SPECIAL PUBLIC SERVICE COMMUNICATIONS ISSUE

QST

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September 2013 WWW.ARRL.ORG

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Official Journal of ARRL The national association for AMATEUR RADIO®

New Functions Enabled by the

The Choice of C4FM Digital

Compared to other digital modulation schemes within FDMA, C4FM has excellent communication quality (BER: Bit Error Rate characteristics). C4FM is the standard method for professional communication devices in FDMA, and is therefore considered to be the main stream digital communication mode in the future.

Automatic Mode Select(AMS) function detects the receive signal mode

The FT1DR/FTM-400DR operates in three digital modes and an analog mode.
Enjoy communication in the mode that suits each purpose.

1. V/D Mode (Simultaneous Voice/Data Communication Mode)

A high-speed data communication mode that uses the entire 12.5 kHz bandwidth for data communication. The FT1DR automatically switches to this mode when sending and receiving images, allowing a large amount of data to be transmitted quickly.

2. Voice FR Mode (Voice Full Rate Mode)

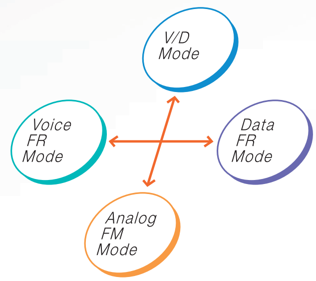
Half of the bandwidth is used for voice signal with error correction. The very effective error correction code provides benefits such as minimal interruption of communication.

3. Data FR Mode (High-speed Data Communication Mode)

This mode uses the entire 12.5 kHz bandwidth to transmit digital voice data. The larger voice data size allows voice communication with high sound quality.

4. Analog FM Mode

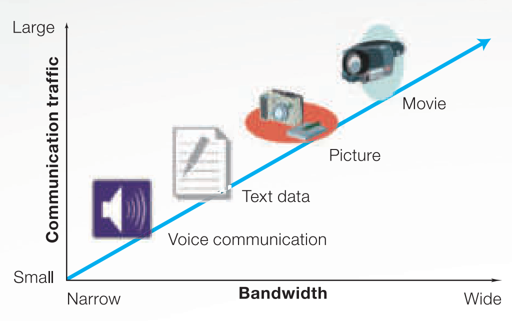
Analog FM is effective for communication with a weak signal that causes voices to break up in the digital modes. The analog mode allows communication even at distances where noise and weak signals make communication almost impossible.



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

FT1DR

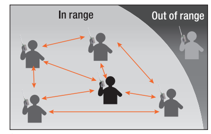
7.4V 1100 mAh Lithium Ion Battery FNB-101LI and battery charger PA-48 / SAD-11B(USA version), PC Connection Cable SCU-18 included



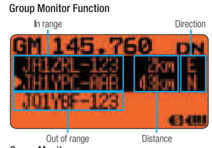
Bandwidth and data transferring rate

Digital Group Monitor (GM) Function

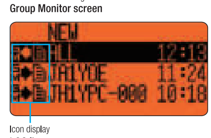
The digital GM function automatically checks whether members registered in a group are within communication range, and displays information such as distance and direction for each call sign on the screen. This convenient function makes it possible not only to see whether any friends are in communication range, but also to instantaneously determines the location and relationship between all members of the group. This function can also be used to send messages and data such as images between members of a group, permitting convenient and fun communication between friends when out for a drive or hike. Sent and received messages and images can be checked on the LOG List screen, with icons making them easy to distinguish.



Group Monitor Function



Group Monitor screen

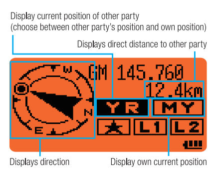


LOG list screen

Smart Navigation Function

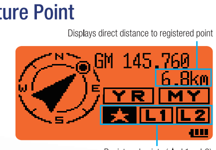
A real-time navigation function that records the location and direction of Group Monitor (GM) stations

Digital V/D Mode communicates information such as position data at the same time as the voice signal, allowing you to view the distance and direction of the other party in real time while communicating. This makes it possible to confirm your position and the other party's in situations such as hiking and driving where your positions are constantly changing, providing an easy way to meet up or join routes.

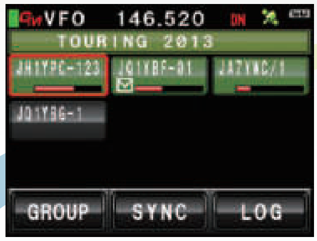


Backtrack Function to Return to Departure Point

This function allows navigation back to the departure point, or a point previously added to the memory.
When hiking or camping, just register the starting point or the position of your tent and then you can constantly check the direction and distance from your current position. The arrow of the compass display constantly shows the direction to the registered point, making it extremely convenient in finding your way back to the registered place – just move in the direction so that the arrow in the heading-up display points straight upward.



C4FM FDMA Digital Transceiver



Digital Group Monitor

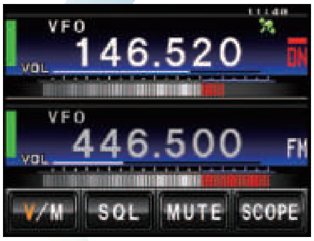
Smart Navigation Screen

APRS® Screen

* APRS® is a registered trademark of Bob Bruninga, WB4APR.

3.5-inch full color touch panel operation

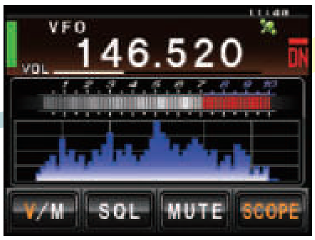
The icon symbols, multi-function key display and pop-up messages are all displayed in high-resolution color thanks to the full-color, high luminance TFT liquid crystal screen. The settings and status of the wireless devices are displayed in an easy-to-understand format. You can perform various operations simply and easily by gently touching the screen.



Dual Band Screen

Clock / Timer Screen

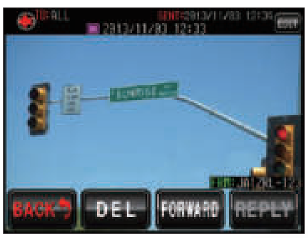
Message Screen

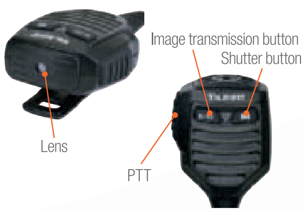


Band Scope Screen

Snapshot Function (Image Data Transmission)

Simply connect an MH-85A11U (option) microphone with camera.
Press the microphone shutter button to take snapshots, and then the image data can be displayed on the screen and easily sent to other C4FM FDMA digital transceivers.





* micro SD card is required by the snapshot function.

Image data which was sent from a group member is displayed on the full-color screen. This image data also retains a time record and the GPS location data of the snapshot. It is easy to navigate to that pictured location by using back track function.
In addition, you can observe on the screen, whether or not transmitted data was successfully received by the member station. The snapshot image or received data is stored in a high capacity micro SD card. You can recall and send that image data from the SD card anytime. The pictures and data files may be easily viewed and edited by using a personal computer.

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

FTM-400DR

DTMF Microphone MH-48A6JA, Mounting Bracket, Bracket for Controller, Control Cable 10ft (3m), PC Connection Cable SCU-20, and DC Power Cable included

YAESU The radio

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

Life is a JOURNEY. Enjoy the ride!

MINI COOPER SHOWN WITH CP-5M UNIVERSAL LIP MOUNT ON THE DOOR EDGE.

All the mounts attach to van doors, truck side doors, SUV doors, etc... and require no holes. Includes 16' 6" deluxe cable assy w/18" mini RG-1888A/U type coax for weather seal entry.

Choose a mount depending on the antenna size and vehicle mounting location space.

For Small Antennas & Limited Space

MODEL	ANT CONN / COAX CONN
Maldol EM-5M	SO-239 / PL-259
Footprint:	1.1"x .75"
Max Antenna:	40"

For Medium Size Antennas

MODEL	ANT CONN / COAX CONN
COMET CP-5M	SO-239 / PL-259
COMET CP-5NMO	NMO / PL-259
Footprint:	3.4" x 1.25"
Max Antenna:	60"

For Tall or Multi-band HF Antennas

MODEL	ANT CONN / COAX CONN
COMET HD-5M	SO-239 / PL-259
COMET HD- 5 3/8-24	3/8-24 / PL-259
Footprint:	3.75" x 1.1 "
Max antenna:	80"

COMET BNC-24 DUAL-BAND 2M/70CM HT ANTENNA RX range: 100-1200MHz
• Wavelength: 2M 1/4 wave • 440MHz 1/2 wave • Length: 17" • Conn: BNC Super flexible featherweight whip

COMET SMA-24 DUAL-BAND 2M/70CM HT ANTENNA RX range: 100-1200MHz
• Wavelength: 2M 1/4 wave • 440MHz 1/2 wave • Length: 17" • Conn: SMA Super flexible featherweight whip

COMET SMA-503 DUAL-BAND 2M/70CM HT ANTENNA RX range: 100-1200MHz
• Length: 8.75" • Conn: SMA

Maldol MH-209 *(BNC Conn)* **MH-209SMA** *(SMA Conn)* **2M/70CM DUAL-BAND HT ANTENNAS**
3" length, soft rubber cover. Good performance in a small package!

COMET NEW! CSB750A DUAL-BAND 2M/440MHZ W/FOLD-OVER
Wavelength: 2M 1/2 wave, 70cm 5/8 wave x 2 • VSWR: 1.5:1 or less • Length: 42" • Conn: PL-259 • Max Pwr: 150W

COMET NEW! CSB770A DUAL-BAND 2M/440MHZ W/FOLD-OVER
Wavelength: 2M 5/8 wave center load, 70cm 5/8 wave x 2 center load • VSWR: 1.5:1 or less • Length: 51" • Conn: PL-259 • Max Pwr: 150W

COMET NEW! CSB790A DUAL-BAND 2M/440MHZ W/FOLD-OVER
Wavelength: 2M 7/8 wave center load, 70cm 5/8 wave x 3 center load • VSWR: 1.5:1 or less • Length: 62" • Conn: PL-259 • Max Pwr: 150W

Maldol AX-50 DUAL-BAND 2M/440MHz
Wavelength: 2M 1/4 wave • 70cm 9/8 wave • Length: 21" • Conn: PL-259 • Max Power: 60W

Maldol AX-75 DUAL-BAND 2M/440MHz W/FOLD-OVER
Wavelength: 2M 1/2 wave center load • 70cm 5/8 wave x 2 • Length: 30" • Conn: PL-259 • Max Power: 60W

Maldol AX-95 DUAL-BAND 2M/440MHz W/FOLD-OVER
Wavelength: 2M 1/2 wave • 70cm 5/8 wave x 2 • Length: 38" • Conn: PL-259 • Max Power: 60W

COMET B-10 / B-10NMO DUAL-BAND 2M/440MHz
Wavelength: 146MHz 1/4 wave • 446MHz 1/2 wave • Length: 12"
• Conn: B-10 PL-259 ,B-10NMO - NMO style • Max Pwr: 50W

COMET SBB-2 / SBB-2NMO DUAL-BAND 2M/440MHz
Wavelength: 146MHz 1/4 wave • 446MHz 5/8 wave center load • VSWR: 1.5:1 or less • Length: 18"
• Conn: SBB-2 PL-259 • SBB-2NMO NMO style • Max Pwr: 60W

Maldol EX-107RB / EX-107RBNMO DUAL-BAND 2M/440MHz
Wavelength: 146MHz 1/2 wave • 446MHz 5/8 wave x 2 • VSWR: 1.5:1 or less • Length:29"
• Conn: EX-107RB PL-259 • Ex-107RBNMO NMO style • Max Pwr: 100W

COMET SBB-5 / SBB-5NMO DUAL-BAND 2M/440MHz W/FOLD-OVER
Wavelength: 146MHz 1/2 wave • 446MHz 5/8 wave x 2 • Length: 39"
• Conn: SBB-5 PL-259, SBB-5NMO - NMO style • Max Pwr: 120W

COMET SBB-7 / SBB-7NMO DUAL-BAND 2M/440MHz W/FOLD-OVER
Wavelength: 146MHz 6/8 wave • 446MHz 5/8 wave x 3 • Length: 58"
• Conn: SBB-7 PL-259, SBB-7NMO - NMO style • Max Pwr: 70W

COMET and Maldol Mobile

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

In This Issue

September 2013 Volume 97 Number 9

Technical

News and Features

Our Cover
Year-round training opportunities can make a big difference in the efficiency and effectiveness of Amateur Radio's response in the community, whether it's in a disaster or emergency situation, or for a town festival or athletic event. Here, Paul Ciezniak, K1SEZ, devotes some time to getting familiar with go-kit gear. [RJS Photography, photo]

Radiosport

Columns

Departments

Digital and Mobile Editions

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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.

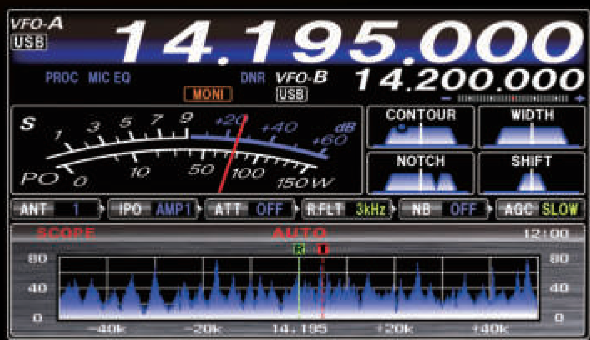
Superior triple conversion receiver, and optimum gain distribution at each IF stage will eliminate out of band unwanted signals.

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.

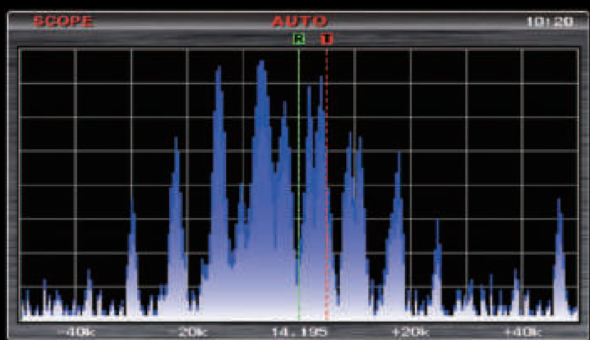
Similar to the high end series Yaesu transceivers, it uses the 32-bit high speed floating point DSP, TMS320C6727B by Texas Instruments, for its IF DSP.
The acclaimed superior Yaesu DSP algorithm is highly effective in weak signal processing and enhancement.

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

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

The radio...YAESU

HF/50 MHz 100 W Transceiver

FTDX 3000

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.

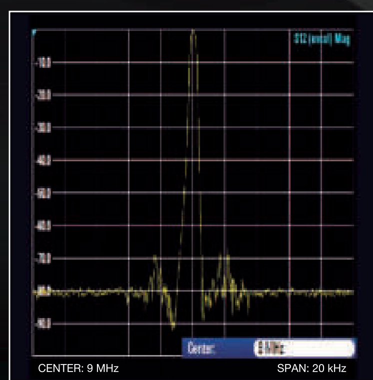
4.3-inch Large and wide color LCD display with high resolution

High Speed Spectrum Scope built-in

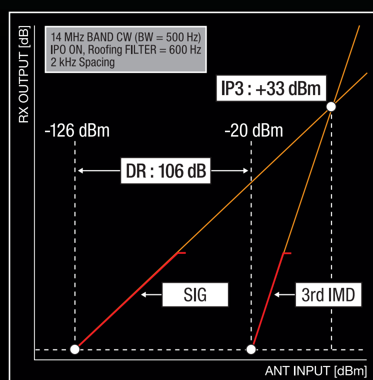
AF SCOPE display and RTTY/PSK encoder/decoder

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 (2kHz Spaceing)

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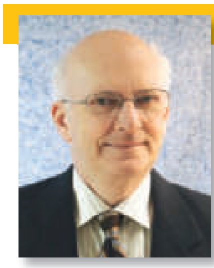


David Sumner, K1ZZ — dsumner@arrl.org
ARRL Chief Executive Officer

Symbol Rate

"At its July meeting the ARRL Board of Directors acted to address a portion of the FCC Rules that advances in digital communications have rendered obsolete."

Section 97.307(f) of the FCC Rules limits the digital data emissions of amateur stations operating below 28 MHz to a symbol rate not to exceed 300 bauds, and on 10 meters (28.0-28.3 MHz) to a symbol rate not to exceed 1200 bauds. In a digital system the symbol rate is the number of times per second that a change of state occurs. It should not be confused with data rate (also called bit rate) although in a binary system the values will be the same.

The symbol rate limits date back to the *Third Report and Order* in FCC Docket 20777 and became effective on March 17, 1980, when amateurs in the United States were authorized to use ASCII. Anyone familiar with the early modems used for data communication on telephone lines will recognize their origins. The April 1980 issue of *QST* observed that in the comments filed in this rulemaking proceeding "there was general agreement that the permissible bandwidths of ASCII or other radioteleprinter signals should be similar to the traditional bandwidths associated with the use of the Baudot Code in the various frequency bands." By limiting the symbol rate the FCC thought it was achieving that objective.

Since that time the rationale for a regulatory limit on symbol rate has been eroded by advances in modulation techniques that have effectively divorced the bandwidth of a digital signal from the symbol rate. For example, in the words of the 2013 edition of *The ARRL Handbook for Radio Communications*, "By using multiple carriers each with multiple-bit-per-symbol modulation it is possible to obtain quite high data rates while maintaining the low symbol rates that are required to combat the effects of multi-path propagation on the HF bands." The tradeoff is that multiple carriers mean greater bandwidth — and bandwidth is a precious commodity.

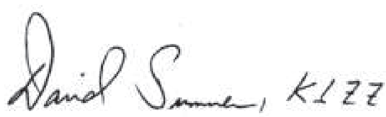
One implementation of our old nemesis, Broadband over Power Lines (BPL), took this to an extreme by generating thousands of carriers at intervals of 1.1 kHz across the entire HF spectrum. Of course, such a broad signal would not propagate uniformly via the ionosphere — but the example illustrates that there is no technological limit to the bandwidth of a digital HF signal. At the present time the only bandwidth limits on amateur HF digital transmissions that are contained in the FCC Rules are on automatically controlled digital stations operating outside narrow designated subbands (Section 97.221 imposes a 500 Hz bandwidth limit on these stations) and on stations operating in the five channels of the 60 meter band (up to 2.8 kHz bandwidth is permitted, per Section 97.303(h)).

The guiding principle for our use of the spectrum allocations to the Amateur Radio Service is cooperation in the sharing of access to a limited resource. Without defining the terms, the FCC Rules say that amateur stations "must be operated in accordance with good engineering and good amateur practice." No one could reasonably argue that a single amateur station or network ought to be able to occupy an entire amateur band or subband, nor has anyone attempted it. On the other hand, the state of the Amateur Radio art has advanced far beyond where it stood in 1980. Amateurs have developed a wide variety of digital data modes that make efficient use of the bandwidth of a typical SSB transceiver while being sufficiently robust to cope with the often-hostile HF environment. These developments are constrained unnecessarily by the 300-baud symbol rate limit.

Recognizing that the amateur community is not well served by the existing rules, at its January 2013 meeting the ARRL Board of Directors created an ad hoc committee to evaluate possible changes and offer recommendations for consideration at its July meeting. The committee recommended that a *Petition for Rule Making* be prepared seeking the deletion of all references to symbol rate from Section 97.307(f) and the adoption of a bandwidth limit of 2.8 kHz for amateur data emissions below 29.7 MHz. The Board adopted the committee's recommendations. No timetable has been set for the filing of this petition, which first will be reviewed by the ARRL Executive Committee.

The limit of 2.8 kHz was not chosen arbitrarily. It is already used in Part 97 to set the maximum bandwidth of an amateur station in the 60 meter band and is a bit greater than the bandwidth of data modes now in widespread use on HF by amateurs. Unlike a petition filed by an individual amateur in 2007 that was denied by the FCC, it would not prohibit anything that is now commonly being done. It is important to note that the limit would apply only to data modes in the subbands where RTTY and data are authorized emission types and not to either analog or digital phone emissions.

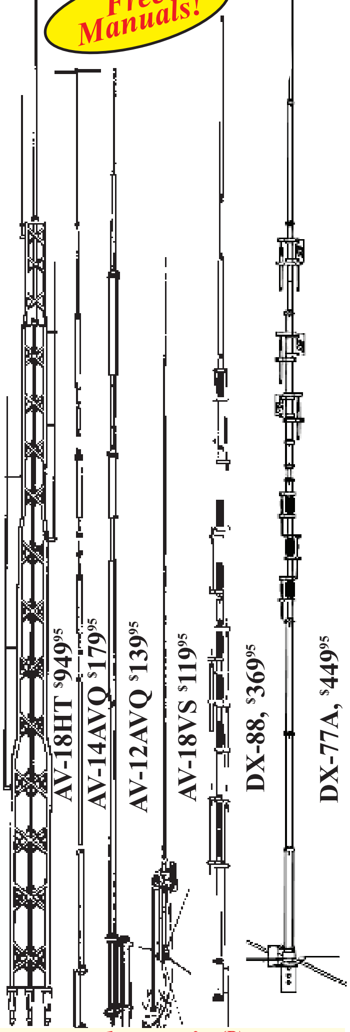
While there is commercial and military interest in wider bandwidths that would allow higher HF data rates, in the Amateur Radio Service we must balance the desire for minimal regulation against the need for equitable access to limited spectrum by literally hundreds of thousands of amateur licensees — each of whom has the same right to operate. Some will argue that 2.8 kHz is too confining, others that it is excessive. Those positions were taken into account by both the ad hoc committee and the Board. Once the petition is filed and assuming the FCC does not dismiss it out of hand — as indeed it should not, given that the existing rules clearly need to be fixed — there will be additional opportunities for those arguments to be heard.



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(R) Classics

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

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

All handle 1500 Watts PEP SSB, have low SWR, automatic bandswitching (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, $949.95. (10,12,15,20,40,80 M, 160, 17 Meters optional). 53 ft., 114 lbs.
Standing 53 feet tall, the famous *Hy-Gain HyTower* is the world's best performing vertical! The AV-18HT features automatic band selection achieved through a unique stub-decoupling system which effectively isolates various sections of the antenna so that an electrical 1/4 wavelength (or odd multiple of a 1/4 wavelength) exists on all bands. Approximately 250 kHz bandwidth at 2:1 VSWR on 80 Meters. The addition of a base loading coil (**LC-160Q, $109.95**), provides exceptional 160 Meter performance. **MK-17, $89.95**. Add-on 17 Meter kit. 24 foot tower is all rugged, hot-dip galvanized steel and all hardware is iridited for corrosion resistance. Special tilt-over hinged base for easy raising & lowering.

AV-14AVQ, $179.95. (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.

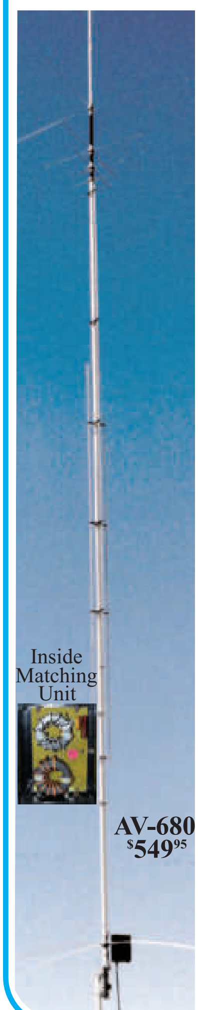
DX-77A, $449.95. (10, 12, 15, 17, 20, 30, 40 Meters). 29 ft., 25 lbs.
No ground radials required! Off-center-fed Windom has 55% greater bandwidth than competitive verticals. Heavy-duty tiltable base. Each band independently tunable.

Model #	Price	Bands	Max Power	Height	Weight	Wind Surv.	Rec. Mast
AV-18HT	$949.95	10,15,20,40,80	1500 W PEP	53 feet	114 pounds	75 MPH	------
AV-14AVQ	**$179.95**	**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"**

80-6 Meters

Hy-Gain's new AV-680 adds 75/80 Meters with no radials!

Includes 40, 30, 20, 17, 15, 12, 10 and 6 Meters operation with low 17 degree radiation angle and omni-directional world-wide coverage. No ground or radials needed. Handles full 1500 Watts key down continuous for two minutes.



Highly Efficient
The AV-680 uses quarter wave stubs on 6, 10, 12 and 17 meters and very efficient end loading coil and capacity hats on 15, 20, 30, 40 and 80 Meters -- no traps. End loading allows efficient operation with a low-profile. Resonators are placed in parallel not in series.

Each band individually tunable
Extra wide low VSWR bandwidth. End fed with broadband matching unit. Single coax cable feed. Automatic bandswitching.

Sleek and low-profile
Low 2.9 sq. ft. wind surface area. Small footprint for mounting easily on decks, roofs and patios. 26 feet, 18.5 lbs.

Built-to-last
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Hy-Gain verticals are the best built, best performing and best priced multiband verticals available today.

hy-gainR ***warranty***
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AV-640, $449.95. 8 bands: 40, 30, 20, 17, 15, 12, 10, 6 Meters. 25.5 ft., 17.5 lbs.

AV-620, $349.95. 6 bands: 20, 17, 15, 12, 10, 6 Meters. 22.5 ft., 10.5 lbs.

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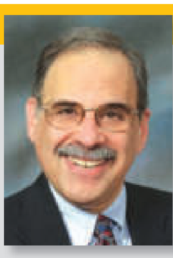

Harold Kramer, WJ1B – hkramer@arrl.org, ARRL Chief Operating Officer/*QST* Publisher

Visiting W1AW

W1AW: The Hiram Percy Maxim Memorial Station.

This is the time of year when we welcome many visitors to ARRL Headquarters in Newington, Connecticut. Besides touring the administration building, most of our guests want to visit and operate W1AW, The Hiram Percy Maxim Memorial Station, just across the parking lot. W1AW, which was dedicated 75 years ago this month, is open for visitors from 9 AM to 4 PM Monday through Friday. Guest operator hours are from 10 AM to Noon and from 1 to 3:45 PM. When you visit, we ask that you register at the main building first. One of our tour guides will then escort you to W1AW.

Visitors operate the station on a first-come first-served basis. If you want to operate W1AW, please bring your Amateur Radio license, or a copy of it, with you. When you enter the station, you will most likely be greeted by W1AW Station Manager Joe Carcia, NJ1Q, or W1AW Operator Scott Gee, WB9RRU. Just show your license and they'll set you up to operate. It's quite an experience to be on the air from W1AW, especially when you find yourself in the middle of a pileup!

Of course, operating the station is just one part of the W1AW experience. Many visitors photograph the towers, antennas and the building itself before they enter, so bring your camera. In W1AW's foyer you'll find some remarkable historical items including "Old Betsy," Hiram Percy Maxim's original rotary spark gap transmitter. The "Old Man's" original desk is also located in the foyer along with a display case containing some amazing early radio equipment.

As you progress further inside the building, you'll notice that the main room is divided into two separate areas: the bulletin station and the guest operator studios.

The bulletin station is comprised of dedicated transmitters and amplifiers for 160, 80, 40, 20, 17, 15, 10 and 2 meters, all mounted in a six-bay rack. The bulletin transmitters use separate, fixed-position antennas for each of the HF bands. CW practice is transmitted from 9 to 10 AM, Tuesday through Thursday, and CW practice, CW bulletins, digital and phone bulletins are transmitted 3:30 to 11 PM Eastern Time Monday through Friday. The exact times, operating frequencies and transmission modes are available on the ARRL website at **www.arrl.org/w1aw-operating-schedule**.

There are three well-equipped guest operating studios. Much of the studio equipment has been donated by Amateur Radio equipment manufacturers. The guest studios have access to the same HF antennas the W1AW bulletin transmitters use, plus antennas for VHF+. All are rotatable, except for 60, 80 and 160 meters. More information about W1AW's antenna farm can be found at **www.arrl.org/w1aw-antenna-farm**.

The three studios can be operated simultaneously but, obviously, not all on the same band. Each operating studio is equipped with headphones, microphones, CW paddles and foot switches. There is a computer and logging software in each studio and we ask all guest operators to log their QSOs so that we can honor QSL requests.

Studios One and Three are primarily HF positions. Studio One, our "contest studio," features an Icom IC-7700 transceiver with an Icom IC-PW1 amplifier along with a Yaesu FTDX9000D transceiver with an Acom 2000A amplifier. Studio Three offers a Kenwood TS-590 transceiver, an Alpha 9500 amp and a Yaesu FTDX5000 transceiver with a Yaesu VL-1000 "Quadra" amplifier.

ARRL Emergency Preparedness Manager Mike Corey, KI1U, in Studio One.

Studio Two is outfitted for operation on the digital modes and VHF/UHF bands using a Flex-5000 SDR transceiver along with Icom IC-7000 and 9100 (for satellite) transceivers. It houses an Automatic Packet Reporting System (APRS) and equipment for satellite operations. W1AW also has MARS (Military Auxiliary Radio System) and SATERN (Salvation Army Team Emergency Radio Network) capability.

The station houses additional equipment for EchoLink, Winlink 2000 and the W1AW IRLP node. Although this IRLP node was installed for staff use during communications emergencies, it is also available for casual use during visitor hours. More detailed information about W1AW's facilities can be found online at **www.arrl.org/inside-w1aw**. A video tour of W1AW is available at **www.arrl.org/w1aw**.

If you have a group of 10 or more that would that would like to operate and/or tour W1AW, please e-mail our Membership Manager, Diane Petrilli, at **KB1RNF@arrl.org** to make the necessary arrangements.

Enjoy your visit to Whiskey One Alpha Whiskey!

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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.

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Programs

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National Centennial Convention, July 17-20, 2014 – **ARRL2014.org**

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

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Logbook of the World – **www.arrl.org/lotw**

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

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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**
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ARRL Volunteer Examiner Coordinator (ARRL VEC) – **www.arrl.org/vec**
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ARRL is an incorporated association without capital stock chartered under the laws of the State of Connecticut, and is an exempt organization under Section 501(c)(3) of the Internal Revenue Code of 1986. Its affairs are governed by a Board of Directors, whose voting members are elected every three years by the general membership. The officers are elected or appointed by the directors. The League is noncommercial, and no one 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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As an ARRL member, you elect the Director and Vice Director who represent your division on ARRL policy matters. If you have a question or comment about ARRL policies, contact your representatives at the addresses shown.

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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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The ALS-1300 is fully protected to prevent amplifier damage if you: switch to a band different from your transceiver, use the wrong antenna or have overly high SWR, if the heat sink temperature exceeds a safe level, if the dual 600 Watt modules are significantly RF unbalanced. Whenever the amplifier faults, it is automatically bypassed.

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Options

MOD-10MK $39.95, low-pass filter assembly gives you 12 and 10 Meter operation. Requires FCC ham license.

QSK-5, $359.95, pin-diode T/R switch gives lightning fast silent QSK operation.

Here's what they say . . .

I have had my amp now for a few days and WOW! I picked the amp up at the factory and Mike was very helpful in showing me the ins & outs of the amp. Mine is S/N 8 and these amps are in high demand. It will truly talk 1200 watts all night long and never get warm. Thanks to Ameritron for the way they treat their customers and taking time that I was satisfied. N5SBZ

I've been using SN3 for about six weeks now. No processors or digital read-outs, but very easy to use and it puts out 1200 watts on most bands with no problem. I have been operating QSK as the internal relays are plenty fast enough. AD5X

I have had this fine amp now for a week and have made a number of QSO's (20). It can make the difference, and has in a number of occasions, getting thru the QRN and making a contact. Some of my QSO's have lasted up to 1 hour and there has not been a single problem...runs cool and gives me excellent results. KB4KKX

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Steve Ford, WB8IMY, upfront@arrl.org

The Day the Tower Tilted

by Murray Green, K3BEQ
k3beq@arrl.net

Weather radar had warned of a line of approaching thunderstorms. Trees were bending in a howling wind and rain was splattering hard against the windows. As I made my way to the basement, I was suddenly startled by a loud *thud.*

After carefully opening the front door, I was confronted with the sight of a 50-foot twin chestnut/oak tree split in two. One trunk had fallen on the power lines. The other trunk had plunged across a set of guy wires supporting my Rohn 25G antenna tower and had landed on the roof.

As the storm died down, I was able to go outside and assess the damage. I was pleased to see that the tree hadn't penetrated the roof. The tower was intact as well, but something wasn't right. It was tilting to one side!

The Tower

My tower has four sets of guy wires, each with earth anchors turned three feet deep into the soil. One of the guy wire sets was attached to a 10 foot steel pipe buried in four feet of cement. Another earth anchor was attached to the pipe. (The pipe was there to elevate the guy wires so that people could pass safely beneath them.)

When the tree fell on this set of guys, the wires slowed the fall of the trunk like a rubber band and prevented it from going through the roof. However, the weight of the tree bent the steel pipe at its base and yanked the pipe's earth anchor out of the ground. The overstressed guys also pulled the tower in the direction of the fallen tree, snapping the guy wires on the opposite side in the process.

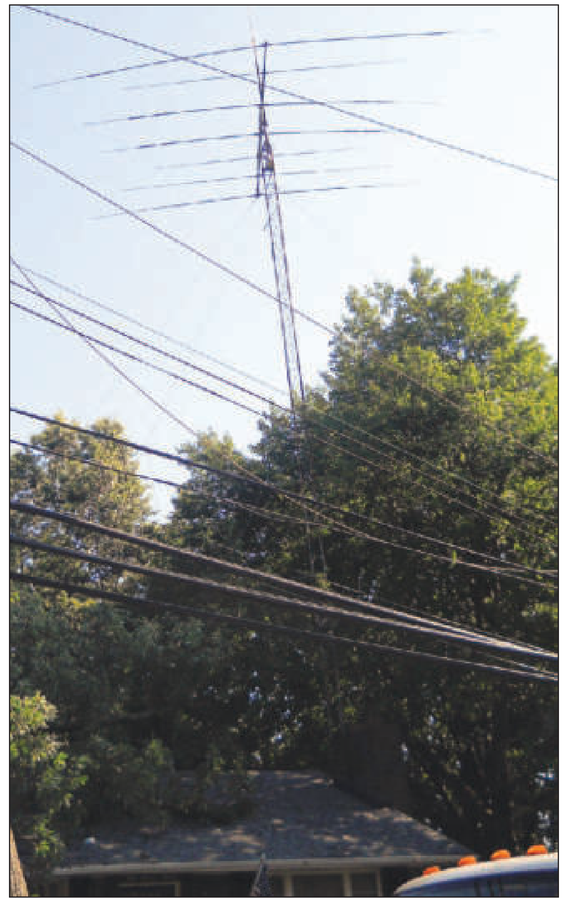
Help is on the Way

I grabbed the telephone and called my tower repairman, Mike Cizek, W3MC, followed by the power company, the insurance agency and a tree removal company.

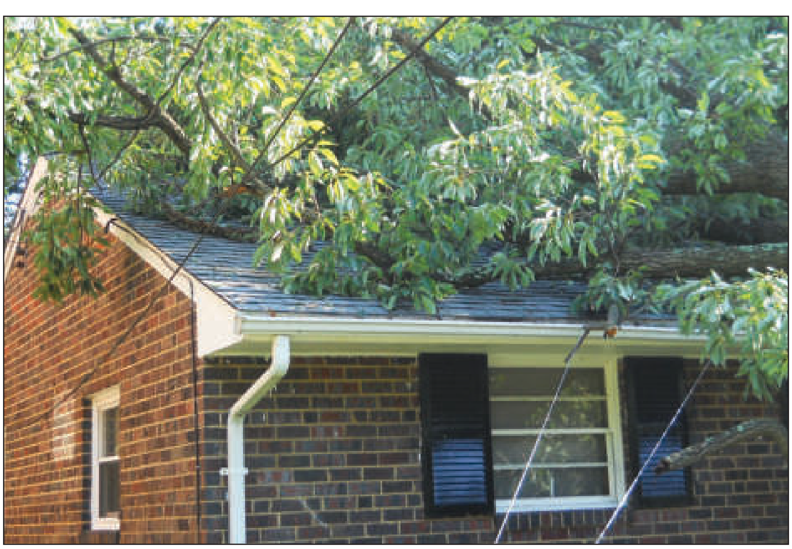
Mike rigged up temporary guy wires to stabilize the tower, but he was concerned about structural damage and what might happen if more storms arrived before he could finish the job.

Moment of Truth

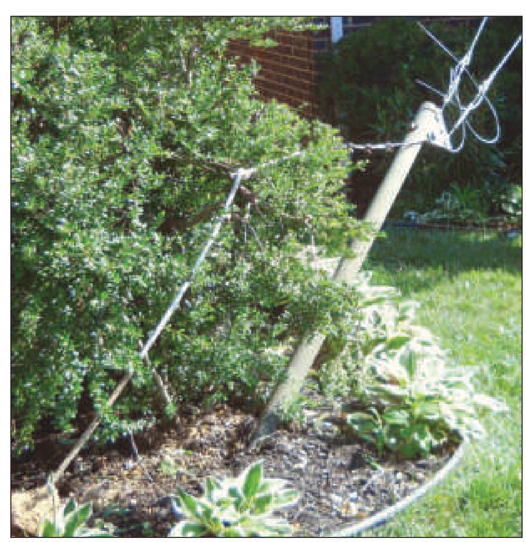
A week later, with the temperature hovering around 100 °F, Mike installed the permanent guy wires and then climbed the tower to inspect it. As Mike finally descended the tower, he was smiling. "All okay!" he shouted. "There is some scraping of the metal at the joint where the tilt occurred, but she's okay. Your tower is ready for another storm."



When I walked outside after the storm and saw my tower, it was obvious that something was very wrong!



The tower guy wires (see the lower right portion of this photo) probably saved my roof by gently lowering the tree trunk as it fell.



The sheer weight of the tree severely bent the 10 foot steel pipe and pulled out the earth anchor behind it.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Letters from Our Members

Encryption of Emergency Communications

I read that the FCC is being asked to consider a change in the rules concerning signal encryption by amateurs, particularly during emergency communications. Under the current rules, encryption is not allowed when the purpose is to intentionally obscure the content of a transmission.

I cannot think of any emergency situation where it would be necessary to encrypt a message. I can certainly see why some amateurs would desire encryption, however. As the saying goes, "Nothing adds excitement like something that is none of your business."

John Davis, WA8YXM
Davison, Michigan

When Technology Trumps Technocracy

I recently toured Kurdistan — the independent territory of Northern Iraq. It's a great place to visit, with its pioneer attitude toward growth and modernization. Alas, it has no policy concerning Amateur Radio transmissions.

Years ago ham radio was disbanded by the then-dictator Saddam Hussein. It has still not recovered. Kurdistani lawmakers have no idea what hams do. When I asked about transmitting from Erbil, I received a blank stare. Since I did not want to get into trouble with any of the local police or military, I turned to EchoLink since Wi-Fi was readily available.

I live in Sun Lakes, just south of Phoenix, Arizona. So, I naturally looked to make contact with someone from my neighborhood. Ken Delgado, K7GEL, obliged and we had a brief ragchew. To the call sign listing on the EchoLink server, I added Kurdistan to my identity. (There is no listing for Iraq or Kurdistan in the EchoLink system.)

My conversations on EchoLink from an area that is completely devoid of Amateur Radio enthusiasts generated a slew of questions from Kurd onlookers. Perhaps they will again organize into a formal group and reestablish Amateur Radio in their land.

Since EchoLink depends on the Internet, I didn't make an Amateur Radio contact *per se*. Even so, EchoLink proved to be an excellent tool for staying connected with the ham community in spite of local laws, or lack thereof.

Everett Rockwood, KG4TDQ
Sun Lakes, Arizona

Observations of a New Amateur Radio Operator

I am a new Amateur Radio operator — very new. Shortly after getting my license I joined the ARRL to reap the benefits of membership. You may choose to call me green, rookie, novice, newbie, neophyte or wet behind the ears and you would be absolutely correct. My perspective is that if I don't know much as a new operator then I am in the same place as many new hams. As the saying goes, "information is power." Getting the information is a whole other story.

Some of my observations:

The ARRL website has a ton of useful information, but it is not user friendly to navigate and its organization is less than desirable. There is a lot of "link clicking" before you get to where you are going. There is a row of links across the top of the page, links on the left side of the page and links in the middle of the page! Way too many links. Reorganization of the website would go an extremely long way to making it user friendly.

Looking beyond the ARRL Web, personal websites related to Amateur Radio are often arranged like they were created in the late '80s or early '90s. Again, often there is great information, but the presentation is lacking. Some studies suggest if you cannot find what you are looking for on a website within 30 seconds you will leave. Organization and presentation are critical.

We live in an information-driven society and the presentation of the message in Amateur Radio can be improved. Maybe it is time to re-evaluate how the message is not only sent, but also received.

Scott Kirshner, KG7DSH
Goodyear, Arizona

Tim Samaras, WJØGI

I was saddened to hear of the death of storm researcher Tim Samaras, WJØGI, in the May 31 tornado near Reno, Oklahoma. I first met Tim soon after I moved to the Denver area. Although I subsequently moved to Roswell, New Mexico in 2001, we kept in touch.

In 1973, when he was just a 15 year old teenager, it was very evident that Tim wasn't your average high schooler. He was passionate about every project he undertook, especially about chasing severe weather. I can remember how excited he was to accomplish one of his goals of measuring the barometric pressure inside a tornado — goal he achieved in 2003. His later efforts to photograph the inside of a tornado were realized, too!

And his latest project, an attempt to capture a lightning genesis event, was just as rewarding. Through all of this, he never forgot his family, his friends or Amateur Radio. May he rest in peace.

Alan Applegate, KØBG
Roswell, New Mexico

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Protecting Your Rotator

A brake delay circuit can keep a jammed rotator from spoiling your operating experience!

John F. Sehring, WBØEQ/VE6EQR

After perusing the *QST* Internet archive (**www.arrl.org/arrl-periodicals-archive-search**), I found that adding a brake delay to the popular Hy-Gain antenna rotators hasn't been discussed for several decades.[1]

I believe there are still large numbers of older Hy-Gain rotators serving faithfully (I have two from 1980) and new units are still being sold. Most of the models with the bell-shaped rotator housing (as shown in the lead photo) would benefit greatly from adding this improvement.

The Brake is a Great Feature — But...

The Hy-Gain rotators that use non-digital control boxes and have three paddle switches in a row on the front panel are vulnerable to damage. Trouble will occur if the brake wedge tries to engage while the motor is running or while the antenna is still turning. This could lead to excess torsional stress on the support structure, damage to the brake or jamming of the rotator.

I've come across a delay circuit from the past that is so simple and reliable, I think it's well worth reviving.[2]

The Way it Works

With unmodified rotator operation, the brake release switch is first engaged and held. This energizes the brake release solenoid that pulls out the brake wedge thus releasing the brake. It also supplies voltage to both the CW and CCW rotation switches. Engaging either of them will energize the appropriate motor winding to start rotation. The brake release switch must continue to be held down while the rotator is moving.

When finished, release the rotation switch — but you must wait until the motor and antenna have coasted to a stop before letting go of the brake release switch. That's because there's a danger of the brake trying to engage while the antenna is still rotating due to its inertia (larger antennas take longer to stop). This is important, as in most cases we cannot observe our turning antenna to see what it's doing. This problem can also easily happen if your finger slips off the brake release switch. Ouch!

A Simple Fix

With the brake delay modification shown here, after energizing the brake release switch and one of the rotation switches, the added delay circuit will hold the brake off (energize the brake release solenoid) for about 8 seconds, even if you release all of the switches. During this time, you need use only the rotation switches to turn the antenna, as the brake will be held off by the delay circuit.

[1]Notes appear on page 31.

Figure 1 — View of the front panel showing the added LED (D4) indicator that shows that the brake is disengaged.

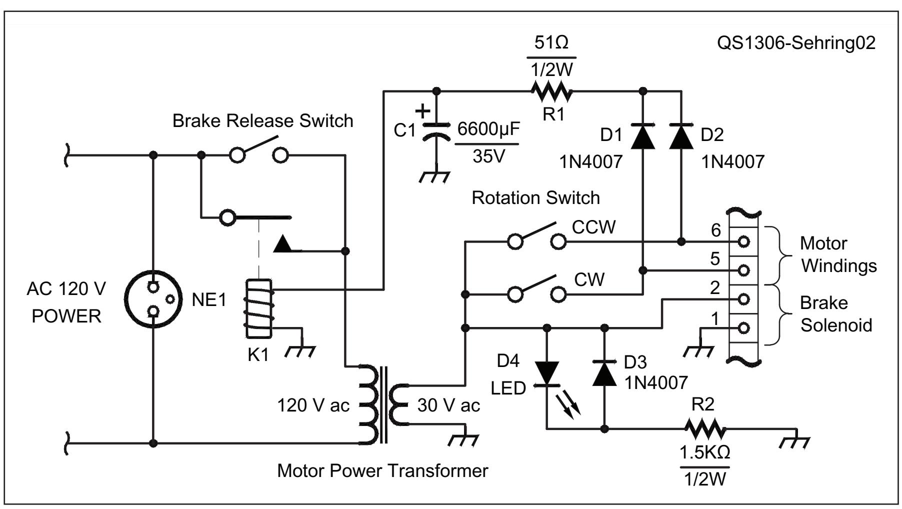


Figure 2 — Partial schematic diagram and parts list of the modified rotator controller. Numbered parts are those added.

C1 — 6600 µF, 35 V electrolytic capacitor, three 2200 µF in parallel.
D1-D3 — 1N4007 silicon diode.
D4 — Light emitting diode.
K1 — 24 V dc relay with SPST (N.O.) 10 A contacts. For example, NTE R25-11 D10-24.
NE1 — 120 V ac neon indicator.
R1 — 51 Ω, ½ W resistor.
R2 —1.5 kΩ, ½ W resistor.

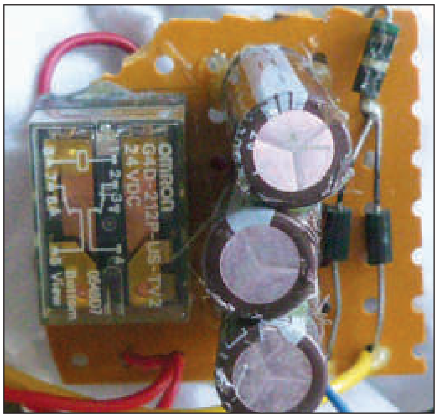


Figure 3 — View of the components mounted on a scrap of perforated project board. K1 is on the left, the three capacitors that make C1 in the center and D1-D3 on the right.

After releasing the rotation switch when you are finished turning the antenna, the brake will be held off for another 8 seconds. This will give the motor and antenna plenty of coast-down time before the brake automatically reengages.

You can rotate again, within 8 seconds, without needing to press the brake release switch once more. During this time, pushing either rotation switch will give you yet another 8 seconds of brake delay.

I added a green color LED indicator to the front panel just above the brake release switch (see Figure 1). It lets me know when the brake is off and the unit is ready for safe rotation.

How it Works

The brake delay circuit works as follows (see Figure 2):

- When the BRAKE RELEASE is engaged, along with either one of the ROTATION switches, diode D1 or D2 quickly charges the capacitor C1 through small resistance R1, and relay K1 closes. K1 then energizes the brake release solenoid.
- After the rotation switches are released, capacitor C1 discharges slowly through the larger resistance of the relay's coil winding. During this delay, K1 contacts keep the brake release energized and the rotation switches ready for action.

This discharge takes about 8 seconds and is set by the relay coil's dc resistance and the value of capacitor C1. In this case it is the RC product of relay K1's coil dc resistance (1100 Ω) and C1 (6600 µF). You can alter the delay by changing the value of C1. Increase the value if you wish to make the delay time longer.

During the delay interval, whenever either of the rotation switches is actuated, capacitor C1 is recharged via diode D1 or D2 giving another 8 seconds of delay time.

The brake release LED indicator (D4) circuit is also shown in Figure 1. It illuminates during the delay to show that the brake release is actuated and operating voltage is available to the rotation switches.

Assembly

I mounted all the parts of the delay circuit on a 2 × 1.5 inch perforated project board that easily fits inside the controller's case (see Figure 3).

While You're There

As a general improvement, I replaced the 28 V incandescent pilot light with a 120 V ac neon indicator. I mounted it in a hole drilled into the front panel, centered just above the controller's meter. The original hot bulb sometimes tried to melt the top of the meter's plastic case and wasted a few watts of power, too. With this modification, when you leave the direction indicator meter on, the unit's standby power use will be minimal.

Another general improvement I made was to give some protection to the analog meter. The controller uses a high quality Weston 0-1 mA dc meter movement. Any problem causing excess current in the indicator circuited could easily destroy the meter. I thus added two ordinary silicon diodes, wired in parallel opposing, across the meter terminals to offer protection against this. They will not affect the meter reading at all. Full scale voltage across this meter is but 50 mV and the silicon diodes won't conduct until the potential reaches 700 mV.

Notes

[1]These were previously sold under the brand names CDR and CDE.

[2]J. Reinke, AB6I, "Hints and Kinks — Brake Protection for the CDE Ham IV Rotator," *QST*, Apr 1982, p 52.

Photos by the author.

John Sehring, WBØEQ/VE6EQR, has held an Advanced class license since 1975 but has had a strong interest in radio and electronics since an early age. He had to be kept away from anything that had knobs on it.

John spent 4 years overseas in the USAF as an avionics technician. He then earned BS and MA degrees in applied physics. John spent a career teaching the use of computers for dynamic simulations of systems of a mechanical and thermal nature.

He is now retired and enjoying a long list of mostly ham radio and homebrew audio projects. He is a great fan of boat anchor radio and test equipment — almost anything with vacuum tubes is favored. His favorite band and mode is 10 meter FM on which he uses surplus Motorola two way FM equipment. You can reach John at 12 Westridge Rd, Okotoks, Alberta T1S 1N3, Canada or at **wb0eq@yahoo.com**.

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

A Cautionary Tale

In both of my samples of 30-year-old CDE rotator control boxes, I've found what I consider to be a serious electrical safety problem. Its presence is sneaky since you can't see it without very careful examination.

The factory-supplied ac power cord to the controller is of the molded to the plug, three wire type, with hot, neutral and safety ground blades at the plug. The power cord itself shows what appear to be three insulated wires going into the case. Looks good, right? Wrong!

Opening the control box reveals that there are actually only two conductors in the power cord. The third "wire" (normally the safety ground, usually with green insulation) is just empty, dummy molded-in insulation containing no wire!

I think for a piece of in-shack electrical, ac-powered equipment that's going to be connected to long outside conductors such as rotator cable, feed lines, antennas, towers and other accessories, this is a dangerous condition. You think you have an ac power safety ground and you actually don't. The safety ground is normally connected reliably to the unit's metal chassis. By the way, some of the schematics of these older rotators (which can be found on the Internet) show a safety ground and some do not. The models presently sold by Hy-Gain have a proper ac safety ground.

The fix is of course to immediately replace the cord set with the correct three-wire type.

Two Handy Mods for Your UPS

Easily adapt your uninterruptable power supply to accommodate a larger battery for public service applications.

Phil Karras, KE3FL

I was dissatisfied with my uninterruptable power supply (UPS) — I wanted the option of a larger battery than was internally provided and I was annoyed by the buzzer used to indicate a battery fault. As it turned out, these objections were easily overcome. I added color-coded extension wires with Anderson Powerpoles® to connect to an external battery and the buzzer was easily unsoldered and a front panel LED wired into its place (see Figure 1). [It goes without saying that internal modifications such as these will invalidate your warranty. — *Ed.*] Here's how I made these modifications.

External Battery

The battery compartment of my UPS has two heavy gauge wires that connect to the battery. I cut off the connectors for the internal battery and spliced similar heavy gauge wire to extend about a foot outside the UPS (see Figure 2). I maintained the same external color coding as the interior — red for positive and black for negative. Splicing heavy gauge wire can be a bit of a challenge. My trick is to strip about a half inch from each conductor and then place them side by side with the ends pointing in opposite directions. I then bind them with thin wire to ensure that they stay together while soldering. After soldering and confirming that there are no sharp ends sticking out, I slip a piece of heat shrink tubing over the joint and secure it with a hot air gun. If you don't have a hot air gun, you can use the heat from the barrel of your soldering iron to shrink the tubing.

I used a Dremel tool to grind two grooves for the wires to exit the UPS with the battery compartment lid in place. I then added red and black Anderson Powerpole connectors to the wires to match up with similar connectors on my external battery (see Figure 3).

Replacing a Buzzer with an LED

My UPS uses a buzzer to warn of a battery fault, but I prefer a visual warning rather than an auditory one. I removed the buzzer from the UPS circuit board by heating the solder connections and then clearing the solder away with a solder sucking tool. Desoldering braid can also be used to remove the molten solder. After removing the buzzer, I verified the activation voltage and used this in determining the series resistor value. Noting positive and negative, I then added extension leads to reach the front panel where the LED would be mounted. If you have a new LED with unclipped leads, the cathode (negative side) is the shorter of the two. Otherwise, if you are using a salvaged part with clipped leads, the cathode will be the lead by the flat spot on the ring at the base of the LED. Another quick way to verify polarity and functionality is to use a 9 V battery with a 1 kΩ series resistor to test candidate LEDs.

There are many different LEDs on the market with widely varying specifications. In general, the two electrical parameters to note are the LED's rated current and the forward voltage drop at that current. A series resistor is required when driving the LED from a voltage source. To calculate the resistance, subtract the LED's forward voltage drop from the voltage source and divide the difference by the rated current. Note that the rated current is often an absolute maximum specification, so it's good practice to derate it somewhat.

There are special clips for mounting various diameter LEDs. Alternatively, I find it just as easy to drill a hole that will be a snug fit, then press the LED through the hole and secure it with a dab of adhesive.

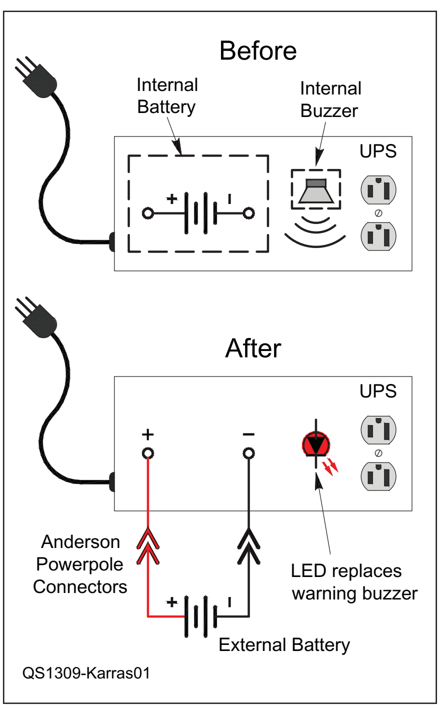


Figure 1 — Modifications to the UPS include provisions for an external battery and replacing the internal warning buzzer with a panel mounted LED.

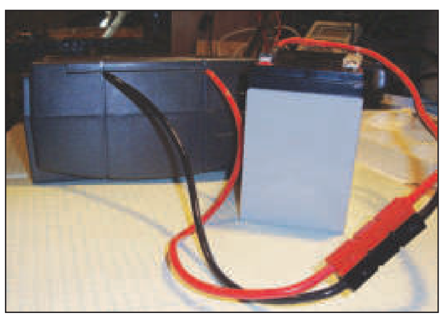


Figure 2 — Connections to an external battery via Anderson Powerpoles.

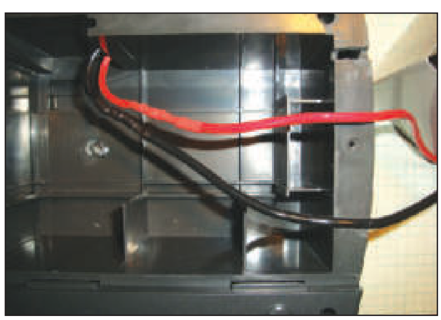


Figure 3 — Heavy gauge wires spliced to the internal battery connections exit through grooves cut in the case.

ARRL Life Member Phil Karras, KE3FL, who holds an Amateur Extra class license, is a Volunteer Examiner and has received ARRL appointments as an Official Relay Station and Official Emergency Station. Phil is the Assistant Emergency Coordinator for Carroll County, Maryland. He can be reached through his website at **http://cs.yrex.com/ke3fl**.

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

A 21 MHz Four Square Beam Antenna

This popular antenna for the lower bands can also work well on 15 meters.

Garth Swanson, G3NPC

The four square beam is a square array of four vertical elements whose radiation pattern can be rapidly switched in direction by altering the relative phases of the four driving currents. The main beam relies on constructive interference of the signals from the elements. The relative phase of waves from an element of the array is made up of the phase shift of its drive current and the phase shift associated with the additional path length due to its spatial separation from the lead element.

At low frequencies, where mechanical rotation is difficult for large structures, phase control is an attractive possibility. This makes a four square popular with contesters and DXers on 160 through 40 meters. The elements are generally positioned at the corners of a ¼ wavelength square. At 21 MHz the antenna is more compact and can be easily accommodated in smaller yards allowing changing directions without a tower or a rotator. The array maintains the low angle radiation characteristic of a simple ¼ wave vertical monopole but is able to offer forward gain and reject noise and unwanted interference that is outside the main lobe.

This practical description of my antenna is based on my article in the current issue of *QEX*, which includes the theoretical basis for many of the design choices presented here.[1]

The Antenna Array

The array is formed of four ¼ wave vertical monopoles at the corners of a ¼ wave square. Although a maximum radiation efficiency of 80% can be achieved with a monopole at 21 MHz with 13 or more ground radials, eight radials per monopole were selected for this design. This was done for convenience but had the effect of reducing the radiation efficiency to 65%, equivalent to a small eventual loss of array output of 0.9 dB. Each of the four elements had its own set of ¼ wavelength radials lying on the ground, now buried at a depth of about ¾ inch.

The basis of the array is the ¼ wave vertical and a first step is to carefully characterize this element to ensure that its driving point impedance is known across the band ensuring that it is resonant at the center of the band or at a frequency of interest. This should be done in isolation either without installing its three neighbors or, if they are present, by open circuiting their neighboring driving points during the measurements.

The design was centered on a frequency of approximately 21.2 MHz using elements adjusted to be resonant in isolation with a length of 10.95 feet. The monopoles consisted of three telescoping aluminium sections with an insertion length of about 4 inches locked by stainless steel screws. Each was topped by a short telescoping whip that allowed fine adjustment of the overall length. The details of its construction are shown in Figure 1. The element was insulated from an aluminium ground post by a short length of polyethylene water pipe and secured by U bolts (see Figure 2).

Figure 3 shows the parallel electrical response of one of the elements in isolation. These values of impedance are fairly typical, but reflect the eight radials that I used and the ground on which they lay. The elements of an array should be characterized on the ground on which they are to be used.

The side length of the array was 11.64 feet, a ¼ wavelength in free space. In order to ensure, to the extent possible, that the coupling between the elements was only electromagnetic, their radial systems were not connected directly to each other. Each radial set was returned to its own ground mounting.

Taking Into Account Inter-element Coupling

Electromagnetic coupling between the four elements means that their properties cannot be considered to be independent of each other. This is most easily seen through the changes in driving point impedance of an element when a similar element is brought near

[1]Notes appear on page 40.

Table 1
The Phases of Unit Element Currents Needed for Broadside and Diagonal Firing

Element	NW	NE	SW	SE
Broadside (S firing)	0°	0°	–90°	–90°
Diagonal (NE firing)	-90°	–180°	0°	–90°

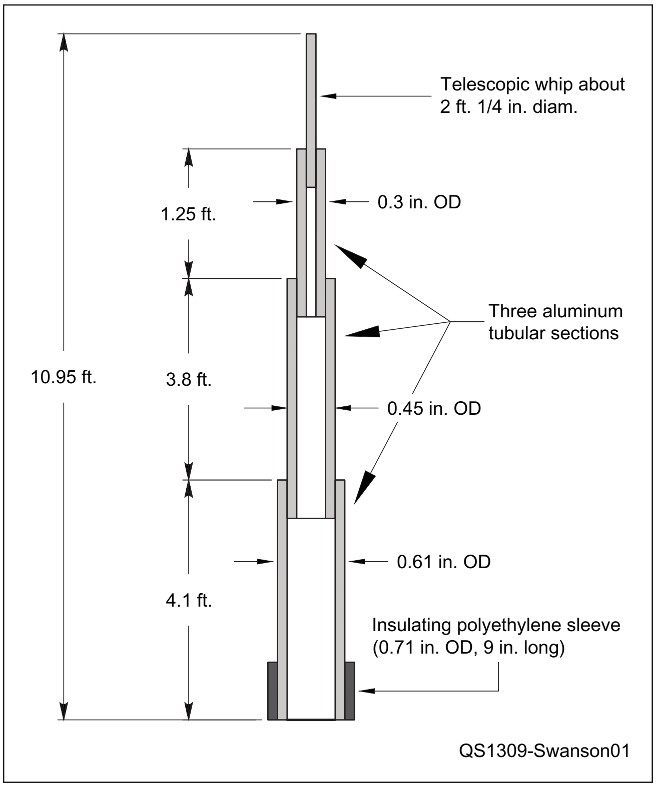


Figure 1 — Constructional details of the monopole. The dimensions were converted from the author's metric sizes. Use available telescoping tubing of similar size.

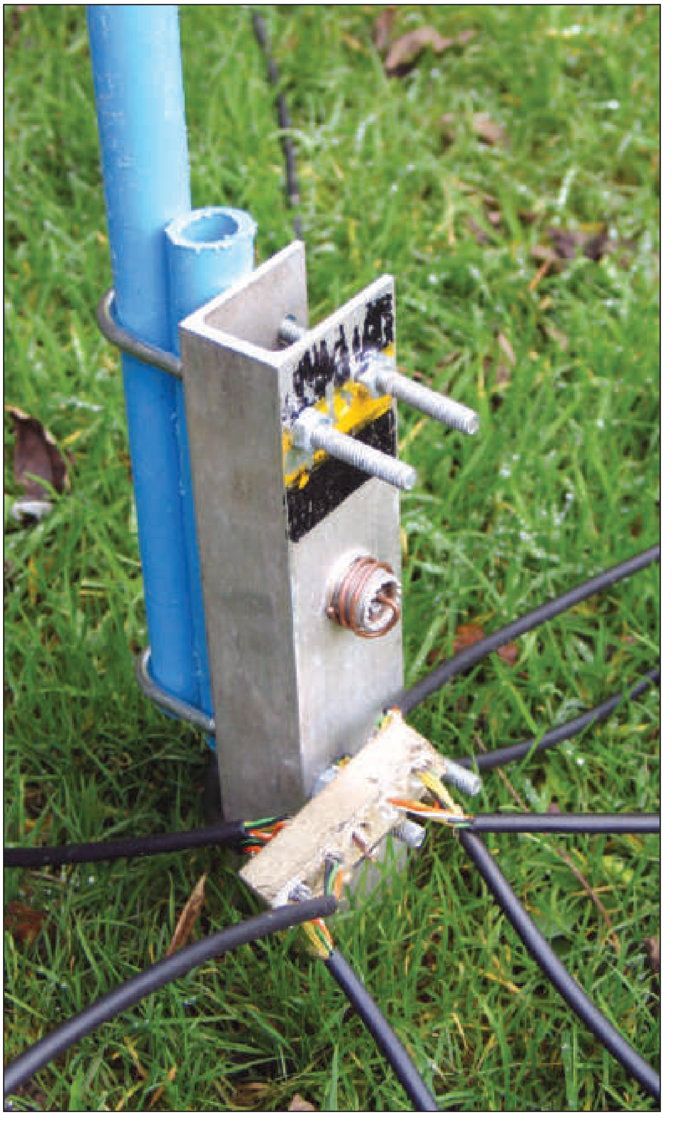


Figure 2 — Details of the monopole mount for each element.

and, more importantly, when that second element is excited.

The related article in *QEX* shows how these measured values of mutual impedance can be used to arrive at the individual element driving point impedances that are defined by the currents flowing simultaneously into the four element driving points.

The choice of driving point currents is determined by the radiation pattern that is sought. Table 1 summarizes two possibilities. The element currents are phase shifted and must be represented as complex quantities in any calculation. Since diagonal firing gives a higher gain and a narrower forward lobe it is this that I have implemented.

Table 2 shows the driving point impedances that result from the set of currents chosen for diagonal firing. These values are based on impedance and mutual impedance measurements made on my ground and with eight ¼ wave radials on this terrain.

While these values can be regarded as typical, an optimum design for any other location would require a new set of impedances to be measured using the procedures that have been described in the *QEX* article.

Delivering the Required Currents

As was already mentioned, it is the set of drive currents that determines the radiation pattern. The problem then is how to deliver the currents into the four driving point impedances.

A particularly straightforward method that has been chosen here is to make use of a transmission line of an appropriate length to transform the current feeding an antenna element into a voltage that can be preset at the feed point. The method is sometimes called *current forcing* because the length of the feeder, the load impedance and the feeder input voltage completely define the voltage distribution along the

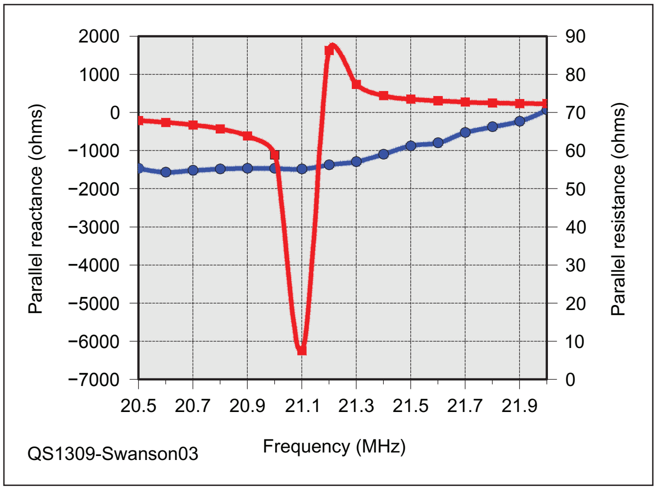


Figure 3 — The parallel electrical response of one of the elements with its eight ground level radials when its three neighboring elements were open circuited. The red curve is reactance, the blue is resistance.

Table 2
Calculated Driving Point Impedances for Diagonal Firing

Element	Driving point impedance (Ω)
Leading	77.5 + *j*76.2
Central (off-axis)	66.2 – *j*18.7
Rear	1.0 – *j*31.1

feeder and at its termination. It is this terminating voltage that forces the required current to flow into the element driving point.

The four elements have to be individually driven so that four separate feeders of different length are needed to provide the transformations that deliver the complex currents required at each driving point. Ideally the four feeders should be driven together at one point but as Al Christman, K3LC, has pointed out they can only be brought together at a common node and fed from the same source if the voltages at the sending end of the feeders are equal in magnitude and phase.[2] I have demonstrated that in this case, and in others, that points on the four feeders with the same voltage and phase do not always exist and it has been necessary to modify the Christman method.

The approach that I have used successfully and recommend is to select points that have the same phase and translate the voltages using transformers. Table 3 summarizes the electrical parameters at the four feeder inputs before making the voltage transformations and shows the lengths of RG-58 feeders that are required to establish the driving point current magnitudes and phase shifts for diagonal firing.

At 9.84 feet for the rear element, 17.06 feet for each of the central elements and 22.63 feet for the leading element, the phase is the same. These feeder lengths would deliver the required complex currents to the element driving point impedances shown in Table 2 and could be driven in common only if voltage scaling were used. This design procedure that takes into account inter-element coupling is a key step in the design of this four square array.

Arranging a Common Feed Point for the Array

The modified Christman method, in which the input voltage of each feeder is scaled to the same value, has been applied to the four square array as well as to a practical two element design and theoretically to a broadside-firing four square array.

There is a 3% difference in voltage between the required feeder input voltages for the rear and lead elements. This discrepancy is comparable with the accuracy of the calculations so these feeder inputs were simply paralleled. The pair of central element feeders had the same voltage and phase distributions so their inputs could be paralleled together but they did require a voltage about 20% larger, so magnitude scaling was necessary.

Transformers offer a straightforward means of scaling and provide a way of ensuring that the common input impedance of the array is close to 50 Ω. Importantly though, there should be no phase shift in the transformation. A winding of any practical transformer has a leakage inductance due to flux that does not link the other winding. This gives rise to an element of inductive reactance that causes the phase between the winding voltage and its current to be non-zero. The consequence would be an error in the phase of the current delivered to the antenna. This occurs in both windings and it is essential to ensure that the overall phase shift is nulled. Although in principle one transformer could have been used with two secondary windings it proved much easier to neutralize the leakage reactances when one transformer was used for each set of feeders. The calculated individual feeder input impedances are shown in Table 3.

Figure 4 shows the interconnection of the two transformers and the placement of the series preset 150 pF neutralizing capacitors.

Design of the Power Splitting Transformer

The ratio of their turns ratios, k, was set by the voltage scaling factor, in this case 0.84. The absolute number of turns in the secondary windings was then determined depending on the number of primary turns that had been selected.

The transformers were constructed on Type 61 ferrite toroidal rings having an outside diameter of 2.4 inches and an inside diameter of 1.6 inches. The primary windings were formed from a single strand of #22 SWG (similar to #21 AWG) enameled copper wire and the secondaries were of four twisted strands of the same wire wound compactly onto the toroid in the same sense and interleaved with the primary turns. Care was taken to begin the ground ends of the two windings

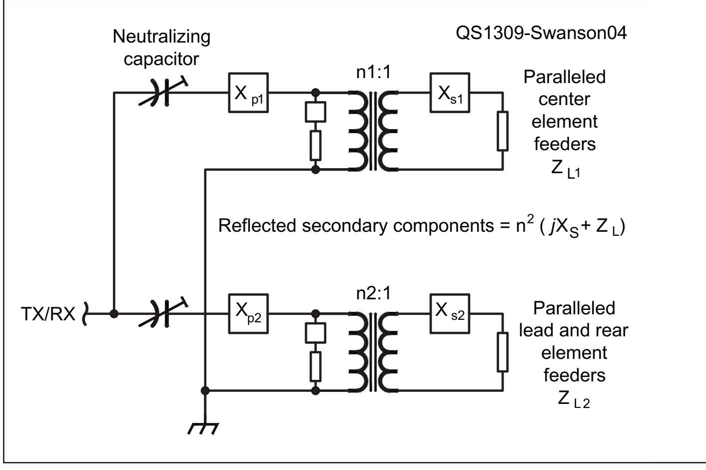


Figure 4 — The interconnection of the feeder transformers.

Table 3
Electrical Parameters at the Equal Phase Points

Position of Feed Point	*Lead Feeder*		*Central Feeder*		*Rear Feeder*	
Length (feet)	**Voltage (V)**	**Phase (°)**	**Voltage (V)**	**Phase (°)**	**Voltage (V)**	**Phase (°)**
9.84					55.0	90.3
17.06			63.4	90.2		
22.63	53.5	90.3				
Input Z of Feeder (Ω)	16.6 – *j*15.5		46.3 – *j*21.3		21.0 – *j*161.6	

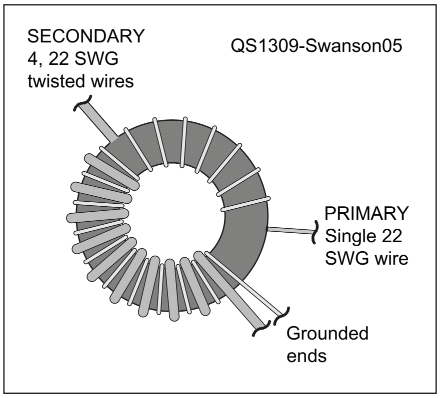


Figure 5 — Transformer winding configuration.

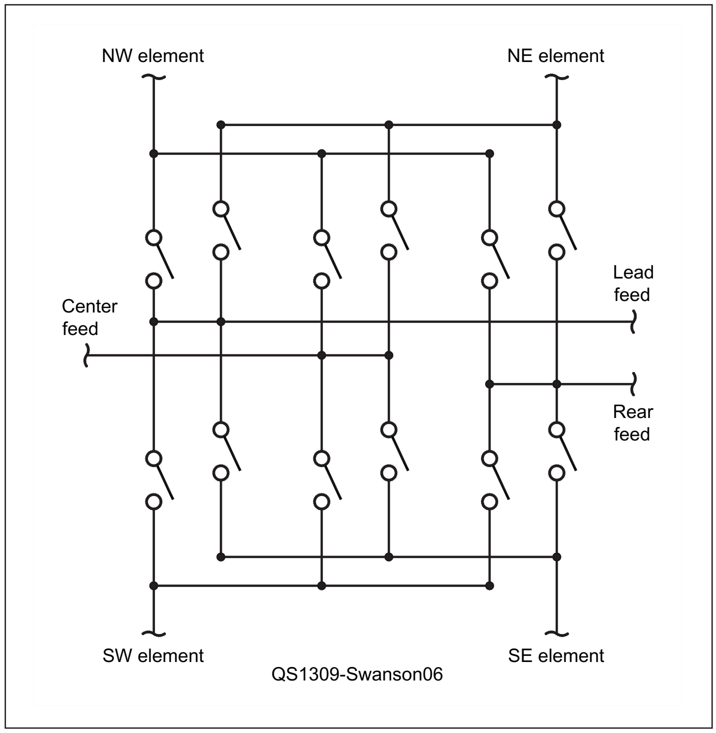


Figure 6 — Functional schematic of the router switch array.

at the same position. This helped to minimize the local potential differences between the windings ensuring that capacitive currents between the windings were minimized. The winding scheme is shown in Figure 5.

In practice 20 primary turns were selected for each transformer because these fitted conveniently onto the chosen toroids. The numbers of secondary turns for the two transformers were then adjusted mathematically to achieve a suitable value for the paralleled primary reflected impedances, always preserving the required ratio between the two secondaries.

The setting of the neutralizing trimmers has to be done when the secondary is terminated with a resistance. In this case the load resistance was 100 Ω. When each primary is excited with a voltage at the design frequency the secondary voltage is observed. If a high impedance oscilloscope is available, the phase of the primary and secondary voltages can be compared and the trimmer adjusted until the phase difference is zero. This condition also corresponds to a maximum in the secondary voltage, so that an observation of this RF voltage with a simple diode RF probe and a dc voltmeter would suffice. Once this procedure has been carried out the individual transformers can be connected to the power splitter circuit without further adjustment.

The overall design procedure led eventually to a measured common node input impedance of 51 –*j*29 Ω for the finished array. The details of the transformers are summarized in Table 4.

Table 4 shows that more primary turns were required than had been anticipated by a simple view of transformer design. This could be due to winding end effects where the end turns coupled inefficiently to the core. Careful adjustment of the number of turns was made as measurements checked the open circuit voltage ratio. Small errors in achieving the specification are due to an inability to realize fractional turns.

The attenuation of each transformer was about 1.2 dB, equivalent to a transformation efficiency of 76%. The realization of the transformers required great care, but there is certainly scope for further improvement here.

The Direction Control System

In order to direct the beam to one of the four diagonal directions the feeds to the elements have to be rerouted, ideally under electrical control. Figure 6 shows the topology of a switching matrix for routing the three possible phase-shifted feeds to the appropriate elements for a particular direction of fire. The switches used were RF latching reed relays with a current carrying rating of 1.5 A and a switching time of 2 ms.[3] They were chosen because of their ability to maintain a particular setting without being continuously energized, and because they were hermetically sealed and suitable for operation outside. The switches had an actuation current of 16 mA suitable for control by TTL pull down devices. This matrix was built on glass-epoxy strip board and the boxed router is shown in Figure 7.

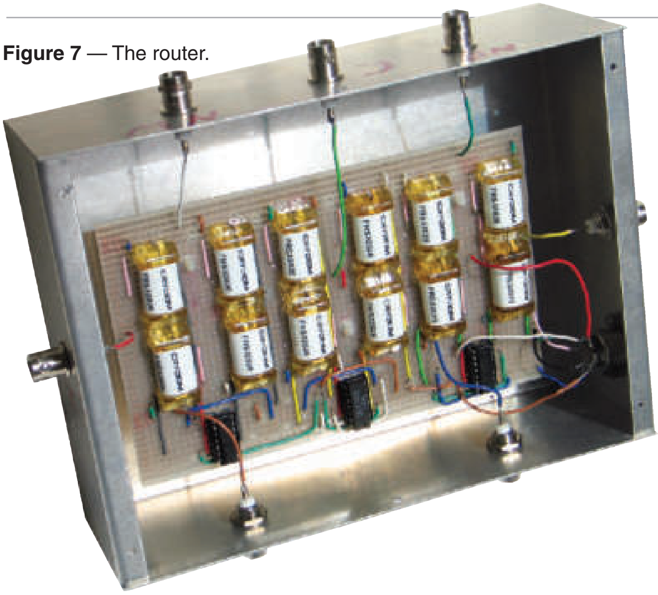
Switching Cell Design

The basis of the design is a group of three switches that are used to attach an individual element to one of three feeders: L (lead), C (center) and R (rear). The module for antenna element 1 is shown in Figure 8. The switches used were the Crycom FRS32026 (6) with reset, 6 and 5, and set coils, 2 and 1, that could be operated by the application

Table 4
Details of the Two Transformers Used for Voltage Scaling and Impedance Matching

	Theoretical designs Lead/Rear	Center	*Actual Designs* Lead/Rear	Center
Primary turns	20	20	23	23
Secondary turns	8.4	10	8	10
Combined input Z (Ω)	51 –*j*29			
Open circuit voltage ratio	2.4	2.0	2.3	2.0
	Required	Required	Measured	Measured

Figure 7 — The router.



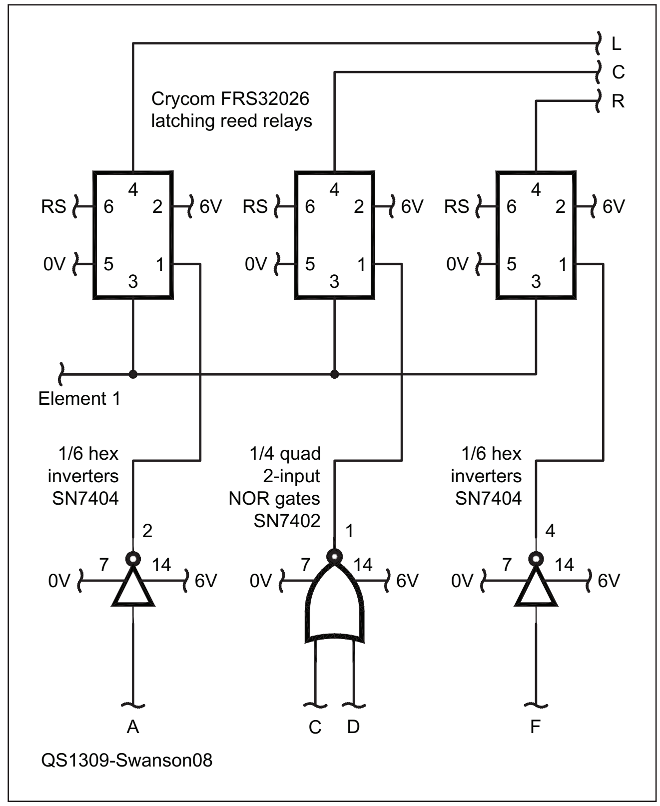


Figure 8 — One cell of the switch array.

of 6 V.[3] The reset signal caused the switch to open and remain open on the removal of this voltage. It was then ready for closure on the application of a +6 V potential difference between pins 2 and 1.

The set coils were controlled by either a two input NOR gate or a single logic inverter. If the logical control signals caused an output potential to fall to zero the coil would conduct a current of about 16 mA to ground causing the switch to close. The three reed relay switches in Figure 8 allowed element 1 to be connected to either the lead feeder using logic terminal A, the central feeder with C or D and the rear feeder with F. This allowed the antenna element to fulfill its correct role in any of the four directions of diagonal fire. The relays latching capability allowed it to "remember" either state after excitation of the coils had been removed. Any selection, set, operation had always to be preceded by the reset operation. The logical NOR gates were TTL devices arranged in groups of four, two input devices (SN7402), the inverters were provided by two hex inverters (SN7404).

Control System

The complete router was an array of four such modules, one for each antenna element (see Figure 9). Although shown separately, the reset terminals, RS, were connected together and the complete array of switches was reset simultaneously preceding a change in the direction of fire. The logical excitations necessary for the four directions are shown in Table 5. Notice that each logical input is only used once. This allows the four logical inputs for a particular direction to be hard wired together so that they can be switched together to select a desired direction.

The switch module requires four direction control inputs, the RESET input and two supply inputs, +6 V and ground. Figure 10 shows these lines at the operator's position. Before selecting a direction the array of 12 latching reed relays has to be reset. Setting the four DPDT switches down ensures that the RESET line is grounded. When the push switch is actuated, the reset coils are all energized and the switches reset to their open state. A direction is selected by switching one of the DPDT switches up so that its direction control line is energized when the push switch is momentarily pressed. This line is hard wired at the matrix to the logic inputs that ensure that each of the four elements is driven appropriately. In addition, the matrix has three RF inputs and four RF outputs. Because of the low load

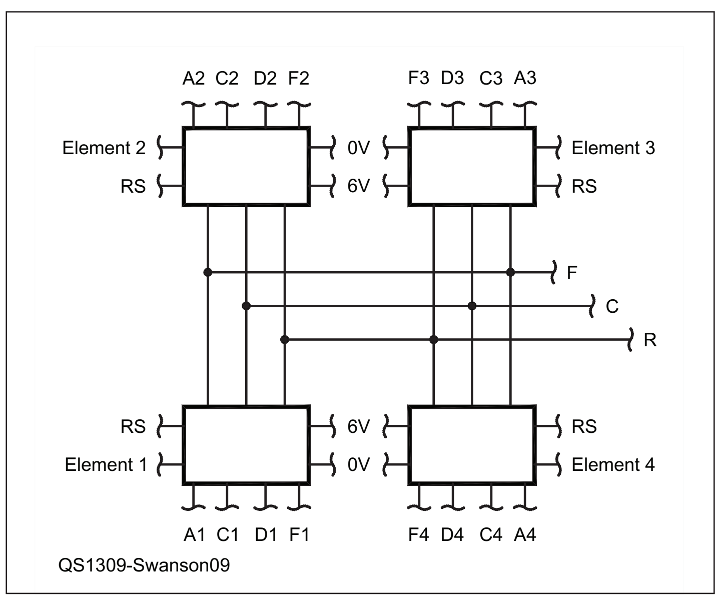


Figure 9 — The interconnection of four router cells.

Table 5
Logical Excitations for Steering

Leading Element	Lead	Center	Rear	Center
1	A1	C2	F3	D4
2	A2	C3	F4	D1
3	A3	C4	F1	D2
4	A4	C1	F2	D3

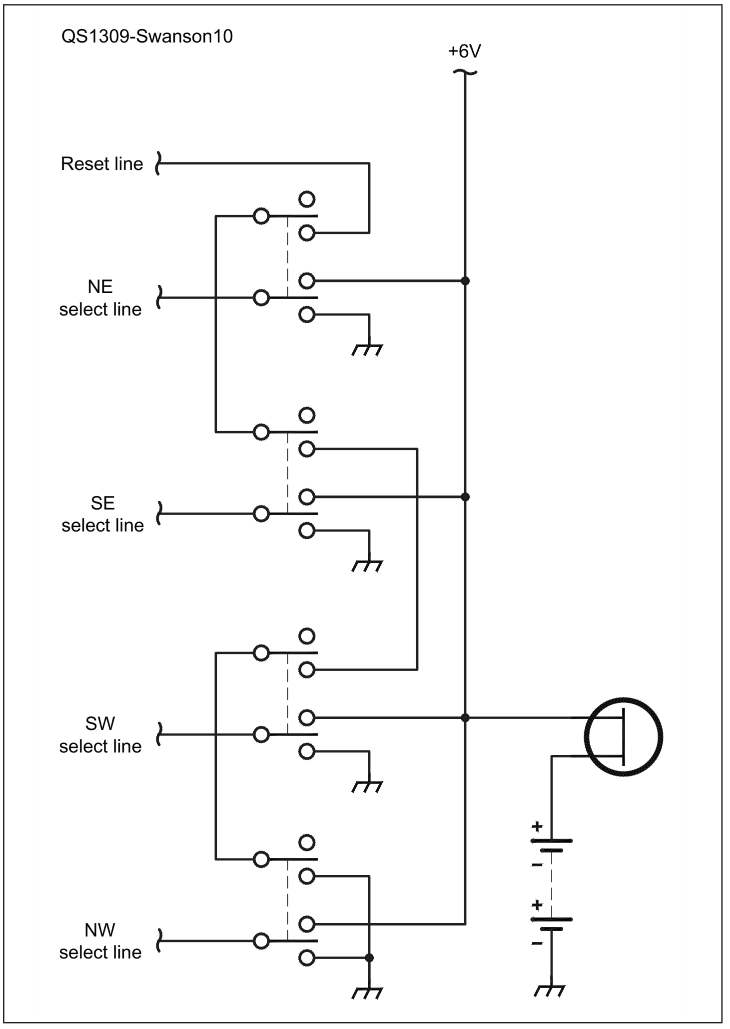


Figure 10 — Control switches at the operating position.

requirements, the power for the control of the array was supplied by a 6 V battery.

Interconnections

The box was linked to the operating position by a seven conductor cable. The beam was steered by resetting the reed relays and then briefly energizing the appropriate direction control line to set the required switch configuration. The 6 V battery that powered the reed relays and the control circuitry was at the operating position. All switching was carried out in the absence of RF excitation to avoid the possibility of contact damage due to arcing. The system has been in use for 2 years without any degradation. In principle, the direction of fire could be changed in as little as 4 ms.

Phasing Lines

The antenna design depends critically on RG-58 transmission lines that have definite lengths — 9.84, 17.06 and 22.63 feet. Locating the switching matrix at the center of the array meant that exposed feeders between the matrix box and the elements could be 8.2 feet long with the complementary lengths of 1.64, 8.86 and 13.12 feet, contained within the weatherproof box placed on the ground at the center of the array. This box also contained the power splitter.

The overall measured RF loss from the power splitter output to the elements via the switching matrix was no greater than 0.8 dB and depended slightly on the selected direction. Thus, from the power splitter input to the element inputs, there was a loss of about 2 dB, a feed system efficiency of 63%. Since the elements each have a radiation efficiency of about 70% the effective radiation efficiency of the antenna array measured at its feed point was 42%.

Directional Behavior

The polar radiation pattern was measured at stations at 22.5° intervals at a radius of 125 feet from the array center. At this distance the phase errors were no greater than 2°, giving a good approximation to the far field pattern. The measurements were made using a tripod mounted field strength meter with a dynamic range of 90 dB based on a design published by the Utah Amateur Radio Club.[4] At each location in turn, the received signal, a relative measure of the signal strength, was recorded for each of the four beam headings with good reproducibility.

Figure 11 shows the observed polar patterns for each beam heading. Each is formed from 16 measured points. Because data smoothing has been used to help visualize the patterns, caution is required in interpreting some of the finer angular detail. The patterns are very similar and show clear evidence that switching occurred as intended. They are plots of relative field strength and do not reveal that the maximum signal strength at each diagonal angle was actually the same, ±1 dB. The front to back ratio for each pattern was at least 20 dB. These are logarithmic plots that intrinsically exaggerate detail in the rear sectors, it should be remembered that these features are about 100 times smaller than the main lobes.

Simulated Performance

I used the freely available *4NEC2* package based on the *NEC2* electromagnetic modelling code to simulate and predict the behaviour of the array. *4NEC2* has the advantage of being able to set current as well as voltage excitations and offers the use of a hybrid ground in the simulation. The detail of my approach to modeling this four square with its ground level radials uses a concentric hybrid ground, the inner disc-like region being more conductive because of the radials. The outer zone has the properties of the actual terrain extending to infinity. The appropriate two-zone parameters for the hybrid ground are stated in Table 6; they represent the behavior of the monopole with eight radials operating at 21.2 MHz on the imperfect ground.

Figure 12 shows the computed behavior of the antenna on the hybrid ground when driven with the ideal perfectly defined set of drive currents; it provides a basis for comparison when the actual currents were used.

For comparison the measured complex drive current for each element at the four beam headings was used in a similar simulation to arrive at the calculated polar patterns for the

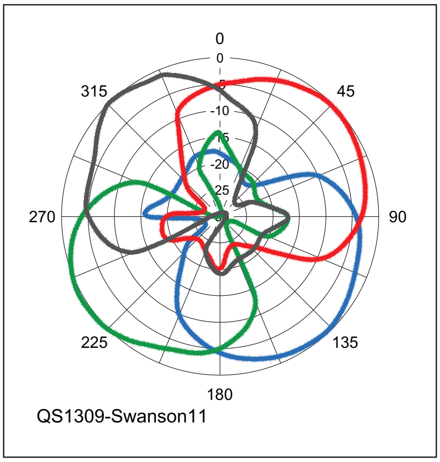


Figure 11 — Measured polar radiation patterns for the four diagonal beam headings.

Table 7
The Actual Measured Elemental Drive Currents with Respect to the Rear Element

Beam heading	NE	SE	SW	NW
NE	1.0, –180°	0.67, –90°	1.0, 0°	0.77, –90°
SE	0.93, –105°	1.04, –165°	0.89, –90°	1.0, 0°
SW	1.0, 0°	0.69, –97°	0.97, –192°	0.70, –90°
NW	0.86, –90°	1.0, 0°	0.71,–90°	1.07, –180°

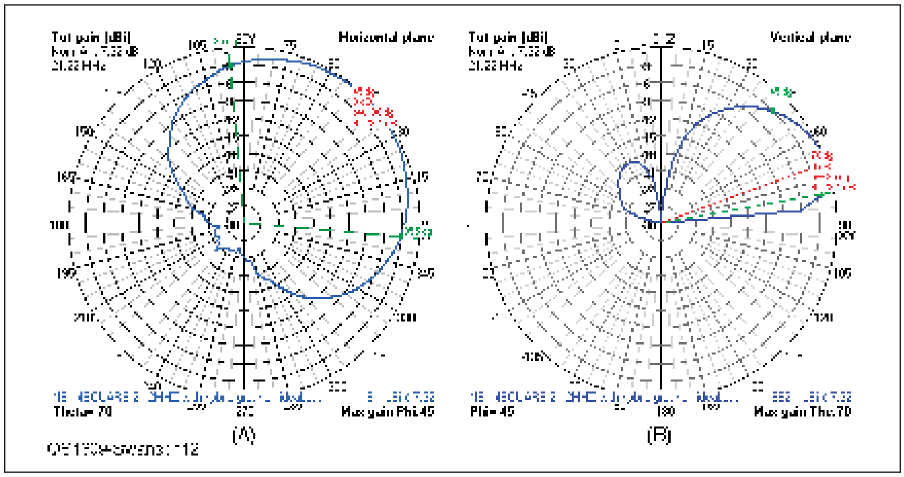


Figure 12 — Computed ideal radiation patterns on the hybrid ground with perfectly defined driving currents.

four directions, again on the hybrid ground. The normalized currents which sometimes deviated from the intended values are listed in Table 7, the reasons for this will be discussed later.

The modeled polar patterns using the actual drive currents are shown in Figure 13 (this and the following Figures can be found at **www.arrl.org\qst-in-depth**). There is good agreement between these and those that were measured. The front to back ratios span the range from 20.6 to 14.7 dB and are somewhat smaller and less consistent than those measured. The beam widths are in very good agreement with the measurements. Predicted, but not measured, are the forward gains. These are very similar for the four directions, ranging between 7.00 and 7.36 dBi as shown in Figure 14.

The simulation also provides the elevation of the main lobe above the horizon. Although the only pattern presented here, Figure 15, is for the NE direction, the peak elevation is close to 20° for all beam headings, with a half power vertical beam width of 35°.

A very useful indication of the insensitivity to frequency across the 21 MHz band is provided by the two NE polar patterns in Figure 16. This 2% change of frequency caused a change of only 0.5 dB in the front to back ratio and a negligible change in gain of only 0.05 dB.

Table 6
The Hybrid Ground Electrical Parameters Used for Simulation

Region	Relative permittivity	Electrical conductivity (S/m)
Inner zone	73	0.75
Outer zone	42	0.088

Discussion

The antenna's behavior on the hybrid ground, but with a perfect set of drive currents, provides a basis for comparison; see Figure 12. It shows that the forward gain should be 7.32 dB, the highest attainable value on this practical ground. The behavior in the rear section is determined by the degree of cancellation of the fields from the four elements. It is here that small differences between the field components become apparent and reflect imperfections in the array and its feed system that cause errors in the drive currents.

Figure 13 represents the superimposed data on rectilinear axes to aid comparison. There is significant and consistent detail in the rear sector. The overall impression is of similarity in the main lobes for the four beam headings.

The actual drive currents were inserted into the simulation and the predicted gain values come close to the maximum attainable on the hybrid ground, compare Figures 12 and 14.

The observed front to back ratios were at least 20 dB on this ground and Figure 12 suggests that an improvement by 3 to 4 dB might be achievable. Although appreciable, it is questionable if this improvement would have practical value since the ratio was already 20 dB. It is interesting to note that with a perfectly defined set of drive currents and a perfect ground the best possible gain and front to back ratio would be 10.8 dBi and 29.8 dB.

In Table 7 the off-axis element drive currents are highlighted. Firstly they are invariably low compared with the on-axis elements. It should be relatively easy to correct this by increasing the number of secondary turns of the appropriate transformer and should lead to an improved front to back ratio. However this will undoubtedly disturb the transformation of the central element feeder impedances and measures will be needed to ensure that the transformed impedances combine in parallel to approach 50 Ω.

Harder to understand are the off-axis current asymmetries. These elements are driven from the same secondary winding through two feeders that have the same lengths and should deliver very similar drive currents. The asymmetries are not reversed nor replicated if the beam heading is oppositely directed. Had they been due to different local environments for the pair of axis elements the asymmetry would have persisted when the feeders were interchanged, this did not occur.

No account was taken in the design of the delays introduced by the switching matrix. Although they would be relatively small the path lengths through the matrix were not equal for the four signals and depended on the pattern of switch closures. It is possible that this is a source of asymmetry and a careful study of these pathways is needed.

There are strong indications from modeling on a practical ground that the forward gain is between 7 and 8 dBi, but this needs to be confirmed by measurement and would require reference to a standard antenna.

The loss between the common feed point and the element driving points is 2 dB, of which 1.2 dB is attributable to the transformers. The use of iron dust toroids could improve this. The Micrometals mixture 10 offers lower loss than the type 61 ferrite but at the expense of relative permeability.[5,6] A comparison of the two is the subject of current experimentation.

Conclusions

I have shown how to construct an electronically steerable four square phased array antenna for use at 21 MHz. The antenna has a diagonal firing configuration with a main beam that can be switched rapidly to one of four orthogonal directions. A novel feed system has been described that uses two RF transformers to ensure that the element feeders can be driven with the same voltage and phase. The overall loss from the array feed point to the element inputs was 2 dB, most in the RF transformers. This elaboration of the Christman method allows it to be used universally in situations where only equal phase points exist on the set of feeders.

On an imperfect practical ground the antenna achieved a measured front to back ratio in excess of 20 dB a value consistent with listening and on-air use that showed differences of between three and four S-units. The forward gain has not yet been measured; however, based upon computer modeling using a hybrid model to represent the practical ground its gain is estimated to be between 7 and 8 dBi. The horizontal and vertical half power beam widths are 90° and 35° respectively, with a vertical beam elevation of 20°. Modeling has also predicted that the antenna characteristics vary only slightly across the operating bandwidth of 0.45 MHz at 21 MHz. The directional properties of the antenna accorded well with computer modeling, potentially pointing the way toward further improvement.

In comparison with a four element Yagi, the diagonally firing four square antenna at 21 MHz is likely to have a gain 2 to 3 dB lower. It has a similar front to back ratio and a half power main beam width that is 30° wider. While there is scope for further refinement of this implementation of the four square antenna, it is doubtful if the resulting improvements would significantly affect the gain and beam width, but could improve the observed front to back ratio by 3 to 4 dB.

Notes

[1]G. Swanson, G3NPC, "A 21 MHz Four Square Beam Antenna," *QEX*, Sep/Oct 2013.

[2]A. Christman, K3LC, "Feeding Phased Arrays — An Alternate Method," *Ham Radio*, May 1985, p 58.

[3]Crycom FRS32026, now replaced by Cynergy3 FRS22012. See **www.cynergy3.com**.

[4]**www.utaharc.org/rptr/wdr_fsm2.html**

[5]Micrometals mixture 10 see **www.micrometals.com/appnotes_index.html** or Fair-Rite mixture 61 see **www.fair-rite.com/newfair/pdf/Broadband.pdf**.

[6]*The ARRL Antenna Book*, 16th Edition, ARRL, 1991.

J. Garth Swanson, G3NPC, obtained a full transmitting license in 1957 at the age of 16. He earned two degrees from Imperial College London: a BSc (Eng) in 1963 and a PhD in Electrical Engineering in 1967.

He then worked at the Westinghouse Research Laboratory in Pittsburgh for 4 years, working on thin film electronic devices. On returning to the United Kingdom, he spent a year in industry and then moved to a career in academia, eventually becoming chairman of the Electrical Engineering department at King's College at the University of London where he was a Professor of Physical Electronics with research interests in electronic and optoelectronic materials. On his retirement in 2001 he became Professor Emeritus at King's College and has pursued an interest in phased array HF antennas.

He currently serves as the Program Secretary of the Dorking and District Radio Society. You can reach Garth at **garth@swansons.org.uk**.

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

New Products

TEN-TEC Microphone Equalizer/Audio Interface

The Model 717 microphone equalizer/audio interface allows connection of newer dynamic microphones to older transceivers that require a higher microphone input level. The unit works with Icom, Yaesu and Kenwood transceivers, as well as older TEN-TEC radios with 4 or 8 pin circular microphone connectors. High and low frequency response are adjustable. Price: $119. For more information, or to order, visit **www.tentec.com**.

Feedback

- In "The Doctor is IN" [July 2013, pp 54-55], there is a typo in the response to William, W5VDM. The correct formula for the approximate distance to the radio horizon is 1.32 × [height (ft)]$^{0.5}$.

- In "The Real Q-Pole" [July 2013, pp 37-38] the spacing between the rods of the Q section is 2¾ inches measured at the outer edges of the two elbows, not 1½ inches as shown in the diagram. This is not an electrically critical dimension, but should be noted.

- "Hands-On Radio" column #127 [August 2013, pp 53-54] mistakenly uses 1.866 for the square root of 3 when the correct value is 1.732. The correct voltage between two phases of a three-phase 120 V system is then 120 × 1.732 = 208 V. Two hundred and forty volts would be supplied in a split-phase system with each phase supplying 120 V.

- In "The August 2013 Rookie Roundup — RTTY" announcement [August 2013, p 82] the photo caption is inaccurate. The operator on the right is Eugene Mah, KK4JRP (now AB4UG). The photo was taken by Thomas Glaab, AJ4UQ, and the club is the Charleston Amateur Radio Society (CARS).

Done In One: Audio Voltmeter

An inexpensive chip is the heart of this simple project.

Paul Danzer, N1II

Often on a repeater Jim's signal sounds louder than Bill's, but is it really louder, or is it just that the characteristics of their voices are different? This one-evening project uses a "hi fi" bar driver chip as an audio voltmeter, so you can tell who is louder and by how much.

The audio you hear is not linear; twice as loud does not mean twice the voltage. It is usually measured in units called *decibels* (dBs). Therefore if you want to measure audio you need a meter or an indicator that responds to these units. The circuit shown in Figure 1 does exactly that.

A full explanation of dB is in *The ARRL Handbook for Radio Amateurs* or at **www.howstuffworks.com/question124.htm** and other places on the web.

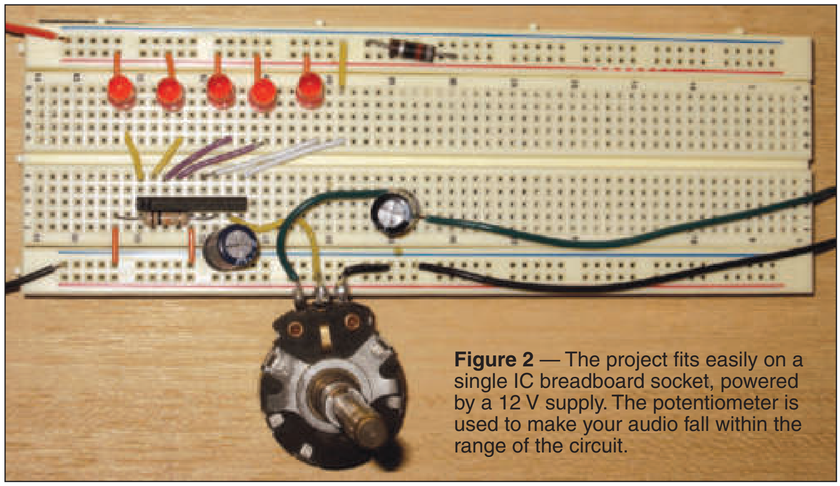


Figure 2 — The project fits easily on a single IC breadboard socket, powered by a 12 V supply. The potentiometer is used to make your audio fall within the range of the circuit.

Building the Meter

The chip is available by mail order from RadioShack for approximately $4.50 plus a few more dollars for shipping. Unfortunately it's not a standard 14 pin or 16 pin dip integrated circuit configuration. It will, however, plug in to one side of a 14 pin socket. This means you can use the standard RadioShack Modular IC Breadboard Socket 276-003 (see Figure 2) or build it permanently on RadioShack printed circuit board 276-170 with the same layout.

In Figure 2 the green wire on the right is the input and the black wire coming from the –12 V bus is the other (ground) lead for the signal. The red and black leads on the left are the +12 V and –12 V connections.

With the notch cut-out on the top left, pin 1 of the microcircuit is also on the left end.

According to the manufacturer the chip has a 30 dB range (see Table 1). This means if you have a signal — let's say Jim's signal — and set R3 so Jim's voice lights up LED #3 this is the reference. If Bill's voice now lights up LED # 5 this means Bill's voice (audio) is 17 dB stronger then Jim's — according to Table 1. Alternately if Bill's voice only lights up LED #1 it means his voice is 13 dB lower than Jim's.

Depending on the chip you have, the lowest LED should light with an input voltage or 20 mV or 0.02 V — with the center terminal of R3 turned up to the end connected to pin 8. The highest LED (LED #5) should light with an input of around 0.5 V.

If you want to experiment, connect the +12 V and –12 V terminals to a 9 V battery so the circuit is isolated from everything else. Since the circuit will give you an indication of voltages as low as 20 mV it is a very handy way to see if there's any voltage at all on a particular wire — as may happen due to leakage from a hot 60 Hz wire to another wire that's supposed to be grounded.

You can also replace C2 with a 10KΩ resistor. Now can measure relative DC voltages again ranging from approximately 20 mV to almost half a volt but your results will be logarithmic — that is in dB!

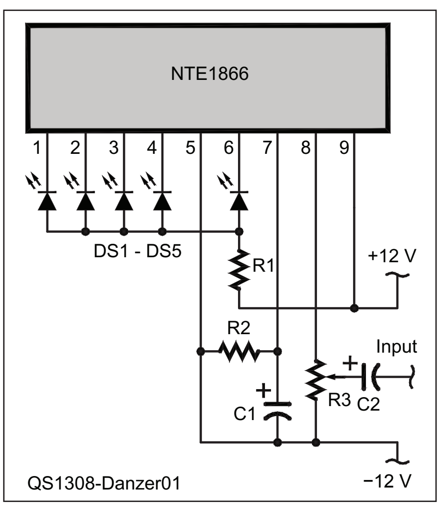


Figure 1 — Schematic diagram and parts list for the audio voltmeter. The single chip has a 30 dB range.

NTE1866 — Available from **www.radioshack.com**.
LED#1-5 — Any red LED such as RadioShack 276-330. The longer lead is the positive end (connected to R1).
R1 — 82 Ω, ¼ W (grey red black).
R2 — 10 kΩ, ¼ W (brown black orange).
R3 — 10 kΩ potentiometer.
C1 — 10 mFd electrolytic capacitor 50 V dc.
C2 — 2.2 mFd electrolytic capacitor 50 V dc.

Table 1

LED	Audio Voltage
LED # 5 (pin 6)	+17 dB
LED #4 (pin 4)	+10 dB
LED #3 (pin 3)	0 dB
LED #2 (pin 2)	–7 dB
LED #1	–13 dB

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

You can reach Paul at 2 Dawn Rd, Norwalk, CT 06851 or at **n1ii@arrl.net**.

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

Build An Audio Distribution System

In a public service setup with multiple operators and multiple radios, an ADS can help your team hear what needs to be heard.

William H. Ellis, KF7PB

When operators are responding to a disaster, the noise level in an emergency operations center can make it difficult to copy messages. This problem motivated motivated our Mercer Island Radio Operators (MIRO) emergency communications group to develop an audio distribution system (ADS) that allows each of three operators wearing headphones to hear any one (or simultaneously two) of four radios. The ADS is comprised of a master unit and a remote unit for each of the three operators (see Figure 1).

Master Unit

The audio output from each of the four radios is connected to the master unit (see Figure 2). In turn, the speaker for each radio is switched on or off from the master unit. The master unit is designed so that if its power is turned off, the audio from each radio is connected to its speaker as a fail-safe mechanism.

The master unit also amplifies the audio from each radio and controls the speaker audio level independently of the audio level set by the radio's volume control. An indicator LED for each radio aids in balancing the audio levels. Four audio channels (one from each radio) are supplied to each remote unit along with along with switched 12 V power.

Remote Unit

Each remote unit monitors all four audio channels simultaneously. Any channel can be independently directed to either the left or right earphone of a stereo headset (see Figure 3). This gives the operator the flexibility of listening to one channel with the left ear and another channel with the right ear. Alternatively, one channel can be sent to both ears or one earphone can be muted to listen to a spoken conversation in one ear while still monitoring a radio channel in the other.

The operator sets up the listening environment by pushing SELECT switches for the LEFT and RIGHT stereo headset channels. Each time a SELECT switch is depressed the next radio audio channel is selected round robin style. Between the fourth and first audio channels is an audio-off channel to effect the mute function. So, for example, pressing a SELECT switch five times will bring the operator back to the starting point. Two LEVEL controls independently adjust the volume of the LEFT and RIGHT stereo headset earphones.

ADS Setup and Operation

Initial setup of the ADS involves adjusting each radio's audio level so that a given signal will produce the same volume at a remote unit. This is done by turning the squelch down in each of the four radios in turn and adjusting the audio output level of that radio until its associated LED on the master unit illuminates. After that, the squelch control is

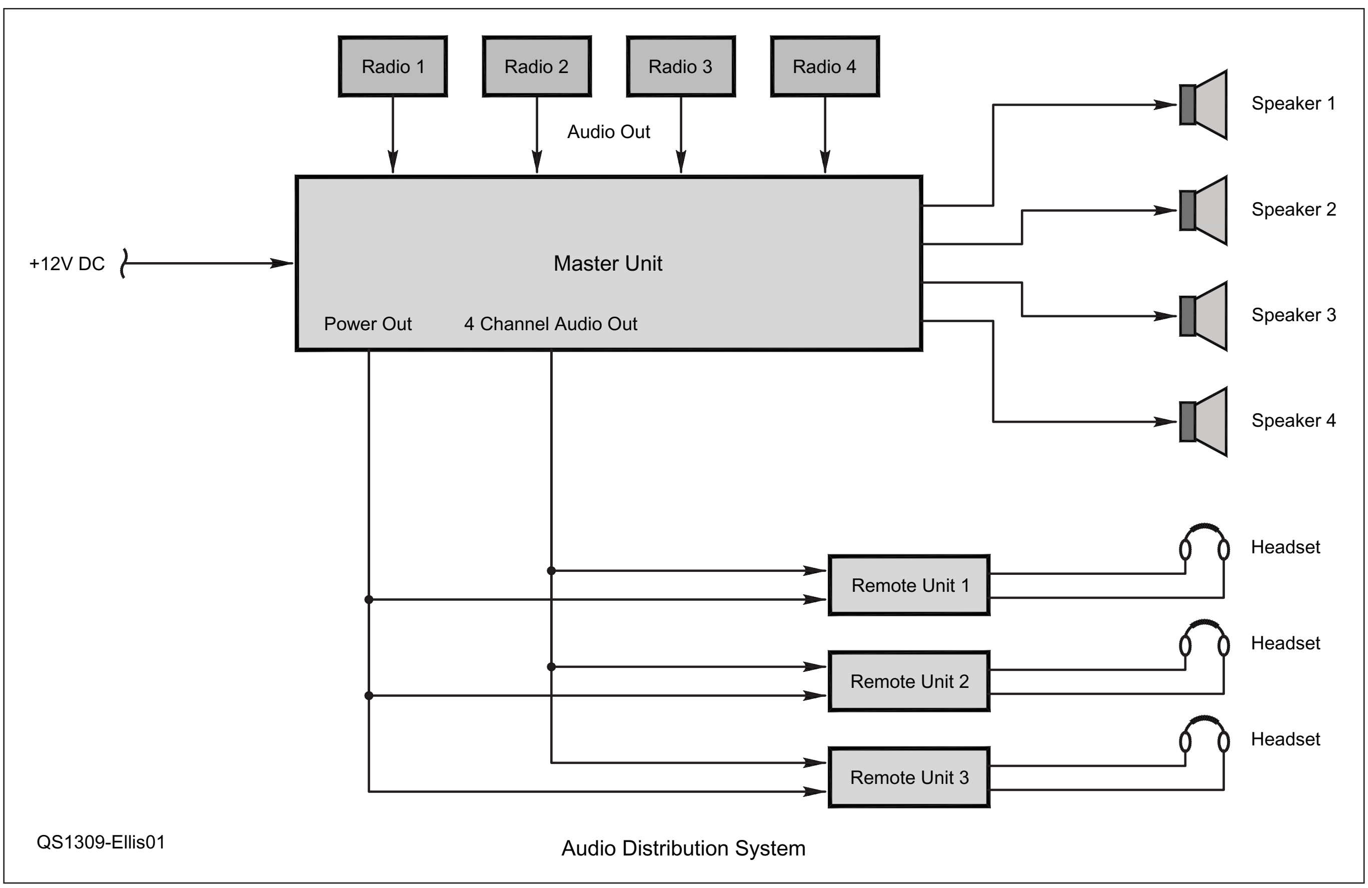


Figure 1 — ADS block diagram.

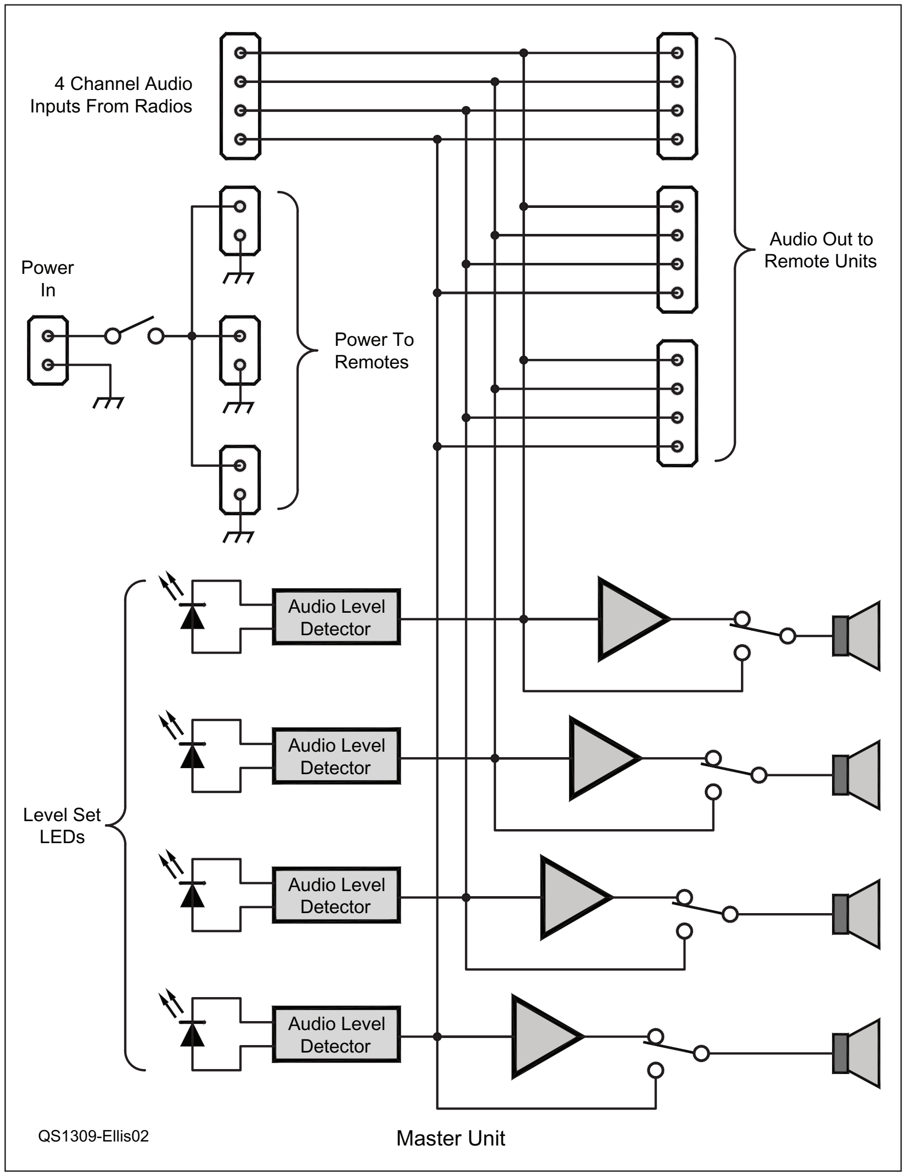


Figure 2 — ADS master unit block diagram.

advanced on each radio until the audio is silenced when no signal is present.

Remote unit adjustment is according to operator preference where any of four radio channels plus mute can be directed to either the left or right earphone of a stereo headset. In addition, the left and right earphone volume levels are independently adjustable.

Note that the ADS only controls the audio outputs from the radios and is not connected to the microphone inputs. It is up to an operator to physically pick up the microphone of a radio in order to transmit.

Circuit Design

Detailed schematic diagrams of both the master and remote units are available in the digital edition of this issue of *QST*, as well as at the ARRL *QST* in Depth web page at **www.arrl.org/qst-in-depth**.

Master Unit

The master unit circuitry is partitioned across three printed circuit boards (PCBs): a main board, a front panel board and a connector board. Audio inputs from the radios come into the master unit main PCB via the rear panel and the connector board. The four audio inputs each connect to a circuit known as an infinite impedance detector (one of four similar circuits is shown in Figure 4).[1,2] The rise time of the signal at the emitter of the detector transistor is essentially the same as that of the signal due to the current gain of the transistor while the fall time of the signal is determined by the time constant of the 47 kΩ resistor and the 10 µF capacitor (0.47 s) connected between the emitter and ground. This extra "hang time" increases the visibility of the audio level indicator LED. Each detected audio signal is connected to a comparator. The other side of each comparator is connected to a voltage divider that sets a threshold level where the comparator will switch. When the detector voltage crosses the threshold, the comparator's open collector output will sink current, causing its associated INPUT LEVEL SET LED to light (see Figure 5 for front panel layout).

The audio signals are also routed to relays on the main board. When the POWER switch is OFF, the relays connect the audio signals to the speakers, bypassing the TDA7056A amplifiers. When the POWER switch is ON, the amplifier outputs are switched to the

[1]Notes appear on page 44.

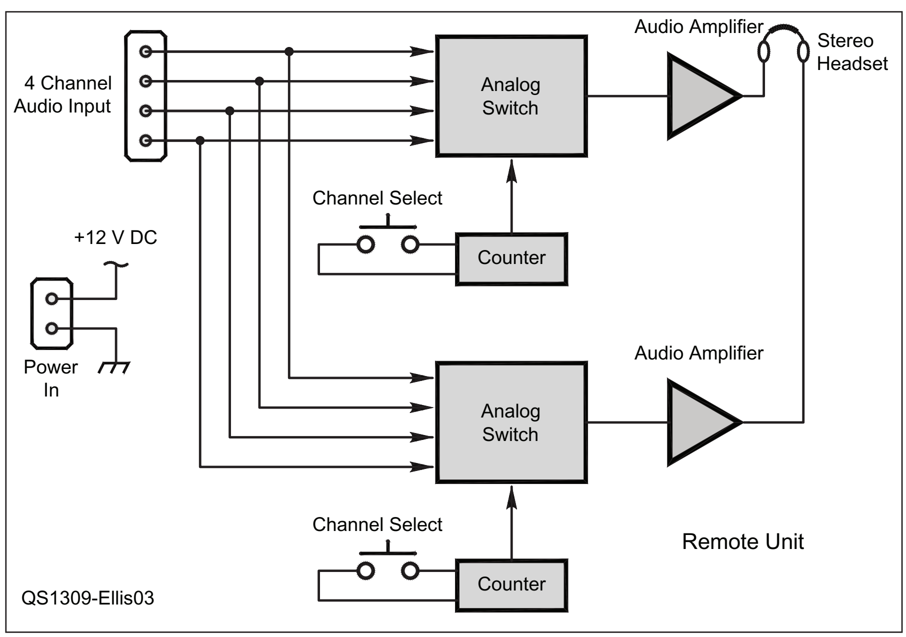


Figure 3 — ADS remote unit block diagram.

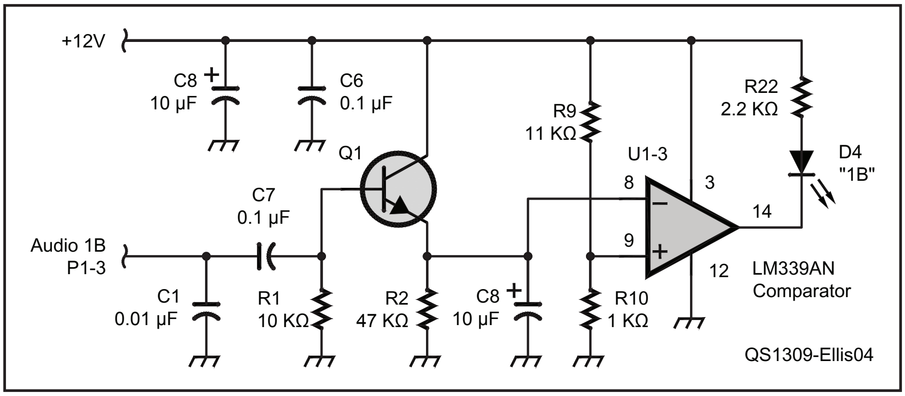


Figure 4 — Partial schematic of master unit showing one of four audio level detection circuits.

speakers. The amplifier ICs have an output power of up to 3 W and are used without heat sinks. The amplifier SPEAKER LEVEL controls are located on the front panel PCB. The front panel also contains four SPEAKERS switches that switch the amplified audio to the speakers.

The rear panel of the master unit also has four power connectors, one power in and three power out connectors going to the remote units. It also has four audio input connectors and three RJ-45 audio output connectors carrying four channel audio to the remote units.

Remote Unit

The remote unit circuitry is divided between a front panel PCB and a main PCB. Power and audio from the master unit enter the remote unit via rear panel connectors. The front panel board also has nine LEDs, one to show that the power is on and eight to show which radio audio is connected to which side of the stereo headset (see Figure 6). Additionally, there are radio audio selection push buttons and two controls that adjust the audio level in the headset.

Figure 7 a is partial schematic detailing the left channel audio path and control of a remote unit. A counter/decoder U5 selects which one of four audio channels is switched to the left ear phone amplifier U7. Each state of the counter/decoder results in one of its outputs being active. The first four states (“=0” to “=3”) each control one of four analog switches (U3-1 to U3-4) along with associated indicator LEDs driven by Darlington transistor buffers in U2. Depressing the SELECT bush button switch S2 causes the counter to advance one state as shown in the state diagram. The fifth state “=4” serves as a mute for the left ear phone since no audio switches are enabled. A transitory sixth state “=5” asynchronously resets the counter to the first state “=0.” Similar circuitry controls the audio for the right earphone.

Mechanical Design

The extruded aluminum housings for this project are designed so that reversing two pieces of the same extrusion will mate.[3] All that is needed to complete the housing is a front and back panel of 1⁄16 inch aluminum sheet. The extrusion for the master unit is larger than that used for the remote unit although both extrusions have the same design.

The extrusions are purchased in lengths sufficient to make all of the housing parts needed. These parts cut easily on a table circular saw using a standard tungsten carbide toothed blade. Cut very carefully to ensure that the lengths are exact so that all of the internal components fit as needed. No finish was applied to the extrusions.

The extruded bodies have internal slots that allow PCBs to be inserted into the housings at various levels from the bottom (see Figure 8). It is important to make accurate drawings of all parts to ensure that the PCB components at the front and rear mate exactly with the holes in the front and rear panels.

One of the more difficult projects is making front and rear labels for the units. I laid the covers out using a CAD program and then printed them on a laser printer. I covered them with a transparent sticky backed material to protect them. Next I put double stick carpet tape on the panels and laid the labels on them. Once they were in place I used an X-Acto knife to cut the holes through the label. It is a tedious process results in labels that work even if they are not perfect.

Conclusion

The ADS has proven to be a successful project. Noise levels in the emergency operations center are reduced when the ADS is in use. Were I to design a second ADS, I’d consider using PCBs with plated through holes and I would like to further improve the front and rear labels. Finally, I would provide for additional remote units and reduce the number of connectors on the master unit.

Notes

[1]B. Goodman, W1JPE, “The Infinite Impedance Detector,” *QST*, Oct 1939, pp 110-112.
[2]D. Wissell, N1BYT, “The HZX Headphone Amplifier,” *QST*, Sep 1998, pp 67-69.
[3]**http://enclosuresandcasesinc.com/split-body---specs.html**.

William Ellis was first licensed in the early 1950s. He received a BSEE from Purdue University in 1958 and a MSE degree from George Washington University. He spent 35 years in the Cable TV industry working in various capacities and retired in 2002 from Finisar Corp. Today he spends most of his amateur radio time working with the Mercer Island Radio Operators in pursuit of improving emergency communications for the City’s Emergency Management Organization.

Figure 5 — Master unit front panel.

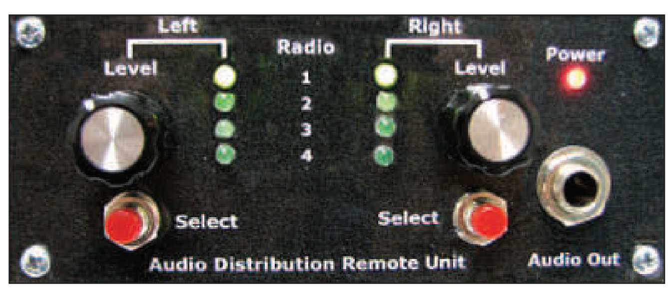


Figure 6 — Remote unit front panel.

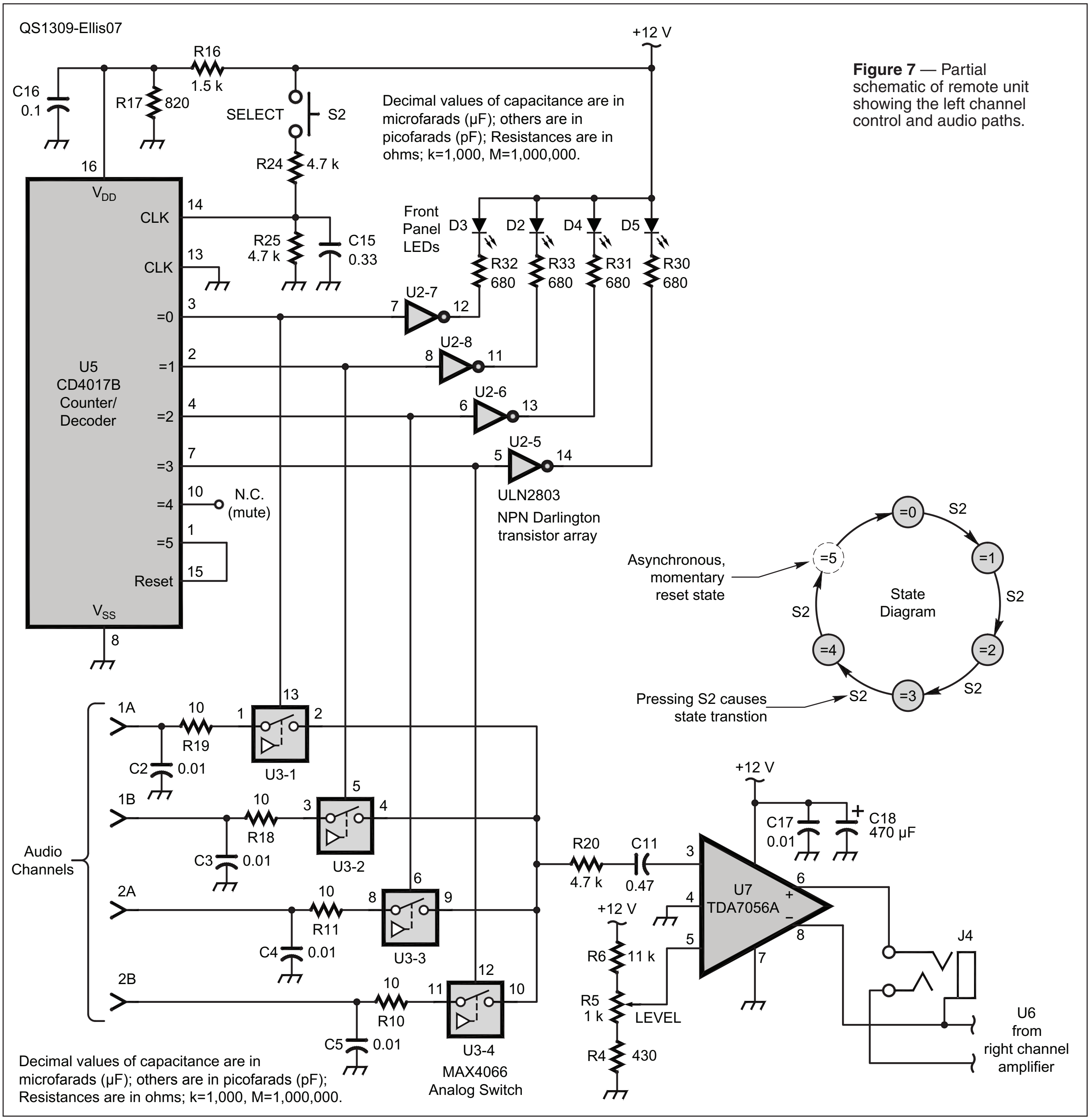


Figure 7 — Partial schematic of remote unit showing the left channel control and audio paths.

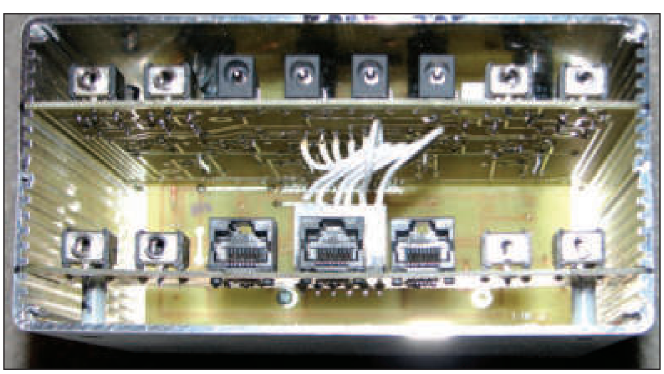


Figure 8 — Extruded aluminum was used to construct cases for both master and remote units (master unit shown).

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

Decibels and dBm Demystified

With the use of a few shortcuts, decibels are remarkably easy to understand and use.

Bob DeVarney, W1ICW

When evaluating the strength of a signal it is helpful to know how it compares to a given reference. For example, someone may say: "Your signal is strong!" But what does that really mean — strong compared to what?

The need for a coherent way to compare signal strengths and how they change under various conditions is as old as telecommunications itself. The original unit of measurement was the "Mile of Standard Cable." It was devised by the telephone companies and represented the signal loss that would occur in a mile of standard telephone cable (roughly #19 AWG copper wire) at a frequency of around 800 Hz. If you were measuring loss in a telephone line in the early 20th century, you might say that it amounted to 5 Miles of Standard Cable. Since everyone knew how much signal was lost in 1 mile of cable, the effect of a 5-mile loss was easy to understand.

In the 1920s, this unit of measure was replaced by the *Bel* in honor of Bell System founder and famous inventor Alexander Graham Bell. One Bel represented a 10-fold gain or loss of power, which is far too large for most applications, so the *decibel*, or ⅒ of a Bel, became the widely used measure of signal change.

Decibels and Sound

Many people think of decibels in terms of sound intensity. In this application the decibel is used to quantify sound pressure levels (see Figure 1). The reference level 0 dB corresponds to a pressure of 0.0002 microbars. If you increase the sound pressure level beyond 0.0002 microbars, the resulting change is expressed in a number greater than zero; if you reduce the pressure below 0.0002 microbars, the number is less than zero. To put this in perspective, if you're standing about 300 feet from a jet airliner that's spooling up for takeoff, you'll be exposed to sound pressure levels in the neighborhood of 150 dB!

But as you'll see in a moment, decibels can also be used to express a difference, or change, in RF signal intensity.

Figure 1 — This sound pressure meter (Decibel 10th for the iPhone) measures in dB. Here it is indicating an average sound level of 82 dB with a peak at 92 dB.

It's Easier with Shortcuts

We have all seen the famous decibel formula, $dB = 10 \times \log_{10}(b/a)$, but what does it really mean? Simply put, we take the log (to the base 10) of the ratio of the power levels in question (b and a), and multiply it by 10. [Note that because power increases with the square of voltage, if signals are measured in volts, the expression becomes $dB = 20 \times \log_{10}(V_2/V_1)$ — *Ed.*] In the old days, we could look up the number in our book of log tables and find the logarithm for it. We would multiply this on our slide rule and *voila!*

Today most electronic calculators include logarithm functions. The calculator app on your smartphone or tablet probably does, too. If you're math averse, the good news is that there are several handy shortcuts that you can file away in your memory and put to work at a moment's notice.

- If a power level doubles, it is a 3 dB increase or +3 dB. If a power level drops by the same amount, it is a decrease of 3 dB or –3 dB.
- Boost power four times and you're looking at +6 dB; decrease power four times and it is –6 dB.
- A change in power of 10 times is +10 dB; ⅒ the power is –10 dB.
- Additional multiples of 10 merely add additional zeros on the end.
- You can add or subtract dB values to get additional ratios as needed.

Here's a real world example: Let's say we apply 100 W to a 2 meter vertical antenna that has a gain of +3 dB. The result is an *effective radiated power* (ERP) that is *double* the level of the RF power from the transceiver, or 200 W.

Of course, we have a coaxial feed line between the transceiver and the antenna. This particular feed line introduces a loss of 3 dB per 100 feet at 150 MHz for a change of –3 dB. If we have 100 feet of cable, we have a net result of 50 W of RF arriving at the antenna — our power applied to the antenna has been cut in half. With an antenna gain of +3 dB, our effective radiated power is now 100 W (50 × 2).

My old Cushcraft 215WB Boomer antenna had a specified gain of +13 dB. Thirteen dB is +3 dB plus another + 10 dB, but because of the way logarithms work, instead of getting 12 times as much power out (a doubling plus a 10-fold increase), we get two times 10 or *20 times* as much effective radiated power.

More Shortcuts

For powers of 10 it gets even easier. A 10 dB change is a 10-fold gain or loss. A 20 dB change is a 100-fold gain or loss. You can remember this by recalling that when you double from 10 to 20 dB, you need to replace the single zero increase at 10 dB with two zeros for a 100-fold, thus a 20 dB increase.

As you can probably guess, 60 dB is 1,000,000 (note the 6 zeros) or 1/1,000,000, depending on whether it is plus or minus. Go to 63 dB and you have two times 1,000,000 or 2,000,000.

Now for a tricky one: Suppose you wanted to figure out the gain in an HF amplifier that boosted your signal from 100 W to 500 W. We haven't really talked about a dB value that represents a five times increase, but you can probably guess it's a number between +6 dB (4 times) and +10 dB (10 times).

Well, we can work backwards. We know that 1 kW would be 10 times the power output (100 W times 10 would be 1000 W) and we know that 500 W is half or –3 dB from that. Subtract 3 dB from 10 dB and you have +7 dB!

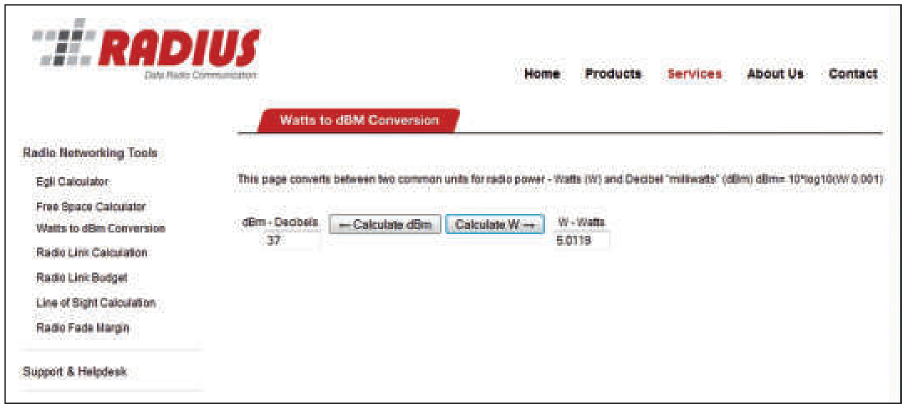


Figure 2 — This handy calculator at **www.radius.net/power-to-dbm-conversion.html** converts dBm to watts, and vice versa. As you can see here, 37 dBm is 5.0119 watts.

What about dBm?

Occasionally we will see levels represented in dBm. There is a lot of confusion surrounding this term. The lower case "m" stands for milliwatt (mW) and 0 dBm is a reference power of 1 mW. That's 1/1000th of 1 W. An increase of +10 dBm would be 10 times that or 10 mW. In other words, dBm is another way of referring to power. It can make life a bit easier if you're doing system calculations, among other things.

For instance, say I have a transmitter that puts out 100 W, a feed line that has 3 dB loss and an antenna gain of 6 dB. Instead of having to use the decibel formula three times, we convert the power to dBm once, do the additions and subtractions and convert back.

Here is an example: 100 W = 100,000 mW, so the power level is +50 dBm (remember that 50 dB is 1 followed by five zeros times the power). Then we lose 3 dB in the coax, so we are down to +47 dBm (+50 minus the 3 dB loss). Finally, we gain 6 dB at the antenna for a net result of +53 dBm. We know this is 3 dB above 50 dBm, so it should be double the power, or 200 W. When all is said and done, we have effectively doubled the power of our 100 W transmitter with this antenna system, at least in its preferred direction.

It is important to stress that while decibels represent change, dBm represents a particular power level. It's like saying, "I have so many watts of power." All the same rules of decibels apply when using dBm. If, for instance, I wanted to know how many dBm 5 W of power is, I first recall that 1 W is 1000 mW or +30 dBm. I also know that ten times that is 10 W, or +40 dBm. Therefore, half of that should be +40 dBm – 3 dB or +37 dBm. Thus 5 W equals +37 dBm!

Close Enough for Everyday Work

While these shortcut procedures don't exactly cover every case, they are close enough for many applications. If you want exact values, you can either break out your scientific calculator or use one of the many online converters. You'll find a good one at **www.radius.net/power-to-dbm-conversion.html** (see Figure 2).

We've all looked at the specs for the latest gadget on the market and drooled over its new features. Sometimes we will even go so far as to check the receiver specs, which are usually expressed in *SINAD* for a particular microvolt level, usually something like "0.25 μV for 12 dB SINAD." The smaller this number is, the higher the receiver sensitivity, other variables notwithstanding. My moonbounce receiver hears down to 0.05 μV, or –133 dBm.

When you see dBm used in place of the familiar microvolt numbers, all you really need to remember is that –120 dBm is right around 0.23 μV, which is decent receiver performance for anyone. Here's a handy chart if you are curious: **wa8lmf.net/miscinfo/dBm-to-Microvolts.pdf**.

Lastly, as a curious historical aside, in the very early days of the Japanese consumer electronics invasion, they sometimes released receiver figures in something called ssG units, or *dBf*. Instead of using the familiar milliwatt as the reference unit, they used the *femtowatt* instead. Instead of being 1/1000th of a watt, the femtowatt is 1/1000,000,000,000,000th of a watt. So, 1 femtowatt equals –120 dBm.

An advertisement for a vintage Sansui stereo receiver shows a value of 11 dBf as its sensitivity specification, or roughly 1.95 μV. I remember seeing these unusual receiver specifications on some vintage Icom gear I had, back when they called themselves Inoue Communications, and that was a very long time ago!

Bob DeVarney, W1ICW, has been employed for the last 22 years by Verizon Wireless as a Cell Site Technician. From early 1990 to August 1991, he worked for Clark Communication Electronics as its service manager. Prior to that he was employed for nearly 5 years as an engineering technician by Joslyn Defense Systems. Bob has been an Amateur Radio operator since April 1980 and has held the call signs KA1FBJ, WE1U and W1ICW. His primary interest is 2 meter moonbounce. Bob is currently enrolled part time in the Bachelor of Electronics Engineering Technology program at Vermont Technical College in Williston, Vermont. He lives in Milton, Vermont with his wife Cherie, their dog Dusty and 15 chickens. You can contact Bob at 43 W Milton Rd, Milton, VT 05468-3245 or at **w1icw@arrl.net**.

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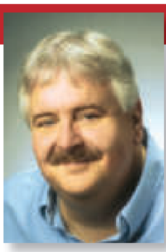


Steve Ford, WB8IMY, wb8imy@arrl.org

Public Service APRS with the Garmin Montana

The Automatic Packet Reporting System (APRS) is an excellent tool for public service applications. The APRS digital communications network is robust by design and relatively easy to use. Each mobile APRS station requires a Global Positioning System (GPS) receiver and an encoder to translate the position data from the GPS receiver to audio tones for transmission by any ordinary 2 meter FM transceiver (144.39 MHz is the most common APRS frequency). Several amateur transceivers available today are designed for APRS use with built-in GPS receivers and packet radio encoders or Terminal Node Controllers (TNCs).

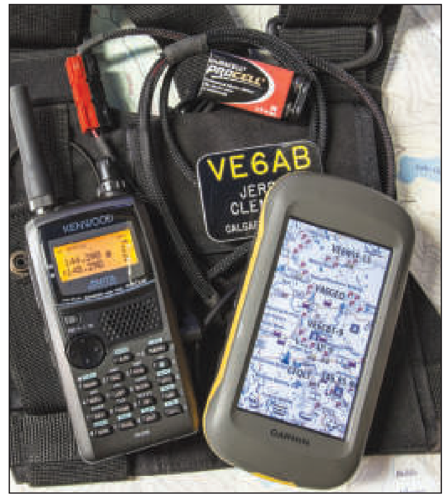
What makes APRS ideal for public service is the fact that station locations can be displayed on computer generated maps. For example, a net control station at a community bike race could have dedicated APRS gear and a laptop computer to display the positions and movements of mobile and portable stations on the race course. Each of these stations would carry GPS receivers and would relay their position information back to net control every minute or so. See Figure 1.

Jerry Clement, VE6AB, opted to try an approach that has the potential to allow every participant to be aware of the movements of everyone else — even those on foot. The trick, however, was to do this with GPS receivers that were extremely lightweight and highly portable. More importantly, the receivers needed to have the ability to load new maps depending on the environment (local topographic maps, for example).

Jerry's solution was to pair a Kenwood TH-D72 handheld transceiver that had a built-in TNC with a Garmin Montana handheld GPS unit. He had to cobble together his own custom interfacing cables, but in the end everything worked perfectly. The Montana is a pricey unit, but for a ham who is actively involved in public service, it offers unique functionality for the investment.

As Jerry states, "The beauty of the Montana is the fact that there are all kinds of *free* tropo maps available for downloading. I also use the Montana in my mobile, as Garmin makes a cradle with a data connector that I wired up a plug for, which allows the Montana to talk to my Kenwood D710 rig. Regardless of which transceiver I use, after the built-in packet TNC decodes an APRS packet, the info is instantly transferred to the Montana and a position icon is placed on the map.

"You can then set the Montana to allow you to navigate to any other APRS station. You also can watch APRS activity right on the screen. Static positions are indicated with blue icons and the associated call signs, although you can assign a custom icon for each station. The Montana provides fast and accurate fixes, and you get 2D, 3D and night views.



The Garmin Montana and a Kenwood TH-D72 transceiver. [Jerry Clement, VE6AB, photo]

"By touching any of the beaconing stations on the screen, all the pertinent information is highlighted. By touching NOTES, a keyboard comes into the view and I am able to include additional information for that station, such as the name of the operator, his e-mail address and phone number, or anything else I might want to add to his resume. It is all saved under waypoint management in the menu.

"The Garmin Oregon can talk to the Kenwood TH-D72 as well. It is much the same as the Montana, but smaller and less expensive. I also purchased and downloaded the *TravelPlus Mobile GPS* from the ARRL Store, and although the Montana wasn't listed, the repeater directory worked fine on the Montana, as it would on the Oregon.

"I'm confident this hardware would likely work with other transceiver brands, including simple FM voice rigs with external APRS-compatible packet radio TNCs. It is just a matter of making the proper cable connections."

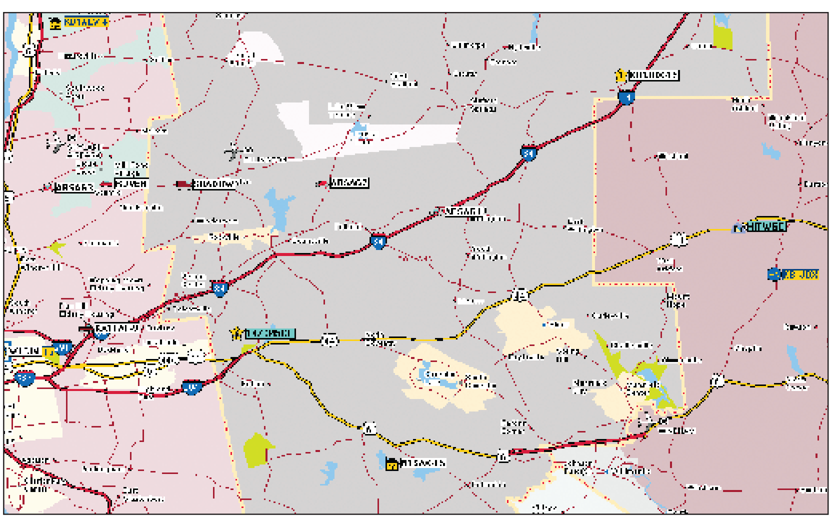


Figure 1 — APRS in action during a charity bike ride in Connecticut. With APRS software running on a laptop at the net control station, the operator can see the positions of all the amateurs assisting the event.

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

FiFi Software Defined Receiver

This compact receiver kit goes together quickly and offers an economical introduction to the world of SDR.

Reviewed by Steve Ford, WB8IMY
QST *Editor*
wb8imy@arrl.org

This little — and I do mean *little* — software defined receiver began its life as a university research project in Meschede, Germany. The goal of the project was to create an economical software defined receiver that offered LF, MF and HF capability, included its own sound device and could be connected to a computer through a standard USB cable.

Several iterations later, the receiver made its debut at the Deutsche Amateur Radio Club (DARC) *FichtenFieldday* radio camp where participants assembled the device that came to be known as *FiFi* (for **Fi**chten**Fi**eldday). *FUNKAMATEUR* magazine began selling FiFi through its online store and the little radio's popularity spread from there.

FiFi tunes from 200 kHz to 30 MHz with receive modes determined by the software you happen to be using. The original FiFi was particularly vulnerable to overload, especially from nearby broadcast stations. To help reduce overload, they added a preselector on a separate PC board with a number of multipole filters that switch in and out automatically according to frequency. Both boards fit snugly within an enclosure that is only 3.5 × 2 × 1 inches.

If you purchase a FiFi, you'll have to assemble it. Not to worry, though. All the surface mount components are already soldered onto the PC boards; all you have to do is add a handful of connectors, two 12-pin headers and an IC.

Bottom Line

The FiFi Software Defined Receiver kit is easy to put together and can receive a wide variety of modes in the 200 kHz to 30 MHz range.

Arrival and Assembly

Despite being ordered from Germany, FiFi arrived within a week by air mail. The package contained the pre-populated main and preselector boards and the remaining kit components (see Figure 1), along with a CD-ROM.

The FiFi manual is on the CD as a PDF document in the Baumappe folder, but there is a

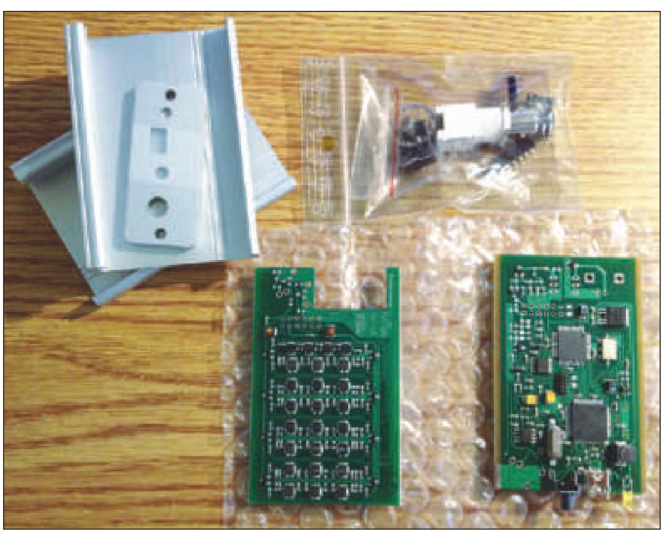


Figure 1 — FiFi arrives as a collection of two PC boards, a handful of parts and an enclosure.

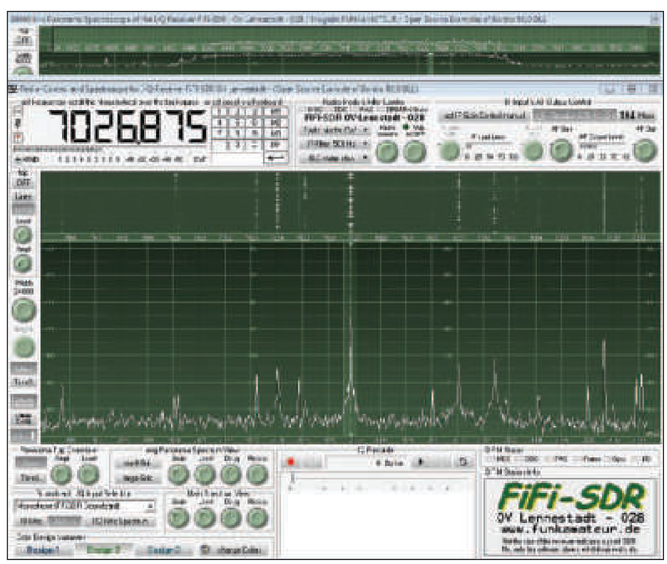


Figure 2 — Listening to multiple CW signals on 40 meters with *RadioJet*.

catch — it is written entirely in German and there is no English translation available. This might seem like a show stopper, but it is important to emphasize that your only task is to solder a few components onto the main board, join the main and preselector boards together at the header, slide everything into FiFi's brushed aluminum enclosure and attach the end panels. Even if you can't read a word of German, you can still follow the images and diagrams to achieve success. My total assembly time amounted to just 20 minutes.

If you run into difficulty, I recommend the English FiFi-SDR website at **http://o28.sischa.net/fifisdr**. You'll find a great deal of information there, with a substantial amount of it in English.

Connecting FiFi to the outside world is a matter of hooking up two cables. The antenna connection is made through a BNC jack, which is a convenient alternative to the SMA connectors that are so common on other software defined receivers. Power is taken via the computer USB cable, so you won't need a separate power supply. However, the kit does *not* include the requisite USB 2.0-to-Mini USB-B cable, so you'll need to provide one. You'll find the cable at many vendors, including RadioShack (part number 26-2739).

Before you attach FiFi to your computer for the first time, make sure the FiFi drivers are on your hard drive where *Windows* can find them. Copy everything from the FiFi-Treiber_O28_20100927 folder on the CD to an appropriately named folder on your computer (name it "FiFi," if you prefer). Then, plug in the FiFi USB cable and *Windows* should automatically install the necessary drivers. If you make the mistake of not copying the FiFi files first, you'll see an error message telling you that it cannot locate and install some of the software components.

Table 1
FiFi Software Defined Receiver

Manufacturer's Specifications	Measured in the ARRL Lab
Frequency coverage: Receive only, 200 kHz to 30 MHz.	55 kHz to 50.000 MHz.
Power requirement: 5 V dc via USB power.	
Modes of operation: SSB, CW, AM, FM, DRM (optional).	As specified. DRM and synchronous AM depend on software; see text.
Receiver	**Receiver Dynamic Testing**
Sensitivity: SSB, –116 dBm at 10 dB SINAD.	Noise floor (MDS), 500 Hz BW 0.137 MHz –110 dBm 0.475 MHz –120 dBm 1.0 MHz –124 dBm 3.5 MHz –124 dBm 14 MHz –122 dBm 28 MHz –123 dBm
Noise figure: Not specified.	14 MHz, 25 dB.
AM sensitivity: Not specified.	10 dB (S+N)/N, 1 kHz, 30% modulation, 6 kHz BW: 1.0 MHz 4.07 µV 3.8 MHz 4.26 µV 29.0 MHz 4.95 µV
FM sensitivity: 0.56 µV at 12 dB SINAD, 3 kHz deviation, 12 kHz bandwidth.	For 12 dB SINAD, 3 kHz deviation, 12 kHz BW: 29 MHz, 2.09 µV.
Spectral display sensitivity: –140 dBm.	–125 dBm.
Blocking gain compression dynamic range: Not specified.	Gain compression, 500 Hz BW: *20 kHz offset* / *5/2 kHz offset* 3.5 MHz 105 dB 105/105 dB 14 MHz 104 dB 104/104 dB 28 MHz 105 dB 105/105 dB
Reciprocal mixing dynamic range: Not specified.	20/5/2 kHz offset: >133/104*/104* dB

Up and Running

In case you are unfamiliar with software defined reception as implemented by FiFi, this is a good time to pause for a brief explanation.

The signals arriving at FiFi's antenna port are amplified before being filtered by the preselector. They are then mixed with the output of a local oscillator with the result being two "base-band" audio signals that comprise the so-called *In-Phase* (I) and *Quadrature* (Q) channels. These two signals contain all the information your software needs to work its demodulation magic.

The next step is to send the I/Q data to your computer. FiFi gives you two ways to do this. You can transfer the baseband audio from FiFi's ⅛-inch stereo output jack to an external sound device (such as the one in your computer) for final conversion and processing. However, your computer must have a *stereo* audio input — either mic or line level. Alternatively, you can let FiFi do the work with its own sound chips and port the resulting data to your computer over the USB cable. (Most FiFi owners prefer the USB solution.)

FiFi's approach to SDR is compatible with several programs. Your software choice determines the types of signals you are able to hear and the ways in which you can process those signals.

On the FiFi CD-ROM you'll find a free version of the Bonito *RadioJet* software for *Windows* that is specifically designed for use with FiFi. This program will decode AM, FM, SSB and CW signals (see Figure 2).

As a bonus, *RadioJet* also has the ability to directly decode Digital Radio Mondiale (DRM) shortwave broadcasts. Most SDR programs provide DRM functionality by requiring the user to purchase licensed DRM software separately (or use the free *DREAM* application). The audio must then be passed to the DRM software through the use of a Virtual Audio Cable program. In contrast, *RadioJet* does all the DRM decoding itself. You just tune the DRM signal until it is centered within the 12 kHz bandwidth window and then click your mouse cursor to switch to the DRM mode. I was able to enjoy several DRM broadcasts in this fashion, and you'll find a complete schedule at **www.wwdxc.de/drm.htm**.

Another program I used with good success was *SDR-Radio* by Simon Brown, HB9DRV (the father of *Ham Radio Deluxe*). This free *Windows* software has an almost bewildering array of features, including filter bandwidths adjustable down to 50 Hz. It doesn't decode DRM, but unlike *RadioJet* it *does* offer synchronous AM — a real treat for the ears (see Figure 3). You'll find *SDR-Radio* online at **http://sdr-radio.com**.

Both of these programs ran on my 64-bit *Windows 7* computer and communicated with FiFi over the USB cable without a hiccup. You just have to make sure that you select "FiFi-SDR" as the sound device when

ARRL Lab Two-Tone IMD Testing (500 Hz bandwidth)**

Band	*Spacing*	*Input Level*	*Measured IMD Level*	*Measured IMD DR*	*Calculated IP3*
3.5 MHz	20 kHz	–45 dBm	–124 dBm	79 dB	–5 dBm
		–38 dBm	–97 dBm		–5 dBm
14 MHz	20 kHz	–46 dBm	–122 dBm	76 dB	–8 dBm
		–23 dBm	–97 dBm		–8 dBm
		0 dBm	–4 dBm		–2 dBm
14 MHz	5 kHz	–45 dBm	–122 dBm	77 dB	–6 dBm
		–38 dBm	–97 dBm		–8 dBm
		0 dBm	–3 dBm		–2 dBm
14 MHz	2 kHz	–45 dBm	–122 dBm	77 dB	–6 dBm
		–19 dBm	–97 dBm		–8 dBm
		0 dBm	–3 dBm		–2 dBm
28 MHz	20 kHz	–45 dBm	–123 dBm	78 dB	–6 dBm
		–36 dBm	–97 dBm		–5 dBm

Two-tone second order IMD dynamic range:	+11 dBm.
Adjacent channel rejection: Not specified.	20 kHz spacing, 40 dB.
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz offset: 29 MHz, 40 dB.†
S-meter sensitivity: Not specified.	S9 signal at 14.2 MHz: 50 µV.
Squelch sensitivity: Not specified.	29 MHz; 0.43 µV.
IF/audio response: Not specified.	Range at –6 dB points, (bandwidth): CW (500 Hz filter): 751-1251 Hz (500 Hz). USB: (2.5 kHz filter): 67-2500 Hz (2433 Hz). LSB: (2.5 kHz filter): 63-2502 Hz (2439 Hz). AM: (6 kHz): 61-2935 Hz (5870 Hz)

Size (height, width, depth): 0.9 × 2.2 × 4.3 inches; weight, 3.2 ounces.

Price: $169.95.

*No reciprocal mixing occurred up to the blocking threshold level.
**ARRL Product Review testing includes Two-Tone IMD results at several signal levels. Two-Tone, Third-Order Dynamic Range figures comparable to previous reviews are shown on the first line in each group. The "IP3" column is the calculated Third-Order Intercept Point. Second-order intercept points were determined using –97 dBm reference.
†Measurement was phase noise limited at the value indicated.

running *RadioJet*, or "SoftRock" when using *SDR-Radio*.

In addition, thanks to an Apple Camera Connection Kit adapter and a Griffin iMic with a stereo audio input, I fed I/Q signals from FiFi's ⅛-inch jack to my iPad using a standard stereo audio cable. With the free *iSDR* application from the iTunes Store, I was able to listen to signals from FiFi with relative ease (Figure 4). The only cumbersome part of the exercise involved all the cables and adapters dangling off the iPad, not to mention the fact that I still had to plug the FiFi USB cable into my computer to power the radio!

The FiFi Experience

When you attach a USB cable between FiFi and your computer, the front panel LED begins to blink (there is no ON/OFF switch). This means that Fifi's microcontroller has started up. Next, you fire up your chosen software and start listening. In a crude A/B comparison with my Kenwood TS-2000 transceiver, FiFi could hear anything the TS-2000 could, and at about the same strength. Of course, the true performance is detailed in the ARRL Lab results you'll see in Table 1.

One thing I noticed was that even with the help of the preselector, FiFi tended to be overwhelmed by strong signals. This wasn't a problem most of the time; it only became apparent when tuning through the amateur bands during contests with several strong signals in proximity. Otherwise, I consistently found FiFi to be a pleasure to operate.

And like most software defined receivers, FiFi is upgradable. When you hold down the front-panel button while plugging in the USB cable, FiFi switches to what I call "storage device

Figure 3 — Synchronous AM reception with *SDR-Radio*.

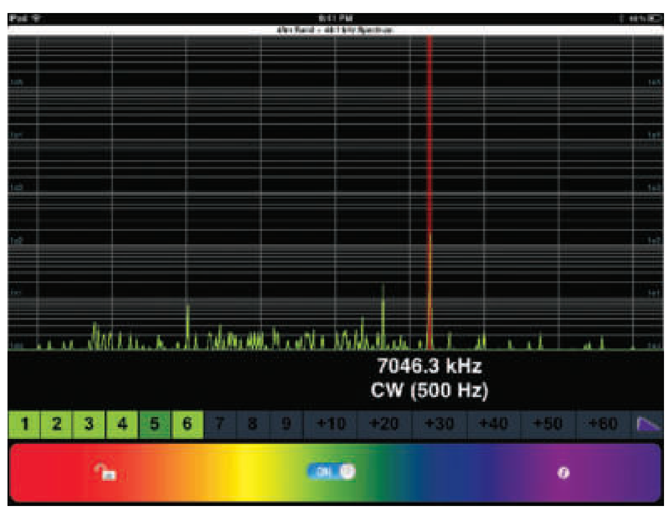


Figure 4 — Using FiFi with an Apple iPad and the *iSDR* app.

mode." That is, it becomes a like a plug-in thumb drive. If you ever need to upgrade FiFi, you can use this mode to access its memory and load new software.

FiFi isn't the top performing software defined receiver on the market, but for less than $180 US, it is hard to beat.

Distributor: Available from the FUNKAMATEUR online shop at **www.box73.com**.

See the Digital Edition of *QST* for a video overview of the FiFi Software Defined Receiver

MeterBuilder MB-1 Programmable RF Power Meter

Reviewed by Larry Wolfgang, WR1B
Senior Assistant Technical Editor
wr1b@arrl.org

Let's be clear right from the start. Calling this box an RF power meter is like referring to a Lamborghini Aventador Roadster as "just another car." It may be true, but it certainly is not an adequate description! As you will see, the MB-1 is a very advanced programmable RF power meter and might be better called a programmable station monitor. There is a lot of versatility built into this instrument.

One of the first things you notice when looking at the front panel is the variety of display features. Most obvious is an analog cross-needle meter with scales for forward and reflected power, with SWR read at the intersection of the two needles. Then there are four 7-segment LED digital displays. Not visible in the photo is a bar graph display along the top of the LCD information display.

You can measure forward and reflected power as well as SWR. Would you like that to be average or peak power? Okay. Maybe you would like to subtract the reflected power from the forward power, to display the actual power delivered to the load. Okay. Your choice of peak or average power will be displayed on the cross-needle analog meter. Would you prefer a 7-segment LED digital display? You can have that, too. How about a simple bar graph for a quick visual indication of any of those parameters? The MB-1 has you covered!

But wait, there's more! What if you want to be able to display average power and PEP at the same time? Sure. The analog meter and four digital displays can all be programmed to show different information.

If that isn't enough, just add more displays! Our MB-1 included an optional Expansion Kit with two 1½ inch, high-visibility 7-segment LED displays and an LED bar graph. You can connect two of those three expansion displays at once. Seven-segment displays are available in various sizes up to 7 inches high from a number of suppliers, so you can add an even larger display.

Bottom Line

The MeterBuilder MB-1 is an accurate RF power meter that can be built from a kit or purchased assembled and tested. It covers a wide range of frequencies and power levels with the standard coupler, and can be expanded with multiple couplers and displays.

You can add up to four more analog meters — two cross needle meters with linear or non-linear scales, as well as other linear and non-linear scale meter movements. The MB-1 provides calibration functions for just about any meter. By now you are getting the idea — this is one very fancy station accessory.

Menu Control

This versatility comes with a price. There is an extensive set of menu controls to adjust the MB-1's many display parameters and features. There are 14 pushbuttons on the front panel, with most performing two or three different functions. The Expansion Kit included four gray MENU buttons and a red POWER button, to make them easier to distinguish from the black buttons supplied with the standard kit. (Yes, I did say “kit.” More about that later.)

Red, green and yellow LEDs on the switches help identify which buttons are active in the various menu modes, and they also indicate when certain meter functions are active during normal operation. The LEDs also blink to indicate whether you have held the button for a short, medium or long duration while selecting various menu functions. While there are labels printed above or below the buttons, it takes some practice to figure out the menus.

In general, green LEDs indicate normal operation, while yellow or red LEDs indicate “abnormal” or “non-standard” operating conditions. For example, if you have stumbled into the Demo mode or selected one of the virtual couplers instead of a real coupler, you will see several yellow LEDs. This may explain why the meter is not behaving as you expected.

The *User’s Manual* is supplied as a 227 page PDF file downloadable from the manufacturer’s website. It is a lot to print out, but I expect many owners will want a copy of this documentation for reference. I won’t attempt to describe all of the parameters that you can adjust with the menu options in the MB-1, but I will touch on some that I think will interest many readers. Check out the manual for full details.

You can adjust the Peak Hold and Decay time constants for the panel meter (or another analog meter that you have connected). You can adjust the brightness of the LED and LCD displays, and you can also set the time delay for Sleep mode — or turn it off altogether.

The Averaging Filter controls the computation of average power measurements. You might think that a long averaging time is best for displaying average power, and in general that’s true, especially for SSB measurements. In some circumstances, however, a short timing window is better. With the MB-1, you can turn on the “Snap” feature, so that when the circuitry detects a constant power, such as when you are adjusting an antenna tuner, it will use a shorter averaging window, but during normal SSB operation, the longer averaging time will be used.

SWR readings can change a bit, especially when you are operating SSB. To provide a stabilized reading, select display of the SWR Min or SWR Max values (or both) rather than (or in addition to) the instantaneous reading. The MB-1 calculates minimum and maximum values of power or other measurements, so you can obtain a readout of those values, too.

The Rear Panel

Figure 5 shows the MB-1 rear panel. What are all those phono jacks for? Added versatility, of course! External meters connect to jacks on the right side block. There are also six jacks in that right block for the contacts on the double-pole, double-throw relay that goes with the SWR alarms. Use these relays to control amplifiers or other external devices that you want to disable if the SWR is too high. Most transceivers have high SWR power rollback, but that isn’t always the case with external power amplifiers. The MB-1 can trip an alarm and either sound an alert or activate the relays to take an amplifier offline if the SWR exceeds a preset threshold. You can also set the alarm to trip if a certain power threshold (max or min) is exceeded.

Figure 5 — Looking at the back of the MB-1, you can see lots of phono jacks for coupler inputs and external meter outputs as well as a number of test signals and auxiliary power. The pair of ICD connectors is for the external 7-segment display and bar graph. There is also an RS-232 serial port that you can connect to a computer for firmware updates.

Other jacks provide 5 V output power for external circuits. These outputs are not fuse protected, except by the fuse on the 12 V input supply, so be careful. Phono jacks at the bottom left of the left side block provide 50 µA and 200 µA test signals. You can use these to determine the full scale range of external panel meters that you might be considering for use with your MB-1.

Multiple Couplers

One power coupler is provided with the MB-1. This coupler has been calibrated over the 160 to 6 meter range and is rated to 1500 W ICAS (1000 W ICAS on 6 meters). You’re not limited to the standard coupler, though. The block of phono jacks on the left side of the rear panel provides inputs for up to four couplers. If you have a coupler designed for a higher frequency range or a higher power, you can connect it to the MB-1. With the appropriate coupler, you can measure up to 30,000 W. If you have a power sensor that has been calibrated by an instrumentation laboratory, you might want to compare it to the standard coupler.

You can connect couplers other than RF sensors to your MB-1, too. For example, if you have an RF ammeter or other analog sensor, you can establish a calibration table in the MB-1 for that sensor. Just about

Figure 6 — All of the parts for the MB-1 were packaged inside the chassis. The Expansion Kit components (not shown) were included in the box with the MB-1 kit.

Table 2
MeterBuilder MB-1 Programmable RF Power Meter

Frequency range:	1.6 – 60 MHz with MB-HF1 sensor
Sensor serial number:	MB90091
Power range:	10 mW – 1500 W with MB-HF1
Power requirement:	12-15 V dc @ 800 mA max
Current consumption:	392 mA at 13.8 V dc
PEP measurement:	Active
Size (height, width, depth):	5.5 × 8.9 × 7.7 inches
Weight:	10.2 lb

Price: MB-1 kit, $599; assembled and tested, $699. Expansion kit, $149.

ARRL Lab Measurements

Frequency (MHz)	Actual Forward PowerMB-1 (indicated power) 2	14	28	50
5 W CW	5.0	5.0	4.9	5.0
5 W 50%	5.0	5.0	4.9	5.0
100 W CW	101	100	90	94
100 W 50%	102	100	100	102
100 W Two-Tone	—	100	—	—
1 kW CW	1060	1026	1010	1044
1 kW 50%	1100	1040	1020	1150
1 kW Two-Tone	—	1040	—	—
SWR Accuracy				
50 Ω (1:1 SWR)	1.01:1	1.05:1	1.10:1	1.20:1
25 Ω (2:1 SWR)	2.14:1	2.00:1	1.84:1	—
100 Ω (2:1 SWR)	2.12:1	2.15:1	2.25:1	—

Insertion loss: < 0.1 dB throughout operating range.

— = not measured

any quantity can be measured with the appropriate sensor that generates a dc voltage in proportion to the measured quantity. RF current, temperature and pressure sensors come to mind.

I tried the coupler I built years ago as part of a digital wattmeter from *The ARRL Handbook*. Conveniently, I had used phono plugs on the leads from that coupler, so it plugs right in to the MB-1. Calibration was a simple task of measuring the coupler output voltage for several power settings from my transceiver. Just select the coupler number (2 to 4) and the calibration menu. The MB-1 walks you through the process.

It seems there is nothing this versatile box can't do. Well, not quite. With the ability to use four different sensors, my thoughts ran to a contest or Field Day station, where each transmitter could use a separate coupler to provide an input to the meter, and the remote display capabilities could be used to give each operator an indication of transmitter power, SWR or whatever other parameter they wanted to monitor. Searching the *User's Manual* I could not find any mention of how to display the measurements from different sensors simultaneously. An e-mail to the MeterBuilder tech support desk brought a quick reply indicating that it is not possible to display multiple sensors. Only one sensor can be selected at any time. When I questioned this further, the answer was that there is so much computation going on in the unit's microprocessor that there was not room in the processor for the additional computations that would be required to track more than one sensor. They did leave open the possibility that this capability could be added in the future.

Firmware Updates

Speaking of the future, the DB-9 connector on the MB-1's rear panel is a serial port, which you can connect to a computer to load new firmware as updates become available. You won't need to connect a computer to the MB-1 for any other reason, though. There is no computer control program and no interface to read data from the MB-1.

ARRL Lab Test Results

ARRL Test Engineer Bob Allison, WB1GCM, compared the MB-1 measurements with the transmitter output power as measured by the Lab's calibrated HP-437B power meter with appropriate calibrated power attenuator and cables. Results are shown in Table 1.

As you can see, the worst measured case is for 100 W continuous carrier on 28 MHz, where the measurement is low by 10% compared to the HP-437B. In all other cases, the power is within a few percent of the value measured by the Lab's equipment. The measured SWR values are also very close to the theoretical values using resistive loads of 25, 50 and 100 Ω.

The MB-HF 1 coupler that comes with the MB-1 has been calibrated at the factory, and a calibration table has been stored in the MB-1 memory. The calibration table uses reference frequencies on 80, 20, 10 and 6 meters.

To perform the initial setup of the meter, I used my digital VOM to measure the output voltage from the coupler, and used the calibration voltage printed on the coupler to fine tune my transmitter output. Then, with the coupler plugged in to the MB-1, I adjusted the FWD trimpot on the side of the meter to set the appropriate power reading on the MB-1. I had to swap the cables from the coupler to the MB-1 and adjust the REFL trimpot in the same way. I checked the settings for several transmit power levels, but that's about it for calibrating the MB-1.

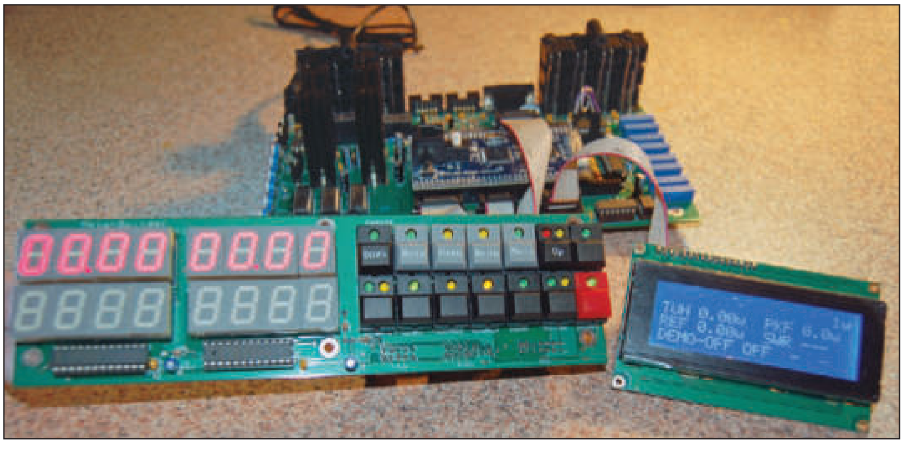


Figure 7 — The assembled circuitry, ready for the initial checkout and testing.

With a lab grade (calibrated) voltmeter to make those measurements, it may be possible to obtain even better accuracy. You could also perform the adjustment using a calibrated wattmeter connected in series with the MB-1 coupler.

Our test engineer was quite impressed with the accuracy of this meter considering that I built it from a kit and calibrated it with a common VOM similar to what most amateurs might have at home. Of course we could have adjusted the MB-1 to exactly match power and SWR measurements from the Lab's test setup.

In reviewing the Lab numbers again as I complete this review, I wonder if we might have activated the Band Correction feature for the 10 meter test. Information from the manufacturer indicates that their tests with an NIST certified power sensor shows the MB-1 coupler to be essentially flat across the entire HF range, including 6 meters. So they say there is no need to activate that feature.

Building the Kit

When we purchased the MB-1 for this review, the meter was available only as a kit. The manufacturer now offers the MB-1 assembled and tested as well.

When I received the MB-1, it was like Christmas, opening one package after another to see what was inside (see Figure 6). I had already printed out the *Assembly Manual* (a 54 page document) from the MeterBuilder website.

One of my personal rules for kit building is to read through the assembly instructions and do a careful parts inventory. In this case, it quickly became apparent that this kit is for experienced builders. The *Assembly Manual* gives some good general guidelines, but you are not led step by step through the process. There is a Display Board and a Controller Board, with some suggestions about what components to install first. Beyond that, you populate the boards as you see fit.

All of the components you will install are through hole parts. You will not have to solder any surface mount devices. The MB-1 uses a surface mount microprocessor, but it's on a daughter board that comes assembled. The Microchip PIC18F8722 microprocessor and various surface mount components are already soldered in place. The LCD board also comes as a small, fully assembled daughter card that plugs into the display board.

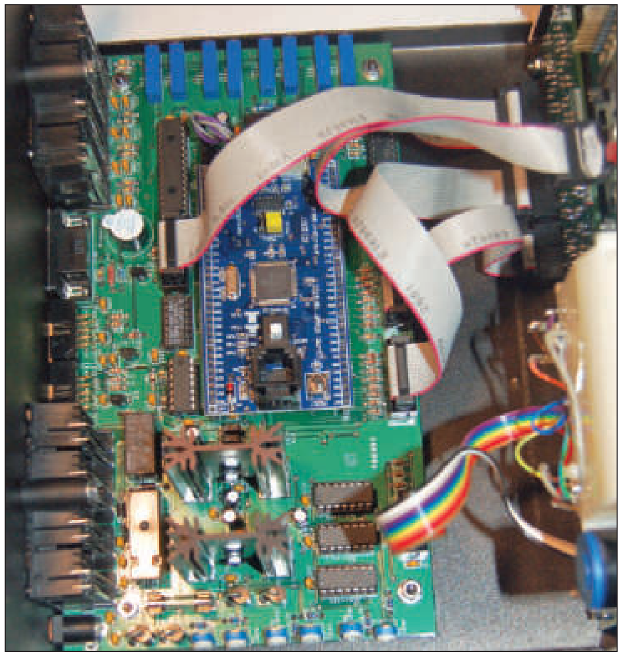


Figure 8 — Looking inside the MB-1 enclosure, you can see that there is plenty of space inside.

I did not need any special tools to build the MB-1. I have a temperature controlled soldering station with a fine tip, assorted hand tools and a magnifier lamp on an extension arm that I find increasingly handy for reading color codes and component values. These are all standard fare for any builder, I believe. In addition I kept my digital VOM handy to double check the occasional resistor or capacitor value. The meter also helped with the final adjustments to the meter display circuits.

I spent about four hours reading through the *Assembly Manual*, taking inventory and sorting the components into a couple of plastic boxes with adjustable compartments. With resistors and capacitors sorted into separate bins by component value, it's easy to pick out the correct value part as you work your way across the circuit boards. (Of course I still verified each component value again before installing it on the board!)

The actual assembly time was about another six to eight hours. I work very slowly on a project like this, double and triple checking each component and board location. It is much easier to put the correct part in each location than it is to have to go back and unsolder and remove parts later.

During assembly I installed the gray switch caps and other components supplied with the Expansion Kit. I also selected the blue LED backlit cover for the cross-needle panel meter. The standard kit comes with a white LED backlit cover. Note that you could also choose to install LEDs of any other color, but I think the blue backlight gives the meter a nice soft glow in my shack.

After all of the components are installed, the *Assembly Manual* walks you through the initial checkout and meter self-tests. There is much more detail here than there is in the actual assembly section. Figure 7 shows the various circuit boards and display modules during the initial checkout. Figure 8 is a peek inside the completed MB-1 chassis. There is plenty of room to work inside the cabinet.

For the final adjustments I turned to the MB-1 *Quick Start Guide*, written by Phil Salas, AD5X, and available for download from the manufacturer's website. Phil's review of the MB-1 is also available there, and is another five pages of good information. The website has a lot of information and ideas for using the MB-1 and is worth a look.

Manufacturer: FullWave LLC, 48 Eastwood Blvd, Manalapan, NJ 07726, **www.meterbuilder.com**.

See the Digital Edition of *QST* for a video overview of the MeterBuilder MB-1 Programmable RF Power Meter

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

Inverted V or Horizontal Dipole — What's the Difference?

Q Jim, EI4HH, asks: Can you illustrate for me the transmit pattern of an inverted V antenna? Is it significantly different from that of a horizontal dipole?

A The patterns (elevation and azimuth) of a horizontal ½ wave dipole antenna are very similar to those of an inverted V with 90° between the wires that is somewhat higher. As noted below, operating on higher frequencies is a completely different story. Figures 1 and 2 show the *EZNEC* predicted elevation patterns of a 40 meter horizontal dipole at a height of ½ wave (69 feet) above typical earth compared to a 90° inverted V with apex height 12% higher (77 feet).[1] You will note that the elevation peaks of the higher inverted V and the dipole are both at 28°. The azimuth patterns of both are shown in Figures 3 and 4. There are some other differences between a ½ wave horizontal dipole and an inverted V to keep in mind:

- While the dipole has a feed impedance close to 70 Ω, the inverted V is closer to 50 Ω at resonance at that height — usually a plus for the inverted V.
- The inverted V needs to be about 1.5 feet longer to resonate at the same frequency on 40 meters.
- The inverted V has about 0.6 dB less peak gain. This is not lost power, the V spreads it over a slightly wider area with a beamwidth of about 92° compared to 85° for the dipole.

All of the above relate to the inverted V operating on its fundamental or ½ wave resonance. In that case, it is almost a wash, and often easier to get a single support up 12% higher to get very similar results. A very use-

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

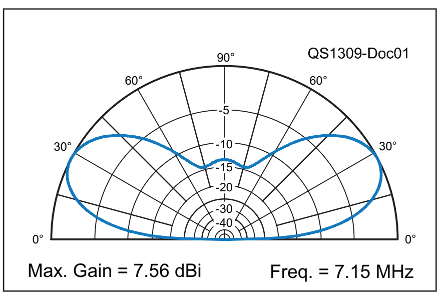


Figure 1 — Elevation pattern of a 40 meter ½ wave horizontal dipole ½ wave above typical ground.

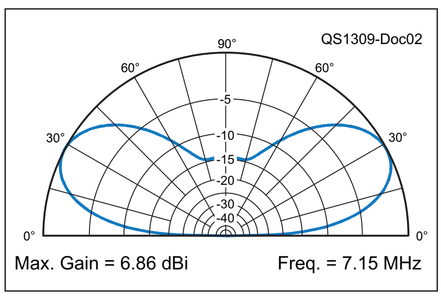


Figure 2 — Elevation pattern of a 40 meter ½ wave inverted V dipole with apex 15% higher than ½ wave. Note the similarity to Figure 1.

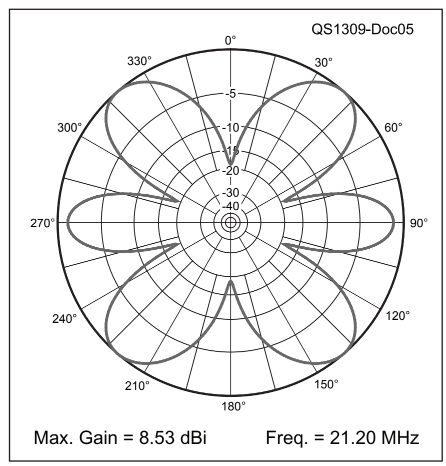


Figure 5 — Azimuth pattern of the 40 meter ½ wave horizontal dipole shown in Figure 1 operated on its third harmonic (15 meters).

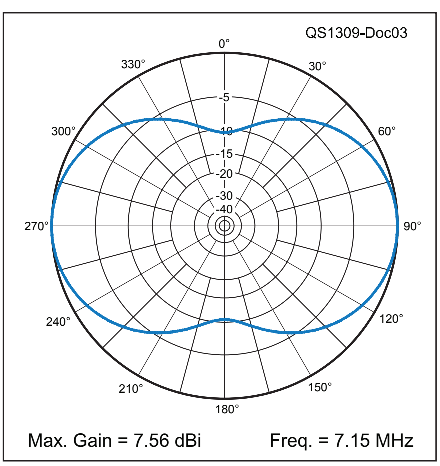


Figure 3 — Azimuth pattern of the 40 meter ½ wave horizontal dipole shown in Figure 1.

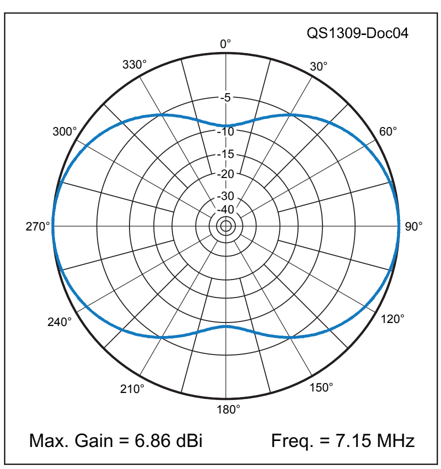


Figure 4 — Azimuth pattern of a 40 meter ½ wave inverted V dipole shown in Figure 2.

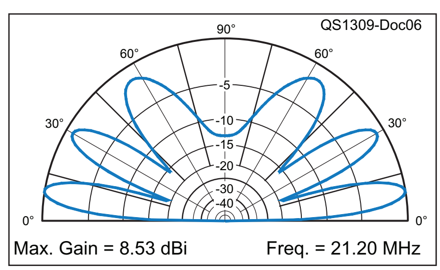


Figure 6 — Elevation pattern of the 40 meter ½ wave horizontal dipole shown in Figure 1 operated on its third harmonic (15 meters).

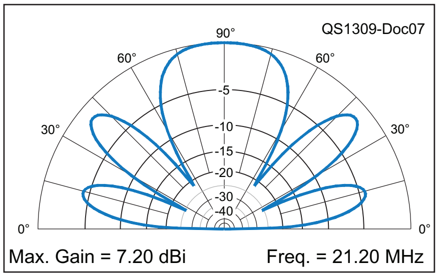


Figure 7 — Elevation pattern of the 40 meter ½ wave inverted V operated on its third harmonic (15 meters).

Table 1
Loss of 10 Feet RG-58A/U on 2 Meters and 70 Centimeters

Band (MHz)	1:1 SWR (dB)	1:1 SWR (%)	2:1 SWR (dB)	2:1 SWR (%)
146	0.7	15	0.9	20
440	1.4	25	1.7	32

ful arrangement is to use two inverted V antennas for different bands perpendicular to each other and connected in parallel to a single feed line. The two Vs can be used as supports for a common mast. Because they are perpendicular, there will be little coupling, thus avoiding coupling effects that often make adjusting parallel connected dipoles difficult.

The story is quite different, however, if we wish to operate the antenna on higher bands, as is often done with a 40 meter dipole on 15 meters, or with dipoles fed by window line used on frequencies above their ½ wave resonance. In this case, the performance is very different between the inverted V and the horizontal dipole. For example, the ½ wave high 40 meter horizontal dipole on 15 meters (3⁄2 wave high on 15) has a 6 lobe pattern with elevation peak at 9° and an intensity of more than 8 dBi in each of the 6 peaks — a very useful pattern (see Figures 5 and 6), particularly if the lobe positions are in desired directions. If we change to an inverted V, we see that the majority of the energy heads skyward, as shown in Figure 7, and the low elevation lobes are about 4 dB weaker, and are at significantly higher angles. Thus an inverted V operated on harmonics often results in disappointing outcomes, if long distance operation is desired.

Q **Ralph, W6DV, asks: I have an antenna analyzer that I use to measure impedance, but I am constantly frustrated by the difficulty of getting the sign right. Most commercial analyzers provide the magnitude of the reactance, but they don't tell me whether the reactance is capacitive or inductive. Is there an easy way to automatically determine the sign?**

A I'm sure it's possible, but also sure that it's not trivial — otherwise everyone would do it!

The trick I use, and it's one that will work with almost any analyzer, is to slightly shift the frequency and see what happens to the value of the reactance. If an increase in frequency results in an increase in reactance, then the reactance is inductive, if the value goes down it's capacitive.

There is one major caveat, however. You need to be able to observe the reactance carefully as you adjust the frequency. This method only works if the reactance doesn't go past zero as you move it. In most cases, with most instruments, that isn't an issue if you tune very slowly, you just have to watch the indicator as you tune. I believe that most analyzers that do provide the sign of the reactance automate that process internally.

Q **Marcus, KI6WDX, asks: In my mobile shack, I installed four V/UHF antenna mounting kits, each kit supplied with about 17 feet of RG-58A/U coax cable. I installed each cable with the idea of protecting each coax run from the possibly of chafing the coax cable or it coming into contact with the vehicle's interior exposed metal areas. Since I had quite a bit of coax left over after installing the connector end, I merely coiled up the excess coax and tied this coiled amount off using some plastic wire ties.**

These kits were installed quite some time ago and, since the installation, I've not noticed any problems. My question is, does having the excess coax length coiled into what I consider to be a choke in anyway impact the RF signal from getting to or from the designated roof mounted whip antenna, all of which were permanently installed in the vehicle's metal roof?

A Well, coiled up coax (unlike window line which should never be coiled if being used) is not usually a significant problem. The coil can act as a common mode choke, which is usually a good thing. The one issue, for sure, is that the extra coax will add some attenuation. You didn't say how much was coiled up, but let's say 10 feet (you can scale the numbers for other lengths).

The attenuation of 10 feet of standard RG-58A/U depends on the SWR. The amount of loss for 1:1 and 2:1 SWR on 146 and 440 MHz is shown in Table 1.

On the VHF and UHF bands, in most conditions, having a line of sight (LOS) path is more important than the amount of power available. Keep in mind that one S-unit is 6 dB, so that extra loss probably doesn't matter most of the time. On the other hand, if you are trying to squeeze out every watt, it could make a small difference if conditions are marginal.

All of this assumes coax with a good quality shield. If the shield is too sparse, there will be more coupling from the outside into the inside with a greater length, which can bring in noise. The same kind of effect can happen with poor shield connections, so make sure that your connector backshells are tight — particularly for mobile use, give them just a bit of a twist with pliers to make sure they don't vibrate off — and check them for tightness from time to time. This is particularly important with UHF type connectors that rely on a tight backshell for the shield connection.

Q **Mark, KG1Q, asks: I have a question regarding a 500 foot high hill that's 5500 feet due north of my location. I have a five band Yagi antenna at 40 feet with which I've been doing pretty well toward most directions. I'm curious if the hill to my north is the reason why I'm hearing stations on 20, 17 and 15 meters from azimuths between 350° and 10° 2 to 3 S units lower than others in the area hear them. It seems I cannot hear stations from China, Taiwan, Malaysia and Guam at all, while a friend 3 miles away hears them at S-5. Does the hill play a role at all to my HF propagation in that direction?**

A Assuming a flat earth (a close approximation at this distance) that hill top is at an elevation of 4.8° (see Figure 8). While the peak of your elevation lobe is much higher than that — about 23° on 20 meters — you will still have a reasonable signal at around 5°, down about 9 dB, but that's still a respectable 3 dBi (see Figure 9).

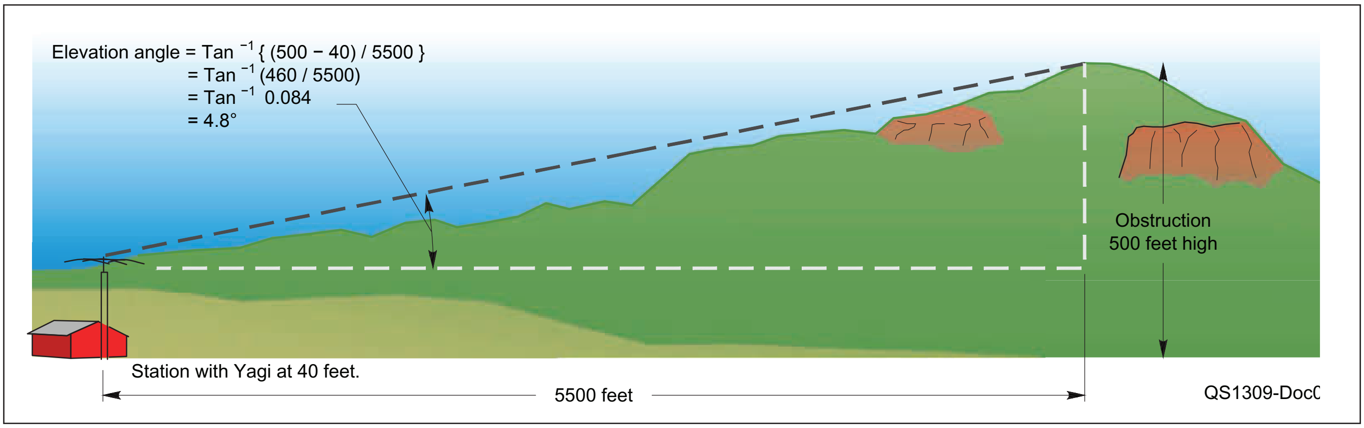


Figure 8 — Flat earth approximation of elevation angle needed to just clear the obstruction described.

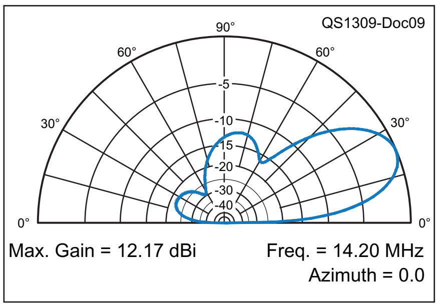


Figure 9 — Elevation pattern of a three element Yagi at 40 feet above typical earth. At 5° elevation, it is down by 9 dB from the peak, but still has an intensity of 3 dBi.

It will be even stronger on the higher bands. The distance from your location to those destinations range from about 6000 to 8000 miles, typically a two to three hop F layer propagation path. If your friends are getting there on two hops, by having energy at lower elevations, they will do better due to the additional attenuation of the third hop, so the hill could easily explain the difference.

One thing to keep in mind is that ionospheric propagation doesn't always take the geometric straight line path, particularly with paths through the polar region. You might try pointing your beam off either edge of your hill and see if you can hear them from those directions. You might even do better via long path for those distant destinations, although the long path distances are more than twice as far.

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 to **doctor@arrl.org**.

ARRL VEC Volunteer Examiner Honor Roll

The ARRL VEC Honor Roll recognizes the top 25 Volunteer Examiners 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.

If you are an ARRL VE, you can see your session stats online at **www.arrl.org/ve-session-counts**.

If you're not a VE, become one! See **www.arrl.org/become-an-arrl-ve**.

Examiner	*Sessions*	*Accreditation Date*	*Examiner*	*Sessions*	*Accreditation Date*
Harry Nordman, ABØSX	575	09-Jan-02	Gerald Grant, WB5R	349	04-Jan-85
Sammy Neal, N5AF	522	20-Nov-84	Victor Madera, KP4PQ	345	01-Mar-92
David Bartholomew, ABØTO	465	22-Mar-02	John Hauner, KØIH	332	11-Jan-85
Franz Laugermann, K3FL	448	01-Dec-91	David Fanelli, KB5PGY	327	01-Oct-91
Kevin Naumann, NØWDG	443	17-Nov-02	Adolph Koehler, K5VCR	316	29-Sep-95
Bill Martin, AIØD	439	01-Nov-84	E. Drew Moore, W2OU	316	01-Aug-90
John Moore III, KK5NU	409	21-May-95	Daniel Calabrese, AA2HX	304	01-Nov-91
Paul Maytan, AC2T	398	06-Sep-84	Morris Jones, AD6ZH	303	27-Nov-01
Karen Schultz, KAØCDN	390	06-Sep-84	Roland Kramer, WØRL	302	21-Jun-01
Jeanette Nordman, ABØYX	389	21-Aug-03	Robert Hamilton, NØRN	301	19-May-87
Royal Metzger, K6VIP	368	29-Apr-85	Loren Hole, KK7M	299	06-Sep-84
John Mackey Jr, KSØF	358	01-Oct-90	Michael Faucheaux, N5KBW	295	15-Jul-96
Richard Morgan, KD7GIE	355	11-Aug-00			

Steve Ford, WB8IMY, wb8imy@arrl.org

I.C. Engineering Digi-Field Field Strength Meter

by Bob Allison, WB1GCM

A field strength meter is really a receiver that measures the electric field of a transmitter. A simple field strength meter is not much more than an antenna, a diode and a meter, which at least lets the user know if an RF signal is present nearby. More elaborate field strength meters are actually calibrated receivers that can be used for measuring antenna patterns of commercial broadcast stations, providing accurate signal strength measurements in micro-volts per meter.

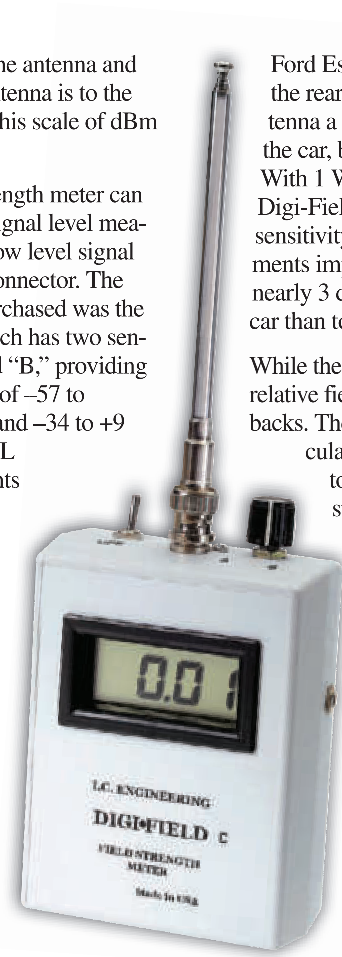
My first field strength meter was very basic and wasn't very useful for making measurements, but it at least told me that RF was leaving my antenna tuner. Recent *QST* Product Reviews have shown a number of antenna tuners can tune to a low SWR without an antenna connected! Field strength meters can also be used for antenna adjustments, such as adjusting antenna element spacing and determining the effectiveness of a ground radial system. With that in mind, it's a good idea to have one, such as I.C. Engineering's Digi-Field field strength meter.

Up Close with the Digi-Field

The Digi-Field is a small, battery operated device with minimal controls. It can sniff out signals from dc to 12 GHz. There is a power ON/OFF switch, an A/B (sensitivity) switch and a ¾ by 1¾ inch LCD digital display, all housed in a heavy duty 5 × 3⅛ × 1½ inch plastic case. A ⅛ inch monaural phone jack provides demodulated audio while in the vicinity of strong AM transmitters. An internal 9 V battery powers the meter. With a current consumption of only 20 mA, battery life is quite good. A low voltage indicator pops up on the display if the battery voltage drops below 7.2 V.

While using the supplied telescoping whip antenna, the meter displays relative signal strength, which is easily converted to within a fraction of a dBm using the provided calibration curves for 250 kHz, 1, 100, 500 and 1 GHz[1]. The sensitivity of the instrument depends on the length of the antenna and how close the pickup antenna is to the transmitting source, so this scale of dBm is also relative.

The Digi-Field field strength meter can also be used for direct signal level measurement by placing a low level signal directly into the BNC connector. The Digi-Field meter we purchased was the "Model C" version, which has two sensitivity settings, "A" and "B," providing a total input level range of –57 to +4.5 dBm at 100 MHz and –34 to +9 dBm at 500 MHz. ARRL Laboratory measurements showed the meter has a +3 to +6 dB level offset compared to the charts provided. With an accurate signal generator, the user of the Digi-Field can chart the meter readings versus the input level in dBm at any desired frequency.



Measuring RF

The Digi-Field's manual does go into detail about measuring field strength, power density, antenna factor and antenna gain, and it provides the instructions and equations used to determine these figures. Mind you, *precise* antenna measurements, such as antenna radiation patterns, cannot be made without a properly designed antenna range. For instance, ground reflections may add to or even cancel the desired signal. To cancel all reflections, you need an *anechoic chamber* built with material that absorbs electromagnetic energy. Still, the manual gives instructions on how to roughly determine the radiation pattern of a mobile antenna using a non-conductive tripod, string and protractor.

In an empty parking lot, I tried the string and protractor method (without the tripod). I started by placing a 2 meter, ⅝ wavelength mag-mount antenna on top of my wife's Ford Escape, centered and just in front of the rear hatch. This location gave the antenna a ground plane toward the front of the car, but little ground plane to the rear. With 1 W of RF into the antenna and the Digi-Field meter 10 feet away (with the sensitivity switched to "A"), my measurements implied that the signal level was nearly 3 dB higher towards the front of the car than toward the rear.

While the Digi-Field is a ruggedly built relative field strength meter, it has its drawbacks. The user must go through a few calculations (using a scientific calculator) to be able to determine the field strength in micro-volts per meter. The manual has a few errors, the most glaring of which is an antenna pattern of a typical mobile antenna that looks like an antenna pattern of a directional antenna. My main complaint was the inability to look inside while attempting to see if there was any adjustment for calibration. The case screw holes are covered by rubber feet, which are glued in place. After prying off the rubber feet and loosening the case screws, I could not separate the case to get inside without ruining it. According to I.C. Engineering, the case is sealed to prevent tampering that might ruin the meter's response.

But these are small glitches in the scheme of things. Overall, I found the Digi-Field to be easy to use and, with the provided calibration charts, every bit the match of more expensive meters.

Manufacturer: I.C. Engineering, 1801 Aleppo Ct, Thousand Oaks, CA 91362; tel 805-493-5057; **www.digifield.com**. *$239.*

[1]Additional charts for 2, 4, 5 and 10 GHz available from I.C. Engineering. Other accessories available.

Hands-On Radio

H. Ward Silver, NØAX, n0ax@arrl.org

Experiment #128

Phasors, Part Three

I confess to using the wrong value for $\sqrt{3}$ in last month's column. It's 1.732. The implications of that mistake are addressed on the "Hands-On Radio" web page.[1] Now, on to modulation!

What if, as seems to happen on a regular basis, one tuner-upper attracts a competing tuner-upper with another unmodulated carrier identical in frequency and amplitude except for having a slightly different phase — say 45° — ahead of the original carrier? The new signal's phasor is given as A∠45°, just ahead of the first signal by 45°. Even though both phasors are rotating around the origin, that relationship never changes.

Since both of the signal phasors have the same frequency, why not do away with the rotating and look only at the differences? What would happen if you take a seat on the first carrier's phasor, looking out toward the arrow's head from the origin, and spin around with it? From your new perspective, the phasor doesn't move or change at all because you're rotating with it at the same rate (frequency) and its length (amplitude) is constant. The second carrier with the 45° phase difference is pointed off to the left, halfway between straight ahead and to your left. It, too, doesn't move or change, but the phase difference means it points in a different direction.

Let's say that the competing tuner-upper starts to drift down a little bit in frequency. As the frequency of the second signal drops, the rate at which its phasor rotates gets a little slower, too. That means it will start to fall behind the original phasor and from your perspective, the second phasor appears to rotate clockwise or backwards according to our counterclockwise-equals-positive convention. The lower the second signal's frequency, the faster it rotates backwards. Let's say the second signal stabilizes at a frequency 1 Hz lower. To you, it appears to rotate backwards, passing backwards across your phasor once per second. Similarly, if the frequency of the second signal increases, it will appear to rotate counterclockwise.

Another possibility is that the phase of the second signal (with respect to the original signal) jumps around. In this case, what you would see is the phasor for the second signal shifting its position relative to the first signal — sometimes ahead, sometimes behind.

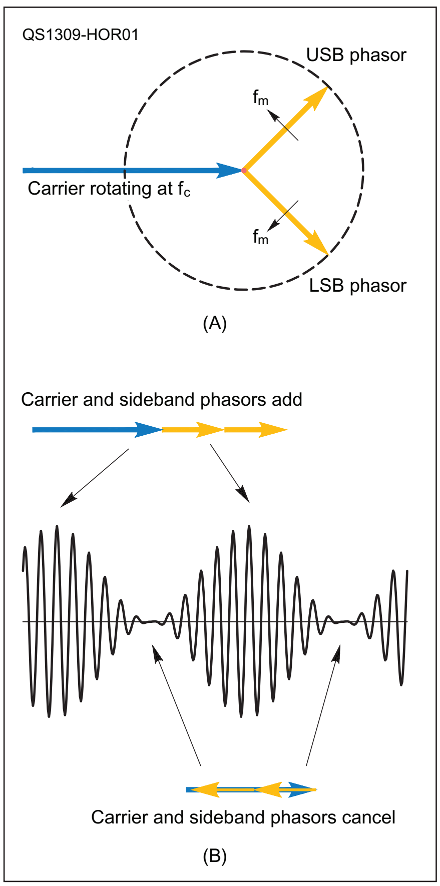


Figure 1 — Amplitude modulation shown as a combination of three phasors. At A, the sideband phasors are shown rotating in opposite directions at the frequency of the modulating signal, f_m, with respect to the carrier which is rotating at f_c. 100% modulation is shown at B in which each sideband has half the carrier amplitude so that the sum of all three phasors varies from zero to twice the unmodulated carrier amplitude.

AM from the Phasor Point of View

AM produces three signals when a carrier is multiplied by a modulating signal. The first signal is the carrier with frequency, f_c. If the modulating signal is a single tone with frequency, f_m, two sidebands are created with frequencies, f_c+f_m (the upper sideband) and f_c-f_m (the lower sideband). See the Modulation chapter of the *ARRL Handbook*.[2] Each of these signals can be treated as a phasor and the trio can be added together as we discussed in the previous column.

The amplitude of the three phasors doesn't change but their relative directions do. Figure 1A shows what the three phasors look like from your perspective, sitting comfortably on the carrier phasor rotating at the carrier frequency, f_c. Since the upper sideband (USB) phasor has a higher frequency than the carrier, you see it rotating counterclockwise at the modulating frequency, f_m. Similarly, you see the LSB phasor rotating clockwise at f_m. (Viewed all by themselves, the USB and LSB phasors are actually rotating at $f_c \pm f_m$.)

Note that these counter-rotating sideband phasors have the same amplitude and are always ahead of or behind the carrier phasor. Think about what this means for the sum of the three phasors. Using the tip-to-tail method of adding phasors, the resulting AM signal's phasor will always be aligned with the carrier phasor because of the symmetry of the sideband phasors. However, the amplitude of the AM phasor will grow and shrink as the two sidebands add to, then oppose, the carrier phasor.

What happens if each sideband has exactly half the amplitude of the carrier? When the sideband phasors are both "pointing out" the resulting AM phasor's amplitude equals the sum of the carrier plus the two sidebands: twice the original carrier's amplitude. When the sideband phasors are "pointing in" their

[1]All previous Hands-On Radio experiments are available to ARRL members at **www.arrl.org/hands-on-radio**.

[2]Available from your ARRL dealer, or from the ARRL Store, ARRL order no. 6948. Telephone toll-free in the US 888-277-5289, or 860-594-0355, fax 860-594-0303; **www.arrl.org/shop/; pubsales@arrl.org**.

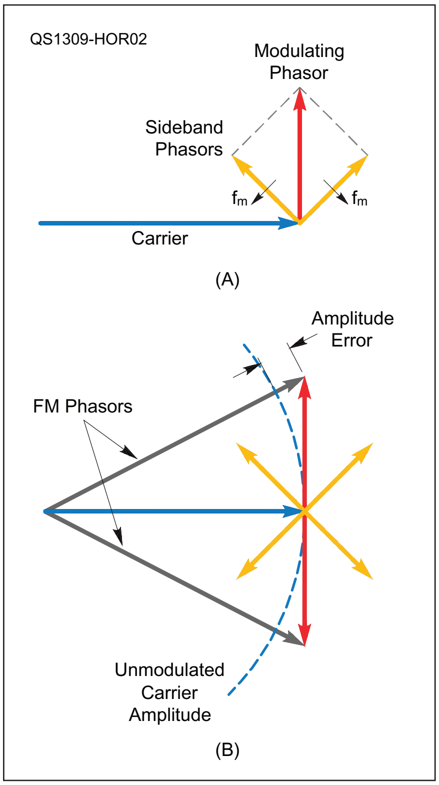


Figure 2 — Frequency or phase modulation shown as a combination of three phasors. A shows sideband phasors similar to AM but oriented so they create a modulation phasor at right angles to the carrier. B shows the FM phasor moving ahead of and behind the carrier according to the alignment of the sideband phasors. Using only one set of sidebands reduces bandwidth but creates a small amplitude error in the resulting signal.

sum cancels with the carrier and there is no signal. Thus, the AM phasor's amplitude varies from zero to twice that of the original carrier — just as you see in Figure 1B, which represents 100% modulation.

FM and PM from the Phasor Point of View

From the standpoint of the unmodulated carrier, the phasor of an FM or PM signal moves ahead and behind that of the carrier as the amplitude of the modulating signal changes. (For the rest of this column, FM will be used to mean both FM and PM.)

Just as for AM, a pair of counter-rotating sideband phasors with frequencies of $f_c \pm f_m$ add and cancel just as for AM. Unlike AM, however, they are oriented so that they are creating a separate modulating phasor at right angles to the carrier phasor as in Figure 2A. The resulting FM phasor created by the sum of the carrier and the modulating phasor shifts ahead of and behind its unmodulated position as in Figure 2B.

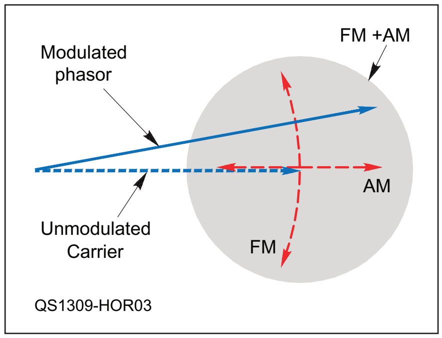


Figure 3 — The effects of AM and FM modulation on an unmodulated carrier. Combining AM and FM results in a two-dimensional region for the resulting signal phasor.

It's not that simple, however, because FM and PM signals have constant amplitudes — only the frequency (or phase) may shift with modulation. That means the final sum of the phasors must have a constant amplitude, that of the original unmodulated carrier, shown as the arc in Figure 2B. The figure shows the small amplitude error created by including just the one set of modulation sidebands. When the modulation level is low, the error is small enough that one pair of modulation sidebands is acceptable and this is called "narrowband FM."

As the modulation level increases ("wideband" FM) and the resulting FM phasor moves farther and farther from the unmodulated carrier, the resulting amplitude error would become larger. To keep the FM phasor close enough to the required amplitude, additional sets of sideband phasors are required. Each successive set operates at right angles to the previous set. This is the complex set of sidebands.

IQ Modulation with Phasors

As Figure 3 shows, the phasor of a modulated carrier moves around in an area defined by whether the modulation is AM or FM. If AM, the movement is horizontal, changing the phasor's amplitude. If FM, the movement is along an arc, changing the relative phase. There's no reason a signal can't have both AM and FM components with the resulting phasor located anywhere within the indicated area.

Oversimplifying to a degree, this is what IQ modulation is in which two different modulated signals are combined: the I signal (for *in phase*) and the Q signal (for *quadrature*). Both the I and Q signals are regular carrier signals, but the Q signal is 90° ahead of the I signal as shown in Figure 4. Modulating the I and Q signals independently and combining them can cause the resulting phasor to move

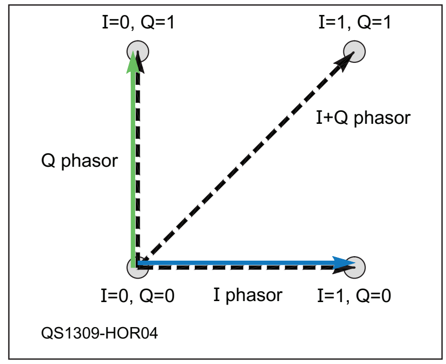


Figure 4 — IQ modulation uses two independent carriers, I (in-phase) and Q (quadrature) shifted 90 degrees. By turning the I and Q carriers on and off, the resulting signal phasor takes any of four positions in the resulting constellation diagram, representing four different data symbols.

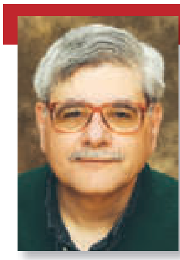
around in the pattern of any of the AM or FM phasors discussed previously.

Digital data can be transmitted by turning the I and Q signals on (1) and off (0) independently (also called *amplitude shift keying*), creating four possible combinations (00, 01, 10, and 11). By adding the on-or-off I and Q phasors together, the result is four different phasors shown in Figure 4. This is called *quadrature amplitude modulation* or *QAM* and each position of the phasor is called a *symbol*. If there are four possible symbols, it is called 4-QAM. A receiver demodulates the I and Q signals separately and decodes the phasors into the same on/off combinations, reproducing the same stream of digital data.

From your perspective, sitting on the I signal's phasor, the end points of the four phasors form a square called the modulation's *constellation diagram*. Complex schemes with hundreds of points in the constellation have been devised — for example, digital cable TV signals use 64 or 256 points, called 64-QAM or 256-QAM, respectively.

All this from simple rotation! The interested reader may want to tackle additional information found online. You can learn more about IQ Modulation at **www.home.agilent.com/upload/cmc_upload/All/IQ_Modulation.htm?cmpid=zzfindnw_iqmod**, Amplitude and Frequency/Phase Modulation at **www.zhinst.com/blogs/michele/files/downloads/2012/12/AMFM.pdf** and Digital Modulation at **http://ee.eng.usm.my/eeacad/mandeep/EEE436/CHAPTER2.pdf**.

Nevertheless, even if you stop here, you'll have traveled from a basic definition of phasors to how they can be used to visualize the modulation processes we use every day.



Steve Sant Andrea, AG1YK, hk@arrl.org

Racking Radios and Coloring Cables

Shack in the Rack

I am always on the lookout for ways to transport my public service radios. Any method has to meet two criteria as a way to organize the radios, wires and associated support gear. The first is equipment protection and the second is gear organization.

The first criterion is self-explanatory. Public service jump kits need to be ready to go in a hurry. Grab and go kits are subject to bumps and bruises sustained in disaster environments. They need to be kept safe from the bent knobs, smashed displays and stressed connectors that are the hazards of taking the rigs out of their safe shack environment. The second criterion, organizing all pieces of equipment, means that once deployed, the operating environment takes up minimal space while providing the greatest communications flexibility. This is especially tricky given how many critical cables, connectors and wires are associated with these devices.

Figure 1 — An Allsop monitor stand makes a great base for a digital go-kit station. [Jon Rudy, K3QF, photo]

Stand and Deliver

A few years ago I was organizing my work station in my home office and needed a way to keep the monitor off my docked laptop. I discovered the Allsop Metal Art Monitor Stand (**www.allsop.com**). It comes in two sizes (15 × 11 and 19 × 12 inches) and have simple U-shaped tubular steel legs held together with spot welded, perforated sheet steel on the top colored an anodized black or gray. I thought it would be easy to hang a radio off the bottom and use the top for the laptop platform (see Figure 1).

Mounting the 144/440 MHz radio's bracket, speaker and wattmeter wasn't a problem, but the power supplies (for radio and laptop) were more of a challenge. Zip tie wraps were the perfect solution. With so many holes on the top, mounting is easy for almost any shape.

The results were fantastic. I was able to put all the gear I needed on the front side and tuck the power supply away in the back. I secured all the cables as neatly as possible under the stand with only the necessary pigtails emerging from the sides and back (see Figure 2). These included the RF output, SignaLink USB cable, connector for digital operation, ac power cord and laptop power. I was even able to side mount a surplus 12 V gooseneck lamp, to illuminate the radio and workspace in low light situations (see Figure 3).

Wrap Rack

The second rack came from a most unlikely place — the kitchen. I happened upon a "wrap organizer," which is a rack for organizing boxes of foil, cling wrap and wax paper. The Schulte Wrap Organizer is made

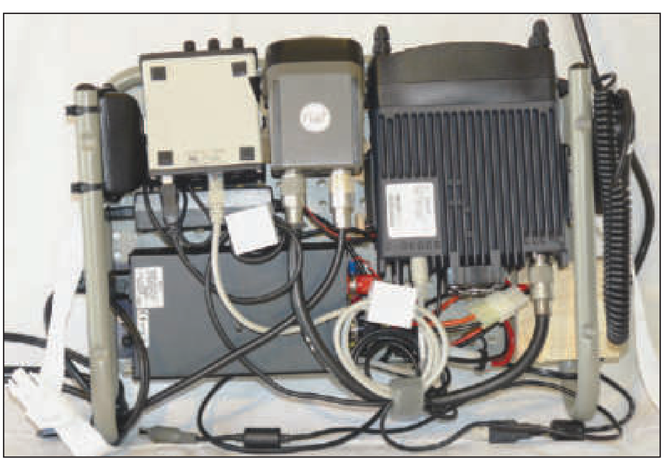


Figure 2 — A hook and loop strap turns a tangle of wires into a tidy bundle secured to the bottom of the stand. [Jon Rudy, K3QF, photo]

Figure 3 — Folded up and ready to travel, the digital station even has room for a gooseneck lamp. [Jon Rudy, K3QF, photo]

Figure 4 — A wrap rack provides a three tier frame to support a power supply, transceiver and tuner, with space on top for a wattmeter and room on the side for a SignaLink and paddle. [Jon Rudy, K3QF, photo]

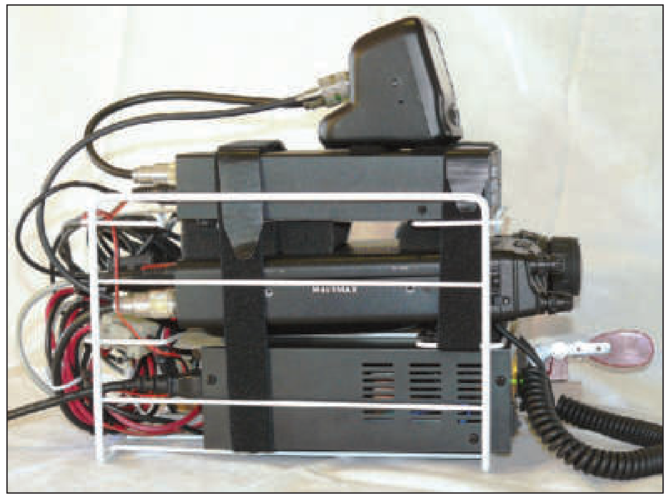


Figure 5 — Hook and loop straps keep everything secured to the solid steel wire frame. [Jon Rudy, K3QF, photo]

from heavy gauge white painted steel wire that forms three shelves, the top two having an I shape. I took a gamble ordering it for my jump kit idea, but for less than the price of a burger meal, I thought it was worth a try. After all, my spouse could use it in the kitchen if it didn't fit.

I was delighted to find that my power supply, FT-857 transceiver and tuner all fit neatly in the spaces provided (see Figure 4). The open nature of the setup allowed me to neatly wrap and secure cables to the back side. I used stretchy hook and loop straps to hold it all together for a grab and go shack in the rack setup (see Figure 5).

Using some trusty plastic tie wraps, I secured the SignaLink USB modem (**www.tigertronics.com**) to the side and mounted a microphone clip to the radio using one of the mounting holes. The wattmeter is held on the top with sticky hook and loop fasteners so it is removable for transport. The keyer paddle is tie-wrapped to the side. I'm not entirely happy with the paddle and am considering other arrangements. As with any homebrew design, it is still a work in progress. *— 73, Jon Rudy, K3QF, 608 W High St, Manheim, PA 17545*, **jonk3qf@gmail.com**

Color Coded Cables

For a long time I've tried to find an efficient method of marking cables for easy identification. Paper tags never worked well. Engraved aluminum tubing sleeves lasted forever but were difficult to install and read. Commercial lettering tape was difficult to read at a distance. Then it came to me: resistors are color coded so why not cables?

Heat shrink tubing is now readily available, comes in all sizes and in a rainbow of colors. I use it for all types of cables although, in some applications, one needs to plan ahead and place the heat shrink tubing on the cable before installing the desired connector.

I use color codes to indicate the length and/or the location of a cable (see Figure 6). When getting ready to pack for the field its handy to glance at a coil of coax with brown, green and brown bands and instantly know it is 150 feet long.

I use a length of white heat shrink tubing as a base color so black and brown bands stand out. For coax in the shack, one of my methods is to identify all cables coming from the attic antennas with a green base color. Outdoor HF antenna cables have a yellow base color. Other colored bands on the base color tell me the specific antenna. The possibilities are limited only by your imagination. *— 73, Walter Martin, KB5HOV, 10944 Grissom, Suite 715, Dallas, TX 75229*, **kb5hov@alumni.southwestern.edu**

Figure 6 — Colored heat shrink applied to the ends of cables can be used to indicate length or application at a glance. [Walter Martin, KB5HOV, photo]

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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.

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

Fun With Old Style Simple Transmitters

Simple Transmitters — 1946 and Now

The 1946 style one tube CW transmitter described by Martin Huyett, KØBXB, in the November 2012 issue of *QST* brought back memories of my first rig.[1] Those elegantly simple rigs were great fun.

I found it interesting to compare the very basic 1946 circuit to a bare bones style rig that I had recently constructed.[2] As a further experiment, I started with that logic chip transmitter circuit, and eliminated fancy features.[3] The resulting bare bones 2013 transmitter has 13 parts and meets 2013 FCC rules. That is very comparable to the 11 parts in the 1946 style rig. Figure 1 shows the schematic diagram of my new transmitter. Note that I used a brass strip to short seven of the inverter inputs together, and another brass strip to short seven of the inverter outputs together, connecting them in parallel. One inverter serves as an oscillator and the seven parallel inverters form an amplifier.

In 1946, the old style transmitter cost about $4, which is equivalent to $38 in 2013 dollars. The cost for the 2013 simple rig is about $5 in today's dollars. The most expensive parts in the 2013 rig are the $1.56 crystal and the 37 cent 74AC540 logic chip. I used ground plane construction instead of the more common printed circuit board technique for the 2013 rig.

I put my new rig on 17 meters. (We did not have a ham band at 17 meters in the old days). Using four AA batteries as a power supply, it put 1 W into my half wave vertical. My first contact was with KL7QZ, 2650 miles away!

The rig needs a 6 V power supply. Figure 2 shows a simple way to obtain a regulated 6 V

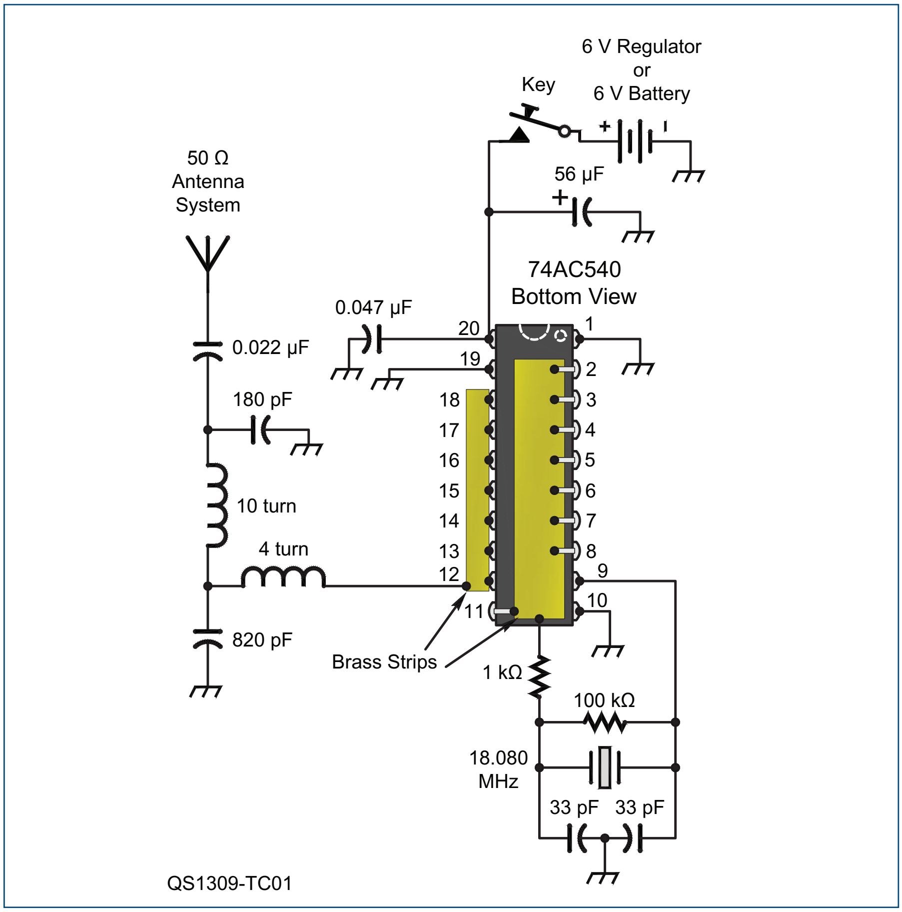


Figure 1 — The schematic diagram for the simple 2013 transmitter, showing how brass strips can be used to short the inputs and the outputs of seven of the inverters on the 74AC540 to connect them in parallel. The coils have 5⁄16 inch ID and have an air core. The 10 turn coil is 3⁄8 inch long and the four turn coil is spaced out to ½ inch long.

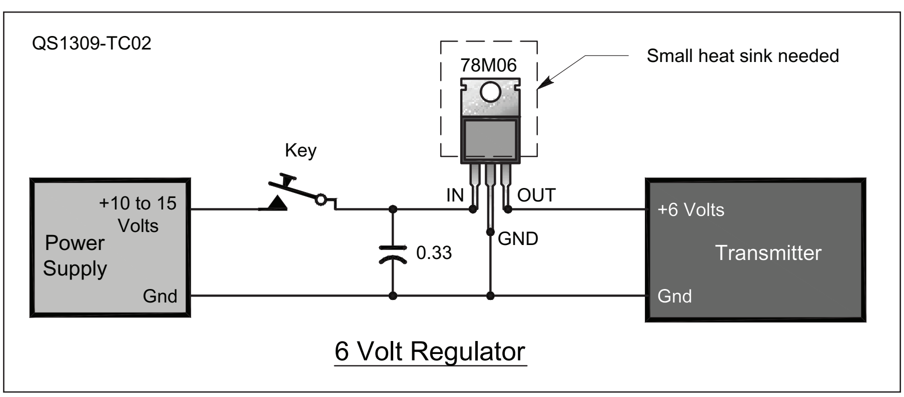


Figure 2 — You can connect a 78M06 regulator IC to your 12 V shack power supply, to provide the 6 V needed by the transmitter.

[1]Martin Huyett, KØBXB, "Have Fun Building the Simplest Transmitter," *QST*, Nov 2012, pp 46-48.

[2]Lew Smith, N7KSB, "A 2 Watt Logic Chip Transmitter," *QST*, Dec 2011, pp 38-40.

[3]If you want more details about this simple 2013 transmitter, contact the author at **evieandlewsmith@gmail.com** for schematics, parts list, photos, and construction details. A kit of parts is also available.

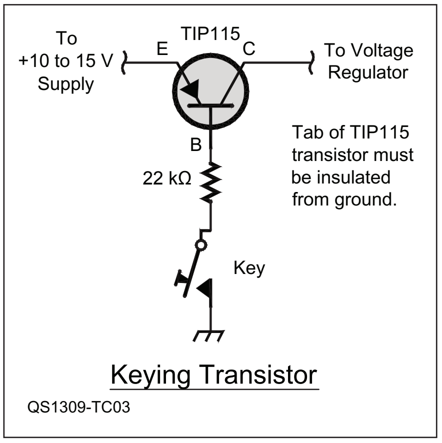


Figure 3 — You can connect a TIP115 Darlington transistor between the 12 V supply and the 78M06 regulator IC, and key the transistor base to ground as an alternative way to key the transmitter.

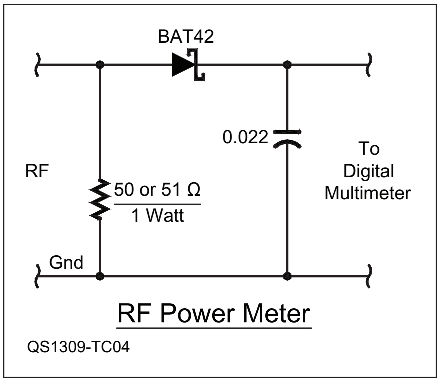


Figure 4 — Here is the schematic diagram of an RF power sampler that you can build to connect to the transmitter output and use a digital multimeter to measure the output power.

supply from your 12 V supply. You will need to attach a small heat sink to the tab of the 78M06 regulator IC. I key the regulator input. Figure 3 shows an alternative way to key the transmitter, using a TIP115 Darlington transistor to key the regulator. Note that you will have to insulate the TO-220 case tab from circuit ground.

Figure 4 shows the circuit I used to measure the output power from my transmitter. A 1 W 50 or 51 Ω resistor serves as a load for the rig and a BAT42 Schottky diode rectifies the signal voltage so it can be measured using a digital multimeter.

This "old versus new" exercise showed me that simple transmitters can still be built. Furthermore, if modern components are used, simple transmitters are much less expensive and far easier to build than those built in the "good old days." To top it off, 17 meters provides QRP DX that the 1946 ham could only dream about. Whether built 1946 style, or 2013 style, simple rigs are a blast! — *73, Lew Smith, N7KSB, 4176 N Soldier Trail, Tucson, AZ 85749*; **evieandlewsmith@gmail.com**

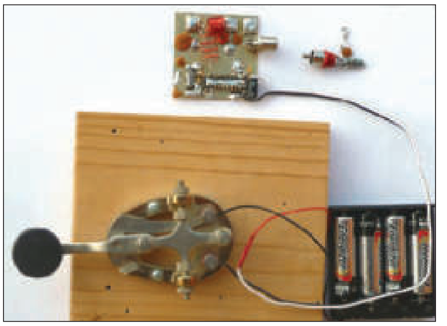


Figure 5 — Here is the simple 2013 transmitter with a key and 4 AA cells to operate it. Note the small RF power sampler built on an RCA plug that can be used to measure the transmitter output power.

Set Your Radio and Software for Proper RTTY Operation

I read with interest the "Eclectic Technology" column by Steve Ford, WB8IMY, in the August 2012 issue of *QST* (page 56) in which he describes how to operate PSK31 on 60 meters.

Here are some really easy instructions for operating traditional 170 Hz shift RTTY at 45.5 baud while adhering to the FCC and National Telecommunications and Information Administration (NTIA) rules for the 60 meter band.

The rules state that all the permitted digital modes must be centered in the 60 meter band channels. Also, to satisfy the NTIA, the radio receiver must be configured so that an upper sideband SSB signal can be copied in case the primary users need to tell you the channel is occupied. For RTTY, we use the same suppressed carrier SSB channel frequencies (the frequencies that appear on your transceiver display) that Steve lists in his column.

One simple way of generating the "ham-RTTY" data mode in the 60 meter band channels is to operate using the so-called "AFSK" method of generating the data signals. A computer sound card generates audio tones that are fed into the transmitter microphone or other audio input connector. With a properly adjusted SSB transmitter, the audio tones (one at a time) produce an RF signal at the carrier frequency plus the audio tone frequency for an upper sideband transmission. (The RF signal would be the carrier minus the audio tone frequency for a lower sideband transmission.) In effect, the transmitted RF output frequency shifts between two frequencies as the audio input tones shift. The result is a frequency shift keyed RF output — FSK.

The following settings work well with "AFSK" RTTY. I based these instructions on the very popular MMTTY RTTY software, but you can use the same technique with other RTTY applications.

1) Set the rig to upper sideband SSB or upper SSB digital mode, just as you would for PSK31 (this keeps you consistent with the NTIA requirement that you monitor the channel for upper sideband transmissions) with the dial set to your chosen upper sideband suppressed carrier channel frequency.

2) In MMTTY select the Mark frequency as 1415 Hz (in upper sideband this will actually be the Space frequency).

3) Set MMTTY to "Reverse" (because you are using upper sideband).

4) Set Shift to 170 Hz and baud rate to 45.45.

This will have the effect of centering the RTTY tones at the radio dial frequency plus 1500 Hz, with the two tones at ± 85 Hz. In other words, the Mark and Space tones will appear dead center in the channel. The tones will be 1415 and 1585 Hz above the upper sideband SSB dial frequency.

Note that with MMTTY set to "reverse," the MMTTY tone nomenclature is not correct. The 1415 Hz frequency is actually the Space frequency, while the Mark frequency appears at 1415 + 170 = 1585 Hz above the channel SSB "carrier" frequency. If your MMTTY ini file does not include "MARK=1415," you can edit the MMTTY.INI file to add 1415 to the list, so the Mark= line looks like:

[ComboList]

Mark=2125,2000,1700,1445,1415,1275,
1170,1000,915,660

You can operate with these same parameters in any other ham band where RTTY is permitted. It will work just fine, and will be compatible with all other RTTY users! As an added benefit you can simultaneously run *Digipan* software to get its excellent frequency calibrated waterfall display to see the other RTTY signals. The two RTTY tones should straddle the 1500 Hz marker on the *Digipan* display. For RTTY, you transmit and receive from the MMTTY widow. Also, using this method you can listen for any SSB signal on the channel and you can transition instantly to PSK31 without changing anything on the rig. — *Kai Siwiak, KE4PT, 10988 NW 14th St, Coral Springs, FL 33071*; **ke4pt@arrl.org**

Taking the Mystery Out of ARES — The Role of the PIO

Educating your community about the capabilities of your ARES® group can lead to a scenario where everybody wins.

Oscar Fuller, KO1F

Ever wonder why your ARES or public service teams are underutilized? You're called on to serve during emergencies and your services are certainly appreciated. But when the dust settles and the emergency has passed, you return home and remain overlooked — until the next disaster strikes.

So how can you fill this "down time" and make a contribution to your community? Maybe it's time to go on an "information offensive" in order to enlighten your local town officials about your team's capabilities; spread the word about your resources and availability assisting with civic events as well as emergencies.

More activity for your ARES team is a win-win. Your community gets the benefit of the support. You get more practice with deployments and providing assistance. During planned events you get to try new approaches or experiment with new technologies to test them out before a real emergency.

The Importance of the PIO

The critical role during down time for ARES groups is that of the *PIO* or Public Information Officer. PIOs are an integral part of the ARRL Field Organization and work with the Section's Public Information Coordinator (PIC). The job of the PIO is to be proactive in keeping local served agencies and the general public current on the group's activities. There are numerous opportunities for promotion outside of a disaster response: Field Day, licensing test sessions, club meetings and a presence at local and regional hamfests. The after-action report is a great tool for providing an overview on the role your group played during emergencies or community service events.

The PIO is one of the most important positions in your group. PIOs need to have a large set of skills: a wide knowledge of Amateur Radio, projecting a professional image, being adept at public speaking, being comfortable in front of a camera and having the ability to be diplomatic. PIOs need to be able to explain everything from the SKYWARN system to Field Day to the general public, the classroom and the media.

In these times of constant belt-tightening, it's probable that most towns would appreciate your team's communications assistance at community events. The PIO can communicate how ARES can add support to an event without the organizers having to incur any additional expense.

A Twofold Approach to Community Awareness

Because of our history of providing support during emergencies, your group's best approach may be to build a relationship with your local emergency management. Many of you already know your local Emergency Management Director (EMD) and he or she is aware that you're available when an emergency strikes. Your EMD knows you can provide reliable communications backup. Often this person is involved with safety planning for civic events. Talk to your EMD about utilizing your team to assist with event communications.

For example, ARES members who are placed along a parade route or around the field during a fireworks display can report any issues that might arise, freeing up paid fire and law enforcement resources for higher priority assignments. So if you don't already, get to know your local EMD and build on that relationship to expand the contribution you and your team can make to the community.

Oscar's, KO1F, shack is an efficient layout that allows him to deal with any communications situation — from a major hurricane to a long ragchew. [Judith Peshon Fuller, photo]

The second approach is to tell the ARES story to any audience you can find.

Be Prepared to Speak

Civic clubs and other organizations have meetings in your community every week and are always looking for speakers. Contact any of your local clubs, find the person responsible for scheduling speakers and get your PIO scheduled to address the group.

With very little effort you'll be able to find a group that is happy to have you talk about ARES. I've given talks to organizations ranging from civic clubs to the local women's club. You'll find an eager audience even in those organizations that have little to do with communications or emergency planning.

Also consider your served agencies. How much do they know about your capabilities? Sure, they may know the basics of your abilities and that you can be called on during emergencies. But how much do they know about the breadth of options you offer? Impress them with a presentation on topics beyond voice communications. Talk about APRS, digital data transmission, high speed multimedia or *Airmail* — the list goes on. Doing so will help build a stronger bond between you and your served agencies and simultaneously you may develop new ways of providing service using nontraditional modes and methods.

In addition to the general awareness you are building, you'll find that speaking to these groups will generate a "pull" effect that will stimulate your participation in events you might otherwise miss.

Don't forget local chapters of the major disaster relief agencies. Check to see which ones already work with hams at **www.arrl.org/served-agencies-and-partners** and fill them in on your group's capabilities.

Building and Delivering a Presentation

First, recognize that, as the PIO of an ARES group, you are the expert; no one in your audience knows more about the subject than you. You're there to share a hobby you enjoy that can also bring significant benefits to your community.

I can almost guarantee there is someone in your group who knows how to put together a *PowerPoint* presentation. Perhaps a team member or a spouse or family member can help develop some slides. Get this person working with you right up front; it'll save lots of time down the line.

Next, think about building your message. What is your team's specialty? What are its strengths? Do you have an expert in your group? What experiences have you had, locally or on a deployment?

Tips for Developing a Presentation

- Make it personal — To the extent possible give a snapshot of your group and what it can deliver to the community.

- Make it local — Include local pictures, highlight local hams.

- Don't limit your talk — What may seem mundane to you can be very interesting to your audience. When you speak, take along your jump kit. Set up a station and make it part of the show.

I impressed a men's club group once by getting its e-mail list and sending its members an e-mail using *Airmail* to invite them to the presentation. They were amazed when I explained how *Airmail* works and that they could send e-mail via Amateur Radio. You have a story to tell and a willing audience; it's time to share that story.

Tips on Giving a Presentation

Prepare — Don't "wing it." Come prepared to cover the topic in a crisp, professional manner.

Practice — I practice giving my presentations to my wife or someone who knows little or nothing about ARES and Amateur Radio. Their feedback is priceless. You can also practice in front of a mirror.

Know your audience — It will help you relate and make your message more relevant to them.

Respect your audience — They are giving you their time and attention.

Dress for success — If the audience tends to wear suits, you should wear a suit. Present yourself as their peer. Appearance does matter and is part of presenting yourself and your team as professional communicators.

Face your audience — *Do not* read your slides; your audience can read for themselves. Work the room, move around and make eye contact with your audience.

Slow down — You'll have a time constraint but you don't have to rush. Cover the high points and respond to questions. The time will fly by, so pace yourself and stay on track.

Smile and be humorous — Make sure they know you are happy to be there. If you have a funny story, tell it. The best ones I've found are those in which I can lightly make fun of myself. It goes without saying that any humor must be in good taste and appropriate for the audience.

A well designed set of slides is invaluable for helping your audience understand how your ARES team can fit into the community's emergency plans. [Oscar Fuller, KO1F, slide]

Use plain language — You're the only one who understands the acronyms and codes we sometimes use to communicate — keep ham radio jargon out of your presentation slides and your talk.

Remember to KYSS — Keep Your Slides Simple. Don't put too much information on a slide. Just hit the high points, show the value of your service and pique your audience's interest in using your group's skills.

Involve your audience — Ask questions of your audience as you present. Make any questions or interruptions part of the presentation. It's all part of engaging your audience.

Leave something behind — If you have a handout or contact cards, have enough for everyone. At several of my talks, I've taken the opportunity to hand out Connecticut state emergency preparedness brochures.

Stay within your time limit — Leave time for questions.

Be honest — Always.

Nerves are part of the deal — If you're not feeling a bit nervous, you're not paying attention. But don't let nerves defeat you. Channel that nervous energy to bring life to your presentation and discussion. You'd be surprised how a little distraction like holding on to a ballpoint pen during the presentation takes away your fear.

Other Ways of Communicating

Presentations and talks are great, but they are not the only way to get in touch with your community. Consider sending an activity report to your local EMD. This goes a long way to keeping you on his or her mind when an opportunity to serve arises. Show the flag at Field Day or ARES exercises and have signage available to post at events you conduct.

You Have Lots of Help

The ARRL provides lots of support to PIOs and public relations efforts. Go to the ARRL website at **www.arrl.org/pio-handbook** for help with content, including fully prepared *PowerPoint* presentations.

Oscar Fuller, KO1F, an ARRL® member, holds an Amateur Extra class license and is the acting DEC for Connecticut ARES Region 5. He has participated in major national exercises and was dispatched to the Gulf Coast to support emergency communications efforts after Hurricane Katrina. He is an active member of the local civil preparedness volunteer organization in Danbury, Connecticut, providing communications support through ARES. Oscar is married and has three children and four grandchildren. He can be reached at 32 Carriage House Dr, Danbury, CT 06810, **oscar@voidstar.org**

New Products

Dual Band 144/440 MHz Antenna Tuner from MFJ

The MFJ-923 VHF/UHF dual band antenna tuner covers the 144 MHz and 440 MHz amateur bands. It has a built-in cross needle meter that measures SWR, forward and reflected power in two ranges: 300 W or 30 W. Power rating is 200 W, and it's designed to match a variety of mobile and home station antennas. The tuner has a single input connector (SO-239) and a single output connector (another SO-239), compatible with the single antenna connector on most dual band VHF/UHF transceivers and dual band antennas. Price: $199.95. For more information, to order or for your nearest dealer, call 800-647-1800 or see **www.mfjenterprises.com**.

Adventure Portable, Part I: Rocky Mountain High

Following the Arkansas River with Amateur Radio along for the ride.

Max McCoy, KCØMAX

Beneath a diamond canopy of stars, with the temperature hovering just above freezing, I pulled my sleeping bag tight around me and tuned up the radio. It was early June, and I was snug in a dome tent at an altitude of just over 10,000 feet in the mountains near Leadville, Colorado. Although I was tired from a day of setting up camp and exploring, I wanted to make a contact before turning in.

I was operating low power (QRP) portable. Or, at least, tentable. Because the night was so still — the only sound was the whisper of the nearby Arkansas River — I wanted to do so without disturbing that stillness. I reached out into that gorgeous night sky with a 5 W PSK31 signal radiating from the dipole antenna above my tent. The red LED on my radio blinked and flickered as I called CQ CQ DE KCØMAX PSE K, and I anxiously watched the waterfall on my laptop for a response.

The author sets up camp and tries to make a few SSB QRP contacts.

It had become increasingly important to me that I log a contact on this first night of an adventure that was expected to stretch into the weeks — and months — to come.

When I got the go-ahead for a sabbatical project to follow the Arkansas River from its headwaters near the Continental Divide down to the plains, I knew Amateur Radio would be part of the journey. The project itself is about the natural and cultural history of the river, and QRP seemed a perfect complement. But now that I had actually begun the first leg of the journey, kicking around the headwaters near Leadville, I felt unexpected pressure.

I imagined what it would feel like to fail at this first attempt, to have my digital CQ go unanswered. From personal experience, I know that frustration can become a ham's worst enemy.

Discovering QRP

I'm a writer and professor of journalism by trade, but my hobby is Amateur Radio. I first got my ticket years ago, and wanted to operate HF, but lost interest because I was overwhelmed by the practical side of things. If you haven't had someone show you how to solder a PL-259 or tune an antenna, things can get disappointing in a hurry.

Then, I discovered the QRP community. After attending one of the early OzarkCon conventions hosted by the Four State QRP Group (the "four states" being Arkansas Kansas, Missouri and Oklahoma), I found an extended family of Elmers who gave generously of their time to help an English major understand the fundamentals of radio. Especially helpful was Joe Porter, WØMQY, a legendary QRPer who coordinated OzarkCon until 2009. Soon, I was building my own kits and making homebrew antennas — and logging some satisfying HF contacts.

My increasing skill set also came in handy in other ways, from troubleshooting temperamental electronics at work to rebuilding classic guitar amplifiers at home. As I learned more about the hobby, I was amazed by the range of activities QRP offered. Low power operating didn't mean strictly CW, and I was particularly drawn to some of the digital modes.

Philosophically, QRP suited me just fine. Not only is it one of the most economical ways to get into ham radio, it also presents a low environmental footprint and stresses operating skill over brute power. For the newcomer who would also like to get into kit building, there are kits available for every taste and budget. QRP also has the advantage of being a safe introduction to hands-on electronics, with potentials of typically no more than 12 V.

What to Take?

I knew I would be operating QRP portable. The question was, what rigs and antennas would I take? Although some hardcore low-power enthusiasts might insist that CW is the only way to go because of its efficiency, I knew that I wanted to employ a variety of modes. So, my Icom 703 transceiver was my first choice.

Although no longer produced, the Icom 703 is the little brother of the 100 W IC-706. I bought mine new almost a decade ago and it has performed remarkably well. An advantage is the internal antenna tuner and onboard filtering and signal processing. A disadvantage is its size and weight — it is the same dimensions as the Icom IC-706 — and its need for an external power supply.

At camp, this wouldn't pose a problem. I would power the 703 from a sealed lead-acid battery a ham friend had salvaged from work to give me, and would recharge from mains when available, or my Jeep when necessary. I would also bring an old laptop that had outlived its usefulness, except to run the *Ham Radio Deluxe* software package to control the '703. A Tigertronics SignaLink SL-1+ would provide the interface to the radio.

While the Icom would be my main rig, I also wanted something lighter, something I could throw in a backpack with a handful of 9 V or AA batteries while hiking. While there are a number of options — and my dream rig of the moment is an Elecraft KX3 — my choice was limited by my budget. I settled on another older radio, a Small Wonder Labs DSW-II that I had built from a kit. Together with an Arizona ScQRPions paddle, I would be set for operating CW.

For antennas, I knew from experience that it would be hard to beat a dipole. I already had a 40 meter dipole I had thrown together a few months ago as part of a ham radio demonstration I did for a local Cub Scout group. I'd use the dipole as my camp antenna, strung nearly invisibly in the trees. For hiking, I would use a vertical, a Pacific Antenna PAC-12 that I had built from a kit, with coils for both 20 and 40 meters. This antenna sets up quickly, generally in five minutes, is tuned by a telescoping whip, and breaks down into sections that are no more than a foot long.

All of this and more — coax, connectors, battery chargers, power inverter and an electronics repair kit with soldering iron — was packed into my Jeep Wrangler, along with all the necessary camping and hiking gear. Space also had to be found for food and clothing, photo gear, and of course maps and research materials.

When I reached Leadville, some 650 miles and 10 hours away, it was like entering another world. I'm a flatlander, a native Kansan. Leadville, with its thin air and picture postcard panoramas, seemed as far away as the Land of Oz.

Historic Leadville

At 10,152 feet above sea level, Leadville is the highest incorporated city in the United States. Situated just below the timberline, it has long been joked that Leadville has "10 months of winter and two months of mighty late fall." The city is surrounded by some of the most spectacular snow-marbled peaks to be found anywhere, and Mt Elbert — named for a territorial governor and at 14,433 feet the second highest peak in the continental United States — looms just a few miles to the southwest. The area is bounded by the Continental Divide to the west and north.

Leadville is one of the most famous mining camps in the world, situated in a fabulously mineral rich area, and having gone through several cycles of boom and bust since the 1860s. There is lead in Leadville, but there have also been prodigious amounts of gold, silver and molybdenum.

Parked near the Arkansas River in Leadville, Colorado.

When gold was first discovered in California Gulch, near the present-day city limits at the south edge of town, a boom town sprang up overnight on what had once been a pine flat. The placer deposits were exhausted in a few years, but another boom — this time in silver — came in the 1870s, and new mining operations were made possible by the use of pneumatic drills. By the 1890s the town had again gone bust. By 1915, however, molybdenum production had begun.

Better known as "moly," molybdenum is primarily used in the production of high strength steel alloys. The Climax Mine, once the world's largest producer of molybdenum, straddles Fremont Pass a few miles north of Leadville. After a period of inactivity, the mine began production again last year. The Climax Mine occupies the headwaters of three major river systems, including the Arkansas; past mining destroyed the original river bed, but a project has been underway since 2006 to restore the natural channel.

Clumsy Fingers

One of the first things I did after making camp was to take a four wheel drive-only road to the timberline and shove my hand into a snowdrift. It's the snowmelt that fills the Arkansas River each spring and summer, resulting in the rush of white water that thrills rafts of tourists during the nearly two mile descent to the plains.

The second thing I did was take a look at the peaks that ring the area. Several are 14,000 feet or more, the better part of a mile higher than Leadville. I began to worry about my radio signal getting out; especially when I found that I couldn't receive NOAA weather radio stations on my handheld scanner.

Also troubling was the physical toll that camping and hiking at altitude had taken. Not only was I exhausted that first night, but my joints ached and my fingers were clumsy. When I discovered the dipole was cut a little too long for operating PSK31 on 40 meters, it took me much longer than it should have to trim the ends to get an SWR below 1.5:1. As I tuned the antenna, it struck me that I really was on my own. I had gotten used to operating QRP with a group, typically going to a local park or some other convenient area. But now, I was a long way from home.

Later I called CQ CQ DE KCØMAX from the tent. After several minutes with no response, my heart sank. What had I done wrong? Had I been foolish to attempt QRP portable from a location ringed by 14,000 foot peaks? Then, I noticed that while the '703 was transmitting, there was no modulation. Somehow, I had inadvertently muted the laptop. After unchecking the mute box, I called CQ again.

An answer came in less than a minute. It was Craig, NV1O, from Apache Junction, Arizona — about 700 miles away. He reported nearly 100 percent solid copy. My spirit soared to the tops of those snow-covered peaks. We had a nice chat as I explained what I was doing in Colorado, and told him a little bit about myself. It was just the kind of ragchew I liked.

"Glad to be ur first contact," he told me when it came time to sign.

Not as glad as I was, Craig.

Max McCoy, KCØMAX, is an associate professor of journalism at Emporia State University in Emporia, Kansas. He can be reached at **max@maxmccoy.com**.

NBEMS Today: New Features Improve Usability

Since it was first announced in 2008, NBEMS has evolved into an efficient messaging package.

Harry Bloomberg, W3YJ

The Narrow Band Emergency Messaging System (NBEMS) has grown in popularity since its introduction in *QST*.[1,2,3] In this article I will discuss recent improvements in usability, including a real-world case where hospital employees who had received just a few hours of training were able to send and receive messages with only a computer and a mobile radio.

What is NBEMS?

NBEMS is a suite of digital emergency communications programs developed under the direction of Dave Freese, W1HKJ. It runs equally well in *Linux*, *Windows* or *Mac OS X*.

There are many programs in the NBEMS suite. Those most commonly used are *Fldigi* and *Flmsg*.

Fldigi, the heart of NBEMS, uses your computer's sound card to encode and decode digital signals using Olivia, MT63, PSK31, RTTY, Domino or MFSK.

Flmsg is used to transmit a variety of message forms such as ICS-213 and the ARRL® Radiogram, and also spreadsheets in CSV (Comma Separated Value) format. *Flmsg* includes a checksum feature used to verify the accurate receipt of a message. Data errors trigger a checksum error and alert the operator to the corrupt data. Any station monitoring the transmission can receive the *Flmsg* message, so it can act as a one-to-many message passing method.

Other programs in the NBEMS suite include *Flarq* for one-to-one message transfers; *Fllog,* a cross-platform operating log; *Flrig* for more powerful rig control than *Fldigi; Flwrap* for manual checksum calculations and *Flkey* for controlling and programming a K1EL Winkeyer.

All messages are sent point to point with no specialized digital infrastructure that could become a failure point. NBEMS works extremely well through analog FM repeaters, simplex channels and HF.

For more detailed information, please refer to Dave Freese's NBEMS page (**www.w1hkj.com**), the NBEMSham Yahoo group, the Western Pennsylvania ARES® NBEMS Documentation page (**wpaares.org/html/nbems.html**) or the ARRL NBEMS page (**www.arrl.org/nbems**).

Improvements in Usability

A major emphasis of NBEMS development has been to simplify the programs to reduce errors when operating under stress.

Auto Open of Incoming Messages

A major improvement in NBEMS usability is the auto open feature that automatically opens and displays an incoming *Flmsg* message. When properly configured, *Fldigi* will verify the message's checksum and open the message either in *Flmsg* or your computer's default browser, which can also act as a printer interface.

Should there be a checksum error, the operator can choose to request retransmission or to ignore the error and see if *Flmsg* can reconstruct the message. Most of the time we instruct operators to request a retransmission. For a very low priority message or if circumstances prevent a retransmission, at least the operator will receive part of the message.

One Step AutoSend

In very early versions of NBEMS, sending a message was a multistep process of creating the message in *Flmsg*, exporting it to *Fldigi* and manually starting and stopping the transmission.

The latest version of *Flmsg* has an AutoSend feature. This feature prompts the operator to save the message if there are unsaved changes — we don't want to risk losing a potentially critical message. Once the message has been saved, *Flmsg* will automatically communicate with *Fldigi* to transmit the message with no further operator intervention. When the message has been sent, *Fldigi* will automatically return to listening for incoming data. The *Flmsg*/*Fldigi* interface has been rewritten to address earlier communications problems.

CSV File Transfer

The previous NBEMS workflow for passing spreadsheets in CSV format required many steps. The new workflow is much simpler. To send a file, you open the NBEMS CSV form in *Flmsg,* drag and drop the CSV file into the form and click the AutoSend button (see Figure 1).

As with other incoming files, *Flmsg* will automatically open incoming CSV files if *Fldigi* is properly configured. You can then click a button in *Flmsg* to bring up your computer's navigation tools to save the spreadsheet file, usually to a USB drive to hand to your served

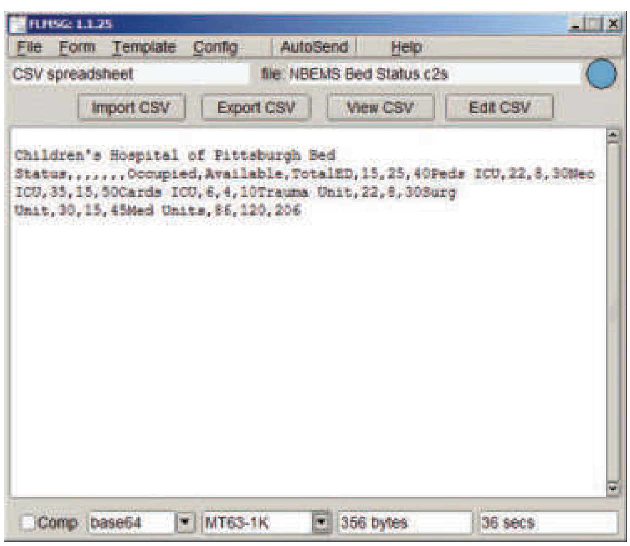


Figure 1 — This is the form *Flmsg* uses to send spreadsheet data. The data is entered using the comma separated format. The buttons at the top allow you to manipulate the CSV file.

[1]S. Ford, WB8IMY, "Narrow Band Emergency Messaging System," *QST*, Apr 2008, p 80.
[2]D. Klever, KB3FXI; H. Bloomberg, W3YJ; "NBEMS — a Digital Emcomm Tool," *QST*, Aug 2009, pp 73-74.
[3]D. Klever, KB3FXI; H. Bloomberg, W3YJ; "A Digital Simulated Emergency Test," *QST*, Jun 2010, pp 76-77.

agency liaison. You can also save the file and open the spreadsheet in your default spreadsheet manager.

File Size and Transfer Time

Repeaters handle much of our public service work and timing them out is a concern. A new feature in *Flmsg* displays both the size of the message file and an estimate of how long it will take to transmit using the chosen mode (see Figure 2).

In addition, *Flmsg* can compress data before transmitting. For long files, this can increase throughput by three times. However, compression changes plain text into gibberish, so an error in receiving one character makes it impossible to recover the rest of the data. We therefore recommend compressing only large spreadsheets.

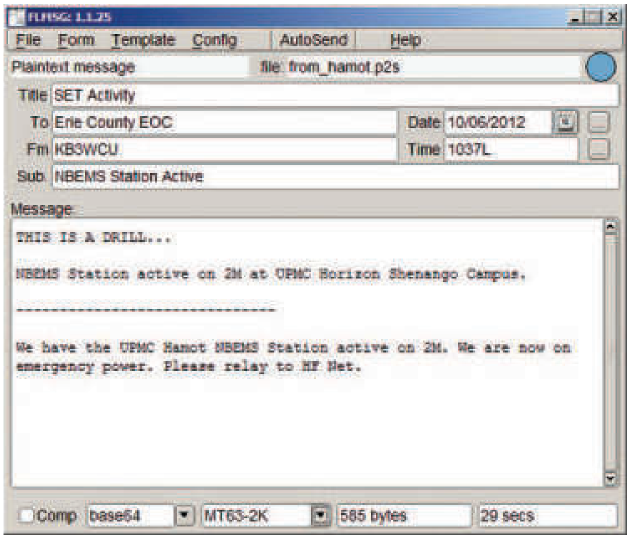


Figure 2 — This is an ICS-213 message in *Flmsg*. Note the AutoSend button at the top. At the bottom is the compression checkbox and information on file size and transmit time.

NBEMS in Action: UPMC Hospitals

A highlight of Western Pennsylvania ARES' (WPAARES) most recent SET was the passing of data between two University of Pittsburgh Medical Center (UPMC) Hospitals approximately 80 miles apart through a pair of linked analog repeaters.

One of the hospitals was UPMC Horizon in Farrell, and the station was staffed by experienced operators Joe Vaccaro, W3JTV, and Greg Singer, KB3WCU. The other station was at Children's Hospital of Pittsburgh of UPMC (CHP). One operator at CHP was a long time ham with little digital experience. The remainder of the operators consisted of hospital employees who learned Amateur Radio during lunchtime licensing classes. CHP supports this group of hams by buying equipment and encouraging their training. The leader of the CHP group is Steve Lipp, W3SLL. Other members of the team for this drill were Luci Kammenzind, KB3ZBC, and John Wiersch, KB3ZCY.

WPAARES conducted an hour long NBEMS training session at CHP during one lunchtime session. This was followed by the employees practicing among themselves and by checking into the WPAARES Digital Training Net. The use of acoustical coupling between computer and radio simplified training. All a ham at CHP needed to do to transmit a message was push a radio's PTT button and then press the *Flmsg* AutoSend button. Receiving a message was just as simple; just hold their radio's speaker close to their computer's built-in microphone. Most of CHP's computers ran *Windows*, but one doctor used NBEMS on a *MacBook*, showing the value of its cross-platform capability.

The 147.195 MHz N3ETV repeater in New Castle and 443.45 MHz University of Pittsburgh repeater were linked up to provide a path between the two hospitals. The Pittsburgh repeater sits atop the 500 foot tall Cathedral of Learning on the University of Pittsburgh0 campus and is just a few miles from CHP so it is in easy range of the temporary station CHP used for the drill, a mobile transceiver running 10 W into a mag mount antenna from inside the hospital. The hams at CHP sent a spreadsheet to UPMC Horizon. Explaining the new CSV workflow to them took just a few moments over the air and the data was passed.

SET communications were a great success with six messages exchanged between hospitals. Traffic included ICS-213 forms and CSV files. Due to the great distance between the two hospitals, the path between New Castle and Pittsburgh was quite noisy and there were a few checksum errors. But because of the ease of retransmitting with AutoSend, messages were quickly resent.

In an unplanned part of the UPMC hospital interaction, we learned from monitoring our 80 meter voice net that UPMC hospitals in Bedford and Erie were also participating in the SET. Our 80 meter voice net control station requested that UPMC Hamot in Erie, approximately 200 miles north of Pittsburgh, originate a digital message to UPMC Horizon and CHP. This message was sent on 80 meters and received by the Skyview Radio Society station, K3MJW, which relayed the message to UPMC Horizon and CHP via the linked repeaters. Both hospitals then originated messages back to UPMC Hamot, again, relayed by Skyview to the 80 meter digital net. Staffing the Skyview station were Geoff Wolf, AB3LS, and W3YJ.

The key to the drill's success was the simplicity of NBEMS and the improved workflow. This allowed inexperienced CHP operators to send and receive messages using just computers and a bare-bones temporary station.

The Future of NBEMS

Work on NBEMS is ongoing. Recent versions of *Fldigi* contain new high-speed modes developed by John Douyere, VK2ETA. These modes promise to be many times faster than our current fast mode, MT63. With some, it may be practical to send spreadsheets and other files in their native binary formats without first exporting to text. Experimentation with these new modes continues.

An exciting recently released tool is *Flamp*, which implements a modified version of the Amateur Multicast Protocol (AMP). *Flamp* simplifies the automated transmission of large data files by automatically breaking messages up into data blocks and repeatedly sending the blocks. A receiving station uses *Flamp* to track and save the checksum-verified blocks. When all blocks have been received without error, *Flamp* reassembles the blocks into the original file. If some blocks cannot be copied correctly, even after multiple retransmissions, the receiving station may manually request that only the missing blocks be resent. This may significantly increase the efficiency of sending large files to multiple stations.

The NBEMS philosophy is "Keep it simple and free." The programs are released under the GNU Public License (GPL) meaning that full source code is available. Currently NBEMS needs more C++ programmers. If you want to write code for the good of Amateur Radio, please contact Dave, W1HKJ, at **w1hkj@arrl.net**.

Photos by the author.

Harry Bloomberg, W3YJ, an ARRL® member, is the ARES assistant section emergency coordinator for the Western Pennsylvania Section with responsibility for digital emergency communications. Harry holds an Amateur Extra class license and belongs to Panther Amateur Radio Club. He can be reached at 201 Delafield Rd, Pittsburgh, PA 15215-3204, **w3yj@arrl.net**

2013 Simulated Emergency Test

Get ready for the SET on October 5-6.

Steve Ewald, WV1X

It's time to get ready for the 2013 ARRL Simulated Emergency Test (SET), which is just around the corner on October 5-6. ARRL Field Organization leaders are planning an event that will actively involve all radio amateurs, especially members of the Amateur Radio Emergency Service® (ARES®), the Radio Amateur Civil Emergency Service (RACES) and the ARRL National Traffic System (NTS), among many other public service-minded groups. Public service agencies in your community will also be invited to participate. You, too, can be a part of this annual nationwide training exercise!

How to Join the SET

To participate in this year's emergency test, contact your local ARRL emergency coordinator or net manager. If you don't know who to call, get in touch with your ARRL Section Manager for assistance. See page 16 of *QST* for Section Manager contact information or check the Section web pages at **www.arrl.org/groups/sections**. Whether you're a new licensee or an experienced radio amateur, the SET is a great opportunity to learn or practice useful skills in traffic handling, net operation and emergency communications management. Make this the year that you decide to create a personal plan and to be ready to help if you're needed. Taking part in a SET is a positive step toward doing just that.

National Preparedness Involves You and Many Others

The ARRL is an affiliate of Citizen Corps, an initiative within the Department of Homeland Security to enhance public awareness and safety. Your local or section-wide simulated emergency test might involve the local representatives of Citizen Corps, its many affiliates, and Citizen Emergency Response Team. For details on these programs, visit **www.ready.gov/** and **www.ready.gov/citizen-corps**.

ARRL's longstanding relationships with several organizations will be tested this fall, too. Some of these organizations include the American Red Cross, the Salvation Army, the National Weather Service, the National Communications System, the Association of Public Safety Officers – International as well as Radio Emergency Associated Communications Teams (REACT) and Civil Air Patrol. More details on these national agreements may be found at **www.arrl.org/served-agencies-and-partners**.

You are encouraged to consider this year's ARRL Simulated Emergency Test and all preparations as well as post exercise evaluations as a demonstration of your readiness, as well as Amateur Radio's readiness. Be an active participant in SET and join the nation and your local ARRL Section, your state and your local community in exercising national preparedness.

SET to Go!

Additional background on the annual SET is presented in the article *2012 Simulated Emergency Test Results* in the July 2013 issue of *QST*. Also, guidelines and specific SET reporting forms for the ARRL Section and Field Leaders are posted on the ARRL website at **www.arrl.org/public-service-field-services-forms**.

If you are the Emergency Coordinator, Net Manager or a Section Leader who is in charge of reporting this year's SET activity on behalf of your group, please feel free to download the forms from the web page, fill them out and return them to ARRL Headquarters.

Although October 5-6 is the main weekend for the annual Simulated Emergency Test, ARRL Sections, ARES teams or nets may conduct their exercises any time between September 1 and November 30. Check with your local ARRL Field Organization leadership for the exact date in your area.

Many recent events and disasters including tornados, hurricanes, flooding and wildfires have given us a heightened awareness of the need for emergency communications. Your help is needed, and the ARRL SET is a great way to get involved in public service communications and personal preparedness.

The SET is a perfect opportunity to put together and test your go-kit. Peyton Barnes, KE5ZDZ, shows how he converted a cooler into a convenient and portable go-kit. [Peyton Barnes, KE5ZDZ, photo]

ARRL Board Names Award Winners, Okays LoTW Initiatives

At its second meeting of the year, July 19 and 20 in Windsor, Connecticut, the ARRL Board of Directors confronted a broad agenda that included the naming of ARRL award winners (see sidebar, "ARRL Recognizes Award Winners"), the efforts of the Ad Hoc LoTW (Logbook of The World) and Symbol Rate Rule Modernization committees, creation of a new field appointment for youth and a procedure for eventualARRL CEO succession.

IARU President Tim Ellam, VE6SH (R), listens as Radio Amateurs of Canada President Geoff Bawden, VE4BAW, extends RAC's greetings to the Board. Ellam and Bawden were guests at the meeting.

ARRL President Kay Craigie, N3KN, opens the July Board meeting. ARRL First Vice President Rick Roderick, K5UR, is to her right.

LoTW

ARRL Dakota Division Director Greg Widin, KØGW, reported on the work of the Ad Hoc LoTW Committee.

The Board resolved to authorize $75,000 to procure outside professional services with the goal of improving LoTW's database implementation. The Board also okayed the hiring of a full-time Head-quarters staff member with "strong IT development and architectural skills" to address the LoTW improvements.

Symbol Rate Rule Modernization

The Board directed ARRL General Counsel Chris Imlay, W3KD, to prepare a *Petition for Rule Making* with the FCC seeking to modify §97.307(f) to delete all references to symbol rate. The *Petition* would ask the FCC "to apply to all amateur data emissions below 29.7 MHz the existing bandwidth limit, per §97.303(h), of 2.8 kHz."

The Board determined that the current symbol rate restrictions in §97.307(f) "no longer reflect the state of the art of digital telecommunications technology," and that the proposed rule change would "encourage both flexibility and efficiency in the employment of digital emissions by amateur stations."

New Section Level Youth Field Appointment

ARRL Rocky Mountain Division Vice Director Dwayne Allen, WY7FD, acting on behalf of Director Brian Mileshosky, N5ZGT, who was unable to attend, presented the report of the Ad Hoc Committee on Youth in the Second Century. A highlight of the report was the proposed creation of a Section Youth Coordinator as a section level appointment in the ARRL Field Organization.

The Board subsequently resolved on Allen's motion to adopt the committee's recommendation to establish the Section Youth Coordinator (SYC) position, to replace the current Assistant SM for Youth. The Board further resolved to have the Program and Services Committee and ARRL staff define the roles and responsibilities of the SYC, considering the recommendations in the Ad Hoc Committee on Youth in the Second Century's report to the Board.

CEO Succession

The Board devoted considerable time and discussion throughout the meeting to the issue of CEO (chief executive officer) succession. While current CEO David Sumner, K1ZZ, has no immediate plans to retire he is approaching normal retirement age, and that, in part, prompted the Board's desire to put in place a procedure for naming a new CEO when the time comes. The Board agreed to establish a CEO Candidate Screening Committee consisting of five directors. Elected to serve as the initial committee were Directors Dennis Bodson, W4PWF; Bill Edgar, N3LLR; Dick Isely, W9GIG; Jim Weaver, K8JE and Dr David Woolweaver, K5RAV. Among its first responsibilities, the new committee will establish CEO search criteria. The committee may employ an independent management consultant and is to recommend at least three CEO candidates to the Board for consideration at the appropriate time.

Other Actions

In other actions, the Board

- adopted new 5 and 3 centimeter band plans, as proposed by the UHF/Microwave Band Plan Committee, which was dissolved with the Board's thanks
- express its desire for the issuance by the FCC of the special call sign W100AW in recognition of the League's centennial in 2014
- directed Headquarters staff to investigate the feasibility, benefits and costs of preparing license training materials designed for shorter licensing course sessions
- asked that the DX Advisory Committee (DXAC) study and, if warranted, recommend changes to the DXCC rules.

ARRL Recognizes Award Winners

At its July meeting, the ARRL Board of Directors named the winners of two prestigious awards. Dr Robert S. Dixon, W8ERD, of Delaware, Ohio, was awarded the 2013 ARRL Technical Service Award. He was recognized "for numerous technical contributions" to Amateur Radio and for sharing "his abilities and enthusiasm" for Amateur Radio. A *QST* author, Dixon designed and created one of the first tactical communications bridge systems for his local ARES team.

The Board named well-known microwave experimenter Brian D. Justin, WA1ZMS, of Forest, Virginia, as the winner of the ARRL Doug DeMaw, W1FB, Technical Excellence Award. The Board recognized Justin for his "distinguished lifelong Amateur Radio career," which has included expeditions that garnered Justin the first VUCC Award on 47, 76, 122, 145 and 241 GHz. Justin was further commended for developing and building several millimeter-wave stations and for operating several repeaters, from 146 to 1200 MHz.

Rick Lindquist, WW1ME, ww1me@arrl.org

ARRL to FCC: Changes to Encryption Rules Not Necessary

Amateur Radio continues to effectively serve health care agencies that are subject to HIPAA.

The ARRL wants the FCC to deny a *Petition for Rule Making* (RM-11699) that seeks to permit the encryption of certain amateur communications during emergency operations or related training exercises. Don Rolph, AB1PH, of East Walpole, Massachusetts, petitioned the Commission in March to suggest an additional exception to §97.113, which currently prohibits "messages encoded for the purpose of obscuring their meaning."

"While Mr Rolph has concisely stated his argument, it is ARRL's considered view that there is no factual or legal basis for the assumption that encryption of transmissions…is necessary in order to continue and enhance the utility of Amateur Radio emergency and disaster relief communications," the League said in comments filed July 8 with the FCC. The ARRL also turned away Rolph's assertion that the current prohibition in §97.113 "has impacted the relationship of Amateur Radio volunteers and served agencies and significantly limited the effectiveness of amateurs in supporting emergency communications." The League said it's unaware of any evidence that served agencies have been reluctant to utilize Amateur Radio as part of their emergency or disaster relief communications plans because of the encryption restrictions in Part 97. The Amateur Service rule is based on a similar prohibition in international telecommunication law, the ARRL noted.

The League characterized as "erroneous" and "unfounded" Rolph's assumption that encryption of certain information may be required under the provisions of HIPAA — the Health Insurance Portability and Accountability Act. "This mistaken assumption leads to the conclusion that the inability of Amateur Radio operators to encrypt the content of their transmissions in order to obscure the meaning of the transmissions renders Amateur Radio less (and decreasingly) useful to served agencies than it would be if encryption of those transmissions was permitted," the ARRL said. The League also said it was unaware of any instance in which state statutes have been cited as a reason not to employ Amateur Radio for emergency communication.

Radio amateurs, the ARRL countered, are not "covered entities" under HIPAA, which applies only to health care providers, health plans and health care clearinghouses. And, the League added, there is no expectation of privacy in Amateur Radio communications.

The ARRL said it's not possible to determine the validity of the claim "that health care agencies subject to HIPAA are or might be unwilling or reluctant to utilize Amateur Radio in emergency communications and disaster relief planning" because of any lack of privacy inherent in Amateur Radio. "Permitting encryption might remedy the concern as a practical matter, if the concern exists," the League continued, but "the complete dearth of even anecdotal evidence of the existence of that concern" makes it impossible to justify the proposed rule change on that basis.

The ARRL said that should it become necessary in the future for radio amateurs to protect the privacy of individuals whose medical data may be transmitted by Amateur Radio during or after an emergency or disaster, "the Commission may be asked to revisit this matter." More than 200 comments were filed on RM-11699, most tending to support the ARRL's arguments.

HAARP Facility Shut Down

The High Frequency Active Auroral Research Program (HAARP) — a subject of fascination for many hams and a target of conspiracy theorists and anti-government activists — closed down in the spring. HAARP's program manager, Dr James Keeney at Kirtland Air Force Base in New Mexico, told ARRL that the remote 35-acre ionospheric research facility near Gakona, Alaska, was shuttered in early May.

"It comes down to money," Keeney said. "We don't have any." As of mid-July, no one was on site, access roads were blocked, buildings were chained and the power turned off. HAARP's website through the University of Alaska no longer is available; Keeney said his program could not afford to pay for the service. The only bright spot on HAARP's horizon is that the Defense Advanced Research Projects Agency (DARPA) was expected to be

The sprawling High Frequency Active Auroral Research Program (HAARP) facility near Gakona, Alaska. The antenna field is in the foreground. Mount Wrangell is in the background. [US Air Force photo] on site as a client to finish some research this fall and winter.

Keeney said the proximate cause of HAARP's shutdown was less fiscal than environmental. As he explained it, the diesel generators on site no longer pass Clean Air Act muster. Repairing them to meet EPA standards will cost $800,000.

HAARP is best known for its 3.6 MW HF (approximately 3 to 10 MHz) ionospheric research instrument (IRI), feeding an extensive system of 180 antenna elements and used to "excite" sections of the ionosphere. Other onsite equipment is used to evaluate the effects.

Larry Ledlow, N1TX, of Fairbanks, Alaska, said HAARP ionosonde and riometer data have been "invaluable, especially being more or less local, to understand current conditions in the high latitudes." Similar data from other sites, he said, "simply do not accurately reflect the unique propagation we endure here." To fill the gap, Ledlow said, several members of the Arctic Amateur Radio Club — including Eric Nichols, KL7AJ, author of *Radio Science for the Radio Amateur* and articles in *QST* — have discussed building their own instruments. "It's all very preliminary," he said, "but we really feel the pinch losing HAARP." Nichols, of North Pole, Alaska, has conducted experiments at HAARP. He called the shutdown "a great loss to interior Alaska hams and many others."

The ultra-high power facility long has intrigued hams, even outside of Alaska. In 1997, HAARP transmitted test signals on HF (3.4 MHz and 6.99 MHz) and solicited reports from hams and shortwave listeners in the "Lower 48" to determine how well the HAARP transmissions could be heard to the south. In 2007 HAARP succeeded in bouncing a 40 meter signal off the moon. Earlier this year, HAARP scientists successfully produced a sustained high-density plasma cloud in Earth's upper atmosphere.

As things stand, the Air Force has possession for now, but if no other agency steps forward to take over HAARP, the unique facility will be dismantled, Keeney said.

Canada Seeks New 472-479 kHz Ham Band

Canada has proposed creating a new MF Amateur Radio band at 472-479 kHz. The 7 kilohertz sliver of spectrum would be available to hams on a secondary basis. The new 630 meter band was proposed in a *Consultation* released in June by Industry Canada, the nation's radiocommunication regulator. It proposed numerous revisions to Canada's table of allocations warranted in the wake of World Radiocommunication Conference 2012 (WRC-12). Last year the ARRL asked the FCC to carve out the same band for US hams.

CQ World Wide DX Contest Rules Get Complete Rewrite

The rules of the CQ World Wide DX Contest have been completely rewritten, effective with this fall's SSB and CW events (RTTY is not affected). "The CQ WW DX Contest rules have evolved for over 50 years," said Contest Manager Randy Thompson, K5ZD, in announcing the updates July 1.

"Changes in technology, operating practices and enforcement efforts caused the rules to become increasingly complex." The primary goal of the rewrite, he said, was "to make the rules simpler and easier to understand."

One change offers a "Classic Overlay" category for single-operator, all-band entries. "The Classic Overlay category is intended for the radio purists who want to participate in the most traditional way," Thompson explained. Entrants will use a single radio and operate without outside assistance, and only the first 24 hours of actual operating time will count toward the operator's score. Also new is a "Rookie Overlay" category for operators licensed 3 years or less. The CQ WW is doing away with the "Xtreme Contesting" and "Team Competition" categories, and "Checklog" is now listed as a noncompetitive entry category.

The rewrite creates two categories of Club Competition — US and DX. Entrants must log contacts as they occur and may not edit their logs after the contest ends. The updated rules also address "unsportsmanlike conduct," such as having an excessive bandwidth, and disqualifications. "Red and Yellow cards have been removed in favor of one action — disqualification," Thompson noted. The SSB event takes place October 26-27, the CW event November 23-24.

FCC News

Location Service Deployment May Constrain 902-928 MHz Amateur Use

A portion of the 902-928 MHz (33 centimeter) band may become less useful to radio amateurs in urban areas as a result of an FCC *Order*. The FCC has given Progeny LMS, LLC the okay to begin commercial operation of its multilateration location and monitoring service (M-LMS) on approximately 4 megahertz of the M-LMS portions of the band between 919.750 and 927.750 MHz where it holds licenses.

"Progeny is deploying a wide-area positioning system to provide more precise location services in areas where Global Positioning System (GPS) and other existing services may not work effectively, particularly indoors and in urban canyons," the FCC said in its *Order*, released June 6.

The FCC opened 33 centimeters to hams on a secondary basis (Amateur Radio is secondary on *all* bands above 420 MHz) in 1985, provided hams did not interfere with the automatic vehicle monitoring (AVM) service, subsequently expanded into the M-LMS. While M-LMS operations at least on paper have a higher priority than unlicensed Part 15 devices on the band, Progeny had to demonstrate through field testing that its network would not cause "unacceptable levels of interference" to such Part 15 devices as cordless telephones and baby monitors. The FCC said this was a result of its policy to promote "co-existence" in the band, while not elevating Part 15 devices to co-equal status with M-LMS systems.

ARRL CEO David Sumner, K1ZZ, has pointed out that effectively setting unlicensed services such as Part 15 at a higher priority than licensed services "is the reverse of the usual situation in which Part 15 devices are at the bottom of the pecking order." Federal (military) radiolocation and ISM Part 18 devices are at the top of the 902-928 MHz food chain. Sumner predicted in his "It Seems to Us" editorial in the June 2012 issue of *QST* that operations such as Progeny's "will pose some new challenges for amateurs in a band that is already impacted by other users." On the other hand, he pointed out, sharing bands with the military has helped Amateur Radio to stave off spectrum grabs from commercial interests.

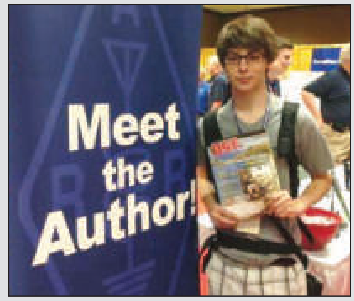
"It is good to see the progress that our neighbors to the north are making in implementing the new 472-479 kHz amateur allocation," said ARRL CEO David Sumner, K1ZZ. "We hope the FCC will act soon on the petition that the ARRL filed on November 29, 2012, to achieve this goal for amateurs in the United States."

Newfoundland LF/MF enthusiast Joe Craig, VO1NA, says he's looking forward to making many domestic and even transatlantic contacts — and eventually American amateurs — on 630 meters. "I am happy to learn that we are a step closer to getting the new 472-479 kHz band," he told ARRL. Craig believes the new band will appeal to a wider group of hams than the more-demanding LF allocations. "Transatlantic QSOs, though challenging, should be fairly common using conventional CW and digital modes," he predicted. "You will probably have to homebrew your transmitter, but many new HF transceivers can receive on 472 kHz."

Last November the FCC released a *Notice of Proposed Rule Making and Order* (ET Docket 12-338) proposing the creation of a new LF ham band at 135.7 to 137.8 kHz. Canadian hams already have such an allocation.

KC9UUS is Amateur Radio Newsline's 2013 Young Ham of the Year

A 16-year-old *QST* Cover Plaque Award winner from Bloomington, Indiana, is this year's *Amateur Radio Newsline* "Young Ham of the Year." Readers gave the thumbs up to Padraig Lysandrou, KC9UUS, for his article "A Crazy Idea: DXpedition to Cyprus," which appeared in the May 2013 issue of *QST*.



ARNewsline's Young Ham of the Year Padraig Lysandrou, KC9UUS, at Dayton Hamvention, holding a copy of the *QST* containing the article for which he won the Cover Plaque Award.

Lysandrou is among the protégés of Neil Rapp, WB9VPG, a Bloomington High School South chemistry teacher who, at age 5, once was the youngest ham in the US. Rapp invited the young man to join the school's Amateur Radio club and introduced him to the hobby. Rapp and Dr Scott Wright, KØMD, nominated Lysandrou as Young Ham of the Year.

He was scheduled to receive the *Amateur Radio Newsline* Young Ham of the Year Award at the Huntsville (Alabama) Hamfest in August. The Young Ham of the Year Award was created by *Amateur Radio Newsline* with corporate sponsorship from Yaesu, *CQ* magazine and Heil Sound. — *Amateur Radio Newsline*

Scouts Planning for Fun During Jamboree on the Air 2013

Scouting's 56th Jamboree on the Air (JOTA) 2013 takes place the weekend of October 19-20, from 0000 local time Saturday to 2400 local time Sunday. Held each year on the third weekend of October, JOTA provides an opportunity for members of the Boy Scouts of America to experience Amateur Radio first-hand, perhaps planting the seed for a lifetime of ham activity. JOTA is the largest Scouting event in the world, with nearly 750,000 Scouts participating from 6000 stations in 150 countries around the world. Not a contest, JOTA's goal is to foster Scout-to-Scout communication across borders.

Licensed mentors often open their stations to Scouts on JOTA weekend, serving as control operators. Radio operation will be on 80 through 6 meters and 2 meters and 70 centimeters FM simplex, all modes. Through its Radio Scouting sponsorship, Icom America is providing stations for JOTA and other Scouting events, including the loan of five stations that will be on the air for JOTA 2013. In 2012 more than 18,500 US Scouts took part in JOTA from more than 200 stations, up by nearly 500 percent from a year earlier.

ARRL Announces Colvin Awards to DXpeditions

The ARRL has made Colvin Award grants to help support three upcoming DXpeditions. Recipients are the K9W Wake Atoll, T33A Banaba Island and FT5ZM Amsterdam Island DXpeditions. The K9W DXpedition is scheduled for September-October 2013, the T33A DXpedition for November 2013 and the FT5ZM DXpedition for January-February 2014.

The Colvin Award is funded by an endowment established by Lloyd Colvin, W6KG (SK), who, with his wife Iris, W6QL (SK), logged more than 1 million contacts during their world travels, assembling one of the largest QSL collections in the world. Approximately $6000 in annual investment income is available.

The Colvin Award is conferred in the form of grants in support of Amateur Radio projects that promote international goodwill in the field of DX. Applicants must be groups with a favorable track record in the field of DX and with experience that is directly related to the project being proposed. Proposed projects must have as a goal a significant achievement in the field of DX.

Dayton Hamvention Attendance Holds Steady

The Dayton Hamvention website has announced that 24,542 people attended Hamvention® 2013, approximately the same as last year's attendance. The Dayton Amateur Radio Association (DARA) has sponsored Hamvention since 1952. Originally called the Southwestern Ohio Ham-vention, the inaugural event, held in March in downtown Dayton, attracted 600 attendees — twice the number anticipated. Hamvention attendance peaked at 33,669 in 1993, before the 1996 change in date from April to May. While attendance has fluctuated over the years, Dayton Hamvention has grown to international proportions, attracting members of the worldwide Amateur Radio community each spring. On its website DARA already is counting down the days, hours and minutes until the next Dayton Hamvention, which will be held May 16, 17 and 18, 2014.

Rick Palm, K1CE, k1ce@arrl.org

Hams at Hazard

When disaster strikes hams take on considerable risk for their communities and their hobby.

On the occasion of the 2013 public service/emergency preparedness issue of *QST*, let's dig a little deeper for the answers to why we choose to engage in an activity that at times is not all that benign. For evidence, one need not look further than the diamond-shaped memorial that sits starkly in front of ARRL® headquarters in Newington, Connecticut. This is the Monument to Fallen Hams, which displays the names and call signs of those who have died while on duty. Why do we choose to step into harm's way — with a handheld transceiver clutched in one hand and the other outstretched to a disaster-devastated community?

In the premier issue of the ARRL periodical *The ARES E-Letter* written by your editor, was this[1]: "Last year (2004), [Florida] was the scene of four calamitous hurricanes that ripped up lives and property — we adopted a new moniker, 'The Plywood State.' It was a wonder to monitor firsthand the Floridian radio amateurs fulfilling their public service mission by providing communications for their neighbors and response agencies, in some cases directly in the path of harm's way. For example, as I huddled with my wife in the center of the living room of our wind-buffeted, boarded-up house in Flagler County during one storm, I listened with simultaneous horror and admiration as an ARES® operator transmitted his mobile position out in the maelstrom on his way to delivering another radio to an emergency shelter full of terrified community members."

As this article is being written, Colorado ARES operators are on the fire lines, supporting agencies engaged in fighting volatile, dangerous wildfires there. In the June 2013 issue of *QST*, a "Public Service" column report discussed the radio amateur's role in drills and planning for interoperable communications systems for potentially devastating seismic activity along the New Madrid fault.[2] Is there any environment less stable in which to work than a post-temblor city block?

Not all hazardous duty is explicit and patent; some contexts and threats are insidious. The radio amateurs who were serving at the finish line of the Boston Marathon this past April faced losing their lives through largely unforeseen circumstances. Those amateurs included volunteer radio operator and ARRL Chief Operating Officer Harold Kramer, WJ1B, who heard and felt the bomb blast but luckily was not harmed.[3]

Why do we do it? First people are inclined to help their neighbors. We simply cannot stand by and watch others suffering when we can do something for those in need. We would do practically anything to save someone's life or remove potentially life-threatening environmental factors within our power, even at great risk to ourselves. We radio amateurs trained in disaster response communications protocols are in a unique position to make a greater contribution in this regard than most.

Second, there is an aspect of "giving back" to Amateur Radio, which as an avocation has given to us hams so much joy, with the magic of discovery and the fulfillment of our sense of wonder. Using our skills and license to support the public interest in such a profound way is to say thanks. Our service also shows the public and the regulators that we are worthy of having access to the valuable resource of the electromagnetic spectrum. And we do enjoy the full spectrum, unlike those who would love to exploit it for profit but who are kept at bay by our very track record of humanitarian service to the public.

Third, although we are not ambulance chasers, there is no denying a certain rush of adrenaline when we exercise our training and skills side by side with our professional counterparts on the field in a cordoned-off disaster area. Add to that the brothers-in-arms camaraderie and bonding that occurs among emergency radio operators in the trenches — and there's yet another strong motivating factor.

The Fallen Hams Monument in front of ARRL HQ was dedicated in 1991 to "honor those 'hams' who died in service to the public." [S. Sant Andrea, AG1YK, photo]

[1] R. Palm, K1CE, *ARES E-Letter*, August 17, 2005, **www.arrl.org/ares-el?issue=2005-08-17**

[2] R. Palm, K1CE, "Tennessee Leads Major Interoperability Exercise for Earthquake Awareness Month," *QST*, Jun 2013, p 78.

[3] H. Kramer, WJ1B, "A Witness to Tragedy in Boston," *QST*, Jul 2013, p 13.

And last, there is the almost mythical, mystical feeling I first had when I started playing with my father's radios as a child and still have today. I wager that all radio amateurs hold it, if perhaps subconsciously: a shimmering, ethereal image of oneself as the heroic lone operator hunkered down at midnight in an old cabin in the middle of a nor'easter. There he sits, while the lights blink off and on with the winds howling outside, tapping on a key, answering an SOS from a ship in distress on the stormy sea. While this scenario is perhaps not an accurate one in today's world, it most certainly has been played out by our Amateur Radio ancestors. It plays out in different ways today and is, I submit, the most compelling reason for why we do it.

We may not be that lone radio operator in the cabin with snow plastered on the windows, but we are at the height of hurricane season and need to be ready for the stark reality of what may come — quite possibly, in harm's way. — *Rick Palm, K1CE*

Recent Exercises Help Prepare Georgia Amateurs

The horrific tornado destruction that occurred in Moore, Oklahoma in May is fresh on our minds and unfortunately we continue to see other disaster-related tragedies unfold in the Midwest. We stand with and applaud our fellow radio amateurs who were and are called upon to assist their communities in distress (**www.arrl.org/news/amateurs-in-oklahoma-respond-to-storm-aftermath**). This time the carnage was not in Georgia, but we know all too well that a similar scenario is not "if" but "when" here, too.

The Installation Emergency Manager (IEM), United States Marine Corps (USMC) Logistics Base (MCLB) in Albany, Georgia contacted the Albany Amateur Radio Club to request and plan for Amateur Radio support for communications emergencies. Officials called for a tabletop drill involving the scenario of a storm in the Gulf of Mexico, which could cause adverse conditions at the Base.

Several of us reported to the Emergency Operations Center (EOC) at the MCLB early for the drill briefing. In the room were many of the various Base officials, as well as county emergency management officials, the coroner, sheriff and others. As the incident unfolded we were given the signal to prepare to handle emergency traffic. Antennas for the D-STAR station and for the HF bands together with batteries were set in place. As "injects" developed and a "tornado" caused destruction on the Base, we were notified that a building was damaged with smoke and fire evident. Ensuing messages indicated casualties and one fatality.

Base gates were "closed" against ingress or egress. For expected needs outside of the perimeter of the Base a shelter was set up at a nearby church. We were briefed on Base internal communication systems that included two trunked systems, but one had been out of order for a long time and had not yet been repaired, and the other was suspect. It was suggested that internal communication was at risk and officials agreed that we should recruit a communicator for the shelter to keep the EOC management advised and informed. We met this request and also sent another communicator to the triage area that had been set up at the site of the casualties. We assigned an additional operator to shadow the Incident Commander.

Then at mid-morning, the IEM suddenly switched off the lights and informed all players that power and communications were lost. All were told to back away from their computers because they would be out of service. A written emergency advisory message was handed to us to send to Fort Stewart to be forwarded to Camp Lejeune, North Carolina. It was a heavy responsibility, but fortunately we succeeded. The message was relayed via a D-STAR link (the Pembroke D-STAR repeater is situated at the edge of Fort Stewart). We also had a reliable 40 meter SSB net as backup.

Todd Hargrave, NT4TH, had been deployed to Fort Stewart and was on hand to receive and relay the critical message. Hargrave is a former USMC VHF/UHF/HF radio instructor and MARS chief. He is the emergency coordinator for Effingham County ARES (ECARES), new District EC for the Southeast District of Georgia and a member of Navy-Marine Corps MARS (NNNØHBU). Mission accomplished. — *Eugene C. Clark, W4AYK, ARRL Georgia Section Manager*

Georgia EMA, FEMA, ARES Test Mobile Command Vehicles

The Georgia Emergency Management Agency (GEMA) and the Federal Emergency Management Agency (FEMA) conducted a test deployment of Mobile Command Vehicles (MCV) during the week of May 13-16, 2013. The test at Stone Mountain Park in Stone Mountain, Georgia, was to demonstrate and examine the capabilities of the MCVs. ARES was called upon to test its capabilities during field operations there.

The Georgia Statewide ARES HF Net was called into special sessions on Tuesday, May 14 and on Wednesday, May 15. A net was called each hour during the day for check-ins and traffic. Several different Net Control Stations were used and tested.

A special session of the Georgia State Net (GSN) was called on Tuesday at 10:30 AM, on 3549 kHz medium speed CW, with a special session of the Georgia Digital PSK31 Net called on Wednesday at 10:30 AM, on 3583 kHz. Other special nets were called as needed.

In addition to the statewide HF Nets, Georgia D-STAR and Georgia WINLINK 2000 systems were active. Several repeaters in the metro Atlanta area were also active in support of these operations. All ARES operators and groups were encouraged to participate in this drill to demonstrate the capabilities of Amateur Radio.

Tom Holcomb, K5AES, of Tucker, Georgia operated station WX4GMA at GEMA HQ. He reported that the DeKalb ARES VHF repeater on 145.45 MHz, located in Exchange Park, was originally listed as the main service, but the signal from the MCV site was degraded/blocked by Stone Mountain, so the W4BOC VHF Repeater (146.76 MHz), on top of Stone Mountain, was utilized with permission.

"The communications were basically good for the entire exercise with the expected weaker HF signals from the MCV Teams due to the close proximity of the State Operations Center (SOC) to Stone Mountain Park" Holcomb said. "However, all MCV teams were able to make contact with the SOC on HF to verify their task completion. Most messages were comprised of MCV Grid Coordinates for location. VHF D-STAR repeaters also provided clear reliable communications from the MCVs to the SOC."
— *ARRL Georgia Section*, **gaares.org**

Contest Corral – September 2013

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				Bands	Contest Title	Mode	Exchange	Sponsor's Website
Date-Time		Date-Time		HF / VHF+				
31	0000Z	31	See website	1.8-28 / -	CWops CW Open	CW	Serial and name	www.cwops.org/cwopen.html
31	1200Z	1	0400Z	1.8-28 / 50+	Colorado QSO Party	Ph CW Dig	Call sign, name and county or S/P/C	www.ppraa.org/coqp
1	1800Z	2	0300Z	1.8-28 / 50+	Tennessee QSO Party	Ph CW Dig	RS(T) and county or S/P/C	www.tnqp.org
2	2300Z	3	0300Z	1.8-28 / 50	Labor Day Sprint	CW	RST, S/P/C, MI QRP nr or power	miqrp.org
3	0200Z	3	0400Z	3.5-28 / -	ARS Spartan Sprint	CW	RST, S/P/C and power	www.arsqrp.blogspot.com
6	8 PM	7	2 AM	3.5 / - 070	Club KA3X Memorial Sprint	Dig	Call sign, RST and S/P/C	www.podxs070.com
6	0230Z	6	0300Z	1.8-14 / -	NS Weekly Sprint	CW	Serial, name and S/P/C	www.ncccsprint.com
7	0000Z	8	2400Z	3.5-28 / -	All-Asian DX Contest	Ph	RS, operator age (YL may send 00)	www.jarl.or.jp/English
7	0000Z	7	2400Z	3.5-28 / -	Russian Radio RTTY WW	Dig	RST and oblast or WAZ zone	www.radio.ru/cq/contest/rule-results/index2.shtml
7	1100Z	7	1700Z	28 / -	DARC 10 Meter Digital "Corona"	Dig	RST and serial	www.darc.de/referate/ukw-funksport
7	1300Z	8	1300Z	1.8-28 / -	IARU Region I Field Day	Ph	RS and serial	See IARU Society web pages
7	1300Z	7	1600Z	7 / -	Straight Key Party	CW	RST, serial, category, name, age	www.agcw.de
7	1800Z	8	1800Z	1.8-28 / 50+	QCWA Fall QSO Party	Ph CW Dig	Call sign, chapter, name, 2-digit year lic'd	www.qcwa.org/qso-party.htm
8	0000Z	8	0400Z	3.5-14 / -	North American Sprint	CW	Call signs, serial, name and state	www.ncjweb.com
8	1500Z	9	See website	1.8-28 / -	QRP ARCI Two Sidebands Sprint	Ph	S/P/C and ARCI member nr or power	www.qrparci.org/contests
9	1600Z	9	See website	3.5 / 50, 144	OK1WC Memorial Contest	Ph CW	RS(T) and serial	www.hamradio.cz/ok1wc
11	1300Z	13	See website	1.8-28 / -	CWops Monthly Mini-CWT Test	CW	Name and member number or S/P/C	www.cwops.org/onair.html
14	0000Z	15	2400Z	3.5-28 / -	Worked All Europe DX Contest	Ph	RS and serial	waedc.de
14	0000Z	14	2359Z	1.8-28 / -	FOC QSO Party	CW	RST, name, FOC nr if member	www.g4foc.org
14	1200Z	15	2359Z	1.8-28 / 50	Straight Key Weekend Sprintathon	CW	RST, QTH, name, member nr if member	www.skccgroup.com
14	1400Z	15	0200Z	3.5-28 / 144	Arkansas QSO Party	Ph CW Dig	RS(T), county or S/P or "DX"	www.arkanhams.org
14	1600Z	14	2400Z	3.5-28 / 50	Ohio State Parks On the Air	Ph CW Dig	"Ohio" or S/P/DX and Park ID	parks.portcars.org
14	1800Z	16	0259Z	- / 50+	ARRL September VHF Contest	Ph CW Dig	Grid square	www.arrl.org/contests
15	0000Z	15	0400Z	3.5-14 / -	North American Sprint	Ph	Call signs, serial, name and state	www.ncjweb.com
15	1300Z	16	0700Z	1.8-28 / 50,144	Classic Exchange	Ph	Name, RS, S/P/C, type of equipment	www.classicexchange.org
16	0100Z	16	0300Z	1.8-28 / -	Run For the Bacon	CW	RST, S/P/C, Flying Pig nr or power	www.fpqrp.org
19	0030Z	19	0230Z	3.5-14 / -	NAQCC Monthly QRP Sprint	CW	RST, S/P/C and NAQCC mbr nr or power	naqcc.info
21	6 AM	22	12 mid	- / 10G+	ARRL 10 GHz Cumulative Contest	Ph CW Dig	6-character grid locator	www.arrl.org/contests
21	1200Z	22	1200Z	1.8-28 / -	CIS DX PSK Contest	Dig	RST and DXDA code	www.eupsk.com
21	1200Z	22	1159Z	3.5-28 / -	Scandinavian Activity Contest	CW	RST and serial	www.sactest.net
21	1400Z	22	0300Z	3.5-28 / 50+	South Carolina QSO Party	Ph CW	RS(T) and county or S/P/C	scqso.com
21	1600Z	21	1800Z	1.8-28 / -	Feld-Hell Hell on Wheels Sprint	Dig	RST, S/P/C, Feld-Hell member nr	www.feldhellclub.org
21	1600Z	22	2400Z	1.8-28 / 50,144	Washington State Salmon Run	Ph CW Dig	RS(T) and county or S/P/C	www.wwdxc.org
22	1300Z	23	0700Z	1.8-28 / 50,144	Classic Exchange	CW	Name, RS, S/P/C, type of equipment	www.classicexchange.org
22	1700Z	22	2100Z	3.5-28 / -	BARTG Sprint 75	Dig	Serial	www.bartg.org.uk
23	7 PM	23	11 PM	- / 144	144 MHz Fall VHF Sprint	Ph CW Dig	4-character grid square	www.svhfs.org
25	0000Z	25	0200Z	1.8-28 / 50	SKCC Straight Key Sprint	CW	RST, QTH, name, SKCC nr or power	www.skccgroup.com/sprint/sks
28	0000Z	29	2359Z	- / 2.3G+	ARRL EME Contest	Ph CW Dig	Call signs, sig rpt, acknowledgement	www.arrl.org/contests
28	0000Z	29	2359Z	3.5-28 / -	CQ WW RTTY Contest	Dig	RST, CQ zone and State/VE area (US/VE)	www.cqwwrtty.com
28	1400Z	29	See website	1.8-28 / 50,144	Texas QSO Party	Ph CW Dig	RS(T), county or S/P/C	www.txqp.net
29	0000Z	29	2359Z	1.8-28 / -	Maine QSO Party	Ph CW	RS(T), county or "DX"	www.maineqsoparty.com

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 (July 1 for September *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.

2013 ARRL DX Phone Results

From iguanas in the shack to blown-up equipment and unexpected QRP contacts, the ARRL DX Phone event offered a cornucopia of contesting.

Ward Silver, NØAX, n0ax@arrl.org

After the relatively quiet conditions two weeks earlier for the ARRL DX CW contest, hopes were being stealthily raised that maybe — just maybe — we'd enjoy those coveted high-latitude openings on 15 and 10 meters. Once again, though, Old Sol decided to drive us all nuts by tossing a joker on the table. Solar indigestion resulting in a coronal mass ejection peaked the particle perceptors on February 25 and again on February 28. On Friday, the planetary A index hit a nasty 27, boding poorly for propagation. While the A index innocently returned to a wide-eyed and modest 12 on Saturday, March 2 and to an even more relaxed 7 on March 3, the damage had been done!

Paths from the US and Canada over and through the northern auroral zone were ephemeral at best and non-existent at worst, especially for stations at northern latitudes. Single Op, High Power entrant AL9A summed up the Alaskan point of view from 60° North latitude pretty well: *"#@%&*!^ propagation! This one really stunk!"* On the other hand, stations in the low latitudes or across the geomagnetic equator from North America made far milder assessments. For example, VK4TS decided to participate as a 40 meter single-band entry: "Nice 40 meter run into USA, 44 states in three and a half hours was fantastic."

How often does a rookie place in the Top Ten in the first time out? Brad, K7EUG, operating at NP2N is obviously a quick study — he placed #10 in SOHP! [George Cutsogeorge, W2VJN, photo]

Despite the strange conditions, we still had a lot of fun. It's hard to spend two days chasing and logging DX without getting a fair amount of enjoyment out of the experience. In fact, one-third of the soapbox comments from W and VE included the word "Good" or "Great" and about one-sixth mentioned "First," and one mentioned iguanas: *"Had a blast operating from a house on the beach; iguanas walking all over the place."* — HC8/K7ST.

Top Ten Golden Logs

Call	QSOs
OG6N	986
EA1CBX	513
OM3GI	430
F5LIW	403
HB9AUS	401
K1HT	401
OK6Y (OK2PTZ, op)	363
WA6FGV	362
KB0EO	345
OH2XX	333

Record Participation

When the e-mail robot finally closed its inbox, it had ushered in a new participation record of 3545 logs — 18 more than last year! (1817 W/VE logs — a little less than 2012 — and 1733 DX logs — a little more this year) 875,714 QSOs were reported by DX stations. That's an average of 18,244 per hour — not a bad rate — and an increase of 60,000-and-change over 2012. W/VE logs contained 691,336 QSOs, which is down by about one percent this year. There are a lot of W/VE stations who could be seeing their call sign in the results and aren't because they didn't send in a log! Nevertheless, Rose-Anne Lawrence, KB1DMW, has no doubt been sorting a lot of QSLs at the ARRL Incoming Bureau as a result of the ARRL DX contest activity this year!

Back to that Sun, though. Conditions were a bit worse than those in 2004 (both flux and the A index were a little higher) and last year (flux was lower but the A index was higher) but not dramatically. This shows the value of large worldwide "propagation experiments" such as DX contests. With so many stations active and on a wide range of bands, the effects of solar and geomagnetic phenomena on propagation are much clearer than during day-to-day operation when activity is much sparser. This is a good reason to upload your contest log to Logbook of The World (**www.arrl.org/lotw**) and deepen our ham radio database of point-to-point communications on the ham bands!

It was definitely not all doom and gloom, even on Friday as the coronal particle stream collided with the magnetosphere. The first night of a geomagnetic storm period often exhibits improved propagation on the low bands — why, no one knows — before the general turbulence overhead shuts down DX paths. Many accounts of 160 meter operation note that the first night was definitely better with many CW signals on the band chasing the TX5K and XT2TT DXpeditions along with the SSB contesters.

On the High Bands

But weren't things just awful on 10 meters? If so, that fact was well-disguised. The first five scores in the Top Ten for W/VE Single Op, Single Band on 10 meters would all have beaten last year's top score of 166k! But record territory was not attainable this year as noted by none other than Martti, OH2BH, operating at CR1Z: *"As it was considered last year to break the 10 meter EU record we went with full force on it after great success on CW part. But it was not to be."*

The winning 15 meter score of 527,904 was certainly competitive with 2012's 612,000, as well. Definitely the bands were not open everywhere for everybody at the same time. Here are two typical comments:

KD4ACG, West Central Florida: *"I'd call it a successful weekend, even without an Asian, Pacific or Oceania contact."* K7ACZ, Nevada: *"Fair openings on 10 meters but nada to Europe."*

Yes, these stations were commenting on the same contest! Propagation was good enough for TO1A (French Guiana), FM5BH (Martinique) and 6V7S (Senegal) to place in the 10 meter Top Ten, which in lean years is quite difficult for stations north of the Equator.

The moral of the story is that during a contest, there are opportunities that may not be otherwise available. As KD9MS observed, *"I've never heard bands so dead at 18:00Z on the day of a contest and then heard them JUMP like they did this weekend."* Contests just seem to make their own propagation, don't they? It

Top Ten

W/VE

US Single Operator, High Power

VY2ZM	5,640,480
VE3EJ	5,314,140
VB3E (VE3AT, op)	5,105,964
W2RE	4,938,558
VY2TT (K6LA, op)	4,374,360
N5DX	4,201,245
W9RE	3,733,776
NC1I (K9PW, op)	3,695,913
K1ZR	3,542,121
K3ZO	3,147,660

US Single Operator, Low Power

N1UR	2,801,970
N1PGA	1,634,256
NA8V	1,328,250
N4TZ	1,297,125
N5AW	1,147,032
KE3X	706,680
WA2JQK	650,025
KD9MS	632,388
WD5K	621,621
WA1S	599,238

US Single Operator, QRP

N1TM	402,555
NØKE	239,220
NDØC	225,345
KS4X	188,877
NT4TS	179,550
KT8K	164,268
W2ID	130,824
W2WGK	101,088
W6QU (W8QZA, op)	92,916
KØOU	52,200

US Single Operator, 10 Meters

W3BGN	247,194
N8II	204,363
K9BGL	187,824
K2SSS	186,576
W5PR	172,536
W3EP	148,653
K4WI	108,570
N2PP	105,066
K1VSJ	91,350
NC2V	64,824

US Single Operator, 15 Meters

N4PN	527,904
N7DD	456,780
VE3KZ	322,500
NU6S	182,016
WD5R	175,152
NY7N	169,200
N9TGR	162,960
W6AFA	145,530
AK5DX	140,868
WA8RCN	137,547

US Single Operator, 20 Meters

W4AAA (KK9A, op)	801,288
W4SVO	398,196
WR2G	143,112
K6HNZ	120,486
K7MH	110,424
W1AVK	83,106
VA7ST	72,150
VE1SQ	55,593
W4RRE	49,665
K4TRH	48,840

US Single Operator, 40 Meters

W7WA	242,520
K3ZJ	94,464
VE3MIS (VE3VE, op)	74,292
W1FQ	38,916
K8DJC	32,256
N3LL	30,132
VE3DZ	30,030
VA3XH	22,059
VE9AA	21,672
W4JKC	18,954

US Single Operator, 80 Meters

W1XX	71,610
WX4G	44,622
K1KNQ	25,926
K4KZZ	23,973
W4QNW	19,992
WA4TII	19,665
W4DD	16,218
KT8D	10,434
N4DTF	5,100
WI9H	2,574

US Single Operator, 160 Meters

W2MF	11,952
KM1R	2,418
AG4W	1,872
K1HAP	1,863
VE3EDY	1,260
WD5COV	867
K4EJQ	630
W3GH	585

US Single Operator Assisted, High Power

K3WW	4,513,374
N3RS	3,519,585
AA3B	3,511,437
N2MM	3,220,140
W1GD	2,863,995
N3RR	2,702,898
W3FV	2,698,404
KN2M	2,399,460
N4ZC	2,396,163
N2WKS	2,389,527

US Single Operator Assisted, Low Power

W1NT	1,228,857
W3KB	1,219,392
K1BX	1,216,614
WB4OMM	1,119,492
WE9R	1,064,496
KA2KON	981,681
KA2D	935,022
AA4R	745,308
W1KT	686,280
WX1S	658,350

US Multioperator Single Transmitter, High Power

W2PV	7,510,293
K1LZ	6,708,876
N4WW	3,928,344
KØRF	3,563,802
W1NA	3,113,376
WB9Z	3,098,592
N2IC	3,027,156
N1MM	2,986,164
W3MF	2,387,100
W2FU	2,250,024

US Multioperator Single Transmitter, Low Power

NR4M	2,256,384
N1BA	1,633,464
N5DO	1,008,780
K2PO	833,490
W3ZGD	612,978
W2TZ	603,585
W3YI	278,343
W3WN	126,444
N9CM	64,050
WC2FD	53,757

US Multioperator Two Transmitters

N2NT	7,143,840
KB1H	5,745,969
K9CT	5,568,000
K8AZ	5,307,153
KØTV	4,870,125
WX3B	4,324,500
KA1ZD	3,636,684
W6WB	3,403,332
K2AX	3,060,225
KT4TX	2,556,444

US Multioperator Unlimited Transmitters

K3LR	15,571,080
W3LPL	13,845,402
WK1Q	8,366,295
W4RM	6,636,942
K1KI	4,700,343
N6ZZ	3,890,025
NE3F	3,405,840
WØAIH	3,290,805
K1KP	3,061,926
W3DQ	678,153

DX

DX Single Operator, High Power

8P5A (W2SC, op)	9,277,644
P49Y (AE6Y, op)	7,677,195
CR2X (ES2RR, op)	6,890,328
V26M (N3AD, op)	6,681,255
KP2M (N2TK, op)	6,237,840
PS2T (PY2YU, op)	4,600,077
LX7I (LX2A, op)	4,455,513
YN5Z (K7ZO, op)	4,356,108
NH7A	4,036,032
NP2N (K7EUG, op)	3,863,808

DX Single Operator, Low Power

J88DR (G3TBK, op)	3,817,614
VP2V/KE2VB	3,528,960
HI3TEJ	3,114,294
HI3TT	2,119,005
V31Y (K1LI, op)	1,786,428
EI9HX	1,262,202
WP2XX	1,203,276
XE1XOE	1,089,225
KP4EU	989,238
ZL3IO	903,261

DX Single Operator, QRP

YW2LV (YV5YMA, op)	1,826,496
F5BEG	159,894
CO2CW	152,409
DL8LR	65,268
HG3M (HA3MY, op)	49,215
EA3FF	36,252
IK1BBC	32,472
SP4LVK	31,752
PY2BN	30,636
OZ6OM	25,704

DX Single Operator, 10 Meters

TO1A (F5HRY, op)	557,784
LU1FAM	508,680
LU7HN	425,700
LR2F	412,920
FM5BH	412,056
CR1Z (OH2BH, op)	361,080
PY2LED	357,717
6V7S (RK4FF, op)	307,803
PU5FJR	296,100
PU2LEP	277,005

DX Single Operator, 15 Meters

FY5KE (F1HAR, op)	673,074
ZF2AH	631,260
PX5E (PP5JR, op)	507,600
TMØT (TU5KG, op)	385,398
CO6LC	364,620
S5ØK	329,040
S55T (S55OO, op)	307,980
HA3OV	291,342
3Z5N (SP5GRM, op)	278,400
HQ2N (JA6WFM, op)	277,359

DX Single Operator, 20 Meters

KP2MM (N2TTA, op)	408,516
OH8X (OH6UM, op)	396,540
PW5G (PP5WG, op)	391,254
C6AZZ (KQ8Z, op)	300,303
HK3C	296,100
FM5FJ	293,220
YU7AV	278,280
SN3X (SP3SLA, op)	261,516
EE8T	258,396
TM4L (F8ARK, op)	255,006

DX Single Operator, 40 Meters

YY4DNN	349,221
CQ8X (OH8NC, op)	299,040
EF7X (EA7KW, op)	247,608
CO8ZZ	119,955
YW5T (YV5JBI, op)	104,193
S56X	102,492
EA3CI	96,513
S54ZZ	91,875
CE3EEA	71,280
SN3R (SQ6NTM, op)	60,360

DX Single Operator, 80 Meters

KP4KE	165,480
GM3PPG (G4BYB, op)	125,424
YV5MSG	89,586
CO6CAC	87,450
CT2ITR	70,740
OK7K (OK1NS, op)	65,142
EA7EU	55,476
OM2KI	46,449
F6IGS	29,400
HK6P	28,509

DX Single Operator, 160 Meters

KV4FZ	51,183
OK1W	288
SP1GZF	90
LU2DVI	27
RY7Y	12

DX Single Operator Assisted, High Power

CE3CT	3,691,776
ZZ2T (PY2MNL, op)	2,831,706
EB3CW	2,586,708
IR2C (IW2HAJ, op)	2,405,160
OK1GTH	2,187,438
ZM1A (ZL3CW, op)	1,528,230
OS8A	1,362,060
EI3KG	1,285,200
S52WW	1,205,595
EA7RU	1,102,950

DX Single Operator Assisted Low Power

P4ØP (W5AJ, op)	4,630,209
KP2/KØBBC	1,524,507
KP2DX (KP2BH, op)	1,199,862
TM1E (F1JRD, op)	832,842
IB1B (IW1QN, op)	724,032
IZ5EBL	680,241
V4/ACØW	672,252
3G1D (CE1VIL, op)	583,464
TM7X (F5BSB, op)	458,337
CO2WL	413,478

DX Multioperator Single Transmitter, High Power

PJ2T	8,271,822
VP5H	7,703,358
EI7M	5,301,000
XE7S	5,242,560
CS2C	5,189,940
TO22C	4,626,453
ED1R	3,940,695
IO5O	3,011,952
EF8R	2,593,410
TM1T	2,547,360

DX Multioperator Single Transmitter, Low Power

VP9I	4,147,266
HI3K	3,165,120
V31VJ	1,931,904
WP3DX	1,278,900
PW1A	1,203,270
KH6RC	962,745
KH6CJJ	547,956
GT8IOM	323,439
CE2LS	318,384
PY2RH	314,976

DX Multioperator Two Transmitters

PJ4G	12,375,231
TM6M	7,516,740
TI8M	6,618,240
HD2A	5,587,296
II9P	4,125,915
PX2C	4,112,325
HG7T	3,186,477
9A7A	3,176,496
PI4DX	2,703,114
ZV5O	2,508,822

DX Multioperator Unlimited Transmitters

HK1NA	15,278,994
C6ANM	5,954,382
9A1A	5,795,712
LP1H	5,627,421
9A1P	5,103,648
E7DX	4,396,122
HA3ØS	3,612,168
LZ9W	3,537,360
JA3YBK	1,467,144
G1ØØC	1,054,755

makes you wonder about how often the bands are open but empty through the week. How many of us (and the author is also occasionally guilty) turn on the rig, spin through the band, don't hear it packed wall to wall, and turn it off? We won't catch many fish without a line in the water, so call CQ! You never know.

Record-breaking Efforts

Whether you think the bands were hot or cold, there are a big bunch of new call signs in the record books and the tables show all of the category winners by district and continent. Particularly noteworthy are the three all-time records set this year:

- NR4M — W/VE Multi-single, Low Power
- P4ØP (W5AJ, op) — DX Single Operator Unlimited, Low Power
- HK1NA — DX Multi-multi

The HK1NA station and team led by Jorge, HK1R, have been coming on strong, winning

W/VE Single Operator Region Leaders

Boxes list call sign, score, and power (Q = QRP, LP = Low Power, HP = High Power).

Northeast Region

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

VY2ZM	5,640,480	HP
W2RE	4,938,558	HP
VY2TT (K6LA, op)	4,374,360	HP
NC1I (K9PW, op)	3,695,913	HP
K1ZR	3,542,121	HP
N1UR	2,801,970	LP
N1PGA	1,634,256	LP
KE3X	706,680	LP
WA2JQK	650,025	LP
W2TF	586,686	LP
N1TM	402,555	Q
W2ID	130,824	Q
W2WGK	101,088	Q
W1TW	23,976	Q
W1CEK	2,808	Q

Southeast Region

(Delta, Roanoke and Southeastern Divisions)

N5DX	4,201,245	HP
AD4Z	2,882,316	HP
K1TO	2,721,420	HP
K4AB	2,662,200	HP
K4JPD (N4OO, op)	2,045,406	HP
WA1S	599,238	LP
K4DMR	478,956	LP
W4FT	386,073	LP
K4NC	328,440	LP
NR3X	319,716	LP
KP4KOE	44,541	LP
KS4X	188,877	Q
NT4TS	179,550	Q
N4ZAK	35,880	Q
K3TW	22,176	Q
KJ4FUU	3,219	Q

Central Region

(Central and Great Lakes Divisions; Ontario East, Ontario North, Ontario South and Greater Toronto A

VE3EJ	5,314,140	HP
VB3E (VE3AT, op)	5,105,964	HP
W9RE	3,733,776	HP
K8GL	1,504,485	HP
N8BJQ	1,281,630	HP
NA8V	1,328,250	LP
N4TZ	1,297,125	LP
KD9MS	632,388	LP
VE3NB	556,830	LP
VE3BR	507,756	LP
KT8K	164,268	Q
AI9K	22,119	Q
VA3RKM	3,330	Q
K8DRT	765	Q
KD2BGM	75	Q

Midwest Region

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

K5TR	2,389,146	HP
NR5M	2,222,841	HP
K5RX	1,492,260	HP
K7KU (KØKR, op)	897,444	HP
KØCN	515,844	HP
N5AW	1,147,032	LP
WD5K	621,621	LP
W5GFI	383,640	LP
WBØTSR	218,022	LP
WØETT	203,988	LP
NØKE	239,220	Q
NDØC	225,345	Q
KØOU	52,200	Q
KKØQ	50,100	Q
NØUR	18,972	Q

West Coast Region

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

W6YI	1,565,748	HP
K5RR	1,001,286	HP
K6XX	813,564	HP
WA7LT	497,652	HP
KZ1W	379,665	HP
N6RV	473,526	LP
K7ACZ	283,500	LP
VE6EX	240,588	LP
AA6K	199,125	LP
N7IR	194,040	LP
W6QU (W8QZA, op)	92,916	Q
N6HI	6,072	Q
KK7VL	1,254	Q

an extremely close race in the ARRL DX CW contest just two weeks prior and then running away with the category in the Phone weekend. They added a new 80 meter, five element vertical array this year to take the continental record from PJ2T (2009) and the old 1994 all-time record from 6D2X. ¡Bien hecho! Hector noted, *"Great weekend with great friends! Murphy attempted to make his entrance several times but we closed the door…thanks to all the team and thanks to all the folks who worked HK1NA."*

The W/VE Multi-single, Low Power record was beaten not just once but by three teams this year: NR4M with 2.2 million points, N1BA at 1.63 million and N5DO at 1.0 million. I sense that this category record will not last long as the low power categories are attracting more interest with every contest.

Accuracy Leaders

Bold indicates a new record

W-VE

Single-Op

Call	Category	QSOs	Error %	Index
VE3EJ	SOHP	3799	0.4	13.540
VB3E (VE3AT, op)	SOHP	3687	0.4	13.527
W2RE	SOHP	3711	0.6	13.509
VY2ZM	SOHP	3949	1	13.496
VY2TT (K6LA, op)	SOHP	3505	0.8	13.465

Single-Op Unlimited

Call	Category	QSOs	Error %	Index
N3RS	SOUHP	2537	0.8	13.324
K3WW	SOUHP	3193	1.8	13.324
AA3B	SOUHP	2554	1.1	13.297
W1GD	SOUHP	2163	0.6	13.275
N2MM	SOUHP	2400	1.3	13.250

Multi-Op

Call	Category	QSOs	Error %	Index
K3LR	MM	7801	0.7	13.822
W3LPL	MM	7347	0.9	13.776
WK1Q	MM	5146	0.9	13.621
W2PV	MSH	4543	0.9	13.567
N2NT	M2	4554	1.4	13.518

DX

Single-Op (Non-assisted)

Call	Category	QSOs	Error %	Index
8P5A (W2SC, op)	**SOHP**	**8958**	**0.3**	**13.922**
P49Y	SOHP	7673	0.5	13.835
CR2X (ES2RR, op)	SOHP	6930	0.2	13.821
V26M (N3AD, op)	SOHP	6929	0.5	13.791
KP2M (N2TK, op)	SOHP	6601	0.3	13.790

Single-Op (Assisted)

Call	Category	QSOs	Error %	Index
P4ØP (W5AJ, op)	SOULP	4951	0.4	13.655
CE3CT	SOUHP	4833	0.6	13.624
ZZ2T (PY2MNL, op)	SOUHP	3856	0.5	13.536
EB3CW	SOUHP	3359	0.7	13.456
IR2C (IW2HAJ, op)	SOUHP	3172	0.9	13.411

Multi-Op

Call	Category	QSOs	Error %	Index
HK1NA	**MM**	**14,472**	**0.7**	**14.091**
PJ4G	M2	12,140	0.4	14.044
TM6M	M2	8157	0.3	13.882
VP5H	MSH	7646	0.7	13.813
LP1H	MM	7213	0.5	13.808

Similar interest is beginning to be shown in the Single Op Unlimited, Low Power category outside W/VE as Robert W5AJ, operating as P4ØP, scored a whopping 4.63 million points to more than double PY1NX's previous all-time record of 2.09 million points. This is Robert's second category win in a row, having triumphed in SOLP as P4ØV in 2012.

Twenty-seven new records were set in 2013, 18 of which were in either in SOULP or MSL. Twelve were set in W/VE and 6 by DX stations. The most common year in the record books remains 2002 (the mode) although probably for not much longer as two records from that year were taken this year. 2002 is also the median year for records with half of the records being set after 2002.

Are you looking for some low hanging fruit to pick? All of the ARRL contest records are available online at **www.arrl.org/contest-records**. There is but one lonely W/VE record remaining unclaimed for 2014 — the ninth district Multi-Single Low Power category. Hint, hint! There is nothing to whet the competitive edge like an evening with the record book!

Speaking of whetting an edge, some records got a mighty close shave this year. Answering the question, "Who shaves the barber?" Jeff, VY2ZM, lathered up his own Canadian SOHP record from 2004 but failed to nick it by a measly 0.1% — the closest of our close calls this year. Tom, W2SC, operating as 8P5A was another self-shaver who put forth a valiant effort but left his razor un-bloodied.

Keeping the String Alive

Intense competition around the world is making it harder and harder to remain "king of the hill" for more than one year. On any given weekend, propagation and the excellent stations now in abundance around the world put the top spots up for grabs. How bad do you want that walnut in your shack?

The two W/VE stations that keep on keepin' on are N1UR with the longest winning streak of all — five #1 finishes in SOLP — and K3LR with a fourth top finish in MM over arch-rival W3LPL. Both of these top stations would have even longer streaks except for a single year's interruption. On the DX side, W2SC may not have set a new record from 8P5A but Tom did push his SOHP win streak to four and we are especially pleased to welcome a new Top Band Top Gun in Herb, KV4FZ, with a third win on our MF contest band.

You may recall that last year we wondered if Joe, W6VNR, would return to ZF2AH and get his sweep of the single-band categories on 15 meters? Pulling off that feat from the close-in Grand Caymans would require some excellent propagation. The challenge was just a little too great this year. Joe managed to come awfully close with 631,260 points but F1HAR piloted FY5KE to a narrow victory with a total score of 673,074. I figure that Joe has one or two years left in Solar Cycle 24 to grab that final brass ring for his collection.

Affiliated Club Competition

Unlimited Category

	Score	Entries
Yankee Clipper Contest Club	280,011,087	214
Frankford Radio Club	241,516,347	150
Potomac Valley Radio Club	198,552,147	192
Northern California Contest Club	63,410,340	75
Society of Midwest Contesters	62,412,156	103
Contest Club Ontario	59,330,229	66
Florida Contest Group	58,329,390	103
Minnesota Wireless Assn	51,469,086	105
Tennessee Contest Group	29,197,617	54
Arizona Outlaws Contest Club	27,290,112	67

Medium Category

North Coast Contesters	81,919,140	31
Hudson Valley Contesters and DXers	33,664,590	37
Mad River Radio Club	28,726,794	32
Carolina DX Association	26,958,444	49
South East Contest Club	22,052,151	28
Central Texas DX and Contest Club	21,941,415	19
Alabama Contest Group	20,221,701	34
Southern California Contest Club	19,243,050	39
DFW Contest Group	18,248,865	37
Georgia Contest Group	16,150,836	18
Maritime Contest Club	15,393,759	19
Willamette Valley DX Club	14,239,938	33
Order of Boiled Owls of New York	12,914,817	15
Central Virginia Contest Club	10,234,386	19
Western New York DX Assn	9,888,888	16
Grand Mesa Contesters of Colorado	9,732,741	19
North Texas Contest Club	8,396,985	7
Contest Group Du Quebec	7,940,817	17
CTRI Contest Group	6,417,783	16
ORCA DX And Contest Club	6,411,393	19
Louisiana Contest Club	6,115,764	11
Northern Rockies DX Association	5,913,078	5
Mother Lode DX/Contest Club	5,504,574	25
Rochester (NY) DX Assn	5,432,832	20
Western Washington DX Club	5,369,343	29
Utah DX Assn	4,343,868	19
Bristol (TN) ARC	4,195,245	17
Delara Contest Team	3,979,371	15
Iowa DX and Contest Club	3,494,478	5
Spokane DX Association	2,927,412	19
Portage County Amateur Radio	1,291,608	11
West Park Radiops	680,496	18
Kentucky Contest Group	638,031	4
Radio Club of Redmond	403,212	6

Local Category

Southwest Ohio DX Assn	5,330,160	5
Hilltop Transmitting Assn	3,486,843	5
Madison DX Club	2,913,174	6
Saskatchewan Contest Club	2,486,769	9
Mississippi Valley DX/Contest Club	2,178,405	7
New Mexico Big River Contesters	2,166,405	3
Kansas City Contest Club	2,070,795	10
Bergen ARA	1,834,818	9
Alberta Clippers	1,707,510	4
Allegheny Valley Radio Association	1,659,984	5
Metro DX Club	1,146,483	10
Meriden ARC	1,111,752	6
San Diego DX Club	1,084,422	4
Northern Arizona DX Assn	948,852	5
599 DX Association	876,645	4
Brazos Valley ARC	822,300	8
Southern California DX Club	794,394	4
Derby City DX Association	755,523	3
Montachusett ARA	711,441	3
West Park Radiops	680,496	18
Kentucky Contest Group	638,031	4
Sterling Park ARC	598,482	7
Oakland County Amateur Radio	448,440	3
Wireless Association of South Hills	421,833	4
Kansas City DX Club	419,409	5
Heartland DX Association	418,716	3
Vienna Wireless Society	417,696	4
Radio Club of Redmond	403,212	6
Milford (OH) ARC	387,828	7
Great South Bay ARC	383,994	5
Badger Contesters	370,260	4
Low Country Contest Club	330,480	5
Fort Wayne Radio Club	282,021	5
Skyview Radio Society	270,642	3
Southeastern DX Club	251,169	3
South Jersey DX Assn	223,398	4
QSY Society	178,074	3
Wireless Society of Southern Maine	160,920	3
Gloucester Co ARC	135,699	4
10-70 Repeater Assn	112,353	3
Blue Ridge ARC	107,784	4
Pueblo West Amateur Radio Club	87,003	4
Albuquerque DX Assn	85,431	3
South Jersey Radio Assn	83,025	4
Fox River Radio League	82,113	3
Parkersburg Amateur Radio Klub	79,413	3
Nanaimo Amateur Radio Association	56,436	3
Alexandria Radio Club	53,511	4
Falmouth ARA	2,928	4

Detecting Radio-activity

Stations that have full-time efforts on a single band — the SOSB and MM or M2 entrants — make it a point to "pull a vacuum" and work everything that moves. With their big signals and consistent presence, their totals are a great way to assess activity levels.

Fifteen meters regained the "money band" moniker this year as FY5KE (F1HAR, op) piled up 3688 QSOs on his way to the SOSB-15 championship. On 20 meters from Colombia, the MM DX winning HK1NA team logged 3674 QSOs along with 3329 QSOs on 10 meters. It looks like the north coast of South America was very, very good to the high-band operators this year. Here in the US and Canada, the W3LPL MM crew pulled in 2434 contacts on 15 meters and 1197 on 10 while W3LPL's competition at K3LR rang the 20 meter bell with 2261 QSOs. Several DX stations were able to log 62 states or provinces, the maximum recorded this year, and the K3LR ops on 20 and 15 meters worked 149 and 143 DXCC entities during their shifts, respectively.

As the chart of W/VE single op categories shows, this is the first year ever that Single Operator Unlimited logs outnumbered Single Operator, Low Power and SOU is now the most popular category. If current trends continue, the same will be true for DX logs, as well, with 429 SOU logs to SOSB's 491 this year. DX SOLP logs also saw healthy growth this year.

Why the shift to SOU? Probably because having a continuous stream of spots to choose from is so much fun! Station automation has progressed to the point at which just clicking on a spot tunes the radio, switches any filters and antennas, aims the rotator and away you go to a log full of exotic calls, hard to work states and provinces, and the hours fly by! While the traditional, find-it-yourself style of operating will be with us forever, clearly the use of spotting information from the Internet is the way of the future.

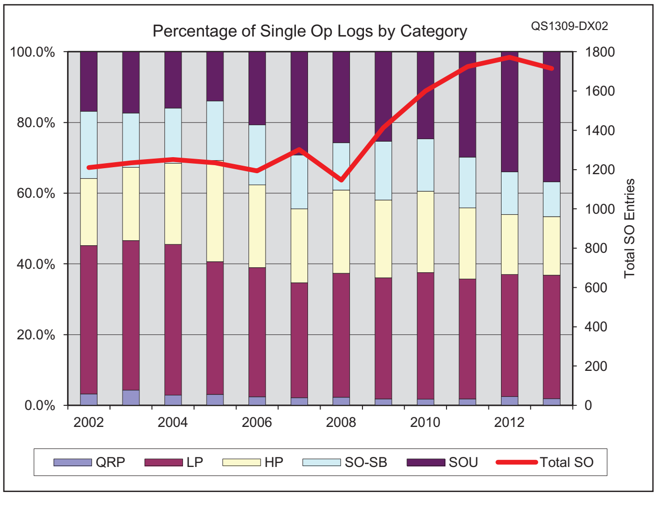
However, this leads to "issues." Can we talk? First off, you do still have to copy the information of the station you're calling — such as the call sign! A significant percentage of call signs that get spotted are BØGUS. Think before you call or log…it's really easy to copy a letter (or two) wrong so don't trust that spotted call unless you don't mind QSO point penalties for invalid contacts. Listen, listen, listen…

The second issue is that stations on the DX side need to give their call signs frequently enough that callers don't have to guess at it. Yes, not ID-ing makes your rate higher but at the expense of everybody else's error rate. That's just poor sportsmanship! Some of the top stations ID with every QSO so there is no excuse — none — for not giving a call sign every few QSOs.

The lifeblood of a contest may look like the big guns in these write-ups, but the truth is that a successful contest depends on the participation of many casual operators who do their best with modest stations or get on "just for a while." Mark, AA2MA, exemplifies this approach by deciding to have some fun behind the wheel, reporting that he *"Operated [the] contest while mobile on solo trip from Madison, AL to Waco, TX. Recorded QSOs in MS, AR, and TX…Had a ball on my 1st SSB contest and it kept me awake on a 12 hour drive. Many thanks to my ham friends around the world!"* The chart shows how many logs were big and how many were little. Nearly 60% of all logs contained 200 or fewer QSOs. These operators are truly "the life of the party" and I hope they keep coming back, year after year!

ARRL Affiliated Club Competition

Little Pistols and the casual operators also have a delightfully and mutually beneficial relationship with their clubs. At all levels, from the mass mayhem of the annual YCCC vs PVRC vs FRC Unlimited Club challenges to a local bragging rights challenge in the Local Club listings, making a group effort is fun and motivating. Do you have a local contest club? If not, start one! If you do, join one! I can't think of a better suggestion for someone just getting started in contesting.



The trend in Single Operator logs away from the SOHP and SOSB categories to SOU continues with SOU the most popular this year for the first time.

Overall, the club scene

seems pretty healthy. There were 41 more logs submitted for club totals than last year (2051). Four more clubs joined the fun bringing the total number to 89 — can 100 contest clubs be far behind? It only takes a few logs to make up a Local Club entry!

Let's start with the Local Club category. Here we can see the direct results of putting in a little extra effort on the air as the Southwest Ohio DX Association jumped ahead of last year's 1-2-3 clubs to take the gavel. The average number of logs submitted by the 42 Local Clubs was just a bit more than 4 and there were 194 total logs submitted among the entries.

Next up the scale are the Medium Clubs where the North Coast Contesters duked it out with the Hudson Valley Contesters and DXers to a 1-2 finish. Making a big charge, though, was the Mad River Contest Club that added ⅓ more logs (32 this year versus 24 last year) and made a big jump to third place. Watch out next year!

And the main event, ladies and gentlemen… from the northeast corner of the country and weighing in at 214 logs, the Yankee Clipper Contest Club. And from along the mid-Atlantic seaboard, the challenger, at 150 logs, is the Frankford Radio Club. Well, when the dust settled in the Contest Branch, YCCC had once again vanquished all comers with a bazillion points from 13 lucky logs more than last year. Notable is the stealthy advance in the standings of the Northern California Contest Club, Society of Midwest Contesters, and Contest Club Ontario!

Accuracy

Why is it that we have radio contests, anyway? Certainly, they are fun, but I don't see anything in the FCC's Basis and Purpose about having fun on the radio. I see a couple of points about advancing communications technique and training operators, though. That's why contests are so valuable to us — we improve our stations, technique and general radio know-how, all while having a good time. A crucial part of contesting and training is accuracy when communicating. Thus, it is just as important to note and reward high accuracy as it is a high score.

The top five Accuracy Indexes are shown in the table for SOHP/LP, SOUHP/LP, MO stations. (See the online article for an explanation of the index.) This year's Goldfinger Award goes to OG6N who turned in the largest Golden Log for ARRL DX Phone since your author has been tracking accuracy rates!

DXing

While 5-Band DXCC in a weekend continues to elude the competitors — no station achieved DXCC on 80 meters — the top multiplier totals continue to stay high with lots of activity from around the world putting even semi-rare DXCC entities on the air.

I'm sure the 10 meter operators are not complaining, though, with a second straight year of high multiplier totals.

The top DX multiplier totals were mostly

Continental Leaders

Continent	Call	Score
Africa		
Single Operator High Power	EF8U (IK1HJS, op)	3,313,542
Single Operator Low Power	EF8O (EA8OM, op)	39,738
Single Operator QRP	J28AA (E7ØA, op)	900
Single Operator Assisted, High Power	EA8CNB	74,088
Single Operator Assisted, Low Power	EA8BZH	56,604
Single Operator 40 Meters	EA8CNR	1,581
Single Operator 15 Meters	CT3BD	121,278
Single Operator 10 Meters	6V7S (RK4FF, op)	307,803
Multioperator, Single Transmitter, High Power	EF8R	2,593,410
Multioperator, Single Transmitter, Low Power	ZS6WN	173,628
Asia		
Single Operator High Power	JAØJHA	888,282
Single Operator Low Power	JH4UYB	264,576
Single Operator QRP	JR4DAH	21,306
Single Operator Assisted, High Power	JF2QNM	136,998
Single Operator Assisted, Low Power	8N1TW (JM1UWB, op)	88,164
Single Operator 80 Meters	JE1SPY	399
Single Operator 40 Meters	JA1XMS	33,462
Single Operator 20 Meters	JI1LET	38,364
Single Operator 15 Meters	JR1CBC	168,780
Single Operator 10 Meters	JF1SQC	726
Multioperator, Single Transmitter, High Power	JA8RWU	591,126
Multioperator, Single Transmitter, Low Power	RKØAWQ	48
Multioperator, Two Transmitters	JA1YPA	97,170
Multioperator, Multi Transmitters	JA3YBK	1,467,144
Europe		
Single Operator High Power	CR2X (ES2RR, op)	6,890,328
Single Operator Low Power	EI9HX	1,262,202
Single Operator QRP	F5BEG	159,894
Single Operator Assisted, High Power	EB3CW	2,586,708
Single Operator Assisted, Low Power	TM1E (F1JRD, op)	832,842
Single Operator 160 Meters	OK1W	288
Single Operator 80 Meters	GM3PPG (G4BYB, op)	125,424
Single Operator 40 Meters	CQ8X (OH8NC, op)	299,040
Single Operator 20 Meters	OH8X (OH6UM, op)	396,540
Single Operator 15 Meters	TMØT (TU5KG, op)	385,398
Single Operator 10 Meters	CR1Z (OH2BH, op)	361,080
Multioperator, Single Transmitter, High Power	EI7M	5,301,000
Multioperator, Single Transmitter, Low Power	GT8IOM	323,439
Multioperator, Two Transmitters	TM6M	7,516,740
Multioperator, Multi Transmitters	9A1A	5,795,712
North America		
Single Operator High Power	8P5A (W2SC, op)	9,277,644
Single Operator Low Power	J88DR (G3TBK, op)	3,817,614
Single Operator QRP	CO2CW	152,409
Single Operator Assisted, High Power	XE1OGG	585,144
Single Operator Assisted, Low Power	KP2/KØBBC	1,524,507
Single Operator 160 Meters	KV4FZ	51,183
Single Operator 80 Meters	KP4KE	165,480
Single Operator 20 Meters	KP2MM (N2TTA, op)	408,516
Single Operator 15 Meters	ZF2AH	631,260
Single Operator 10 Meters	FM5BH	412,056
Multioperator, Single Transmitter, High Power	VP5H	7,703,358
Multioperator, Single Transmitter, Low Power	VP9I	4,147,266
Multioperator, Two Transmitters	TI8M	6,618,240
Multioperator, Multi Transmitters	C6ANM	5,954,382
Oceania		
Single Operator High Power	NH7A	4,036,032
Single Operator Low Power	ZL3IO	903,261
Single Operator QRP	NH6AB	11,172
Single Operator Assisted, High Power	ZM1A (ZL3CW, op)	1,528,230
Single Operator Assisted, Low Power	YBØNFL	9,348
Single Operator 80 Meters	KH6QJ	135
Single Operator 40 Meters	VK4TS	27,720
Single Operator 20 Meters	VK3GK	10,170
Single Operator 15 Meters	DU1EG	1,242
Single Operator 10 Meters	KH7Y	172,068
Multioperator, Single Transmitter, High Power	VK3VT	4,602
Multioperator, Single Transmitter, Low Power	KH6RC	962,745
South America		
Single Operator High Power	P49Y (AE6Y, op)	7,677,195
Single Operator Low Power	LO7H (LU7HW, op)	716,568
Single Operator QRP	YW2LV (YV5YMA, op)	1,826,496
Single Operator Assisted, High Power	CE3CT	3,691,776
Single Operator Assisted, Low Power	P4ØP (W5AJ, op)	4,630,209
Single Operator 160 Meters	LU2DVI	27
Single Operator 20 Meters	PW5G (PP5WG, op)	391,254
Single Operator 15 Meters	FY5KE (F1HAR, op)	673,074
Single Operator 10 Meters	TO1A (F5HRY, op)	557,784
Multioperator, Single Transmitter, High Power	PJ2T	8,271,822
Multioperator, Single Transmitter, Low Power	PW1A	1,203,270
Multioperator, Two Transmitters	PJ4G	12,375,231
Multioperator, Multi Transmitters	HK1NA	15,278,994

Sponsored Plaque Winners

Thanks to the generous sponsorship of numerous clubs and individuals, we are pleased to announce the winners of a sponsored ARRL DX Phone plaque. The ARRL wishes to thank the plaque sponsors for their continued commitment to the ARRL Plaque Program. Without their support and dedication, the Plaque Program would not be possible. Unsponsored plaques may be purchased by the plaque winner. If you wish to purchase an unsponsored plaque or order a duplicate plaque, contact ARRL Contest Branch Manager Mike DeChristopher, N1TA, at 860-594-0232 or by e-mail at n1ta@arrl.org. The cost for plaques is $75 and includes shipping.

Plaque Category	Plaque Sponsor	Winner
W/VE Single Operator High Power Phone	Frankford Radio Club	VY2ZM
W/VE 1.8 MHz Phone	Butch Greve, W9EWC Memorial	W2MF
W/VE 3.5 MHz Phone	Jeffrey Briggs, VY2ZM	W1XX
W/VE 7 MHz Phone	Charles Wooten, NF4A	W7WA
W/VE 21 MHz Phone	Northern Illinois DX Association	NU6S
W/VE 28 MHz Phone	Ralph Fontaine AF7DX	W3BGN
W/VE Single Operator QRP Phone	Jeffrey Briggs, K1ZM	N1TM
W/VE Single Operator Assisted, High Power Phone	Pete Carter, K3VW Memorial	K3WW
W/VE Multioperator Single Transmitter High Power Phone	Steve Adams, K4RF	W2PV
World Single Operator High Power Phone	North Jersey DX Association	8P5A (W2SC, op)
World 1.8 MHz Phone	Fred Race, W8FR, In Memory of ZL2BT	KV4FZ
World 7 MHz Phone	Jim Rafferty, N6RJ Memorial — Cayman ARS	YY4DNN
World 14 MHz Phone	Don Wallace, W6AM, Memorial Award	KP2MM (N2TTA, op)
World 28 MHz Phone	North Shenandoah DX Association NS4DX	TO1A (F5HRY, op)
World Single Operator Phone QRP	Bill Parker, W8QZA	YW2LV (YV5YMA, op)
World Single Operator Assisted, High Power Phone	Southern California DX Club	CE3CT
Asia Multioperator Single Transmitter, High Power Phone	Yankee Clipper Contest Club	JA8RWU
North America Multioperator Single Transmitter, High Power Phone	Nick Lash, K9KLR	VP5H
World Multioperator Two Transmitters Phone	W6NL and K6BL	PJ4G
W/VE Single Operator High Power Combined Score	National Contest Journal	VY2TT (K6LA, op)
W/VE Single Operator Low Power Combined Score	In Memory of Fred Gern, K2FR — Rochester DX Association, Inc.	N1UR
Japan Single Operator Low Power Phone	Western Washington DX Club	JH4UYB
Seventh Call Area Single Operator High Power Phone	Willamette Valley DX Club	K5RR
World Multioperator Unlimited Phone	Stanley Cohen, W8QDQ	HK1NA
World Single Operator Low Power Combined Score	C. Sharp, K5DX Memorial by the Texas DX Society	J88DR (G3TBK, op)
Canada Single Operator Low Power Phone	Contest Club Ontario	VE3NB

Bob Raymond, WA1Z, teamed up with Kurt Pauer, W6PH (not shown), as the two contest veterans took control of the MSL category as VP9I for a win from VP9GE's fine Bermuda station. [Kurt Pauer, W6PH, photo]

from Caribbean stations but the team effort by XE7S team was noteworthy: HK1NA (354), PJ2T (346), PJ4G (341), VP5H (338), XE7S (320). Just out of the top five were TI8M and CS2C so the wealth is definitely being shared!

Extended Results

Look to the online extended version of these results (**www.arrl.org/contest-results-articles**) for more commentary and the following features:

- The story of the first fully-remote Multi-Multi at K4VV
- A complete table of Top Ten boxes since 2002
- Changes in QSOs and multipliers compared to the halcyon year of 2002
- More detail about how category entry levels change from year to year
- Collected soapbox comments from W/VE and DX logs

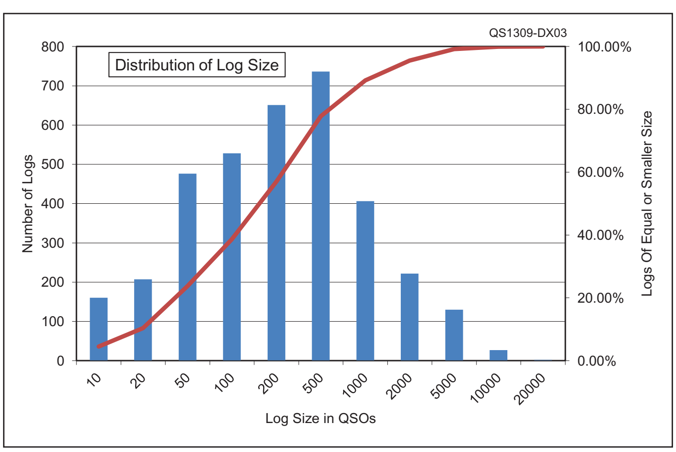
Volunteer authors have created a complete set of division, regional and continental write-ups to take a close look at the competition in your area, including the Caribbean's annual conflagration of contesting, plus a look at both the Phone and CW contests from Europe by OH2BH.

The ARRL Soapbox web pages (**www.arrl.org/soapbox**) contain more photos and stories, too. Even more Soapbox commentary is compiled by Dink, N7WA, from the popular 3830 score posting website at **www.eskimo.com/~mwdink/3830** and he has created simple apps for devices running the Android operating system. Go to your online app store and search for N7WA.

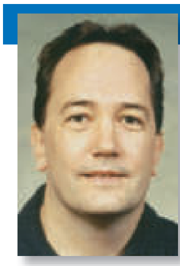
Wrapping It All Up

As this article goes to press, there are conflicting predictions about the future of Solar Cycle 24 and of solar cycles, generally. Some expect another peak similar to 2011-12 to occur late this year or early next. Others say the fall and winter of 2012-2013 was as good as it's going to get. I suspect that the only way to really tell will be to turn on your radio during the two weekends of ARRL DX 2014 (15-16 Feb and 1-2 Mar) and log what you hear.

And your 2014 contest author will be someone new after my dozen years at the keyboard. I figure that a solar cycle is long enough to have my say and return to the ranks of those making the news instead of reporting on it. In particular, I appreciate the support of the numerous volunteers who have contributed to the online write-ups with sidebars and regional analysis. Don't forget to say "Thanks!" to them and to any of the log checkers, robot wranglers and certificate printers who do all the paddling under the water where you can't see it!



57% of all logs have 200 or fewer QSOs, making up the majority of all contest entries and reinforcing how important it is that participation from modest stations and part time operators remain healthy!



Bernie McClenny, W3UR, w3ur@arrl.org

Ethiopia

QS1309-HDX01

After the passing of Sid May, ET3SID, ET3AA continues to grow and participate in the IARU HF World Championship.

Ethiopia, aka the Federal Democratic Republic of Ethiopia, is located on the Horn of Africa and is the second most populated country on the continent. Despite a population of more than 84 million people, currently, no nationals have an ET Amateur Radio license. Sid May, ET3SID (SK), a Scottish expatriate, wanted to bring ham radio to the Ethiopians and he established the Ethiopian Amateur Radio Society (EARS) and its club station ET3AA in 1993.[1]

Several requirements make it difficult for nationals to obtain an ET Amateur Radio license. First they need to have a license and they have to pay a fee, which isn't easy given the current financial situation in Ethiopia. Next the operator has to have their own radio. They cannot use someone else's radio as the equipment is attached to a specific license. For example, those operating the club radio must use ET3AA. Finally, they have to pay a fee of more than 100% of the value of the equipment.

[1]J. DeLoach, WUØI, "Amateur Radio in Ethiopia," *QST*, Mar 2012, p 68.

Despite these difficulties about 2 years ago more than 50 students, some who have since graduated, have passed their American Amateur Radio tests thanks to the help of David Collingham, K3LP, and others. Some of the students continue to show interest by operating at the University's club station, ET3AA, and others have gone on to do other things in Amateur Radio.

Over the last two decades Sid May, ET3SID; G4CTQ and AB3OZ, was the leading force behind the Amateur Radio banner within Ethiopia. He continued this work until his passing in September of last year. Ken Claerbout, K4ZW, has been to Ethiopia several times on work assignments and has picked up Sid's banner. While there he not only got on the air, but also helped students at Addis Ababa University's Institute of Technology. Here is an update from him.

ET3AA Update

Ken Claerbout, K4ZW

I recently visited Ethiopia and dropped by the ET3AA club station located at the Addis Ababa University, Institute of Technology. The timing of my visit was not optimum for the students because they were finishing their final exams and, for several of them, senior projects too. Nevertheless the turnout was good and we accomplished a lot.

Tsegaye Atsbaha, KB3WWJ, installs a 10/12 meter modification in the ET3AA Ameritron amplifier as Dagi Solomon, KB3WWY, (foreground) and Getu Zeleke, KB3WWU, assist.

The operating position left a lot to be desired. It was cramped and not very user friendly. We moved a nice desk into position and that will make the station much more functional and fun to operate. A new computer was installed so contacts can be logged in real time. If I had not forgotten the serial cable, we would have had the PC controlling the transceiver. Thanks to the generosity of the Virginia DX Century Club (VADXCC) of Virginia Beach, Virginia, the station has a new Heil Pro Set headphone/boom microphone and foot switch. VADXCC also donated money to help with QSLing costs.

Contest software was loaded on the new PC in preparation for the IARU contest in July. The students are extremely excited about operating the contest as a team and several said: "We need to work hard so we can win." The students have installed an upgrade from Ameritron that allows their solid state amplifier to operate on 12 and 10 meters.

One of the students has been studying wire antennas and wanted to build a dipole for 40 meters. I gave him some guidance but let him do the calculations, soldering and installation. Once it was up I showed him how to

Getu Zeleke, KB3WWU, operates on 15 meters SSB from the ET3AA club station.

Getu, KB3WWU, proudly showing off the 40 meter dipole he built.

measure SWR and trim the antenna. I received a report several days ago that he was able to work Eastern Europe with this antenna! That, and the reception of broadcast stations, left him with a big smile and the desire to experiment further.

The biggest challenge is patience; not jumping in right away because I know what to do. The best way for them to learn is to let them do it for themselves. For many of us, years have passed since we first experienced the magic of putting up a wire and working stations in foreign lands. This is all new to many of these students; but hopefully, it will fuel their interest and create lasting memories.

The current status of the station is good but there are always improvements that can be made. The university has pledged their continued support and the government continues to renew the license since ET3SID's passing. The challenge, of course, is keeping the students engaged and the station relevant, especially to new members, since some of the more active members will be graduating soon.

Hopefully, someday these students will be able to obtain their own ET3 call signs and even be allowed to have home stations. The Ethiopian government has been opposed to this but efforts continue to convince them otherwise. For many of us, Amateur Radio opened up a new world of opportunities. It is my hope that the same thing will happen for these young people. They have so much potential and just need the right opportunity. It would be a great way to carry on the wonderful legacy started by Sid May, ET3SID (SK).

ET — Future

So as you can see, things are slowly progressing for Amateur Radio in Ethiopia thanks to people like ET3SID; Dave, K3LP; Ken, K4ZW, and others. As I am putting this column together K4ZW is about to return to Addis Ababa where he will be joining the students at the ET3AA club station for the IARU HF World Championship. It will be great to see the EARS Headquarters station being represented by ET3AA on July 13-14, 2013.

One other person who deserves recognition is Bob Schenck, N2OO. He has been handling the QSLing duties for the ET3AA club station. He does not have all the logs, so it might be a good idea to e-mail him first if your contact is more than a year old (see ET3AA on QRZ.com for complete details). So hats off to the unsung heroes who have been working diligently to help the Ethiopian people enjoy the great opportunities of ham radio.

Second Peak in Cycle 24?

In June I attended the Potomac Valley Radio Club's meeting where my next door neighbor Frank Donovan, W3LPL, did a presentation on "Propagation Trends for 2013-2014." Frank talked about the possibilities of a second peak for Cycle 24. Whether you are a 6 meter operator, HF DXer or contester you will be interested. A version of this excellent presentation (done at Contest University) can be found on YouTube at **www.youtube.com/watch?v=ioXTt_i44_4**.

After a hard day's work it's time for pizza, burgers, salad and drinks as David, KB3WWI; Dagi, KB3WWY; Getu, KB3WWU, and Tsegaye, KB3WWJ, relax.

Potential DX for September and October

September and October should be very good for upcoming DXpeditions. Sometime between September 20 and October 20 K9W will operate as a multiop DXpedition from Wake Island (**www.wake2013.org**). 3B9EME will be on from Rodrigues Island, mostly on EME but also some HF is planned from September 1-9. 9M6DXX, is leading a multiop effort to Laos (XW) from September 6-16. See last month's column for more information.

JA1NLX is going to Papua New Guinea as P29VNX from September 7-14 (**www.asahi-net.or.jp/~yy7a-ysd/P29VNX-2013.htm**). LZ1GC and 3D2DD will be QRV from Rotuma Island between September 27 and October 11 (**3d2gc.com**). VK2CCC is heading back to Lord Howe Island as VK9LL September 22-29. G3RWF will again be on the air as 5X1NH in Uganda from September 24 through most of November before going to Rwanda as 9XØNH.

The Dutch are going to TN2MS in Congo from October 12-24 (**www.tn2ms.nl**). Sable Island is expected to be QRV as CYØP from October 1-11 (**www.cy0dxpedition.com**). The Italians are using special call TO2TT from Mayotte (FH) from October 3-17 (**www.i2ysb.com**). Another multiop effort will be heading to Mozambique where they will activate C82DX starting in mid-October (**c82dx.com**).

And to top all that off we have the CQ WW DX SSB Contest the last weekend of October. So, as you can see, there is plenty of DX to be worked and conditions should be great, especially on the high bands. Check out the websites and watch your favorite DX publication for updates and breaking news of other upcoming DXpeditions.

Photos courtesy of Ken Claerbout, K4ZW.

Wrap Up

That's all for this month with a special thanks to K4ZW, K3LP and *The Daily DX* for helping to making 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 16-Aug 18, 1500Z-2100Z, W9S, Baraboo, WI. Yellow Thunder Amateur Radio Club, Inc. **Badger Steam & Gas Engine Club 50th Anniversary Annual Show**. 14.240 7.240. Certificate. Yellow Thunder Amateur Radio Club, PO Box 202, Baraboo, WI 53913. **www.yellowthunder.org**

Aug 17, 1400Z-1830Z, K9EAM, Green Bay, WI. Green Bay Mike & Key Club. **Tall Ships in Green Bay**. 21.370 14.270 7.270; PSK31 14.070. QSL. Dave Catalano, N8KQS, 2937 Beth Dr, Green Bay, WI 54311. **www.k9eam.org**

Aug 17-Aug 18, 1300Z-2359Z, K1AOM, Portsmouth, NH. Radio Adventurers of Maine. **USS *Albacore* Memorial**. 18.135 14.260. Certificate & QSL. Mark Burton, 200 Purkis Rd, Buckfield, ME 04220. **k1aom.us**

Aug 17-Aug 18, 1521Z-1520Z, W2GSB, West Babylon, NY. Great South Amateur Radio Club. **Fire Island Lighthouse**. 21.170. QSL. Bob Myers, PO Box 1356, West Babylon, NY 11704. **www.gsbarc.org**

Sep 1-Sep 30, 0001Z-2359Z, WQ8CWA, Newark, OH. QCWA Mid-Ohio Chapter 212. **10th Anniversary**. 21.365 14.262 7.244 3.810. QSL. Bob Cashdollar, 1319 Granville Rd, Newark, OH 43055. SASE not required. **www.qrz/db/wq8cwa**

Sep 5-Sep 10, 1514Z-1514Z, WA4TRS, Fletcher, NC. Road Show Amateur Radio Club and Western Carolina Amateur Radio Clubs. **North Carolina Mountain State Fair**. 50.130 18.135 14.270 7.248. Certificate & QSL. Road Show Amateur Radio Club, 57 Echo Lake Dr, Fairview, NC 28730. Complete list of frequencies and updates **theroadshowarc.com**

Sep 7, 0800Z-1400Z, W8NCK, Fremont, OH. Sandusky Valley Amateur Radio Club. **Ohio State Parks on the Air**. 7.240. QSL. John B. Stahl, 1700 County Rd 157, Fremont, OH 43420. **johnbstahl@gmail.com**

Sep 7, 0900Z-2100Z, W4P, Viper, KY. KY Mountains Amateur Radio Club. **Battle of Lake Erie Bicentennial Station**. 14.300 7.200 3.815; PSK31 14.070; CW 14.036. Certificate. John Farler, 1264 Hall Mountain Rd, Viper, KY 41774. **kmarc.net**

Sep 7, 1200Z-2000Z, K4V, Louisa, KY. Big Sandy Amateur Radio Club. **US Chief Justice Fred M. Vinson Memorial**. 14.280 7.275. QSL. Joe W. Compton, 123 2nd St, Louisa, KY 41230. **k4pga2@gmail.com** *or* **www.bsarc.org**

Sep 7, 1600Z-2200Z, N9D, Chesterton, IN. Lake County Amateur Radio Club. **Indiana Dunes — Indiana Parks on the Air**. 14.260 7.225. QSL. Lake County Amateur Radio Club, W9LJ, PO Box 90, Crown Point, IN 46308. **www.w9lj.org**

Sep 7, 1600Z-2359Z, W8C, Corwin, OH. West Chester Amateur Radio Association. **125th Anniversary of Corwin OH Circus Train Wreck**. 21.350 14.250 7.250. QSL. Mike Braun, PO Box 913, West Chester, OH 45071. *Also working the Ohio State Parks on the Air on the same day.* **wc8voa.org**

Sep 7, 1700Z-2200Z, W7K, Logan, UT. The City of River Heights Emergency Radio Operators. **Apple Days Amateur Radio Demonstration**. 14.260 7.200. QSL. Quentin Gardner, 709 E 350 S, Logan, UT 84321. **www.qrz.com/db/w7k** *or* **www.riverheights.org**

Sep 7-Sep 8, 1500Z-0500Z, VE7SUN, Delta, BC, Canada. Delta Amateur Radio Society. **Harris Barn Restoration**. 21.250 14.200. Certificate & QSL. Harris Barn Special Event Station, c/o 11655 95 Ave, Delta, BC V4C 3T5, Canada. Full details at **www.deltaamateurradio.com**

Sep 7-Sep 15, 0000Z-2359Z, W6JBT, San Bernardino, CA. Citrus Belt Amateur Radio Club. **Route 66 On The Air Special Event**. 28.466 14.266 7.266 3.866. Certificate & QSL. Citrus Belt Amateur Radio Club, PO Box 3788, San Bernardino, CA 92413. *18 clubs across the nation are participating in this event using the call signs of W6B–W6T. Full info at* **www.w6jbt.org**

Sep 8-Sep 22, 1600Z-0000Z, W6A, San Francisco, CA. San Francisco Radio Club. **America's Cup Finals**. 21.275 14.275 7.255 3.875. QSL. Tony Dowler, K6BV, PO Box 1749, Pacifica, CA 94044. . *Some weekday activity may occur but look for us 3 consecutive weekends; additions and corrections at* **www.sfarc.org**

Sep 12-Sep 14, 1300Z-2200Z, K4S, Sapelo Island, GA. Kennehoochee Amateur Radio Club. **IOTA NA058, Lighthouses USA738 and USA1014**. 28.030 21.030 14.030 7.030. QSL. Kennehoochee ARC, PO Box 1245, Marietta, GA 30066. *160-10 meters CW, SSB, RTTY and PSK. QSL via LoTW, eQSL or direct.* **www.w4bti.org**

Sep 13-Sep 14, 1600Z-2359Z, W2W, Plattsburgh, NY. Champlain Valley Amateur Radio Club**. Battle of Plattsburgh Commemoration**. SSB 28.390 21.360 14.290 7.190; CW 28.190 21.140 14.060 7.030. QSL. John Jerdo, KA2WQK, 18 Sandy Pines Tr Prk, Keeseville, NY 12944. **www.cvarc.us**

Sep 13-Sep 15, 0800Z-1159Z, K4Y, Tompkinsville, KY. Monroe County Amateur Radio Group. **Old Mulkey Meetinghouse Special Event**. 28.415 14.260 7.225, KD4QHG Link (Echolink 471541). Certificate & QSL. Mark D. Warren, 400 Martin Subd, Tompkinsville, KY 42167. *The 13th is kids day; please be patient with the kids when you hear them.*

Sep 13-Sep 15, 1400Z-2100Z, NWØAA, Angle Inlet, MN. Northwest Angle Amateur Radio Club. **Northwest Angle Recognition**. 14.240 7.200 3.930 DIGI. Certificate & QSL. Dan Whipple, 11726 Norway St NW, Minneapolis, MN 55448. **qrz.com/nw0aa**

Sep 14, 1400Z-2100Z, N4C, Spivey's Corner, NC. Sampson County Amateur Radio Service. **National Hollerin' Contest**. 14.264 7.264. Certificate. Cliff Ireland, 170 Pinecroft Dr, Dunn, NC 28334. **www.nationalhollerincontest.com**

Sep 14, 1400Z-2200Z, W8VP, Cambridge, OH. Cambridge Amateur Radio Association. **National Road & "S" Bridges — 185 years old**. 14.260 7.235. Certificate & QSL. Cambridge Amateur Radio Association, PO Box 1804, Cambridge, OH 43725. *9th Special Event in CARA's year-long 100th Birthday Celebration. QSL. Certificate for anyone who works* all *12 monthly events.* **www.w8vp.org**

Sep 14-Sep 15, 1500Z-2100Z, N1NBQ, Nantucket, MA. Nantucket ARES. **Nantucket County Fair**. 28.400 21.365 14.250 7.232. Certificate. N1NBQ, PO Box 727, Nantucket, MA 02554. *Rare grid square FN41FX.* **gatv@comcast.net**

Sep 18-Sep 22, 0000Z-2359Z, K4MIA, Loxahatchee, FL. PBSE Radio Society. **National POW/MIA Recognition Day**. 21.300 18.150 14.265 7.185. QSL. Michael Bald, 6758 Hall Blvd, Loxahatchee, FL 33470. *Please take time to honor our POWs/MIAs on Fri Sep 20.* **www.qrz.com/db/k4mia**

Sep 20-Sep 21, 1700Z-1700Z, W0S, Bloomfield, MO. Bootheel & SEMo Amateur Radio Clubs. **Stars & Stripes**. 28.450 14.260 7.260 3.950. Certificate. Stars & Stripes, PO Box 98, Jackson, MO 63755.

Sep 20-Sep 22, 2200Z-1800Z, K5P, Plano, TX. Plano Amateur Radio Klub. **Plano Balloon Festival Special Event Station**. 14.250. QSL. Stan Starks, 732 Eagle Lake Ct, Allen, TX 75002. **www.k5prk.net**

Sep 21, 1600Z-2359Z, WC8VOA, West Chester, OH. West Chester Amateur Radio Association. **69th Anniversary of the Dedication of the Voice of America Bethany Relay Station near Cincinnati, Ohio**. 21.350 14.250 7.250. Certificate & QSL. Mike Braun, PO Box 913, West Chester, OH 45071. **wc8voa.org**

Sep 21-Sep 22, 1400Z-2200Z, K4EG, Burlington, NC. Alamance Amateur Radio Club. **2013 Carousel Festival**. 14.265 14.059 7.235 7.055. QSL. Alamance Amateur Radio Club, K4EG, Carousel Festival, PO Box 390, Elon, NC 27244. **www.k4eg.com** *or* **cwfun.org/funspots/carousel**

Sep 21-Sep 22, 1600Z-0600Z, N7S, Scappoose, OR. Columbia Amateur Radio Association. **Scappose Sauerkraut Festival**. 21.320 14.240 7.245 3.960. QSL. CARA, PO Box 13, Saint Helens, OR 97051. *Other frequencies/bands and digital modes may be used.* **www.colemer.org/CARA.HTML**

Sep 21-Sep 22, 1700Z-1700Z, VE7RC, Salmon Arm, BC, Canada. Shuswap Amateur Radio Club. **Copper Island CISA Activation**. 14.210 14.110 7.210 3.810. QSL. Ron Essex, PO Box 2613, Salmon Arm, BC V1E 4R5, Canada. *The first activation of the only island in Shuswap Lake — Grid Square DO00HV; qualifies for Canadian Islands Awards Program (CISA).* **www.sarc.ca/blog**

Sept 21-Sep 23 and Sep 28-Sep 30, 1300Z-0500Z, WØCXX/NØCXX, Cedar Rapids, IA; **W5ROK**, Richardson, TX; **W4CRC**, Melbourne, FL; **W6CXX**, Tustin, CA. Rockwell Collins Amateur Radio Club. **80th Anniversary of the Collins Radio Company**. HF and 6 m; CW AM SSB. Certificate & QSL. Steve Larson, N3SL, 22 N Hidden Acres Dr, Sioux City, IA 51108. *Several stations participating. Primary operating hours 0900 to 2400 local time for each station as operators are available. Work 3 different stations for certificate.* **www.w0cxx.us**

Sep 22, 1200Z-1700Z, W8DYY, Miamisburg, OH. Mound Amateur Radio Association. **MARA Annual Swap Meet**. 14.235. QSL.

Mound ARA, PO Box 1262, Miamisburg, OH 45342. **www.w8dyy.org**

Sep 22, 1500Z-2200Z, W9PVR, Richland Center, WI. Pine Valley Repeater Amateur Radio Club. **Qualifying Long Island (WI051) in the Wisconsin River near Lone Rock, WI**. SSB 14.250 7.250; CW 14.030; PSK31 14.070. QSL. Josh Roskos, KC9WWH, 306 Fremont St, Boscobel, WI 53805. **www.w9pvr.com**

Sep 26-Sep 28, 1322Z-1322Z, K5C, Lawton, OK. Lawton-Ft Sill Amateur Radio Club. **Comanche Code Talkers of WWI & WWII**. 50.125 21.295 14.295 7.295. Certificate & QSL. Lawton-Ft Sill Amateur Radio Club, PO Box 892, Lawton, OK 73502. **www.w5ks.org**

Sep 28, 0010Z-0015Z, KW6WW, Wrightwood, CA. Wrightwood Emergency Communications Group. **3rd Annual Hot Diggity Dog Day**. 40 80 20 10 meters. QSL. Alex Garibay, PO Box 168, Wrightwood, CA 92397. **www.kw6ww.com**

Sep 28, 1600Z-2000Z, K9UXZ, Effingham, IL. National Trail Amateur Radio Club. **Old Settler's Reunion**. 14.250 7.250. Certificate. National Trail ARC, PO Box 903, Effingham, IL 62401.

Sep 28-Sep 29, 1000Z-1630Z, N4WIS, Virginia Beach, VA. USS *Wisconsin* Radio Club. **USS *Wisconsin* Final Decommissioning**. 14.264 7.264. QSL. N4WIS, USS *Wisconsin* Radio Club, PO Box 6682, Virginia Beach, VA 23456. **www.n4wis.org/n4wis/index.php**

Sep 28-Sep 29, 1421Z-1420Z, K5DR, Lafayette, LA. Lafayette Amateur Radio Repeater Club. **Celebrating 145 years of Tabasco Brand Pepper Sauce Spicing up the World**. 21.280 14.280 14.070 7.280. QSL. Glen Thibodeaux, KF5FNP, PO Box 92110, Lafayette, LA 70509. *All frequencies and modes at* **www.qrz.com/db/k5dr**

Sep 28-Sep 29, 1900Z-0400Z, WE7GV, Sahuarita, AZ. Green Valley Amateur Radio Club. **19th Annual Fiesta Sahuarita**. 14.246 14.244 14.242. Certificate & QSL. Green Valley Amateur Radio Club, 601 N La Canada Dr (SAV), Green Valley, AZ 85614. **gvarc.us**

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.

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**.

Strays

Helvetia Telegraphy Club offers Morse Code Training Software and Proficiency Awards

To encourage more amateurs to learn Morse code, the Swiss Helvetia Telegraphy Club is offering Morse code proficiency awards in the form of attractive lapel pins. Applicants must first download and install the *HQX Morse Code Training Software* for *Windows* developed by club member Beat Oehrli, HB9HQX. Using the software, applicants must pass a Morse code exam at one of three speeds: 80, 100 or 120 characters per minute (16, 20 or 24 words per minute). Successful applicants who submit test files for validation will receive PDF certificates and will be eligible to purchase lapel pins for $11 US each. For complete details see the Helvetia Telegraphy Club website at **www.htc.ch/en/node/438**

"Stack Exchange" Needs Your Help

Serge Stroobandt, ON4AA, is asking fellow amateurs to support the establishment of an Amateur Radio section within "Stack Exchange." Stack Exchange is a combination Internet forum, wiki, blog and poll. It is a question and answer site that is much more qualitative and easier to search than an ordinary Internet forum. The Stack Exchange administrators will not open a new Q&A section until they are sure that a critical mass of members will commit to actively participating. Interested amateurs are asked to see **http://area51.stackexchange.com/proposals/43029/amateur-radio/**.

Two Presidents at a Moment in History

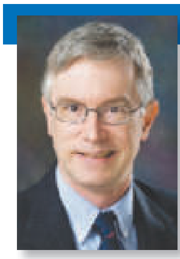
ARRL President Kay Craigie, N3KN, traveled to England to join her counterpart, Radio Society of Great Britain President Bob Whelan, G3PJT, in celebrating the RSGB's 100th birthday. Craigie stated, "Every country needs a tireless advocate for Amateur Radio within its own boundaries, such as the ARRL in the US and the RSGB in the United Kingdom. No single Amateur Radio society can mount the kind of advocacy effort necessary at the international level to protect and advance the interests of Amateur Radio. However, working together under the auspices of the International Amateur Radio Union, the ARRL, the RSGB, and other national societies have been able to achieve positive outcomes for Amateur Radio worldwide. This has been true in the first century of the ARRL and the RSGB and will continue as our two organizations begin a second century of service to Amateur Radio and our members."

NYC and the World of Radio

Phil Brown, WE7A, alerts members to an online podcast titled "#137 NYC and the World of Radio." This particular podcast features the rich radio history of New York City and includes a mention of Amateur Radio. You'll find the podcast at **http://boweryboys.libsyn.com/-137-nyc-and-the-world-of-radio**.

American Legion HF SSB Net

The American Legion Amateur Radio Club (TALARC) conducts an HF SSB Net the second Saturday of each month at 1700Z at 14.310 MHz. United States veterans from all wars and their family members are encouraged to check in. While being a member of the American Legion is encouraged, it is not a prerequisite for checking into the net. A club website is maintained at **www.legion.org/hamradio**.



Jon Jones, NØJK, n0jk@arrl.org

Comments on the 4 Meter Band

6 and 4 meters present some interesting crossband opportunities.

I received more comments regarding the July WA50 column's lead "The 4 Meter Band — A New Challenge for VHFers?" than any other to date.[1] There is a lot of interest out there. Leif, LA9BM, mentioned that the new Icom 7100 will include 70 MHz in its European version. He also notes the excellent 4 meter antennas from InnovAntennas. They also make 6 meter designs (**www.innovantennas.com**).

Emil, W3EP, reminded me of the crossband work between 4 and 6 meters. This is one way for Canadian and stateside operators to participate on 4 meters. From the US, one would transmit to Europe on 6 meters and receive on 4 meters. Some may remember back in Solar Cycle 21, before many European countries had 6 meter allocations, US hams would transmit on 6 and listen on 10 meters for Europe. Emil compiled a list of East Coast 6 meter operators with 4 meter receivers (see Table 1).

Emil suggests transmitting to Europe on 50.185 MHz and listening on 70.185 MHz when conditions appear favorable. E_s would be the most likely mode, but crossband contacts have been made via F2. If Solar Cycle 24 takes off this fall, the months of November and December would be the most likely time for F2 to Europe. The ON4KST region 2 chat page (**www.on4kst.com/chat**) is a way to coordinate cross band activity. Emil says the following Icom radios will receive on 4 meters: IC-706, FT-847, IC-7000 and IC-7100 as well as several Icom communications grade receivers.

Brian, WA1ZMS, has a new beacon operational on 4 meters — WG2XPN on 70.005 MHz. The Transmit frequency is 70.005 MHz CW. Effective Radiated Power is 3 kW from a 3 element Yagi at 15 meters high, aimed at 60° azimuth. The grid is FM07fm.

This beacon has already provided some amazing results as this letter from Joe, CT1HZE, attests:

> Brian, WA1ZMS:
> Your WG2XPN 4 meter beacon was received July 7, 2013 in GJ, DL, I, and ISØ.
> This is amazing! Distances > 7,000 km!
> I think we have seen for the first time clearly four hops via E_s on 4 meters today.
> Joe, CT1HZE

On the Bands

50 MHz. "It was the best of times, it was the worst of times..." — C. Dickens, *A Tale of Two Cities.*

The month of June was a tale of two very different 6 meter bands. One brought amazing Far East, South American and South Pacific DX to well equipped DXers. The other 6 meter band was on vacation during the June VHF Contest and for much of the month. Which 6 meter band you encountered depended on when you were on and the performance of your station.

The month started out well. On June 1 there was aurora and a strong opening to South America. The aurora opening was mostly for northern tier stations. Dan, KF6A (EN73) had good copy on the WBØRMO and NØLL beacons via aurora. He sent me an interesting recording of Larry's beacon.

Some aurora E_s appeared and Dan, KF6A, worked KL7KY at 0555 UTC. W9EWZ (EN52) worked Garth, VE8NSD (DP20) at 0604 UTC and Lefty, K1TOL (FN44) snagged KL7KY at 0639 UTC. The following afternoon K1TOL (FN44), KA9CFD (EN40), N3DB, K2MUB and VE2XK (FN07) all logged Javi, LU5FF around 1900 UTC. Later NØLL (EM09) logged 9Y4D at 2109 UTC, P43A at 2122 UTC and YV1DIG at 2151 UTC. Dan, KF6A, also worked many of the Caribbean and South Americans. Bill, KØHA (EN10) worked CO, FG, P4, WP4, YV, 6Y and 9Y.

That evening Ed, N5DG, caught a great opening to Japan, logging 38 JAs. KØHA heard some of the JAs very weak. Sunday was good for DX as well. Mike, K7ULS, operating portable in Utah made 55 stateside contacts plus XE2JS, XE2X, XE2WK, CO2QU, CO2 and ZF1EJ. N7CW operating from the rare grid DM36 Sunday morning June 2 delighting FFMA grid chasers. NØJK mobile in EM28 logged CO2QU (EL93) at 0044 UTC on the 3rd. The E_s seemed to dry up after the first weekend of June.

Things picked up with aurora June 7 and the WØW grid expedition to EN48. They logged many stations that evening in the 8th and 9th call areas. Bill, KØHA (EN10), was busy during the aurora. He gave K9PG his first ever aurora contact on 6 meters. "My first ever AU QSO...pretty cool...sorry for being so weak...I'm working with a little 3 el Yagi up about 17 feet here." — Paul, K9PG (EN53). The next day Bernie, W3UR (FM19), and Rick, NE8Z, worked rare HC1HC! Rick has operated numerous times from Ecuador as HC1MD, but HC1HC was his first HC on 6 meters from Michigan.

The Saturday of the ARRL June VHF contest was a disappointment for many with few E_s reported. But 6 meters can sometimes surprise even during mediocre conditions. An E_s opening occurred Saturday evening of the contest from the Midwest to the West Coast. In the midst of this opening to California, Jay, KØGU (DN70) worked ZL3NW at 0136 UTC June 9 and the real prize — E51WL at 0152 UTC for a new country. Possibly an E_s - TEP/F2 opening of the same type as the VK4MA opening in May. Chuck, NA6XX (CM97), found Li, BA4SI, at 0013 UTC. "My keyer hand was shaking when the QSO with Li was finished. Not sure I could have sent a report 5 minutes after the QSO!"

E_s was better on Sunday with the band open

[1] J. Jones, NØJK, "The 4 Meter Band — A New Challenge for VHFers?," *QST*, Jul 2013, pp 91-93.

Table 1
North American Stations with 4 Meter Receive Capability

Call	Grid
VE2DFO	FN25VJ
W1IPL	FN54FC
K1SIX*	FN43AD
W1JR	FN42EV
W1JJ*	FN41GP
W1XX	FN41EJ
W3EP*	FN31VP
WB4SLM	EM82DP
KE4WBO	EL96VW

to W4 Sunday morning and later to W7 from the Midwest. K7TM/p (DN42) was very loud for over 2 hours to EN20 where NØJK was portable. From Oregon, WB8VLC (CN84), worked WL7N (CO45), with a 59 signal while in his car in the garage. But for most, the June contest was more like the September event.

On June 11 Fred, KH7Y, Hawaii worked a loud Li, BA4SI, at 2323 UTC. A rare European opening for the Pacific Northwest occurred on the 12th. K7CW worked S59A (599), HA5JI, ON4GG, DL8YHR, DG1CMZ and S57RR. Paul, K7CW, achieved DXCC on 6 meters with his contact with Dale, CE2AWW. A huge accomplishment from the Pacific Northwest. WD5COV (DM62) "worked DL8YHR for a new country and shortly followed with Qs to DL9USA and DG1CMZ. This all happened around the 1800 UTC hour mark. I also heard a SV station but did not complete a QSO." N7NW found PA2M at 1807 UTC. The opening included Texas. Ed, N5DG (EM20) worked S57A and S57RR around 1835 UTC. Bob, K6QXY, worked "DL8YHR, S59A, 9A8A, ON4GG and PA2M. I heard IK5MEJ for a long time but no QSO, I also heard S57RR."

Dave, N7DB, commented on this rare opening "The footprint in the West June 12 covered a wide area. N7CW (DM34) was the farthest southwest. K6QXY (CM86) and N6ML (CM97) were in on the opening this morning."

The strongest part of the path seemed to favor CN87. K7CW got the best of it working IK5MEJ at 1625Z (first contact from the Pacific Northwest this morning), then S59A at 1630Z, HA5JI at 1638Z, ON4GG at 1704Z, PA2M at 1747Z, DL8YHR at 1750Z and S57RR at 1811Z. Paul also reported the VE8WD/b 599+++ at 1740Z.

Hal, N7NW (CN87), worked S59A at 1642Z, ON4GG at 1707Z, DL8YHR at 1750Z, PA2M at 1755Z and finally S57RR at 1810Z.

Lew, W7EW (CN84), worked eight stations with his "fabulous" array from Salem, Oregon. Lew heard Costas, SV1DH, on 50.088 do a full CQ sequence, but he changed frequency and vanished. Here are what some of the EU stations posted for W7EW: ON4GG, 559 @ 1700Z; DF1YQ, 579 @ 1708Z; IK5MEJ, 1751Z; OK1DO, 559 @ 1822Z; DG1CMZ, 539 @ 1836Z, and DL5MAE was hearing W7EW @ 1851Z. KF7PCL (CN76) on the Washington Coast worked ON4GG at 1747Z and heard S57RR later.

John, W7KNT (DN26), in Montana reported S57RR at 1829Z. Earlier John heard VE7FG/b via backscatter at 1725Z. KE7V (CN88) heard UT5URW at 1644Z.

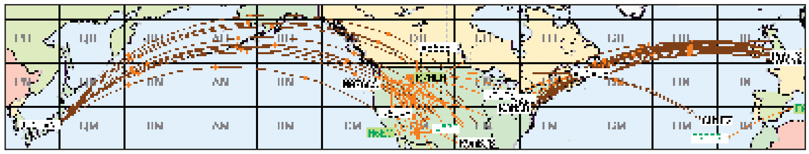


Figure 1 — June 14 produced a tremendous opening between North America, Europe and

Also out West, N6ML (CM97), reported S57RR @ 1634Z and S59A @ 1640Z. Bob, K6QXY (CM88), posted IK5MEJ @ 1627Z and DL8DHR @ 1646Z. N7CW (DM34) reported S59A @ 1708Z, HA5JI @ 1712Z and S57RR @ 1803Z. The band opened to Japan that afternoon for KØYW, KØHA, KCØCF, NWØW and others.

On June 14 via EME, Lance, W7GJ, worked Randson, BV2DQ, at 0219 UTC for Lance's DXCC # 187 (see Figure 1). Randson uses a kilowatt amplifier and a 6 element Yagi. Also on the UTC 14th, TF3ML set up an elaborate portable station in grid HP93 and gave many a rare Iceland 6 meter contact including Russ, K4QI (FM06). Tim, NWØW (EM47) logged him at 0025 UTC. Tim also heard OX3KQ.

On June 15 a huge JA opening occurred. Jay, KØGU, worked 93 JAs between 2222 UTC 6-14 to 0017 UTC 6-15. From DM99 in western Kansas using a T-11 log periodic Yagi (= 4 elements on 6 meters) Bruce, KØBJ, relates "At 2313 UTC I worked JE1BMJ who CQed. Then JA9SJI, JQ1TIV, JH1BZJ, JA1BK, JA1FNA, JN1IGJ, JR1GJP, JH1IIT, JF1IRW, JA2VFH, JH1HFQ, JK1AFI and JI1DMH to 2338 UTC on my CQs. Then I scanned and got JA1UAV at 2352. KØGU was working *up* 1 and had a large pile calling him, which I could hear pretty well."

Bruce, KØYW (DM67), caught the opening as well. "After listening for a bit, I worked VE6BBP in DO43, closely followed by W7TDZ in DN15 at 2246 UTC. I went to 50.097.5 and heard a good 579 CQ from JE1BMJ. I immediately called Han and received a 599 from him. I moved up a couple of kHz and started calling CQ. I had a good following, working: JA1FNA, JA1UAV, JA1DMH, JM1IGJ, JL1MTY, JH1BZJ, JR1GJP and JA2VFH at 2306 UTC just 15 minutes after hearing and working JE1BMJ. The E_s had to be really aligned as these stations were very closely located. I went on to work 18 more JAs, in the next hour. Propagation basically spread out and moved south and west from JA1 down the island chain into JA7, JAØ, JA3, JA4, JA9."

KCØCF (EN32) and NWØW (EM47) also worked Japan. NWØW worked JQ2VVH at 2341 UTC. Bill Hein, now AA7XT in DM59, worked 19 JAs running a K3 barefoot at 80 W to a 8 element LFA Yagi (see Figure 2) on a cranked down tower 10 feet high (due to high winds). Steve, W5KI, in Arkansas "worked 29 JA stations, primarily from 2312 UTC to 2356 UTC. I had heard and worked Han, JE1BMJ, earlier at 2236 UTC and he was still workable well after June 15/0000 UTC, the end of my run with other stations." He felt this was the best JA opening since June, 2006. K3PA in EM29 worked JA7QVI (QM08) at 0100 UTC. Han, JE1BMJ, worked VYØHL at 0015 UTC June 15. Han believes this is the first JA — VYØ and first JA to CQ zone 2, 6 meter contact! While the JA opening was in progress, N4DB worked MDØCCE at 2331 UTC.

The afternoon of the 15th, Dave, N9HF (EL99), worked TJ3SN Camer-oon at 2010 UTC for his DXCC # 94. He heard TJ3SN call CQ for over 45 minutes but TJ3SN made only two more stateside contacts.

Figure 2 — This is the antenna setup Bill Hein, AA7XT, used to work Japan on June 14-15 with 80 W! [Bill Hein, AA7XT, photo]

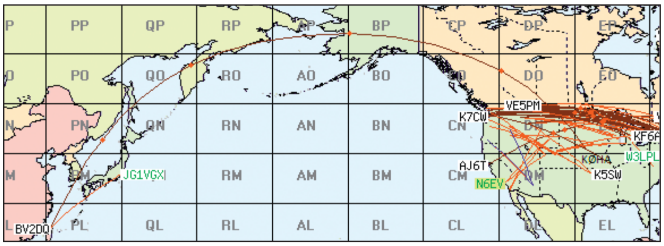


Figure 3 — On June 17 Bill, KØHA (EN10), worked Randson, BV2DQ, at 0050 UTC on 50.075 MHz. [**dxmaps.com**]

On June 17, Tim, NWØW (EM47), heard JL8GFB 599 and worked BA4SI at 2328 UTC the 18th (see Figure 3). Sam, K5SW (EM25), worked JL8GFB (QN03) at 0028 UTC on the 19th. A few minutes later, Jim W7OUU found BA4SI at 0036 UTC. Ed, N5DG (EM20), worked BV2DQ on June 21 at 0015 UTC. NWØW (EM47), caught a nice opening to GØGHC and others in Europe on the 20th.

June 23 was a big day to the Caribbean and South America for many. An unusual early morning opening from New England, W8 and W9 to Argentina started things off. K1SIX, W9RM (EN52) and others worked LU7FA around 1400 UTC. E_s was present in North America, but it was too early for TEP on to Argentina. Do you have any idea what happened? Jim, K6MIO/KH6, thinks it was possibly multihop E_s from North America down to northern South America. From there an F2 hop on to Argentina. The local solar time for the F2 hop would be around 10 AM. It is early winter in Argentina — a good season for F2 south of the geomagnetic equator.

Dave, VP2/W9DR, made many contacts via E_s. K4QI (FM06) worked EA8, FG, FM, V3, PA and OA4TT with good signals. A really rare South American country appeared — CP6UA. Many called but few made contacts. K4QI heard CP6UA for 2 hours with a good signal, but no luck. K9CT IL finally worked CP6UA at 1815 UTC. Bill, KØHA (EN10), heard PV8ADI very loud and had weak copy on CP6UA. Bob, K6QXY, worked the special South Korean 6 meter station 6M6M at 0051 UTC on the 27th.

The month ended with an unexpectedly strong (K_p 7) aurora June 28-29. It was not due to a CME impact or coronal hole solar stream. Rather "the geomagnetic storm that began late on June 28 occurred when the Earth passed through a region of south-pointing magnetism in the solar wind" — **Spaceweather.com**. Visual aurora was seen as far south as Kansas!

NØJK (EM28) was portable and worked WA9LFO (EN54) at 0107 UTC June 29 on 50.107 MHz. Many aurora contacts were reported (see Figure 4). K1TOL (FN44) worked MMØAMW via auroral E_s at 2234 UTC. As the aurora continued, an odd late night opening to Brazil occurred. K2AXX (FN12), K1RZ (FM19), KJ4E (EL98), and others worked PV8ADI (FJ92) around 0230 UTC. PV8ADI was back the next afternoon around 2000 UTC. A rare opening from the central USA to northern Europe took place around 1640 UTC June 30. KØGU (DN70) and KØHA (EN10) worked ES, OH and SM. KØHA logged OH1XX, OH2AUK, SM3GSK, ES1CW, ES2JL and SM5EDX. KØGU heard the OH1SIX/b 50 W to a turnstile antenna! Jay logged OH2BPU, OH3SR, OH1XT, OH2AUK, ES2JL, OH1ND, OH3DP, LY1CX, SM5EDX and ES6RQ between 1452-1654 UTC.

144 MHz QRP EME and 2 Meter E-Skip. Mike, K7ULS, Utah made 19 EME contacts June 1 with 13 "new initial contacts" using two 12 element Yagis and 350 W portable. WFØN (EM28) has made several EME contacts running just a single 12 element Yagi and 350 W. On the 26th WFØN worked VK5APN at 1256 UTC via EME.

E_s on 2 meters from Bobby, N3LL (EL86), Florida to KA9CFD (EN40) and KØOU (EM29) at 2100 UTC June 1. The band opened again at 2300 UTC and Bobby heard the NØLL/b 599+! Gary, NØKQY (DM98), caught an E_s opening on the 23rd to WP4O (EL87) and KD4ESV (EL87) at 2322 UTC. He lives 30 miles west of NØYK and credits Chad with "putting the fire back in the radio." Lance, W7GJ, worked 9XØEME via EME on the 26th. Also on the 26th, Jay, KØGU, worked VA7FC, VE7SL on E_s and K6MYC on FAI around 0430 UTC.

The strong aurora June 28-29 pleased many. W9EWZ (EN52) worked K2PQI, WV (FM09), W1AIM, VT (FN34) at 2311 UTC on the 28th and K3ZO, MD (FM18) for new states at 0027 UTC on the 29th. He noted the aurora peaked around 70 degrees azimuth. VE2DFO (FN25) worked W9EWZ (EN52) at 2250 UTC.

222 MHz. No aurora reports but Rick, WØRT (EM27), says a tropo contact with KF4WE (EM56) during the June VHF contest was his grid #51 on the band. Jay, NY2NY, has a new 222 MHz beacon on 222.055 MHz at FN30rx. It currently runs 5 W to a small Yagi pointed towards Boston. Reception reports to **jay@ny2ny.us**

1296 MHz. JD, NØIRS (EM29), heard the K5PJR/b (EM36) 559 1296.136 MHz on June 28 at 1138 UTC via tropo.

Here and There

The exceptional contacts made on the 6 meter band this summer deservedly get attention, but this column is about the other bands above 50 MHz as well. There is a lot of activity out there on UHF and the microwaves from reports appearing in KA1ZE's *205Morning Report*, when Stan published it. Please send me your reports.

Namibia, V5. Operators Hans, DF2UU, and Hardy, DF3GY, will be active as V55V from the shack of Martin, V51W, during the SSB Field Day (September 7-8th) and the Worked All Europe DX SSB Contest (September 14-15th). QSL via DJ8VC, by the Bureau or direct. Activity outside of the contest will include 6 meters using CW and SSB. (Thanks *Ohio/Penn DX Bulletin*)

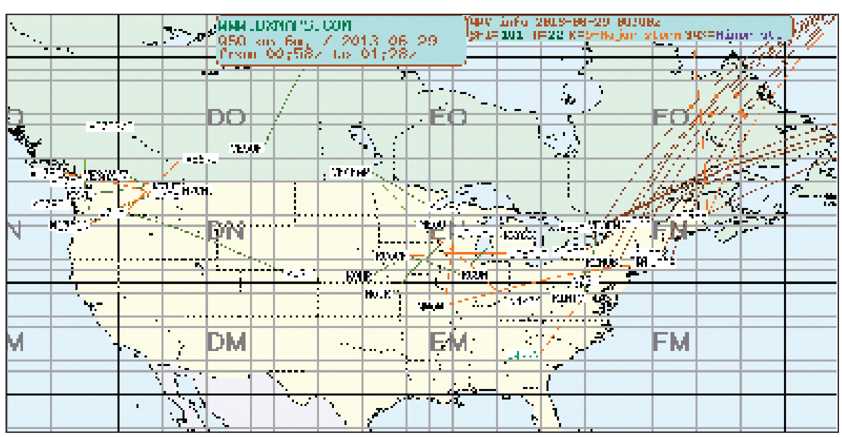


Figure 4 — An intense auroral opening helps many North American and English stations cross the pond. [**dxmaps.com**]

Mary M. Hobart, K1MMH, k1mmh@arrl.org

ARRL Foundation Presents the 2013 Scholarship Winners

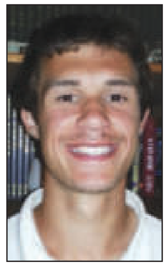
The ARRL Foundation is proud to present the winners of the scholarship awards for the 2013-2014 academic year. The value of the 82 scholarship awards for 2013 totals $110,600. These scholarship winners join the 2013 Goldfarb Scholarship winner, Calvin P. Darula, KØDXC, of St Bonifacius, Minnesota. The Board of Directors offers its heartiest congratulations to each of these bright young hams who represent the future of Amateur Radio. The application period for the 2014 Scholarship awards opens October 1, 2013.

Michael Almeter, W4MJA
Gwinnett Amateur Radio Society Scholarship

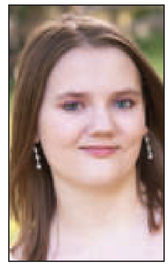
Chad Anderson, KG7AJA
Wilse Morgan WX7P Memorial ARRL Northwestern Division Scholarship

Michael Balourdas, KJ6FDA
Thomas W. Porter, W8KYZ, Scholarship Honoring Michael Daugherty, W8LSE

Lee Becham, KD4NTS
Henry Broughton, K2AE, Memorial Scholarship

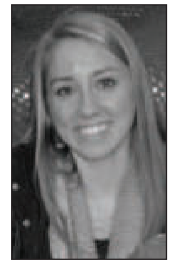


Charles Bigelow, KB3YVS
Scholarship of the Morris County Radio Club of New Jersey



Kathryn Boyle, KDØOWZ
Challenge Met Scholarship

Daniel Bradke, W2AU
Henry Broughton, K2AE, Memorial Scholarship

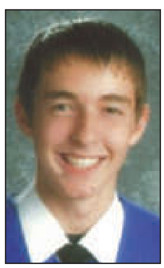


Caitlin Brady, W3CJB
You've Got a Friend in Pennsylvania Scholarship

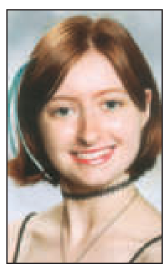
Jeremy Breef-Pilz, KB1REQ
New England F.E.M.A.R.A. Scholarship

Sophie Brogdon, W1SSB
Southeastern DX Club Scholarship

Morgan Burcham, KE5VFK
Mississippi Scholarship

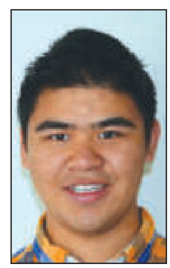


James Calloway, KE5GAQ
ARRL Foundation General Fund Scholarship

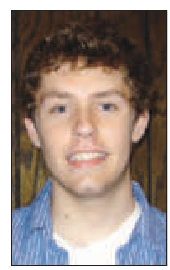


Veronica Celone, KB1WBA
YASME Foundation Scholarship

John Champagne, W1NGZ
Magnolia DX Association Scholarship



Alexander Chan, KJ6VPO
Charles N. Fisher Memorial Scholarship



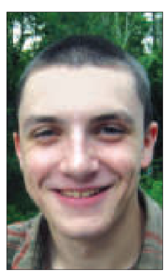
Hunter Clark, KC9LGG
Alfred Friend Jr, W4CF, Memorial Scholarship

Justin Coco, KE5YSV
Louisiana Memorial Scholarship

Diane Collard, KDØLSZ
Irving W. Cook, WAØCGS, Scholarship

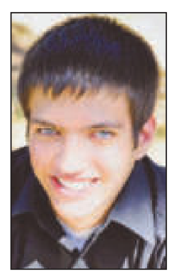
Christina Crawford, KD8DGL
Dayton Amateur Radio Association Scholarship

William Cromarty, N6WIL
Victor Poor, W5SMM, Memorial Scholarship

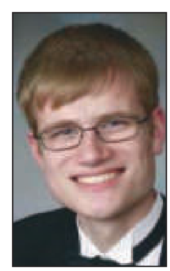


David DeMattia, K1DVD
New England F.E.M.A.R.A. Scholarship

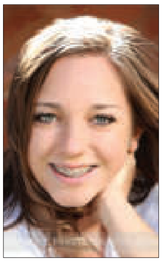
James Fagan, KE7IDC
Central Arizona DX Association Scholarship



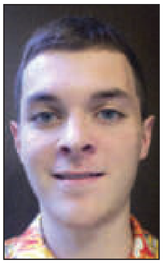
Brenden Fatchett, WØTOL
ARRL Rocky Mountain Division Scholarship



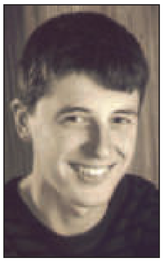
Joseph Felkins, KK4KSK
Jackson County Amateur Radio Association Scholarship



Amy Floyd, KCØZSF
PhD ARA Scholarship

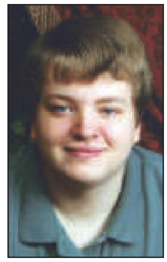


George Fotopoulos, KB1PQU
New England F.E.M.A.R.A. Scholarship



Joey Freeland, KDØHFZ
Ray, NØRP, and Katie, WØKTE, Pautz Scholarship

Forrest Gasdia, AB1LG
New England F.E.M.A.R.A. Scholarship



Dale Gilbert, KK4GQK
Jake McClain Driver Scholarship

John Girard, KC9RGW
Dayton Amateur Radio Association Scholarship

Robert Giuliani, K1RJG
Androscoggin ARC Scholarship

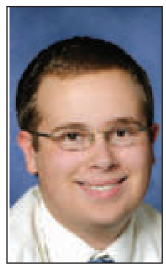
Thomas Gober, N5DUX
Tom and Judith Comstock Scholarship

Frank Graves, KF5ISD
Allen and Bertha Watson Memorial Scholarship

Jaydee Griffith, KE7WSX
YASME Foundation Scholarship

Run-Xiang Guo, KC9VHK
Dayton Amateur Radio Association Scholarship

Cortez Hadley, KC9MLB
Six Meter Club of Chicago Scholarship



Joshua Hallfirsch, KD8KKR
Seth Horen, K1LOM, Memorial Scholarship

Jason Harris, KJ4IWX
L. Phil and Alice J. Wicker Scholarship

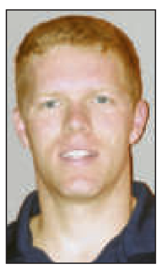
Monica Hernden, KD8GGB
Bill Salerno, W2ONV, and Ann Salerno Memorial Scholarship

Jordan Hoellman, KB3RZQ
You've Got a Friend in Pennsylvania Scholarship

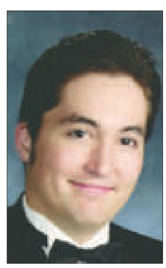
Steven Holland, KC9TTQ
Edmond A. Metzger Scholarship

Jeremy Hong, KD8TUO
Zachary Taylor Stevens Memorial Scholarship

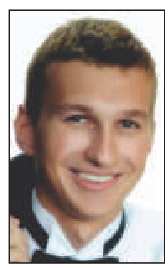
Robert (Paul) Hoops, W3EGL
Henry Broughton, K2AE, Memorial Scholarship



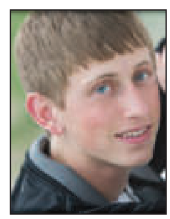
Jordan Hoover, KC9PXM
Indianapolis ARA Scholarship



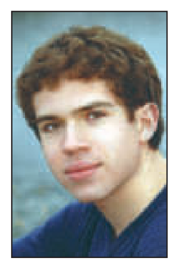
Mason Ivy, KJ6SDM
ARRL Foundation General Fund Scholarship



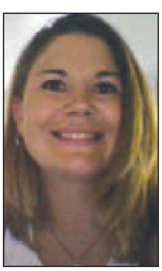
Andrew Janeczek, KI4YEJ
Orlando Hamcation® Scholarship



Caleb Johnson, KC9KVF
YASME Foundation Scholarship



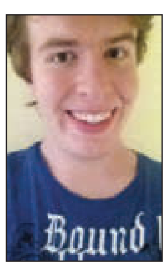
Timothy (Max) Kelley, KC2SPY
ARRL Foundation General Fund Scholarship



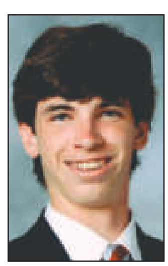
Melanie Kelly, KC9YBR
Chicago FM Club Scholarship

Shaun Koide, KH6EI
K3OMI Gary Wagner Scholarship

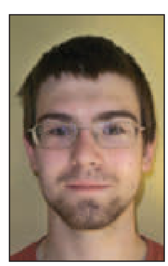
Sherman Lam, KJ6PJH
Outdoor Hams Scholarship



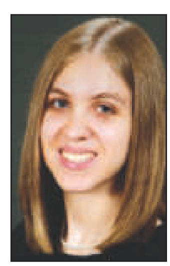
Zachary Lange, KB1YIM
New England F.E.M.A.R.A. Scholarship



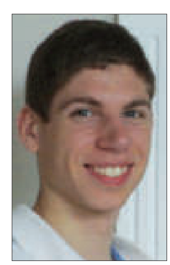
Samuel Lapides, KB1TZJ
Yankee Clipper Contest Club Youth Scholarship



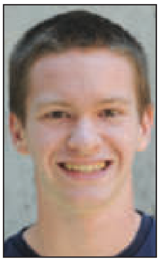
Dennis Latyshev, KC9VVH
Perry F. Hadlock Memorial Scholarship



Jessica Lipa, KX8A
L. B. Cebik, W4RNL, and Jean Cebik, N4TZP, Memorial Scholarship



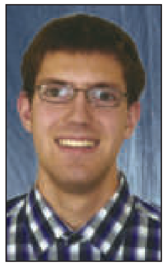
Joseph Lipa, N8OY
Byron Blanchard, N1EKV, Memorial Scholarship



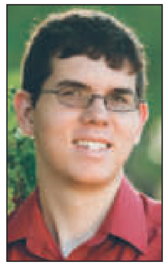
Duncan MacLachlan, KUØDM
Ted, W4VHF, and Itice, K4LVV, Goldthorpe Scholarship

Kerry Manderbach, KØXOK
Paul and Helen L. Grauer Scholarship

Johnathan Mayo, AB3FX
L. B. Cebik, W4RNL, and Jean Cebik, N4TZP, Memorial Scholarship



Matthew McBride, KB1WEV
Dr. James L. Lawson Memorial Scholarship



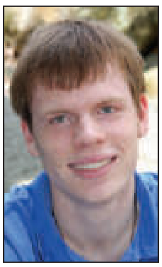
Carey McCachern, N5RM
L. B. Cebik, W4RNL, and Jean Cebik, N4TZP, Memorial Scholarship

Kristi Melfi, KC2TMB
Norman E. Strohmeier, W2VRS, Memorial Scholarship

Joy Mellera, KI6AJC
William Bennett, W7PHO, Memorial Scholarship

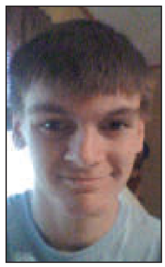
Kelly Moore, KDØIXR
Paul and Helen L. Grauer Scholarship

Luke Newmeyer, KD7WUK
K2TEO Martin J. Green Sr. Memorial Scholarship



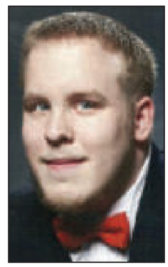
Christopher Palm, KC9JTL
YASME Foundation Scholarship

William Probst, KJ4RXM
North Fulton ARL Scholarship

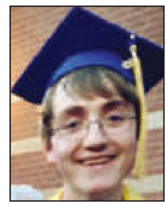


Damian Ray, KK4HQX
Charles Clarke Cordle Memorial Scholarship

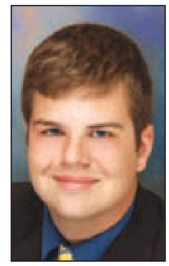
Alyssa Rios, KI6EEK
Charles N. Fisher Memorial Scholarship



Jordan Sakal, KB1ZDZ
New England F.E.M.A.R.A. Scholarship



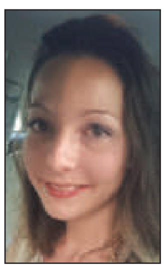
Nicholas Schleif, KDØRHE
Dayton Amateur Radio Association Scholarship



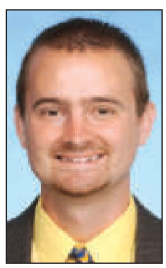
Jonathan Smith, KF5ICW
Fred R. McDaniel Memorial Scholarship

Blakely Sturzenegger, KK4LVJ
Donald Riebhoff Memorial Scholarship

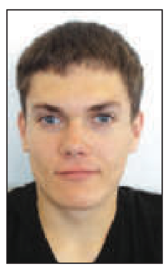
Kathryn Swenson, KC9OYG
David Knaus Memorial Scholarship



Natasha Wamsley, KD8JCU
Dayton Amateur Radio Association Scholarship



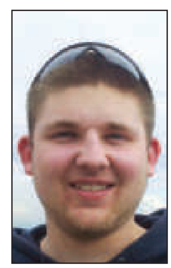
Tyler Wamsley, KC8UHB
Dayton Amateur Radio Association Scholarship



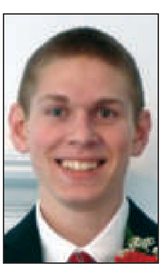
Christian Welch, NA7CW
ARRL Foundation General Fund Scholarship

Jesse Werle, KJ4CCH
Wayne Nelson, KB4UT, Memorial Scholarship

Lindsay Westerfield, KD5UVL
Carole J. Streeter, KB9JBR, Scholarship



John Wheeler, KD7YZD
Mary Lou Brown Scholarship



Matthew Williams, W1MAT
Richard W. Bendicksen, N7ZL, Memorial Scholarship

Elisabeth Younce, KD7WOL
Bill Salerno, W2ONV, and Ann Salerno Memorial Scholarship

ARRL FOUNDATION

John Dilks, K2TQN, k2tqn@arrl.org

Earl Abbott, W2FTT (SK)

A great collector and Elmer lives on through his collection.

Although I didn't know Earl Abbott, I feel I got to know what a fine person and outstanding ham he was as I had the privilege of going through (and inheriting some of) his extensive radio estate.

He lived in New Jersey, about 40 miles from me, but he wasn't a member of any ham clubs that I belonged to and we didn't have any common friends except for Toby Spratt, KB2ZL, now a Silent Key.

Upon Earl's death in 1996, his widow, Maria, missed her homeland of Mexico and wanted to return there, so she needed to sell their house. She called Toby to help sell Earl's large collection of radios and related equipment in preparation for selling the home and Toby thought of me. I had started collecting seriously in the 1990s and many local hams knew I was looking for early radios and boat anchors.

I went to look over the equipment. Toby acted as Maria's agent and we negotiated a deal. I agreed to take everything, leave no trash and sweep the cellar clean when done. That day I loaded my van with everything small that I could carry up the stairs. On the way home, the scope of what I had just bought set in. My van was loaded to the roof and there was still so much left in the cellar.

The next day I could barely function. I realized I had bitten off more than I could chew. After a couple of anguished days, I began to put together a plan. It was simple; I would go every Saturday, bring some items home and take the rest to a hamfest on the next Sunday. I got some offers of help from a few collector friends.

My friends and I ended up going to the house every Saturday (and a few Sundays too) from June through February of the next year. I gave much of Earl's gear to my friends who helped me unload the cellar. There was plenty for all. Everything got passed on; nothing was thrown away and I'm sure Earl would be glad about that. I also found some really nice items for my collection, which grew rapidly that year.

Eventually everything was gone, the cellar was swept clean (as I had promised) and Maria was happy — as was my wife, because I would finally stay home for a while on weekends.

Figure 1 — Earl's station, W2FTT, in 1938. From the left are a homebrew modulator, McMurdo Silver 5C receiver and a homebrew transmitter. [Earl Abbott, W2FTT, photo]

Figure 2 — Earl's National Radio Institute Diploma. [John Dilks, K2TQN, photo]

Getting to Know Earl

I saved all of Earl's papers, books and magazines. These became the basis of my library. While reading the letters sent to him by fellow hams, I realized what a great man he had been. Many of the letters thanked him for a gift he had sent, ranging from small parts and tubes to complete radios. And since he was an engineer, the designs and modifications he shared were greatly appreciated. It appears that he refused to take any money for these things.

Earl grew up in the home of his mother and her family. As a kid he and his friends experimented with electricity. He built a basic station and made friends with other hams in the area. One of his later homebrew stations is shown in Figure 1.

Earl worked at various jobs and saved his money. He wanted to become a radio engineer after seeing ads in

Figure 3 — At the back is Earl's big Collins TDO AM transmitter with the Collins broadcast board on the right just behind the chair. [John Dilks, K2TQN, photo]

Figure 4 — This is how Earl's shack looked circa 1990. You can see larger photos at **www.k2tqn.com**. [John Dilks, K2TQN, photo]

Figure 5 — A close-up of Earl's receivers. [John Dilks, K2TQN, photo]

magazines. He attended the National Radio Institute while living in a boarding home in Washington, DC. As his diploma testifies (see Figure 2), he graduated as a certified "Radio-Trician" (radio engineer).

When he returned home, Earl sent resumes to stations around the country, albeit without success. Eventually he landed an engineer position at station WBAB, then in Atlantic City, New Jersey. He remained there several years and was frequently seen in various hotels setting up equipment for live orchestra broadcasts.

From there he went to the RCA Wireless station WSC. Later he would move on to the Civil Aeronautics Administration receiving station in Warren Grove, New Jersey, near his home. [The Civil Aeronautics Administration became the Federal Aviation Agency (FAA) in 1958.]

Eventually Earl retired from the FAA and spent his time working on his ham station. Over the years his station grew to include an abundance of gear.

His friend Alan Gray, now W3BV, has this to say:

> Our biggest trade was for my Collins TDO. [The model TDO was a commercial transmitter used in broadcasting and government service. — *Ed.*] The TDO used a pair of 813s modulated by pair of 805s, had an autotuner housed in a 6 foot high cabinet and weighed approximately 1500 lbs (see Figure 3).
>
> The TDO was so heavy that when Earl installed it in the downstairs entrance hallway of his mother's home he had to reinforce the section of flooring underneath. It was controlled remotely from the second floor shack (using a Collins control panel I acquired for him. It used a rotary telephone dial to select the 10 preset channels.). The 805 modulators were later modified to a pair of 810s by Earl. At the time Earl was working for the CAA/FAA.
>
> Earl had a beautiful ham shack [see Figures 4, 5 and 6] with a Collins broadcast board, two large matching Collins 16 inch turntables on both sides, and an RCA 77 ribbon mike mounted over the board. In the same shack he had two large Ampex studio-type tape recorders (the big ones that stood on the floor) and racks of professional grade audio amplifiers (Altec, McIntosh, etc) and related processing gear. He used the turntables to play records through the audio gear and amplifiers in the racks, which in turn drove a pair of Altec Lansing "Voice of the Theater" speakers (huge!) downstairs in the living room.

Figure 6 — Here is Earl's relay and control panel, which was rescued by Al Klase, N3FRQ. The panel was still live and Al had to cut the power when we came to remove it. [Al Klase, N3FRQ, photo]

Linc Mott, WB2KZI, added:

> Earl Abbott and I were once related through marriage. It was he who taught me the code and furthered my interest in Amateur Radio. He spent many hours helping me with the theory and schematics that were required for licensing in 1946. My first call was W2RCQ.
>
> Earl was an Engineer of Communications and was employed at that time with WSC at Tuckerton. For the sake of the record, Earl was one of the most particular operators anyone should wish to know or meet. He honored all of the FCC rules and regulations to the 'T'.

When Earl married Maria they moved into a home together. He moved his TDO and all his equipment into the cellar and built a first class station there. He continued to accumulate more and more gear until it was packed to the ceiling. This was the shack I bought.

I feel I got to know Earl personally while going through his radio papers and by playing with his toys. I now treasure them as he once had. Ultimately Earl's estate enabled me to build my mobile museum, which I take on the road to exhibit at hamfests. More about my mobile museum in next month's column.

Convention and Hamfest Calendar

Gail Iannone, giannone@arrl.org; www.arrl.org/hamfests-and-conventions-calendar

Abbreviations
Spr = Sponsor
TI = Talk-in frequency
Adm = Admission

Alabama (Attalla) — Sep 21 D F H R T V
8 AM-1 PM. *Spr:* Gadsden ARC. Etowah Cty Fairgrounds, 100 Veterans Dr. *TI:* 147.16 (100 Hz). *Adm:* Free. Travis Cox, W4TPU, 256-490-3468; **travis@hopper.net**; **www.garc.org**.

Arkansas (Little Rock) — Sep 21 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. *TI:* 146.94. *Adm:* $5. Mark Barnhard, KD5AIV, 501-221-3909; **mbarnhard@aristotle.net**; **www.carenclub.com**.

Connecticut (Manchester) — Sep 21 D F H R S T V
8 AM-2 PM. *Spr:* Pioneer Valley Radio Assn. Marcus Communications, 33 Mitchell Rd. *TI:* 146.79 (82.5 Hz). *Adm:* $7. George Lillenstein, AB1GL, 860-716-3367; **AB1GL@arrl.net**; **www.pvra.net**.

Florida (Jacksonville) — Oct 5 F R T
7:30 AM-1 PM. *Spr:* Orange Park ARC. Jacksonville Dog Fanciers, 6932 Morse Ave. *TI:* 146.67. *Adm:* Free. Greg Fitcher, N4RVD, 904-716-0187; **n4rvd@arrl.net**; **oparc.net**.

Florida (Orlando) — Sep 21 F H R T
8 AM-2 PM. *Spr:* Bahia Shrine AR Unit. Bahia Shrine Center, 2300 Pembrook Ave. *TI:* 147.39 (103.5 Hz). *Adm:* $4. Den Ardinger, KT3S, 407-332-0405; **dba327@hotmail.com**; **radio.bahiashrine.org/Tailgate.htm**.

Florida (Punta Gorda) — Sep 14 D H R T
6 AM-2 PM. *Spr:* Peace River Radio Assn. Tropical Gulf Acres Clubhouse, 28245 Pasadena Dr. *TI:* 147.255 (136.5 Hz). *Adm:* $4. Tom Lambie, N4XJQ, 941-369-3670; **n4xjq@comcast.net**; **w4dux.net**.

Georgia (Dallas) — Sep 14 F H R T
8 AM-2 PM. *Spr:* Paulding ARC. Earl Duncan Park (Paulding Meadows), 472 Paulding Meadows Dr. 23rd Annual Hamfest. *TI:* 146.895 (77 Hz). *Adm:* Free. Bill Houston, WD4LUQ, 770-445-9191; **wd4luq@att.net**; **www.pauldingarc.com**.

W9DXCC CONVENTION

September 20-21, Elk Grove Village, IL
H Q R S

Friday 1 PM-Saturday all day. *Spr:* Northern Illinois DX Assn. Holiday Inn-Elk Grove Village, 1000 Busse Rd. Friday DX University Program; CQ Awards; CW Copying Contest; W9D Special Event Station; special guest from ARRL HQ Dave Patton, NN1N, MVP Manager; hospitality suites; Saturday banquet. *TI:* 147.36 (136.5 Hz). *Adm:* advance $39, door $44 (additional cost for banquet). Paula Uscian, K9IR, 847-358-6644; **pmuscian@sbcglobal.net**; **www.w9dxcc.com**.

Illinois (Peoria) — Sep 21-22 D F H Q R S T V
Saturday 6 AM-dusk, Sunday 6 AM-1 PM. *Spr:* Peoria Area ARC. Exposition Gardens, 1601 W Northmoor Rd. *TI:* 147.075 (103.5 Hz). *Adm:* advance $7 (with double stub), door $10 (with single stub). Merle Joiner, KB9VQH, 309-693-3378; **kb9vqh@icloud.com**; **www.w9uvi.org**.

Coming ARRL Conventions

August 17
West Virginia State Convention, Weston, WV*

August 17-18
Alabama State Convention, Huntsville, AL*

August 18
Kansas State Convention, Salina, KS*

August 25
Western Pennsylvania Section Convention, New Kensington, PA*

August 31-September 1
North Carolina Section Convention, Shelby, NC*

September 6-8
Southwestern Division Convention, Buellton, CA*

September 14
Roanoke Division Convention, Virginia Beach, VA

September 20-21
W9DXCC Convention, Elk Grove Village, IL

September 20-22
ARRL/TAPR Digital Communications Conference, Seattle, WA

September 27-28
SEDCO/W4DXCC Convention, Pigeon Forge, TN

September 27-29
Mid-Atlantic States VHF Conference, Bensalem, PA

September 28
North Dakota State Convention, West Fargo, ND
Washington State Convention, Spokane Valley, WA

September 29
EmComm East Convention, Rochester, NY

October 6
Maryland State Convention, West Friendship, MD

October 12
Pacific Northwest VHF Conference, Moses Lake, WA

October 12-13
Florida State Convention, Melbourne, FL

October 13
Connecticut State Convention, Meriden, CT
Iowa State Convention, Sergeant Bluff, IA

October 18-19
Microwave Update Conference, Morehead, KY

October 26
Delaware State Convention, Georgetown, DE

November 2
Fall TechFest, Lakewood, CO

November 2-3
Georgia Section Convention, Lawrenceville, GA

November 8-9
Midwest Division Convention, Lebanon, MO

*See August *QST* for details.

Indiana (Greenfield) — Sep 21 F H T V
8 AM-1 PM. *Spr:* Hancock ARC. First Church of God, 700 N Broadway St. *TI:* 145.33. *Adm:* Free. Joe White, KC9UKE, 317-908-4664; **joewhite@hrtc.net**.

Indiana (Mitchell) — Oct 5 D F H R T V
8 AM-2 PM. *Spr:* Hoosier Hills Ham Club. Lawrence Cty Fairgrounds, 11265 US Hwy 50 W. *TI:* 146.73 (107.2 Hz). *Adm:* $5. William Warren, KB9TMP, 812-675-2450; **hoosier.hills.ham.club@gmail.com**; **www.hoosierhillshamfest.org**.

Iowa (West Liberty) — Oct 6 D F H R T V
7 AM-1 PM. *Sprs:* Muscatine and Washington Area ARCs. Muscatine Cty Fairgrounds, 101 N Clay St. Go Kit Contest. *TI:* 146.91 (192.8 Hz). *Adm:* $7. Tom Brehmer, NØLOH, 563-263-3097; **n0loh@live.com**; **www.kc0aqs.org/hamfest**.

Kansas (Gardner) — Sep 14 D F H R S
8 AM-1 PM. *Spr:* Santa Fe Trail ARC. Johnson County Fairgrounds, 136 E Washington St. *TI:* 147.24 (151.4 Hz). *Adm:* $5. Mike Costello, KBØISQ, 913-764-0702; **kb0isq@arrl.net**; **sftarc.org**.

Kansas (Wichita) — Oct 5 D F V
8 AM-1 PM. *Spr:* Valley Center ARC. RiverWalk Church of Christ, 225 N Waco. *TI:* 146.94. *Adm:* $4. Steve Periman, NØYYI, 316-617-1658; **wichitaareahamfest2013@gmail.com**; **www.vcarc.org.**

Kentucky (Bowling Green) — Oct 5 D H Q V
7:30 AM-2 PM. *Spr:* Kentucky Colonels ARC. Sloan Convention Center, 1021 Wilkenson Trace. *TI:* 147.165. *Adm:* $6. Ed Gann, N4HID, 270-843-8911; **edwardgann@insightbb.com**; **vettecityhamfest.com**.

Kentucky (Richmond) — Sep 21 D F H Q R S T V
8 AM-3 PM. *Spr:* Central Kentucky ARS. Madison County Fairgrounds, Old KY Rte 52. *TI:* 145.37 (192.8 Hz). *Adm:* $6. Michael Rogers, KE4ISW, 859-575-2199; **ke4isw@arrl.net**; **www.qsl.net/ckars/hamfest**.

Maine (Alexander) — Sep 21 D F H R T V
8 AM-noon. *Spr:* St Croix Valley ARC. Alexander Elementary School, 1430 Airline Rd. *TI:* 147.33 (118.8 Hz). *Adm:* $5. Roger Holst, W1LH, 207-454-2174; **holst@midmaine.com**; **stcroixvalleyamateurradioclub.org**.

MARYLAND STATE CONVENTION

October 6, West Friendship, MD
D F H Q R S T V

6 AM-1 PM. *Spr:* Columbia ARA. Howard Cty Fairgrounds, 2210 Fairgrounds Rd. *TI:* 147.39 (156.7 Hz). *Adm:* $6. Dave Prestel, W8AJR, 443-812-4403; **dave.prestel@gmail.com**; **carafest.org**.

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

Massachusetts (Cambridge) — Sep 15. Nick Altenbernd, KA1MQX, 617-253-3776 (9 AM-5 PM); **w1gsl@mit.edu**; **www.swapfest.us**.

Michigan (Adrian) — Sep 15 D F H R T V
8 AM-3 PM. *Spr:* Adrian ARC. Lenawee Cty Fairgrounds, 602 N Dean St. *TI:* 145.37 (85.4 Hz). *Adm:* $5. Mark Hinkleman, NU8Z, 517-423-5906; **cqnu8z@comcast.net**; **w8tqe.com**.

Michigan (Madison Heights) — Oct 6
D F H R V
8 AM-2 PM. *Spr:* Utica Shelby Emergency Communications Assn. United Food and Commercial Workers Hall, 876 Horace Brown Dr. *TI:* 147.18 (100 Hz). *Adm:* $5. Ray Anderson, K8RDJ, 586-979-4456; **usecaarc@hotmail.com**; **www.usecaarc.com**.

Michigan (Petoskey) — Oct 5 R T
8-11 AM. *Spr:* Straits Area ARC. Emmanuel Evangelical Church, 620 Emmet St. Foxhunt. *TI:* 146.68 (110.9 Hz). *Adm:* $5. Dirk Esterline, KG8JK, 231-348-5043; **kg8jk@qsl.net**; **www.w8gqn.org**.

Michigan (Utica) — Sep 21 D F T
8 AM-noon. *Spr:* General Motors ARC. Trinity Lutheran Church, 45160 Van Dyke Ave. *TI:* 443.075 (123 Hz). *Adm:* $5 per carload. Robert Corr, N8CY, 248-346-2733; **n8cy@arrl.net**; **www.GMARC.org**.

Minnesota (East Grand Forks) — Sep 14
D F H R S V
8 AM-noon. *Spr:* FORX ARC. Heritage Village, Beier Bldg, 219 20th St NE. *TI:* 146.94. *Adm:* $5. Donna Schaffer, KCØSKD, 701-739-2957; **kc0skd@arrl.net**; **www.wa0jxt.org/**.

Minnesota (Henderson) — Sep 21 D F H V
8 AM-noon. *Sprs:* SMARTS Radio Club and Sibley County CERTS Team. Henderson Road House, 510 Main St. *TI:* 146.61 (136.5 Hz). *Adm:* $5. Don Burgess, KCØQNA, 612-578-7561; **kc0qna@yahoo.com**.

Mississippi (Brandon) — Sep 21 R T
9 AM-1 PM. *Sprs:* ARRL Mississippi Section and Central Mississippi ARA. Shiloh Park, 322 Shiloh Rd. "ARRL Day in the Park." *TI:* 147.345 (100 Hz). *Adm:* Free. Malcolm Keown, W5XX, 601-636-0827; **w5xx@arrl.org**; **www.arrlmiss.org**.

New Jersey (Tinton Falls) — Sep 21
D F H R T V
8 AM-noon. *Spr:* Garden State ARA. MOESC (formerly MAECOM), 100 Tornillo Way. *TI:* 147.045 (67 Hz). *Adm:* $5. John King, KA2F, 732-542-1822; **ka2fwb2hdj@gmail.com**; **www.gardenstateara.org**.

New Jersey (West Windsor) — Sep 14
D F H R T V
8 AM-2 PM. *Spr:* Delaware Valley Radio Assn. West Windsor Community Park, Princeton-Hightstown Rd. *TI:* 146.67 (131 Hz). *Adm:* $7. Frank Palecek, KC2TKD, 609-306-5038; **frankpal@comcast.net**; **w2zq.com**.

New York (Horseheads) — Sep 28
D F H R S T V
8 AM. *Spr:* ARA of the Southern Tier. Chemung County Fairgrounds, Grand Central Ave. 38th Elmira Hamfest/Computerfest, transmitter hunt. *TI:* 147.36. *Adm:* advance $5, door $6. Randy Viele, N2SYT, 607-301-0040; **2013hamfest@arast.org**; **www.arast.org**.

New York (Lancaster) — Sep 8 F H R T
7 AM. *Spr:* Lancaster ARC. Bowen Road Grove – Como Park, 3845 Bowen Rd. *TI:* 147.255 (107.2 Hz). *Adm:* $5. Luke Calianno, N2GDU, 716-481-5747; **luke48@gmail.com**; **gbhamfest.hamgate.net**.

EMCOMM EAST CONVENTION

September 29, Rochester, NY
R S
9 AM-5 PM. *Spr:* Monroe County ARES. St John Fisher College, 3690 East Ave. Amateur Radio emergency communications conference, vehicle displays. *TI:* 146.61 (110.9 Hz). Registration: advance $35, door $40. Jeff Wigal, WY7Q, 585-236-4115; **info@emcommeast.org**; **emcommeast.org**.

NORTH DAKOTA STATE CONVENTION

September 28, West Fargo, ND
D F H Q R S V
8 AM-2 PM. *Spr:* Red River Radio Amateurs. Red River Valley Fairgrounds (Hartel Ag Bldg), 1805 W Main Ave. *TI:* 145.35 (123 Hz). *Adm:* $7. Tim Gooding, KDØYX, 701-361-5856; **kd0yx@cableone.net**; **rrra.org**.

Ohio (Berea) — Sep 22 D F H Q R S V
8 AM-2 PM. *Spr:* Hamfest Assn of Cleveland. Cuyahoga Cty Fairgrounds, 164 Eastland Rd. *TI:* 146.73 (110.9 Hz). *Adm:* $6. Glenn Williams, AF8C, 440-835-4897; **af8c@arrl.net**; **www.hac.org**.

Ohio (Stow) — Aug 25 D F R T
8 AM-noon. *Spr:* Cuyahoga Falls ARC. Robert Pinn Armory, 4630 Allen Rd. *TI:* 147.27 (110.9 Hz). *Adm:* $5 per vehicle. Frank Tompkins, W8EZT, 330-928-4048; **w8ezt@arrl.net**; **cfarc.org/tailgate2013.html**.

Oklahoma (Ada) — Sep 13-14 D H R S V
Friday 4-8 PM, Saturday 8 AM-1 PM. *Sprs:* Ada, Durant and Shawnee Radio Clubs. Chickasaw Community Center, 700 N Mississippi. *TI:* 147.285 (114.8 Hz). *Adm:* $6. Chris Faulkner, KD5NQA, 580-332-1435; **kd5nqa@yahoo.com**.

Pennsylvania (Belle Vernon) — Oct 6
D H R T
8 AM-1 PM. *Spr:* Monessen ARC. Rostraver Central Fire Hall, 1100 Fells Church Rd. *TI:* 147.225. *Adm:* $5. Chris Grilli, W3CDU, 724-258-8419; **grilli@verizon.net**; **www.w3csl.org**.

MID-ATLANTIC STATES VHF CONFERENCE

September 27-29, Bensalem, PA
D F H R S T
Friday 7-11 PM (Hospitality Suite and Table-top Flea Market), Saturday 8 AM-5 PM (Conference), Sunday 8 AM-1 PM (Mini-Fest). *Spr:* Mt Airy VHF Radio Club (Pack Rats). InnPlace Hotel Bensalem, 3327 Street Rd. *TI:* 146.52. Conference Registration: advance $40, door $45; banquet advance $40, door $45. Rick Rosen, K1DS, 610-270-8884; **rick1ds@hotmail.com**; **www.packratvhf.com**.

Pennsylvania (Brownstown) — Oct 5
D H R T V
7 AM. *Spr:* Red Rose Repeater Assn. West Earl Community Park, Rte 772. *TI:* 147.015 (118.8 Hz). *Adm:* $2. Dave Phillips, W3CWE, 717-392-7252; **w3cwe@comcast.net**; **www.w3rrr.org**.

SEDCO/W4DXCC CONVENTION

September 27-28, Pigeon Forge, TN
D H Q R S
Fri 2 PM, Sat 11 AM. *Spr:* South-Eastern DX and Contesting Organization. MainStay Suites, 410 Pine Mountain Rd. Fellowship of DXers and contesters, banquet (Sat, 7:30 PM, $30). *Adm:* advance $25, door $30. Dave Anderson, K4SV, 828-777-5088; **DaveK4SV@yahoo.com**; **W4DXCC.com**.

Texas (Gainesville) — Sep 7 D F H R T V
7 AM-1 PM. *Spr:* Cooke County ARC. Gainesville Civic Center, 311 S Weaver St. RV parking adjacent to Civic Center ($15 with full hookup); 940-668-4530). *TI:* 147.34, 442.775 (both 100 Hz). *Adm:* advance $8 (by Aug 15), door $10. James K Floyd, N5ZPU, 940-668-7511; **jfloyd54@suddenlink.net**; **www.gainesvillehamfest.org**.

ROANOKE DIVISION CONVENTION

September 14, Virginia Beach, VA
D H Q R S T V
8:30 AM-4 PM. *Spr:* Tidewater Radio Conventions. Virginia Beach Convention Ctr, 1000 19th St. *TI:* 146.97. *Adm:* advance $9, door $10. Carl Clements, W4CAC, 757-235-4813; **w4cac@arrl.org**; **vbhamfest.com**.

Washington (Des Moines) — Aug 24
F H R T
9 AM-1 PM. *Spr:* Highline ARC. Des Moines Activity Center, 2045 S 216th St. *TI:* 146.66 (103.5 Hz). *Adm:* $3. Dennis Reanier, W7UBA, 206-241-6812; **w7uba@comcast.net**; **highlinearc.org/**.

ARRL/TAPR DIGITAL COMMUNICATIONS CONFERENCE

September 20-22, Seattle, WA
H S
Cedarbrook Lodge, 18525 36th Avenue South, Seattle, Washington; **www.cedarbrooklodge.com**. Friday evening social and Saturday evening banquet. The Sunday seminar is a four-hour presentation by an expert in the field. Register by contacting the TAPR at 972-671-8277; **www.tapr.org/dcc**.

WASHINGTON STATE CONVENTION

September 28, Spokane Valley, WA
D F H Q R S T V
9 AM-5 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, Lilac City ARC and Panoramaland ARC. University High School, 12420 E 32nd Ave. Auction, test gear table, no-host post hamfest dinner (Sat, 5:30 PM, Timer Creek Grill Buffet, 9211 E Montgomery Dr). *TI:* 147.38. *Adm:* $5, 18 and under free. Betsey Ashleman, N7WRQ, 509-448-5821; **n7wrq@aol.com**; **www.kbara.org**.

Wisconsin (Cedarburg) — Sep 28
D F H R T
8 AM-1 PM. *Spr:* Ozaukee RC. Fireman's Park, 796 Washington Ave. *TI:* 146.97 (127.3 Hz). *Adm:* $5. Tom Ruhlmann, W9IPR, 262-377-6945; **teruhlmann@wi.rr.com**; **www.ozaukeeradioclub.org**.

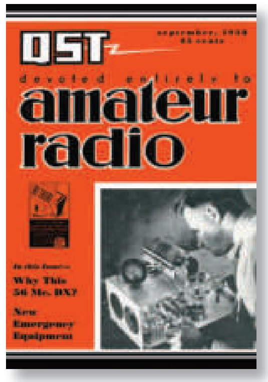
September 2013 W1AW QUALIFYING RUNS

W1AW Qualifying Runs are held at 10 PM EDST on Friday, September 6 (0200 Z, September 7) and at 7 PM EDST (2300Z) on Wednesday, September 18. The West Coast Qualifying Runs will be transmitted by station K6KPH at 3581.5, 7047.5, 14047.5, 18097.5 and 21067.5 kHz at 2 PM PDST on Saturday, September 14 (2100Z). Unless indicated otherwise, sending speeds are from 10 to 35 WPM.

75, 50 and 25 Years Ago

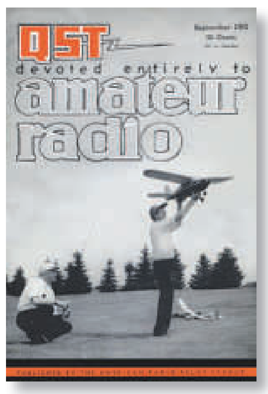
Al Brogdon, W1AB

September 1938



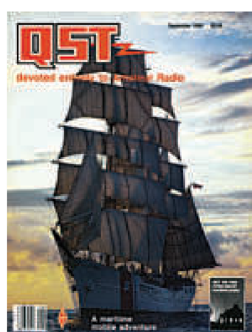
- The cover photo shows an ARRL Lab technician working on an impressive (but unidentified) piece of ham equipment.
- The editorial beats the drum for the ARRL National Convention, soon to be held in Chicago.
- Fenton Priest, W3EMM, and Laurie Turner, W3BEK (both from Virginia), tell us how "Norfolk Amateurs Prepare for Emergencies."
- In "Preselection Simplified," T. M. Ferrill, W1LJI, reports on his simple but effective one-tube receiving R.F. amplifier that covers all five H.F. bands.
- "Further Reports on 56-Mc. DX" tells us that W1EYM and W6DNS made history with their transcontinental QSO.
- J. A. Pierce, W1JFO, reports on his "Interpreting 1938's 56-Magecycle DX," looking at the propagation paths covered and working backward to figure out the type of propagation.
- Byron Trowbridge, W9TMP, describes his antenna, "A DeLuxe Antenna Structure" — truly a monster!

September 1963



- The cover photo shows W1OLP, ready to launch a radio-controlled model airplane.
- George Wilson, W1OLP, presents a discussion of "Radio Control of Model Airplanes."
- In "The Moonbounce Problem, 28 Mc. and Up," H. T. Howard, W6UGL, presents the basic facts for determining the equipment and antennas needed for Lunar communication on 10 meters and the v.h.f and u.h.f. bands.
- "The Bugless Bug," by Gilbert Boelke, W2EUP, describes his electronic keyer and his successful efforts to get the "bugs" out of the circuit.
- Ernest Manly, W7LHL, tells us about "A Two-Meter Transverter" that he built to use his 14-Mc. s.s.b. gear to operate 2 meters.
- In "Send-Receive Switching," Lew McCoy, W1ICP, tells us how to minimize the number of operating controls in the ham station.
- Louise Moreau, WB6BBO, gives us a good history of one of our favorite numbers, "Seventy-Three," relating both facts and folklore.

September 1988



- The cover photo shows the USCG tall ship *Eagle*.
- The editorial takes another hard look at repeater frequency coordination.
- Contester Lew Gordon, K4VX, helps out the multi-transmitter contest stations, with "Band-Pass Filters for HF Transceivers."
- Steven Stuntz, NØBF, presents another computer project, "Baudot and ASCII RTTY Programs for Atari Computers."
- Andrew Griffith, W4ULD, describes "A Dipper Amplifier for Impedance Bridges" that will help us with our antenna projects.
- Doug DeMaw, W1FB, tells us about "A Simple Resonant ATU" — an HF transmatch that's suitable for low or high power.
- Chuck Bender, W1WPR, writes a W1AW vignette, "The W1AW Dedication — 50 Years Ago This Month."
- In "The *Eagle* is QRV," Rick Booth, KM1G, spins the tale of how he got permission to operate on board the USCG training ship *Eagle* during a cruise from Long Beach, California, to Acapulco, Mexico.

Field Organization Reports

June 2013

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**.

570 W5DY
538 W5KAV
405 KT2D
401 KC5ZGG
399 KK5NU
380 KØIBS
360 WM2C
319 WB9FHP
312 N8OSL
270 N1UMJ
264 KC2LIX
255 K9LGU, WB8RCR
240 N7EIE
237 KB8VXE
231 KD8EBY, WB8R
230 N7CM, K7EAJ, KK4BVR, WD8USA, K8RDN
228 KJ4PJE
225 W4SEE
220 W9BGJ
207 WB8YYS
200 N2WGF, K2HAT, NX8A
197 K4VWK
195 KB1NMO
192 KC8QWH
191 WA2BSS
190 KB8QKC
180 KB2RTZ, KK3F
173 W7FQQ
172 KF7PDV
171 KD7THV
170 KT5SR, N8IO, VE7GN
169 K2GW
167 KD5RQB
165 K6FRG, KE5HYW, N8JMW
160 KGØGG, WA5LOU, WB4ZIQ, N8FVM
159 KB1UAU
155 N5TMC
151 KD8AAD
150 WA7PTM, K6HTN, WK4P
148 KB5SDU
145 WB9WKO, WA3EZN, W4DNA
140 WB9QPM, K7BFL, K7OAH, KB2BAA, KC2QVT, K4IWN, KC8YVF, WA4STO
135 W7JSW, WK4C
131 KD8HPG
130 WA1STU, WE2G, N9VC, AG9C, W9WXN, K6JT, W7EKB, W8DJG, N8CJS, K4BEH, WB2FTX, W3YVQ, W2EAG, KW1U
129 W9ILF
127 K1PJS
125 WØRJA, K6JGL, K2TV, N2JBA, WØLAW, N9WLW, W8MAL
121 KC2UMX
120 KØVTT, NN7H, K4GK, WA2NDA, NA7G, KB8RCR, WB8WKQ, KA4FZI, WB6UZX
119 KK7DEB
118 N2GJ
115 K4JUU, KØPTK
110 W7QM, VE3GT, WA1MXT, N5NVP, K4AXW, WO2H, KF5GC, NX9K, KC5OZT, KF5IOU, KA1G, W7GB, K7BDU, W7QM, NM1K, N7XG, N7YSS, N3RB, N7IE, N1IQI, K1YCQ, N9MN
106 N2DW
105 KJ6IJJ, AK4RJ, W4TTO, N1TF
103 N2VC
102 KB5PGY
101 K8CSI
100 KJ6PCC, WØCLS, NØMEA, WAØVKC, N3SW, K4SCL, WG8Z, WD8Q, KC8UR, K1HEJ, N1JX, KB2QO, AA2SV, KB3LNM, WB4Y, W7YV, AJ4TH, W3GQJ, NU8K
96 NA9L, W3CB, KJ4G
95 NØYR, KF5TTN, WAØCGZ, WB6OTS
94 N2RTF, KJ7NO
90 N3KB, N5RL, KA5AZK, KE5YTA, WB4BIK, WB8SIQ, N8IBR, K3IN, N3ZOC, WA4BAM, KJ4HGH
89 N1CKM, W2CC
88 AB9ZA
87 K7FLI, KB1YNE
86 KB9KEG
85 N5MBQ
84 W8IM
83 WDØGUF
82 W1INC, AB1AV, N8SY, N1LKJ
81 NC3F
80 KR6LH, KØDEU, NIØI, NØMHJ, KCØZDA, KB3GJT, KB7RVF, KC7ZZ, KK7TN, KC2EMW, KU6J, KZ8Q, K8KV, WB4RJW
78 KBØDTI
77 W5XX
76 KB8HJJ, WB6FTQ
75 N2KIV, KA8IAF
74 AJ7B
73 N6HD, NS7K, WS4P
71 WA9QIB, KA2GQQ, KC4PZA
70 K9LOT, KDØAYN, KØDLK, NØDUW, NØDUX, WØFUI, KDØNJK, N3NTV, KØPTK, KØRXC, KD7ZUP, N2YJZ

The following stations qualified for PSHR in previous months, but were not recognized in this column yet. (May) WA4STO 140, W7EKB 130, KØPTK 115. (Apr) NC3F 125.

Section Traffic Manager Reports

The following Section Traffic Managers reported: AK, AL, AR, AZ, CO, EB, EMA, ENY, EPA, EWA, GA, ID, IA, IL, IN, KS, LA, LAX, MDC, ME, MI, MN, MS, NC, NE, NFL, NH, NLI, NNJ, NTX, OH, OR, SC, SD, SFL, SJV, SNJ, STX, SV, TN, UT, VA, WCF, WI, WMA, WNY, WPA, WWA, WY.

Section Emergency Coordinator Reports

The following ARRL Section Emergency Coordinators reported: GA, EWA, IA, ID, KS, MDC, MI, MN, MO, ND, NH, NLI, OH, SJV, STX, WV.

Brass Pounders League

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

KK3F 3318, NX9K 1865, WB9FHP 1545, K6HTN 1132, WA4STO 1036, KW1U 686, N9VC 595, WØRJA 556, K6JT 556, WA1STU 553, N1IQI 532, WA4BAM 517, WB8WKQ 513, K6FRG 508.

The following stations qualified for BPL with Originations plus Deliveries: NM1K 111, K8LJG 108. The following station qualified for BPL in May, but was not recognized in this column yet: WA4STO 825.

Silent Keys

Silent Keys Administrator, sk@arrl.org

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

N1IWT **West**, John M., Southington, CT
♦ W1NJM **Hart**, George, Hartford, CT
K1SFY **Marsden**, Albert E., Norwalk, CT
KA1UNW **Floberg**, Randall, Wallingford, CT
W1VEM **Gallipeau**, George W. Jr, Naples, FL
WA1VHC **Chandler**, William W., North Adams, MA
W1YPK **Bailey**, Carrol W., Holden, MA
W1YXQ **Brouker**, Richmond, Unionville, CT
KC1Z **Mac Hardy**, James R., West Hartford, CT
W1ZFP **Johnson**, Robert L., Hillsville, VA
N2AKP **Matuga**, Alphonse J., Bronx, NY
KA2ECJ **Deyo**, Robert E. Sr, Rockaway, NJ
W2EIR **Dispenza**, Dan A., Paramus, NJ
W2FMX **Peterson**, John C., Waterville, NY
KB2GP **Redding**, James V., Bloomington, IN
♦ K2LF **Clark**, Richard L., Hurley, NY
W2LFU **Vosk**, Richard B., Tucson, AZ
W2LVP **Dominy**, Harold B., Boynton Beach, FL
♦ W2ORA **Duffin**, Joseph D., Moorestown, NJ
WA2RKP **Commerford**, Albert P., Delevan, NY
N2RRT **Rura**, Vera M., Trenton, NJ
NA2TC **Chamberlain**, Terry L., Troy, PA
N2UKA **Lake**, Edward M., Denville, NJ
W2WGH **Ozmon**, Walter R. Jr, Richmond, CA
WA2WTB **Poulos**, Christopher J., Cherry Hill, NJ
WA2WUH **Denham**, James R., Logan Township, NJ
KB2YGR **Farrar**, Charles R., Ocean Grove, NJ
N2YU **Skorup**, Gordon Edward, Marlton, NJ
K2YV **Robinson**, Robert E., Homosassa, FL
N3CRX **Kornfeld**, Steven, Glenside, PA
WA3JVQ **Krokos**, Francis J., Wilkes Barre, PA
KB3SRK **Gonzales**, Santos, Allentown, PA
W3UKG **Clark**, William T., Ridley Park, PA
W3UYC **Messenger**, George E., Westminster, MD
K3VMX **Windley**, William T., Seaford, DE
W3WCJ **Avery**, Robert A., Pen Argyl, PA
N3ZHT **Miller**, Anthony J., Erie, PA
K3ZXQ **Erdman**, Warren D. III, Deltona, FL
WA4ANW **Leistico**, Dale J., Hillsboro, OR
♦ WA4BNZ **Shell**, Ray M., Godfrey, IL
KD4BWE **Tucker**, Cheryl L., Dothan, AL
AG4E **Heintzelman**, Kipp, Melbourne, FL
N4EUC **King**, Clarence J. Sr, Sarasota, FL
♦ AE4G **Medvedeff**, Andre "Andy" S., Clearwater, FL
KU4HM **King**, Carl S., Raleigh, NC
N4ICQ **Childre**, Walter M., Dothan, AL
W4ISM **Flynn**, James H. Jr, Vienna, VA
K4KGJ **Jackson**, Gerald W., Ohatchee, AL
KD4LOH **Hinsley**, Lawrence "Mel," Tullahoma, TN
KQ4MS **Netterville**, Jerry W. III, Raleigh, NC
♦ WX4S **Ingraham**, Edward R., Jonesborough, TN
KK4SA **Cummings**, John W. Jr, Atlanta, GA
KC4SLS **Matthews**, Clyde S., Ooltewah, TN
K4UUM **Pollock**, Henry M., Reidsville, NC
K4VOP **Rowan**, James H., Oak Ridge, TN
KJ4WLZ **Brand**, George, Homosassa, FL
WA4WYQ **Smith**, William M., Hoover, AL
KC4YKV **Sauter**, George A., Mobile, AL
WB4ZCQ **Thompson**, James E., Nashville, TN
K4ZD **Hanrahan**, Robert L., Powder Springs, GA
KC5AD **Houghton**, Charles W. Jr, Denham Springs, LA
WB5BTZ **Cordiale**, Anthony C., Hot Springs National Park, AR
KD5CVL **Pisciotti**, Robert J. Sr, Norco, LA
KE5DK **Kirtley**, Donny K., Lufkin, TX
W5GKV **McKeithen**, O. A. "Billy," Baton Rouge, LA
KC5ILL **Brumback**, Roger A., Broomfield, CO
W5MHY **Beckman**, David A., Pearland, TX
K5MRC **McRight**, Lester L., Mesquite, TX
KG5PV **Wolfe**, Kenneth W., Central, LA
KD5QIC **Dyess**, David W., Austin, TX
N5RNB **Hays**, Morris S., Midwest City, OK
KD5UVG **Vardiman**, Bill A., Valley Mills, TX
W5UWB **Butrovich**, John III, Orange Grove, TX
W5WUP **Eichenberger**, Frank C., Morrilton, AR
AA5XM **Leuchter**, Marcus D., Houston, TX
K5YFW **DuBose**, Walter D., San Antonio, TX
K5ZLA **Unnasch**, Wilbert V., Taylor, TX
WD6ASN **Barden**, Jerry J., Madera, CA
KG6DA **Knod**, Michael K., Fresno, CA
♦ KQ6FM **Carlson**, G. L. "Don," Sparks, NV
K6GHB **Brundage**, George H., Carmichael, CA
♦ K6KM **Snider**, William L., Yankee Hill, CA
KB6KRI **Taylor**, Eugene H., Burbank, CA
WA6ORK **Cahhal**, Donald L., Des Moines, IA
W6PBI **Veregge**, Elwood C., Gardnerville, NV
KM6RP **Johnson**, Donald V., Highland, CA
KD6TDD **Turner**, James H., Lodi, CA
WB6TKR **Curl**, Robert J., Long Beach, CA
KB6TRE **Loepprich**, Norman S., Palm Desert, CA
N6UMG **Bryant**, Layton M., El Sobrante, CA
K6UMX **Johnson**, Louis D. Sr, Fontana, CA
AA6VK **Spiva**, Tom L., Esparto, CA
♦ W6WBK **Baucom**, Clifton D., Liberty Hill, TX
KC6ZSQ **Young**, Harriette E., Ventura, CA
K6ZYY **Wirt**, Eliot, San Jose, CA
N7DG **Greenwood**, Donald R., Bellingham, WA
WA7HYD **Huson**, Robert D., Marysville, WA
W7MQL **Potts**, Cyril J., Grants Pass, OR
♦ WX7P **Morgan**, Wilse G., Rice, WA
WB7QKK **Mastin**, William M., Gilbert, AZ
W7TXN **Monroe**, John C., Seattle, WA
KB7UG **Chaddock**, Jim, Ferndale, WA
KD7UIF **Coster**, Jerry N., Great Falls, MT
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The Silent Keys listing in the August 2013 issue of *QST* mentioned Donald E. Bishop, KJ5SI, of Columbus, Mississippi in error. We are happy to report that Mr Bishop is alive and well. *QST* regrets the error.

♦ Life Member, ARRL

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

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

Strays

I Would Like to Get in Touch With...

…anyone who knew Stuart Craigie, who worked for Tropical Radio Telegraph in Nicaragua and possibly elsewhere in Central America. Stuart was licensed in the US by 1920, using the call sign 3MV and living in Richmond, VA. His later call signs in the USA and Nicaragua are unknown. Contact Carter Craigie, N3AO, at **n3ao@arrl.net**.

I would like to get in touch with...

Anyone who owns a 1940 or 1941 *Radio Amateur's Callbook*. Samuel Beverage, W1MGP, 163 Middle Rd, North Haven, ME 04853-3116; **w1mgp@arrl.net**.

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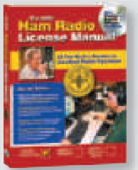

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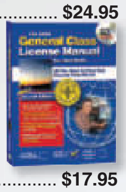

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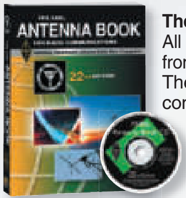

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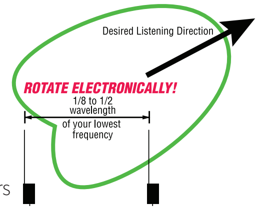

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New!

The 40VE-2 is a single-band vertical antenna system with a low profile top hat assembly and is less than 25 feet tall. It is specifically designed for low visibility and is great for HOA restricted areas, while providing optimum performance on 40 meters. The antenna can be modified for single-band operation on 30 meters by shortening the height. There are no traps, coils or linear loading elements. This aluminum and stainless steel antenna is durable, attractive and offers a low profile that will blend into the surroundings.

- Full band coverage on 40 or 30 meters with SWR under 1.5:1, no tuner needed
- Tunable above and below 7 MHz range for MARS and CAP frequencies
- No coils or traps, maximum radiation efficiency
- Power handling up to 5 kW
- Less than 25' overall height

DXE-40VE-2...$219.95

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Start operating digitally! 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, including PSK-31, SSTV, CW, RTTY, MT63 and Echolink®. It's easy to install and set up, and software is included.

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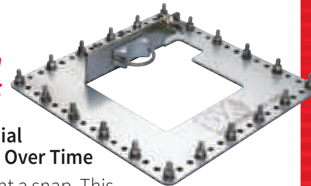

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Make radial attachment a snap. This plate fits 3" pipe, 4x4 and 6x6 posts and you can use up to 120 radials. It's made from .125" thick 304 stainless steel, not cheap aluminum and uses a patented high current coax-to-radial connection. This ensures excellent, lasting radial connectivity.

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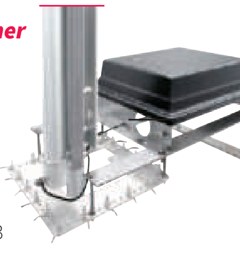
MFJ-998RT Remote Tuner Mounting System



This Remote Tuner Mounting System lets you mount your MFJ-998RT tuner to any quarter-wave vertical antenna. It's ideal for the full legal limit power DXer. The ATU-2 mounts securely to the DX Engineering RADP-3 Radial Plate.

Using stainless steel brackets and specialized connectors and hardware, the DXE-ATU-2 ensures maximum power transfer to antenna without arcing. The DXE-MBV-ATU-2 is a complete package that bundles the DXE-ATU-2 with a bias tee power injector and the MFJ-998RT remote IntelliTuner.

DXE-ATU-2	Remote Tuner Mounting System $64.50
DXE-MBV-ATU-2	Remote Tuner Mounting System with MFJ-998RT $814.45

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These clamps include stainless steel flat washers, lockwashers, nuts and bolts. They have corrosion-resistant aluminum saddles with a rough finish for a secure grip. They are also available with black powder-coated saddles. See the entire selection at DXEngineering.com.

U-Bolt Cast Saddle	Tube O.D.	Bolt Thread	Price
DXE-SAD-050A	0.50"	1/4"-20	$5.25
DXE-SAD-075A	0.75"	1/4"-20	$5.65
DXE-SAD-100A	1.00"	1/4"-20	$6.05
DXE-SAD-125A	1.25"	1/4"-20	$6.85
DXE-SAD-150A	1.50"	1/4"-20	$7.75
DXE-SAD-175A	1.75"	1/4"-20	$8.90
DXE-SAD-200A	2.00"	5/16"-18	$10.05
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DXE-SAD-250A	2.50"	5/16"-18	$12.05
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DXE-SAD-300A	3.00"	5/16"-18	$13.60
DXE-SAD-300B	3.00"	3/8"-16	$15.25
DXE-SAD-400A	4.00"	3/8"-16	$34.70
DXE-SAD-450A	4.50"	3/8"-16	$39.95

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U-Bolt Black Powdercoated Saddle	Tube O.D.	Bolt Thread	Price
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DXE-PSAD-075A	0.75"	1/4"-20	$10.95
DXE-PSAD-100A	1.00"	1/4"-20	$11.05
DXE-PSAD-125A	1.25"	1/4"-20	$11.85
DXE-PSAD-150A	1.50"	1/4"-20	$12.75
DXE-PSAD-175A	1.75"	1/4"-20	$13.90
DXE-PSAD-200A	2.00"	5/16"-18	$15.05
DXE-PSAD-250A	2.50"	5/16"-18	$17.05
DXE-PSAD-300A	3.00"	5/16"-18	$18.60

V-Bolt Black Powdercoated Saddle	Tube O.D.	Bolt Thread	Price
DXE-PCAVS-1P	0.50"-1.75"	1/4"-20	$10.90
DXE-PCAVS-2P	1.00"-2.00"	5/16"-18	$12.95

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The saddles feature serrated edges to grip hard pipe surfaces. These clamps include stainless steel V-bolts, and can be ordered with a tab and 1/4" hardware for grounding applications.

V-Bolt Stainless Saddle	Pipe Size	Ground Lug	Price
DXE-SSVC-1P	1/2"-3/4"	No	$6.95
DXE-SSVC-1PG	1/2"-3/4"	Yes	$7.95
DXE-SSVC-150P	1"-1 1/2"	No	$9.95
DXE-SSVC-150PG	1"-1 1/2"	Yes	$10.95
DXE-SSVC-2P	1"-2"	No	$11.95
DXE-SSVC-3P	2"-3"	No	$14.95

Super Duty Saddle Clamps

Super Duty Saddle Clamps are designed for maximum clamping strength to control large or unbalanced loads. They feature an A356-T6 cast aluminum saddle, with rough, as-cast finish for a secure grip. The clamps include a cast stainless reinforcement plate; armor coated bolt sets are available separately.

Part Number	Tube O.D.	Price
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DXE-SDS-300P	3.00"	$51.00

Resin Support Blocks

Securely mount tubing to any flat surface. These blocks have an insulated mount between the tubing and plates, ideal for antenna construction and electrical applications.

Block Part Number	Tube O.D.	Reinforcement Plate Required	Price
DXE-RSB-I02500	1/4"	DXE-RSB-DP-1	$2.65
DXE-RSB-I03125	5/16"	DXE-RSB-DP-1	$2.85
DXE-RSB-I03750	3/8"	DXE-RSB-DP-1	$2.65
DXE-RSB-I05000	1/2"	DXE-RSB-DP-2	$2.90
DXE-RSB-I06250	5/8"	DXE-RSB-DP-2	$2.90
DXE-RSB-I03400	3/4"	DXE-RSB-DP-3	$3.10
DXE-RSB-I10000	1"	DXE-RSB-DP-3	$3.15
DXE-RSB-I11250	1 1/8"	DXE-RSB-DP-4	$4.70
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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.

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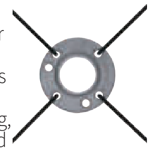
Guy Rings



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 $7.95

Telescoping Antenna Tubing Kits

Available in either fiberglass or aluminum, these kits contain several tapered sections of DX Engineering tubing and stainless steel band camps, allowing you to build your own vertical antenna. You can design, experiment and create an adjustable setup tailored specifically to your specs. The tubing telescopes smoothly and comes in larger sizes and wall thicknesses.

DXE-FTK50 — Fiberglass Antenna Tubing Kit, 50' Max. Length $138.00

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1K2 VHF 1,200 Watt Amplifiers

These compact amps are perfect for Field Day and DXpeditions, and they're also perfect for your shack. The 1K2 is the smallest 1,200 watt amplifier ever offered and it weighs a mere 13 pounds. Adding the built-in switching power supply brings the total weight to just 20 pounds. These amplifiers use a single LDMOS FET rated at an incredible 1,250 Watts, able to handle a 65:1 SWR.

1K2 Amplifiers are designed for EME (CW and JT65), SSB, CW or the very popular JT6M for meteor scatter.

MSQ-6M-1K2 — 6 Meter 1,200 Watt Amplifier with Power Supply — Was ~~$3,299.00~~ **Sale $2,995.00**

MSQ-6M-1K2-NOPS — 6 Meter 1,200 Watt Amplifier without Power Supply — Was ~~$2,699.00~~ **Sale $2,425.00**

MSQ-2M-1K2* — 2 Meter 1,200 Watt Amplifier with Power Supply — Was ~~$3,299.00~~ **Sale $2,995.00**

MSQ-2M-1K2-NOPS* — 2 Meter 1,200 Watt Amplifier without Power Supply — Was ~~$2,699.00~~ **Sale $2,425.00**

Sale prices on M2 Amplifiers expire on 10/1/2013

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1330 to 2130 UTC (November-February)
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Sale Code: **1309QS**
Prices & specifications subject to change without notice.

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Tech/International: **330.572.3200** Country Code: **+1**
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Made in USA

Made in the USA to DX Engineering's Rigid Specifications.

Available in full spools or cut to your custom length.

Bulk Cable	Impedance	Length	Price
Low-Loss Mini-8 Cable			
DXE-8X	50 Ω	per foot	**$0.31**
DXE-8X-1000	50 Ω	1,000'	**$259.99**
Low-Loss Cable			
DXE-213U	50 Ω	per foot	**$0.89**
DXE-213U-500	50 Ω	500'	**$409.99**
DXE-11U	75 Ω	per foot	**$0.52**
Premium Low-Loss Cable			
DXE-400MAX	50 Ω	per foot	**$0.82**
DXE-400MAX-500	50 Ω	500'	**$364.99**
Low-Loss Foam Cable			
DXE-8U	50 Ω	per foot	**$0.79**
DXE-8U-500	50 Ω	500'	**$359.99**
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**

Multi-Conductor Control Cable

The ideal cable to control your rotator or antenna switch, this color-coded stranded copper cable is reliable and flexible. A vinyl jacket shields it from the elements and it is available by the foot and in bulk spools. Find all the details at DXEngineering.com.

Part Number	Conductors (Gauge)	Description	Price/ Foot
COM-CW3	3 (20 AWG)	Standard	**$0.25**
COM-CW4	4 (20 AWG)	Standard	**$0.28**
DXE-CW8	2 (18 AWG) 6 (22 AWG)	Standard	**$0.48**
DXE-CW8-HD	2 (16 AWG) 6 (18 AWG)	Heavy Duty	**$0.89**
DXE-CW9	9 (24 AWG)	Cat5e	**$0.32**
DXE-CW9S	9 (24 AWG)	Shielded	**$0.36**

DXE-8X BNC Jumper Cables

These male BNC jumper cables use secure, crimped connectors and tube-shrink seals, which make them impervious to the elements. They are Hi-Pot and high voltage tested. In addition to these 50 Ω assemblies, 75 Ω cables are available as well.

DXE-8XDB002 2' Length..... **$14.25**
DXE-8XDB003 3' Length..... **$14.75**
DXE-8XDB006 6' Length..... **$15.75**
DXE-8XDB012 12' Length..... **$17.75**
DXE-8XDB025 25' Length.... **$21.75**
DXE-8XDB050 50' Length.... **$32.75**

Phasing Cables

DX Engineering provides precision, electrically-tuned phasing lines for your 50 or 75 Ω applications. Choose from pre-manufactured four-square and two-antenna array cables or contact us with your custom application.

Multi-Conductor Heavy Duty Tinned Copper Flat Braid

A critical part of any grounding system, this Flat Braid is made with terminals for quick, easy installation. See more sizes and grounding solutions at DXEngineering.com.

Part Number	Length	Price
7 AWG Braid Rated at 85 Amps 1" Wide, for a 1/4" Stud		
DXE-TCB10-RT01	1'	**$5.75**
DXE-TCB10-RT03	3'	**$8.75**
DXE-TCB10-RT05	5'	**$12.75**
DXE-TCB10-RT10	10'	**$18.75**
10 AWG Braid Rated at 53 Amps 1/2" Wide, for a #10 Stud		
DXE-TCB05-RT01	1'	**$4.75**
DXE-TCB05-RT03	3'	**$5.75**
DXE-TCB05-RT05	5'	**$6.75**
DXE-TCB05-RT10	10'	**$9.75**

DX Engineering is the Best Place to Get Coax, Here's Why:

- 100% Hi-Pot and High Voltage Tested
- Your **Coax Cable Order is Shipped FREE** Anywhere in the Contiguous 48 States
- Weatherproof: Adhesive Shrink Tubing Seals Connections
- Silver-plated PTFE-insulated Connectors
- Hand Crafted by Top Techs

See DXEngineering.com for more connector options.

Made in USA

Black PVC Jacket

DXE-8U 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%

Pre-cut Cable with Connectors		
Part Number	Length	Price
DXE-8UDU002	2'	**$13.25**
DXE-8UDU003	3'	**$13.75**
DXE-8UDU006	6'	**$16.75**
DXE-8UDU025	25'	**$41.75**
DXE-8UDU050	50'	**$64.75**
DXE-8UDU100	100'	**$117.75**

UV-Resistant, Non-Contaminating, Black PVC Jacket

DXE-213U 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%

Pre-cut Cable with Connectors		
Part Number	Length	Price
DXE-213UDU003	3'	**$14.75**
DXE-213UDU006	6'	**$18.75**
DXE-213UDU012	12'	**$24.75**
DXE-213UDU025	25'	**$39.75**
DXE-213UDU050	50'	**$68.75**
DXE-213UDU075	75'	**$95.75**
DXE-213UDU100	100'	**$118.75**
DXE-213UDU150	150'	**$171.75**

UV-Resistant, Black PE Jacket

DXE-8X Low-Loss Foam Dielectric Cable

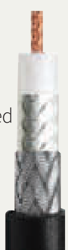
Known as RG-8X or Mini-8

- 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%

Pre-cut Cable with Connectors		
Part Number	Length	Price
DXE-8XDU003	3'	**$11.75**
DXE-8XDU006	6'	**$12.75**
DXE-8XDU012	12'	**$16.75**
DXE-8XDU025	25'	**$21.75**
DXE-8XDU050	50'	**$32.75**
DXE-8XDU075	75'	**$43.75**
DXE-8XDU100	100'	**$53.75**
DXE-8XDU150	150'	**$74.75**

UV-Resistant, Non-Contaminating, Black PVC Jacket



DXE-400MAX 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%

Pre-cut Cable with Connectors		
Part Number	Length	Price
DXE-400MAXDU003	3'	**$16.75**
DXE-400MAXDU006	6'	**$18.75**
DXE-400MAXDU018	18'	**$35.75**
DXE-400MAXDU025	25'	**$43.75**
DXE-400MAXDU050	50'	**$66.75**
DXE-400MAXDU075	75'	**$99.75**
DXE-400MAXDU100	100'	**$119.75**
DXE-400MAXDU150	150'	**$179.75**

We have a tuner that will work for you!

*We make tuners that will work with any transceiver. Don't know which one is right for you? Give us a call or see the **Tuner Comparison Chart** on our web site for more selection help!*

LDG ELECTRONICS

radio not included

AT-897Plus for the Yaesu FT-897

If you own a Yaesu FT-897 and want a broad range automatic antenna tuner, look no further! The AT-897Plus Autotuner mounts on the side of your FT-897 just like the original equipment and takes power directly from the CAT port of the FT-897 and provides a second CAT port on the back of the tuner so hooking up another CAT device couldn't be easier. ***Suggested Price $199.99***

NEW! AT-600ProII

Building on the success of the AT-600Pro, we refined and expanded the model with an optional external 4.5" analog meter. The new AT-600ProII keeps many of the same features of the previous model, but simplifies the operation. With the two-position antenna switch, there are 2,000 memories that store tuning parameters for almost instantaneous memory recall whenever you transmit on or near a frequency you've used before. Includes six-foot DC power cable. ***Suggested Price $369.99***

Optional M-600 external analog meter $129.99

AT-1000ProII

LDG Electronics' new flagship 1KW tuner features: 5 to 1,000Watts PEP; RF Sensing; Auto and Semi Tuning Modes; 1.8 to 54 MHz range; 6 to 800 ohm range (15 to 150 on 6M); simplified operation; and an optional external 4.5" analog meter. With the two position antenna switch, there are 2,000 memories that store tuning parameters for almost instantaneous memory recall whenever you transmit on or near a frequency you've used before. Includes six foot DC power cable.

Suggested Price $539.99

Optional M-1000 external analog meter $129.99

Z-100Plus

Small and simple to use, the Z-100Plus sports 2000 memories that store both frequency and tuning parameters. It will run on any voltage source from 7 to 18 volts; six AA batteries will run it for a year of normal use. Current draw while tuning is less than 100ma. The Z-100Plus now includes an internal frequency counter so the operating frequency is stored with tuning parameters to make memory tunes a blazingly fast 0.1 seconds; full tunes take an average of only 6 seconds. Includes six foot DC power cable. ***Suggested Price $159.99***

Z-11ProII

Meet the Z-11ProII, everything you always wanted in a small, portable tuner. Designed from the ground up for battery operation. Only 5" x 7.7" x 1.5", and weighing only 1.5 pounds, it handles 0.1 to 125 watts, making it ideal for both QRP and standard 100 watt transceivers from 160 - 6 meters. The Z-11ProII uses LDG's state-of-the-art processor-controlled Switched-L tuning network. It will match dipoles, verticals, inverted-Vs or virtually any coax-fed antenna. With an optional LDG balun, it will also match longwires or antennas fed with ladder-line. Includes six foot DC power cable. ***Suggested Price $179.99***

radio not included

Z-817

The ultimate autotuner for QRP radios including the Yaesu FT-817(D). Tuning is simple; one button push on the tuner is all that is needed - the Z-817 takes care of the rest. It will switch to PKT mode, transmit a carrier, tune the tuner, then restore the radio to the previous mode! 2000 memories cover 160 through 6 meters. The Z-817 will also function as a general purpose antenna tuner with other QRP radios. Just transmit a carrier and press the tune button on the tuner. Powered by four AA internal Alkaline batteries (not included), so there are no additional cables required. ***Suggested Price $129.99***

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

HAM-IV

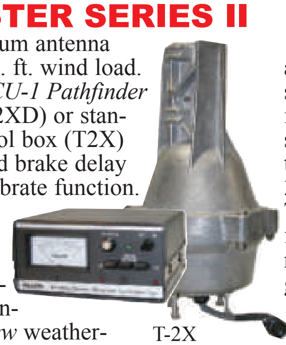
HAM-IV **$649.95**

The most popular rotator in the world! For medium communications arrays up to 15 square feet wind load area. *New* 5-second brake delay! *New* Test/Calibrate function. *New* low temperature grease permits normal operation down to -30 degrees F. *New* alloy ring gear gives extra strength up to 100,000 PSI for maximum reliability. *New* indicator potentiometer. *New* ferrite beads reduce RF susceptibility. *New* Cinch plug plus 8-pin plug at control box. Dual 98 ball bearing race for load bearing strength and electric locking steel wedge brake prevents wind induced antenna movement. North or South center of rotation scale on meter, low voltage control, max mast size of 2 1/16 inches.

HAM IV and HAM V Rotator Specifications	
Wind Load capacity (inside tower)	15 square feet
Wind Load (w/mast adapter)	**7.5 square feet**
Turning Power	800 in.-lbs.
Brake Power	**5000 in.-lbs.**
Brake Construction	Electric Wedge
Bearing Assembly	**dual race/96 ball bearings**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight	26 lbs.
Effective Moment (in tower)	**2800 ft.-lbs.**

TAILTWISTER SERIES II

For large medium antenna arrays up to 20 sq. ft. wind load. Available with *DCU-1 Pathfinder* digital control (T2XD) or standard analog control box (T2X) with *new* 5-second brake delay and *new* Test/Calibrate function. Low temperature grease, alloy ring gear, indicator potentiometer, ferrite beads on potentiometer wires, *new* weatherproof AMP connectors plus 8-pin plug at control box, triple bearing race with 138 ball bearings for large load bearing strength, electric locking steel wedge brake, North or South center of rotation scale on meter, low voltage control, 2 1/16 inch max. mast.



T-2X **$799.95**

T-2XD **$1229.95** with DCU-1

TAILTWISTER Rotator Specifications	
Wind load capacity (inside tower)	20 square feet
Wind Load (w/ mast adapter)	**10 square feet**
Turning Power	1000 in.-lbs.
Brake Power	**9000 in.-lbs.**
Brake Construction	Electric Wedge
Bearing Assembly	**Triple race/138 ball brngs**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight	31 lbs.
Effective Moment (in tower)	**3400 ft.-lbs.**

CD-45II

CD-45II **$449.95**

For antenna arrays up to 8.5 sq. feet mounted inside tower or 5 sq. ft. with mast adapter. Low temperature grease good to -30 F degrees. *New* Test/Calibrate function. Bell rotator design gives total weather protection, dual 58 ball bearing race gives proven support. Die-cast ring gear, stamped steel gear drive, heavy duty, trouble free gear train, North center scale, lighted directional indicator, 8-pin plug/socket on control unit, snap-action control switches, low voltage control, safe operation, takes maximum mast size to 2 1/16 inches. MSLD light duty lower mast support included.

CD-45II Rotator Specifications	
Wind load capacity (inside tower)	8.5 square feet
Wind Load (w/ mast adapter)	**5.0 square feet**
Turning Power	600 in.-lbs.
Brake Power	**800 in.-lbs.**
Brake Construction	Disc Brake
Bearing Assembly	**Dual race/48 ball brings**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight	22 lbs.
Effective Moment (in tower)	**1200 ft.-lbs.**

HAM-V

HAM-V **$1099.95** with DCU-1

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

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.

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.**

Digital Automatic Controller

DCU-1 **$749.95**

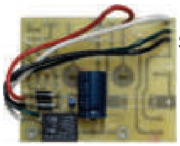
Automatically controls T2X, HAM-IV, V rotators. 6 presets for favorite headings, 1° accuracy, 8-sec. brake delay, choice for center of rotation, crisp *plasma* display. Computer controlled with many logging/contest programs.

AR-303 Rotator/Controller

AR-303 **$89.95**

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

NEW! Automatic Rotator Brake Delay



RBD-5 **$29.95**

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

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100W HF/6M Mobile with Antenna Tuner

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TH-D72A

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2M FM Mobile

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TS-590S
100W HF/6M Transceiver

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2M/440 FM Mobile

TS-990S
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TS-990S
200W HF/6M Flagship Transceiver

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Dual analog meters, LCD

The world famous MFJ-259B gives you a complete picture of your antenna's performance. You can read your antenna's SWR and Complex Impedance from 1.8 to 170 MHz.

MFJ-259B is a complete ham radio test station including -- frequency counter, RF signal generator, *SWR Analyzer*™, RF Resistance/Reactance Analyzer, Coax Analyzer, Capacitance/ Inductance Meter and more!

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.

Built-in frequency counter, Ni-MH/Ni-CD charger circuit, battery saver, low battery warning, smooth reduction drive tuning.

Super easy to use! Just set the bandswitch and tune the dial -- just like your transceiver. SWR and Complex Impedance are displayed instantly!

Fully portable, take it anywhere -- remote sites, up towers, on DX-peditions. Use 10 AA or Ni-Cad or Ni-MH batteries (not included) or 110 VAC with MFJ-1312D, $15.95. Rugged metal cabinet only 4x2x6¾ inches.

MFJ *No Matter What*™ **Warranty**

Every MFJ analyzer is protected by MFJ's famous one year No Matter What™ limited warranty. We will repair or replace your MFJ analyzer (at our option) for a full year.

MFJ-249B, $269.95. If digital display is all you need MFJ-249B does everything MFJ-259B does without analog meters.

More hams use MFJ analyzers than all others in the world!

MFJ-269 1.8-170 MHz *plus* 415-470 MHz, 12-bit A/D

MFJ-269
$389⁹⁵

MFJ-269 is a *super* MFJ-259B that adds 415-470 MHz and 12-bit A/D converter that gives you much better accuracy. *Complex Impedance Analyzer* reads series/*parallel* equivalents and magnitude/phase. *CoaxCalculator*™ gives line length from electrical degrees and vice-versa for any frequency, Velocity Factor, coax loss in dB. Use any characteristic impedance 10-600 Ohms. Has LCD log SWR bargraph, N-connector.

MFJ-266C 1.5-65, 105-230 300-490 MHz -- *all* Ham Bands

MFJ-266C
$359⁹⁵

New! 220 MHz band!

MFJ-266C *new* compact *wide-range* analyzer covers HF (1.5-65 MHz), VHF (105-230 MHz, including 220 MHz band) and UHF (300-490 MHz). Antenna Analyzer mode reads frequency, SWR, complex impedance *simultaneously*. 500 MHz freq. counter mode has 100 Hz resolution, measures relative field strength/ frequency for tracking interference. Signal Generator mode, solid-state switching, and electronic tuning. Backlight, N-connector.

MFJ-225 1.5-180 MHz *continuous* Two-Port Graphic Analyzer

MFJ-225
$399⁹⁵

Out in the field, MFJ-225 is a compact completely *self-contained handheld graphing analyzer*. On the bench it becomes a full-fledged two-port (S21) desktop machine when teamed up with your PC. Using powerful IG-miniVNA freeware, you'll run detailed data analysis and print out stunning color-graphic plots to document your work! Built-in back-lighted *3-inch LCD graphic* display. Make fine adjustments using full-screen easy-to-view SWR bargraph, capture vivid swept displays for SWR, impedance, return loss, phase angle, more. DDS generator.

MFJ-269*PRO*™ Analyzer

MFJ-269Pro, $419.95.

Like MFJ-269, but UHF range covers *430 to 520 MHz* to include commercial and industrial frequencies. Rugged protective shell protects knobs, switches, meters, digital display for commercial, industrial and lab work.

HF/VHF/UHF SWR Analyzer™

CLOSEOUT!!!

MFJ-266B, $299.95.

Has all the features of MFJ-266C but MFJ-266B covers 1.5-65 MHz, 85-185 MHz and 300-490 MHz. Does not cover 220 MHz band.

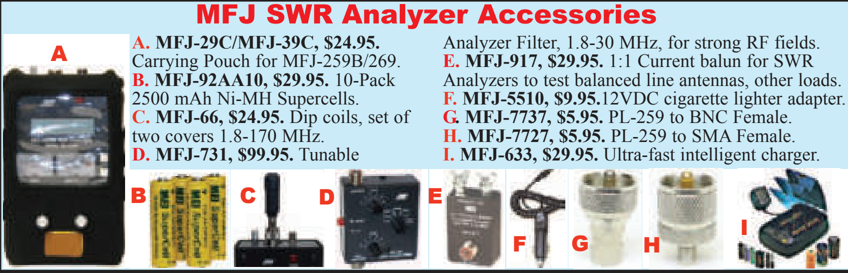
HF/6M SWR Analyzer, 1-60 MHz

MFJ-213, $199.95.

Reads SWR, complex impedance, impedance magnitude. Measures capacitance, inductance, field strength, frequency, generate test signals. Fine tune stubs, analyze coax, test baluns, RF transformers, plus other RF tasks.

MFJ SWR Analyzer Accessories

A. MFJ-29C/MFJ-39C, $24.95. Carrying Pouch for MFJ-259B/269.
B. MFJ-92AA10, $29.95. 10-Pack 2500 mAh Ni-MH Supercells.
C. MFJ-66, $24.95. Dip coils, set of two covers 1.8-170 MHz.
D. MFJ-731, $99.95. Tunable Analyzer Filter, 1.8-30 MHz, for strong RF fields.
E. MFJ-917, $29.95. 1:1 Current balun for SWR Analyzers to test balanced line antennas, other loads.
F. MFJ-5510, $9.95. 12VDC cigarette lighter adapter.
G. MFJ-7737, $5.95. PL-259 to BNC Female.
H. MFJ-7727, $5.95. PL-259 to SMA Female.
I. MFJ-633, $29.95. Ultra-fast intelligent charger.



Dealer/Catalog/Manuals

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or call toll-free 800-647-1800

• 1 Year *No Matter What*™ warranty • 30 day money back guarantee (less s/h) on orders direct from MFJ

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300 Industrial Pk Rd, Starkville, MS 39759 **PH:** (662) 323-5869
Tech Help: (662) 323-0549
FAX:(662)323-6551 8-4:30 CST, Mon.-Fri. ***Add shipping.***

MFJ *IntelliTuner*™ Automatic Tuners

More hams use MFJ tuners than all other tuners in the world!

World's most advanced Automatic Antenna Tuners feature world renowned MFJ AdaptiveSearch™ and AutomaticRecall™ algorithms -- world's fastest ultra-wide range tuning. Nine World Class models! Choose your features: Digital/Analog/Audio SWR-Wattmeter, Antenna Switch, Balun, Radio Interface, Digital frequency readout, Remoteable, Coax/Balanced Lines/Wire Tuning, Field Upgradeable . . .

MFJ-998 1500 Watt *Legal Limit IntelliTuner*™

Only the MFJ-998 gives you fully automatic antenna tuning for your legal limit full 1500 Watts SSB/CW linear amplifier!

MFJ-998 **$699.95**

Ultra-fast Automatic Tuning

Instantly match impedances from 12-1600 ohms using MFJ's exclusive *IntelliTune*™, *Adaptive Search*™ and *InstantRecall*™ algorithms with over 20,000 *VirtualAntenna*™ Memories.

Safe auto tuning protects amp

MFJ's exclusive *Amplifier Bypass Control*™ makes tuning safe and "stupid-proof"!

Digital/Analog Meters

A *backlit* LCD meter displays SWR, forward/reflected power, frequency, antenna selected, an auto-ranging bargraph power indication, and much more.

Has quick-glance auto-ranging Cross-Needle SWR/Wattmeter.

MFJ VirtualAntenna™ Memory

MFJ new *VirtualAntenna*™ Memory system gives you 4 antenna memory banks for *each* of 2 switchable antenna coax connectors. Select up to 4 antennas on each antenna connector. Each antenna has 2500 memories, 20,000 total. Has binding post for end-fed long wire antennas.

Download & Upgrade Remotely

Download from internet and upgrade your MFJ-998 firmware as new features are introduced.

Plus Much More!

Built-in radio interface controls most transceivers.

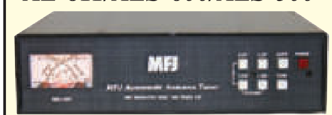
Automatically bypasses with excessive tuning power.

Use balanced line antennas with external **MFJ-912, $59.95**, 1.5 kW 4:1 balun.

Small 13Wx4Hx15D inches easily fits into your ham station. 8 pounds. Requires 12-15VDC at 1.4 amps maximum or 110 VAC with **MFJ-1316, $21.95**.

for 600 Watt amps

AL-811/ALS-600/ALS-500



For 600 Watt amps like Ameritron AL-811/ALS-600/ALS-500M. Matches 12-800 Ohms. 10,000 *Virtual Antenna*™ memories. Cross-Needle SWR/Wattmeter. 10Wx2¾Hx9D inches.

MFJ-994B **$359.95**

***No Matter What™* Warranty**

Every MFJ tuner is protected by MFJ's famous one year *No Matter What*™ limited warranty. We will repair or replace your MFJ tuner (at our option) for a full year.

300 Watt...Best Seller

Digital Meter, Ant Switch, Balun

The *world's best selling* automatic antenna tuner is *highly acclaimed the world over* for its ultra high-speed, wide matching range, reliability, ease-of-use! Matches virtually *any* antenna.

MFJ-993B **$259.95**

300 Watt *Extra*...Wide Range

SWR/Wattmeter, 10000 VA Memories

***Extra** wide matching range at less cost.* Exclusive dual power level: 300 Watts/6-1600 Ohms; 150W/6-3200 Ohms. Cross-Needle SWR/Wattmeter.

MFJ-991B **$219.95**

200 Watt ... Compact

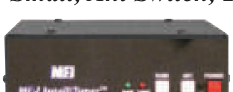
Digital Meter, Ant Switch, Wide Range

World's fastest compact auto tuner uses MFJ *Adaptive Search*™ and *InstantRecall*™ algorithms. 132,072 tuning solutions instantly match virtually any antenna with near perfect SWR.

MFJ-929 **$219.95**

200 Watt ... Econo

Small, Ant Switch, 20K VA Memories

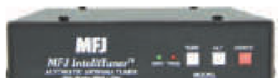


MFJ-928 **$199.95**

High-speed, wide matching range and compactness at low cost! Leave in-line and forget it -- your antenna is *always* automatically tuned! 2-position antenna switch.

200 Watt *MightyMite*™

Matches IC-706, FT-857D, TS-50S



MFJ-925 **$179.95**

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!

G5RV Antenna

MFJ-1778 **$44.95**

Covers all bands, 160-10 Meters with antenna tuner. 102 ft. long. Can use as inverted vee or sloper. Use on 160 Meters as Marconi. 1500 Watts. Super-strong fiberglass center/feed-point insulators. *Glazed ceramic* end insulators. All hand-soldered connections. Add coax, some rope and you're *on the air!* **MFJ-1778M, $39.95.** G5RV Junior. Half-size, 52 ft. 40-10M with tuner, 1500 Watts.

200W...Weather-sealed

for Remote/Outdoor/Marine

MFJ-926B **$279.95**

***Fully** weather-sealed for remote Outdoor/Marine use*! Tough, durable, built-to-last the elements for years.

200 Watt...Remote

Coax/Wire Ant, No pwr cable needed

MFJ-927 **$259.95**

Weather protected fully automatic *remote* auto tuner for wire ***and** coax* antennas -- an MFJ exclusive. Powers through coax -- No separate power cable needed.

Free MFJ Catalog

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10 Bands: 80-2 Meters

$299.95 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*(R) 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.

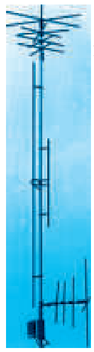
This gives you consistently high performance by killing feedline radiation, pattern distortion, SWR shifts, RFI, noise pickups.

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-1786 $419.95

MFJ's *tiny* 36 inch diameter loop antenna lets you operate 10 through 30 MHz *continuously* -- including the WARC bands!

Ideal for limited space -- apartments, small lots, motor homes, attics, or mobile homes. Enjoy DX and local contacts mounted vertically. Get both low angle radiation for excellent DX and high angle radiation for local, close-in contacts. Handles 150 watts.

Super easy-to-use! Only MFJ's super remote control has *Auto Band Selection*™. It auto tunes to desired band, then beeps to let you know. No control cable is needed. Fast/slow tune buttons and built-in two range Cross-Needle SWR/Wattmeter lets you quickly tune to your exact frequency.

All welded construction, welded butterfly capacitor with no rotating contacts, large 1.050 inch diameter round radiator -- *gives you highest possible efficiency*.

Each plate in MFJ's tuning capacitor is welded for low loss and polished to prevent high voltage arcing, welded to the radiator, has nylon bearing, anti-backlash mechanism, limit switches, continuous no-step DC motor -- smooth precision tuning. Heavy duty thick ABS plastic housing has ultraviolet inhibitor protection.

Cover 40-15 Meters. MFJ-1788, $469.95. Like MFJ-1786 but covers 40 - 15 Meters continuous. Includes remote control.

MFJ *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.

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.

Free MFJ Catalog

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MFJ . . . the world leader in ham radio accessories!

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. C*eramic* 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

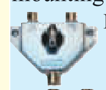
Ultra high quality center fed dipoles will give you trouble-free operation for years. Custom injection-molded UV-resistant center insulator has built-in coax connector and hanging hole. Heavy duty 7-strand, 14-gauge hard copper antenna wire. Extremely strong solderless crimped construction. Authentic *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	MFJ-1779B	MFJ-1779C
$69.95	**$49.95**	**$29.95**
160M, 265 ft.	80-40M, 135 ft.	20-6M, 35 ft.

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. 6 1/4Wx4 1/4Hx1 1/4D in.

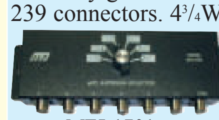


MFJ-1702C
$39.95
2-Positions

MFJ-1702C Like MFJ-1704, but for 2 antennas. 3Wx2Hx2D"

MFJ-1700C
$99.95

MFJ-1700C *Antenna/ Transceiver Switch* lets you select one of six antennas and one of six transceivers in any combination. Plug in an antenna tuner or SWR wattmeter and it's always in-line for any antenna/transceiver combination. Has lightning surge protection. Handles 2 kW PEP SSB, 1 kW CW, 50-75 Ohm loads. Unused terminals are automatically grounded. 1.8 to 30 MHz. SO-239 connectors. 4 3/4W6 1/2Hx3D inches.



MFJ-1701
$69.95

MFJ-1701 *Antenna Switch* like MFJ-1700C but lets you select one of six antennas only. 10Wx3Hx1 1/2D inches.

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*® coax and *Teflon*® 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.

33 ft. Telescoping fiberglass Mast
3.8 feet collapsed, 3.3 lbs.

MFJ-1910
$79.95

Super strong fiberglass mast has huge 1 3/4 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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MFJ 160-6 Meter Antenna

Self-supporting 43 foot vertical -- no guy wires required . . . 1500 Watts . . . exceptional performance . . . low-profile . . . includes base mount and legal limit balun . . . assembles in an hour . . .

MFJ-2990
$359.95

New!

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

Exceptional Performance

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

With an automatic antenna tuner there's no fuss -- just talk!

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

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

Fully self-supporting, Extremely low wind loading, Very low visibility . . .

With just 2 square feet wind load, the fully self-supporting MFJ-2990 -- *no guy wires needed* -- has the lowest wind-loading and lowest visibility of any vertical antenna! The key is a six foot section of tapering diameter *stainless steel* whip that flexes in strong wind instead of stressing the bottom sections. Its 2-inch O.D. and .120 inch thick walled tubing bottom section makes it incredibly strong -- it'll stay up!

Weighs just 20 pounds -- you can easily put it up by yourself because its corrosion resistant *6063 aircraft aluminum* tubing and stainless steel construction make it light *and* super-strong.

Assembles in an hour

You can easily assemble it in an hour! Ground mounting lets you completely hide its antenna base in shrubbery. Includes ATB-65 high-strength antenna mount. Requires ground system -- at least one radial. More extensive ground system will give much better performance.

Great for Stealth Operation in antenna restricted areas

This very low-profile antenna is perfect for stealth operation in antenna restricted areas. Hide it behind trees, fences, buildings, bushes. Use it as a flagpole. Telescope it down during the day. Put it up at night and take it down in the morning before the neighbors even notice!

Quick and easy installation makes it great for DXpeditions, field day and other portable and temporary operations.

MFJ *Automatic* Tuners

MFJ-998
$699.95

For legal limit 1500 Watt SSB/CW amplifiers. Auto-ranging LCD and Cross-Needle SWR/Wattmeter, antenna switch, amp bypass, matches 12-1600 Ohms, 1.8-30 MHz.

MFJ-993B
$259.95

Dual power range -- 300 Watt range matches 6-1600 Ohms. 150 Watt/6-3200 Ohms. Auto-ranging LCD and Cross-Needle SWR/Wattmeter, antenna switch, 1.8-30 MHz.

MFJ *Manual* Tuners

MFJ-989D
$389.95

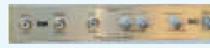
1500 Watts SSB/CW, 1.8-30 MHz. Active peak-reading Cross-Needle SWR/Wattmeter, balun, dummy load, antenna switch, aircore roller inductor.

MFJ-949E
$179.95

World's most popular tuner! 300 Watts, 1.8-30 MHz. Peak/Average Cross-Needle SWR/Wattmeter, 8 pos. antenna switch, dummy load, 1kV capacitors.

Window Feedthru

MFJ-4602
$69.95



Bring 3 coaxes, balanced line, random wire, ground thru window. Connectors mounted on *stainless steel* panel. 3/4" thick *pressure-treated* weather-proof wood.

Free MFJ Catalog

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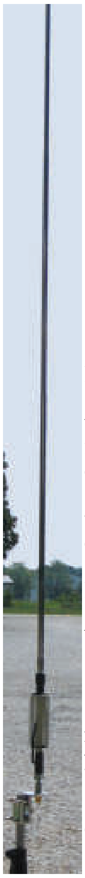
MFJ Big Stick™

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.

Portable/Mobile Emergency Communications Center

Micro-phone, radio not included

MFJ-706
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Slide your Icom IC-706 or IC-7000 into this MFJ-706/7000 to get an entire portable/mobile *emergency communications center*. MFJ *PeakPowerBoost*™ lets you plug into vehicle cigarette lighter or light duty 10/15 Amp 12V DC power supply. Built-in automatic antenna tuner, 3/8-24 antenna mount.

MFJ *BigEAR™*

8-Band Portable Dipole

34 feet Radiators, 7-55 MHz

For hams on-the-go!
Operate anywhere, anytime with a strong QSO grabbing signal!

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.

True general coverage -- tunes up with low SWR on any frequency 7-55 MHz. Handles QRP to full killowatt PEP.

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.

Distinctive V-shaped elements are set 45 degrees from the horizon to keep element tips high in the air. This maximizes radiation, minimizes ground loss and prevents hazardous contact.

MFJ's heavy-duty *NoTool*™ mast lock lets you easily and quickly mount on any tripod or mast up to 7/8 inches. SO-239 for coax. With fewer parts to assemble, set-up and tune-up is much faster!

18 foot Telescopic Fiberglass Mast with Tripod

MFJ-1919EX, $139.95. ***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, 3/4 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.

MFJ-1918, $49.95, *Smaller tripod*. Supports 66 lbs. 1 inch diameter mast extends 6 foot. Collapses to 3.2Hx.3D feet. Triangle base spreads to 2.75 feet. Weighs 6.75 lbs.

17 foot *Stainless Steel* Telescoping Whip

MFJ-1979, $59.95. Super-strong, super long *17 foot stainless steel* telescoping whip. 27 in. collapsed. 10 sections. 3/8-24 threaded base.
MFJ-1977, $44.95/12ft;**MFJ-1796, $39.95**/10ft
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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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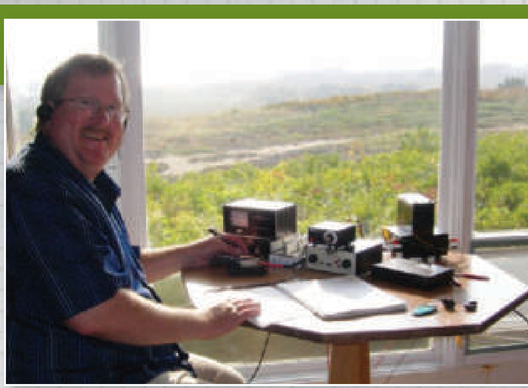
QST QuickStats

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 5 through July 3, 2013.
Get on the web and vote today at **www.arrl.org/quickstats**!



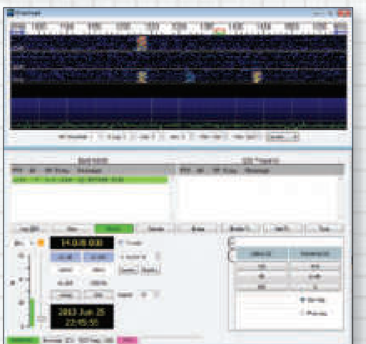
Do you take ham gear on your summer vacation trips?

- Yes, a VHF/UHF rig **31%**
- Yes, an HF rig **5%**
- Yes, VHF/UHF and HF rigs **28%**
- No **21%**
- I don't take summer vacations **15%**

WB1GCM on Cape Cod

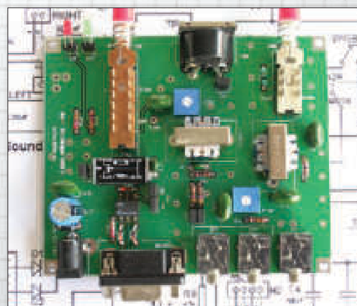
Have you tried the new JT9 digital mode?

- Yes **8%**
- No **67%**
- I've never heard of it before **25%**



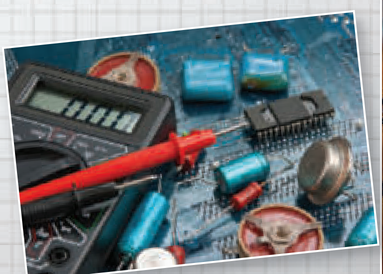
Do you own a computer/transceiver interface for HF digital operating?

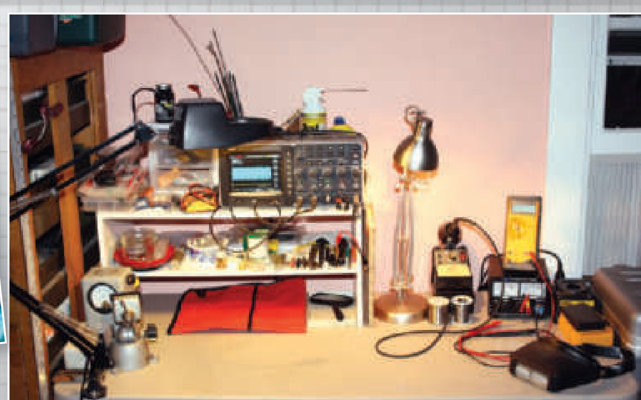
- Yes, a commercial model **53%**
- Yes, an interface I built myself **16%**
- No **31%**



Do you have a dedicated electronics "bench" in your home for making equipment repairs, working on projects, etc?

- Yes **57%**
- No **43%**





[Ward Silver, NØAX photo]

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RX: 0.030–60.000MHz*

Four 32 Bit IF-DSPs + 24 Bit AD/DA Converters

2 Independent Receivers

+40dBm 3rd Order Intercept Point

3 Roofing Filters

Selectable, "Build Your Own" IF Filter Shapes

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RX: 0.030–60.000MHz*

Two 32 Bit IF-DSPs + 24 Bit AD/DA Converters

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3 Roofing Filters

Selectable, "Build Your Own" IF Filter Shapes

IC-7600

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100 Watt Output (30W AM), Optional PS-126

RX: 0.030–60.000MHz*

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3 Roofing Filters

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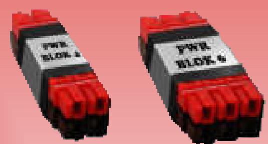

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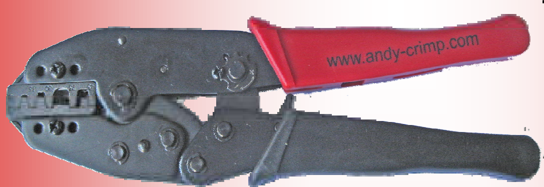

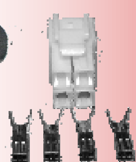

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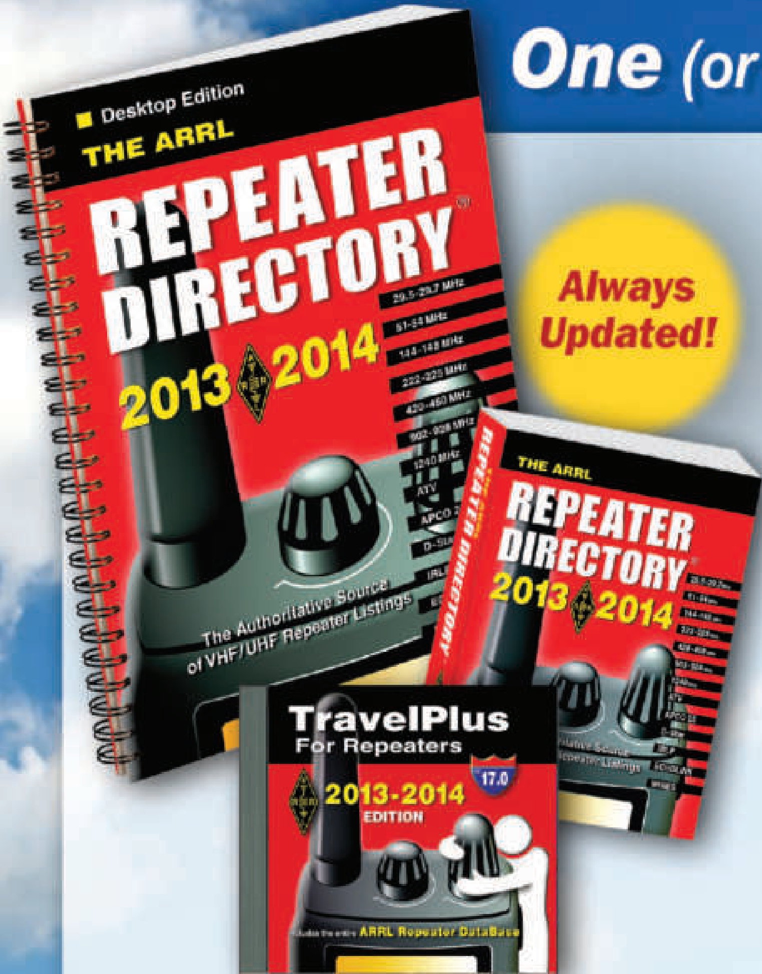
One (or two) for the Road...



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- Transmitter Hunt
- Prize Drawings
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- Youth Events
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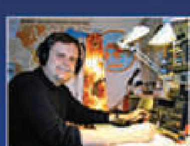

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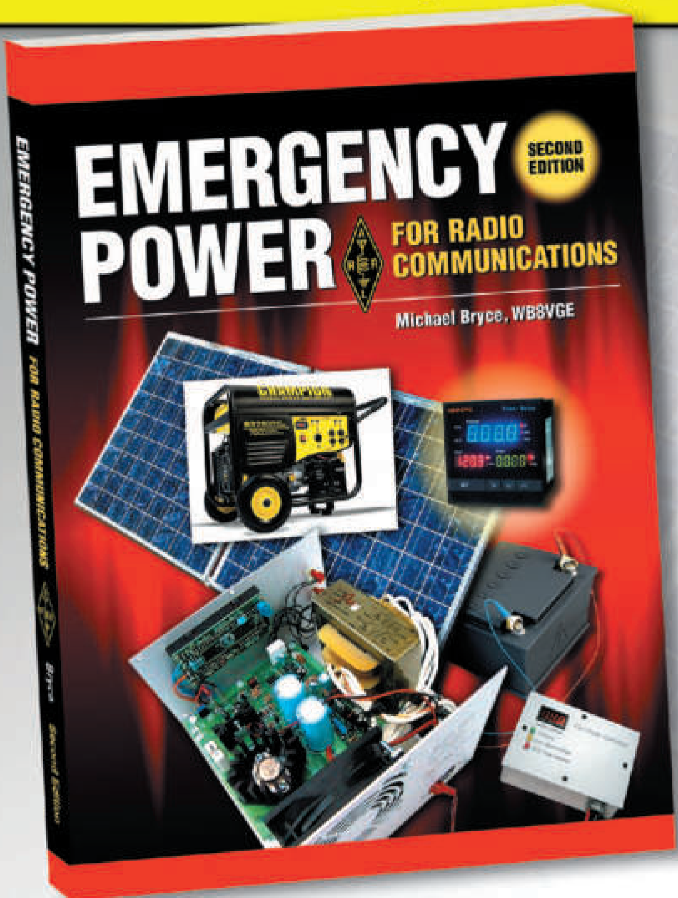

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1. Advertising must pertain to products and services which are related to Amateur Radio.

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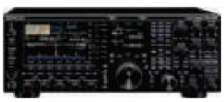

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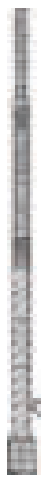

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