goods by bank check, followed by instructions to deduct the cost of your item from the overpayment, and to transfer the overage back or to another individual. This is a well-known scam. Unfortunately, we have no control over this and other scams of this type. Once your email address is posted, you are vulnerable to those individuals seeking to provide you with questionable information.

QST Ham Ads on the Web
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www.arrl.org/ham-ad-listing

Club/Hamfests/Nets

FRIEND OF BILL W?? 12:30 pm Eastern: HAAM Net Sat 14.290, Sun 14.340 and Mon-Fri 14.316 http://www.qsl.net/haam/

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Lake Amateur Radio Association 2014 Annual tailgate November 1 Contact Frank Anders, KK4MBX email twfrank111@aol.com

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October 2014	Wednesday, August 13, 2014	Friday, August 15, 2014
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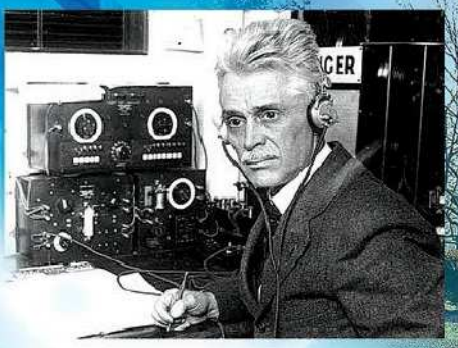

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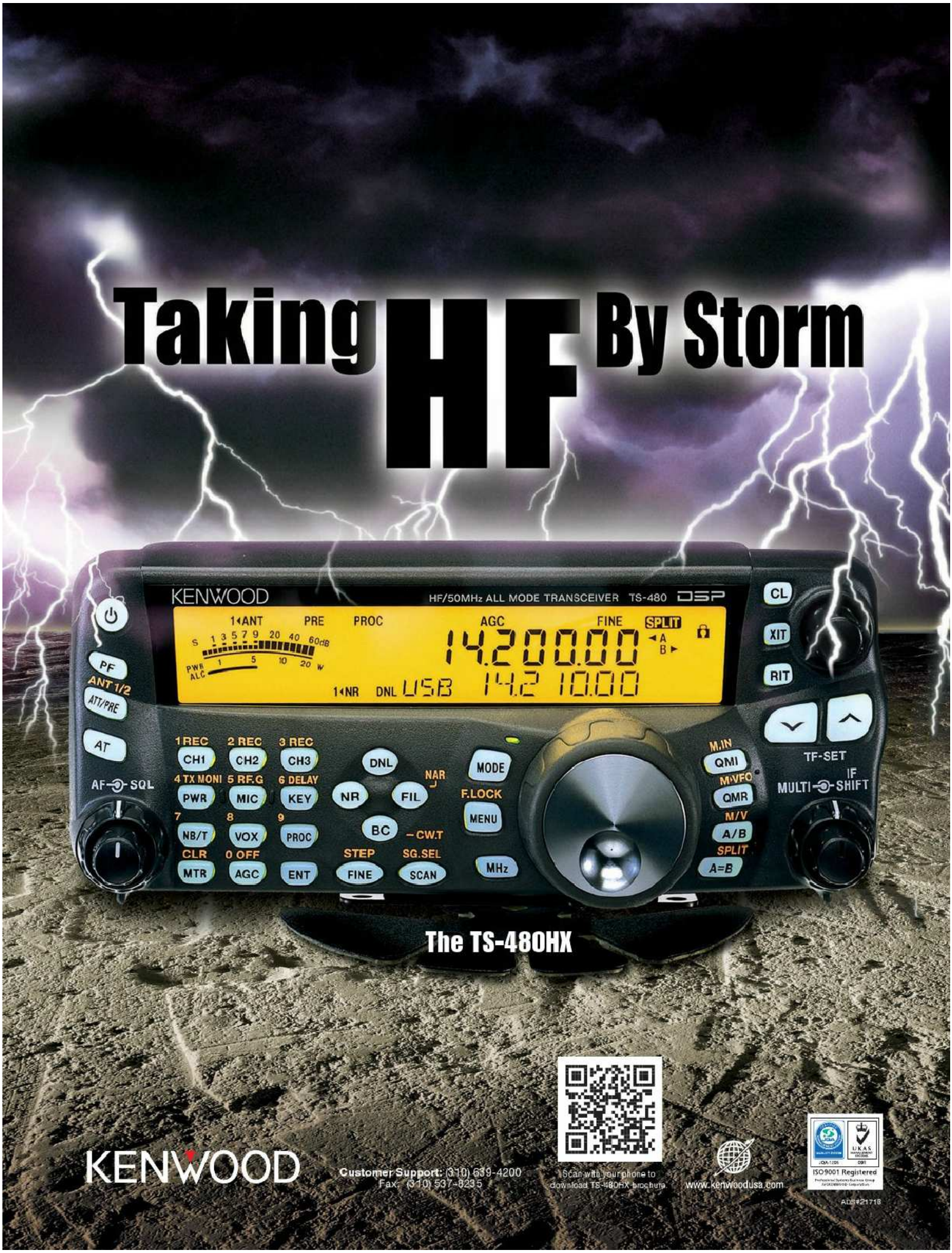
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