

# QST



**ARRL** The National Association for  
**Amateur Radio®**

September 2023 [www.arrl.org](http://www.arrl.org)

DEVOTED ENTIRELY TO AMATEUR RADIO

## Ham Radio Goes to High School

### QST Reviews

**Yaesu FTM-200DR**  
C4FM/FM Mobile  
Transceiver

**MFJ-419 CW Elmer**

**Taidacent RF**  
Power Meter





# Fun to Operate Multi-Functional Mobile

## Leading C4FM Digital & High-Resolution Full-Color Display

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

# FTM-200DR

**C4FM**  
DIGITAL CLEAR VOICE  
Clear and Crisp Voice Technology

**AMS**  
Automatic Mode Select

66 db GPS

**WIRES-X**

microSD  
Card

Bluetooth®



《 Actual Size 》

### PMG-SR Monitor

Monitor a Primary Memory Group with a Single Receiver

PMG-SR\* operation provides constant monitoring and communication on up to 5 channels in the PMG group, regardless of the VFO or Memory channel operation. Instantly register the current display frequency to the PMG group by pressing and holding the "PMG" key. AUTO mode or MANUAL mode PMG operation can be selected.



### CFL Display

Custom Function List Display

The CFL screen allows checking and immediately executing priority functions simply by using the "F/Menu" key and dial.

Up to 8 functions or settings from the set-up menu can be registered in the custom function list.

KEYPAD	HOME
SCAN	TXPWR HIGH
SQL T-SQL	ARS AUTO
RPT-R	TONE 88.5
DTMF	APRS OFF
HIGH	

### 3W Outstanding Audio Output

### Worldwide WIRES-X Internet Communications

### APRS Fully Compatible

\* FTM-200DR is a single receiver, there is no audio output when monitoring multiple registered channels. While the Operating channel is active, the real-time reception status of other channels is not displayed.

**YAESU**  
Radio for Professionals

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

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

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



# *Carries the Yaesu genes for true RF performance*

- SDR circuit emphasizes Receiving Performance
- Powerful RF Front-End & Low Noise Oscillator Enable Phenomenal Multi-Signal Receiving Characteristics\*
  - RMDR : 113dB+    • BDR : 127dB+
  - 3rd IMDR : 102dB+    • TX Phase Noise : -143dBc/Hz
- Band-Pass-Filters dedicated for the amateur bands to eliminate out-of-band unwanted signals
- Built-in High-speed Automatic antenna tuner
- Effective QRM rejection by Dual-core DSP
- AE<sup>SS</sup> (Acoustic Enhanced Speaker System) with SP-40 speaker to create High-fidelity audio output
- 3DSS, real-time 3-Dimensional Spectrum Stream presentation
- High Resolution 4.3-inch TFT Color Touch Panel Display
- VMI (VFO Mode Indicator) shows the current operating mode
- "PRESET" Mode functions most suitable for FT8 operation
- Equipped with the External Display terminal

\*Multi-signal receiving characteristic: 14MHz band/2kHz separation

\*TX Phase Noise: 100W, CW mode

## **FT-710 AE<sup>SS</sup>**

- Includes External Speaker SP-40

## **FT-710 Field**

- Includes Carrying Belt
- To use the AE<sup>SS</sup> function, External Speaker SP-40 (Optional) is required

- Display is not included. The image is shown with an optional third-party external display that may be connected using a DVI-D digital cable.



\* Photo shows the FT-710 AE<sup>SS</sup>

HF/50MHz 100W SDR TRANSCEIVER w/ SP-40

## **FT-710 Ae<sup>SS</sup>**

*Acoustic Enhanced Speaker System*

HF/50MHz 100W SDR TRANSCEIVER

## **FT-710 Field**

**YAESU**  
*Radio for Professionals*

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

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

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



## Cushcraft 10, 15 & 20 Meter Tribander Beams

Only the best tri-band antennas become DX classics, which is why the Cushcraft World-Ranger A4S, A3S, and A3WS go to the head of the class. For more than 30 years, these pace-setting performers have taken on the world's most demanding operating conditions and proven themselves every time. The key to success comes from attention to basics. For example, element length and spacing has been carefully refined over time, and high-power traps are still hand-made and individually tuned using laboratory-grade instruments. All this



It goes without saying that the World-Ranger lineup is also famous for its rugged construction. In fact, the majority of these antennas sold years ago are still in service today! Conservative mechanical design, rugged over-sized components,

stainless-steel hardware, and aircraft-grade 6063 make all the difference.

The 3-element A3S/A3WS and 4-element A4S are world-famous for powerhouse gain and super performance. **A-3WS, \$649.95, 12/17 M. 30/40 Meter add-on kits available.**

attention to detail means low SWR, wide bandwidth, optimum directivity, and high efficiency -- important performance characteristics you rely on to maintain regular schedules, rack up impressive contest scores, and grow your collection of rare QSLs!

## MA-6B 6-Band Beam Small Footprint -- Big Signal 2-Elements on 20/17/15/12/10/6 Meters!!!

Cushcraft's latest MA-6B gives you 2-elements on 6 bands! Solid signal-boosting directivity in bantam size/weight.

It mounts on your roof or mast using standard TV hardware. It's perfect for exploring exciting DX without the high cost and heavy lifting of installing a large tower and a full-sized array. 7' 3" boom has less than 9' of turning radius. Contest tough -- handles 1500 Watts.

The unique MA-6B is a two-element Yagi on 20/17/15/12/10/6 Meters. It delivers solid power-multiplying gain

over a dipole on all bands. Automatic band switching and a super easy installation in a compact 26 pound package.

When working DX, what really matters are the interfering signals and noise you don't hear. That's where the MA-6B's impressive side rejection and front-to-back ratio really shines.

**MA-5B, \$759.95.** Like MA-6B but 5 bands: 20/17/15/12/10 Meters. 12/17M is a single element trapped dipole.

See [mjenterprises.com/cushcraft](http://mjenterprises.com/cushcraft) for gain figures.



## Cushcraft R9 . . . 80-6 Meters . . . No Radials...1500W

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

Big Brother R9 now includes

75/80M for ragchewing and worldwide low band DX without radials!

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

Use full 1500 Watts SSB/CW when the going gets tough to break through pile-ups/poor band conditions.

The R9 is super easy to assemble,

installs just about anywhere, and its low profile blends inconspicuously into the background in urban and country settings alike.

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

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

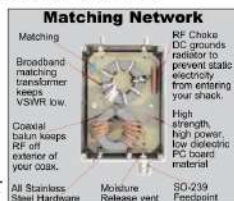
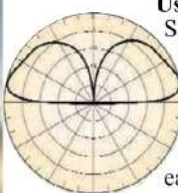
Nature can dish out.

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

**R8, \$699.95.** Like R9 antenna but less 75/80 Meters.

**R-8TB, \$119.95.** Tilt-base lets you tilt your antenna up/down easily by yourself to work on.

**R-8GK, \$99.95.** Three-point guy kit for high winds.



## Cushcraft Dual Band Yagis One Yagi for Dual-Band FM Radios

Dual-bander VHF rigs are the norm these days, so why not compliment your FM base station with a dual-band Yagi? Not only will you eliminate a costly feed

line, you'll realize extra gain for digital modes like high-speed packet and D-Star! Cushcraft's A270-6S provides three elements per band and the A270-10S provides five for solid point-to-point performance. They're both pre-tuned and assembly is a snap using the fully illustrated manual.



## Cushcraft Famous Ringos Compact FM Verticals

W1BX's famous Ringo antenna has been around for a long time and remains unbeaten for solid reliability. The Ringo is broad-banded, lighting protected, extremely rugged, economical, electrically bullet-proof, low-angle, and more -- but mainly, it just plain works! To discover why hams and commercial two-way installers around the world still love this antenna, order yours now!

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

**Cushcraft**  
Amateur Radio Antennas

308 Industrial Park Road, Starkville, MS 39759 USA

Open: 8-4:30 CST, Mon.-Fri. Add Shipping.

• Sales/Tech: 662-323-5803 • FAX: 662-323-6551

<http://www.cushcraftamateur.com>

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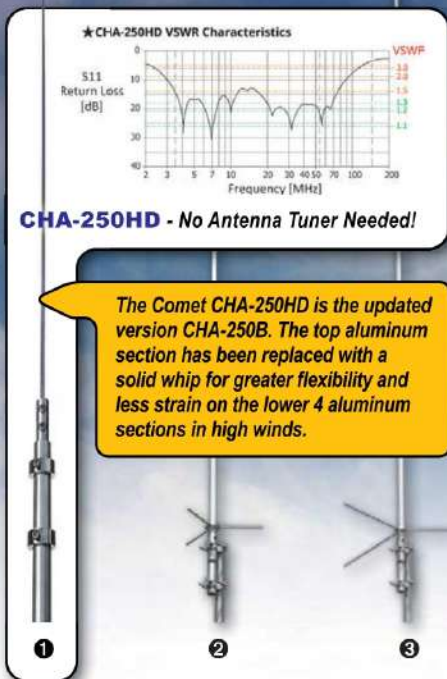
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**Enjoy the ride!**



**CTC-50M Window Gap Jumper**  
No more drilling or open windows!



## Base Antennas

### 1 COMET CHA-250HD BROADBAND 80M THROUGH 6M VERTICAL ANTENNA

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

### 2 COMET GP-3 DUAL-BAND 146/446MHZ BASE REPEATER ANTENNA

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

### 3 COMET GP-6 DUAL-BAND 146/446MHZ BASE REPEATER ANTENNA

Wavelength: 146MHz 5/8 wave x 2 • 446MHz 5/8 wave x 5 • Max Pwr: 200W • Length: 10'2" • Weight: 3lbs. 8ozs. • Conn: Gold-plated SO-239 • Construction: Fiberglass, 2 Sections

### 4 COMET GP-9 / GP-9N DUAL-BAND 146/446MHZ BASE REPEATER ANTENNA

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

### 5 COMET CX-333 TRI-BAND 146/220/446MHZ BASE REPEATER ANTENNA

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

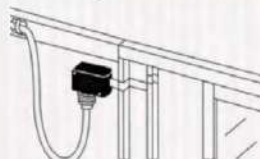
### 6 COMET GP-15 TRI-BAND 52/146/446MHZ BASE REPEATER ANTENNA

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

### 7 COMET CTC-50M WINDOW GAP JUMPER

Avoid drilling holes or leaving windows open/unlocked. Flat coax easily forms to window frame. Low loss SO-239 on each end, 15 inch length.

• Max Pwr: HF 100W PEP • VHF 60W FM • UHF 40W FM • 900-1300 MHz 10W FM



### CAA-500MarkII

1.8-500MHz Antenna analyzer

The CAA-500MarkII combines the simplicity and accuracy of an analog instrument, PLUS...a full color LCD graphic display • Resistive (R) and Reactive (X) components of impedance graphed and displayed numerically • SWR readings in both graphic and numerical results.

Operates on 8-16VDC external power, 6 AA Alkaline or NiMH rechargeable cells • Trickle charger built in (only when using NIMH batteries) • Typical battery life: 9 hours of continuous operation • Battery level indicator • Selectable auto power-off time limit preserves battery capacity • SO-239 connector for 1.8-300MHz range • N-female connector for 300-500MHz range

The perfect combination of analog and graphic information, designed in particular for antenna diagnostics and adjustments while on the roof, tower or in the field!

### CAA-5SC

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

Shoulder strap included.



**Call or visit your local dealer today!**  
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## Write for QST

[www.arrl.org/qst-author-guide](http://www.arrl.org/qst-author-guide)  
email: [qst@arrrl.org](mailto:qst@arrrl.org)



## Our Cover

The 75-member Council Rock High School South Amateur Radio Club, KC3JND, was founded in 2014 and thrives with the support of local hams and clubs as well as three of the school's science teachers, who are also hams. Read this month's "Club Station" column by KC3JND members Taylor Arnosky, KC3WFW, and Alba Sinani, to learn about the club's ham radio projects and operations, and how multidisciplinary learning is woven into all of it. [Photo courtesy of KC3JND]



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# Propagation Know-How

NEW!

## ***Here to There: Radio Wave Propagation***

presents the principles of amateur radio propagation in an easy-to-understand style. Knowing ionospheric structures, how they form, and which bands they interact with will prepare you for practical operating and help you make the most of your time on the air. This reference will elevate your operating and open new possibilities regardless of your preferred mode(s) or your license class.

### **Topics Include:**

- **Fundamentals of Radio Wave Propagation**

A breakdown of the science underpinning your communications.

- **The Sun and Solar Activity**

Understand how the Sun interacts with the ionosphere and what that means for your transmissions.

- **Sky-Wave, or Ionospheric, Propagation**

How radio waves, primarily at HF and below, travel through the ionosphere.

- **VHF and UHF Non-ionospheric Propagation**

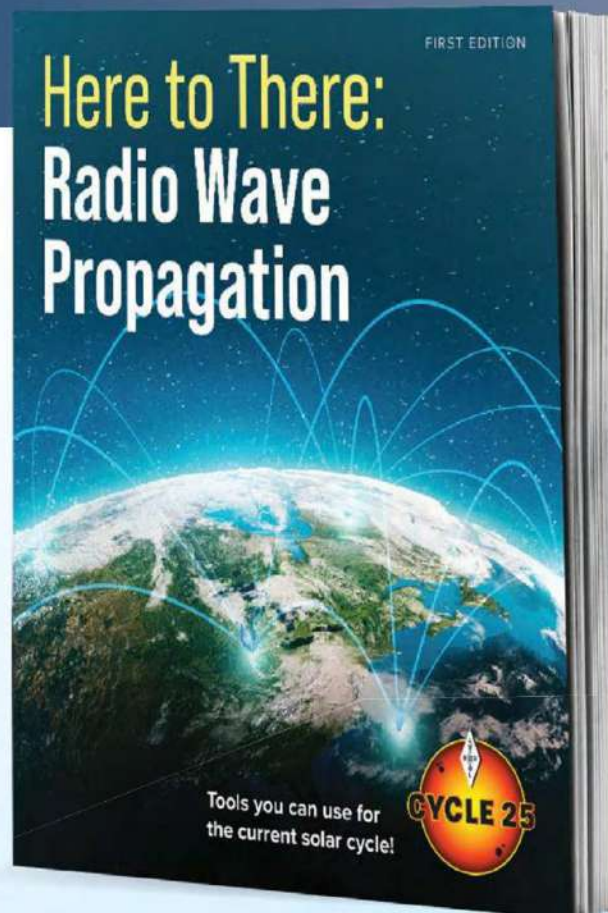
Ways in which VHF, UHF, and microwave propagation defies line-of-sight limits.

- **Propagation Predictions for HF Operation**

Programs and tools available to assess and plan for propagation in the HF spectrum.

- **VHF and UHF Mobile Propagation**

Whether in a car or at your home station, learn about the terrain and atmospheric effects impacting your transmissions.



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Base antenna is 20m-6m with  
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controlled coil.

Ground radial systems available.

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[diamondantenna.net](http://diamondantenna.net)

When it comes to quality and performance, DIAMOND ANTENNA is the worldwide leader in VHF/UHF base and mobile antennas.

DIAMOND ANTENNAS help you get the most out of your on-air experience.

For all your base station and repeater needs, DIAMOND has an antenna that will work for you.

You've tried the rest, now own the best!

Here is a small sample of our wide variety of antennas

Model	Bands	Length Ft.	Max Pwr. Rating	Conn.
<b>Dualband Base Station/Repeater Antennas</b>				
X700HNA (4 section)	2m/70cm	24	200	N
X510HD (3 Section)	2m/70cm	17.2	330/250	UHF or N
X300A (2 Section)	2m/70cm	10	200	UHF or N
X200A (2 Section)	2m/70cm	8.3	200	UHF
X50A (1 Section)	2m/70cm	5.6	200	UHF or N
X30A (1 Section)	2m/70cm	4.5	150	UHF
<b>Monoband Base Station/Repeater Antennas</b>				
F23H (3 Section)	144-174 MHz (W/ Cut Chart)	15	350	UHF
F22A (2 Section)	2m	10.5	200	UHF
CP22E (Aluminum)	2m	8.9	200	UHF
F718A (Coax Element)	70cm	15	250	N
<b>Dualband Mobile Antennas</b>				
SG7900A	2m/70cm	62.2 in.	150	UHF or NMO
SG7500A	2m/70cm	40.6 in.	150	UHF or NMO
NR770H Series	2m/70cm	38.2 in.	200	UHF or NMO
MR77 Series	2m/70cm	20 in.	70	Mag Combo
AZ504FXH	2m/70cm	15.5 in.	50	UHF
AZ504SP	2m/70cm	15.5 in.	50	UHF
NR7900A	2m/70cm	57 in.	300/250	UHF
<b>Monoband Mobile Antennas</b>				
NR22L	2m	96.8 in.	100	UHF
M285	2m	52.4 in.	200	UHF or NMO

## **X700HNA Special Features:**

- Heavy duty fiberglass radomes
- Four section assembly
- Overlapping outer shells for added strength
- Stainless steel mounting hardware & radials
- Strong waterproof joint couplings
- Type-N cable connection
- Wideband performance
- Highest gain Dual-band Base Antenna!

*The Standard By Which All Others Are Judged*



**RF PARTS  
COMPANY**

Diamond Antenna is a division of RF Parts Company



## Second Century



# Participating in Science

*In March 2021, when I gave the keynote address to the QSO Today Virtual Ham Expo hosted by Eric Guth, 4Z1UG, I briefly mentioned the advent of the new solar cycle, Cycle 25, and went out on a limb. Up to that point, most space weather scientists were calling for a lackluster cycle similar to Cycle 24. However, there were some opposing predictions, based on evolving science, that the new cycle was going to be, as I stated then, "gangbusters." These predictions were based on looking beyond the smoothed numbers and instead looking at the granularity of the data points to see exactly how long or short the previous cycle was, to determine the potential of the next cycle.*

Now, that said, predicting weather is not an exact science. Even on Earth, where we have a network of technologies reporting real-time data from the surface, air, and space, look at how difficult it is to get a reliable forecast. Now, extend that to space weather. Our tools become vastly less capable, not only of measuring what's happening, but also of helping us understand what's about to happen — and ultimately, for us amateur radio operators, what the impact on propagation will be.

With the internet came the ability to collect significant amounts of real-time data to help us measure what is happening right now. From the Reverse Beacon Network (RBN) using CW signals to PSK Reporter's use of FT8, we now have the ability to measure and report what is happening on the bands. This can be extremely valuable for a few reasons. First, you can measure how your station is performing with the current set of conditions. Second, using predictive tools like VOACAP, you can compare how you think conditions should be performing for you versus how they really are. As you spend more time understanding how propagation is affecting your own station, you're getting into the science of propagation. You're building a personal correlation between what is being reported about the sun, the solar weather, and conditions on Earth.

Hams are not the only ones using this data. In study after study, space weather scientists are using our data as a basis for understanding their own views and theories on science to evolve stronger predictive tools and reports in the future.

How do you get more involved in the science of propagation? Here's a quick checklist:

**Prepare:** Take advantage of the various informational resources from articles and books, to blogs and YouTube to gain a strong understanding of what we do know and what the vernacular and data definitions mean. This is one of the reasons we brought out a new book for Cycle 25, *Here to There: Radio Wave Propagation* ([www.arrl.org/here-to-there-radio-wave-propagation](http://www.arrl.org/here-to-there-radio-wave-propagation)), to give a primer on the latest space science learning for hams.

**Operate:** Experiment with your station. Use different antennas with different takeoff angles. Use various power levels.

Try using WSPR at very low power levels to see how propagation is affecting your ability to be heard. It takes less than 30 seconds to get on a band, call CQ using CW, and see on the RBN where you were heard.

**Participate:** Set your WSJT client to report what you're hearing back to PSK Reporter. A weakness RBN has — a small number of reporting stations — is dwarfed by the huge number of stations around the world that are reporting into the PSK Reporter server. If you have a software-defined radio and can set up a node on RBN, please do so! Participating in these reporting networks and others helps add data points in real time to our ability to measure and understand what is happening with space weather.

**Investigate:** Expand your own knowledge of how things are working by getting into the fundamentals of your station and determining why things seem to be performing the way they are. Assume nothing. Make sure you understand your antennas, how the ground and terrain affect their performance, and how you would expect signals from your station to be working based on the current solar weather indexes, and try to eliminate variables so you can focus on the science.

**Analyze and Report:** Science evolves because we are able to learn from others. Join online groups and share what you've learned. Be prepared to be told you're wrong! Learn while sharing.

These solar conditions benefit everyone. The HF bands become more interesting. VHF bands become exciting from the thrill of bouncing signals off aurora. Everyone should be taking advantage of this gift of an active and exciting opportunity to delve into space weather, its science, and furthering the knowledge base and understanding of propagation. Be radio active, be a connector by getting local Technicians on 6 meters and 10 meters to experience propagation, and share the results with us at ARRL!

A handwritten signature in black ink, appearing to read "David A. Minster", followed by the call sign "NA2AA" in a smaller, printed font.

David A. Minster, NA2AA  
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## Member Spotlight

In 2023, this page will highlight amateurs who have achieved recognition in areas outside of, or related to, amateur radio.



# Dr. Dirk Basting, N4AN

Dr. Dirk Basting's, N4AN, fascination with both science and ham radio began in childhood. In his family's home in Selters, Germany, Dirk remembers finding a battery, a small wire, and a light bulb. The light bulb instantly lit up when joined to the battery via the wire. "So," he thought, "would it take longer to light up with a longer wire?" He promptly disproved the hypothesis and abandoned the experiment — but not his scientific curiosity. "I built all kinds of devices that my parents weren't aware of," he admitted. "I once tried to make TNT, but thankfully, that didn't work either."

Dirk's father was a physician, and he sometimes let the boy tag along on patient visits. One of these patients was a ham. Dirk was enamored with the concept and tried to get licensed during high school, but he couldn't pass the Morse code requirement. The journey from listener to operator was thus put on hold.

### The Eureka Moment

Dirk went on to study chemistry at the Philipps University of Marburg, where a professor tasked him with creating a new iodine-based compound. Close to a breakthrough, he leaned forward to watch the distillation flask. "Then, the thing exploded," Dirk recalled. "I was in the hospital for 4 weeks. That's when I decided chemistry was not for me." In some cases, failure was a blessing. Had Dirk been successful in these earlier experiments (such as his home-made TNT), he might not have redesigned one of the most ubiquitous tools in modern technology.

He and his classmate-turned-colleague, Bernd Steyer, were also stu-



dents of renowned physicist Fritz Peter Schäfer. Sensitive to Dirk's incident, he gave the two a physics project: to build a nitrogen laser from scratch. They were successful, and they rushed to secure a patent. That device was the inspiration for Lambda Physik, the laser supply company Dirk and Bernd started in 1972, while in the depths of their PhD work at the Max Planck Institute in Göttingen. Meanwhile, they tinkered with the prototype and produced an accessible type of excimer laser. Dirk explained, "We were not the inventors." Indeed, physicist Dr. Fritz Houtermans proposed the first model. "But we were the first to build it in a smaller, commercialized form," he said. Excimer lasers use ultraviolet light to vaporize their targets without causing heat damage to surrounding areas — a process known as *photoablation*.

Dirk loaned one to famed IBM researcher Dr. Rangaswamy Srinivasan. He brought the laser to his colleagues,

including ophthalmologist Dr. Stephen Trokel, and they determined it was ideal for laser-assisted in situ keratomileusis (LASIK) surgery. Since its conception, millions have benefited from LASIK surgery. Dirk's excimer laser soon reached Silicon Valley; IBM's Almaden lab used it to design finer transistors and integrated circuits. Furthermore, when silicon is illuminated by its beam, it takes on a polycrystalline structure useful for digital displays and solar panels. One of Lambda Physik's top clients, Intel, uses the lasers for their semiconductors.

### Laser-Focused on Amateur Radio

Dirk retired and sold the company to Coherent in 2003. This allowed him to get licensed in 2008 and begin operating. However, his Fort Lauderdale condominium had an antenna ban at the time. "At one meeting, I explained how important ham radio is for the community. A storm arrived just as I was giving the speech," he said. He told the homeowners association that if the storm compromised phone lines, he could still transmit over the air. Antennas were permitted after that, and Dirk has about eight of them up for various bands and modes.

Dirk now frequently travels with his wife, Rosemarie, and their sightseeing agenda involves looking for amateur radio antennas. "All over the world, every time I see an antenna on a roof, I knock on the door and ask if there's a ham living there." Dirk's accomplishments may set him apart from the average person, but when among radio amateurs, all that matters is their shared vocation.



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# ELECRAFT K4

## High-Performance Direct-Sampling SDR



### A direct-sampling SDR you'll love to use

Our new K4 transceiver harnesses advanced signal processing while retaining the best aspects of the K3S and P3. It features a 7" touch display, plus a rich set of dedicated controls. Per-VFO transmit metering makes split mode foolproof. Band-stacking registers and per-receiver settings are versatile and intuitive. Control usage information is just one tap away thanks to a built-in help system.

### Modular, hybrid architecture adapts to your needs

The basic K4 covers 160-6 m, with dual receive on the same or different bands. The K4D adds diversity receive, with a full set of band-pass filters for the second receiver. (Thanks to direct RF sampling, there's no need for crystal filters in either the K4 or K4D.) The K4HD adds a dual superhet module for extreme-signal environments. Any K4 model can be upgraded to the next level, and future enhancements—such as a planned internal VHF/UHF module—can be added as needed.

### Single or dual panadapter, plus a high-resolution tuning aid

The main panadapter can be set up as single or dual. Separate from the main panadapter is our per-receiver *mini-pan* tuning aid, with a resampled bandwidth as narrow as  $\pm 1$  kHz. You can turn it on by tapping either receiver's S-meter or by tapping on a signal of interest, then easily auto-spot or fine tune to the signal.

### Comprehensive I/O, plus full remote control

The K4's rear panel includes all the analog and digital I/O you'll ever need. All K-line accessories are supported, including amps, ATUs, and our K-Pod controller. The USB display output supports its own user-specified format. Via Ethernet, the K4 can be 100% remote controlled from a PC, notebook, tablet, or even another K4, with panadapter data included in all remote displays. Work the world from anywhere—in style!

### K4 KEY FEATURES

Optimized for ease of use

Modular, upgradeable design

7" color screen with touch and mouse control

ATU with 10:1+ range, 3 antenna jacks

Up to 5 receive antenna sources

Full remote control via Ethernet



The K4 interfaces seamlessly with the KPA500 and KPA1500 amplifiers

The performance of their products is only eclipsed by their service and support. Truly amazing! Joe - W1G0



For complete features and specifications visit [elecraft.com](http://elecraft.com) • 831-763-4211



# Up Front

## It's Never Too Late

At a recent VE session in Dover-Foxcroft, Maine, 86-year-old Elizabeth Homchuck passed her first-ever ham radio license exam. She was issued a Technician-class license with the call sign KC1SXE. Congratulations, Elizabeth!



Left to right: Peter Bither, AI1O (VE); Elizabeth Homchuck, KC1SXE; Debra Kaczowski, KB1WRY (VE), and Lloyd Frink, K2KJ (VE). [Lloyd Frink, K2KJ, photo]

## Looks Like 73 to Me

As Ron Ochu, KO0Z, was driving through Cottleville, Missouri, this establishment caught his eye — 73 Brew. Upon visiting, however, he noticed it was actually called Seven Brew, with a fancy 7B logo. Though he was a little let down by the name, he says the coffee was pretty good.



## Red-Hot Ether Sniffer

Using 1920s technology, Scott Freeberg, WA9WFA, built this regenerative radio. Affectionately called the "Red-Hot Ether Sniffer," it's built on a wooden chassis that was typical of construction in that era. Some of the parts are genuine 1920s, including the wooden chassis, Bakelite front panel, copper sheet shielding, knobs, and audio transformers, which were recovered from a junked 1920s AM broadcast radio. The rest of the parts are more modern. Scott thanks longtime friends Harold Borchers, KB0ROB; Russ Iverson, W0CWU (SK), and Chuck Milton, W4MIL, for their inspiration, technical advice, and encouragement.



Front view of the controls: adjustable antenna link (top right), coarse frequency tune (lower right), fine tune (center), volume control (upper left), and throttle capacitor (lower left).



The rear view of the radio shows filament voltage adjustment; battery connections made to the screw terminals, and headphone and antenna connections made to the Fahnestock clips.

If you see something ham-related out in the world, take a photo of it and send it to "Up Front" at [upfront@arrl.org](mailto:upfront@arrl.org).



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As the pioneers of software-defined radios, we didn't set out to change the course of the entire amateur radio industry, but it kind of turned out that way. When you're looking to connect with people and places that may or may not even be on the map, you better have the best technology partner on the planet. We revolutionize for the love of amateur radio and the community that goes along with it. We aim higher and look farther in hopes of creating tools and solutions for things we can't even see just yet. We are your best partner to Find Everywhere. [FlexRadio.com](http://FlexRadio.com)



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This antenna kit is popular with portable operators,  
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## Correspondence

# Letters from Our Members

### Special Event Station Success

I was just reading the April 2023 issue of *QST* and saw my photo in the “Celebrating Our Legacy” column! The letter from Randy Maurer, WA3HLP, included a paragraph about Randy’s participation in a special event station on USS *Nimitz* CVN-68 when we returned from Operation Desert Shield/Desert Storm in 1991. I was the Chief Operating Officer of the Military Auxiliary Radio System (MARS), and Pete Rowland, KE7VW, and I ran the station part-time. Randy provided our crew with many phone patches via MARS during our deployment in the Persian Gulf.

We invited Randy on board during our tiger cruise [A voyage in which friends and family members of the military are allowed to be on the ship. — Ed.] from Hawaii back to our home port of Bremerton, Washington, to show our appreciation for his great work handling phone patches during the deployment.

We made several hundred contacts with our special event station during the tiger cruise, and spent many hours on the receiving end of big pileups! We sent out certificates to everyone who made contact.

I thought you’d appreciate some background on Randy’s letter. Keep up the great work with *QST*!

**Jeff Kinsman, N7TBU**  
Riverton, Wyoming

### The Handbook Shows How Things Remain the Same

Having been a ham for 40 years, I have discovered that everyone has a specialty — some of us like antennas, some repairing equipment, some computers, etc. I have always been fascinated with DXing and history.

Over the years, I have helped many

hams or family members of deceased hams go through equipment and decide what to donate or sell. In doing so, I have added to my personal collection. One thing that I obtained was the 1st edition of *The Radio Amateur’s Handbook*, published in 1926.

I was inclined to reread a little of it and found a quote in the first paragraph from the first chapter of interest because it still holds true today:

Few hobbies can be compared to that of the amateur radio enthusiast. The experimenter, the man who enjoys communicating with distant lands and receiving cards and letters from foreign countries, and the operator who most enjoys talking with his fellow enthusiasts scattered all the way across the country — each does his part in amateur radio.

Despite how much time has changed communication, the basics of communicating are still the same. *The ARRL Handbook* is still a foundational work that can and will get more radio enthusiasts involved in the hobby for years to come.

**Craig Anderson, N7GLT**  
Sierra Vista, Arizona

### Fun with the Glove Antenna

I’ve been using the 2-meter glove antenna from Jim Grebey’s, N4KCT, article, “A 2-Meter Glove Antenna for Portable Operations,” in the January 2023 issue of *QST*. The antenna performs incredibly well, and I have no doubts about the declared 10 dB of gain. What I like the most is the portability, as well as the ease of setup, take-down, and storage.

In April, my wife and I drove to a small coastal community not far from our home in Maine. We intended to set up the glove antenna on a portable mast and check into the weekly York

County Emergency Communications Team net. The ocean winds were very gusty, so we were forced to remove the glove antenna from the mast and lay it on the asphalt pavement behind our car. With the coax connected to our Alinco DR-735T, resting on the back seat of our car and plugged into the cigarette lighter, we checked into the net on time. We were given a signal report of 4 by 9. We had a strong signal and were very readable but with some static interference. We were hitting the repeater 16 miles inland with the antenna laying on the ground!

The 2-meter glove antenna is a great companion to the Alinco DR-735T, which has a freely programmable power-out function between 5 and 50 W. I love operating portable with this combination.

**Rick Alderette, KB1ASM**  
Hollis Center, Maine

### In Praise of the Simple Approach

“Microphones and Ham Radio” by Lindy Williams, K6EB, in the April 2023 issue of *QST* was one of the best technical articles I have read in 7 years. It has just enough technical data and graphs not to confuse you. This minimalist approach to technical articles should become a standard for others.

**Sam Birnbaum, W2JDB**  
Oceanside, New York

Send your letters to “Correspondence,” ARRL, 225 Main St., Newington, CT 06111. You can also submit letters by fax to 860-594-0259, or via email to [letters@arrl.org](mailto:letters@arrl.org). We read every letter received, but we can only publish a few each month. We reserve the right to edit your letter for clarity, and to fit the available page space. Letters published in “Correspondence” may also appear in other ARRL media. The publishers of *QST* assume no responsibility for statements made by correspondents.



## \*NEW! ANC-4+



### ANC-4+ Antenna Noise Canceller

## ANC-4+ Now Shipping!

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- R&L Electronics [www.randl.com](http://www.randl.com)
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### The familiar, rugged ANC-4 now with:

- External TX/RX control - great for QRP operation
- Continuously Adjustable TX hang time
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- TX LED indicator
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- Heavy steel laser-cut housing for precise tuning and mechanical stability

Kill Noise before it reaches your receiver!  
Great for suppressing power line noise, plasma TV noise & many other local electrical noises.



## Navigator

The Premier Sound Card Modem!

See QST Short Takes Review - May 2014-P. 62

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1200/9600 bps AX.25 Packet

Available with USB or RS-232 connection

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Proven FTDI Chip. 9 and 25 pins for all radios, TNCs, Rotor Controllers & more!

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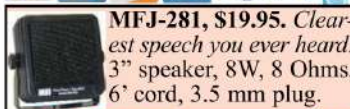
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2-Meter/440  
\$29<sup>95</sup> MHz antenna is perfect for your dual band mobile or HT. Powerful 3 1/2 inch magnet holds firm at high-way speeds, rubber guard, 19" black stainless steel whip, low SWR, excellent gain, 300 Watts PEP, 12 feet coax with PL-259. Free BNC adapter.



**MFJ-1729** **MFJ-1729**  
\$49<sup>95</sup> **Power\*Gain™**  
Ham Radio's most powerful dual band antenna gives whop-ping gain on 440 MHz and 2-Meters! Low SWR. 27 1/2" stainless steel *Slim-line™* radiator mini-mizes wind vibration for less SWR flutter for longer range, bet-ter readability. 12' coax, PL-259, Heavy duty magnet mount.



**MFJ-1728B** **MFJ-1728B 5/8**  
\$39<sup>95</sup> **Wave 2/6 Meter**  
**Mobile Full 50-**  
inch 5/8 Wave gives you maximum possible gain of *any* single ele-ment antenna on 2-Meters. On 6-Meter "magic band" you get a powerful signal with its high-performance low SWR full 1/4 Wave. 300 Watts PEP, heavy duty magnet, 12 feet coax, stainless steel radiator.



## MFJ Super-Strong Magnet Mounts with Coax/PL-259

### MFJ 5-inch Magnet



**MFJ-335BS**  
SO-239

**MFJ-335BM**  
NMO

**MFJ-335BT**  
3/8 - 24

For HF sticks

\$29<sup>95</sup>  
Each

**Best Seller!**  
These jet-black 5-inch

super strong magnet mounts have 17' coax-ial line terminated with PL-259 connectors. SO-239 (BS) or NMO (BM) for your VHF/UHF antennas or 3/8-24 threaded (BT) for your HF hamstick antennas with a 3/8-24 threaded connector.

### MFJ 3-inch Magnet



MFJ-333BS pictured

\$19<sup>95</sup> Each

3-inch black magnet antenna mounts. 17 foot coax is ter-minated with PL-259 connec-tor. Choose SO-239 (BS) or NMO (BM). For VHF/UHF lightweight antennas.

### MFJ SMA/BNC Cables, \$34<sup>95</sup>

Release strain on your HT's antenna connector! 3 ft. flexible, mini coax with SO-239 connector.

A. MFJ-5612S SMA Male.

B. MFJ-5612SF SMA Fe-male Wouxun/Baofeng.

C. MFJ-5612B BNC Male.



### MFJ Triple 5" Magnets



\$49<sup>95</sup> Each

**MFJ-336S**

SO-239

**MFJ-336M**

NMO

**MFJ-336T**

3/8x24

**Three** super-strong 5-Inch Magnets make up this MFJ *Goliath™* Tri-Magnet Mount. 1/4" thick steel triangle base. 17' coax. Select SO-239, NMO, 3/8-24 antennas. **Caution:** once on, it's difficult to get off!

## HF/VHF/UHF 200 Watt Duplexers



**MFJ-916B**  
\$44<sup>95</sup>

Use separate HF/VHF and 440 MHz UHF antennas with single transceiver **OR** use two separate HF/VHF and 440 MHz UHF transceivers with a single HF/VHF/UHF antenna. Heavy-duty diecast enclosure houses low/high pass net-works that separate/combine HF/VHF/UHF sig-nals. Low loss SO-239s. 50 Ohm ports. **MFJ-916BC, \$79.95** 3 ft. coax pigtailed on 2-port side.

## 1.8-200 MHz SWR/Wattmeter

**Compact** 1.8-200 MHz SWR/Wattmeter has HUGE 3" *Cross-Needle* meter.

Read forward/reflected power and SWR simultane-ously. Perfect for mobile/portable. 30/300 Watt ranges. Built-in meter light. SO-239s. 3 1/2 Wx3 1/4 Hx3 1/4 D". **MFJ-842, \$79.95** covers 140-525 MHz, 15/150 Watts.

**MFJ-822**  
1.8-200 MHz  
\$79<sup>95</sup>  
MFJ-842, 140-525



## VHF/UHF Hi-Gain Antennas



**A. MFJ-1402, \$29.95.**

**VHF/UHF RuffRider Junior™.** Premium, short 16 1/2" antenna fits in any garage on any auto. 1/4 Wave on 2 Meters, 1/2 Wave, gain on 440 MHz. 100W. No foldover. B or C.

**B. MFJ-1412, \$39.95.**

**VHF/UHF RuffRider High Power™.** Just 40" long handles full 200 Watts. Great for high power mobile amp. 1/2 Wave, gain on 2 Meters, 3/8 Wave, great gain on 440 MHz. Black or chrome.

**C. MFJ-1422, \$59.95.**

**VHF/UHF RuffRider High Gain™.** 41 1/2 inch long antenna gives extra gain with little height increase. Handles 150 Watts. 1/2 wave with good gain on 2 Meters, 5/8 wave, excellent gain on 440 MHz. Black or chrome.

**D. MFJ-1432, \$69.95.**

**VHF/UHF RuffRider Hyper Gain™.** 62 1/2" brute gives whopping gain on 7/8 Wave 2-Meters, 5/8 Wave and a **MONSTER** gain on 440 MHz. MFJ will rock your ham radio world! 150 Watts. Use tri-magnet. Black or Chrome.



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MFJ-1675T - 75 Meters  
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MFJ-1630T - 30 Meters  
MFJ-1620T - 20 Meters  
MFJ-1617T - 17 Meters  
MFJ-1615T - 15 Meters  
MFJ-1612T - 12 Meters  
MFJ-1610T - 10 Meters  
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\$21<sup>95</sup> Each 6-30 Meters  
40-60 Meters, \$34.95  
75 Meters, \$29.95



**Each** is ruggedly constructed. A heavy duty 4", 3/8 inch diameter fiberglass rod; a nearly indestructible .125 inch diameter PH-17-7 stainless steel whip and chrome plated brass fittings will give you years of service. It's sleek, low profile construction has low wind loading and its semi-rigid fiberglass elimi-nates the need for springs or guys.

**Black** anti-static jacket protects loading coil, blends with any vehicle. Stainless steel whip is adjustable for lowest SWR. Push it down to park in the garage or fully extend it for maxi-mum efficiency during mobile operation.

**Includes** allen wrench and complete tuning and matching instructions. Handle 250 Watts PEP. Whips are 7 feet fully extended, and collapse to about 4 feet for easy storage. **Simply** screws into any 3/8 x 24 female mount for quick band-changing. Get them all for great band coverage!

### 3/8-24 Ham Stick Mounts

**MFJ-343, \$19.95.**

Tough 3/8-24 hard mount for perma-nent installation.



**MFJ-342T, \$19.95.**

3/8-24 HF horizontal or vertical 1/4 or 1/2 inch pipe or mirror mount.



**MFJ-344, \$19.95.**

Like MFJ-342T, but horizontal pipe mount.

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# MFJ-4416C Super Battery Booster

**Boost battery voltage as low as 9 Volts back up to 13.8 VDC! Keeps your transceiver at full power output, compensates for run down battery, wiring voltage drop, car off . . .**



**MFJ-4416C**  
**\$249<sup>95</sup>** Keeps your transceiver at full power output, provides full performance, high efficiency, prevents output signal distortion and transceiver shutdown. Compensates for run-down battery, wiring voltage drop or when car is off. Provides up to 25 Amps peak with 90% efficiency. Selectable 9/10/11 Volts minimum input voltage prevents battery damage from over-discharging. RF sense turns MFJ-4416C off during receive to save power, increases efficiency and reduces noise. Adjustable 12 to 13.8 VDC output pass-through improves efficiency and lets transceiver run cooler. Has output over-voltage crowbar protection. *Anderson PowerPoles*™ and high-current 5-way binding posts for DC input, regulated output. 7<sup>3</sup>/<sub>4</sub>Wx4Hx2<sup>1</sup>/<sub>8</sub>D". **MFJ-4416BRC, \$119.95.** Booster Remote Control.



## Super Heavy Duty Battery Booster

**Super** robust with heavy duty transistors, rectifier, improved switch-mode transformer, larger heatsink. Input and output EMI filters reduce noise to minimum. Rugged construction. *PowerPoles*™ and 5-way binding posts. MFJ software adjusts output voltage, measure load current, set minimum voltage level, over-current trip level, ignition control, more. External boost enable, remote input/output voltage sampling, remote controllable with MFJ-4416BRC.



**MFJ-4418**  
**\$299<sup>95</sup>**

## RFI Filter for DC power

**Connects** between rig and 12/ 24/50 VDC power supply/battery. Reduces RFI, hash, transients, motor noises, alternators, fuel pump whine, power windows, more! Binding posts/*PowerPoles*™.



**MFJ-1142**  
**\$99<sup>95</sup>**

## Digital Volt/Amp Meter

**Connect in-** line. Displays 4.5-30 VDC and up to 30A simultaneously. .01-.1V resolution. Dual .28" red/blue LED digits. *Anderson PowerPoles*™. Reverse polarity protection. 3x2x1 inches.



**MFJ-4422**  
**\$79<sup>95</sup>**

## RFI Ferrite Chokes

**Suppress** RFI. Snap and locks on DC power line, coax, wires. Effectively removes RFI and noise. Install end-to-end or loop multiple turns for more suppression. .275" hole dia. 4 in package.



**MFJ-700A4**  
**\$19<sup>95</sup>**

## PowerPole™ DC Outlet Box

**One** fused 30 Amp input and 25, 10, 5 Amp fused outputs with *Anderson PowerPoles*™. Has open fuse indicator. Sturdy metal construction, 2<sup>3</sup>/<sub>4</sub>Wx3<sup>1</sup>/<sub>4</sub>Hx1<sup>1</sup>/<sub>2</sub>D inches.



**MFJ-1104**  
**\$69<sup>95</sup>**

## MFJ Low Pass Filter

**High** attenuation above 40 MHz. 1.5kW, 1.8-30 MHz. SWR<1.3. Nine Chebyshev poles, *Teflon*™ dielectric capacitors, high-Q inductors, ground plane shielding, RF tight.



**MFJ-704**  
**\$119<sup>95</sup>**

## Lightning Surge Protector

**Protect** your expensive equipment from lightning induced surges on 50 Ohm coax. Use for transceivers up to 400 Watts, 1000 MHz. **MFJ-272, \$37.95.** 1.5 kW.



**MFJ-270**  
**\$27<sup>95</sup>**

## MFJ 30-Amp Power Supply

**World's** most compact 30A switching power supply. Volt/Amp meter. Adjust 4-16 VDC output. 120/240 VAC input. *PowerPoles*™, binding posts. 5Wx2<sup>1</sup>/<sub>2</sub>Hx6D", 3 lbs.



**MFJ-4230MVP**  
**\$159<sup>95</sup>**

## High-efficiency Loop Tuner

**Instantly** turn wire or coax into a small, high-efficiency multi-banded loop antenna. 150W, 5.3-30 MHz. Tripod/mast mount included. **MFJ-936C, \$389.95.** Relative RF antenna current and Cross-needle SWR/Wattmeter. **MFJ-933C, \$279.95.** Like MFJ-935C, no meter.



**New!**  
**MFJ-935C**  
**\$299<sup>95</sup>**

## 25-1300 MHz Discone Ant

**Receives** 25-1300 MHz. Transmits 50-1300 MHz up to 200 Watts. Test various X-mitters on one coax. 50 ft. coax, stainless steel elements.



**MFJ-1868**  
**\$99<sup>95</sup>**

## 17-foot Telescopic Whip

**17-foot** stainless steel whip collapses to 27". Full 1/4 Wave on 20/17 Meters, 30-160 Meter operation with loading coil. Fits any standard 3/8-24 threaded mount.



**MFJ-1979**  
**\$69<sup>95</sup>**

## MFJ Field Strength Meter

**Relative** field-strength readings .1-500 MHz. Sensitivity control, 1<sup>3</sup>/<sub>4</sub> inch meter. 20-inch telescoping whip. Finger contact increases sensitivity.



**MFJ-801**  
**\$49<sup>95</sup>**

## Telescopic Fiberglass Mast

**Super-strong** heavy-duty mast with *QuickClamps*™. 38 ft. ext., 6 ft. collapsed. 2<sup>1</sup>/<sub>2</sub>" OD bottom, 1" OD top. .125" thick wall. Supports "real" weight.



**MFJ-1906HD**  
**\$269<sup>95</sup>**

## Tuned Indoor Active Antenna

**Rival** outside wire antennas hundreds of feet long and pick up signals loud and clear all over the world. 0.3-40 MHz.



**MFJ-1020C**  
**\$129<sup>95</sup>**

## Giant 2<sup>1</sup>/<sub>2</sub> inch LED Clock

**Giant** 2<sup>1</sup>/<sub>2</sub> inch super bright LEDs -- see from across the street day or night. 12/24 switch, 110VAC, 9V battery backup.



**MFJ-117**  
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## MFJ 2-Position Remote Antenna Switch

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# W1AW Schedule

PAC	MTN	CENT	EAST	UTC	MON	TUE	WED	THU	FRI
6 AM	7 AM	8 AM	9 AM	1300		FAST CODE	SLOW CODE	FAST CODE	SLOW CODE
7 AM- 12 <sup>45</sup> PM	8 AM- 1 <sup>45</sup> PM	9 AM- 2 <sup>45</sup> PM	10 AM- 3 <sup>45</sup> PM	1400-1945	VISITING OPERATOR TIME				
1 PM	2 PM	3 PM	4 PM	2000	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE
2 PM	3 PM	4 PM	5 PM	2100	CODE BULLETIN				
3 PM	4 PM	5 PM	6 PM	2200	DIGITAL BULLETIN				
4 PM	5 PM	6 PM	7 PM	2300	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE
5 PM	6 PM	7 PM	8 PM	0000	CODE BULLETIN				
6 PM	7 PM	8 PM	9 PM	0100	DIGITAL BULLETIN				
6 <sup>45</sup> PM	7 <sup>45</sup> PM	8 <sup>45</sup> PM	9 <sup>45</sup> PM	0145	VOICE BULLETIN				
7 PM	8 PM	9 PM	10 PM	0200	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE
8 PM	9 PM	10 PM	11 PM	0300	CODE BULLETIN				

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

♦ Morse code transmissions: Frequencies are 1.8025, 3.5815, 7.0475, 14.0475, 18.0975, 21.0675, 28.0675, 50.350, and 147.555 MHz.

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

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

Code bulletins are sent at 18 WPM.

For more information, visit us at

[www.arrl.org/w1aw](http://www.arrl.org/w1aw)

♦ W1AW Qualifying Runs are sent on the same frequencies as the Morse code transmissions. West Coast qualifying runs are transmitted by various West Coast stations on CW frequencies that are normally used by W1AW, in addition to 3590 kHz, at various times. Underline 1 minute of the highest speed you copied, certify that your copy was made without aid, and send it to ARRL for grading. Please include your name, call sign (if any), and complete mailing address. Fees: \$10 for a certificate, \$7.50 for endorsements.

♦ Digital transmissions: Frequencies are 3.5975, 7.095, 14.095, 18.1025, 21.095, 28.095, 50.350, and 147.555 MHz.

Bulletins are sent using 45.45-baud Baudot, PSK31 in BPSK mode, and MFSK16 on a daily revolving schedule.

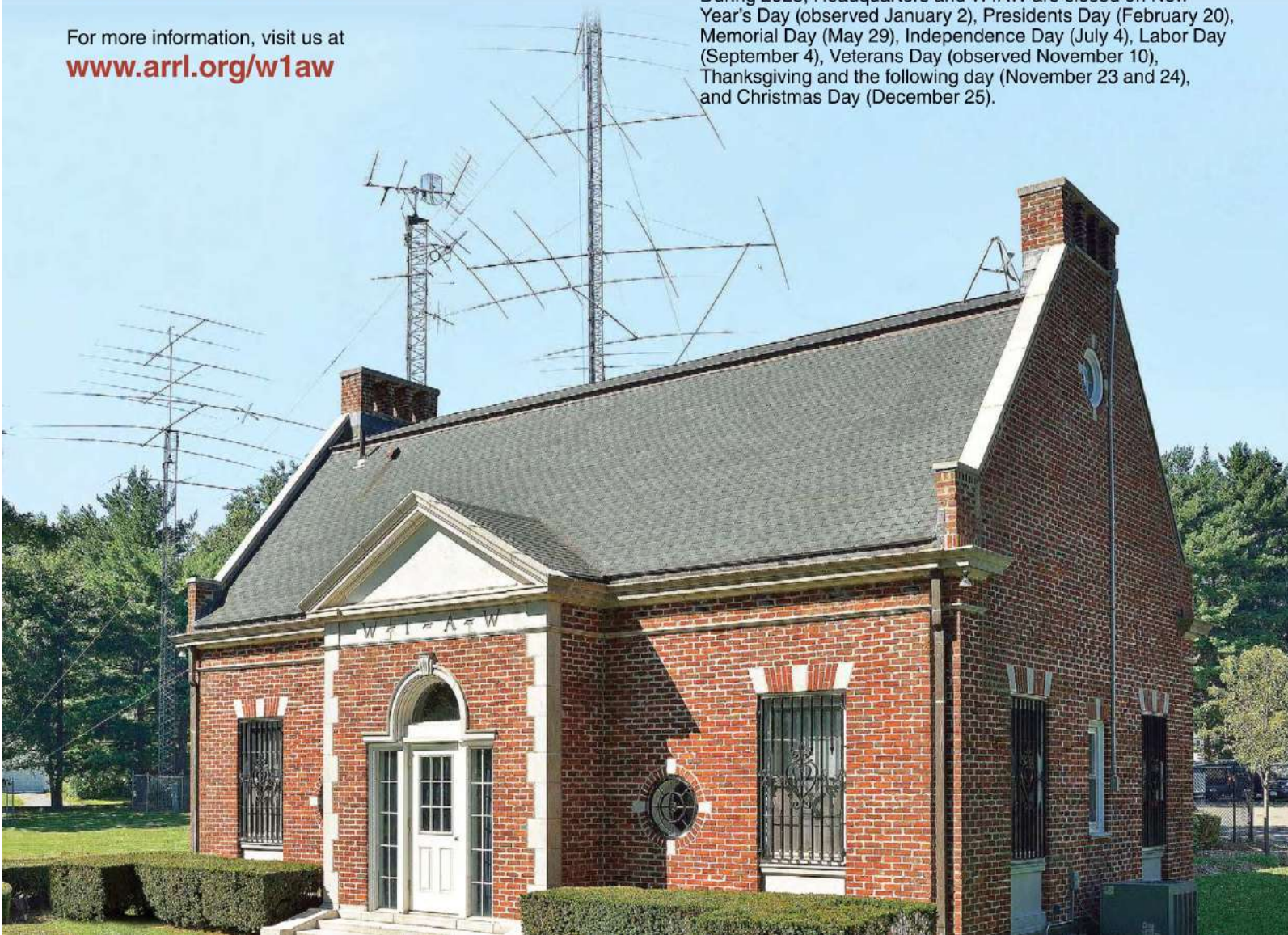
Keplerian elements for many amateur satellites will be sent on the regular digital frequencies on Tuesdays and Fridays at 6:30 PM Eastern time using Baudot and PSK31.

♦ Voice transmissions: Frequencies are 1.855, 3.99, 7.29, 14.29, 18.16, 21.39, 28.59, 50.350, and 147.555 MHz. Voice transmissions on 7.290 MHz are in AM double sideband, full carrier.

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

W1AW code practice and CW/digital/phone bulletin transmission audio is also available real-time via the *EchoLink Conference Server* W1AWBDCT. The conference server runs concurrently with the regularly scheduled station transmissions. The W1AW Qualifying Run texts can also be copied via the EchoLink Conference Server.

During 2023, Headquarters and W1AW are closed on New Year's Day (observed January 2), Presidents Day (February 20), Memorial Day (May 29), Independence Day (July 4), Labor Day (September 4), Veterans Day (observed November 10), Thanksgiving and the following day (November 23 and 24), and Christmas Day (December 25).





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- Various PC applications (free software): ARCP-990 enabling PC control, ARHP-990 enabling remote control, and ARUA-10 USB audio driver.
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# Understanding the Boltzmann Constant

The Boltzmann constant is a fundamental physical measure of thermal noise.

## Adrian Ryan, 5B4AIY

In this article, I'll define *minimum detectable signal* (MDS) and explain what the S-meter indicates, by using the Boltzmann constant from the world of thermodynamics.

Austrian physicist Ludwig Boltzmann first linked energy and probability in 1877, but never actually ascribed a numerical value to this constant. It was theoretical physicist Max Planck who first assigned a value, in his derivation of the law of black body radiation (known as Planck's law) in 1900.

The value of the Boltzmann constant is  $k = 1.380649 \times 10^{-23}$  J/K (<https://physics.nist.gov/cuu/Constants/index.html>). This is the energy increment for each increment of temperature on the absolute scale. It can be expressed as a power by recognizing that 1 J of energy dissipated in 1 second equals 1 W.

With time introduced into the equation, and because bandwidth is the reciprocal of time, the Boltzmann constant can also be expressed as  $k = 1.380649 \times 10^{-23}$  W/Hz/K. This is the amount of noise power in watts for each hertz of bandwidth and each kelvin (temperature above absolute zero). More user-friendly units are preferable, so this can be expressed in decibels relative to 1 W (dBW), by means of the expression,

$$\begin{aligned}k_{dBW} &= 10 \times \log_{10}(1.380649 \times 10^{-23} \text{ W/Hz/K}) \\&= 10 \times (-22.86) \\&= -228.6 \text{ dBW/Hz/K}\end{aligned}$$

You may be wondering where the 10 multiplier comes from. The original logarithmic power ratio is the bel, but this is inconveniently large, so the decibel (dB) is used, and there are 10 dB to the bel.

Even dBW is inconveniently large, and we prefer decibels relative to 1 mW, or dBm. Because there are 1000 mW in 1 W, and a power ratio of 1000 is +30 dB, adding this to the previous figure allows us to arrive at the first of our three magic numbers:

$$k_{dBm} = -228.6 + 30 = -198.6 \text{ dBm/Hz/K}$$

This number is the *fundamental thermal noise power*. Because we normally operate our receivers at ambient temperature, to find the actual noise power, this figure must be multiplied by the ambient temperature —  $T$  in kelvins — usually taken to be 290 K. The dBm scale is logarithmic, so the figure needed (in dB) is

$$\begin{aligned}T_{dB} &= 10 \times \log_{10}(290) \text{ dB} \\&= 10 \times 2.462 \\&= 24.62 \text{ dB}\end{aligned}$$

Thus, the noise power at room temperature in a 1 Hz bandwidth is

$$\begin{aligned}Np &= -198.6 + 24.62 \\&= -173.98 \text{ dBm}\end{aligned}$$

This is usually rounded to -174 dBm, giving us our second magic number.

## In an SSB Bandwidth

The MDS (the minimum power level that can be processed by a receiver to provide a relevant output) is



usually measured in a 2.4 kHz bandwidth for SSB, and a 500 Hz bandwidth for CW. To take this into account,

$$B_{2400} = 10 \times \log_{10}(2400) \\ = 10 \times 3.4 = 34 \text{ dB}$$

Thus, the fundamental thermal noise floor at room temperature in a 2.4 kHz bandwidth gives us our third magic number:

$$Np_{2400} = -174 + 34 = -140 \text{ dBm}$$

### In a CW Bandwidth

For 500 Hz CW, the third magic number is

$$Np_{500} = -174 + 10 \times \log_{10}(500) \\ = -174 + 27 \\ = -147 \text{ dBm}$$

These numbers equate to the noise floors that would be measured for a perfect receiver. But all practical receivers are noisy, and the degree to which they are less than perfect is indicated by their noise figure. So, if we assume that the noise figure of a practical receiver is about 10 dB, then the actual noise floor would be at -130 dBm for SSB and -137 dBm for CW.

**“An expert CW operator can reliably copy a signal very close to the actual noise floor of the receiver, but in this scenario, we’re talking about a typical operator.”**

In practice, a number of empirical studies have shown that to reliably detect an SSB speech signal, we need a signal + noise-to-noise ratio of about 10 dB at the loud-speaker or headphones, and thus for our example receiver, the actual usable signal would be 10 dB above the noise floor, or -120 dBm for SSB and -127 dBm for CW.

An expert CW operator can reliably copy a signal very close to the actual noise floor of the receiver, but in this scenario, we’re talking about a typical operator.

### The Receiver Input Voltage

We need to figure out what the input voltage ( $V_{in}$ ) would be for this signal. To do that, we have to turn the power in dBm back into watts. That requires us to turn dBm back into dBW, and thus we have to subtract 30 dB. If we assume that the input impedance of the radio is 50  $\Omega$ , then, remembering that  $V_{in} = (R \times P)^{1/2}$

volts, where the  $1/2$  power means the square root, it’s fairly easy to calculate that the input voltage at the antenna terminals for the SSB bandwidth is

$$V_{in} = \{50 \times \text{antilog}_{10}[(-120 - 30)/10]\}^{1/2} \\ = \{50 \times \text{antilog}_{10}[-15]\}^{1/2} \\ = 0.224 \text{ } \mu\text{V}$$

Equally, if we measure the actual MDS, then it’s also possible for us to estimate the noise figure of the receiver.

### Bandwidth

At this point, I should explain that we have treated bandwidth in a somewhat cavalier fashion. What we really need is the noise bandwidth of the receiver, which is somewhat wider than the -6 dB bandwidth by the *shape factor* (SF) of the filter.

The SF of a filter is the ratio of the -60 dB bandwidth to the -6 dB bandwidth. Most modern receivers use filters that are synthesized by a digital signal processing chip and have an equivalent SF that would be extremely difficult to achieve by analog methods — typically around 1.2:1 or better. Thus, the noise bandwidth of an SSB filter with a -6 dB bandwidth of 2.4 kHz and an SF of 1.2:1 is actually

$$\text{Noise}_{BW} = BW_{6dB} (1 + SF)/2 \\ = 2400 (1 + 1.2)/2 \\ = 2640 \text{ Hz}$$

Using the -6 dB bandwidth, rather than the actual noise bandwidth, represents an error of only 0.4 dB and is usually ignored. Even with a shape factor as wide as 2:1, the error is only 1.8 dB, which is still of little significance.

### An Example

As an example, consider ARRL measurements of a modern direct sampling receiver, such as the Icom IC-7610, which was featured in Product Review in the October 2018 issue of QST.

The measured noise floors at 14 MHz in a 500 Hz bandwidth were -130 dBm/-138 dBm/-142 dBm, corresponding to preamplifier off/preamplifier 1/preamplifier 2. Because the thermal noise floor in a 500 Hz bandwidth is -147 dBm, and the measured noise floor was -138 dBm, this gives a noise figure of 9 dB, exactly what was measured.

Recognizing that a 2.4 kHz bandwidth is 7 dB wider, these figures would then be -123 dBm, -131 dBm, and -135 dBm.



The multifunction meter from an Icom IC-7610 displaying its two independent receivers. The top scale shows the S-meter, which displays the level of the receiving signal strength. The left meter shows a received CW signal at a level of S-5, while the right meter shows a received upper sideband signal at a level of S-4. The IC-7610 scales its S-meter at 3 dB per S-unit.



The manufacturer's specifications state that the sensitivity is 0.16  $\mu\text{V}$  for a 10 dB signal + noise-to-noise ratio in a 2.4 kHz bandwidth with preamplifier 1 on. This is a power level of

$$\begin{aligned} P_{\text{dBm}} &= 10 \times \log_{10}(V^2/R) \\ &= 10 \times \log_{10}[(0.16 \times 10^{-6})^2/50] \\ &= 10 \times (-15.29) = -152.9 \text{ dBW} \\ &= -123 \text{ dBm} \end{aligned}$$

Because the noise floor in a 2.4 kHz bandwidth with preamplifier 1 on is -131 dBm, this implies a noise figure of about 8 dB, which is also in close agreement with the measured figure of 9 dB when rounding and some of the approximations related to noise bandwidth are considered.

One can also estimate the preamplifier gains and show that the actual gain of preamplifier 1 is about 8 dB, and that of preamplifier 2 is about 12 dB.

You might be wondering what all this means in practice. In fact, sub-microvolt sensitivity is rarely usable on the HF bands. Atmospheric and manmade noise from any reasonable antenna system can be 20 dB or more above the noise floor, and so it will be this external noise that will generally limit the ability of the receiver to detect signals rather than any noise figure or sensitivity shortcomings.

### The S-Meter

It's important to understand these figures, particularly for a direct sampling radio, and to adjust the receiver to maximize the dynamic range performance. To do this, tune to an idle frequency on the band of interest and note the S-meter reading. Then, either disconnect the antenna or select an unused input, and note the new reading. If the S-meter reading has fallen by about 6 to 8 dB, then the receiver's gain settings are optimized. If the S-meter reading falls by more than this, there's too much gain. Conversely, if it hardly changes, then there's insufficient gain.

Although it's possible to accurately calibrate the S-meter, most manufacturers fail to do so. It was accepted in the 1930s that S-9 should correspond to an antenna input voltage of 50  $\mu\text{V}$  — an input power of -73 dBm — assuming an input impedance of 50  $\Omega$ .

At the 1981 IARU Region 1 General Conference, the Technical Committee recommended the adoption of having each S-unit correspond with a 6 dB change of signal. This meant that S-1 would then represent an input power of -121 dBm, which is roughly in line with the SSB reliably copyable signal level for most receivers. While some manufacturers abide by this recommendation, others do not, and have scaled their S-meters at 3 dB per S-unit.

### Final Comments

Most manufacturers don't provide an absolute scaled S-meter. Consequently, as you insert attenuation or gain, the S-meter reading changes, and it shouldn't. The S-meter should indicate the absolute level of the signal at the antenna input, regardless of any internal gain or attenuation changes. These gain or attenuation settings are there to optimize the dynamic range of the receiver in response to the prevailing band conditions. After all, an S-9 signal at the antenna input terminals remains the same whether you turn the preamplifier(s) on or not, or insert attenuation or not, so altering the S-meter reading isn't necessary.

Adrian Ryan, 5B4AIY, was first licensed as G3VJN in 1966. He was educated at the Radar Research Establishment, and subsequently worked for the Government Communications Headquarters before moving on to the North Atlantic Treaty Organization (NATO). Adrian was a Senior Engineer with NATO for 30 years, where he worked mainly in switched telecommunications and satellite communications. He is now retired and living in Cyprus. Adrian can be reached at [adrian04@cytanet.com.cy](mailto:adrian04@cytanet.com.cy).

For updates to this article, see the QST Feedback page at [www.arri.org/feedback](http://www.arri.org/feedback).





# Digital Voice the Easy Way

If you use FT8, then you already have all of the necessary hardware to use FreeDV for digital voice on the HF bands.

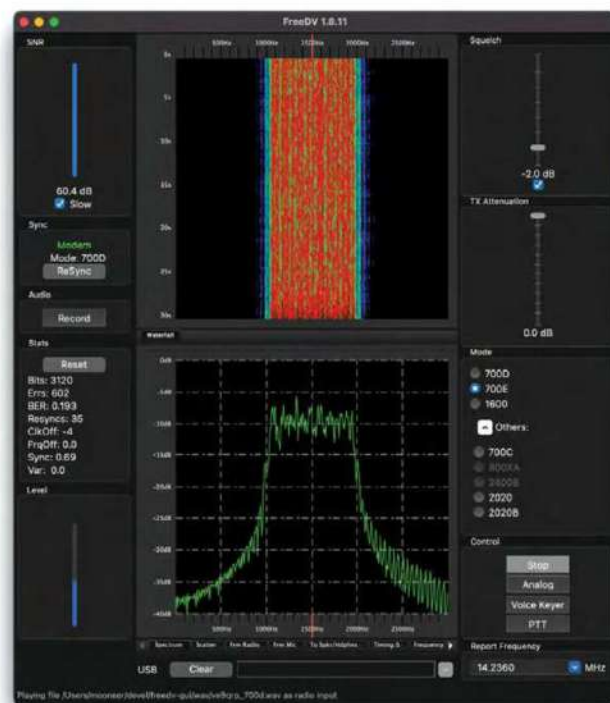
## Ira Brodsky, KC9TC

Most communication and media technologies are going digital. Digitization enables performance enhancements and features that are not available in the analog world. However, digital transmission in the HF bands poses unique challenges, as operators frequently contend with noise (QRN), interference (QRM), and fading (QSB). Digital voice for the HF operator has been in development for more than 20 years, and an overview of that process is detailed at [www.arri.org/qst-in-depth](http://www.arri.org/qst-in-depth). Tremendous progress has been made since the start of that development — HF digital voice no longer requires special hardware — but there's still room for improvement.

HF operators who enjoy portable operation or digital data modes should find FreeDV particularly intriguing. Digital signals are more immune to noise, and there are many tools available for improving the performance of digital systems, such as forward error correction. FreeDV may already have a modest edge over single sideband (SSB) under specific conditions, and there is reason to believe that the performance advantage will grow with time. FreeDV sounds the same at the receiver regardless of how strong the signal is, provided that there aren't too many bit errors. Some users believe FreeDV outperforms SSB when noise is present; others feel that SSB sounds more natural, while FreeDV can sound metallic or robotic.

## HF Digital Voice Pros and Cons

HF digital voice can use less bandwidth than SSB and, therefore, can help reduce QRM on crowded phone bands. FreeDV signals consume between one-third and one-half of the bandwidth of SSB signals. This is partially accomplished by encoding voice at low bit rates. FreeDV's open-source vocoder, Codec 2, operates at speeds ranging from as low as 700 bits per second (bps) to as high as 3200 bps. The faster speeds result in better voice quality.



**Figure 1** — FreeDV's main control console. At startup, the graphical user interface shows only the waterfall, but additional panes can be added.

FreeDV signals sound quiet, just as FM signals sound quiet compared to AM signals. When you listen to an SSB signal, you hear the other operator's voice along with the atmospheric noise present on the radio channel. When you listen to a FreeDV signal, you don't hear the atmospheric noise — you hear only the audio that was encoded by the transmitter. However, digital voice systems are subject to another type of noise known as *quantization*. This noise is created due to errors that occur when encoding continuous signals (analog) as discrete signals (digital). Quantization produces distortion in the audio rather than the background noise in analog signals.



One disadvantage of digital transmission is operators receiving either an exact copy of what was transmitted, or nothing at all. While SSB users often notice that signals are fading as propagation changes, HF digital voice users may find that a loud and clear signal will suddenly disappear.

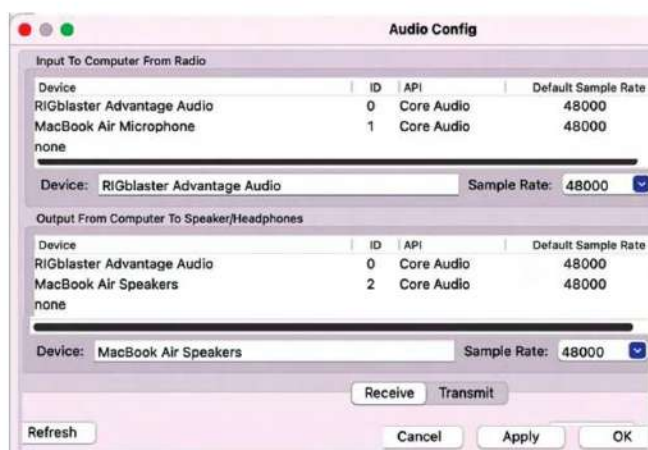
Where on the HF spectrum can you use FreeDV? FreeDV is digital, but it is still considered to be a type of phone emission according to Part 97 FCC rules. Therefore, it must be used in the phone segments of the HF bands, but it isn't allowed on 60 meters. A FreeDV signal sounds like white noise to SSB users. Before transmitting with FreeDV, you should ask in SSB mode if the frequency is in use. The software makes this easy with an analog mode selection on the main screen (see Figure 1).

## Setting Up FreeDV

FreeDV software is available for Windows, Linux, and macOS computers. More information about FreeDV, including links to download the latest software and user manual, can be found at [www.freedv.org](http://www.freedv.org). A test sound file comes with FreeDV, and you can use it by selecting **PLAY FILE FROM RADIO** under the **TOOLS** tab; this allows you to hear what FreeDV sounds like. To receive FreeDV off the air, you can feed the audio from your radio into your computer's sound card. Check band usage with



**Figure 2** — With PSK Reporter and other similar tools, you can see your signal strength and where in the world it is being received. Similarly, users who enable FreeDV's reporting option can see who is decoding their digital voice signal, where they are located, and how strong their signal is. [[www.pskreporter.info/pskmap](http://www.pskreporter.info/pskmap)]



**Figure 3** — Audio must be configured for both transmit and receive. In this case, receive audio is input to a laptop from a rig interface device and output from the laptop to its built-in speakers.

PSK Reporter (see Figure 2). You can also visit the FreeDV Reporter at <http://qso.freedv.org> and ask a FreeDV user to call you. To transmit and receive, you need to plug a rig interface (such as a Signalink or RIGblaster) or an additional USB sound card into your radio or computer. Next, go to **AUDIO CONFIG** under the **TOOLS** tab (see Figure 3). You will need to separately configure transmit and receive via the buttons near the bottom of the window. For the receive configuration, in the top window, start by selecting the input device to the computer from the radio (for instance, a Signalink or RIGblaster). Then, in the bottom window, select the output device from the computer (for instance, the computer's speakers). For the transmit configuration, select the input device to the computer (such as a laptop's built-in microphone), and the output device from the computer to the radio (again, a rig interface or the radio's built-in USB sound card).

If your transceiver can operate with voice-operated exchange (VOX), you are ready to transmit. Otherwise, you will also need to configure your push-to-talk (PTT) method. In the main FreeDV window (see Figure 1), there are four buttons under **CONTROL** in the lower right side of the screen. **START** turns on FreeDV reception, but you need to press the **PTT** button to transmit and release it to resume receiving. If you can't use VOX, go to **PTT CONFIG** under the **TOOLS** tab; this setup is outlined at [www.arrl.org/qst-in-depth](http://www.arrl.org/qst-in-depth). You can also choose between several FreeDV operating modes. Mode 700D provides the best weak-signal performance, and it seems to be many users' default mode. Mode 2020 offers the best speech quality, but it requires stron-



ger signals. Set your radio to lower sideband on bands below 10 MHz, and set it to upper sideband on bands above 10 MHz. Turn off speech compression and noise reduction. Try to keep the frequency response of the receive path as flat as possible. If you are not already using a digital mode, additional FreeDV operating instructions are outlined at [www.arrrl.org/qst-in-depth](http://www.arrrl.org/qst-in-depth).

## The Future of Digital HF Voice

FreeDV is a work in progress that has contributions from radio amateurs around the world under a free software license. Many contributors are listed on [www.arrrl.org/qst-in-depth](http://www.arrrl.org/qst-in-depth). FreeDV has been adapted to work on bandwidth-constrained geosynchronous satellites, such as the QO-100. FreeDV has also been used with internet-based software-defined radios to enable DX communication when propagation is poor or unavailable. FreeDV has many other helpful features, including a voice keyer that can be used to play a .wav file of your transmission. Digital transmission opens the door to capabilities that would be difficult or impossible with analog transmission. For instance, it facilitates automatic testing of HF channel conditions, as well as adjustment of transmission parameters like vocoder rate, modulation, frame sizes, and error correction. It can even embed a link in your phone transmissions that shows a live view of your station and an automatically generated, downloadable QSL card.

Most significant inventions aren't developed overnight. More often, they're the result of a series of

incremental advances. HF digital voice technology has just reached the starting line, and it will be fascinating to see how it evolves over the next several years.

The author wishes to thank David Rowe, VK5DGR, and Mooneer Salem, K6AQ, for their assistance in preparing this article.

### See QST in Depth for More!

Visit [www.arrrl.org/qst-in-depth](http://www.arrrl.org/qst-in-depth) for the following supplementary materials and updates:

- ✓ The history of digital voice for HF
- ✓ How to configure your radio for PTT
- ✓ Easy ways to operate FreeDV if you are not already using a digital mode
- ✓ A list of FreeDV software contributors

Ira Brodsky, KC9TC, was first licensed in 1968, and he holds an Amateur Extra-class license. He has worked in the telecommunications field for more than 40 years as a sales engineer, a product line director, and an independent industry analyst specializing in wireless data. He has authored five books and more than 100 articles. Brodsky has earned the DX Century Club Award and the Worked All States Award, and he also enjoys satellite and portable operation. He can be reached at [ibrodsky64@gmail.com](mailto:ibrodsky64@gmail.com).

For updates to this article, see the QST Feedback page at [www.arrrl.org/feedback](http://www.arrrl.org/feedback).



## Volunteer Monitor Program Report

The Volunteer Monitor (VM) Program is a joint initiative between ARRL and the FCC to enhance compliance in the Amateur Radio Service. This is the June 2023 activity report of the VM Program.

◆ Advisory notices were issued to operators in North Carolina and West Virginia for excessively wide transmissions (over 8 kHz). The operators were reminded that FCC rule 97.307(a) requires that no amateur station use more bandwidth than necessary for the information rate and emission type being transmitted.

◆ A licensee in Georgia received a second advisory notice regarding excessively wide transmissions and was informed that the matter would be referred to the FCC.

◆ A commendation was issued to a licensee in Michigan for courtesy and special efforts made in resolving an interference issue on 14.230 MHz.

◆ Licensees in New Jersey, Arizona, Vermont, and Illinois received advisory notices for FT8 operation on frequencies not allowed under their Technician-class licenses.

◆ A licensee in Nevada received an advisory notice for an out-of-band signal due to operation too close to the band edge on 40 meters.

The totals for VM monitoring during May 2023 were 1,961 hours on HF frequencies, and 2,696 hours on VHF frequencies and above, for a total of 4,657 hours.

For the quarter ending June 30, 2023, there were 15 advisory notices and eight commendations issued, two FCC referrals, and two FCC meetings. *Thanks to Volunteer Monitor Program Administrator Riley Hollingsworth, K4ZDH*



# A Utility Antenna for 88 to 608 MHz

K4ERO describes an extremely flexible antenna for covering VHF through UHF frequencies.

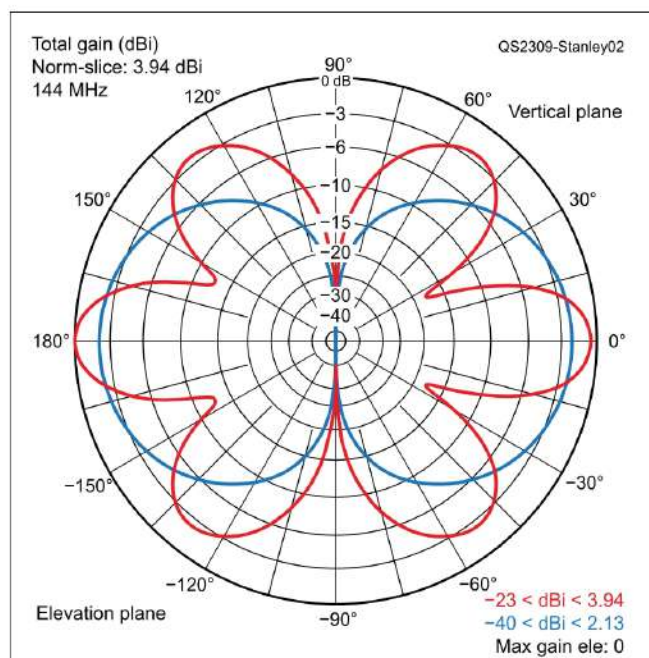
The antenna is a half wave on 88 to 235 MHz, and three half waves from 235 to 608 MHz. The patterns on VHF and UHF are shown in Figure 2. The three half waves for UHF make side lobes at about 50 degrees on either side of the main lobe. However, unlike an end-fed  $\frac{3}{2}$ -wavelength antenna, such as a J pole operating on its third harmonic, the strongest lobe is directly off the sides of the dipole. There's an additional 1.5 dB gain in that narrowed lobe. See *QST in Depth* ([www.arrl.org/qst-in-depth](http://www.arrl.org/qst-in-depth)) for further discussion of this advantage. With vertical polarization, the azimuthal patterns on VHF and UHF are omnidirectional.



**Figure 1** — Ruth Stanley, WB4LUA, shows the utility antenna setup for 2-meter FM with vertical polarization.

**John Stanley, K4ERO**

I've often found a need for an antenna that works for FM, over-the-air (OTA) TV, and aeronautical and weather radio. I also need it to work on the 2-meter, 1.25-meter, and 70-centimeter ham bands. Some of these frequencies use vertical polarization, some use horizontal, and some even use diagonal. This article will explain my solution for such an antenna that's also easily taken to portable locations (see Figure 1).



**Figure 2** — The gain and pattern for VHF frequencies is shown in blue, and for UHF frequencies is shown in red. This is the azimuthal pattern with horizontal polarization. With vertical polarization, it's the elevation pattern.



**Table 1 — Parts List**

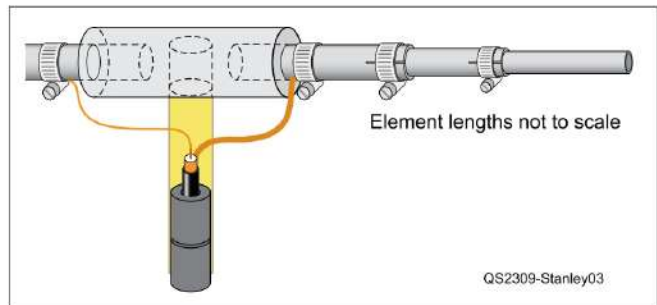
Part	Size	Quantity
HDPE rod	1.25-inch diameter, 3.5 inches long	1
½-inch CPVC	5 inches long (½-inch CPVC has a ⅝-inch outside diameter)	1
Elbow for ½-inch CPVC	½ to ¾ inch	1
¾-inch CPVC	Length as desired for main support	1
Aluminum tubes*	⅝-inch outside diameter by 9.5 inches	2
	½-inch outside diameter by 10 inches	2
	⅜-inch outside diameter by 19 inches	2
Stainless-steel hose clamps	½ inch	6
Mix 43 ferrite beads	Must fit over your coax for a balun	
Coaxial cable (such as mini RG-8 with foam)	As long as you need to reach your radio	
Tape or cable ties		Enough to fasten coax to support pipes
Spade bit	⅝ inch	1

\*Wall thicknesses must allow the aluminum tubes to slide freely inside each other.

### Construction Using Low-Loss HDPE

The parts list can be found in Table 1. To avoid the losses of PVC as an insulating material at RF, use high-density polyethylene (HDPE) for the center insulator piece. You can purchase an HDPE rod that's 1.25 inches × 4 feet for about \$15, plus shipping. That's enough HDPE to make 13 utility dipoles, so the cost per dipole is no more than the cost of the similar PVC parts, making this a good club project. Aluminum tubes are also cheaper when longer pieces are cut to make several antennas.

Cut the HDPE rod to a length of 3.5 inches. Using a spade bit, make holes that are ⅝ inch in diameter and 1 inch deep on the ends. Drill a hole that's ¾ inch deep in the side to fit the ⅝-inch outside diameter (½ nominal size) CPVC piece. Assemble the pieces using hot-melt adhesive (such as hot glue) to achieve a tight fit for the elements and the CPVC support pipe. The support piece could be ½- or ¾-inch regular PVC, because with this design, the PVC isn't in contact with the metal parts of the dipole. A drill press is almost a necessity to get the holes straight. The dipole will work fine if you don't have one; it just won't look as professional. Finally, cut 1-inch slits in the ends of the larger-diameter aluminum tubes so that



**Figure 3** — Construction details for the utility antenna using HDPE for the center insulator.

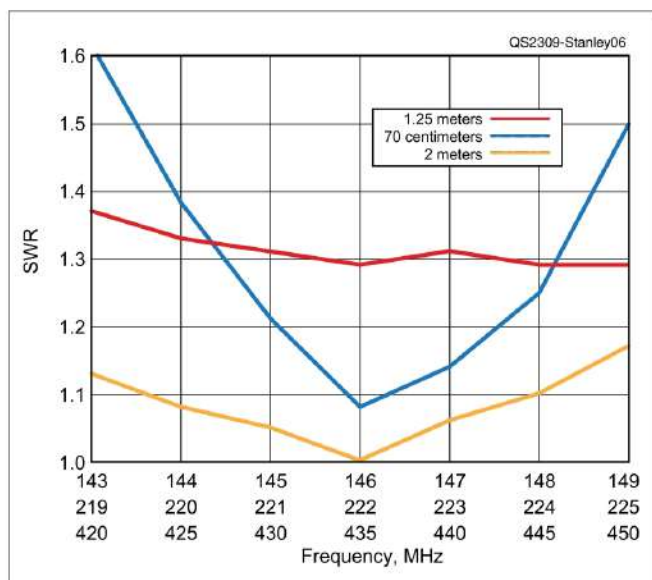


**Figure 4** — Match by spreading the coax leads where they connect to the aluminum elements. In this version, K4ERO used a single, large toroid with two turns of coax.

the hose clamps can tighten them to the next smaller tubing size. See Figure 3 for the assembly details.

A half-wave dipole far from ground or metal objects will have an input impedance of 72 Ω at resonance. This gives an SWR of 1.44:1 with 50 Ω coax. While this is good enough for most VHF transmitters, we can do better. With the dipole split at the center, there's a bit of capacity between the two halves. If we leave a bit of inductance in the lead wires, this will form a balanced L network, which reduces the 72 Ω to 50 Ω for a perfect match (visit the *QST* in Depth web page for more information). This is why I left the two leads (braided and insulated center wire) about 3 inches long and attached them to the aluminum tubing at a short distance from the center of the dipole (see Figure 4). You can adjust these lengths and attachment points to get a 1:1 match. While the match was optimized for the 2-meter band, it's also very good when just the dipole length is readjusted for the other ham bands (see Figure 5).





**Figure 5** — SWR on three ham bands with tuning optimized for the 2-meter FM band. Only the element lengths were changed for the other bands. The SWR was measured with a 6-foot length of RG-58.

It's important to use a choke balun on the coax at the feed point. This keeps the coax from being part of the antenna, which can distort the pattern and make the SWR change when you touch the coax. To make the balun, add three mix 43 ferrite beads or pass two turns of coax through a large ferrite bead or toroid. Route the coax at a right angle from the dipole for about 6 inches. Then, turn it 90 degrees to run down the support pole. The exact distance is not critical, because the choke balun makes the coax more or less invisible to RF. One or two additional ferrite beads along the coax help even more with keeping RF off the coax. If touching the coax, SWR bridge, or radio doesn't affect the SWR, you're well decoupled. Read my article, "Controlling Unwanted Feed Line Resonance in VHF Vertical Antennas," in the November 2016 issue of *QST* for more information about decoupling coax from antennas.

## Tuning and Matching

Make sure that the ferrite bead common mode choke is in place prior to tuning the antenna. To change the frequency, slide the aluminum tubes inside each other until you have a dipole that's a half wave long, or one and a half wave for UHF. Use  $5600/f(\text{MHz})$  for the VHF dipole in inches, and three times that for UHF. Then, adjust the length as needed to center the frequency using an SWR meter (see the *QST* in Depth web page for recommended dimensions). The various frequencies can easily be selected with a tape measure ( $\frac{1}{2}$  or  $\frac{3}{4}$  waves), and marks can be made on the tubing to allow for an easy return to your favorite

## What You Can Hear While Using This Antenna

FM broadcast: 88 – 108 MHz

Amateur 2-meter band: 144 – 148 MHz

Weather reports: 162.4 – 162.55 MHz

OTA TV VHF high band: 174 – 216 MHz

Amateur 1.25-meter band: 219 – 225 MHz

Amateur 70-centimeter band: 420 – 450 MHz

Utility UHF (police, fire, etc.): 450 – 470 MHz

OTA TV UHF: 470 – 608 MHz

frequencies. Polarization is changed by swinging the dipole into horizontal, vertical, or diagonal positions. Do not glue the rotating joint, because the friction fit allows the dipole to rotate to change the polarization. The aluminum tubes slide inside each other to allow you to select the frequency by making the total length  $\frac{1}{2}$  or  $\frac{3}{4}$  waves long. Slits on the tubing ends with hose clamps prevent them from slipping in operation.

## Final Thoughts

Enjoy this flexible antenna! An alternate version of the antenna using PVC parts found at local home stores is available on the *QST* in Depth web page.

## See *QST* in Depth for More!

Visit [www.arrl.org/qst-in-depth](http://www.arrl.org/qst-in-depth) for the following supplementary materials and updates:

- ✓ A discussion on patterns when operating on the  $\frac{3}{4}$ -wave mode
- ✓ An alternate version of the antenna using PVC parts
- ✓ More figure references
- ✓ A handy frequency-versus-length chart

All photos by the author.

John Stanley became KN4ERO when he earned his license 68 years ago. One year later, the N was dropped, and he has been K4ERO ever since. Ham radio led him to earning a degree in electrical engineering and experiencing a lifetime of teaching, design, and consulting, mainly at Christian shortwave broadcast stations all over the world, with Ruth Stanley, WB4LUA, his wife of 54 years. As an ARRL Technical Advisor and Editor, John has written or edited many articles for *QST*, *QEX*, and other ARRL publications. He and Ruth now live in their self-built, off-the-grid home in northwest Georgia atop Lookout Mountain. John can be reached at [jnrstanley@gmail.com](mailto:jnrstanley@gmail.com).

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## Product Review

# Yaesu FTM-200DR C4FM/FM Mobile Transceiver

*Reviewed by Martin Arsenault, VE2BQA*  
**ve2bqa@arrl.net**

The FTM-200DR is a VHF/UHF mobile transceiver compatible with both analog FM and Yaesu System Fusion digital mode (C4FM). This dual-band radio has only one receiver; even if it has two VFOs, it can receive only one signal at a time. It can deliver up to 50 W of RF transmit power, and its internal speaker provides up to 3 W of clear and crisp audio, perfect for a mobile installation. It has a nice 2-inch front color display combined with an easy-to-operate menu system. The frequency color can be changed between blue, white, and red. It also incorporates many features like GPS and APRS, band scope, Wide-coverage Internet Repeater Enhancement System (WIRES-X) functionality, and Bluetooth with the optional BU-4 unit.

### Overview

The FTM-200DR is impressive considering its small size and functionalities. With its detachable faceplate, it's perfect for a mobile installation and easy to detach from the included mobile bracket, but it's also a good radio to use in a home station. It features all of the C4FM digital communication functions, such as Automatic Mode Select, Digital Group ID, and Smart Navigation. It's also capable of doing WIRES-X operations with the portable digital node (PDN) function that lets you have a personal WIRES-X digital node at your station using a PC. In other words, it can become a WIRES-X digital hotspot.

Its receiver is wide and can receive from 108 to 137 MHz (AM mode and air band), and from 137 to 999.99 MHz (US cellular blocked) in FM and C4FM modes.

Included with the radio is a DTMF microphone (model SSM-85D), a mobile mounting bracket, a bracket for the faceplate (controller), a 10-foot control cable, a USB cable, and a dc power cable.

### Operations

When you turn on the FTM-200DR for the first time, you will be prompted to enter your call sign. It can be



done with the rotary knob (right knob) and the alphanumeric menu displayed. The call sign input is important if you intend to use the radio to operate in the C4FM digital mode. The programmed call sign will be shown every time the radio is turned on.

Once the call sign is entered, the radio will be in VFO mode. From that point, the operation is simple. I was able to operate the radio with ease, with only quick references to the manual. The front panel incorporates the common controls that are comprehensible for most operators. On the front panel, you will find two main knobs, one on each side; the volume is on the left, and the rotary knob (VFO/multi-function) is on the right. The button layout is clear and self-explanatory.

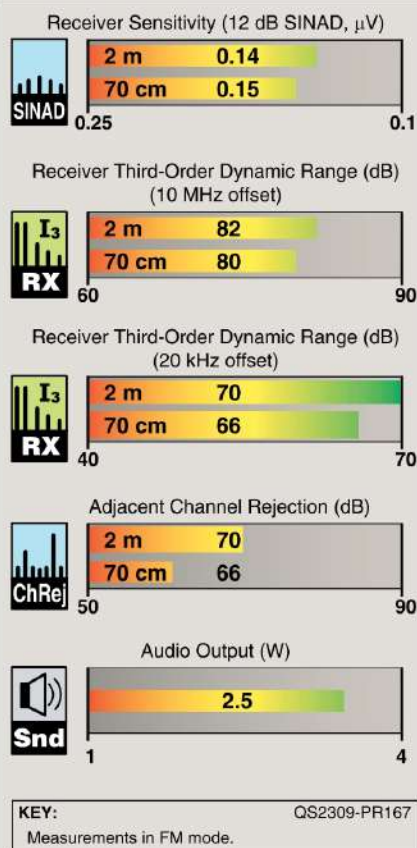
I was able to program my local repeater and start operating in FM mode within just a few minutes. When I rotated the VFO knob, the radio automatically set up the correct VHF frequency shift. I adjusted the power from the menu to the appropriate power level and started transmitting. In the latest VHF and UHF transceivers, Yaesu ensured that their design is easy to operate. It's intuitive and well thought out. It's especially easy to operate this radio in FM mode straight out of the box. For someone who has never tried the C4FM digital mode, this means that you can enjoy this

### Bottom Line

The FTM-200DR is impressive, with its small size but with great versatility. It's easy to operate and very intuitive, and if you wish to explore the C4FM digital mode at a lower price point, the portable digital node function can turn the radio into a WIRES-X hotspot.



## Yaesu FTM-200DR Key Measurements Summary



radio immediately upon reception and learn the advanced features later if you wish.

For faster VFO frequency change, you can press the rotary knob once to change the frequency step to 1 MHz. The MHz digits that are part of the displayed frequency will blink to show the operator which numbers will be changed with the rotary knob.

The **V/M VFO** button can be used to toggle between memory channels and VFO modes.

When pressed once in VFO mode, the **BAND GROUP** button will let the operator switch between air band, 144 MHz (2 meters), 174 – 400 MHz (receive only), 440 MHz (70 centimeters), and 480 – 999.995 MHz (receive only). When the memory mode is selected, the operator can choose from the Memory Auto Grouping (**MAG**) function to access

Table 1

Yaesu FTM-200DR, serial number 2C010805,  
FCC ID# K6620615X40

### Manufacturer's Specifications

Frequency coverage: receive, 108 – 999.99 MHz (USA cellular blocked); transmit, 144 – 148, 430 – 450 MHz.  
Modes: FM, FM-Narrow, C4FM, AM (receive only).  
Power requirements: transmit, 11 A at 50 W RF output; receive, 0.5 A at 13.8 V dc (no operating voltage range was specified).

### Receiver

Sensitivity: FM 12 dB SINAD: 137 – 150 MHz, 0.2  $\mu$ V; 150 – 174 MHz, 0.25  $\mu$ V; 174 – 222 MHz, 0.3  $\mu$ V; 222 – 300 and 336 – 420 MHz, 0.25  $\mu$ V; 420 – 540 MHz, 0.2  $\mu$ V; 540 – 800 MHz, 0.8  $\mu$ V; 800 – 900 MHz, 0.4  $\mu$ V; 900 – 999.99 MHz, 0.8  $\mu$ V; AM: 10 dB S/N, 108 – 137, 300 – 336 MHz, 0.8  $\mu$ V; BER 1% (digital mode), 0.19  $\mu$ V; cellular blocked (USA only).

FM two-tone, third-order IMD dynamic range: Not specified.

FM two-tone, second-order IMD dynamic range: Not specified.

Adjacent-channel rejection: Not specified.

Squelch sensitivity: Not specified.

S-meter sensitivity: Not specified.

Audio output power: 3 W into 8  $\Omega$  at 10% THD.

### Transmitter

Power output: Hi/med/low power, 50/25/5 W.

Spurious emission:  $\geq 60$  dB.

Transmit-receive turnaround time (PTT release to 50% of full audio output): Not specified.

Receive-transmit turnaround time (tx delay): Not specified.

Size (width, height, depth): Control head: 5.47  $\times$  2.09  $\times$  0.7 inches, without knob; radio body: 5.47  $\times$  1.66  $\times$  5.2 inches, without fan.

Weight (approx.): 2.43 pounds (radio body, control head, and control cable).

\*Test results shown are for standard FM mode. Sensitivity, adjacent channel selectivity, and dynamic range increased by 0.5 dB to 1 dB in FM narrow mode.

†Measurement was noise limited at the value indicated.

### Measured in the ARRL Lab

Receive: as specified.

Transmit: as specified.

As specified.

At 13.8 V dc: receive, no signal, max. audio and backlights, 560 mA; lights at min, 500 mA; transmit (hi/med/low): 146 MHz, 8.0/6.0/3.0 A; 440 MHz, 9.0/6.0/3.0 A.

### Receiver Dynamic Testing\*

FM, 12 dB SINAD, 146 MHz, 0.14  $\mu$ V; 440 MHz, 0.15  $\mu$ V; 162 MHz, 0.14  $\mu$ V; AM, 120 MHz, 0.65  $\mu$ V.

20 kHz offset: 146 MHz, 70 dB;† 440 MHz, 66 dB;† 10 MHz offset: 146 MHz, 82 dB; 440 MHz, 80 dB.

146 MHz, 84 dB; 440 MHz, 106 dB.

146 MHz wide receive, 70 dB;†

440 MHz wide receive, 66 dB.†

At threshold: 146 MHz and 440 MHz, 0.12  $\mu$ V, 0.25  $\mu$ V (maximum).

For five bars: 146 MHz, 2.1  $\mu$ V; 440 MHz, 3.3  $\mu$ V.

2.5 W at 10% THD, THD at 1 V<sub>RMS</sub>, 1.9%.

### Transmitter Dynamic Testing

At 13.8 V dc, hi/med/low power:

146 MHz, 53/24/5 W;

440 MHz, 49/23/4.7 W.

146 MHz 66 dB, 440 MHz 73 dB; meets FCC requirements.

Squelch on, S-9 signal: 146 MHz and 440 MHz, 2 – 3.3 ms.

146 MHz, 42 ms; 440 MHz, 48 ms

frequencies programmed on different bands.

The **F MENU** button, when pressed once, brings the operator to the new Custom Function List (**CFL**). The CFL function consists of a shortcut of the 10 most frequently used func-

tions that can be recalled by the operator. Eight functions can be chosen and modified by the operator within the 124 functions available in the main menu.

If the **F MENU** button is pressed and held, the main menu appears and is



clearly categorized with self-explanatory names. The included manual is comprehensive and explains all of the necessary details for every function.

The **DISP** button can be used to change the display view. It toggles between the backtrack view, the frequency view, and the band scope.

The **DX** button is used to activate and operate the WIRES-X functionalities (more on this later).

The **SQL BACK** button lets the operator adjust the squelch level or return to the previous menu or page when navigating in the menu or page system.

Finally, the **PMG PW** button is used in the Primary Memory Group (**PMG**) function. It lets the operator register the channel or frequency in the PMG, which is monitored when the function is activated. The display shows the RF signal level received of the registered PMG channel in a spectrum view, and can switch automatically to the channel when activity is detected.

## Functionalities

### GPS

The FTM-200DR incorporates a 66-channel GPS receiver, which is highly sensitive. It was able to receive a GPS signal without any issue when installed in my home station. The receiver is enabled when the radio is turned on, and an icon shows its status at the top of the display. It requires at least three satellites to be able to find the location coordinates.

In digital mode (C4FM), GPS information is transmitted simultaneously with the voice/data (**DN**) mode. When the digital Voice Wide (**VW**) mode is used, the GPS information won't be transmitted, as the data bandwidth is used for the wider voice mode. Using the backtrack display mode (available from the **DISP** buttons), the screen shows a compass indicating the direction and the distance between you and the other station if it also transmits its position.

### Memory Channels

The radio has 1,104 memories that can be programmed, each with up to 16 alphanumeric labels. Memory can be categorized with the MAG function on each band. It organizes the memory channel by bands, with the label **M-ALL** for navigating along all memory, **M-AIR** for listing the channel on the air band only, **M-VHF** for channels in the VHF band only, **M-UHF** for the channel in the UHF band only, and **OTHER**. With this quantity of channels, it would be interesting to give operators the ability to create their own groups.

### Recording

The FTM-200DR incorporates an SD card slot that lets you record the received audio and back up the radio setting with the programmed memories.

### APRS Data Communication

The FTM-200DR has a built-in modem capable of transmitting and receiving 1200 and 9600 bps APRS data. It can also display the receive station's information on the radio screen. The radio also supports SmartBeaconing with your position.

### Channel Band Scope

The radio offers band range of up to 61 channels and displays the level of received signals adjacent to the active frequency. In VFO mode, it can monitor 61 or 31 channels, and in memory mode it can monitor 21 or 11 channels around the selected channel. The rotary knob can be used to change the central frequency or the central channel. The scan speed is fast, and the audio stays tuned on the current selected frequency/channel.

### Custom Function List

The CFL lets you choose which function from the menu can be accessed in the 10 items of the **CFL** menu. By default, the **CFL** menu comes with 10 pre-programmed functions. The first two are frequency input and home, which are fixed and cannot be changed. The eight other functions can be selected from the main menu.

To select a function to put in the **CFL** menu, you must enter the main menu by pressing and holding the **F MENU** button. When you are in the main menu, choose the selected function you want to put in the **CFL** menu by rotating the rotary knob. When you've made your selection, press and hold the **F MENU** button again. The **CFL** menu will appear, and the new function name will be displayed. Rotate the rotary knob to choose the location where you want to put the function in the **CFL** menu. When the location is selected, press the rotary knob to confirm. If a function was already programmed at that location, it will be replaced by the new function.

### Programming the FTM-200DR Using the ADMS-15 Program

The FTM-200DR can be programmed in two different ways. You can use an SD card or the optional SCU-20 USB cable (sold as an option). Like many other radios on the market, Yaesu makes the radio entirely programmable. All parameters and channels can be set up using the ADMS-15 PC software to program the



radio (available for free download on the Yaesu website). For more information, you can also download the FTM-200DR manual on the Yaesu website.

### Portable Digital Node Modes

This function is interesting. Yaesu made this function available for all of its WIRES-X-compatible products. It lets you use a compatible C4FM radio to act like a network radio or a hotspot to access the Yaesu WIRES-X network directly. It can be done using two different modes:

- The PDN mode is capable of internet communication with digital stations only.
- The portable HRI mode is capable of internet communication with both analog and digital modes.

The main difference between the two modes is that the portable HRI mode supports internet communication in both C4FM and analog modes. A complete connection between the radio and the computer must be made using the optional SCU-58 kit, which includes two cables, the SCU-56 data cable and a second one for the audio. The data cable connects to the data port on the radio's rear panel (see Figure 1).

I did the test in portable digital mode. I used a compatible Windows computer running WIRES-X software connected to the FTM-200DR, using the SCU-58 cable kit.

This transceiver can use two different types of WIRES-X access, "direct access" and "access point." Direct access needs a direct connection between a computer and the FTM-200DR to be used like a network radio. This means it can receive and transmit on the WIRES-X network using the internet from the computer, and in this mode no RF signal is transmitted or needed. This access method could be useful for operators who are unable to install an external antenna due to local restrictions.



Figure 1 — The Yaesu FTM-200DR rear panel.

The access point mode is a more familiar and versatile type of access. This mode turns the FTM-200DR into a hotspot. To access the WIRES-X network, you can still use the FTM-200DR directly with its microphone and speaker, or use another C4FM radio, like the FT5DR, remotely via RF. When using this access mode, the FTM-200DR will transmit the WIRES-X signal through RF and transmit the received RF to the WIRES-X network via the internet. If you used a good outside antenna on the FTM-200DR in PDN mode, you could then extend the access to your node using another radio, like a repeater. This means that you will be able to access your node when you're on the move and within reach of your station. Also, everybody monitoring the simplex frequency in use (please select an appropriate one for your region) will be able to hear the connected node communications in and out of the WIRES-X network, because the signal will be retransmitted by the FTM-200DR.

### Choosing an SCU Cable

Many SCU cable assemblies to connect your radio to a PC are available to use with the WIRES-X network. Depending on your radio model and the intended usage, you will have to choose the right one for you.

For this review, I used the FTM-200DR set up with a Yaesu FT5DR portable radio. I used the SCU-58 cable kit, which I had to order separately. It is compatible with the Windows 8.1 – 11 operating system, and it included the SCU-56 with an audio cable. For my setup, I only connected the SCU-56 to the computer; I did not use the audio cable assembly (that's only needed if you intend to use the FM mode with the WIRES-X network).

### Using the FT5DR as the WIRES-X Node

With a combination of two C4FM radios like the FTM-200DR and the FT5DR, you can set your WIRES-X network the other way around. If you wish, you can use the FT5DR as the WIRES-X node with all of the same features, and use the FTM-200DR to remotely access the WIRES-X network via the FT5DR. But keep in mind that you will need a different cable to connect the FT5DR to a computer (SCU-39).

#### Preparation Procedure

Yaesu included a well-detailed preparation procedure in the PDN instruction manual that indicates the five actions you must take prior to using the PDN function with the FTM-200DR. These actions are:

1. *User registration to get your WIRES-X ID.* This step usually requires 2 – 3 business days to process. You



will need your unique radio ID available through the menu of the radio. You need to do this only once.

**2. Installation of the WIRES-X software on your PC.** The software is available through the WIRES-X page on Yaesu's website, and it's a simple step-by-step process to install the software.

**3. Installation of the USB device driver for the PC connection cable.** Prior to connecting and using the SCU cable, you must properly install the driver. The driver is needed to emulate an RS-232 COM port over a USB connection. The setup is easy to complete using the prolific driver installation manual included both in the software zip file and on the Yaesu website. The installation process can also be performed using the internal Windows driver update function.

**4. Updating the firmware of the transceiver (if required).** You should install the latest firmware available for the radio. The PDN manual contains a section titled "System Requirement," which describes the latest firmware required. Yaesu published the manual and an installation procedure for any new firmware release. It can be found on Yaesu's website.

**5. Connecting the transceiver to the PC.** The last step is to connect the PC to the radio and run the WIRES-X software (which was installed in step 2). But before doing that, you must put the radio in PDN mode before starting the WIRES-X software. If you don't put the radio in PDN mode, you won't be able to register the radio as a PDN, and you'll be stuck. The process differs for each radio and depends on whether you are using the PDN mode or the portable HRI mode. For the FTM-200DR, and because I was using only the PDN mode (not the HRI mode), the procedure was simple. The radio must be off, and the **DX** button must be pressed while turning the radio on.

#### *Using the Portable Digital Mode*

When the preparation procedure is completed and the radio is in PDN mode, you must open the WIRES-X software. You will be prompted the first time to select the serial port. If you followed the procedure, you should be able to identify it as "Prolific USB-to-Serial Comm Port (COM#)." For the rest of the setup, you can refer to the PDN manual that describes the configuration in detail.

After configuring the WIRES-X software, be sure that it communicates with the radio. I configured the radio with its proper RF parameters to use it as an access

point. I chose a frequency that didn't interfere with any local repeaters. I live in a rural area, so the spectrum is not crowded. I selected the band, frequency, and power, and configured the radio. After establishing these settings, I could start the operation of the portable node. For the FTM-200DR, I pressed the **DW** button once, and a flashing red **X** appeared on the upper left corner of the display. This indicates that the radio communicates with the PC to complete the connection. When the PDN is started, the **X** stops blinking and stays red. The display shows the node ID and the city where the station is installed, below the operating frequency. Using the access point, you'll hear all traffic on the frequency within the radio speaker. If you don't want to hear these communications, you can mute them using the **MUTE** key located on the microphone.

### **Connecting a Node or a Room**

When using PDN as the access point, you can connect a node or a room on the internet three different ways:

**1.** You can use the WIRES-X software directly. This is probably the easiest way to do it, but it must be done directly on the computer. Select the room or node in the WIRES-X software, right-click with the mouse on it, and click **CONNECT**. On the right side of the screen, you should see the connection establishing. When connected, you should hear three beeps on the radio and see a pop-up window appear on the computer screen, displaying the room or node status.

**2.** To use the FTM-200DR directly, you must rotate the dial knob over **SEARCH & DIRECT** and press the rotary knob. You'll enter the category view. Rotate the knob on **ALL**, and press it again. It will show you the available rooms sorted by the number of nodes connected to them. The most occupied node will be displayed first. To connect to one of them, rotate the knob, and when selected, press the rotary knob to connect.

If you want to connect a specific node that does not appear, in the category view, select the **SEARCH & DIRECT** item with the rotary knob. Using the rotary knob, enter the node ID or a part of the node ID that you want to search, and press the rotary knob. All rooms and nodes starting with the character that you entered will be displayed. Once you select the room of the node you want, press the rotary knob again to connect. You'll be redirected to the initial display showing the selected room or node ID.





**Figure 2** — The Yaesu FT5DR using RF to the FTM-200DR and connected to the VA2PKK repeater in Rimouski, Quebec.

3. The third way is available remotely using a C4FM digital radio within reach of the PDN station. I have used two different handheld radios, the Yaesu FT5DR and the Yaesu FT2DR. To work properly, both the FTM-200DR and the remote radio need to be on VFO A with the proper RF setting (frequency, split, modes, power, etc.). All radios should have their internal call sign properly configured. Once the radio is configured, press the **GM/X** key on the FT5DR (or the **X** key on the FT2DR) to activate the WIRE-X mode. Then, it will connect to the PDN and display its status on the handheld radio. In Figure 2, you can see that I was connected to the VA2PKK-RPT repeater in Rimouski.

After a connection is established with the room or another node, the FTM-200DR can display some information when receiving a signal. Using the **DISP** button, you can toggle between the standard view (see Figure 3) and the compass view (see Figure 4). At this point, all WIRE-X activities received by the node will be retransmitted on the air and can be heard by other radios in reach of the node.

## Documentation

Yaesu offers many manuals that include comprehensive information for basic and advanced operation of the FTM-200DR. You'll find all manuals on the Yaesu website under the file section of the FTM-200DR page.



**Figure 3** — WIRE-X standard view on the FTM-200DR display.



**Figure 4** — WIRE-X compass view on the FTM-200DR display.

Two manuals require more attention — the “Operating Manual,” which incorporates basic operations, and the “Advance Manual,” which explains signaling functions (CTCSS, DCS, etc.), memory functions, DTMF operation, GPS function, and the entire setup menu operation for a comprehensive usage of the menu.

You'll also find specific manuals for APRS, WIRE-X, PDN, and group monitor function.

## Conclusion

The FTM-200DR is easy to operate with its custom function list. Its size makes it useful for mobile operations. Digital mode is easy to operate and offers different ways to operate from anywhere around your station; it's useful if you're out of range from the nearest WIRE-X repeater. I like the fact that Yaesu included a mounting bracket for the radio, plus its clever approach with their quick-release mobile mount is great and can help to move the radio from the car to the station. Overall, this is a very versatile radio.

**Manufacturer:** Yaesu USA, 6125 Phyllis Dr., Cypress, CA 90630, [www.yaesu.com](http://www.yaesu.com). Available from several US suppliers. Price: \$399.95.



# MFJ-419 CW Elmer

Reviewed by Sean Klechak, W9FFF  
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Morse code remains a skill that many enthusiasts find useful and enjoyable to learn. For those interested in learning Morse code, there are many tools and techniques available, one of which I wrote about in Product Review in the February 2023 issue of QST. Another of these tools is the MFJ-419 CW Elmer, a small and portable device designed to help individuals learn to encode and decode Morse code at specific speeds. Having used the MFJ-419 myself for the past 2 months, I can vouch for its effectiveness as a learning tool.

## Description

The MFJ-419 CW Elmer is a multi-function training device that allows you to learn, receive, and send Morse code with a straight key. It's small and portable, measuring 3.75 × 2.25 × 1 inch, with a small screen (two lines of 16 characters) that displays characters and menu options, a power button, a menu button, a key jack, a headphone jack, and a micro-USB port. The device runs on a 9 V battery and can be powered by a micro-USB cable.

The MFJ-419 has a variety of features, making it a useful tool for learning Morse code. Send mode allows you to practice sending Morse code at your own pace. Receive mode allows you to listen to Morse code transmissions and learn the characters. Analyze mode provides feedback on your transmission speed and timing. The USB text mode allows you to send text to the MFJ-419 so you can practice listening to real messages. Exercise mode helps you practice making dits and dahs with the correct length and with proper spacing between characters and words.

## First Impressions

Included with the CW Elmer was a sheet that said the user manual could be found on the MFJ website. I found that the manual was not available, so I contacted technical support and the PDF manual was promptly emailed to me.

I removed the battery cover, installed a 9 V battery in place, and reinserted the rear cover (see Figure 5). The entire case was made of a decent-quality plastic, and the battery fit inside the case well. I flipped the CW Elmer over so I could see the LCD, and turned the device on by pressing one of the two buttons on the side of the unit. When I pressed the black button, the



CW Elmer started the boot-up sequence (**CQ DE CW-ELMER**).

## Menus and Settings

I didn't read the instruction manual at first, but the first line on the screen read **CW-ELMER**, and the second line flashed multiple options. Every 2 seconds, a new option appeared: **SETTINGS**, **SEND**, **RECEIVE**, or **EXERCISES**. There is a red button on the side of the CW Elmer that has multiple uses, one of which accesses menus and sub-menus (see Figure 6). In hindsight, I probably should have accessed the **SETTINGS** menu first; instead, I accessed the **RECEIVE** menu. I rebooted the device a few times to make certain what I was hearing when the CW Elmer sounded off the introduction of "CQ DE CW-Elmer." Ultimately, at the speed at which the CW Elmer was set, my brain was having trouble separating spacing, and I couldn't automatically recognize certain tones. I may have heard the CW tone for the letter R, but I was uncertain that that's

## Bottom Line

The CW Elmer is a small package full of features allowing the user to understand what is needed to improve sending and receiving Morse code. It is a great tool to learn CW in an easy-to-use, straightforward device.





**Figure 5** — A view showcasing the back of the CW Elmer, which contains a rear-firing speaker and cover that houses a 9 V battery (not included).

what it was, because I was unable to hear the delay between letters.

I accessed the **SEND** menu to begin practicing. However, this was also when I realized just how poor my timing was at the default speed. Before going any further, I accessed the **SETTINGS** menu and adjusted the speed. The default speed turned out to be 15 WPM, which I thought I was doing really well with, especially when sending. I do remember being told to send only as fast as I could receive. Because I had to listen and restart the CW Elmer multiple times with pretty poor timing while sending, I reduced my speed to 10 WPM. On the main screen, I pressed the red button, and when **SETTINGS** was displayed, I saw the **SETTINGS** menu on the top LCD and multiple options on the bottom, including **WPM**, **TIMING**, **CHARS**, and **SIDETONE**. Additionally, there is an **ABOUT** section that shows the version number. The final option within the **SETTINGS** menu is **CANCEL**, which sends you back to the main menu. To access any of these options, tap the red button during the 2 seconds that option is displaying. The options are 5 to 40 WPM in 5 WPM increments.

After you change the speed by pressing the red side button, the unit saves the settings and takes the user back to the main menu. I returned to the **SETTINGS** menu and selected **TIMING MODE**. There are multiple options in timing mode: **NORMAL**, **FARNSWORTH 18**, and **FARNSWORTH 25**. The Farnsworth method is generally considered to be an effective way to learn Morse code. It allows individuals to recognize the patterns of Morse code characters at a higher speed, which makes it easier for them to send and receive Morse

code quickly later on. I chose to stay with the default method, **NORMAL**. Next, within the settings, I chose my character set. The options to choose from are letters only; a combination of letters and numbers; and numbers, letters, and special characters. I started with letters and numbers. Finally, in the **SETTINGS** menu, I selected the sidetone option and which tone I heard best/liked the most. The options for the sidetone are from 200 to 1000 Hz, in 200 Hz increments. I chose 800 Hz for my sidetone.

I briefly tested my sending skills with the CW Elmer. I plugged a 3D-printed straight key into the **EXT KEY** port and found I could navigate through the menus with the key.

## Practice with Sending

I accessed the **SEND** menu and selected **KEY CODE**. In this menu, I could practice sending characters. I practiced the alphabet for a while and confirmed I could use the red button as a straight key. I quickly realized another issue I had been having with Morse code, which was that my timing wasn't yet perfect. I was able to slowly type the alphabet in Morse code, with a space showing between each character on the screen, but when I attempted to send at normal speed, without any spacing, I was basically just coding a bunch of nonsense. This was when I discovered the importance of timing. After practicing sending for a while, I ventured over to the **EXERCISES** menu, which has exercises specifically designed to help you understand, hear, and send characters and spacing with the proper timing.

You can select a few different options from the **EXERCISES** menu: **. DIT TIME**, **\_ DAH TIME**, **DIT ^ DAH PAUSE**, **WORD^WORD PAUSE**, **A^B PAUSE**, and **CANCEL**. Each of these methods helps with timing within a specific area of sending characters. For example, selecting the **. DIT** option shows me my speed (10 WPM). I must tap the straight key and ideally press it for 120 ms. During my first attempt, I held down the **. DIT** for 150 ms. This indication of 150 ms meant I was holding the key for too long, and I needed to release the key quicker to have a shorter dit tone. My second attempt was 129 ms, which is within the acceptable range for a dit. This proved to be one of the most valuable learning tools for me. Not only do I have the opportunity to hear the tone and the tone length, but now I can process what may need modification. After just a few days, I felt more confident listening to QSOs and picking up bits and pieces. My advice on sending is to use the same straight key you would like to use for CW.





**Figure 6** — A side view of the MFJ-419 CW Elmer includes a micro-USB port for power or for use with a terminal client, such as *Tera Term*. A power button controls if the unit is on or off. An external key port allows the user to use their own straight key while practicing Morse code but also allows practicing Morse code with no key, by utilizing the red **KEY** button. The **KEY** button can also act to navigate through the menus. Finally, an HP port allows the user to use the CW Elmer with headphones for better hearing or to be considerate of others in the area.

During my time with the CW Elmer, I switched keys three times. Switching between a 3D key, an older straight key, and the side button threw off my timing in relation to dits and dahs. Stick with one key to eliminate variables while learning. At that point, I had not looked at the printed manual, and I soon felt it was necessary to use it, as there was valuable information regarding options I wanted to try, especially the **RECEIVE** menu.

### Receive Practice

There are three options within the **RECEIVE** menu: **RANDOM**, **USB READER**, and **CANCEL**. Depending on the previously chosen settings, the CW Elmer operator will be presented with random characters; characters and numbers; or letters, numbers, and special characters. Whichever combination you choose, the characters are sent at the speed set by the operator in the **SETTINGS** menu. Additionally, not only are the characters randomly generated based on the operator's selection, but they are also grouped in a combination of three to seven characters. At first, I struggled with this, but over time I recognized that this trains you to always listen and anticipate what may be next.

When using the receive feature, I did not look at the LCD and instead focused on the tone. This allowed my brain to process better "on the fly," without relying on the visualization of the character while learning to decode. When the string of characters stopped, I had enough time to determine which characters I could process and which ones I could not, and then look at the screen to see which characters were displayed. I practiced this for 20-minute sessions throughout the day and made a list of characters I could frequently process or need to work on more. For the characters I still needed to work on, I practiced by going to the **SEND** menu and sending that letter over and over, making sure I heard the sounds for the character I was working on. I also repeated the sending process until I instantly recognized the tones for the single character they had become.

### 3D-Printed Stand

Before learning any more, I felt I had a slight issue with the CW Elmer, but the truth is that I may just have been utilizing it incorrectly. I wanted to look at the 16-character × 2-line screen, but the case had to be flat on the desk, table, or other surface. This also made it difficult for me to hear the sounds. The alternate solution was to stand the CW Elmer up at a 90-degree angle from the surface area. This allowed me to hear the CW Elmer but not see the LCD. This issue enabled me to jump into a CAD program and make up an MFJ-419 CW Elmer 3D-printed stand (shown in red in Figures 5 and 6), which sits at two different angles and allows the operator to see and hear the device well, in both positions. This may have been an oversight in development and a necessary modification for ease of use. The file is available for anyone to print at [www.thingiverse.com/thing:5928755](http://www.thingiverse.com/thing:5928755). In the future, a simple solution might be to add foldable legs on the sides of the device, as standard.

### Using Personalized Text

I had been learning all about proper spacing and sending habits, but I really wanted to attempt the USB reader functionality. The USB reader allows users to upload their own CW text to be heard and decoded. This is when you should use the manual, which clearly explains how to send files and text via a micro-USB and *Tera Term*. The user manual states that drivers should be automatically detected and installed, but you should also download the FTDI drivers, if this is not the case. Using Windows 11, the drivers were detected as unsupported. I followed the instructions in the MFJ manual, downloaded the drivers, and after a few system reboots, Windows properly recognized the device.



Following the instructions in the manual, I used *Tera Term* to access the CW Elmer from my computer. My goal was to upload a text file to the CW Elmer so I could practice real words. There are many text files to choose from; ultimately, I created a list of the top 100 words used in CW/Morse code and saved this list in a .txt file format, as required by the CW Elmer. After saving the list, I noticed it froze while accessing text from the USB in the **RECEIVE** menu. The manual states that I should be able to listen to short messages or long books if I desired; however, my initial observation showed that the text file had stopped being read after 62 characters. I created a new text file with 3,200 words. This time, after 147 characters, the CW Elmer stopped sending me code. My final attempt was a file with 20 words, and after 56 characters, the CW Elmer again stopped.

I reached out to MFJ customer support, and they quickly noted that I had missed the step in the manual to enable the **XON/XOFF** in the *Tera Term* software. Without it, an overflow occurs, and the MFJ-419 seemingly stops giving out characters. With the handshake in place, a buffer overflow is prevented. After enabling this option, I had no issues uploading files and playing them back.

It's nice to be able to put in a list of common words that may be useful for me to learn, even some on repeat, so I can hear them multiple times and become familiar with the tones. Hearing "CQ" and signal reports has been most helpful, as well as just putting a letter I have been struggling with into the text file many times over.

Hearing the constant letter on repeat trained my brain to instantly recognize the series of tones with the associated character.

The final major feature I have come to appreciate is the **ANALYZE** feature. While practicing sending code with the CW Elmer, the keying technique is being analyzed in the background. Accessing the **ANALYZE** menu shows the operator's statistics for dit and dah times, counts, and averages, as well as maximum and minimum key time. This has allowed me to better understand how I am performing overall while sending code.

## Conclusion

All in all, this device is helping me in my quest to learn Morse code. I have found it to be useful in improving both my sending and receiving. I believe anyone learning Morse code would appreciate the CW Elmer's features. This isn't the only option for practicing CW/Morse code, but I have found it useful in my daily travels — I even let the receive feature play tones to me on my daily walk. I always use the headphone jack so as not to disturb the people around me. I've used most of the features of the device without reading the manual first, which is a good sign of how straightforward this device is to use. But the manual is easy to follow and understand, and it's useful for this simple-to-operate device.

*Manufacturer:* MFJ Enterprises, Inc., 300 Industrial Park Rd., Starkville, MS 39759, [www.mfjenterprises.com](http://www.mfjenterprises.com). Price: \$170.

# Taidacent RF Power Meter

*Reviewed by Phil Salas, AD5X*  
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There is so much inexpensive, yet accurate, test equipment now on the market, permitting the average ham to set up a very nice home lab — in particular, the NanoVNA, NanoVNA-F, tinySA, and tinySA Ultra, all of which I've had the opportunity to use and review. However, there is one piece of inexpensive test equipment missing — a good, accurate RF power meter. Enter the Taidacent RF power meter, which is available at [www.amazon.com](http://www.amazon.com).

## Overview

As you can see in the lead photo, the Taidacent RF power meter is an unpackaged unit. It consists of two printed circuit board assemblies that plug together: the RF circuit board (bottom) and the display (top). The RF

## Bottom Line

If your workbench is missing an RF power sensor, you might consider the inexpensive Taidacent unit. Its easy-to-use offset capability permits expanding its use to high-power applications with external attenuators.





input is an SMA connector, and the dc voltage input is a simple screw terminal block. The two-line LCD display shows RF power in W and dBm. It also displays RMS voltage. The display also permits selection of an external attenuator whereby you set the actual attenuation value. Once this is done, this attenuation value is incorporated into the power level display. In this way, power levels up to 100 dBm (10 million W!) will be directly read. The power meter specifications are given in Table 2.

Well, this all looks very good for a \$60 instrument. However, while a measurement resolution of 0.1 dBm looks good, there is no specification on accuracy. So, let's see how well it stacks up.

**Table 2**  
**Taidacent RF Power Meter Specifications**

Parameter	Specifications
Power range	–50 to +0 dBm (1 nW – 1 mW)
Measurement resolution	0.1 dBm
Frequency range	1 – 10000 MHz
Operating voltage	7 – 12 V dc
Operating current	<50 mA
Operating and storage	–40 °C to 65 °C
Size (L x W x H)	55 x 45 x 10 mm (2.2 x 1.8 x 0.4 inches)

**Table 3**  
**Taidacent Power Meter Comparisons to HP and Mini-Circuits Power Sensors**

Frequency	tinySA Ultra Out	HP8484A	HP8481A	PWR-6GHS+	Taidacent
50 MHz	–25 dBm	–24.2 dBm	–24.9 dBm	–24.5 dBm	–24.5 dBm
100 MHz	–25 dBm	–24.1 dBm	–25.0 dBm	–24.6 dBm	–24.6 dBm
500 MHz	–25 dBm	–24.2 dBm	–24.5 dBm	–24.2 dBm	–23.4 dBm

## Some Testing

The unit is specified at 12 V dc maximum, so I built an interface cable with three series 1N4001 diodes, as my standard power supply for running my test lab is 13.8 V dc. And while the power supply output is variable, I wanted to continue to power other equipment needed for some of these tests. This Taidacent power sensor draws about 45 mA, so it could also be powered from a typical 9 V alkaline battery for 6 to 8 hours.

I own an HP437B power meter with HP8484A (–70 dBm to –20 dBm) and HP8481A (–30 dBm to +20 dBm) power sensors, and a Mini-Circuits PWR-6GHS+ (–30 dBm to +20 dBm) power sensor. All are periodically checked by a local NIST-certified testing facility. For my signal source, I used my tinySA Ultra. The output level was adjusted to the value, as measured on my Siglent SSA3021X spectrum analyzer. Table 3 shows the measurement comparisons. I tested the unit up to 500 MHz, as this covers the most popular ham bands.

You can see how close the Taidacent power sensor is to the HP and Mini-Circuits sensors up to 50 MHz. The Taidacent sensor does start to read a little hot above 100 MHz.

The Taidacent power sensor can be set to compensate for external attenuators, thereby displaying actual power into an external attenuator. To do this, press and hold the **MODE** button for about 1 second. This will take you into the offset screen. The **FUN** (function) button lets you select between adding or subtracting an offset, and the **SEL** button increments or decrements the offset. Tapping the **SEL** button lets you change the offset in 0.1 dB steps. Holding the **SEL** button quickly changes the offset. When you have entered your desired offset, press and hold the **FUN** button for about a second; the offset value will be saved as the new default when you power on the unit (**SAVE** will show on the screen momentarily). Tap the **MODE** button to exit the offset function.

I added 50 dB of external attenuation ahead of the Taidacent sensor and compared the power readings to my HP8481A sensor, which has the same offset capability. I used higher-power radios as the signal sources. The results are shown in Table 4.

The errors at the higher frequencies are similar to the errors seen in Table 2. Of course, you can put in an offset to compensate for the



**Table 4**  
**High-Power Comparison**  
**with External Attenuators**

Frequency	HP8481A	Taidacent	Taidacent Variation from HP
50 MHz	14.2 W	14.2 W	0 dB
146 MHz	12.8 W	13.5 W	+0.23 dB
220 MHz	16.8 W	17.5 W	+0.18 dB
440 MHz	11.4 W	13.7 W	+0.8 dB

small errors. I suspect that different Taidacent power sensors will have similar characteristics.

### Packaging the Power Sensor

With a little effort, I was able to package the RF power sensor. If you would like to duplicate this effort, you'll need to purchase four aluminum #4 standoffs (Mouser 761-4505-440-AL-7) and a Serpac H-67 9 V case (Mouser 635-H-679V-B). This case has a compartment for a 9 V battery. You will also need a DHT Electronics SMA-male-to-N-female bulkhead with 6 inches of cable, which is available at [www.amazon.com](http://www.amazon.com).

Remove the installed standoffs from the RF board, and plug the display and RF boards together. Place them such that the display is in the battery side of the case, with the display as close to the battery compartment as it will go. Mark the position of the display with a silver permanent marker, and cut out the hole for the display with a Dremel tool, hot knife, drill and file, or nibbling tool. Place the display in the hole, use the silver marking pen to mark the display mounting holes, and drill out with a 1/8-inch drill bit. Carefully measure



Figure 7 —The packaged RF power meter.

the locations of the **FUNCTION**, **MODE**, and **SET** buttons, and drill 1/4-inch D holes for these below the display cutout. Finally, cut out a slot for the **ON/OFF** switch just above the battery compartment. I used a slide switch, but a toggle switch is easier, as it has a round mounting hole.

Attach the new 1/2-inch standoffs to the RF board. Place the opposite side of the case over the complete assembly, and use the silver marking pen to mark the locations of the two standoffs closest to the opening on the side of the case. Now, carefully determine the center of the marked standoff positions, and drill 1/8-inch D holes for these. Remove the standoffs from the RF board, and place the RF board on the cover. Mark the remaining two mounting holes, and drill with the 1/8-inch bit. Remount the 1/2-inch standoffs on the RF board, plug the RF board and display together, and put in screws through the newly drilled holes to hold the RF board to the case. Next, open the case and put in mounting screws for the display. If you've done this correctly, the RF board will be attached to one side of the case, and the display will be attached to the other side of the case. When the case is put together, the boards should connect to each other properly. Now, connect wires from the battery compartment through the switch, and to the power connector on the RF board.

On the removable side panel, cut a hole for your connector of choice as close to one end of the case as possible. I used the N-to-SMA cable adapter and cut off the SMA connector at the end of the cable. I then stripped and soldered the shield and center conductor to the place on the RF board where the SMA connector is. Now you should be able to put the case together. It should look like the one in Figure 7. I used Casio white-on-clear labeling tape for the labels. Because the **FUNCTION**, **MODE**, and **SET** buttons are recessed, I access them, when necessary, with a toothpick.

### Conclusion

There are numerous power sensors similar to the Taidacent unit. I picked this unit because it is inexpensive and readily available on Amazon. The Taidacent power sensor is a reasonably accurate RF power sensor, especially for ham bands below 500 MHz. The only issue I had was figuring out how to package it.

*Manufacturer:* Taidacent. Available at [www.amazon.com](http://www.amazon.com). Price: \$60.





# Certificate of Code Proficiency Recipients



This month, ARRL recognizes merit and progress in Morse code proficiency on the part of the following individuals, who have achieved proficiency at the following rates, in words per minute.

## March 2023

Russell L. Bast, Jr., AD2BO	10
Benjamin S. Williams, KO4BHX	10
Edgardo A. Aban, KN6SWG	15
Jason S. Cary, K6JSC	15
Gregory S. Glenn, WB6MPH	15
Andy F. Lach, KD9KHA	15
Eugene W. McPherson, N0MHJ	15
Phillip L. Puzick, KB5EBB	15
John H. Smale, K2IZ	25
James T. Patten, W1JTP	40

## April 2023

Daniel E. Cahoon, WD4AJI	10
James P. Murphy, WA2MUX	10
Victor Denisov, N6DVS	25
Michael J. Kerezsi, W3ASW	30

## May 2023

Robert T. Hanley, NB8R	10
Frank C. Richards, KB4VU	15
Peter J. Stohrer, W1FEA	15
Michael F. Born, W9JXT	20
Steven G. Fein, KM6VOV	20

Galen L. Babcock, Sr., AG5LS	25
David W. Rice, AD8WR	25

## June 2023

Charles H. Brown, W3CHB	10
Russell L. Bast, Jr., AD2BO	15
Andrew J. Zimolzak, KI5PED	15
Brian D. Miller, K9RA	35
Ernesto M. Ong, AD5MD	35
Joseph W. Parskey, NJ1P	35

Congratulations to all of the recipients.

## September 2023 W1AW Qualifying Runs

W1AW, the Hiram Percy Maxim Memorial Station at ARRL Headquarters in Newington, Connecticut, transmits Morse code Qualifying Runs to assist ham radio operators in increasing and perfecting their proficiency in Morse code. Amateur radio operators can earn a Certificate of Code Proficiency or endorsements by listening to W1AW Qualifying Runs.

September Qualifying Runs will be transmitted by W1AW in Newington, Connecticut, at the times shown on 1.802.5, 3.581.5, 7.047.5, 14.047.5, 18.097.5, 21.067.5, 28.067.5, 50.350, and 147.555 MHz. The West Coast Qualifying Runs will be transmitted by K6KPH on Saturday, September 23, at 2 PM PDT (2100 UTC) on 3581.5, 7047.5, 14047.5, 18097.5, and 21067.5 kHz. Unless indicated otherwise, sending speeds are from 10 to 35 WPM.

Amateur radio operators who participate in Qualifying Runs may submit proof of 1 minute of the highest speed they have copied in the hope of qualifying for the Certificate of Code Proficiency, or an endorsement to their existing certificate. Legibly copy at least 1 minute of text by hand, and mail the sheet to: W1AW Qualifying Runs, 225 Main St., Newington, CT USA 06111. Include \$10 (check or money order) if this is a submission for your initial Code Proficiency certificate; \$7.50 if you are applying for an endorsement (available for speeds up to 40 WPM). Your test will be checked against the actual transmissions to determine if you have qualified.

Members of the North Fulton (Georgia) Amateur Radio League (<https://nfarl.org>) are offering to subsidize the total cost of a Code Proficiency certificate or endorsement submission for any individual age 21 years and

younger, and who reside in either the US or Canada. Participants who wish to make use of this offer should indicate on their Qualifying Run submissions they are age 21 or younger, and certify as such via their signature. Eligible participants are not required to send any fee with their Code Proficiency submissions.

For more information about Qualifying Runs, please visit [www.arrrl.org/qualifying-run-schedule](http://www.arrrl.org/qualifying-run-schedule).

For information about how to qualify for the Certificate of Code Proficiency, please visit [www.arrrl.org/code-proficiency-certificate](http://www.arrrl.org/code-proficiency-certificate).



## W1AW Qualifying Runs — September 2023

(All times are in Eastern Daylight Time.)

Monday	Tuesday	Wednesday	Thursday	Friday
<b>Labor Day</b>	<b>9/5</b> 7 PM – 2300Z 35 – 10 WPM		<b>9/7</b> 10 PM – 0200Z (9/8 – UTC) 10 – 40 WPM	<b>9/8</b> 9 AM – 1300Z 10 – 35 WPM
	<b>9/12</b> 4 PM – 2000Z 10 – 35 WPM	<b>9/13</b> 7 PM – 2300Z 10 – 40 WPM	<b>9/14</b> 9 AM – 1300Z 35 – 10 WPM	<b>9/15</b> 10 PM – 0200Z (9/16 – UTC) 10 – 35 WPM
<b>9/18</b> 7 PM – 2300Z 10 – 40 WPM		<b>9/20</b> 10 PM – 0200Z (9/21 – UTC) 35 – 10 WPM	<b>9/21</b> 9 AM – 1300Z 10 – 35 WPM	<b>9/22</b> 4 PM – 2000Z 10 – 40 WPM
<b>9/25</b> 10 PM – 0200Z (9/26 – UTC) 10 – 40 WPM		<b>9/27</b> 9 AM – 1300Z 35 – 10 WPM	<b>9/28</b> 4 PM – 2000Z 35 – 10 WPM	



## Ask Dave

Get more information from the “QST: Ask Dave” YouTube playlist at <https://bit.ly/3z2MBMI>.

# Antennas, Grounding, and a Green J Pole

### Antennas Don't Like Nearby Metal Objects

**Q** Butch Butler, K4NAU, asks: Do you foresee any problems using a 40-foot tower to support my new antenna? I'm going to erect a MyAntennas EFHW-7510 antenna. I plan to install the feed point at the tower's base and run the vertical component parallel to the tower to a pulley, then across the backyard about 90 feet in a gradual slope to about 10 feet off the ground, which would leave me about a 30-foot coax run to the operating location. The feed point will be grounded via a bond to the tower ground.

**A** Yes, I do see some potential problems. Running the antenna next to the tower will cause coupling from the antenna to the tower, which will cause the standing wave ratio to go sky-high, making it difficult to tune.

The antenna you have chosen is one I have tested personally. It's a fine antenna and works well as an inverted V. At about 130 feet long, it's too long for hams who don't have room on their property. If you have room, put the feed point near your house, high enough so no one will walk into it. Run it through the air to the top of the tower using the pulley. Then run it to another part of the yard. The beginning, middle, and end points of the antenna do not need to be in a straight line. It can bend as much as 90 degrees or more (see the “Ask Dave” column in the June 2022 issue of QST for further explanation).

### Finding the Utility Electrical Ground

**Q** James Irwin, VE7DKJ, asks: How do I find the utility ground for a new station I'd like to install? My house was built in 2004, and I can't find my utility ground. Therefore, it must be in the foundation and footing, with no access to the interior garage wall from the siding outside. Should I hire an electrician to trace the utility ground for bonding?

**A** A home built in 2004 will most certainly have an electrical system that was inspected to meet the *Canadian Electrical Code*. That means the utility's neutral will be grounded at the entrance panel. Usually, this means a ground rod, which can most likely be found immediately below the entry panel. It may be buried, so some gentle exploration with a trowel could discover it. The other option is an Ufer ground, which is a long piece of concrete reinforcement bar that is laid in a large slab of the building's concrete floor. I don't know where you are located in

Canada, but I suspect you have a standard ground rod near your electrical meter.

Once you put your station in place, you should ground your station to its own ground rod. Your station's ground rod should be bonded to the utility ground rod using #6 AWG or thicker wire. All grounding connections are either pressure connected, such as a stainless-steel hose or a grounding clamp, or copper welded. Solder should not be used because grounding system components can become hot enough during an event, such as a lightning strike, to boil away the solder. This bond can be made with stranded bare wire, which has a larger surface area and more conductivity at higher frequencies. Under no circumstances should this bonding wire ever enter or go under your house. It should be buried outside.

Your station in your home needs a single point from the power supply, the radio, the antenna tuner, etc., to connect all the grounds. Often this is a short piece of copper pipe (that's what I use) connected to the station's ground rod. The station ground is then bonded to the electrical utility ground rod described above.

The video “Station Grounding for Amateur Radio,” on my YouTube channel (<https://youtu.be/Luy8XP8O390>), discusses station grounding in detail. Current amateur best practices can be found in the 2nd edition of *Grounding and Bonding for the Radio Amateur* by Ward Silver, NØAX, available from the ARRL store.

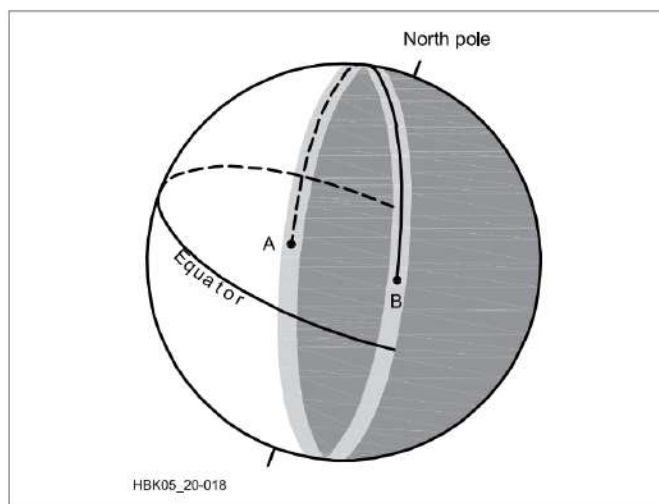
There are many advantages of good grounding, like safer operations, lower noise, insurance compliance, and more. If you are having trouble locating the utility ground, you can call your electrical utility. Note that grounding radio stations and RF is a specialized topic, and many residential electricians may not be familiar with all of the requirements.

### 160-Meter Propagation Is Better in the Winter than in the Summer

**Q** Steve Felkner, KE5SF, asks: Why can I make more 160-meter contacts in the fall and winter than in the summer?

**A** The 160-meter band is a medium-wave signal that has more in common with the AM broadcast band than other ham radio shortwave bands. During the day, medium-wave skywave propagation is almost completely blocked because the ionosphere's D region is highly ion-





**Figure 1** — The gray line encircles the Earth, but the tilt at the equator to the poles varies over 46 degrees with the seasons. Long-distance contacts on 1.8 MHz and 3.5 MHz at more than halfway around the Earth can be enabled by the gray line, putting both ends of the path near darkness and allowing RF to cut across the dark ionosphere with minimal absorption. The strength of the signals indicates that multiple Earth-ionosphere hops are not the likely mode of propagation, since losses in many such hops would be prohibitive. Ducting in the electron density valley above the E region peak in the dark ionosphere is the likely mechanism.

ized. All is not lost, however, as medium-wave signals use ground wave effectively. Ground wave at MF can cover up to a few hundred miles — less as the frequency rises. The D region primarily affects the 160- and 80-meter amateur bands, but higher frequencies are not as strongly affected by the D region. Fortunately, the D region is a daytime phenomenon and quickly dissipates at sunset. Then, your 160-meter signals can bounce off the ionospheric F region and propagate much farther.

The difference between fall and winter versus spring and summer is twofold. First, in the fall and winter, the D region forms later in the morning and dissolves earlier in the evening. Second, and perhaps equally important, there is much less strong thunderstorm static in the winter than in the summer. Of course, below the equator, this biannual effect is reversed.

I want to point out the gray line in Figure 1 (taken from the 100th edition of *The ARRL Handbook for Radio Communications*). It is the twilight band that wraps around the Earth, covering the local sunrise and sunset. This short period makes for some rather interesting propagation as the nighttime layers fade into the daytime layers and vice versa.

## Using Ham Antennas for Short Wave Listening

**Q** Dan Andrews, W4FYP, asks: Why do I get great 80-meter reception when my multiband 10- to 40-meter end-fed half-wave dipole is only 66 feet? I have an Icom IC-7300 and press the **TUNER** button when I change

bands. I receive 80 meters, as well as 20 and 40 meters, though I have not tried to transmit on 80 meters.

**A** Just about any length of wire over 20 feet long can be a great shortwave receiver antenna. Generally, the best antenna to receive a shortwave signal, such as on 80 meters, is a tuned dipole. It will give you the highest signal strength indication. However, a less optimal antenna, such as a 40-meter antenna that listens on 80 meters, will provide a lower signal level. Fortunately, with all other things equal, the received noise will also be reduced proportionally. This means the signal-to-noise ratio will be the same even though the antennas have different capabilities. If the IC-7300 is presented with a lower signal level accompanied by a lower noise level, the RF circuits inside the IC-7300 are excellent and will amplify the signal so that you hear it just fine. While this is a general rule, it does not always work. If the antenna is close to a noise source, it may pick up more noise than signal.

When you press the **TUNER** button, it will go to the last tuned setting for that frequency. To start the tuning activity, you must turn the tuner on by pressing the button and then press and hold to initiate a tuning cycle. You can do this with any band your antenna covers, but doing so on the 80-meter band will likely cause the tuner to give up quickly. You should not transmit on 80 meters until you can use a resonant antenna (see the IC-7300 manual, page 7-1).

All modern HF transceivers are also general-coverage shortwave receivers, and hams are not the only shortwave users. You can listen to any shortwave signal using whichever ham antenna provides you with the loudest signal.

## Green Is Good

**Q** Bill Grohoski, KD2HMO, asks: Does green patina affect the efficiency of a 30-year-old copper J-pole antenna?

**A** The green patina covers copper after it is exposed to the elements for an extended period. The Statue of Liberty is the most famous example. The statue is coated in copper plating and has been in place long enough that the entire statue is green. The green patina protects the copper.

The patina does not affect the antenna's propagation in any way. Most J poles use an SO-239 for the coax connection. If it's held on by a clamp, clean this area and use a plumbing torch to affix it to the J pole permanently. Otherwise, after cleaning the connector, proceed with the installation.

Send your questions to [askdave@arrrl.org](mailto:askdave@arrrl.org). I answer some questions here, and some via videos on my YouTube channel ([www.youtube.com/davecasler](https://www.youtube.com/davecasler)), or during my weekly livestream on Thursdays at 6:45 to 8:15 PM Mountain Time on my channel.



## Hints & Hacks

# Old Tuner Reconditioning; a Stealth Balcony Antenna; Morse Code Ringtones; Pipe Drilling Made Easier

### Emery Boards to the Rescue

My vintage TEN-TEC 277 antenna tuner uses a novel approach to select the desired inductance. It involves a rotary mechanism that contacts the windings of a toroidal inductor (see Figure 1). The contact on the rotary arm had become corroded with age, and oxidation built up on the coil windings. Together, they caused erratic operation on several bands. I tried cleaning the coil with sandpaper, but I couldn't reach the wire surfaces, even when using a flat screwdriver with sandpaper wrapped around the blade.

I considered emery boards used for filing nails — they would be perfect for the job. The boards I acquired were roughly 0.5 inch wide, 4 inches long, and 0.05 inch thick. This gave me plenty of room to clean the coil. To clean the rotating arm, I removed the screw, the nut, and the two plastic insulators located on the left rear side of the tuner. Once finished, I reassembled everything.

I also had trouble with the shunt capacitor. Whenever I turned the knob to the number 7 position and released it, the capacitor would drop to the number 10 position instead. I discovered that the center plate separating the two rotors was the main culprit. It was supposed to provide enough resistance to them, but it no longer did. After cutting an emery board into a small rectangular piece, I jammed it into one side of the center plate to increase the friction. The tuner now works great!



**Figure 1** — A view inside the TEN-TEC 277 antenna tuner. The toroidal coil and the rotary selector arm are to the left of center. [David Vine, WA1EAW, photo]

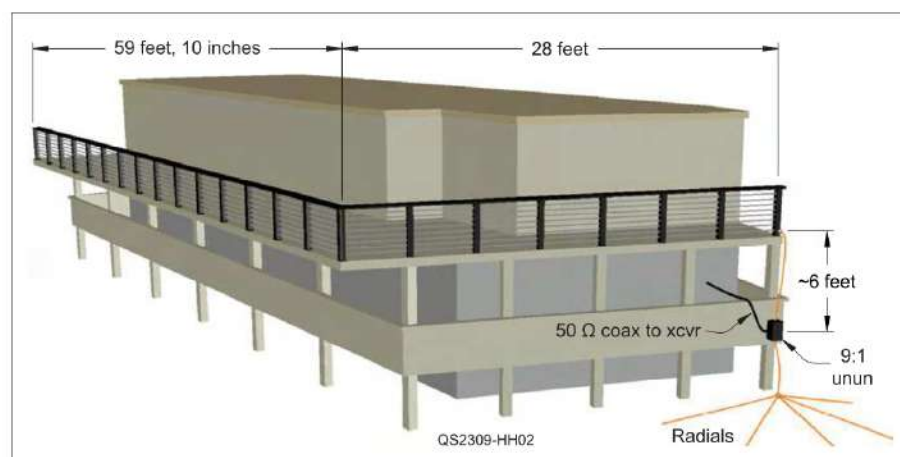
You may not own a TEN-TEC 277, but these techniques can be applied to many older antenna tuners.  
— 73, Theodore Turk, WB8ADA, hammytee@hotmail.com.

### A Multiband HF Railing Antenna

I live in an antenna-restricted homeowner's association community. A large metal railing surrounds my second-floor balcony, so I decided to try using the railing as an end-fed

antenna. To my surprise, it worked — not only on one band, but on several bands!

I connected a wire at the end of the railing and inserted a 9:1 unun near the spot where the coaxial cable enters my station on the first floor (see Figure 2). By using an Icom IC-7610 transceiver with 100 W and an MFJ-994B automatic tuner, I can load the balcony railing on all bands between 160 and 6 meters.



**Figure 2** — A diagram of the author's balcony railing antenna. The radial wires are a few feet long. They are not required, but they will likely improve the antenna's efficiency.



If you have a similar railing or other long metal structure, it may serve as an equally stealthy antenna. Of course, be sure to visit the ARRL RF Exposure web page at [www.arrl.org/rf-exposure](http://www.arrl.org/rf-exposure) to make sure the antenna complies with the latest regulations. — 73, *Hiroki Kato, AH6CY, ah6cy@arrl.net*

## Morse Ringtones

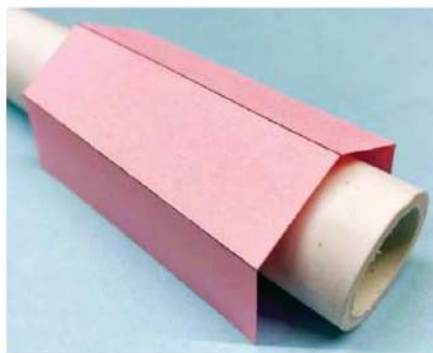
Most cell phones can be configured to play a canned ringtone for different contacts, which can be handy for identifying the caller without looking at the screen. But I began to have difficulty remembering which ringtone was for whom, especially after upgrading phones.

I noticed that my new Android 11-equipped phone lets me create my own ringtones, so I made .wav files with Morse code messages instead of music for each of my contacts. I chose the speed and tone most comfortable for me, and I kept the messages brief. This hack works great, and it is a terrific conversation starter about ham radio. — 73, *Todd Thuss, K4XG, k4xg@arrl.net*

## Accurate Pipe Drilling

A time may come when you'll need to drill precise, aligned holes in PVC or metal pipe; you might, for example, need them positioned at 90 degrees (quadrature). This can be a challenging exercise, but I've found a simple, low-cost method.

First, cut a 3-inch strip of paper and wrap it around the pipe. With a writing utensil, mark the paper where it overlaps, and cut it again so that its ends meet perfectly when wrapped around



**Figure 3** — Marks have been drawn along the creases in the paper strip. [John Portune, W6NBC, photo]



**Figure 4** — After using the paper creases as a guide, the pipe has been marked for 90-degree holes. [John Portune, W6NBC, photo]



**Figure 5** — Four 6-32 screws drilled into the pipe at 90 degrees (quadrature). [John Portune, W6NBC, photo]

the pipe. For simple, straight-across holes, fold the paper in half to make a crease. Mark the top edge of the crease with a felt-tipped pen (see Figure 3). Next, wrap the marked paper around the pipe again, and mark the center of the first hole at the butted ends (see Figure 4). Then, mark the opposing hole at the center of the crease on the other side.

If you require four holes at quadrature, simply fold the paper in half again and mark the new creases. For other angles, divide all 360 degrees of a single wrap of paper by the needed marks. I find the fine divisions on a metric millimeter ruler to be helpful with this.

Center punch the marks and drill small guide holes to center the drill bit during the final drilling stage (see Figure 5). After drilling the guide holes, you can use a centering guide block for pipe drilling to make perpendicular holes. Inexpensive pipe drilling blocks are available on the internet and in the tool section of most hardware stores. — 73, *John Portune, W6NBC, w6nbcmail@gmail.com*

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# The Pony Express Reenactment and Ham Radio

Amateur radio is an important part of this multi-state, commemorative relay event.

**Matthias "Matt" Zapatka,  
AJ4BB/DL6ZM/DU3ZM**

My wife and I currently live in northern Nevada. We learned that the National Pony Express Association's (NPEA) annual Re-Ride, which occurs every June, would be passing through Austin, Nevada. So, we decided to observe the 2021 event to see how the NPEA incorporates amateur radio in their reenactment.

## The Pony Express Then and Now

For a brief period in the 19th century, the fastest way to send a message across the US was via the Pony Express, a mail delivery system made up of a relay of horse riders. Each rider carried a leather *mochila*, which was a pocketed saddle cover that held letters addressed to the other side of the country. The Pony Express spanned about 1,900 miles, from St. Joseph, Missouri, to Sacramento, California, and it took an average of 10 days to send mail from one end to the other. Stations were built along the entire stretch of the route, and they gave riders a chance to swap their fatigued horses for rested ones before setting off

again. The job was risky; aside from the harsh landscape, riders faced revolver-wielding bandits, perilous weather, and countless other threats. However, the service was discontinued once telegraph lines were constructed toward the west. But the courageous Pony Express riders are still honored by hundreds of volunteer reenactors in the NPEA's yearly Re-Ride.

In 2021, the riders started in Sacramento. The starting point alternates between Sacramento and St. Joseph every year. The Re-Ride follows the original route, to an extent — the exact locations of some trail sections have been debated. Riders need not worry about robbers nowadays, though the journey still has its challenges. For this reason, volunteer ham radio support is utilized for their safety. The Lyon County Search and Rescue team coordinated radio communications during this Re-Ride.

## Readying for the Ride

My wife and I knew that we would lose cell phone service south of Battle Mountain. The area is largely deso-



late, and 30 minutes or more could pass before seeing another car on the way to Austin. Therefore, we made sure the backup HF equipment in our go-kit was functional, as we did not have a Garmin inReach or any other commercial satellite communication device. We programmed several repeaters into a Yaesu FTM-350, which had good coverage over the nearby Toiyabe Range. We also programmed the local event frequency (146.550 MHz) on 2-meter simplex so we could listen to the Re-Ride's traffic. The first signals from Austin Base, the tactical call sign for the nearest station, could be heard approximately 40 miles away from Austin. We crossed Highway 50 and parked at Railroad Pass to wait for the rider.

## Radio Integration

We figured the rider was still in the mountains because we could not hear them on the radio. The mochila contained a GPS so that spectators could track each rider's real-time location online, but this method was unreliable due to the updates lagging behind their actual positions. VHF came to the rescue when we got a much better on-air position report at 16:26 PDT (0026 UTC); they were just about to leave the Desatoya Mountains and head toward the Smith Creek Valley. They were still rather far away from our spot at Railroad Pass, where the next rider was also waiting. In the meantime, we followed the radio conversations and were impressed by their level of discipline on the air. For instance, a typical exchange went as follows:

"Austin Base, this is N0CSM, I report we're at mile marker 30 — three zero — the time is 17 hours 29 — one seven two niner — and the riders are back on the trail again."

"Roger that, you are at mile marker three zero at 1729 and the riders are on the road again."

All of the traffic was similarly structured and repeated to ensure message accuracy. When the rider reached Railroad Pass, we were surprised by the speed of the mochila transfer. The exchange was so fast that it was difficult to photograph. We used the VHF/UHF transceiver in the car to ask if we could drive ahead of the rider for better pictures. Passing any animal — especially horses — on the road requires extreme caution,



Lyon County Search and Rescue personnel on standby; they supported amateur radio communications during the 2021 Re-Ride.



The mochila transfer at Railroad Pass. From here, the new rider and horse will begin the next leg of the journey.



The hasty takeoff of the new rider and his horse. They will ride without pause until they reach the next transfer point.



so we wanted permission first. Our back-and-forth went like this:

"Kilo seven kilo sierra golf, this is AJ4BB. We are in a silver Passat behind you and the horse trailer. We request permission to pass you and take some good photos of the rider."

"AJ4BB — this is K7KSG, roger that. You can pass. Just be aware that the rider is in front of us on the trail. Please be careful, and good luck."

We then carefully passed the lead driver and got the shots. A week later, the relay safely arrived in Missouri, thanks, in part, to the support of amateur radio. The NPEA Re-Ride is a great example of ham radio's utility at events that have seemingly nothing to do with it. For more information about the NPEA, how they utilize

ham volunteers, and historical details about the Pony Express, visit their website at [www.nationalponyexpress.org](http://www.nationalponyexpress.org). Perhaps you will want to join the team of volunteers — it's certainly our priority to be more than silent observers next time.

All photos provided by the author.

Matthias "Matt" Zapatka, AJ4BB/DL6ZM/DU3ZM, was first licensed in 1998 at the age of 15, after his schoolteacher introduced him to ham radio. Matt is the chief technology officer and an application engineer for the US subsidiary of a German-based test equipment supplier. His radio interests include emergency communications, near vertical incidence skywave, propagation and antenna research, satellites, WSPR, and low-power operating. He can be reached at [aj4bb@arri.net](mailto:aj4bb@arri.net).

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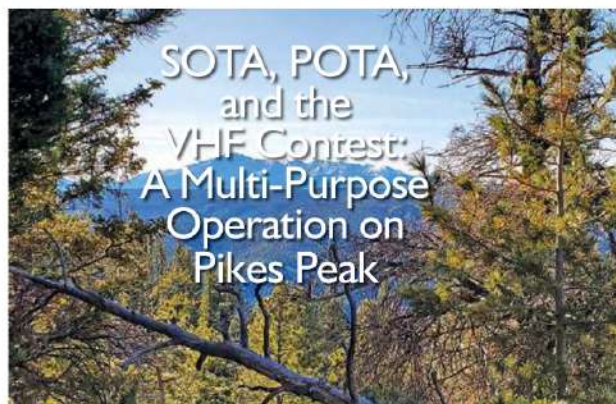
**Bob Witte,  
KØNR**

In his article, "SOTA, POTA, and the VHF Contest: A Multi-Purpose Operation on Pikes Peak," Bob explains the plan and execution of his combination operation during the 2022 ARRL June VHF Contest.

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KØNR's combination operation for the 2022 ARRL June VHF Contest included a Single-Op Portable contest effort along with activations for Summits on the Air and Parks on the Air.

### Bob Witte, KØNR

Lately, my ham radio activity centers on VHF contesting, and the Summits on the Air (SOTA) and Parks on the Air (POTA) programs. The ARRL June VHF Contest is my big event for the year, and I usually operate from a fixed location. In 2022, I decided to do something different: a portable VHF/UHF operation in combination with SOTA and POTA activations.

### Pikes Peak

Increased elevation greatly benefits VHF/UHF operating, and we have quite a few summits to choose from in our part of Colorado. I chose Pikes Peak because it is easy to access via hiking, driving, or a cog railway, and it towers above a large portion of Colorado, including all the major cities. At an elevation of 14,115 feet, Pikes has an excellent radio horizon in all directions.

Though there are no limits on operating time for the June VHF Contest, it would be difficult to do a 30-hour contest effort from Pikes Peak. The summit closes overnight to the general public, conditions are very cold at night, and most importantly, the lack of oxygen

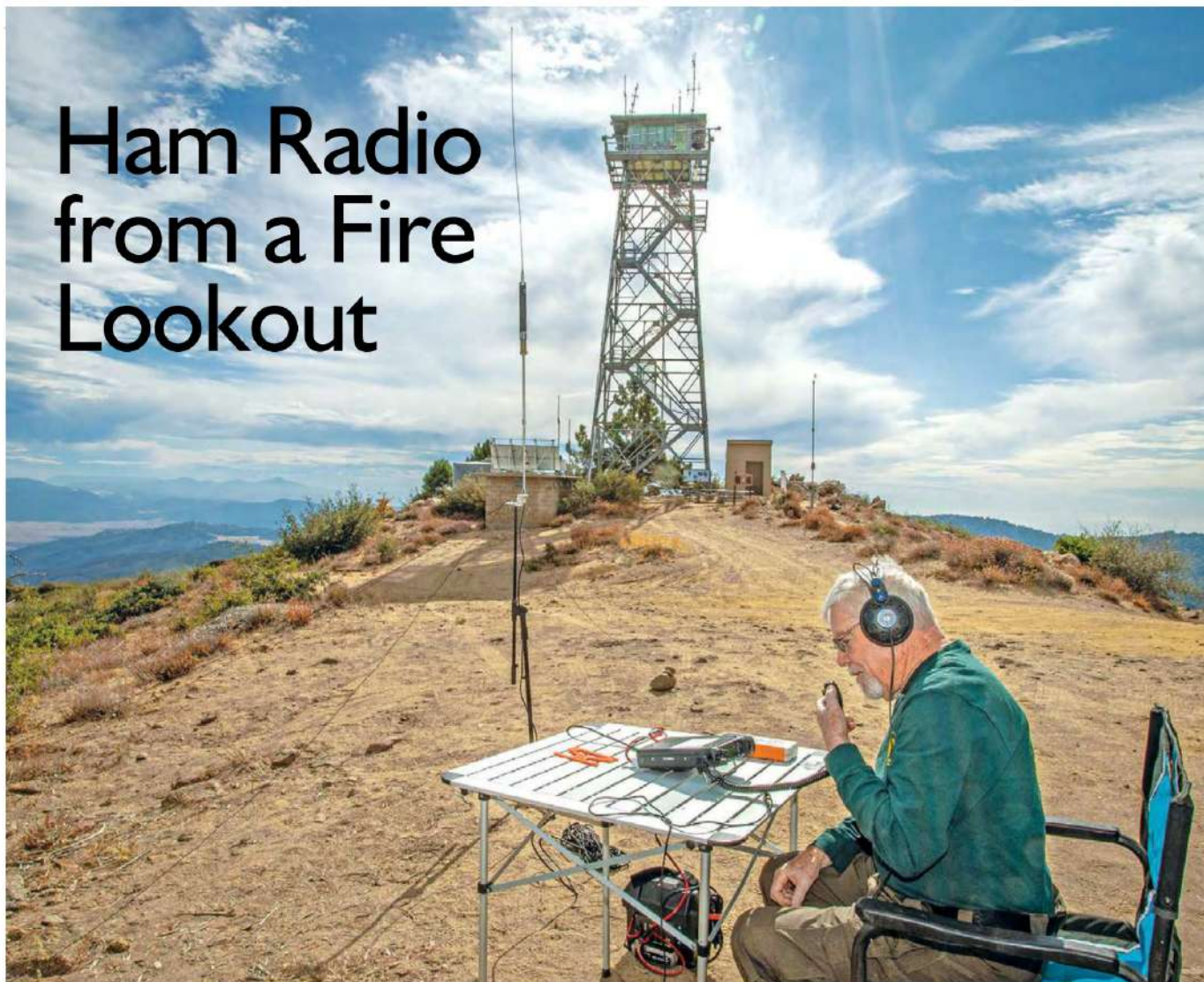


Bob, KØNR, operates on 70 centimeters FM using a handheld Yagi antenna.

Lead photo: Pikes Peak, known as "America's Mountain," towers over the eastern plains of Colorado. This photo was taken from Mt. Herman, another popular SOTA summit.



# Ham Radio from a Fire Lookout



How public service led K6KKM to make UHF/VHF and SOTA contacts from more than 5,000 feet on Palomar Mountain.

## Ernie Cowan, K6KKM

Before keying the microphone, I paused briefly to be sure of what I was going to say. "Cleveland, High Point Lookout, smoke report," I said clearly. A moment later, the forest fire dispatcher responded, and I provided an estimated distance to a faint puff of white smoke. Shortly after, fire equipment and aircraft put the fire out.

I'm a Volunteer Fire Lookout for the US Forest Service as part of the Forest Fire Lookout Association ([www.firelookout.org](http://www.firelookout.org)), which is a nationwide group of trained members who watch over America's wildlands. Cleveland National Forest spreads over vast areas of San Diego, Riverside, and Orange counties in Southern California, where wildland fires not only impact the forests but can devastate highly populated nearby communities.

While mountaintop fire lookouts across the country often command spectacular views, they also provide an opportunity for some incredible amateur radio fun, including making UHF/VHF simplex contacts, accessing distant repeaters, and experiencing prime HF operating locations. Operating from a mountaintop lookout can also allow you to make Summits on the Air (SOTA) activations, because many fire lookout sites are designated SOTA locations. SOTA ([www.sota.org.uk](http://www.sota.org.uk)) is an award scheme for hams that encourages portable operation in mountainous areas.

Above: The 6,140-foot elevation at High Point Lookout offers a great platform for HF contacts. A simple HF radio, power supply, and antenna can provide hours of operating pleasure.



## My Lookout Stations

I perform my volunteer fire duties at two lookout locations on Palomar Mountain in California: High Point and Boucher Hill. High Point Lookout is a 70-foot metal tower that sits at an elevation of 6,140 feet on the eastern edge of the mountain, just a few miles east of the world-famous Palomar Observatory. As one of the highest peaks in San Diego County, High Point Lookout offers views from the eastern barren deserts to the offshore islands of Santa Catalina and San Clemente, more than 90 miles to the west. This is a remote fire lookout that's accessible only by a dirt road. High Point is my favorite location for HF operations. It's nice having an antenna at more than 6,000 feet when I plan to go on the air chasing SSB contacts.

Five miles west of High Point is Boucher Hill Lookout, a 30-foot enclosed, wooden tower sitting at an elevation of 5,438 feet and offering a view of the urban coastal areas of Southern California, in addition to inland wildlands. This lookout is located on a paved road within Palomar Mountain State Park and draws more than 13,000 visitors annually.



▲ A portable station that fits entirely in a canvas carrying bag allows for easy transport and a quick setup. This portable kit includes a Yaesu FT-891, an Impulse Electronics Mity Go-Box with a 15 Ah battery, and a Super Antenna MP1DXR.

► Ernie Cowan, K6KKM, often makes simplex contacts while enjoying the view from the Boucher Hill Lookout in Cleveland National Forest.



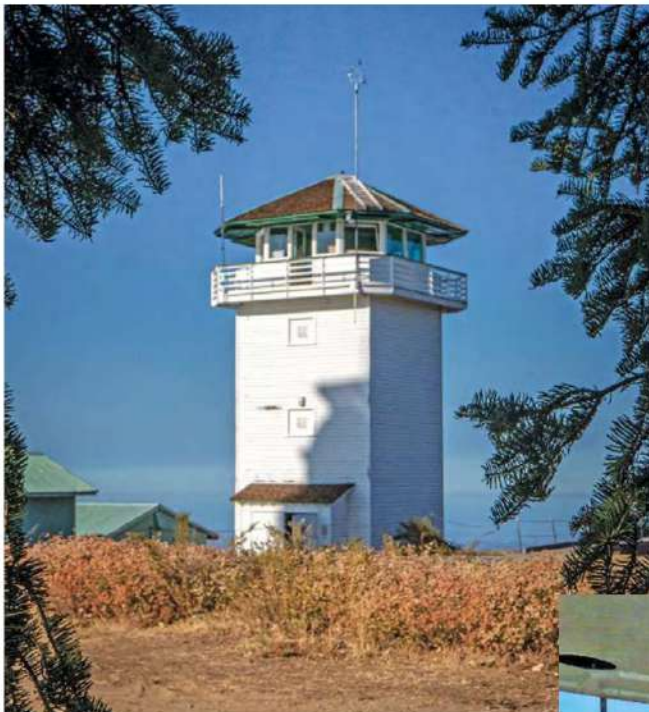
While it might sound boring to spend 8 to 10 hours in a fire tower just watching the world outside, in reality, it's quite interesting. There are visitors to chat with, wildlife to enjoy, weather readings to record, and developing storms and lightning strikes to map, and you're constantly scanning for a potential wildfire. As I like to tell my friends, being a Forest Fire Lookout often involves hours of tranquility, punctuated by moments of choreographed chaos when smoke is spotted.

## Tower Operations

In addition to providing a public service, being a Volunteer Fire Lookout can be exciting, and adding ham radio is the icing on the cake. Ham radio operations can't be mixed with lookout duties, so I don't operate during a fire watch shift. Instead, I frequently set up and get on the air before or after my daytime shifts, during a lunch break, or while I'm enjoying an overnight stay.

From the elevated locations of the towers, I can reach just about any repeater in Southern California on UHF/VHF. While operating simplex, I've talked to SOTA activators and chasers more than 100 miles away on 5 W handheld radios. Typically, my climb to the tower includes an all-band handheld transceiver in my go-bag. This allows me to monitor local





The Boucher Hill Lookout is located at an elevation of 5,438 feet on the west end of Palomar Mountain in northern San Diego County.

repeater traffic or tune in to 146.520 simplex to listen for SOTA traffic.

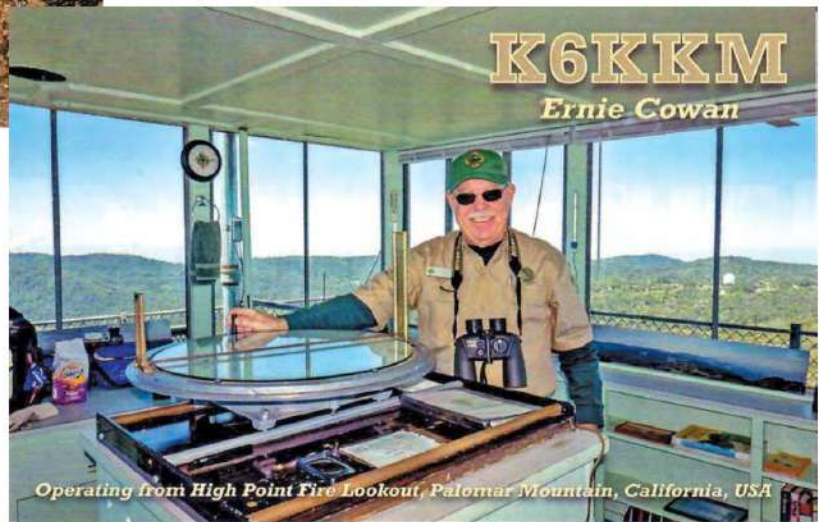
For HF operating, I've assembled a one-bag kit that includes a Yaesu FT-891 transceiver and a Super Antenna MP-1DXR that offers 40 through 10 meters, plus 6-meter coverage without an antenna tuner. SWR can be adjusted by turning a coil, but I also carry a RigExpert antenna analyzer to fine-tune SWR. Power is provided by a lightweight Impulse Electronics Mity Go-Box equipped with a 15 Ah Bioenno battery that allows me to operate for nearly 8 hours before it needs to be recharged. I also prefer using earphones while operating outdoors.

The most surprising and enjoyable thing I noticed when setting up to operate from the fire lookouts was the lack of noise. This is a refreshing change from my home location, where the daytime noise floor can sometimes be close to S-9.

Depending on the time of day and band conditions, I've had success operating on 40 and 20 meters, making solid contacts with stations throughout the US and eastern Canada. I log my contacts manually, then transfer them to *Log4OM* when I'm back in my shack, and eventually upload them to Logbook of The World ([www.arrl.org/logbook-of-the-world](http://www.arrl.org/logbook-of-the-world)). To add a little fun to the activity, I had unique fire lookout QSL cards made that I only share with hams I've contacted while operating from the towers.

### Conclusion

The elevated locations of fire lookouts and ham radio are a perfect combination. Using a simple HF radio, power supply, and antenna can get you on the air quickly and provide hours of great operating.



The unique QSL card Ernie Cowan, K6KKM, prepared to share with contacts that he made while operating from the High Point Lookout in San Diego County.

All photos by the author.

Ernie Cowan, K6KKM, is an active General-class operator who enjoys HF and digital modes. He is active as a Volunteer Fire Lookout for the US Forest Service and enjoys serving as a member of the San Diego County Sheriff's Search and Rescue team. Helping others become hams or learn about new technologies is one of Ernie's passions, but he also spends his free time outdoors, where he uses UHF/VHF modes while hiking. Ernie can be reached at [ernie@packtrain.com](mailto:ernie@packtrain.com).

For updates to this article, see the **QST** Feedback page at [www.arrl.org/feedback](http://www.arrl.org/feedback).





# Portable Operations at Chandler Park

A new antenna provided a challenge in a familiar situation.

## Andrew Shead, W5AWS

On March 4, 2022, at 1900 UTC, Mark Adams, WA5MA, and I operated portable for a few hours at Chandler Park in Tulsa, Oklahoma. Mark operated on 40 meters with a Hamstick dipole mounted on the end of an aluminum painter's pole, secured by a drive-on mast mount. Mark was on the air within about 15 minutes, while I needed more time to become familiar with my new antenna.

My objective was to use an end-fed half-wave (EFHW) antenna in a sloping configuration, with the high end supported by a 31-foot telescoping fiberglass mast, secured by a drive-on mast mount. My intention was to avoid the need for nearby supporting structures, like trees, to allow me to establish my station on any open ground. This was a new experience for me that required some preparation.

## Setup

Tracy McKim, VE3TWM, convinced me that Jackite masts are worth trying, based on his experiences with them on his YouTube channel, *Outdoors On The Air* ([www.youtube.com/@OutdoorsOnTheAir](https://www.youtube.com/@OutdoorsOnTheAir)). Jackite sells a reasonably priced 31-foot mast that is like the one sold by MFJ Enterprises. I improved the mast guying by using  $\frac{3}{16}$  inch Rope Ratchets between the tent pegs, and the mason line loops threaded around the 2-inch Schedule 40 PVC mounting pipe cut to 3 feet. Before going to Chandler Park, I did a test installation at home, as shown in Figures 1 and 2.

## Guying Loops

I wrapped a mason line around the circumference of the pipe, cut it to length, then measured it. I divided the result by eight to find the circumference distance between the equidistant holes. After setting the inter-hole distance on a pair of digital calipers, I stretched and Scotch-taped the line to a table and marked the position of each hole on the line with a black felt-tip pen. I used Scotch tape to temporarily attach the marking line about  $1\frac{1}{2}$  inches below the end of the



Figure 1 — Mounting the mast.



Figure 2 — Guying the mast.





**Figure 3** — Mason line threaded through the holes with the joining half-hitch knot inside the PVC pipe.



**Figure 4** — Antenna deployment at Chandler Park. The ground radial can be seen trailing off to the left.

PVC pipe. Finally, I drilled the holes using a twist drill slightly bigger than the mason line and discarded the marking line. I threaded a fresh mason line through the holes so the joining half-hitch knot is inside the PVC pipe, as shown in Figure 3. The diameter of the PVC pipe was not wide enough to clear the butt-end cap of the mast. The combined tension of the guyed lines caused the pipe to bear down on the end cap, which pressed the butt of the mast against the ground and prevented it from kicking out due to the turning of the mast swaying in the wind.

### Sloping the EFHW Antenna

By sloping the EFHW antenna, the combined weight strain on the mast of the antenna and feed line is

minimal, and it makes it easy to use. At the low end, I installed a camera tripod to hold the matching unit about 5 feet off the ground and ran a ground radial under the antenna wire, as shown in Figure 4. The MFJ-1984LP covers the 40-, 30-, 20-, 15-, and 10-meter bands. It is rated for a maximum power of 30 W.

When Mark and I began our Parks on the Air (POTA) activations, I got three easy contacts on 20 meters within the first few minutes of operating. The maximum power output of the Yaesu FT-818ND is close to 6 W. I doubt all of the power was going out of the antenna, but even so, activators reported receiving me at 59. I mostly received them at 58, though I did get some transmissions at 59.

### Conclusion

Overall, I was satisfied with my results. Assembly and disassembly of the station are easy and can be done anywhere. The weather was very windy, which proved to be a good test of the antenna mast, as everything held fast.

### See QST in Depth for More!

Visit [www.arrrl.org/qst-in-depth](http://www.arrrl.org/qst-in-depth) for the following supplementary materials and updates:

- ✓ Links to purchase the equipment mentioned

All photos by the author.

Andrew Shead, W5AWS, was first licensed in 1981, shortly after leaving Royal Air Force employment, where he first maintained airborne communications equipment and flight simulators. In 2018, Shead retired as project engineer for the company program that manufactured flight training devices used by the Air Force and Navy for their Joint Primary Aircraft Training System. He got on the air for the first time once he passed the Amateur Extra-class exam in 2020 as KI5HYC. His current but very occasional operations are QRP and are entirely portable. In addition to ARRL, Shead is a member of QRP Amateur Radio Club International and the Tulsa Amateur Radio Club.

For updates to this article, see the QST Feedback page at [www.arrrl.org/feedback](http://www.arrrl.org/feedback).





# 2023 Simulated Emergency Test

Emergency preparedness takes the spotlight on October 7 – 8.

## Steve Ewald, WV1X

The ARRL Simulated Emergency Test (SET) is on the horizon, and you'll want to be ready at the individual operator and station levels and within your amateur radio community and ARRL Section. This year's national emergency exercise will occur on October 7 – 8. It will test your skills and the preparedness of many organizations that are called into action when actual emergency situations arise, and it presents an opportunity to develop new skills.

ARRL Field Organization leaders, such as Section Managers, Section Emergency Coordinators, Section Traffic Managers, District Emergency Coordinators, Emergency Coordinators, Net Managers, and their assistants are among the many amateur radio operators who are developing plans and scenarios for this year's SET.

## Working Together

This annual nationwide exercise is a prominent time to work with partner organizations and served agencies to learn what their needs may be before an emergency occurs. An important goal of the SET is getting to know how to work with these organizations at the local, Section, and state levels for effective emergency and public services.

For decades, ARRL has established national working relationships with organizations and agencies like the Federal Emergency Management Agency (FEMA), the American Red Cross, The Salvation Army, the National Weather Service, the National Communications System, the Association of Public-Safety Communications Officials-International (APCO-International), Citizen Corps, National Voluntary Organizations Active in Disaster (NVOAD), REACT International, Inc., the Society of Broadcast Engineers (SBE), and the Boy Scouts of America. More details on these organizations and how they work with ARRL and amateur radio operators can be found at [www.arrl.org/served-agencies-and-partners](http://www.arrl.org/served-agencies-and-partners).

The SET invites all amateur radio operators to become better aware of emergency preparedness and the training that is available. The Amateur Radio Emergency Service® (ARES®), the Radio Amateur Civil Emergency Service (RACES), the National Traffic System, SKY-WARN®, the Community Emergency Response Team



Paul Harig, KC3QIU, operated from the New Cumberland Township Office during the South Mountain Radio Amateurs SET in the Eastern Pennsylvania Section. [Paul Harig, KC3QIU, photo]

(CERT), The Salvation Army Team Emergency Radio Network (SATERN), other auxiliary communications groups, and public service-oriented radio amateurs are encouraged to participate.

## Get Involved

To find out how to get involved in this year's SET, contact your local ARRL Emergency Coordinator or Net Manager. Check on upcoming planned activities through local, state, or Section-wide nets. Contact your local club or clubs in other areas to find out who the Emergency Coordinator is, where the nearest ARES group meets, and which area it serves. In addition, refer to the ARRL Section web pages at [www.arrl.org/groups/sections](http://www.arrl.org/groups/sections).

ARRL Field Organization leaders may conduct their local or Section-wide SET at a time other than the weekend of October 7 – 8 to avoid schedule conflicts and allow maximum participation. Exercises should be held no later than the end of the fall season or the calendar year.

Additional background information regarding the annual SET can be found in the article, "Simulated Emergency Test 2022 Results," in the July 2023 issue of *QST*. Guidelines and specific SET reporting forms for ARRL Section and Field Organization leaders and reporting participants can be found at [www.arrl.org/public-service-field-services-forms](http://www.arrl.org/public-service-field-services-forms). If you are an Emergency Coordinator, Net Manager, or Section leader in charge of reporting this year's SET activity on behalf of your group, please fill out the online reporting forms.



## Happenings



# IARU Administrative Council Met in Germany

The 58th meeting of the International Amateur Radio Union (IARU) Administrative Council (AC) was held in person in Friedrichshafen, Germany, on June 25 and 26, 2023.

In matters related to the World Radio-communication Conference 2023 (WRC-23), the AC received reports on the Conference Preparatory Meeting, the International Telecommunication Union Radiocommunication Sector (ITU-R) Working Party 5A, and the latest updates regarding agenda items 1.2, 1.12, and the current status of agenda item 9.1b, which is about the Radionavigation Satellite Service (RNSS) and the 23-centimeter band.

On the subject of strategic planning, preliminary results from the work of the Relationship Working Group, Legal Working Group, and Finance Working Group were approved. Their work will continue to address a planned restructuring of the IARU. An initial report will be presented at the Region 1 Conference in Zlatibor, Serbia, in November.

The AC received a report on the completion of the IARU officer consultative process regarding nominating candidates for the offices of President and

Vice President for the 2024 – 2029 term. The nominees will be formally submitted to member-societies for ratification later this year.

Reports were received from IARU Beacon Project International Coordinator Peter Jennings, AB6WM/VE3SUN; Electromagnetic Compatibility Coordinator Martin Sach, G8KDF; Satellite Advisor Hans Blondeel Timmerman, PB2T, and Emergency Communications Special Advisor Rod Stafford, W6ROD.

The AC appointed ARRL *ARES Letter* Editor Rick Palm, K1CE, as the IARU Special Advisor on Emergency Communications to assume the responsibilities of Rod Stafford in representing the IARU in the ITU Telecommunication Development Sector.

Gaspar Miró, EA6AMM, presented a report on the IARU Monitoring System and submitted a proposed revision to the current terms of reference (TOR). The AC will continue to review the proposal to consider a resolution to update the TOR.

A report was received on the successful 2023 World Amateur Radio Day

that supported the United Nations initiative to promote Human Security for All.

Preliminary thoughts on how to celebrate the 100th anniversary of the IARU, founded in Paris in 1925, were exchanged.

Nominations for the IARU Michael J. Owen, VK3KI, Memorial Award and the IARU Diamond Award were received.

The members who attended the meeting were IARU President Tim Ellam, VE6SH/G4HUA; IARU Vice President Ole Garpestad, LA2RR; IARU Secretary and former ARRL President Joel Harrison, W5ZN; IARU Region 1 President Sylvain Azarian, F4GKR; IARU Region 2 President George Gorsline, VE3YV, and IARU Region 2 Secretary Rod Stafford, W6ROD. IARU Region 3 Co-Chairmen Ken Yamamoto, JA1CJP, and Yudi Hasbi, YD1PRY, also attended the meeting, along with IARU Assistant Secretary and former ARRL CEO David Sumner, K1ZZ. IARU Region 1 Secretary Mats Espling, SM6EAN, was unable to attend.

## HAM RADIO Drew International Crowds



The 46th annual International Amateur Radio Exhibition, HAM RADIO, attracted more than 11,000 visitors to Friedrichshafen, Germany, on June 23 – 25, 2023.

ARRL, which has nearly 7,000 international members, sends a small delegation to the convention each year to greet members and friends from the global amateur radio community, and to network with other national radio societies. ARRL representatives for this year included President Rick Roderick, K5UR, and his wife, Holly Roderick; CEO David Minster, NA2AA; Director of Operations Bob Naumann, W5OV, and Director of Marketing and Innovation Bob Inderbitzen, NQ1R.





Every year, HAM RADIO draws attendees from around the world. In this photo, ARRL Life Member and Diamond Club donor John Gagen, W2YR, is flanked by ARRL President Rick Roderick, K5UR (left), and CEO David Minster, NA2AA (right). [Bob Inderbitzen, NQ1R, photo]



HAM RADIO attendees queue up at the ARRL booth to have their QSL cards checked for DXCC and other ARRL awards. [Bob Inderbitzen, NQ1R, photo]

Managing Director Klaus Wellmann and Project Manager Petra Rathgeber were delighted with the success of the event. "HAM RADIO lived up to its reputation as Europe's largest amateur radio exhibition. In cooperation with the German Amateur Radio Club (DARC), the perfect partner for the event, we showed that amateur radio plays an important role in society," said Wellmann and Rathgeber in a joint statement. "This year's slogan, 'We're all about STEM!' was brought to full fruition, with many activities focusing on work with young people

— something that really brought in the crowds."

A press release from HAM RADIO reported that young attendees were able to tinker with and make equipment under guidance, and they were also able to test their knowledge in the Ham Rally, a technical scavenger hunt that featured 25 stations. Students were encouraged to try sending Morse code and passing the QSL card quiz. ARRL participated in the Ham Rally by challenging young people to identify the US states.

"We were really happy with the way this year's exhibition went," said DARC Chairman Christian Entsfellner, DL3MBG. A total of 392 participants, including 149 commercial exhibitors and international associations, as well as 243 flea market exhibitors, represented the unique diversity of amateur radio around the world. Plans are already being made for next year's HAM RADIO to be held on June 28 – 30, 2024. More information about HAM RADIO is available at [www.hamradio-friedrichshafen.com](http://www.hamradio-friedrichshafen.com).

## Women of Influence in Engineering 2023 Ham Honoree Michelle Thompson, W5NYV

Co-founder and CEO of the Open Research Institute (ORI) Michelle Thompson, W5NYV, has been selected as a 2023 honoree for the "Women of Influence in Engineering" section published by the *San Diego Business Journal*. The publication celebrates female trailblazers and highlights the honorees' careers and accomplishments.

Thompson has been an amateur radio operator for more than 25 years. She was drawn to the hobby by her father and grandfather, who were amateur radio operators.

"We were a family of tinkerers, and my dad and granddad were always fixing and building things, including amateur radios," said Thompson. "Because of their influence, I was drawn to the vocation of helping people navigate difficult rules and regulations that impede their learning and success."

In 2020, Thompson co-founded ORI, a nonprofit research and development organization that provides all of its work to the general public under the principles of open source and open access to research. She is responsible for amateur satellite service

regulatory reform and is a member of the FCC's Technological Advisory Council.

Thompson is also Chair of the Institute of Electrical and Electronics Engineers (IEEE) San Diego Section. She founded the IEEE Information Theory Society, as well as the local Open Source Digital Radio Group.

Thompson serves as a Technical Specialist for the ARRL San Diego Section, and she is an ARRL Life Member.



## ARRL Section Managers Prepare for New Terms

When the nomination period for the summer ARRL Section Manager election cycle concluded on June 9, 2023, there was only one candidate for each of the ARRL Sections up for election.

The following incumbent Section Managers were declared re-elected to new 2-year terms starting on October 1, 2023:

- Amanda Alden, K1DDN (Colorado)
- Jo Whitney, KA7LJQ (Eastern Washington)
- Diana Feinberg, AI6DF (Los Angeles)
- Carol Milazzo, KP4MD (Sacramento Valley)
- Dan Ringer, K8WV (West Virginia)
- Stuart Wolfe, KF5NIX (South Texas)
- Monte Simpson, W7FF (Western Washington)

Kevin Kerr, W1KGG, of Plains, Montana, was the only nominee for the ARRL Montana Section, and he will be taking the reins of the Montana Field Organization on October 1. Kerr is presently serving as Section Emergency Coordinator of the Montana Section and as a District Emergency Coordinator within the Section. Paul Stiles, KF7SOJ, decided not to run for a new term. Stiles, of Billings, Montana, has been Section Manager of the Montana Section since 2019.

Dr. Antonis Papatsaras, AA6PP, of Larkspur, California, will become the Section Manager of the San Francisco Section on October 1, as he was the only nominee. He currently is an Assistant Section Manager of the ARRL

San Francisco Section and has been President and Director of the San Francisco Radio Club.

Bill Hillendahl, KH6GJV, of Santa Rosa, California, decided not to run for another office term after serving as Section Manager of the San Francisco Section for 20 years.

Section Manager of the Oregon Section David Kidd, KA7OZO, has decided to step down from the role for personal reasons. He was first appointed to the position on July 1, 2018. Effective July 1, 2023, Jonathan Wanzer, KK6GXG, is filling the role for the remainder of the current term.

Wanzer stated:

Homebrew radios, tools, and antennas are not my only interests in the Amateur Radio Service. I like to share with others; I teach license classes and Introduction to Emergency Communications (EC-001). I am an active Volunteer Examiner... I also have the honor of serving fellow hams as the Klamath County Emergency Coordinator and as the Assistant Section Manager for [the ARRL Oregon Section]. [Some] of my greatest privileges [are] in developing contacts and relationships with non-ham groups and providing presentations and information on amateur radio and all it has to offer their members, and the community at large, through the Civil Defense Communications Auxiliary.

Wanzer, of Klamath Falls, will serve as Section Manager of the Oregon Section through June 30, 2024.

## Dual Contests Made for Busy HF Weekend

The World Radiosport Team Championship (WRTC) 2022 coincided with the International Amateur Radio Union (IARU) HF World Championship. Judging for WRTC 2022, held July 8 – 9, 2023, is complete. The event was postponed in 2022 for 1 year. The winners have been posted on the WRTC 2022 website at [www.wrtc2022.it](http://www.wrtc2022.it).

The WRTC judges analyzed each log to verify the contacts made during the competition and cross-referenced them to the official records to ensure accuracy. When the log-checking process was complete, the judges posted the winners. All of the logs, the

final score list, and a YouTube video of the closing ceremony are also available on their website. On July 11, 2023, it was announced that the next WRTC will be hosted in the UK in 2026.

Early numbers for the IARU HF World Championship showed enthusiastic participation for this year's contest. More than 5,000 logs were submitted as of press time. Stations had 7 days after the event to submit their logs.

Volunteer operators from ARRL Headquarters staff participated in the event as the IARU Headquarters station, NU1AW. They logged more than



1,000 contacts from the W1AW Hiram Percy Maxim Memorial Station during the event. W1AW/KH6 served as the ARRL Headquarters station, and it was operated on single sideband by Alexander Benton, KH6YY, in Oahu, Hawaii, and on CW by Lloyd Cabral, KH6LC, in Keaau, Hawaii.



## Public Service

# Emergency Preparations Begin for the 2024 Total Solar Eclipse

On August 21, 2017, 14 states experienced a total solar eclipse. The event attracted untold numbers of people to states in the path of totality, affecting regular traffic operations and putting additional pressures on emergency management, health-care, law enforcement, transportation, and other sectors.

The total eclipse was visible from within a narrow corridor that traversed the country from the North Pacific through parts of Oregon, Idaho, Montana, Wyoming, Nebraska, Kansas, Iowa, Missouri, Illinois, Kentucky, Tennessee, North Carolina, Georgia, and South Carolina. The Federal Emergency Management Agency (FEMA) offered safety advisories, and the administration's Regional Response Coordination Centers were activated to assist state and local emergency management agencies with maintaining situational awareness throughout the event. FEMA Mobile Emergency Response Support teams were strategically located for emergency telecommunications support.

The next total solar eclipse will occur on April 8, 2024 — a mere 7 months from now — and will cross North America, passing over Mexico, the US, and Canada. Much of the eclipse's path of totality will lie in rural areas, where sometimes there is minimal infrastructure and support. Challenges for emergency management and communications during the event will likely include heavy-to-gridlocked traffic conditions; travelers stopped on roadways with temperature, water, food, and bathroom challenges; distracted driving; limited cell

### Consider Solar Eclipse Effects on Radio Wave Propagation and Response Communications

The first science results and observations from the 2017 Solar Eclipse QSO Party were published in "Modeling Amateur Radio Soundings of the Ionospheric Response to the 2017 Great American Eclipse," by Nathaniel Frissell, W2NAF, et al., in *Geophysical Research Letters*, Volume 45, Issue 10. Frissell is a research professor at the New Jersey Institute of Technology. The QSO party was sponsored by HamSCI, the Amateur Radio Science Citizen Investigation.

"From a ham radio perspective, this paper very clearly shows the effect of the eclipse on not just a few, but a very large number of contacts," Frissell said. "You can see from the charts that activity drops off steeply on 20 meters during eclipse totality, while 80 and 160 meters open up. On 40 meters, you can see how the contact distance increases in step with the eclipse."

On 14 MHz (20 meters), eclipse effects were observed as a drop-off in communications for an hour before and an hour after eclipse maximum. On 7 MHz (40 meters), typical path lengths extended from about 500 kilometers (310 miles) to 1,000 kilometers (620 miles) for 45 minutes before and after eclipse maximum. On 1.8 MHz (160 meters) and 3.5 MHz (80 meters), eclipse effects were observed as band openings 20 to 45 minutes around eclipse maximum.

These observations suggest an eclipse-induced weakening of the ionosphere and are consistent with numerous prior HF radio eclipse ionospheric studies. Additional HamSCI eclipse data is available online at [www.hamsci.org](http://www.hamsci.org).

phone service due to heightened network use; potentially limited gasoline availability; medical emergencies, and others. The sidebar "Consider Solar Eclipse Effects on Radio Wave Propagation and Response Communications" provides research about how the total solar eclipse can create additional challenges for emergency communications.

### ARES, RACES, Clubs, and AUXCOMM Should Prepare Now

It's anticipated that by the time of the eclipse, agencies will have been recruiting amateur radio operators and groups — many from the Amateur Radio Emergency Service®

(ARES®) and AUXCOMM — to support their response efforts. ARES consists of licensed amateurs who have voluntarily registered their qualifications and equipment with their local ARES leadership for communications duty for public safety when disaster strikes. The federal government's AUXCOMM and the Auxiliary Communicator (AUXC) position have evolved over recent years to a higher level of qualification, responsibility, and functioning. Last May, 16 amateur radio operators who had previously completed the AUXCOMM course and wanted to complete their *Auxiliary Communicator (AUXC) Position Task Book* attended Florida's second annual communications



training mobilization. Staff from the State of Florida Telecommunications Unit also attended.

Some states now require volunteer radio communicators from ARES, the Radio Amateur Civil Emergency Service (RACES), and other groups who want to be deployed by the state for disaster communications services to complete the Cybersecurity and Infrastructure Security Agency AUXCOMM training course and *AUXC Position Task Book*. So far, Florida has offered one AUXCOMM course in 2023, two in 2022 and 2021, and more are expected. AUXCOMM training equips volunteers with radio operation and data network management skills, and gives them the chance to practice these skills while getting to know the state-level professional response personnel they may be deployed with in an incident or exercise.

In Colorado this past April, the Southwest Incident Management Team's Simulated Wildland Fire Exercise had the City of Delta Emergency Manager formally requesting support from the Colorado AUXCOMM Unit. Each Colorado AUXCOMM member received an Incident Command System (ICS) Resource Order Form (ICS 260) with instructions for mobilization and reporting.

In the same month, members of several New York ARES teams participated in a New York State Communications Unit exercise at the State Preparedness Training Center in Oriskany, New York. The exercise included more than 60 people from 26 agencies around the state. This was the first time AUXCOMM members had participated, showing their value for service in an ICS-structured communications unit.

## Room for All to Serve

All groups can serve during the 2024 solar eclipse. ARES registrants will report to their Emergency Coordinators (ECs) for service under memorandums of understanding (MOUs) signed by their local Emergency Operations Centers. RACES members will serve their local emergency management (formerly, civil defense) officials under their agreements. Local amateur radio clubs will also be involved with various emergency support functions.

FEMA officially recognizes the AUXC position as part of the National Incident Management System and the new ICS Information and Communications Technology Branch, and has signed a new MOU with ARRL. Former FEMA Administrator Craig Fugate, KK4INZ, said, "The agreement emphasizes the importance of skilled amateur radio operators in times of crisis." ARRL has also been elected to serve on SAFE-COM, a group of emergency communications national thought leaders.

Now is the time to prepare for a potentially massive skilled and credentialed amateur radio emergency communications effort in support of multiple federal, state, county, and local government response entities for a cross-country event of conceivably epic proportions. That means getting involved with your ARES and RACES leadership and developing group direction toward AUXCOMM certification and AUXC positions. Contact your ARRL Section Manager, Section Emergency Coordinator, and/or local EC to see how you can help with what will surely be an event of the century.

## Field Organization Reports

June 2023

### 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](http://www.arrl.org/public-service-honor-roll).

485 AD8CM WA3EZ	191 W9EEU	WK4WC KBMDA N2JBA KW1U WZ0C N1LZ K0RCJ K2VTT	101 KB3YRU K1STM	KL7RF WX2DX KC1KVY AB9ZA
445 KK6GXX	180 N8SY	174 K3EAM	100 KG5AOP KZ8Q WB4RJW NX9K W1KX KB3MXK AC8RV WB8SIQ K3YAK KA2HZP K3FAZ N1LAH K8ED AK2Z KB2YAA	89 WB8RGE K4DH 88 W2ARP N3GE 87 K14PRX KB1TCE 86 KT5EM WB2VUF
430 W4DNA	165 N1ZW	128 KC8T	125 W2PAX	
405 N9VC	162 K1XFC	121 KF0BPN		
375 WM5N	158 WM2C	120 W4CMH KR4PI WC4FSU KO4OL KY2D WA1URS K3JL KE4RS K2MTG W2AH NA7G N7IE W7VQ KA9QWC	99 W9GRG	85 WB4ZDU W7PHX WB3FTQ
368 W7PAT	157 WA4VGZ KE8DON	119 KB8RCR	98 KT4WX W2OOD WW3S KC1HHO	84 N7UWX
366 KE4ANW	155 N4CNX	118 W8IM	97 K5OB	80 KR4ST N0ET KB8GUN KC1SLQ
345 W0PZD	153 KD8UUB	115 W5WMC WA0QLW	96 WY7AA K1HEJ	78 KD2TDG W9BGJ
322 KE8BYC	151 K4NWX	114 WV5Q	95 W4NHO	76 KB4OLY W7MIN ND3L
320 WB8YYS	150 KB5PGY	112 KC3MAL	94 KA2GQQ KB1NMO	75 K4FHR KD2YYK
298 KC8YVF	147 N3KRX	110 KB2QO N1IQI W1RVY KD2PQP KT2O WA2U W2ZYN K1UAF W1INC WS4P	92 N2TSO	74 W3ZR KD2QAR K8RDN
276 KO4KUS	146 KB0DTI	105 WD8USA	91 W4TTO	73 K6RAU KN4AAG
265 N5MKY	145 KC9FXE	104 W4EDN W4KX WB8SR K8KRA N8MRS KB8HJJ KA1G	90 KM4WHO KB9GO KC9UC KF7GC AA7BM KT5SR WA3QPX AA3N W4EDN W4KX WB8SR K8KRA N8MRS KB8HJJ KA1G	72 KB9IME KC1OIP KA0DBK
240 KT2D	142 N2DW	103 W4EDN W4KX WB8SR K8KRA N8MRS KB8HJJ KA1G	90 KM4WHO KB9GO KC9UC KF7GC AA7BM KT5SR WA3QPX AA3N W4EDN W4KX WB8SR K8KRA N8MRS KB8HJJ KA1G	71 K2EAG W5XX
236 AC8NP	140 KC8WH	102 W4EDN W4KX WB8SR K8KRA N8MRS KB8HJJ KA1G	90 KM4WHO KB9GO KC9UC KF7GC AA7BM KT5SR WA3QPX AA3N W4EDN W4KX WB8SR K8KRA N8MRS KB8HJJ KA1G	70 K2EAG W5XX
235 W7EES	139 KV8Z	101 W4EDN W4KX WB8SR K8KRA N8MRS KB8HJJ KA1G	90 KM4WHO KB9GO KC9UC KF7GC AA7BM KT5SR WA3QPX AA3N W4EDN W4KX WB8SR K8KRA N8MRS KB8HJJ KA1G	69 K2EAG W5XX
230 ND8W	135 W3YVQ	100 W4EDN W4KX WB8SR K8KRA N8MRS KB8HJJ KA1G	90 KM4WHO KB9GO KC9UC KF7GC AA7BM KT5SR WA3QPX AA3N W4EDN W4KX WB8SR K8KRA N8MRS KB8HJJ KA1G	68 K2EAG W5XX
225 W02H	130 AG9G K9LJU WB9WKO K7OED AC0KQ KD0HHN K4IWW	99 W4EDN W4KX WB8SR K8KRA N8MRS KB8HJJ KA1G	90 KM4WHO KB9GO KC9UC KF7GC AA7BM KT5SR WA3QPX AA3N W4EDN W4KX WB8SR K8KRA N8MRS KB8HJJ KA1G	67 K2EAG W5XX
220 KB8PGW	126 KD2LPM	98 W4EDN W4KX WB8SR K8KRA N8MRS KB8HJJ KA1G	90 KM4WHO KB9GO KC9UC KF7GC AA7BM KT5SR WA3QPX AA3N W4EDN W4KX WB8SR K8KRA N8MRS KB8HJJ KA1G	66 K2EAG W5XX
216 KD2LPM	125 N2LC	97 W4EDN W4KX WB8SR K8KRA N8MRS KB8HJJ KA1G	90 KM4WHO KB9GO KC9UC KF7GC AA7BM KT5SR WA3QPX AA3N W4EDN W4KX WB8SR K8KRA N8MRS KB8HJJ KA1G	65 K2EAG W5XX
205 N2LC	124 N3KRX	96 W4EDN W4KX WB8SR K8KRA N8MRS KB8HJJ KA1G	90 KM4WHO KB9GO KC9UC KF7GC AA7BM KT5SR WA3QPX AA3N W4EDN W4KX WB8SR K8KRA N8MRS KB8HJJ KA1G	64 K2EAG W5XX
200 NW3X	123 N3KRX	95 W4EDN W4KX WB8SR K8KRA N8MRS KB8HJJ KA1G	90 KM4WHO KB9GO KC9UC KF7GC AA7BM KT5SR WA3QPX AA3N W4EDN W4KX WB8SR K8KRA N8MRS KB8HJJ KA1G	63 K2EAG W5XX

The following stations qualified for PSRR in previous months, but were not acknowledged in this column yet: (May) N1LZ 150, KW1U, N1UMJ, W7VQ 130, WV5Q 128, NA7G, N7IE WA4VGZ 120, N1IQI, WZ0C, W1RVY 110, N1LAH 100, KC1KVY 90, W5XX 77, WA1LPM 74. (Apr.) KB9PGY 274, W1RVY 170, KW1U, N1UMJ, N1LZ 130, N1IQI, WZ0C 110, KC1OIP 105, N1LAH 100, KC1HHO 98, N7UWX 90.

### Section Traffic Manager Reports

AR, AZ, CO, CT, EMA, ENY, EPA, GA, IN, KS, KY, LA, MDC, ME, MI, MO, MS, NC, ND, NE, NF, NH, NJ, NY, NV, OH, OR, SC, SJV, SNJ, STX, TN, UT, WCF, WI, WMA, WNY, WPA, WWA, WY.

### Section Emergency Coordinator Reports

The following Section Emergency Coordinators reported: AR, ENY, EPA, GA, ID, MDC, MI, MO, ND, NJ, NNY, NV, PAC, SCV, SDG, SNJ, STX, TN, VA, VI, WMA, WPA.

### 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. Call signs of qualifiers and their monthly BPL total points follow.

NX9K 1,858, KY2D 1,127, W2AH 1,087, WB9WKO 862, AG9G 584, KW1U 562, WA3QLW 531, N9CK 527.

The following stations qualified for BPL in these previous months, but were not acknowledged in this column yet: (May) KY2D 1,086. (Apr.) KW1U 580.



# Contest Corral

# September 2023

Check for updates and a downloadable PDF version online at [www.arrl.org/contest-calendar](http://www.arrl.org/contest-calendar).

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

Start - Finish		Date-Time	Date-Time	Bands	Contest Name	Mode	Exchange	Sponsor's Website
Date-Time	Date-Time							
2	0000	3	2359	1.8-28	All Asian DX Contest, Phone	Ph	RS, 2-digit age	<a href="http://www.jarl.org">www.jarl.org</a>
2	0600	2	0800	7,14	Wake-Up! QRP Sprint	CW	RST, serial, suffix of previous QSO	<a href="http://qrp.ru">qrp.ru</a>
2	0800	3	1000	1.8-28	SARL Field Day Contest	CW Ph Dig	RS(T), # of rigs, category, province or "DX"	<a href="http://www.sarl.org.za">www.sarl.org.za</a>
2	1300	3	0400	All, except WARC	Colorado QSO Party	CW Ph Dig	Name, CO county or SPC	<a href="http://ppraa.org">ppraa.org</a>
2	1300	3	1259	1.8-28	IARU Region 1 Field Day, SSB	Ph	RST, serial	<a href="http://www.darc.de">www.darc.de</a>
2	1300	3	1300	3.5-28	RSGB SSB Field Day	Ph	RS, serial	<a href="http://www.rsgbcc.org">www.rsgbcc.org</a>
2	1400	3	1400	145	IARU Region 1 145 MHz Contest	CW Ph Dig	RS(T), serial, 6-char grid	<a href="http://www.iaru-r1.org">www.iaru-r1.org</a>
2	1600	2	1900	3.5	AGCW Straight Key Party	CW	RST, serial, class, name, age	<a href="http://www.agcw.de">www.agcw.de</a>
2	2000	3	2000	3.5	PODXS 070 Club Jay Hudak Memorial 80m Sprint	Dig	RST, SPC	<a href="http://www.podxs070.com">www.podxs070.com</a>
2	2000	2	2359	1.8-28	CWops CW Open	CW	Serial, name	<a href="http://cwops.org">cwops.org</a>
3	1000	3	1400	144	WAB 144 MHz QRO Phone	Ph	RS, serial, WAB square or country	<a href="http://wab.intermip.net">wab.intermip.net</a>
3	1800	4	0300	All, except WARC	Tennessee QSO Party	CW Ph Dig	RS(T), TN county or SPC	<a href="http://tnqp.org/rules">tnqp.org/rules</a>
4	1900	4	2030	3.5	RSGB 80m Autumn Series, SSB	Ph	RS, serial	<a href="http://www.rsgbcc.org">www.rsgbcc.org</a>
4	2300	5	0300	1.8-28,50	MI QRP Labor Day CW Sprint	CW	RST, SPC, mbr or pwr	<a href="http://www.miqr.net/contest">www.miqr.net/contest</a>
5	0100	5	0300	3.5-28	ARS Spartan Sprint	CW	RST, SPC, pwr	<a href="http://arsqrp.blogspot.com">arsqrp.blogspot.com</a>
7	1700	7	2100	28	NRAU 10m Activity Contest	CW Ph Dig	RS(T), 6-char grid	<a href="http://nrau.net">nrau.net</a>
9	0000	9	2359	1.8-28,VHF	FOC QSO Party	CW	RST, name, mbr or none	<a href="http://g4foc.org/qsoparty">g4foc.org/qsoparty</a>
9	0000	10	2359	2.3 GHz and up	ARRL EME Contest	CW Ph Dig	Signal report	<a href="http://www.arrl.org/eme-contest">www.arrl.org/eme-contest</a>
9	0000	10	2359	3.5-28	WAE DX Contest, SSB	Ph	RS, serial	<a href="http://www.darc.de">www.darc.de</a>
9	1400	9	2200	3.5-28	Ohio State Parks on the Air	Ph	OH park abbreviation or SPC	<a href="http://ospota.org">ospota.org</a>
9	1500	10	0300	3.5-28	Alabama QSO Party	CW Ph	RS(T), AL county or SPC	<a href="http://alabamacontestgroup.org/aqp">alabamacontestgroup.org/aqp</a>
9	1800	11	0300	50 and up	ARRL September VHF Contest	CW Ph Dig	4-char grid	<a href="http://www.arrl.org/september-vhf">www.arrl.org/september-vhf</a>
10	0000	10	0400	3.5-14	North American Sprint, CW	CW	Other's call, your call, serial, name, SPC	<a href="http://ncjweb.com/Sprint-Rules.pdf">ncjweb.com/Sprint-Rules.pdf</a>
11	0000	11	0200	1.8-28	4 States QRP Group Second Sunday Sprint	CW Ph	RS(T), SPC, mbr or pwr	<a href="http://www.4sqrp.com">www.4sqrp.com</a>
13	1900	13	2030	3.5	RSGB 80m Autumn Series, CW	CW	RST, serial	<a href="http://www.rsgbcc.org">www.rsgbcc.org</a>
14	1800	14	1959	3.5	BCC QSO Party	CW Ph Dig	RS(T), T-shirt size	<a href="http://www.bavarian-contest-club.de">www.bavarian-contest-club.de</a>
15	1600	15	1700	3.5	AGB NEMIGA Contest	CW Ph Dig	RST, serial, mbr or none	<a href="http://ev5agb.com">ev5agb.com</a>
16	0300	17	0900	50,70,144,432,1296	SARL VHF/UHF Digital Contest	Dig	RST, 6-char grid	<a href="http://www.sarl.org.za">www.sarl.org.za</a>
16	0600	17	2359	10 GHz to light	ARRL 10 GHz and Up Contest	CW Ph Dig	6-char Maidenhead	<a href="http://www.arrl.org/10-ghz-up">www.arrl.org/10-ghz-up</a>
16	1200	17	1200	3.5-28	Scandinavian Activity Contest, CW	CW	RST, serial	<a href="http://www.sactest.net">www.sactest.net</a>
16	1400	17	0200	All, except WARC & 60	Iowa QSO Party	CW Ph Dig	RS(T), IA county or SPC	<a href="http://www.w0yl.com/IAQP">www.w0yl.com/IAQP</a>
16	1400	17	2000	All, except WARC	Texas QSO Party	CW Ph Dig	RS(T), TX county or SPC	<a href="http://www.txqp.net">www.txqp.net</a>
16	1600	16	2300	All, except WARC	Wisconsin Parks on the Air	CW Ph Dig	WI park abbreviation or SPC	<a href="http://wipota.com">wipota.com</a>
16	1600	17	0359	3.5-28	New Jersey QSO Party	CW Ph Dig	RS(T), NJ county or SPC	<a href="http://www.k2td-bcrg.org">www.k2td-bcrg.org</a>
16	1600	17	2200	3.5-28	New Hampshire QSO Party	CW Ph Dig	RS(T), NH county or SPC	<a href="http://www.w1wqm.org">www.w1wqm.org</a>
16	1600	17	2359	1.8-28,50	Washington State Salmon Run	CW Ph	RS(T), WA county or SPC	<a href="http://salmonrun.wwdxc.org">salmonrun.wwdxc.org</a>
17	0000	17	0400	3.5-14	North American Sprint, RTTY	Dig	Other's call, your call, serial, name, SPC	<a href="http://ncjweb.com/Sprint-Rules.pdf">ncjweb.com/Sprint-Rules.pdf</a>
17	1700	17	2059	3.5-28	BARTG Sprint PSK63 Contest	PSK63	Serial	<a href="http://bartg.org.uk">bartg.org.uk</a>
18	1900	18	2030	3.5-14	RSGB FT4 Contest	FT4	Signal report	<a href="http://www.rsgbcc.org">www.rsgbcc.org</a>
18	1900	18	2300	144	144 MHz Fall Sprint	CW Ph Dig	4-char grid	<a href="http://svhfs.org/wp/sprints/">svhfs.org/wp/sprints/</a>
21	0030	21	0230	3.5-14	NAQCC CW Sprint	CW	RST, SPC, mbr or pwr	<a href="http://naqcc.info">naqcc.info</a>
21	1900	21	2000	3.5-14	NTC QSO Party	CW	Max 25 WPM; RST, mbr or "NM"	<a href="http://pi4ntc.nl">pi4ntc.nl</a>
23	0000	24	2359	3.5-28	CQ Worldwide DX Contest, RTTY	Dig	RST, CQ zone, (US/VE state/prov)	<a href="http://www.cqwwrtty.com">www.cqwwrtty.com</a>
23	1200	24	1200	1.8-28	Maine QSO Party	CW Ph	RS(T), ME county or SPC	<a href="http://www.ws1sm.com/MEQP.html">www.ws1sm.com/MEQP.html</a>
23	1400	23	1800	144,432	AGCW VHF/UHF Contest	CW	RST, serial, pwr, 6-char grid	<a href="http://www.agcw.de">www.agcw.de</a>
23	1400	23	2200	3.5-28	Masonic Lodges on the Air	Ph	Lodge name, lodge no., jurisdiction or SPC	<a href="http://cqmorelight.com/rules">cqmorelight.com/rules</a>
24	0700	24	1000	50	UBA ON Contest, 6m	CW Ph	RS(T), serial, ON (for ON)	<a href="http://www.uba.be">www.uba.be</a>
26	1900	26	2300	222	222 MHz Fall Sprint	CW Ph Dig	4-char grid	<a href="http://svhfs.org/wp/sprints/">svhfs.org/wp/sprints/</a>
28	1900	28	2030	3.5	RSGB 80m Autumn Series, Data	Dig	RST, serial	<a href="http://www.rsgbcc.org">www.rsgbcc.org</a>
30	1200	1	1200	3.5-28	UK/EI DX Contest, SSB	Ph	RS, serial, district code (if UK/EI)	<a href="http://www.ukicc.com">www.ukicc.com</a>
30	2200	1	2200	1.8-14	AWA Amplitude Modulation QSO Party	Ph	Name, SPC	<a href="http://antiquewireless.org">antiquewireless.org</a>

There are a number of weekly contests not included in the table above. For more info, visit: [www.qrpfoxhunt.org](http://www.qrpfoxhunt.org), [www.ncccsprint.com](http://www.ncccsprint.com), and [www.cwops.org](http://www.cwops.org). All dates and times refer to UTC and may be different from calendar dates in North America. Contests are not conducted on the 60-, 30-, 17-, or 12-meter bands. Mbr = Membership number. Serial = Sequential number of the contact. SPC = State, Province, DXCC Entity. XE = Mexican state. 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. Data for Contest Corral is maintained on the WA7BNM Contest Calendar at [www.contestcalendar.com](http://www.contestcalendar.com) and is extracted for publication in QST 2 months prior to the month of the contest. ARRL gratefully acknowledges the support of Bruce Horn, WA7BNM, in providing this service.



# 2023 ARRL International DX Phone Contest Results

This year's ARRL International DX Phone Contest was held March 4 – 5, 2023.

## Sponsored Plaque Winners

Thanks to the generous support of numerous clubs and individuals, we are pleased to list the winners of the sponsored International DX Phone Contest plaques below. For more information on plaque sponsorship or to order a duplicate plaque, contact the ARRL Contest Program at 860-594-0232 or [contests@arrl.org](mailto:contests@arrl.org). Plaques cost \$80, which includes all shipping charges.

Winner	Plaque Category	Plaque Sponsor
<b>CW Winners</b>		
K5GN	W/VE Single Operator High Power	Frankford Radio Club
N1UR	W/VE Single Operator Low Power	The CW Operators' Club
AA3B	W/VE Single Operator Unlimited, High Power	Harold Ritchey, W3WPG, Memorial
K1BX	W/VE Single Operator Unlimited, Low Power	Chick Allen, NW3Y
K9RS	W/VE Multioperator Single Transmitter High Power	The CW Operators' Club
W3LPL	W/VE Multioperator Two Transmitter	The CW Operators' Club
K1LZ	W/VE Multioperator Unlimited Transmitter	Drew Vonada-Smith, K3PA
N4XD	W/VE Single Operator High Power 1.8 MHz	Jim George, N3BB
W3BGN	W/VE Single Operator High Power 3.5 MHz	The CW Operators' Club
N2MF	W/VE Single Operator High Power 7 MHz	Drew Vonada-Smith, K3PA
W7WA	W/VE Single Operator High Power 14 MHz	The CW Operators' Club
K2SSS	W/VE Single Operator High Power 21 MHz	Carl Luetzelshwab, K9LA
T17W	World Single Operator High Power	North Jersey DX Association
FS/KO1A (IZ3EYS, op)	World Single Operator Low Power	The CW Operators' Club
EA8RM	World Single Operator QRP	The CW Operators' Club
NP4Z	World Single Operator Unlimited, High Power	The CW Operators' Club
P44W (W2GD, op)	World Single Operator Unlimited, Low Power	The CW Operators' Club
ZF1A	World Multioperator Single Transmitter High Power	John Patterson, WC0W/V31TP
CR3W	World Multioperator Two Transmitter	Frankford Radio Club, K2TD, Memorial
ZF5T	World Multioperator Single Transmitter Low Power	John Patterson, WC0W/V31TP
IQ1DF (IK1HJS, op)	World Single Operator High Power 7 MHz	The CW Operators' Club
FS/KO1A (IZ3EYS, op)	North America Single Operator Low Power	Fred Hoffert, NA2U
ZF2NZ	North America Single Operator QRP	The CW Operators' Club
ZF1A	North America Multioperator Single Transmitter	The CW Operators' Club
KL7RA	North America Multioperator Unlimited	The CW Operators' Club
AA1K	Atlantic Division Single Operator	Chick Allen, NW3Y
W9KM	Central Division Single Operator Low Power	Society of Midwest Contesters
K9NW	Central Division Single Operator Unlimited, High Power	Society of Midwest Contesters
KG9X	Central Division Single Operator Unlimited, Low Power	Society of Midwest Contesters
AA9A	Central Division Multioperator Single Transmitter	Society of Midwest Contesters
NA8V	Great Lakes Division Single Operator	North Coast Contesters
K2QB	Hudson Division Single Operator Unlimited, Low Power	Hudson Valley Contesters and DXers — In memory of K2ONP
CR3DX	Africa Single Operator	The CW Operators' Club
JF2QNM	Asia Single Operator High Power	The CW Operators' Club
JH4UYB	Asia Multioperator Single Transmitter High Power	Yankee Clipper Contest Club
T17W	Caribbean Single Operator Low Power	Frankford Radio Club, 9Y4VU, Memorial
DK7HA	Europe Single Operator QRP	The CW Operators' Club
EB7A	Europe Single Operator Unlimited, High Power	The CW Operators' Club
EA5RS	Europe Multioperator Single Transmitter	The CW Operators' Club
TM6M	Europe Multioperator Two Transmitter	The CW Operators' Club
EA5M	Europe Single Operator Low Power	Jeff Hartley, N8II
J11RXQ	Japan Single Operator Low Power	The CW Operators' Club
FK8IK	Oceania Single Operator	The CW Operators' Club
OA4SS	South America Single Operator	The CW Operators' Club
<b>CW/Phone Combination Winners</b>		
N1UR	W/VE Single Operator Low Power Combined Score	Ellen White, W1YL, Memorial — ARRL Contest Branch
W9RE	W/VE Single Operator High Power Combined Score	Chick Allen, NW3Y
<b>Overall CW/Phone Winner</b>		
N4JEH	W/VE Youth Overall Winner	Frankford Radio Club, W2OX, Memorial
<b>Phone Winners</b>		
K1LZ (LU9ESD, op)	W/VE Single Operator High Power	Frankford Radio Club
AA3B	W/VE Single Operator Unlimited, High Power	Pete Carter, K3VW, Memorial
WE9R	W/VE Single Operator Unlimited, Low Power	Swamp Fox Contest Group — In memory of Marc Tarplee, N4UFP
8P5A	World Single Operator High Power	North Jersey DX Association
P49Y	World Single Operator Low Power	Arizona Outlaws Contest Club
IU1NKS	World Single Operator QRP	Bill Parker, W8QZA
ED8W (EA7LL, op)	World Single Operator Unlimited, High Power	Charles Dietz, W5PR
W9RE	Central Division Single Operator High Power	Society of Midwest Contesters
K9XR	Central Division Single Operator Low Power	Society of Midwest Contesters
K9NW	Central Division Single Operator Unlimited, High Power	Society of Midwest Contesters
WE9R	Central Division Single Operator Unlimited, Low Power	Society of Midwest Contesters
NA8V	Great Lakes Division Single Operator	North Coast Contesters
ND4Y	Great Lakes Division Single Operator Unlimited, Low Power	Kentucky Contest Group
K1LZ (LU9ESD, op)	USA Single Operator High Power	Ed Sawyer, N1UR
JH4UYB	Asia Multioperator Single Transmitter High Power	Yankee Clipper Contest Club
KH6QJ	Oceania Single Operator High Power 3.5 MHz	Burton M. Parmeter, KG7MD, Memorial Award
WH7T (WH7W, op)	Oceania Single Operator High Power	Albert Crespo, F5VHJ — In Memory of Carl Cook, AI6V



## Continental Winners

### Africa

Single Operator, High Power	CT3KN	2,054,160
Single Operator, Low Power	D44PM	414,120
Single Operator, QRP	EA8RM	108,192
Single Operator Unlimited, High Power	ED8W (EA7LL, op)	5,373,720
Single Operator Unlimited, Low Power	3V8SS	20,445
Single Operator Unlimited, High Power, 20 Meters	CT9ABN	227,880
Single Operator Unlimited, Low Power, 20 Meters	CN8SG	47,334
Single Operator, Low Power, 15 Meters	EA8KY	156,468
Single Operator, Low Power, 10 Meters	EA8KR	161,778
Single Operator Unlimited, High Power, 10 Meters	CQ3A (S53K, op)	388,440
Single Operator Unlimited, Low Power, 10 Meters	EA8TR	129,804
Multioperator, Single Transmitter, High Power	FR8TZ	410,112

### Antarctica

Single Operator, High Power, 10 Meters	LU1ZV (LU8YD, op)	126
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### Asia

Single Operator, High Power	JF2QNM	1,568,136
Single Operator, Low Power	JL8PZO	37,800
Single Operator, QRP	JH7UJU	35,784
Single Operator Unlimited, High Power	JE1LFX	610,560
Single Operator Unlimited, Low Power	JH1EAG	317,088
Single Operator Unlimited, QRP	JA6GCE	34,932
Single Operator, High Power, 80 Meters	JH7XMO	4,374
Single Operator, Low Power, 80 Meters	JE1SPY	735
Single Operator, QRP, 80 Meters	JH1APZ	18
Single Operator, High Power, 40 Meters	JJ0VNR	84,915
Single Operator, Low Power, 40 Meters	JA7HYS	970
Single Operator, QRP, 40 Meters	JR1ABS	462
Single Operator Unlimited, High Power, 40 Meters	JH7MQD	90,168
Single Operator Unlimited, Low Power, 40 Meters	JJ1AEB	480
Single Operator, High Power, 20 Meters	UA9CUA	10,440
Single Operator, Low Power, 20 Meters	EX0M	33,558
Single Operator Unlimited, High Power, 20 Meters	UA9MA	136,290
Single Operator, High Power, 15 Meters	JH1KRC	72,900
Single Operator, Low Power, 15 Meters	JR1AKD	4,620
Single Operator, QRP, 15 Meters	7N4WPY	3,795
Single Operator Unlimited, High Power, 15 Meters	JH7CUO	16,932
Single Operator Unlimited, Low Power, 15 Meters	JM1NKT	52,332
Single Operator, High Power, 10 Meters	JA0JHA	210,168
Single Operator, Low Power, 10 Meters	JA6WFM	61,617
Single Operator, QRP, 10 Meters	JK1CNL	2,508
Single Operator Unlimited, High Power, 10 Meters	A62A (A65BP, op)	97,065
Single Operator Unlimited, Low Power, 10 Meters	H25A	42,480
Multioperator, Single Transmitter, High Power	JH4UYB	1,501,770
Multioperator, Single Transmitter, Low Power	BY5EA	68,634
Multioperator, Two Transmitter	JR2GRX	2,117,910
Multioperator, Multitransmitter	JA3YBK	2,972,682

### Europe

Single Operator, High Power	E7DX (E77DX, op)	5,240,352
Single Operator, Low Power	CT2HOV	879,000
Single Operator, QRP	IU1NKS	322,224
Single Operator Unlimited, High Power	ED5R (EA5Z, op)	4,622,928
Single Operator Unlimited, Low Power	S52NR	1,868,076
Single Operator Unlimited, QRP	DL5IC	305,901
Single Operator Unlimited, High Power, 160 Meters	UT6UD	60
Single Operator, High Power, 80 Meters	GM3PPG (G4BYB, op)	106,029
Single Operator, Low Power, 80 Meters	SP6LUV	12,402
Single Operator, QRP, 80 Meters	IO5K (IK5TBK, op)	378
Single Operator Unlimited, High Power, 80 Meters	HA1TJ	74,970
Single Operator Unlimited, Low Power, 80 Meters	OK1DPU	2,862
Single Operator, High Power, 40 Meters	IK6LBT	266,040
Single Operator, Low Power, 40 Meters	DL5RU	1,152
Single Operator Unlimited, High Power, 40 Meters	IQ1DF (IK1HJS, op)	220,761
Single Operator Unlimited, Low Power, 40 Meters	F4IRT	2,970
Single Operator Unlimited, QRP, 40 Meters	EA3O	4,554
Single Operator, High Power, 20 Meters	CQ8Q (PT2FM, op)	242,460
Single Operator, Low Power, 20 Meters	CT1FOQ	9,135
Single Operator, QRP, 20 Meters	F5BEG	1,344
Single Operator Unlimited, High Power, 20 Meters	HA1AH	276,879
Single Operator Unlimited, Low Power, 20 Meters	R4WDX	32,781
Single Operator, High Power, 15 Meters	CR6T (CT1ESV, op)	460,440
Single Operator, Low Power, 15 Meters	M5LMG	68,475
Single Operator, QRP, 15 Meters	DO3KTM	2,442
Single Operator Unlimited, High Power, 15 Meters	9A3TR	383,040
Single Operator Unlimited, Low Power, 15 Meters	ED7B (EA7ZC, op)	141,423
Single Operator, High Power, 10 Meters	CR6K (CT1CJJ, op)	495,900
Single Operator, Low Power, 10 Meters	EA4KD	193,992
Single Operator, QRP, 10 Meters	DH8BQA	10,701
Single Operator Unlimited, High Power, 10 Meters	EA5S	468,000
Single Operator Unlimited, Low Power, 10 Meters	M5W	108,864
Single Operator Unlimited, QRP, 10 Meters	SP7M	11,130
Multioperator, Single Transmitter, High Power	CU2AA	5,543,082
Multioperator, Single Transmitter, Low Power	3Z1K	453,600
Multioperator, Two Transmitter	TM6M	7,443,072
Multioperator, Multitransmitter	9A1A	7,441,200

### North America

Single Operator, High Power	8P5A	8,584,320
Single Operator, Low Power	WP3C	4,132,179
Single Operator, QRP	CO6EC	2,025
Single Operator Unlimited, High Power	AL2F	842,904
Single Operator Unlimited, Low Power	VP9I (N1SV, op)	2,602,860
Single Operator, Low Power, 160 Meters	CO2RQ	966
Single Operator, High Power, 80 Meters	T15VMJ	77,112
Single Operator, Low Power, 80 Meters	KP4KE	117,936
Single Operator, High Power, 40 Meters	T11T	199,578
Single Operator, Low Power, 40 Meters	CM8JFL	588
Single Operator Unlimited, High Power, 40 Meters	V31XX	548,280
Single Operator, High Power, 20 Meters	CO2XN	549,720
Single Operator, Low Power, 20 Meters	XE2OK	5,625
Single Operator Unlimited, Low Power, 20 Meters	T12MOT	20,250
Single Operator, High Power, 15 Meters	T11I (T12VVV, op)	262,491
Single Operator, Low Power, 15 Meters	CO6LC	339,120
Single Operator Unlimited, High Power, 15 Meters	FG4KH (F1DUZ, op)	237,600
Single Operator Unlimited, Low Power, 15 Meters	KP4PUA	364,620
Single Operator, High Power, 10 Meters	KP4PR	182,178
Single Operator, Low Power, 10 Meters	CO2VDD	203,952
Single Operator, QRP, 10 Meters	T12BSH	75
Single Operator Unlimited, High Power, 10 Meters	V31DK (K0ZV, op)	8,613
Single Operator Unlimited, Low Power, 10 Meters	KP4DRB	12
Multioperator, Single Transmitter, High Power	ZF1A	9,304,440
Multioperator, Single Transmitter, Low Power	VP5M	7,350,633
Multioperator, Multitransmitter	H13LT	5,133,024

### Oceania

Single Operator, High Power	WH7T (WH7W, op)	1,850,217
Single Operator, Low Power	YB1RKT	51,714
Single Operator, QRP	YC1HBP	105
Single Operator Unlimited, High Power	KH7M (NA2U, op)	4,135,980
Single Operator Unlimited, Low Power	YB9ELS	52,875
Single Operator, High Power, 80 Meters	KH6QJ	18
Single Operator, High Power, 40 Meters	YC2CQO	36
Single Operator, High Power, 40 Meters	YD3BSA	36
Single Operator, Low Power, 40 Meters	YB8RVI	2,196
Single Operator Unlimited, QRP, 40 Meters	YC0SJA	84
Single Operator, High Power, 20 Meters	YB1DIU	19,434
Single Operator, Low Power, 20 Meters	FW1JG	29,835
Single Operator Unlimited, High Power, 20 Meters	VK3X (VK3GK, op)	40,500
Single Operator, High Power, 15 Meters	YC0RFS	75
Single Operator, Low Power, 15 Meters	DU9WTZ	1,248
Single Operator Unlimited, High Power, 15 Meters	YB0SAS	450
Single Operator Unlimited, Low Power, 15 Meters	41BNC	252
Single Operator, High Power, 10 Meters	VL4U	135,432
Single Operator, Low Power, 10 Meters	KH6AQ	66,249
Single Operator, QRP, 10 Meters	YG3FAP	18
Single Operator, QRP, 10 Meters	NH6O	18
Single Operator Unlimited, High Power, 10 Meters	ZL1T (ZL1ANH, op)	123,585
Single Operator Unlimited, Low Power, 10 Meters	KH6WI	105,144
Multioperator, Single Transmitter, High Power	VL4A	75,600
Multioperator, Single Transmitter, Low Power	DX1ART	3,168
Multioperator, Two Transmitter	AH2R	1,862,352
Multioperator, Multitransmitter	716O	36

### South America

Single Operator, High Power	ZW2N (PY2MNL, op)	2,088,576
Single Operator, Low Power	P49Y	5,263,506
Single Operator, QRP	PY2PLL	4,158
Single Operator Unlimited, High Power	PV2K (PY2KNK, op)	1,319,298
Single Operator Unlimited, Low Power	HD8M (KE2D, op)	2,651,304
Single Operator, High Power, 40 Meters	LU2DVI	3,150
Single Operator, Low Power, 40 Meters	YV6BXN	33,792
Single Operator Unlimited, High Power, 40 Meters	PY5QW	46,782
Single Operator Unlimited, Low Power, 40 Meters	PY2GTA	192
Single Operator, High Power, 20 Meters	CE3QY	105,165
Single Operator, Low Power, 20 Meters	PY2NY	157,500
Single Operator Unlimited, High Power, 20 Meters	LO7H (LU7HW, op)	168,504
Single Operator Unlimited, Low Power, 20 Meters	PT2SR	18,759
Single Operator, High Power, 15 Meters	ZX2V (PY2XV, op)	345,780
Single Operator, Low Power, 15 Meters	YW6CQ (YV6BXN, op)	159,885
Single Operator Unlimited, High Power, 15 Meters	ZP5DBC	280,260
Single Operator Unlimited, Low Power, 15 Meters	PY2VZ	142,131
Single Operator, High Power, 10 Meters	PX2A (PY2PT, op)	567,360
Single Operator, Low Power, 10 Meters	PY2UD	221,676
Single Operator, QRP, 10 Meters	PY2BN	62,328
Single Operator Unlimited, High Power, 10 Meters	PT5J (PP5JR, op)	675,540
Single Operator Unlimited, Low Power, 10 Meters	PY5FJR	174,345
Single Operator Unlimited, QRP, 10 Meters	PU5ALE	504
Multioperator, Single Transmitter, High Power	CX5A	964,440
Multioperator, Single Transmitter, Low Power	PR1T	909,141
Multioperator, Two Transmitter	PJ4G	11,350,983
Multioperator, Multitransmitter	PJ2T	11,507,886

## Full Results Online

You can read the full results of the contest online at <http://contests.arri.org>. You'll find detailed analysis and more play-by-play, along with the full line scores. Improve your results by studying your log-checking report, too.



**Single Operator, High Power**

8P5A	8,584,320
T11K (T15CDA, op)	5,284,440
E7DX (E77DX, op)	5,240,352
KP2M (KT3Y, op)	2,983,347
IO8V (IK0ETA, op)	2,749,824
EA5DFV	2,269,182
ZW2N (PY2MNL, op)	2,088,576
CT3KN	2,054,160
WH7T (WH7W, op)	1,850,217
TM5A (F5VHJ, op)	1,631,034

**Single Operator, Low Power**

P49Y	5,263,506
WP3C	4,132,179
HI3T	2,078,460
CT2HOV	879,000
T12OY	745,200
HI8J	529,830
HH2AA (K0BBC, op)	525,027
CO2KR	506,520
PJ7AA	488,511
CO8NMN	473,526

**Single Operator, QRP**

IU1NKS	322,224
EA8RM	108,192
JH7UJU	35,784
I25DKR	34,776
GM4M (GM4UBJ, op)	29,304
I25EKW	20,646
PJ1NGT	13,200
I23NVR	8,307
JE1RZR	7,380
SP8DR	6,840

**Single Operator, Unlimited, High Power**

ED8W (EA7LL, op)	5,373,720
ED5R (EA5Z, op)	4,622,928
KH7M (NA2U, op)	4,135,980
OM2VL	3,680,598
ED3X	3,477,942
TM0R	3,411,408
OM0R (OM3GI, op)	3,408,876
IR2Q (IK2PFL, op)	3,160,476
SN7Q (SP7GIQ, op)	3,068,793
ZM4T (ZL3IO, op)	2,732,940

**Single Operator, Unlimited, Low Power**

HD8M (KE2D, op)	2,651,304
VP9I (N1SV, op)	2,602,860
S52NR	1,868,076
HK4/KC1XX	1,569,285
T12WMP	755,013
HI8PAP	694,053
PY2ZR	459,000
YV5RAB	411,642
F22RJ	347,880
9A2EU	336,600

**Single Operator, Unlimited, QRP**

DL5IC	305,901
E70Y	54,810
JA6GCE	34,932
JK2VOC	11,544
F8CPA	612
EA4HH	3

**Single Operator, Low Power, 160 Meters**

CO2RQ	966
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**Single Operator, Unlimited, High Power, 160 Meters**

UT6UD	60
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**Single Operator, High Power, 80 Meters**

GM3PPG (G4BYB, op)	106,029
I5JVA	102,150
T15VMJ	77,112
LZ6Y (LZ1KU, op)	17,910
YO3VU	6,624
JH7XMO	4,374
KH6QJ	18

**Single Operator, Low Power, 80 Meters**

KP4KE	117,936
SP6LUV	12,402
JE1SPY	735
4Z4KX	54

**Single Operator, QRP, 80 Meters**

IO5K (IK5TBK, op)	378
JH1APZ	18

**Single Operator, Unlimited, High Power, 80 Meters**

HA1TJ	74,970
EC7WR	37,392
SO9I (SQ9ORQ, op)	33,264
OK1CRM	25,500
IK1PMR	4,752
SP3GTS	2,850

**Single Operator, Unlimited, Low Power, 80 Meters**

OK1DPU	2,862
LY5GT	210

**Single Operator, High Power, 40 Meters**

IK6LBT	266,040
T11T	199,578
I12S (I22KXC, op)	180,264
OM5R (OM5DX, op)	170,262
YT1A	163,293
JJ0VNR	84,915
S51CK	78,678
LZ6S	73,800
LZ5K	52,668
IK0NMJ	23,478

**Single Operator, Low Power, 40 Meters**

YV6BXN	33,792
PP2CC	24,531
YB8RVI	2,196
DL5RU	1,152
YD8IKY	600
CM8JFL	588
JA7HYS	570
DU1JW	285
ZP6TT	231
JH1RDU	216

**Single Operator, QRP, 40 Meters**

JR1ABS	462
JA2MWV	150
BG4WOM	96
JH3DMQ	48

**Single Operator, Unlimited, High Power, 40 Meters**

V31XX	548,280
IQ1DF (IK1HJS, op)	220,761
S51YI	213,846
CO8ZZ	212,211
SN3A (SP3GEM, op)	155,208
JH7MQD	90,168
G8X (G4FJK, op)	70,560
EI5KF	66,003
PY5QW	46,782
9A2KD	16,608

**Single Operator, Unlimited, Low Power, 40 Meters**

F4IRT	2,970
OE1KDK	510
JJ1AEB	480
PY2GTA	192
JF3KQA	120
IU0PVI	75
E29TGW	30
EA4AFP	27
I22BHQ	6

**Single Operator, Unlimited, QRP, 40 Meters**

EA3O	4,554
YC0SJA	84

**Single Operator, High Power, 20 Meters**

CO2XN	549,720
CQ8Q (PT2FM, op)	242,460
EA3CI	159,906
OH8L (OH8LQ, op)	151,962
ES5RW	131,370
CE3QY	105,165
YT7B	84,336
SP9RCL	60,588
CO2AME	47,889
PR7AR	42,300

**Single Operator, Low Power, 20 Meters**

PY2NY	157,500
ZZ5K (PP5RT, op)	151,164
EX0M	33,558
FW1JG	29,835
YB2CPO	19,782
LT1K (LU6KA, op)	18,603
PP5IP	14,484
CT1FOQ	9,135
ZZ2A (PY2BRP, op)	8,991
XE2OK	5,625

**Single Operator, QRP, 20 Meters**

F5BEG	1,344
IW2EPE	126

**Single Operator, Unlimited, High Power, 20 Meters**

HA1AH	276,879
IR6T (IK6JNH, op)	260,100
CT9ABN	227,880
LO7H (LU7HW, op)	168,504
DL7BC	167,751
DH1TT	162,324
IT9EWR	137,592
UA9MA	136,290
PP1VWV	134,235
IT9XTP	110,760

**Single Operator, Unlimited, Low Power, 20 Meters**

CN8SG	47,334
R4WDX	32,781
T12MOT	20,250
PT2SR	18,759
EB3FLY	10,404
DL4VAI	7,395
E74TM	2,244
9A1BN	891
LY2BGP	756
DL7FB	105

**Single Operator, High Power, 15 Meters**

CR6T (CT1ESV, op)	460,440
S55OO	400,140
ZX2V (PY2XV, op)	345,780
EB7A	287,280
TI1I (TI2VVV, op)	262,491
SN5X (SP5GRM, op)	249,840
TM5T	217,533
XQ1KZ	213,108
LZ2VU	209,391
S50R	172,881

**Single Operator, Low Power, 15 Meters**

CO6LC	339,120
TI2JS	168,606
YV6CQ (YV6BXN, op)	159,885
EA8KY	156,468
XE1CT	121,968
PY2QT	114,072
M5LMG	68,475
PT2EM	66,303
CO2KL	65,124
CE5PHR	51,450

**Single Operator, QRP, 15 Meters**

7N4WPY	3,795
DO3KTM	2,442
OU2V (OZ1FJB, op)	1,344
IU3QJA	561
UT7AA	561
JA1KPF	336
J11NZA/1	294
JH0KFI	3

**Single Operator, Unlimited, High Power, 15 Meters**

9A3TR	383,040
SN2M (SP2XF, op)	376,020
HA5JI	330,840
S50K	300,600
F4GGQ	293,040
ZP5DBC	280,260
I22FOS	266,220
EB5A	261,606
HG1S (HA1DAE, op)	253,980
FG4KH (F1DUZ, op)	237,600

**Single Operator, Unlimited, Low Power, 15 Meters**

KP4PUA	364,620
PY2VZ	142,131
ED7B (EA7ZC, op)	141,423
E7CW (E77FA, op)	137,160
ZW2A (PY2SGL, op)	117,936
EA4AOC	111,150
PY8WW	89,100
M1U (M0UTD, op)	67,200
JM1NKT	52,332
I23KKE	44,997

**Single Operator, High Power, 10 Meters**

PX2A (PY2PT, op)	567,360
CR6K (CT1CJJ, op)	495,900
EI7M (EI3JZ, op)	456,840
LU8DPM	363,420
S53WW	333,720
OK1GTH	296,820
Y8WW	289,260
IK8UND	261,720
MM2N (MM0GPZ, op)	257,346
OQ4U	250,809

**Single Operator, Low Power, 10 Meters**

PY2UD	221,676
CO2VDD	203,952
EA4KD	193,992
LU1DJX	187,824
PY2EX	167,973
9A9R	167,832
FG5GP	166,152
EA8KR	161,778
4M1W (YV1SW, op)	155,229
PY2CX	136,467

**Single Operator, QRP, 10 Meters**

PY2BN	62,328
DH8BQA	10,701
SM5INC	6,696
LU7VCH	2,850
JK1CNL	2,508
JA1NEZ	2,091
G8AFN	828
PA3GLK	495
J11AEP	150
JK1NWD/1	144

**Single Operator, Unlimited, High Power, 10 Meters**

PT5J (PP5JR, op)	675,540
PV2G (PT2IC, op)	497,340
EA5S	468,000
ZP5WBM	426,756
CQ3A (S53K, op)	388,440
TM0T (F4HQZ, op)	379,665
M5B (G3WVG, op)	366,567
HG3R (HA3NU, op)	358,740
TM1W	323,202
V55Y (V51WH, op)	292,404

**Single Operator, Unlimited, Low Power, 10 Meters**

PUSFJR	174,345
PY2HT	164,778
9Z4Y	141,075
PY2CPS	136,080
EA8TR	129,804
AZ1D (LU4DJB, op)	125,628
PU1JSV	113,850
M5W	108,864
KH6WI	105,144
HG0R (HA0NAR, op)	99,057

**Single Operator, Unlimited, QRP, 10 Meters**

SP7M	11,130
Y08WW	4,617
PUSALE	504

**Multioperator, Single Transmitter, High Power**

ZF1A	9,304,440
ZF5T	7,832,088
TO5M	7,322,700
NP4Z	6,878,400
J68HZ	6,626,028
CU2AA	5,543,082
IR4X	5,098,548
TO3Z	5,003,019
TM7A	4,990,941
CQ8M	4,429,404

**Multioperator, Single Transmitter, Low Power**

VP5M	7,350,633
PR1T	909,141
3Z1K	453,600
LU9WE	402,165
F6KFI	82,503
BY5EA	68,634
MX0NYM	57,534
F8AOF	48,024
DX1ART	3,168
ZY1T	2,730

**Multioperator, Two Transmitter**

PJ4G	11,350,983
TM6M	7,443,072
LP1H	5,205,033
EI9E	4,317,660
JR2GRX	2,117,910
AH2R	1,862,352
JH8YOH	1,671,120
C37N	1,274,139
I18K	1,054,728
CB2R	263,088

**Multioperator, Multitransmitter**

PJ2T	11,507,886
9A1A	7,441,200
9A1P	6,617,700
HI3LT	5,133,024
KL7RA	4,087,200
JA3YBK	2,972,682
LN8W	2,686,554
C6ANM	2,521,623
HD1A	2,312,991
M6C	968,418



## Top Ten — US and Canada

<b>Single Operator, High Power</b> K1LZ (LU9ESD, op) 5,718,681 K5TR 4,132,128 W9RE 3,799,872 KQ2M 3,750,930 K4AB 3,719,790 CF3A (VE3AT, op) 3,416,976 VY2TT (K6LA, op) 3,229,032 N9RV 2,810,904 K5WA 2,174,130 NA8V 1,996,176	<b>Single Operator, Unlimited, QRP</b> K8ZT 58,110 KD9NYYE 35,604 K2YG 18,954 KS4X 11,322 N6AN 510	<b>Single Operator, Low Power, 40 Meters</b> KW4SW 25,134 KT4R 9,450 AC0QG 243 KB6DKK 75 W9ADN 72 KW4GF 60 KF6QEX 18 KC1ADT 3	<b>Single Operator, Unlimited, High Power, 20 Meters</b> KV0Q 129,204 WA4JUK 59,280 N7TU 41,940 K5NA 26,622 KK9V 5,733 WB2NVR 2,772 AG7YX 630	<b>Single Operator, High Power, 10 Meters</b> N4OX 594,945 N2IC 516,456 K9BGL 472,191 N1PGA 471,870 W1UE 425,184 K1TO 360,483 K0EJ 307,242 NU6S 259,065 VE3DZ 165,000 NC0B 123,480	<b>Single Operator, Unlimited, QRP, 10 Meters</b> K6JS 27,531 K2GMY 13,230 KQ2RP 3,042
<b>Single Operator, Low Power</b> N1UR 2,879,982 N8II 1,112,046 VE6TN 823,536 K5FUV 706,440 K8ZM 662,475 KD2TT 647,664 W6DVS 610,974 WA3LXD 610,488 KF8N 582,912 VE3LRL 483,309	<b>Single Operator, High Power, 160 Meters</b> K1ZM 5,439 N4XD 1,596	<b>Single Operator, QRP, 40 Meters</b> AE4JB 60	<b>Single Operator, Unlimited, Low Power, 20 Meters</b> N1KJS 10,998 KQ4AHO 5,775 W3RFX 3,948 KF0JOU 3	<b>Single Operator, Low Power, 10 Meters</b> N0UR 112,746 N1WRK 111,720 N2YO 77,922 K6GHA 71,496 W9ILY 70,560 K3SWZ 64,800 WB0LQC 64,068 N8AP 62,712 VE3TM 51,759 VY2LI 49,776	<b>Multioperator, Single Transmitter, High Power</b> K9RS 4,948,053 K8AZ 4,600,800 ND7K 3,558,048 WW4LL 3,412,260 K3ND 3,219,741 W1TJL 3,177,930 KQ3F 2,833,380 W3MF 2,325,168 W2IRT 2,188,695 NX6T 2,024,253
<b>Single Operator, QRP</b> VE3VN 719,901 ND0C 320,076 W1JCW 180,960 W6QU (W8QZA, op) 164,439 KA8SMA 106,128 W3EK 81,096 K4SAA 53,865 NF2L 45,105 AC2N 42,117 WA2JNF 33,972	<b>Single Operator, High Power, 80 Meters</b> W3BGN 36,936 W1HI 11,931 W7BJN 1,653 WG8Y 1,380	<b>Single Operator, Unlimited, High Power, 40 Meters</b> K1IM 8,733 WN4AFP 1,932	<b>Single Operator, High Power, 15 Meters</b> KU2M 515,025 K2SSS 497,610 N7RQ 276,159 VA3AR 223,008 K7ZS 153,468 N4DJ 29,445 N0UJ 22,914 KB7QU 5,880 K2PS 4,293 W0PPF 3,519	<b>Single Operator, QRP, 10 Meters</b> W5GAJ 42,600 VE3NZ 34,713 K3TW 25,584 WB2AMU 21,336 W7USA 13,680 K9JK 6,039 W4SEZ 1,596 N6HI 714 W8IQ 624 N0STP 585	<b>Multioperator, Single Transmitter, Low Power</b> N4SS 2,704,083 N5YT 1,121,418 W3ZGD 925,296 WA1F 915,684 N1EP 428,736 W1JSR 378,927 N8YXR 121,401 VE4WSC 85,410 W3PGA 67,266 NU5DE 64,872
<b>Single Operator, Unlimited, High Power</b> AA3B 4,651,200 K5ZD 4,500,012 N3RD 4,250,640 K3WW 4,221,648 N2SR 4,179,420 K5GN 3,920,895 K1ZZ 3,905,868 K1KI (KM1P, op) 3,856,962 N3RS 3,717,792 AB3CX 3,593,568	<b>Single Operator, QRP, 80 Meters</b> NN1DX 27	<b>Single Operator, Low Power, 20 Meters</b> W1AVK 165,534 W1QWA (W0EWD, op) 155,400 W5RJ 37,446 W8GOC 18,315 K2ACX 5,220 N4RGJ 1,980 VE6CA 168	<b>Single Operator, Low Power, 15 Meters</b> A10L 117,711 W47BNM 52,920 K0BBB 46,620 NU8A 46,200 K2MS 34,776 KC8ZMN 33,408 VE3FH 31,872 W9QL 29,574 WA8ZNC 17,685 N8URE 9,828	<b>Single Operator, Unlimited, High Power, 10 Meters</b> N8OO 712,800 VA2WA 512,820 W9XY 386,400 AD4EB 385,443 K3EST 371,700 W5PR 371,280 KN2M 317,469 K6LL 313,617 NE8P 274,122 K4WI 269,505	<b>Multioperator, Two Transmitter</b> W3LPL 10,032,000 K2AX 5,552,580 N2AA 4,877,700 W4NF 4,212,657 WG3J 3,011,058 K8LX 2,505,840 W2CG 1,447,992 N3XF 1,283,526 W1HS 1,252,125 K3CCR 1,114,860
<b>Single Operator, Unlimited, Low Power</b> WE9R 1,618,461 KK1L 1,280,430 N4XL 1,275,000 W3KB 1,028,748 K1BX 1,000,350 WO1N 950,544 NS3T 919,884 KS1J 908,460 ND4Y 841,464 WA1Z 715,950	<b>Single Operator, High Power, 40 Meters</b> W4AAA 210,087 W6AFA 84,429 WF2W 77,937 N7RK 10,836 KG9Z 300	<b>Single Operator, QRP, 20 Meters</b> K4CUZ 300 AC5O 168 VA7IR 12	<b>Single Operator, Unlimited, Low Power, 15 Meters</b> W1QK 149,178 N2EPE 23,790 VE3BFU 21,450 N1API 1,092	<b>Single Operator, Unlimited, Low Power, 10 Meters</b> K1EP 258,324 W9XT 177,309 VA3IPG 107,448 W9MR 106,560 W6ZL 62,139 WB8JUI 51,516 WA3RHW 50,853 N4NM 45,990 N9VPV 44,019 K3GWK 34,068	<b>Multioperator, Multitransmitter</b> K3LR 12,810,600 K1TTT 6,491,160 AA1K 5,073,588 W2AA 4,286,268 W7RM 4,047,402 NE3F 3,532,032 N1RR 2,857,926 K3MTR 2,761,776 K1KP 2,598,570 W0AA 2,172,690



Alejandro Alvarez, LU8YD, operated as LU1ZV from Esperanza Base — the Argentinian scientific research station in Antarctica for the 2023 ARRL International DX Phone Contest, supplying many participants with a rare multiplier. [Alejandro Alvarez, LU8YD, photo]

The next ARRL International DX Phone Contest will be held March 2 – 3, 2024.



# Volunteers On the Air Update



## Have you worked all the VOTA W1AW portable state activations?

July marked the beginning of the second half of the event. We are excited to report that our first pass of all 50 state activations was completed, and some states have already completed their second activations. On the weekend of the IARU HF World Championship Contest (July 8 – 9), W1AW/KH6 was available on both phone and CW from two big Hawaiian stations (KH6YY and KH6LC). Watch out for other W1AW activations through the end of the year on our schedule at <https://vota.arrl.org>!

Listed below are initial QSO tallies from recent W1AW portable state activations, as of July 10:

- W1AW/KL7 (May 3 – 9) = awaiting logs
- W1AW/2 New York (second operation May 24 – 30) = 4,869 QSOs
- W1AW/0 Colorado (May 24 – 30) = 7,653 QSOs
- W1AW/0 Missouri (May 31 – June 6) = 2,911 QSOs
- W1AW/7 Wyoming (May 31 – June 6) = 1,918 QSOs
- W1AW/5 Alabama (June 7 – 13) = awaiting logs
- W1AW/5 Louisiana (June 7 – 13) = 4,869 QSOs
- W1AW/8 West Virginia (June 14 – 20) = awaiting logs
- W1AW/5 Arkansas (June 14 – 20) = 3,792 QSOs

## VOTA Leaderboard Functionality Updates

- The leaderboard (<https://vota.arrl.org/leaderboard.php>) was updated to allow filtering by US or state only, and to list overall and state rank.
- The search-by-call-sign feature on the leaderboard now provides participant ranking overall within the country and state.
- The state leaderboard has been added to show participants' ranks within a state.

- Participant call signs have been hyperlinked to [www.qrz.com](http://www.qrz.com) for easy lookup.
- A MY VOTA page (<https://vota.arrl.org/my-info.php>) has been added to show overall and state rank information, W1AW portable states contacted, the W1AW portable states still needed to achieve all 50, the schedule of when they are on next, and QSO details (with cursor over points) for more information.

## Hint

For VOTA points, if you are using a call sign that is different than your FCC-assigned personal call sign (on account of your volunteer position having a modest point value or if you believe your point value is at the incorrect volunteer-points tier), please send an email to [vota@arrrl.org](mailto:vota@arrrl.org) with an explanation of your operations, your personal call sign, your volunteer position, the call sign being used, and the duration of the event(s). We will tabulate contacts you make at your volunteer point value.

If you are wondering what the point value is for your call sign, or someone you contact, visit <https://vota.arrrl.org/callPoints.php>.

Send your comments, suggestions, stories, and photos to [vota@arrrl.org](mailto:vota@arrrl.org).

Follow what other VOTA participants are discussing on Facebook at [www.facebook.com/hashtag/volunteersontheair](https://www.facebook.com/hashtag/volunteersontheair).

## Strays

### Motus Project Seeks Help from Hams

Glenn Pollock, WA0FMY, volunteered to install a migratory bird telemetry receiver at a nature center.

The Motus Wildlife Tracking System is a collaborative network of automated radio telemetry stations used to track the movements of migratory animals. A growing network of more than 1,500 receiver stations worldwide detect and log VHF or UHF signals emitted from small radio transmitters attached to the animals. The data generated by Motus can help people better understand the effects of climate change, habitat loss,

and human development on migratory animals, and inform conservation decisions for priority species. Motus is a non-profit organization that brings together wildlife conservation efforts throughout the world.

Motus US Director Adam Smith relayed that there is a need for technical help with the radio installations and the resolution of various noise problems that often occur after the installations. If other hams are interested in helping, contact Adam Smith at [asmith@abcbirds.org](mailto:asmith@abcbirds.org) or Glenn at [pollockg@cox.net](mailto:pollockg@cox.net).



## Club Station

# High School Students Thrive on Ham Radio Curriculum

*For nearly 10 years, Council Rock High School South in Holland, Pennsylvania, has maintained an amateur radio club for its students. In this month's column, Council Rock High School South Amateur Radio Club, KC3JND, members Taylor Arnosky, KC3WFW, and Alba Sinani share how science teachers Jerry Fetter, K3OHI; Jeff Warmkessel, KC3EYC, and Joe Warwick, KB3ZED, took a multidisciplinary approach to incorporating ham radio into the school's curriculum.*

KC3JND was founded in 2014 by K3OHI, KC3EYC, and KB3ZED. In the program and across multiple academic disciplines, students work side by side with technical advisors from the local ham radio community to build and operate a club station at the school. Students also learn about propagation, as well as topics unrelated to ham radio, such as internal and external public relations, writing press releases, and reaching out to local news outlets.

Fetter shared that thoughts of a club first began back in 2003. The three science teachers knew they needed to engage with local radio clubs for help, and they were referred to Andy Vavra, KD3RF. With his help, they created a team of technical advisors in satellite communications from Warminster Amateur Radio Club, K3DN, and Frankford Radio Club, W3FRC, that included Vavra; Bill Ballantine, K3FMQ; Irwin Darack, KD3TB; Joe Horanzy, AA3JH, and Michael Shanblatt, W3MAS.

### Activities Keep the Interest Alive

The club has 75 members this year, and it draws a diverse group of students. Some club members are more oriented toward radio, while others are more focused on hands-on engineering or have interests in the web, photography, writing, or public relations.

KC3JND's founding members have taken advantage of multiple activities, such as foxhunts, School Club Roundup, weather balloon launches, and the ARISS program created and managed by NASA. Fetter explained how activities like these contribute to student growth:



Bill Ballantine, K3FMQ, assists Aaron Yang and Elodie Tu with operating a radio and logging contacts for School Club Roundup. [Photo courtesy of KC3JND]

It's great to get involved because of what this experience brings to our student members, and the opportunities, including scholarships, that open up to them as a result of being involved in the club.

In early May of this year, the club participated in an ARISS contact with US Navy submariner and NASA astronaut Stephen Bowen, KI5BKB, on board the International Space Station (ISS). Eighteen students spoke with Bowen during a lengthy high-elevation pass. This was the third time Council Rock High School South students had spoken with astronauts on the ISS since 2014.

### Building the Station

In late 2014, K3OHI, KC3EYC, and KB3ZED had just applied for the ARISS program when a retiring ARISS coordinator offered to donate the VHF equipment, antennas, and azimuth and elevation rotators that the school needed for the potential contact. This donation set the stage for the school's first ARISS contact and kicked preparations into high gear. Vavra said:





Joe Horanzy, AA3JH (center), briefs Matt Floyd, KC3SFG, and Faith Giedrycz on azimuth and elevation rotator operation, while Michael Shanblatt, W3MAS (right), works with Hannah Erickson on preparing rotator control cables. [Photo courtesy of KC3JND]

We could not have done it without the equipment that was donated to the school. Literally everything we started with came from others, either from the ARISS coordinator or local ham clubs, or it was donated by the technical advisors. Success breeds success, and now that the club has achieved three ARISS contacts with the ISS, the school's administration has been forthcoming with additional funding to build a state-of-the-art HF, VHF, and satellite station.

## Firsthand Experiences

KC3JND makes a positive impact on the lives of all the students involved in the club. A few of them shared how they've been affected by being a member.

Laura Floyd, KC3GWL, led the club's second ARISS contact in 2014, which generated a buzz in the local media. She has since graduated from college on a full scholarship. Laura's brother Matt, KC3SFG, has gained practical knowledge and hands-on experience in electronics and engineering, which he plans to pursue in college.

Paulina Royzman, KC3SFM, was a club member for 4 years and graduated this year. She learned technical skills and gained on-the-air experience, as well as served as one of the club's public relations and community outreach members. When asked about her experiences, Paulina said:

Talking over the radio surpassed the bounds of communications for me on a global scale. The ability to speak with people from all walks of life, cultures, and places — even an astronaut on the ISS — was an awesome experience I will remember for the rest of my life.

David Chanin also graduated this year and served as one of the club's public relations and community outreach

members. He shared that what he learned from working with newspaper and TV reporters boosted his confidence and helped him communicate more effectively with others. He spoke about his time as an intern for a law firm during the summer:

I was working on a project for the law firm and quickly flashed back to my time at the radio club. I used some of the skills I learned at the club when I negotiated with medical writers to write an article on the lawyer's behalf.

## Parting Thoughts

At the end of the 2023 academic year, KC3JND held an online training and test session that resulted in nine new Technician licensees, which is a notable accomplishment. The club prides itself on building a community of passionate and committed members from multiple academic disciplines. Students gain valuable skills and experience in STEM subjects, astronomy, meteorology, public relations, web design, and marketing that can lead to a wealth of opportunities when they enter the workforce. Activities offered by the club have helped foster an awareness and interest throughout the school district and the community about amateur radio and the benefits it provides.

## Write for "Club Station"

QST's "Club Station" column is a designated space for clubs to share specific and practical ideas about what has contributed to their success, in the hope that the information will help other clubs grow and thrive. Visit [www.arrl.org/qst-club-station-guidelines-and-profile-form](http://www.arrl.org/qst-club-station-guidelines-and-profile-form) for more information, including author guidelines and a Club Profile Form (this form is required in order for "Club Station" submissions to be considered complete).

## ARRL Special Service Clubs

ARRL offers the Special Service Club (SSC) program for clubs that demonstrate that they're working to improve the amateur radio community by completing special projects, holding license classes, and working with local groups on events, among other activities. Visit [www.arrl.org/ssc-application](http://www.arrl.org/ssc-application) for more information about this program. Below is a list of new and renewing SSCs as of June 20, 2023.

### Renewing SSCs

Sierra Amateur Radio Club of the  
High Mojave, WA6YBN



Ridgecrest, CA



## Ham Media Playlist

# Temporarily Offline — Diving Deep into Ham Radio

Usually, when people hear the words “temporarily offline,” they think something went wrong. Maybe their favorite radio station or website is down, or their internet connection is not working. In this case, however, it indicates something that went right. “Temporarily Offline” is Steve McGrane’s, KM9G, YouTube channel (<https://youtube.com/temporarilyoffline>), and it is definitely not offline!

### Taking an Interest in Technology

Steve is an Amateur Extra-class radio operator based in Wisconsin. He took an interest in technology as a young child, spending much time playing around on an old MS-DOS personal computer. Eventually, he noticed amateur radio license plates, which prompted him to find out more.

His parents, noticing his interest, purchased computer magazines for Steve and signed him up for the “Shareware of the Month Club.” Other members of his community took note of his interest and gave him older hardware to experiment with and learn from. Steve’s first mentor was essentially a community of mentors.

It wasn’t until Steve broke his parents’ computer one summer that he was forced to put all of his experimentation and learning to the test. His father simply told Steve, “You broke it, you fix it...by the end of summer.” With a sense of urgency he hadn’t experienced before, Steve got to work on the broken PC. Eventually, he found the issue and was able to get the computer back online. It turned out that the PC was only “temporarily offline.” Having had that first success, his confidence grew, and he continued to experiment and learn. Steve learned a valuable lesson that summer — approach every problem with confidence.

### Teaching via “Temporarily Offline”

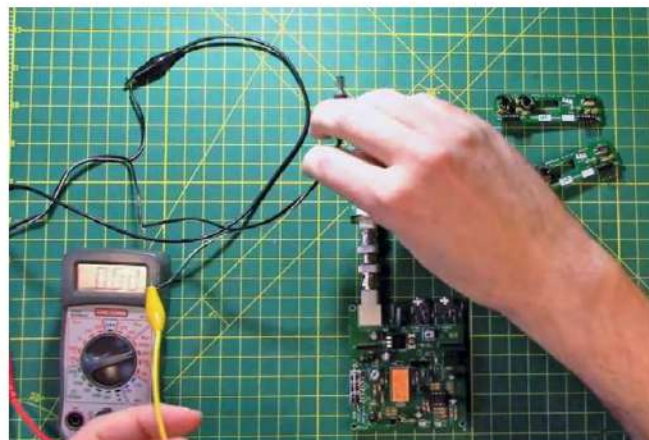
Steve has always wanted to be a teacher of sorts, but being a traditional schoolteacher just wasn’t for him. Instead, he uses his YouTube channel as a platform to satisfy his desire to teach others. When Steve first earned his amateur radio license, and after setting up

his first ham shack, he wanted a radio. Being the experimenter and tinkerer that he is, Steve decided to build one.

When Steve was building the kit that he’d chosen — the QRPGuys DSB Transceiver Kit — he realized that others might be interested in building the kit as well, so he filmed the build (you can watch “How to Build a Low Power Radio – QRPGuys DSB Transceiver Kit #1” at <https://tinyurl.com/to-kitbuild>). He started by going over the kit, explaining some of the basic assembly instructions, and pointing out the kit’s features. He then dove into the build, separating the parts. This may seem like a waste of video time, but for kit building, it’s an important starting point. Steve provided tips and tricks to help get viewers off to a good start and avoid problems later. Over the course of five videos, Steve took viewers through the entire build and testing of the radio. (As a side note, if you want to brush up on your digital multimeter skills, Steve created a course on the ARRL Learning Center website, at <https://learn.arrl.org>, to help get you up to speed.)

### Diving into the Rabbit Hole

Temporarily Offline is different from most other amateur radio YouTube channels. While other HamTubers cover



In the final video of his QRPGuys DSB Transceiver Kit build series, Steve McGrane, KM9G, demonstrates how to test the radio before putting it on the air.





Steve McGrane, KM9G, demonstrates operating FT8 by using just his Android cell phone and a radio in a video titled “FT8 From your ANDROID! – FT8CN.”

only the surface of a broad range of topics, Steve tends to dive deeper into the details. A self-proclaimed “rabbit hole guy,” he is well-known for finding something interesting and drilling down to the nitty-gritty, exploring everything he possibly can about a topic or device.

Currently, Steve is diving into the automatic packet reporting system (APRS). Combining his interest in both retro computers and technology, he enjoys using a vintage Commodore 64 computer to communicate with the International Space Station and other amateur radio operators around the world. Steve is working on a game that will use APRS as its backbone. Of course, Steve’s kit will be in the form of a portable go-box, and he will document his build and progress on his channel as he goes.

More than just a HamTuber, Steve is an advocate for engaging youth in wireless technology. He finds ways to get kids (including his own) interested in amateur radio. Steve also has a keen interest in helping to increase girls’ participation in STEM fields. His daughters can be seen in many of his videos doing POTA activations, going to NASA Space Camp, and helping set up antennas. Steve has supported teachers getting students on the air, by sending equipment, including radios, and offering to serve as a Volunteer Examiner for remote testing sessions.

In his video titled “Xiegu X6100 Rooted! The Sky Is The Limit Now!” (<https://tinyurl.com/to-rooted>), Steve dove into the Xiegu X6100 to see whether the radio was running Linux. After some quick testing he discovered that it did, in fact, run Linux, and this finding opened up all sorts of opportunities for experimentation. What I like best about this series of videos is not what he was able to make the radio do (though that is impressive), but that this sort of experimenting and tinkering is exactly what we need to engage youth who are also interested in computers, hacking, and wireless technology. Steve’s series demonstrates how to solve problems and inspire others to take an interest and try something new.

Steve likes to be on the cutting edge of new opportunities in amateur radio. In his video titled “FT8 From your ANDROID! – FT8CN” (<https://tinyurl.com/TO-ft8>), Steve looks at an Android app that allows users to connect their radio to their phone and operate FT8. Although it is very early in the development stages, Steve digs into it, providing yet another example of a way to reach out to a group of hams, or potential hams, to get them engaged.

So, if you are looking for in-depth content with a technical focus, Temporarily Offline may be the perfect YouTube channel for you.



## How's DX?

# Ducie Island RIB DXpedition, VP6A, 2023

*In this month's column, guest author George Wallner, AA7JV, writes about how the VP6A team broke new ground with a remote operation on the 56th most-wanted DXCC entity.*

The VP6A team went to Ducie Island, VP6/D, on June 11 – 24, 2023, to prove that we can effectively conduct a DXpedition with reduced logistics and minimal environmental impact. Ducie Island is a small, remote atoll located in the South Pacific, about 300 nautical miles east of Pitcairn Island, VP6. We traveled to Ducie on board the motor catamaran, *Magnet*. There were two important innovations that enabled us to achieve our goals on Ducie: the Radio in a Box (RIB), which let us operate without camping on the island, and the Starlink satellite service, which allowed us to have remote operators.

A RIB is a complete station in a weathertight box. Ours were controlled via a UHF data link from the boat, where the local operators were. The RIBs were water-cooled, and they contained FLEX-6700 software-defined radios (SDRs), power supplies, and remote monitoring and control systems. This arrangement not only eliminated the need for camping, but it also shortened the assembly and disassembly time. For more information about RIBs, read the January 2022 "How's DX?" column.

Only Mike Snow, KN4EEI; Gregg Marco, W6IZT, and I, AA7JV, went to Ducie. Our original plan was to anchor on the southwest side of the atoll and set up the stations across the lagoon, on the beach of nearby Pandora Islet.



Mike Snow, KN4EEI, aboard the *Magnet*, handling the single sideband pileups while monitoring the remote station computers. The computers to his right corresponded to the remote stations on the island, which were being operated by hams around the world. [George Wallner, AA7JV, photo]

Upon our mid-morning arrival on June 11, the south side, including the entrance to the lagoon, was completely blocked by 12-foot waves and heavy surf. We slowly cruised around the atoll and found that the waters off the north shore were much calmer. Although this was an exposed open shore studded with sharp rocks, it was our only option. We knew from the weather forecast that we would have 3 days to put the stations ashore and get them on the air. After that period, strong northerly winds would make the location untenable for the boat, and impossible for us to land. We anchored the *Magnet* on the edge of the deepwater drop-off — a precarious position — and immediately went to work.

To quickly set up and move equipment onto the island, and to reduce our footprint, we built a pontoon RIB boat, complete with wheels, to roll up the beach. It carried the RIBs and all of the antenna equipment, and it was pre-wired with generators, batteries, and the UHF data link. The following afternoon was spent building a suitable ramp for the RIB boat.

### Launching the RIB Boat

The next morning, we launched the RIB boat from the *Magnet* at 9:00 AM. We wound our way through the coral and climbed ashore in about 20 minutes. We raised the antennas, and the first three stations were on the air by lunchtime. On the third day, we set up the fourth station and its corresponding antenna. Once a day thereafter,





The RIBs, the RIB boat, and the antennas on Ducie Island during the VP6A operation. [George Wallner, AA7JV, photo]

## Weather Trouble

The weather became increasingly dangerous. In anticipation of difficult conditions, we stockpiled fuel on the island ahead of time. To get to the RIBs, refuel the generators, and repair the antennas, we used an inflatable dinghy to land on the shore. From there, it was a half-mile walk to reach the stations. We had to move the boat again on the eighth day, and we anchored it only about 200 yards from 10-foot-tall waves rolling ashore — they were beautiful, but hazardous. In the middle of the 10th night, the winds reached gale force (60 miles per hour) and our anchor broke loose. We managed to retrieve it during the height of the storm, but by then, the boat had been blown more than a mile offshore. We carefully worked our way back and anchored once more.

we returned to the island to do general maintenance, build new antennas, and refuel the generators.

The weather change arrived on the fourth day, as predicted. The wind and waves forced us to move the boat to the island's southeast side. Fortunately, the UHF data link remained intact, and the radios continued operating without interruptions.

## Remote Operators on Standby

There were four stations on the air; three of them were remotely operated by people from around the world. The call signs of those participants are as follows: 9V1YC, AA1V, AA7A, CT1BOH, CT1EEB, CT1ILT, DJ4MX, F6EXV, JN1THL, KC1KUG, KY7M, KD4Z, KL7YL, KO8SCA, K1DG, K4NHW, K6GFJ, K6TD, K6UFO, KL2A, K6MM, ND2T, N1DG, N2IC, OH2BH, PB8DX, PY5EG, VE4EA, VE5MX, VK3GK, W0GJ, W1RM, W1VE, and W8HC. One station was remotely operated by those of us aboard the *Magnet*.

Despite these difficulties, the remote operators remained unaware of our ordeal and the stations remained on the air. The weather finally improved by the 12th day, which allowed us to return to the north shore. The waves subsided enough for us to retrieve the stations the following day; we ended transmissions at 8:00 AM (1600 UTC), and we went ashore at 9:00 AM to fetch our equipment. We lowered the antennas and packed the gear onto the RIB boat. Then, we rolled it back into the water and were back on the *Magnet*, with all of the equipment, by 10:50 AM.

## The Recap

The VP6A Ducie operation was the first major DXpedition to use remote operators. Initially, we were able to use only FT8. But by the fifth day, with the help of Gerry Hull, W1VE, we were up and running with remote CW. Remote stations had 100 W output, and the local station had a 1 kW power amplifier in the RIB.

We used two V8 antennas from Thomas Schiller, N6BT: an 80- to 10-meter vertical and a 160- to 10-meter vertical. Both were fed via homebrew

automatic tuners. Although we mostly ran 100 W, our signals were greatly enhanced by their proximity to the salt water. Only our 160-meter antenna had poor performance, as we could not get it close enough to the water.

The importance of utilizing remote operators is twofold — it provides a way to reduce the cost of DXpeditions, and it provides a participation opportunity for hams who can't travel. Remote operator Pete Chamalian, W1RM, commented, "At age 80, going to [a] remote island is not in my future, so doing this sort of thing is truly great."

Overall, we made a total of 62,000 contacts, and we used 80 gallons of fuel (about 5 milliliters per contact). The initial setup took 3 hours, and disassembly took 1 hour and 50 minutes. We were on the air for 13 of the 14 days we spent at Ducie.

Development and construction of the RIB technology were funded by the Northern California DX Foundation. We extensively used FlexRadio SDR technology to ease the remote side of the operation, and DX Engineering provided material support. A number of individuals contributed to the technologies we used: Gregg Marco, W6IZT, provided IT support; Warren Merkel, KD4Z, helped us utilize Node-RED software; Mike Snow, KN4EEI, constructed the RIBs and the RIB boat, and Don Greenbaum, N1DG, managed the remote operators. The people on Pitcairn Island were extremely helpful with getting us the correct permits and licenses. Many thanks to everyone — we hope to work you from our next stop!

## Wrap-Up

That's it for this month, with thanks to George, AA7JV. If you have any DX news, photos, or club newsletters, please forward them to [bernie@dailymdx.com](mailto:bernie@dailymdx.com). Until next month, see you in the pileups! — *Bernie, W3UR*



## The World Above 50 MHz

# A Supposedly Dismal 2023 Sporadic-E Season



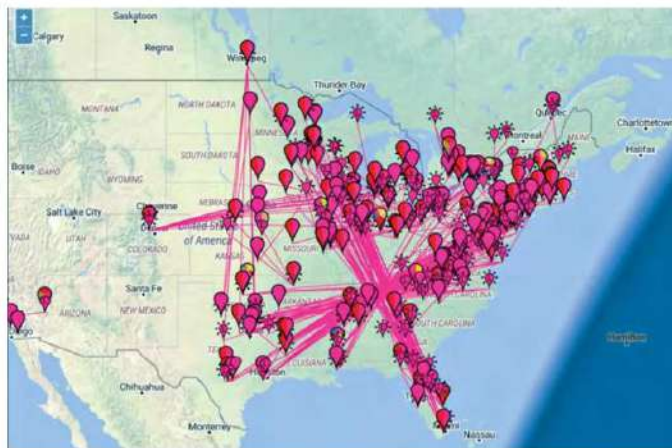
Several commentators felt disappointed by the 2023 summer sporadic-E season, with Rich Zwirko, K1HTV, writing, “June has been less than spectacular.” However, there were some exceptions that I will review in the “On the Bands” section of this column.

Sporadic E has been the primary terrestrial mode of long-distance 6-meter propagation since the decline of Solar Cycle 24. At times, sporadic E can extend thousands of miles and support propagation from North America to Europe, the Middle East, and North Africa, as well as west toward Hawaii and Japan. So, how will the Solar Cycle 25 peak affect sporadic E?

Conventional wisdom states that sporadic E is best during the solar cycle minimum and worst at the maximum. Frank Donovan, W3LPL, expressed the following to the Fred Fish Memorial Award (FFMA) email group:

Weak 6-meter  $E_s$  seasons, on a global scale, seem to strongly correlate with higher sunspot numbers. We had several weak 6-meter  $E_s$  seasons on a global scale during the last solar cycle, and excellent 6-meter  $E_s$  seasons on a global scale during the last solar minimum, including last year, when Solar Cycle 25 was still slowly rising.

But is this always true? Pat Dyer, WA5IYX (SK), kept meticulous records of sporadic-E occurrences in North America from 1972 to 2016. He documented the total minutes per



Lloyd Berg's, N9LB, PSK Reporter screenshot of a 2-meter sporadic-E opening on June 11, during the ARRL June VHF Contest. [[www.pskreporter.info/pskmap](http://www.pskreporter.info/pskmap)]

year that he received commercial FM broadcast stations via sporadic E. When reviewing his data, trends emerge that show significant variation of sporadic E from year to year. Some years had less than 3,000 minutes of  $E_s$ , while peak years had more than 10,000 minutes! During the 1970s, the peak years were 1976 and 1977. Throughout the next decade, 1983, 1987, and 1988 were the best. The 1990s were lower than prior decades, with the top years being 1990 and 1995.

Solar Cycles 20, 21, and 22 took place during the years that Pat made his observations. The years 1976 and 1977 occurred during Solar Cycle 20's minimum. Solar Cycle 21's decline was happening in 1983. Then, 1987 was at the minimum of Solar Cycle 22, but by the next year, it began elevating to a peak in 1990 before reaching another minimum in 1995. Pat also kept records of spo-

radic E during North America's summer  $E_s$  seasons from 2000 to 2016. The top years were 2000, 2009, and 2011. 2000 was at the peak of Solar Cycle 23. At the minimum was 2009, and in 2011, the first peak of Solar Cycle 24 was taking place.

From this data, we can conclude that peak years for sporadic E are more frequent during solar minimums, though it is also true that good years took place amid solar cycle peaks — even in a poor year, there can be some good days. The relationship between solar cycle peaks and sporadic-E occurrence is not clear. Scientists still have only a limited understanding of what causes sporadic E. It appears that VHF operators may experience strong sporadic E, even at Solar Cycle 25's peak. Frank noted, “With the advent of tools such as PSK Reporter, we have more data than ever that [can] be investigated by researchers.”



## On the Bands

**50 MHz.** There were some eventful days in June despite many dry stretches. The ARRL June VHF Contest and June 12 were outstanding. On June 3, Nelson, KD2CYU (FN20), worked D2UY. On June 5, Mike, K7ULS (DN41), worked both Europe and Japan in one afternoon. Just 2 days later, Steve, NN4X (EL98), worked KH6HI (BL01) and AH6U. N7PHY/P was busy from DN38. I, NØJK (EM28), worked LU8YD (FF51) as a result of E<sub>s</sub>-to-transequatorial propagation (TEP). On June 10, Fred, KH7Y (CM98), worked SV9CVY and SV1DH. I decoded JR3REX (PM74) with a whip antenna and a fixed mobile setup. Greg, WQØP (EM19), worked many Japanese stations. WB7AEA (CN85) worked N4SVC (EM80) on SSB with a dipole antenna. Then, on June 11, I worked three Japanese stations while single-operator portable and running 10 W. Jay, KØGU (DN70), made 75 European contacts for the June VHF contest and said it was his “best day to Europe ever!”

June 12 was an amazing day. Mike, K7ULS, from Utah, worked 9K2GS, 9K2GR, UN9L, UN7CL, and many European stations. 9K2GS and A71VV were in on single-frame decodes about every 5 minutes, starting at 1400 UTC, for WQØP, KFØM, NØJK, NØLL, and KØBJ in Kansas. Later, the opening included most of Europe, and I worked IK5YJY. KH7Y worked 9H1TX. John, KØJY (DM68), achieved his DXCC on 6 meters by working YU3TA and UN9L. Jay, KØGU (DN70), worked many European stations and 9K2GS (LL39), EK/RX3DPK (LN20), and A71VV (LL55) for his DXCC #162, as well as UN7ECA for #163 and RD9D for #164.

By June 13, the band cooled off, but Mario, K2ZD, found D2UY for an all-time new one at 2015 UTC. Rich, K1HTV (FM18), decoded A71VV at around 1307 UTC. On June 20, K1HTV worked D2UY, too. NØSL

(EN42) made his first 6-meter contacts with AJ4F (EL29) and KA5CRL (EM02) while using a Butternut vertical antenna. Then, on June 24, Robert, 3B9FR, received WW1L (FN55) at 1557 UTC. John, KL7HBK, worked VK6NH and VK6TM the next day at 0810 UTC. NØALJ (EM26) had an early-morning contact with XE3N (EL60) at 1130 UTC on E<sub>s</sub>. That afternoon featured a rare and strong E<sub>s</sub>-to-TEP opening from the midwest to Brazil. I found Fred, PY2XB (GG66), with a loud signal for nearly an hour on FT8. AAØMZ (EM29) was able to work Fred with a dipole antenna. PY5CC was also in, and a coronal mass ejection impact at 1900 UTC may have increased the TEP maximum usable frequency. These openings are rare during the summer, and they may be more common in September. On June 27, Tac, JA7QVI, worked K7BWH/R in DN02. K1HTV found FP/KV1J, 4O3A, FJ/K3TRM, and OK1NP. KD2CYU also worked FP/KV1J. The E<sub>s</sub> continued into July, with K1HTV reporting that July 5 was in particularly well to North Europe.

**144 MHz.** There was exceptionally strong and widespread sporadic E in the afternoon of June 11, which coincided with the ARRL June VHF Contest. Jim, K5ND (EM12), worked stations in grids FM05, FM06, FM16, and FM27, in addition to two stations in Manitoba, Canada. Ronald, K3FR (FM18), worked K5QE (EM31) with his indoor Yagi. Tor Clay, N4OGW (EM53), worked double-hop E<sub>s</sub> to K7KQA (DN06) and K7POJ (CN83) at a 2,951-kilometer distance. NØLL (EM09) logged W7MEM (DN17). Lloyd, N9LB (EN52), noted strong E<sub>s</sub> between 2200 and 2300 UTC to AC4TO (EM70), KC5MVZ (DM93), W4IFI (DM57), and W4AS (EL95). He noted an E<sub>s</sub> cloud over Tennessee based on intersecting E<sub>s</sub> paths. WQØP (EM19) logged stations in Florida and Idaho, and Lou, KT1R (FM09), put Texas in his log. K1HTV (FM18) logged W5EME (EM32) and K5QE (EM31). George, NE2U (FN20),

worked WB5TUF (EL29), W5EME, and K5QE on FT8, and he made additional contacts on SSB. N4OGW logged NØUD/R (DN76), who was running 50 W and using a four-element Yagi. Jim, KC7QY (DM64), worked N9UM (EN52) on SSB with 50 W and a seven-element Yagi. There was tropospheric propagation from Kansas to Texas on June 20. NØKQY (DM98) worked N7BHC (EL15) on FT8.

**1296 MHz.** Linda Straubel, N9LHS, achieved WAS #20 on 1296 MHz on May 14, 2023. All but one of her contacts were via EME. She is the first woman to achieve WAS on 1296 MHz. Her husband is David Kerl, N9HF. Jeff, W7JW, achieved WAS as well.



Linda Straubel, N9LHS, with her 1296 MHz WAS certificate. [David Kerl, N9HF, photo]

## Here and There

Jeff Wheeler, W7JW (EN82), qualified for the FFMA. He stated, “It’s [the] guys that rove that make it all possible for the rest of us.” Dave Swanson, KG5CCI, also achieved the FFMA by working K7KQA/R in DN05. Paul “Lefty” Clement, K1TOL (FN44), worked KN6UWK (DM02) for his final grid on July 9.

The W6JKV and K5AND Six Meter BBQ will be held on September 29 – 30, 2023, in Austin, Texas. For more information, visit [www.w6jvk5andbbq.com](http://www.w6jvk5andbbq.com).



## Special Event Stations

Working special event stations is an enjoyable way to help commemorate history. Many provide a special QSL card or certificate!

**Through Dec. 31, 0000Z – 2359Z, 8580AA**, Västerås, Sweden. Västerås Radioklubb. **80th Anniversary**. All bands, all modes; 2 – 160 meters. Certificate. See website for QSL information. *This is an operating event.* [www.sk5aa.se](http://www.sk5aa.se)

**Through Dec. 31, 0000Z – 2359Z, K5PRK/50**, Plano, TX. Plano Amateur Radio Klub. **Plano Amateur Radio Klub 50th Anniversary Special Activation**. 14.160. QSL. Plano Amateur Radio Klub, P.O. Box 860435, Plano, TX 75086. *Club members will be activating K5PRK with a /50 suffix throughout the year.* <http://K5PRK.net>

**Aug. 10 – Aug. 25, 0810Z – 0825Z, W5R**, Waco, TX. Heart Of Texas DX Society (W5DXS). **Texas Rangers 200th Anniversary**. 28.437. Certificate & QSL. Larry Merritt, 3200 Colcord Ave., Waco, TX 76707. <http://w5dxs.tripod.com>

**Aug. 19 – Aug. 20, 0001Z – 0024Z, W2DAR**, Swans Island, ME. **International Lighthouse/Lightship Weekend ILLW — Burnt Harbor Lighthouse**. 14.200. QSL. Ron Jocher, 24 Park Ter., East Hanover, NJ 07936.

**Aug. 25 – Aug. 27, 2000Z – 2200Z, W4D**, Dallas, GA. The Silver Comet Amateur Radio Society (W4RSC). **Lee de Forest Birthday Celebration**. 3.60 – 4.00, 7.100 – 7.300, 14.150 – 14.325, 24.00 – 28.00. Certificate & QSL. Silver Comet Amateur Radio Society, P.O. Box 1873, Hiram, GA 30141. [www.silvercometars.org](http://www.silvercometars.org)

**Aug. 26 – Sep. 9, 0000Z – 2359Z, K9A**, Auburn, IN. Northeastern Indiana Amateur Radio Association (W9OU). **Auburn Cord Duesenberg Festival Special Event Station K9A**. 40, 20, and 10 meters; 7.180 14.250 28.350 MHz. Certificate & QSL. Auburn Cord Duesenberg Festival Special Event Station K9A, P.O. Box 145, Auburn, IN 46706. See website for information on receiving a QSL or certificate. [w9ou@arrl.net](mailto:w9ou@arrl.net) or [www.w9ou.org](http://www.w9ou.org)

**Sep. 2, 1200Z – 1800Z, W9EBN**, Marion, IN. Grant County Amateur Radio Club. **32nd Annual Fly/In Cruise/In**. 7.260 14.250 21.350; D-STAR: Ref #24; DMR: talkgroup/3100 Nation and talkgroup/31656 America Link. Certificate & QSL. Grant County Amateur Radio Club, c/o L.B. Nickerson, K9NQW, P.O. Box 1786, Marion, IN 46952. [www.grantarc.net](http://www.grantarc.net)

**Sep. 2, 1500Z – 2100Z, W5R**, North Little Rock, AR. Pine Bluff Amateur Radio Club. **V-J Day at the USS Razorback**. 7.285 14.074 14.283; FT8. QSL. Dr. Michael Gunter, W5KZ, 8719 Middle Warren Rd., Pine Bluff, AR 71603. [www.qrz.com/db/w5r](http://www.qrz.com/db/w5r), [w5kz@arrl.net](mailto:w5kz@arrl.net) or [www.pbarc.net](http://www.pbarc.net)

**Sep. 2, 1500Z – 2030Z, W5KID**, Baton Rouge, LA. Baton Rouge Amateur Radio Club. **V-J Day Remembrance**. 7.040 7.250 14.040 14.250; CW, SSB, FT8. QSL. USS Kidd Amateur Radio Club, 305 S. River Rd., Baton Rouge, LA 70802. *Operating aboard the USS Kidd (DD-661).* [www.qrz.com/db/w5kid](http://www.qrz.com/db/w5kid)

**Sep. 2 – Sep. 4, 1600Z – 1600Z, K7RDG**, Sierra Vista, AZ. Cochise Amateur Radio Association. **Return to Paradise, 45th Anniversary**. 3.890 7.225 14.070 14.285; voice, FT8/FT4/JS8. Certificate. Cochise ARA, P.O. Box 1855, Sierra Vista, AZ 85636-1855. [www.k7rdg.org](http://www.k7rdg.org)

**Sep. 3, 1300Z – 2100Z, W4CA**, Roanoke, VA. Roanoke Valley Amateur Radio Club. **Blue Ridge Bonanza**. 7.265 14.265. QSL. Roanoke Valley ARC, P.O. Box 2002, Roanoke, VA 24009. *Multiple stations and frequencies, 20 and 40 meters along the Blue Ridge Parkway.* <https://blueridgebonanza.info>

**Sep. 8 – Sep. 10, 1230Z – 1930Z, W4G**, Villa Rica, GA. West Georgia Amateur Radio Society. **Villa Rica Gold Rush Special Event**. Certificate. 80, 40, 20, and 15 meters; CW, SSB, and digital. West Georgia Amateur Radio Society, P.O. Box 1535, Carrollton, GA 30117. *Special operation Sep. 9, 1230Z – 1930Z from Pine Mount Gold Museum during the Gold Rush Festival.* [www.wgars.com](http://www.wgars.com)

**Sep. 8 – Sep. 10, 1800Z – 2359Z, W4V**, Winchester, VA. Shenandoah Valley Amateur Radio Club (W4RKC). **Celebrating the Life and Music of the Late Patsy Cline**. 3.845 7.245 14.245 28.345. Certificate & QSL. SVARC, P.O. Box 2273, Winchester, VA 22604. [w4rkcpatsycline.com](http://w4rkcpatsycline.com)

**Sep. 8 – Sep. 12, 0000Z – 0323Z, K4A**, Cordova, AL. Alabama Contest Group. **K4A 9-11 Still in Our Hearts and Mind**. 3.840 7.040 7.190 14.040 14.310 21.040 21.300 28.040 28.400. Certificate & QSL. Robert Beaudoin, 970 Mountainview Rd., Cordova, AL 35550. See website for certificate information. <http://alabamacontestgroup.org> or [wa1fcn@charter.net](mailto:wa1fcn@charter.net)

**Sep. 9, 1300Z – 2100Z, K3S**, Baltimore, MD. Nuclear Ship Savannah Amateur Radio Club. **Nuclear Ship Savannah — Baltimore Defender's Day**. 7 14 21 28. QSL. Ullis Fleming, 980 Patuxent Rd., Odenton, MD 21113. *Operating from the ship. Check spotting networks; we may operate anywhere on 40, 20, 15, or 10 m, SSB or CW.* [qrz.com/db/k3s](http://qrz.com/db/k3s)

**Sep. 9, 1600Z – 2300Z, N16IW**, San Diego, CA. USS Midway Museum Ship. **Commemorating USS Midway Commissioning, September 10, 1945**. 7.250 14.070 14.320; PSK31 D-STAR on PAPA System repeaters. QSL. USS Midway Museum Ship COMEDTRA, 910 N. Harbor Dr., San Diego, CA 92101. [www.qrz.com/db/n16iw](http://www.qrz.com/db/n16iw)

**Sep. 9 – Sep. 10, 1400Z – 0200Z, W0CXX**, Cedar Rapids, IA. Collins Amateur Radio Club. **Celebrating Arthur Collins' Birthday**. 7.180 14.263 21.380 28.380. QSL. Brice Anton-Jensen, 1110 Lyndhurst Dr., Hiawatha, IA 52233. [www.w0cxx.us](http://www.w0cxx.us)

**Sep. 9 – Sep. 10, 1500Z – 2000Z, K2A**, Red Hook, NY. Overlook Mountain Amateur Radio Club. **56th Annual Mid-Hudson RC Society Jamboree at Old Rhinebeck Aerodrome**. 7.250 14.275 21.360; DMR 31368. QSL. Overlook Mountain ARC, P.O. Box 180, West Hurley, NY 12491. [www.omarcclub.org](http://www.omarcclub.org)



**Sep. 9 – Sep. 17, 0000Z – 2359Z, K4MIA**, Loxahatchee, FL. PBSEC. **National POW/MIA Recognition Day**. 7.195 14.265 18.150 28.400. QSL. Michael Bald, 6758 Hall Blvd., Loxahatchee, FL 33470. *Transmitting from a Mark V Navy Seal Special Ops craft on Sep. 15. Please take time to remember our POWs, MIAs, and KIAs, as well as their families. See website for details on operating activities.* [www.qrz.com/db/k4mia](http://www.qrz.com/db/k4mia)

**Sep. 9 – Sep. 17, 0000Z – 2359Z, W6JBT**, San Bernardino, CA. Citrus Belt Amateur Radio Club. **Route 66 On The Air**. 3.866 7.266 14.266 28.466. Certificate & QSL. Citrus Belt Amateur Radio Club, P.O. Box 3788, San Bernardino, CA 92413. *Many participating clubs. See the host website for rules, frequencies, certificate and QSL, and routes of participating clubs.* [www.w6jbt.org](http://www.w6jbt.org)

**Sep. 9 – Sep. 17, 0000Z – 2359Z, W6H**, Rio Rancho, NM. Albuquerque DX Association. **Route 66 On The Air**. 3.866 7.266 14.033 14.266. QSL. Bill Mader, 4701 Sombrete Rd. SE, Rio Rancho, NM 87124. *New Mexico team information at [www.qrz.com/db/w6h](http://www.qrz.com/db/w6h). Certificates at [www.w6jbt.org](http://www.w6jbt.org). [k8te@arrl.net](mailto:k8te@arrl.net)*

**Sep. 10 – Sep. 16, 1100Z – 1700Z, N2F**, Downsview, NY. Northeast Electric Aircraft Technology. **NEAT Fair 2023 24th Year**. 7.190 14.265 24.950 28.420. Certificate & QSL. Ed Bassick, 380 Halley Ave., Fairfield, CT 06825. [www.neatfair.org](http://www.neatfair.org)

**Sep. 10 – Sep. 24, 1200Z – 2300Z, W5R**, Ponca City, OK. Kay County Amateur Radio Club. **Cherokee Strip Land Run and POTA**. 14.275. QSL. John Summers, W0DY, 2516 Windsor Rd., Ponca City, OK 74601. *Pioneer Woman Museum activation, POTA Park K-8646, Sat., Sep. 16.* [www.kaycountyhams.com](http://www.kaycountyhams.com)

**Sep. 15, 1800Z – 2100Z, N3TAL**, Lanham, MD. American Legion Post 275 Radio Team. **National POW/MIA Recognition Day**. 7.275. QSL. American Legion Post 275 ART Team, 8201 Martin Luther King Jr. Hwy., Lanham, MD 20706. [n3tal275@gmail.com](mailto:n3tal275@gmail.com) or [www.qrz.com/db/n3tal](http://www.qrz.com/db/n3tal)

**Sep. 16, 0100Z – 0800Z, N3SLC**, Holtwood, PA. State Line Radio Club. **State Line Radio Club Annual Picnic**. 7.265 14.335 28.385. QSL. Edward Reichenbach, 108 Park Cir., Elkton, MD 21921. *From Muddy Run Park, Holtwood, PA; open to the public.* [www.n3slc.org](http://www.n3slc.org)

**Sep. 16 – Sep. 17, 1700Z – 1800Z, W9DUP**, Lisle, IL. DuPage Amateur Radio Club. **75 Year Anniversary of ARRL Affiliation**. 3.885 14.045 14.070 14.274. Certificate. Brian Eder, P.O. Box 71, Clarendon Hills, IL 60514-0071. [www.w9dup.org](http://www.w9dup.org)

**Sep. 21 – Sep. 25, 1100Z – 2200Z, W9S**, East Peoria, IL. W.D. Boyce Council BSA. **50th Anniversary Camporee**. 3.905 7.225 10.136 14.275; 75, 40, 30, and 20 meters, phone and digital modes. Certificate & QSL. Craig Worrick, 101 S. Inglewood, East Peoria, IL 61611. [sharpshooter729@gmail.com](mailto:sharpshooter729@gmail.com)

**Sep. 23, 0800Z – 1800Z, K1SV**, Arlington, VT. Southern Vermont Amateur Radio Club. **Covered Bridge Special Event**. 7.245 14.318 28.333 146.520. Certificate & QSL. Alden Jones IV, 222 Northside Dr., Bennington, VT 05201. [www.sovarc.org](http://www.sovarc.org)

**Sep. 23, 1400Z – 1800Z, W4ABZ**, Chickamauga, GA. Ringgold Amateur Radio Club. **160th Anniversary of the Battle of Chickamauga**. 7.265 14.265. Certificate. Jim Skeen, 224 Smith Liner Rd., Chickamauga, GA 30707. [www.qrz.com/db/w4abz](http://www.qrz.com/db/w4abz)

**Sep. 23, 1400Z – 2000Z, KS0LV**, Leavenworth, KS. Pilot Knob Amateur Radio Club. **Fred Harvey House Museum on the Air**. 7.230 14.250 18.100 21.074; SSB and FT8. Certificate. PKARC, 34058 167th St., Leavenworth, KS 66048. [www.pkarc.net](http://www.pkarc.net)

**Sep. 23, 1400Z – 2200Z, W8PAR**, Parkersburg, WV. Parkersburg Amateur Radio Klub. **Volcano Days — West Virginia Oil and Gas History**. 7.200 14.225; FT8. Certificate & QSL. Jerry Wharton, KA8NJW, 1722 20th St., Parkersburg, WV 26101. [www.w8par.org](http://www.w8par.org)

**Sep. 23, 1500Z – 2300Z and Sep. 24, 1500Z – 1900Z, N0N**, Johnson, NE. SouthEast Nebraska Radio Club (W9WKP). **SENRC 87th Anniversary**. 7.200. Certificate & QSL. Chuck Bennett, KC0PTK, P.O. Box 67181, Johnson, NE 68506. [senebrradioclub@gmail.com](mailto:senebrradioclub@gmail.com) or [www.facebook.com/SENRC](http://www.facebook.com/SENRC)

**Sep. 24 – Sep. 26, 0000Z – 2100Z, W0M**, St. Peters, MO. Family Motor Coach Association. **FMCA-ARC Fall Rally/POTA**. 7.040 7.240 14.040 14.260. QSL. John Bechtoldt, 1418 South Yale Dr., O'Fallon, IL 62269. *POTA at Gateway Arch on Sep. 25.* [www.fmcaarc.com](http://www.fmcaarc.com)

**Sep. 25 – Oct 7, 1700Z – 1700Z, WR4CC**, Elizabethton, TN. Carter County Amateur Radio Association. **243 Anniversary Muster at Sycamore Shoals on the Watauga River and March to Kings Mountain**. 3.900 7.075 14.290 21.350. QSL. Larry Davis, KM4RWO, 172 Carl Taylor Dr., Elizabethton, TN 37643. [www.wr4cc.org](http://www.wr4cc.org)

**Sep. 29 – Oct. 1, 0000Z – 0000Z, W1E**, Prospect, CT. **Elmer Special Event**. 7.040 14.040 14.310 21.040; SSB and CW. Certificate. Rich Guerrero, 19 Terry Rd., Prospect, CT 06712. [www.qrz.com/db/w1e/elmer](http://www.qrz.com/db/w1e/elmer)

**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 (3 units of postage) 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.

**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](http://www.arrl.org/special-events-application), or email information to [events@arrl.org](mailto:events@arrl.org).

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 **December QST** would have to be received by **October 1**. In addition to being listed in *QST*, your event will be listed on the ARRL Web Special Event page. **Note:** All received events are acknowledged. If you do not receive an acknowledgment within a few days, please contact us. ARRL reserves the right to exclude events of a commercial or political nature.

You can view all received Special Events at [www.arrl.org/special-event-stations](http://www.arrl.org/special-event-stations).



# Convention and Hamfest Calendar

**A = AUCTION**  
**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**

## Abbreviations

*Spr* = Sponsor  
*TI* = Talk-in frequency  
*Adm* = Admission

### Alaska (Big Lake) — Sept. 9 **FHRSV**

10 AM – 4 PM. *Spr*: Matanuska ARA. Big Lake Lions Club, 2942 S. Lions Ct. *TI*: 147.30 (141.3 Hz). *Adm*: \$5. [www.k17jfu.com](http://www.k17jfu.com)

### Arizona (Payson) — Oct. 7 **FHTV**

8 AM – noon. *Spr*: Tonto ARA. Ponderosa Bible Church, 1800 N. Beeline Hwy. *TI*: 147.39 (100 Hz). *Adm*: Free. [www.n7tar.org](http://www.n7tar.org)

### Arizona (Tucson) — Oct. 7 **DFHQRT**

7 AM – 11 AM. *Spr*: Radio Society of Tucson. Calvary Tucson Church, 8711 E. Speedway Blvd. *TI*: 147.160 (141.3 Hz). *Adm*: Free. [www.rstclub.org](http://www.rstclub.org)

### Colorado (Longmont) — Oct. 8 **DFHRV**

9 AM – 1 PM. *Spr*: Boulder ARC. Boulder Co. Fairgrounds, 9595 Nelson Rd. *TI*: 146.70 (no tone). *Adm*: \$5 (under 18 free with paid adult). [www.qsl.net/w0dk/barcfest.html](http://www.qsl.net/w0dk/barcfest.html)

## ARRL CONNECTICUT STATE CONVENTION

October 8, North Haven, Connecticut

### **DFHRSV**

8 AM – 1 PM. *Spr*: Meriden ARC. Best Western Hotel/Scarlett's Fine Events, 201 Washington Ave. *TI*: 147.96 (162.2 Hz). *Adm*: \$10. [www.nutmeghamfest.com](http://www.nutmeghamfest.com)

### Illinois (Belvidere) — Sept. 24 **DFHRTV**

6 AM – 3 PM. *Spr*: Chicago FM Club. Boone Co. Fairgrounds, 8791 IL-76. *TI*: 146.760 (no tone). *Adm*: \$8 Advance, \$10 door. [www.chicagofmclub.org](http://www.chicagofmclub.org)

### Illinois (Chillicothe) — Sept. 9 **DFHQRSV**

Sat. 8 AM – 4 PM, Sun. 8 AM – 1 PM. *Spr*: Peoria-Area ARC. Three Sisters Park, 17189 IL-29. *TI*: 147.075 (156.7 Hz). *Adm*: \$7 Advance, \$10 door. [www.w9uvi.org/midwest-superfest-2023](http://www.w9uvi.org/midwest-superfest-2023)

## W9DXCC CONVENTION 2023

September 15 – 16, Naperville, Illinois

### **HQRS**

8 AM – 5 PM. *Spr*: Northern Illinois DX Association. Chicago Marriott Naperville, 1801 N. Naper Blvd. *TI*: None. *Adm*: \$60 Advance, \$65 door. Email: [edwa9gqk@yahoo.com](mailto:edwa9gqk@yahoo.com)

### Iowa (Boone) — Oct. 7 **DFHQRTSV**

8 AM – 1 PM. *Spr*: 3900 Club. Boone Co. Fairgrounds Community Building, 1601 Industrial Park Rd. *TI*: 146.850 (114.8 Hz). *Adm*: \$7. [www.3900club.com](http://www.3900club.com)

### Iowa (Columbus Junction) — Oct. 1 **DFHRSV**

7 AM – 2 PM. *Spr*: Muscatine ARC. Louisa Co. Fairgrounds, 101 Fairgrounds Rd. *TI*: 146.985 (192.8 Hz). *Adm*: \$10. [www.muscatinearc.org/se-ia-hamfest](http://www.muscatinearc.org/se-ia-hamfest)

### Iowa (Sioux City) — Sept. 23 **FHRSV**

9 AM – 2 PM. *Spr*: Sooland ARA. Morningside Lutheran Church (lower gym), 700 S. Martha St. *TI*: 146.91 (110.9 Hz). *Adm*: \$5. [www.k0tft.com](http://www.k0tft.com)

## ARRL KANSAS STATE CONVENTION

October 7, Wichita, Kansas

### **DFHRS**

8 AM – 2 PM. *Spr*: Valley Center ARC. RiverWalk Church of Christ, 225 N. Waco Ave. *TI*: 146.94 (103.5 Hz). *Adm*: \$5. [www.vcarc.org](http://www.vcarc.org)

### Kentucky (Lexington) — Oct. 7 **DFHRSV**

7 AM – 3 PM. *Spr*: Bluegrass ARS. Highlands Baptist Church, 2032 Parallel Rd. *TI*: 146.760 (67 Hz). *Adm*: \$5 Advance, \$6 door. [www.bluegrassars.org](http://www.bluegrassars.org)

### Kentucky (Paintsville) — Sept. 30 **FHRV**

8 AM – 2 PM. *Spr*: Amateur Radio Community Services. Paintsville Recreation Center, 232 Preston St. *TI*: 147.225 (127.3 Hz). *Adm*: \$5. Email: [grossl@bigsandybb.com](mailto:grossl@bigsandybb.com)

### Kentucky (Richmond) — Sept. 16 **DFHRTV**

8 AM – 1 PM. *Spr*: Central Kentucky ARS. Madison Co. Fairgrounds, 3237 Old Irvine Rd. *TI*: 145.370 (192.8 Hz, also Fusion). *Adm*: \$7 Advance, \$8 door. [www.ckars.org](http://www.ckars.org)

## ARRL LOUISIANA STATE CONVENTION

October 6 – 7, Slidell, Louisiana

### **DFHRSV**

Fri. 2 PM – 5 PM, Sat. 8 AM – 2:30 PM. *Spr*: Ozone ARC. Slidell Municipal Auditorium, 2056 2nd St. *TI*: 147.270 (114.8 Hz). *Adm*: \$5. [www.w5sla.net/hamfest-2023.htm](http://www.w5sla.net/hamfest-2023.htm)

### Maine (Alexander) — Sept. 16 **DFHRTV**

8 AM – noon. *Spr*: St. Croix Valley ARC. Alexander Elementary School, 1430 Airline Rd. *TI*: 147.330 (118.8 Hz). *Adm*: \$5. [www.stcroixvalleyamateurradioclub.org](http://www.stcroixvalleyamateurradioclub.org)

### Maryland (Maugansville) — Sept. 9 **DHT**

8 AM – noon. *Spr*: Antietam Radio Association. Maugansville Bible Brethren Church, 17904 Binkley Ave. *TI*: 147.09 (100.0 Hz). *Adm*: \$5. [www.w3cwc.org](http://www.w3cwc.org)

### Maryland (West Friendship) — Oct. 1 **DFHQRTV**

8 AM – noon. *Spr*: Columbia ARA. Howard Co. Fairgrounds, 2210 Fairgrounds Rd. *TI*: 147.390 (156.7 Hz). *Adm*: \$10. [www.carafest.org](http://www.carafest.org)

### Michigan (Adrian) — Sept. 17 **DFHRTV**

8 AM. *Spr*: Adrian ARC. Lenawee Co. Airport, 2651 W. Cadmus Rd. *TI*: 145.37 (85.4 Hz). *Adm*: \$5. [www.w8tqe.com](http://www.w8tqe.com)

### Michigan (Berrien Center) — Sept. 23 **FT**

9 AM – 1 PM. *Spr*: Blossomland ARA. Five Pines Ministries, 6597 Smith Rd. *TI*: 146.820 (88.5 Hz). *Adm*: Free. [www.w8mai.org](http://www.w8mai.org)

### Michigan (Gaylord) — Sept. 23 **DHRTV**

9 AM – 1 PM. *Spr*: Top of Michigan ARC, Thunder Bay ARC. Gaylord Knights of Columbus Hall, 2573 Wilkinson Rd. *TI*: 146.82 (118.8 Hz). *Adm*: \$5. [www.nm8rc.org](http://www.nm8rc.org)

### Michigan (Kalamazoo) — Oct. 7 **DFQRSV**

9 AM – 4 PM. *Spr*: SMART, Kalamazoo ARC. Kalamazoo Co. Expo Center and Fairgrounds, 2900 Lake St. *TI*: 147.040 (94.8 Hz). *Adm*: \$8. [www.kalamazoohamfest.com](http://www.kalamazoohamfest.com)

### Michigan (Lansing) — Sept. 23 **FHRV**

10 AM – 1 PM. *Spr*: Central Michigan ARC. West Lansing Church of Christ, 5505 W. St. Joseph Hwy. *TI*: 145.390 (no tone). *Adm*: \$5. Email: [kd8yde@inbox.com](mailto:kd8yde@inbox.com)

### Michigan (Negaunee) — Sept. 16 **FHRS**

9 AM – 1 PM. *Spr*: Hiawatha ARA. Negaunee Township Hall, 42 Hwy M-35. *TI*: 147.270 (100 Hz). *Adm*: \$5. [www.qsl.net/k8lod](http://www.qsl.net/k8lod)



**Michigan (Wyoming) — Sept. 9 DFHQRTV**

8 AM – noon. *Spr:* Grand Rapids ARA. The Home School Building, 5625 Burlingame Ave. SW. *Tl:* 147.26 (94.8 Hz). *Adm:* \$8. [www.w8dc.org/grand-rapids-area-hamfest](http://www.w8dc.org/grand-rapids-area-hamfest)

**Minnesota (Lake Elmo) — Sept. 16 FHT**

8 AM – noon. *Spr:* Metro Area Repeater Association. Helwig Farm, 8247 27th St. N. *Tl:* 146.850 (no tone). *Adm:* Free. Email: [wb0wot@arri.net](mailto:wb0wot@arri.net)

**Minnesota (Plymouth) — Sept. 23 RT**

8 AM – 11:30 AM. *Spr:* Twin City FM Club. West Medicine Lake Community Club, 1705 Forestview Ln. N. *Tl:* 146.76 (114.8 Hz). *Adm:* \$5, \$10 sellers. [www.tcfmc.org](http://www.tcfmc.org)

**Mississippi (Biloxi) — Sept. 16 DFHRSV**

9 AM – 3 PM. *Spr:* Jackson Co. ARA. St. Martin Community Center, 15008 Lemoyne Blvd. *Tl:* 145.11 (123.0 Hz). *Adm:* See website. [www.jcmsara.org/hamfest](http://www.jcmsara.org/hamfest)

**New Jersey (Spring Lake) — Oct. 7 DFHRTV**

7 AM – 1 PM. *Spr:* Ocean Monmouth ARC. Spring Lake Heights Fire Department, 700 6th Ave. *Tl:* 145.110 (127.3 Hz). *Adm:* \$5. [www.n2mo.org](http://www.n2mo.org)

**New Jersey (Tinton Falls) — Sept. 23 DFHQRV**

8 AM – noon. *Spr:* Garden State ARA. MOESC parking lot, 100 Tornillo Way. *Tl:* 147.045 (67 Hz). *Adm:* \$5. [www.gsara.club](http://www.gsara.club)

**New York (Glenham/Fishkill) — Sept. 17 FHQRTV**

8 AM – 1 PM. *Spr:* Mt. Beacon ARC. Slater Chemical Fire Company, 79 Old Glenham Rd. *Tl:* 146.970 (100 Hz). *Adm:* \$5, includes one tailgate space. [www.wr2abb.org](http://www.wr2abb.org)

**New York (Henrietta) — Sept. 26 – 30 DFHS**

See AWA website for times. *Spr:* Antique Wireless Association. RIT Inn & Conference Center, 5257 W. Henrietta Rd. *Tl:* None. *Adm:* See AWA website. [www.antiquewireless.org/homepage](http://www.antiquewireless.org/homepage)

**North Carolina (Asheville) — Sept. 9 FHT**

7 AM – 3 PM. *Spr:* Asheville Radio Museum. A-B Tech Community College, 16 Fernihurst Dr. *Tl:* 146.520 (simplex). *Adm:* Free. [www.avrldiomuseum.org](http://www.avrldiomuseum.org)

**North Carolina (Lexington) — Sept. 23 FV**

8 AM – 1 PM. *Spr:* The Healing Springs Mountain VHF Society. Farmers Market Flea Market, 366 Livestock Market Rd. *Tl:* 146.910 (107.2 Hz). *Adm:* \$5. [www.w4par.org](http://www.w4par.org)

**ARRL DAKOTA DIVISION CONVENTION**

**September 23, West Fargo, North Dakota**

**FHQRSV**

8 AM – 1 PM. *Spr:* Red River Radio Amateurs. Red River Valley Fairgrounds, 1805 Main Ave. W. *Tl:* 145.350 (123 Hz). *Adm:* \$10. [hamfest.rrra.org](http://hamfest.rrra.org)

**Ohio (Berea) — Sept. 24 DFRV**

8 AM – noon. *Spr:* Hamfest Association of Cleveland. Cuyahoga Co. Fairgrounds, 19201 E. Bagley Rd. *Tl:* 145.41 (110.9 Hz), 442.225 (131.8 Hz). *Adm:* \$10. [www.hac.org](http://www.hac.org)

**Oregon (Redmond) — Sept. 30 DFHRSV**

8:30 AM – noon. *Spr:* High Desert Amateur Radio Group. Deschutes County Expo Center, 3800 SW. Airport Way. *Tl:* 146.94 (no tone). *Adm:* \$8 Advance, \$10 door. [www.hidarg.org](http://www.hidarg.org)

**Pennsylvania (East Stroudsburg) — Sept. 17 DFHRTV**

8 AM – 1 PM. *Spr:* Eastern Pennsylvania ARA. Moose Lodge 1336, 705 Stokes Mill Rd. *Tl:* 147.045 (131.8 Hz). *Adm:* \$7. [www.qsl.net/n3is](http://www.qsl.net/n3is)

**ARRL SOUTH CAROLINA SECTION CONVENTION**

**October 7, Rock Hill, South Carolina**

**DFHRSV**

8 AM – 2 PM. *Spr:* York Co. ARS. Covenant Presbyterian Church, 1830 Celanese Rd. *Tl:* 147.030 (88.5 Hz). *Adm:* \$5. [www.ycars.org](http://www.ycars.org)

**RV RADIO NETWORK FALL RALLY**

**September 25 – 29, Fredericksburg, Texas**

**DHRSV**

8 AM – 5 PM. *Spr:* RV Radio Network. The Vineyards of Fredericksburg, 2647 N. US Hwy 87. *Tl:* 146.76 (162.2). *Adm:* \$50 Advance (per person). [www.rvradionetwork.com](http://www.rvradionetwork.com)

**ARRL WASHINGTON STATE CONVENTION**

**September 23, Spokane Valley, Washington**

**DHRSV**

9 AM – 4 PM. *Spr:* KBARA, Inland Empire VHF Club, TRI Cities ARC, DX Association, Palouse Hills ARC. University High School, 12420 E. 32nd Ave. *Tl:* 146.380 (100 Hz). *Adm:* \$5. Email: [davcarleton@gmail.com](mailto:davcarleton@gmail.com)

**ARRL WISCONSIN STATE CONVENTION**

**September 22 – 23, Milwaukee, Wisconsin**

**DQRSV**

Fri. noon – 5 PM, Sat. 9 AM – 3 PM. *Spr:* Ham Radio Outlet Milwaukee. 5710 Good Hope Rd. *Tl:* 145.130 (127.3 Hz). *Adm:* Free. Email: [milwaukee@hamradio.com](mailto:milwaukee@hamradio.com)

**To All Event Sponsors**

Before making a final decision on a date for your event, you are encouraged to check the Hamfest and Convention Database ([www.arri.org/hamfests-and-conventions-calendar](http://www.arri.org/hamfests-and-conventions-calendar)) for events that may already be scheduled in your area on that date. You are also encouraged to register your event with HQ as far in advance as your planning permits. See [www.arri.org/hamfest-convention-application](http://www.arri.org/hamfest-convention-application) for an online registration form. Dates may be recorded up to 2 years in advance.

Events that are sanctioned by ARRL receive special benefits, including an announcement in these listings and online. Sanctioned conventions are also listed in *The ARRL Letter*. In addition, events receive donated ARRL prize certificates and handouts. Once the form has been submitted, your ARRL Director will decide whether to approve the date and provide ARRL sanction.

The deadline for receipt of items for this column is the **1st of the second month preceding publication date**. For example, your information must arrive at HQ by **October 1** to be listed in the **December** issue. Information in this column is accurate as of our deadline; contact the sponsor or check the sponsor's website for possible late changes, driving directions, and other event details. Please note that postal regulations prohibit mention in QST of games of chance, such as raffles or bingo.

Promoting your event is guaranteed to increase attendance. As an approved event sponsor, you are entitled to special discounted rates on QST display advertising and ARRL web banner advertising. Call ARRL's toll-free number at 1-800-243-7768, or email [ads@arri.org](mailto:ads@arri.org).





# This year we are celebrating 50 years of the **ARRL Foundation**

On September 21, 1973, in Hartford, Connecticut, the ARRL Foundation was formed to support the mission of ARRL — in the words of the Foundation's Articles of Incorporation: "To advance the art, science, and societal benefits of the Amateur Radio Service by awarding financial grants and scholarships to individuals and organizations in support of their charitable, educational, and scientific efforts."

As many as 100 scholarships, in amounts ranging from \$500 to \$25,000, are awarded annually to amateur radio operators.

**Celebrating the**



**ARRL  
FOUNDATION**

## **THANK YOU**

to our many donors for making this work possible, and congratulations to the numerous scholarship recipients who have benefited from their generosity.



## At the Foundation

# ARRL Foundation Presents the 2023 Scholarship Recipients

The ARRL Foundation is pleased to present the students selected to receive scholarship awards for 2023. Scholarships are made possible through the generosity of individuals and clubs. This year, 113 scholarships totaling over \$600,000 were awarded. The ARRL Foundation Board of Directors offers these students their best wishes for continued success as they pursue their college degrees. The 2024 application period is expected to open in late October 2023. For more information, please visit [www.arrl.org/scholarship-program](http://www.arrl.org/scholarship-program).



**Omar Abioye,  
KI5KDF**  
The Robert A.  
Rodriguez,  
K5AUW,  
Scholarship



**Andrej  
Antunovikj,  
K8TUN**  
The Clive Frazier,  
K9FWF,  
Scholarship



**Joshua Banister,  
KB4JHB**  
The Amateur  
Radio Digital  
Communications  
(ARDC)  
Scholarship



**McKayla Beldyk,  
KO4NXG**  
The Amateur  
Radio Digital  
Communications  
(ARDC)  
Scholarship



**Benjamin  
Bianco, KO4SXZ**  
The East Coast  
Amateur Radio  
Service (ECARS)  
Scholarship



**Ryan Bibby,  
KN4RQL**  
The North Fulton  
Amateur Radio  
League (NFARL)  
Scholarship



**Ian Bigler,  
KC3DTE**  
The Amateur  
Radio Digital  
Communications  
(ARDC)  
Scholarship



**George Blake,  
W6BDD**  
The Amateur  
Radio Digital  
Communications  
(ARDC)  
Scholarship



**Derek Blowers,  
K7KCGP**  
The Irving W.  
Cook, WA0CGS,  
Scholarship



**Ethan Boyd,  
WV8EHB**  
The Amateur  
Radio Digital  
Communications  
(ARDC)  
Scholarship



**Christopher  
Brault, KD8YVJ**  
The Amateur  
Radio Digital  
Communications  
(ARDC)  
Scholarship



**Jeremy Bullock,  
KC1LQQ**  
The Anthony J.  
(Tony) Medeiros,  
Jr., W1PM,  
Scholarship



**Ethan Clarke,  
AE2EC**  
The Henry  
Broughton,  
K2AE, Memorial  
Scholarship



**Geneva Cline,  
N3VAC**  
The Amateur  
Radio Digital  
Communications  
(ARDC)  
Scholarship



**Caroline Conolly,  
K17AJB**  
The Mary Lou  
Brown  
Scholarship



**Holden Correia-  
Fisher, KD2JPV**  
The Dayton  
Amateur Radio  
Association  
Scholarship



**Justin Davis,  
KN6OJR**  
The Dayton  
Amateur Radio  
Association  
Scholarship



**Alison Dean,  
KO4IOK**  
The Fort Meyers  
Amateur Radio  
Club Scholarship



**Corey Dennen,  
NW1BB**  
The New Eng-  
land Federation  
of Eastern  
Massachusetts  
Amateur Radio  
Associations  
(FEMARA)  
Scholarship



**McKenzie  
Denton,  
KO4GLN**  
The Yasme  
Foundation  
Scholarship



**Steven Drabbant,  
K5ZL**  
The Dayton  
Amateur Radio  
Association  
Scholarship



**Kiera Fehr,  
KO4URC**  
The East Coast  
Amateur Radio  
Service (ECARS)  
Scholarship



**Abigail Finchum,  
AB1BY**  
The New  
England Amateur  
Radio Festival  
(NEAR-Fest)  
Memorial  
Scholarship



**Katherine  
Forson, KT5KMF**  
The Amateur  
Radio Digital  
Communications  
(ARDC)  
Scholarship





**Mackenzie Fravel, KO4JFZ**  
The IRARC Memorial, Joseph P. Rubino, WA4MMD, Scholarship



**Landon Gale, AI7HE**  
The Amateur Radio Digital Communications (ARDC) Scholarship



**Jacob Gardner, KE8NIX**  
The Donald Riebhoff Memorial Scholarship



**James Gavrusenko, KB3ZGX**  
The Potomac Valley Radio Club (PVRC) Scholarship



**Michael Gilbert-Cabaceira, KI5TXS**  
The Robert A. Rodriguez, K5AUW, Scholarship



**Kyle Goble, Jr., KN4WPI**  
The Charles Clarke Cordle Memorial Scholarship



**Trevor Goesch, NØTO**  
The William C. Winscott, N6CHA, Memorial Scholarship



**Adam Goodman, W7OKE**  
The O.M. International Sideband Society (OMISS) Scholarship



**Russell Goss, KD9FAL**  
The Ted, W4VHF, and Itice, K4LVV, Goldthorpe Scholarship



**Joseph Greco, KD2PPY**  
The Carole J. Streeter, KB9JBR, Scholarship



**Michael Grimsley, KF4W**  
The Gwinnett Amateur Radio Society Scholarship



**Elaine Gross, KI7PWR**  
The Richard W. Bendicksen, N7ZL, Memorial Scholarship



**Christopher Harper, KG5TIO**  
The Bill, W2ONV, and Ann Salerno Memorial Scholarship



**Brynn Hebert, KG5KRV**  
The Amateur Radio Digital Communications (ARDC) Scholarship



**Tahmara Hendrickson, KC9UJM**  
The Robert D., W8ST, and Donna J., W9DJS, Streeter Scholarship



**John Horan, KE0AQA**  
The PhD ARA Scholarship



**Andrew Johnson, N4HFR**  
The Dayton Amateur Radio Association Scholarship



**Rachel Jones, KO4HLC**  
The ARRL Foundation General Fund Scholarship



**Jonathan Keiser, AG5SY**  
The Amateur Radio Digital Communications (ARDC) Scholarship



**Julianne Knappik, KB1YTT**  
The Ronald Hesselbrock, WA8LOW, Memorial Scholarship



**Caroline Kuebert, KM4VCO**  
The Amateur Radio Digital Communications (ARDC) Scholarship



**Drew Laikin, KQ4AIG**  
The Vienna Wireless Society Scholarship



**Toby Latino, AG5ZM**  
The Walter Gallinghouse, K5DSL, Scholarship



**Wyatt Law, AI6V**  
The You've Got a Friend in Pennsylvania Scholarship



**Zak Law, KJ7ZTE**  
The Wilse Morgan, WX7P, Memorial ARRL Northwestern Division Scholarship



**Faith Hannah Lea, KD3Z**  
The Amateur Radio Digital Communications (ARDC) Scholarship



**Grace Lea, KE3G**  
The Amateur Radio Digital Communications (ARDC) Scholarship



**Hope Lea, ND2L**  
The Amateur Radio Digital Communications (ARDC) Scholarship



**Zechariah Lea, WX4TVJ**  
The Amateur Radio Digital Communications (ARDC) Scholarship



**Matthew Lewis, W5MSL**  
The Amateur Radio Digital Communications (ARDC) Scholarship



**Alisha Lin, K6AML**  
The William Bennett, W7PHO, Memorial Scholarship



**Frederick Linxweiler, N7FCL**  
The K2PLF Martin J. Green, Jr., Memorial Scholarship





**Brennan Long,  
K6BFL**  
The Pikes Peak  
Radio Amateur  
Association  
(PPRAA)  
Memorial  
Scholarship



**Ian MacDonnell,  
N0IAN**  
The Potomac  
Valley Radio  
Club (PVRC)  
Scholarship



**Matthew  
Mackenzie,  
KC1PXL**  
The Rev. Paul E.  
Bittner, W0AIH,  
Memorial  
Scholarship



**Anna Matson,  
KN4IVD**  
The Ernest L.  
Baulch, W2TX,  
and Marcia E.  
Baulch, WA2AKJ,  
Scholarship



**Aidan  
McDonnell,  
K9ETS**  
The Indianapolis  
Amateur Radio  
Association  
Scholarship



**Audrey McElroy,  
KM4BUN**  
The Amateur  
Radio Digital  
Communications  
(ARDC)  
Scholarship



**Lauren  
McLaughlin,  
KJ6KDZ**  
The Dayton  
Amateur Radio  
Association  
Scholarship



**Michael  
McSorley,  
K15MTV**  
The Amateur  
Radio Digital  
Communications  
(ARDC)  
Scholarship



**Benjamin  
Meinhart,  
KD9LJF**  
The Six Meter  
Club of Chicago  
Scholarship



**McKenzie  
Menefee,  
K15MHA**  
The Allen and  
Bertha Watson  
Memorial  
Scholarship



**Elizabeth  
Mentele,  
KE0GFV**  
The Free Family  
Scholarship



**Javan Miller,  
W8UA**  
The Amateur  
Radio Digital  
Communications  
(ARDC)  
Scholarship



**Jeremiah Moix,  
KG5TZR**  
The Amateur  
Radio Digital  
Communications  
(ARDC)  
Scholarship



**Luke Moore,  
AA5L**  
The Amateur  
Radio Digital  
Communications  
(ARDC)  
Scholarship



**Payton Noe,  
KC1IVR**  
The Amateur  
Radio Digital  
Communications  
(ARDC)  
Scholarship



**Ethan Olesko,  
KC3QXT**  
The Steel City  
ARC Scholarship



**Matthew Olinde,  
K15YYK**  
The Louisiana  
Memorial  
Scholarship



**Carine Orélus,  
HH2ORC**  
The Amateur  
Radio Digital  
Communications  
(ARDC)  
Scholarship



**Ian Parker,  
KG5LST**  
The Medical  
Amateur Radio  
Council  
(MARCO)  
Scholarship



**Joseph  
Patton, KC3PMD**  
The East Coast  
Amateur Radio  
Service (ECARS)  
Scholarship



**Sara Payne,  
W5ARA**  
The K2TEO  
Martin J. Green,  
Sr., Memorial  
Scholarship



**Venkata Anjani  
Shrivika  
Pendyala,  
KQ4CUS**  
The Amateur  
Radio Digital  
Communications  
(ARDC)  
Scholarship



**Jordon Posey,  
KN4SKY**  
The Atlanta  
Radio Club  
Scholarship



**Ryan Pribulsky,  
W3LID**  
The Amateur  
Radio Digital  
Communications  
(ARDC)  
Scholarship



**Jeffery  
Purchatzke,  
KM6UFK**  
The Michael R.  
Ware, NN3I,  
Scholarship



**Campbell Reed,  
KD9GEK**  
The Clive Frazier,  
K9FWF,  
Scholarship



**Maria Reichard,  
KE8SPB**  
The Amateur  
Radio Digital  
Communications  
(ARDC)  
Scholarship



**Catherine  
Renteria,  
KM6ZMN**  
The Charles N.  
Fisher Memorial  
Scholarship



**Luke Rickert,  
KE0MDW**  
The CTRI/Chris  
Seeber,  
KA1GEU,  
Memorial  
Scholarship



**Eva Riherd,  
KF0FMC**  
The Paul and  
Helen L. Grauer  
Scholarship



**Anthony Rizi,  
NR1Z**  
The Amateur  
Radio Digital  
Communications  
(ARDC)  
Scholarship



**Tyler Rust,  
KC3KPK**  
The Byron  
Blanchard,  
N1EKV,  
Memorial  
Scholarship





**John Rutherford,**  
**KN4ERY**  
The L. B. Cebik,  
W4RNL, and  
Jean Cebik,  
N4TZP, Memorial  
Scholarship



**Thomas Sanford,**  
**AE2TS**  
The Amateur  
Radio Digital  
Communications  
(ARDC)  
Scholarship



**Moshe Satt,**  
**N2YU**  
The Amateur  
Radio Digital  
Communications  
(ARDC)  
Scholarship



**Emma Schaefer,**  
**KC9YGJ**  
The Amateur  
Radio Digital  
Communications  
(ARDC)  
Scholarship



**Robert Tyler**  
**Schroder,**  
**N2RTS**  
The Amateur  
Radio Digital  
Communications  
(ARDC)  
Scholarship



**Joseph**  
**Schroedl,**  
**KO4TCY**  
The L. Phil and  
Alice J. Wicker  
Scholarship



**Lee Schuett,**  
**KB1ETR**  
The Challenge  
Met Scholarship



**Robert Serrano,**  
**KJ6TSU**  
The RFinder LLC  
— Arthur L.  
Greenberg,  
W2LH, and  
Madeline  
Greenberg,  
W2EEO,  
Memorial  
Scholarship



**William Sims,**  
**KN4LVQ**  
The North Fulton  
Amateur Radio  
League (NFARL)  
Scholarship



**H. Russell Smith,**  
**N0QLT**  
The Ray, N0RP,  
& Katie, W0KTE,  
Pautz  
Scholarship



**Nathan**  
**Sossoman,**  
**N4CEB**  
The Alfred E.  
Friend, Jr.,  
W4CF, Memorial  
Scholarship



**Matthew Spiker,**  
**KY1FF**  
The Gary  
Wagner, K3OMI,  
Scholarship



**Martin Sullaway,**  
**NN1C**  
The Amateur  
Radio Digital  
Communications  
(ARDC)  
Scholarship



**Daniel Thomson,**  
**KB7DRT**  
The Amateur  
Radio Digital  
Communications  
(ARDC)  
Scholarship



**Kyle Upham,**  
**KD9TTU**  
The Edmond A.  
Metzger  
Scholarship



**Dahmesh Upton,**  
**KB1OTB**  
The Dr. James L.  
Lawson  
Memorial  
Scholarship



**Kees Van**  
**Oosbree,**  
**W0AAE**  
The Amateur  
Radio Digital  
Communications  
(ARDC)  
Scholarship



**Kathryn Victor,**  
**KD2WTM**  
The Bill, W2ONV,  
and Ann Salerno  
Memorial  
Scholarship



**Mikayla Wagner,**  
**N1BKR**  
The Dayton  
Amateur Radio  
Association  
Scholarship



**Eryn Wagoner,**  
**KE0WEY**  
The John C. York,  
KE5V,  
Scholarship



**Matthew Walden,**  
**KO4ZTJ**  
The Amateur  
Radio Digital  
Communications  
(ARDC)  
Scholarship



**Ian Wilhite,**  
**KG5HOW**  
The Fred  
R. McDaniel  
Memorial  
Scholarship



**Ruth Willet,**  
**KM4LAO**  
The Amateur  
Radio Digital  
Communications  
(ARDC)  
Scholarship



**Daniel Wood,**  
**KY4DRW**  
The Scholarship  
of the Morris  
Radio Club of  
New Jersey



**Zheming Zhang,**  
**KD2TAI**  
The ARRL  
Scholarship to  
Honor Barry  
Goldwater





# ARRL VEC Volunteer Examiner Honor Roll

The ARRL VEC Honor Roll recognizes the top 10 Volunteer Examiners in each ARRL Division according to the total number of ARRL exam sessions in which they have participated since their accreditations. Considering each session requires an average time commitment of 2 to 4 hours or more, the thousands of hours these VEs have invested represent extraordinary dedication! Whether you are one of our VE Teams that tests once a week, once a month, or once a year, we want to express our warmest appreciation to all volunteers for your generous contribution to the ARRL VEC program.

If you are an ARRL VE, you can view your session stats online at [www.arrl.org/ve-session-counts](http://www.arrl.org/ve-session-counts).

If you are not a VE, become one today! See [www.arrl.org/become-an-arrl-ve](http://www.arrl.org/become-an-arrl-ve).



Volunteer Examiner	Sessions	Accreditation Date	Volunteer Examiner	Sessions	Accreditation Date	Volunteer Examiner	Sessions	Accreditation Date
<b>Atlantic</b>			<b>Hudson</b>			<b>Roanoke,</b>		
James McCloskey, NS3K	339	14-Nov-94	Paul Maytan, AC2T	736	06-Sep-84	Judy Friel, AC4RG	313	01-Feb-91
Jobst Vandrey, AC0LP	324	23-Jun-08	Alan Crosswell, N2YKG	503	26-Oct-94	Alan Moeck, WA2RPX	264	27-Sep-94
George Brechmann, N3HBT	305	01-Apr-91	Fritz Boigris, KB2O	486	26-Oct-84	David Snyder, W4SAR	250	01-May-93
Edward Genoino, WA2NDA	298	10-Jul-85	Sid Markowitz, K2GG	438	27-Sep-94	Terry Sanner, WV8V	243	06-Sep-84
Cully Phillips, N3HTZ	220	01-Sep-91	John Kiernan, KE2UN	309	01-Jul-91	Larry Withrow, AF4HX	222	17-Dec-98
William Klepser, Jr., WB2AIV	215	09-Jun-99	Walter Lesnowich, W2EE	291	06-Mar-08	Henry Wyatt, II, K4YCR	207	28-Jan-98
Michael Harla, N2MHO	212	12-Apr-06	Thomas Carrubba, KA2D	289	01-Sep-93	David Poe, W8IW	205	13-Mar-07
Ralph Abbott, WA3ELQ	190	30-May-05	Robert Casino, N2GDY	270	03-Jun-08	Edwin Williams, KN4KL	204	01-Jan-92
Robert Charles Worek, AG3U	183	26-Jul-06	Carlos Prior, KE2TT	259	01-Jun-90	John Kanode, N4MM	196	07-Jun-85
Gary Reed, N2QEE	177	31-Mar-09	Donald Younger, W2JEK	257	30-Jul-86	Thomas Lewis, W4SIS	194	14-Nov-97
<b>Central</b>			<b>Midwest</b>			<b>Rocky Mountain</b>		
Ed Wagner, AB9FN	407	01-Jul-02	David Bartholomew, AB0TO	785	22-Mar-02	Robert Hamilton, N0RN	419	19-May-87
Allan Bukowski, N9ZD	347	01-Jun-92	Kevin Naumann, N0WDG	691	17-Nov-02	Robert Vosper, KZ1B	354	09-Jul-10
Eldon Boehm, NK9U	332	21-Nov-86	Harry Steger, Jr., W0HMS	636	26-Aug-08	Jeffrey Weinberg, W0QO	330	01-Apr-93
Donald Hlinsky, N9IZU	328	01-Mar-91	Roland Kramer, W0RL	550	21-Jun-01	David Avery, N0HEQ	302	13-Jan-88
Brian Eder, WB9UGX	302	01-Jan-92	Kenneth Simila, KC0VMY	307	18-Feb-07	David Sharpe, K10HG	258	02-Feb-98
Robert Begeman, W9KVK	286	01-Jun-92	John Mountain, Jr., KJ0MTN	252	28-Sep-09	Gary Zabriskie, N7ARE	243	20-Nov-84
Timothy Pechtold, AA9BV	277	01-Nov-92	Edwin Berkel, AE0EB	230	06-Jan-15	Martin Soffran, NM5MS	240	21-Mar-94
James Rinehart, K9RU	258	01-Aug-91	Sidney Ashen-Brenner, N0OBM	213	21-Jun-01	Peter Brisbane, NM5PB	232	20-Jan-14
Frederick Baguhn, W9GOC	254	16-May-02	Charles Wilmes, KW0K	207	28-Apr-09	David Bratcher, AK0MR	193	23-Sep-08
David Nicolaus, W9DN	250	13-Feb-86	Chris Hunt, N0YH	200	05-Aug-20	Denis Campbell, AA0YX	185	02-Feb-96
<b>Dakota</b>			<b>New England</b>			<b>Southeastern</b>		
Jeffrey Goodnuff, W0KF	338	17-Jun-03	*Paul Lux, K1PL	1863	25-Jan-85	***Gary Pike, KA4KBX	6786	03-Sep-09
John Schwarz, Jr., AE0AL	324	26-Oct-94	*Bob Phinney, K5TEC	1633	20-Jan-14	***Justin Pike, KJ4AXF	5119	12-Nov-12
Shep Shepardson, N0NMZ	304	12-Mar-01	Gregory Paul, KC1MND	544	03-Jun-20	***Collin Pike, KJ4AXB	5077	26-Apr-11
Douglas Nelson, AA0AW	245	01-May-90	Phillip Temples, K9HI	519	12-May-89	***Anna Pike, KD4PCU	3604	18-Aug-09
Daniel Royer, KE0OR	240	01-Jul-91	Robert Beaudet, W1YRC	406	01-Aug-90	**Patrick Pike, KJ4AXD	2363	13-Oct-15
Larry Larson, KR0K	225	16-Mar-09	Bruce Anderson, W1LUS	382	11-Feb-88	**Ryan Krenzischek, W4NTR	2061	04-Jan-13
James Rice, II, N0OA	224	04-Dec-00	Barbara Irby, KC1KGS	348	05-Aug-19	Pablo Soto, KP4SJ	394	01-May-92
Dennis Ackerman, KB0OQQ	221	15-Jul-96	Stefan Rodowicz, N1SR	309	20-Nov-84	Val Jacyno, AK4MM	388	08-Nov-11
Robert Tracy, N0TC	194	30-Jul-86	Don Wilson, K1IN	289	01-Apr-92	Robert Cumming, Sr., W2BZY	369	29-Jan-97
Karl Eriksen, WA2DEE	175	08-Jan-90	James Mullen, KK1W	287	01-Mar-91	John Reynolds, W4TXA	347	08-Jun-16
<b>Delta</b>			<b>Northwestern</b>			<b>Southwestern</b>		
Monvel T. Maskew, Jr., K9FQ	765	18-Jul-18	Richard Morgan, KD7GIE	448	11-Aug-00	*Bill Martin, A10D	1074	01-Nov-84
Lorna Westmoreland, KU5J	645	31-Jan-21	Scott Robinson, AG7T	429	01-Aug-91	David Morrill, N7TWT	498	20-Jul-00
Bryan McCammon, K15HAV	389	03-Sep-20	Loren Hole, KK7M	381	06-Sep-84	Richard Buck, KC7OCT	336	21-May-97
Joe Lowenthal, WA4OVO	280	25-May-06	John Clarke, AC7WW	354	20-Jan-03	Donald Kramer, Sr., WA6UVW	332	08-May-98
Bobbie Williams, W1BEW	279	01-Jun-92	S. Riley McLean, W7RIL	338	02-Sep-99	Bruce Ziemienski, WA6BZ	321	25-Mar-02
John Waters, III, KC5FYA	270	14-Sep-21	David Brooks, N7HT	324	10-Jun-87	Ali Hassan, AA6WC	288	01-Jun-90
Roger Gray, N5QS	269	01-Mar-93	Joseph Barry, K7SQ	299	21-Jun-95	Norman Pilawski, WT6Y	282	17-Feb-87
Dawn Gray, N5QT	250	01-Mar-93	Brandin Hess, NL7CW	283	24-Sep-15	Arthur Hoffman, W7ART	278	20-Feb-98
Robert White, A14GI	222	18-Jul-05	Wayne Schuler, A19Q	273	01-Sep-91	Frank Westphal, K6FW	271	06-Sep-84
Daryl Stout, WX4QZ	216	17-Sep-07	Donald Baune, AC0EX	259	19-Sep-06	Gary Hamman, K7GH	255	01-Aug-92
<b>Great Lakes</b>			<b>Pacific</b>			<b>West Gulf</b>		
*Charles Tyrrell, KE8PCB	1001	03-Sep-20	Brian Torr, N6I1Y	795	06-Sep-00	*Franz Laugermann, K3FL	1328	01-Dec-91
David Potter, KE8OHG	937	03-Jun-20	Morris Jones, AD6ZH	554	27-Nov-01	*Tanner Jones, W9TWJ	1164	31-Jul-07
Earl Paazig, W8BR	570	16-Apr-02	Dieter Stussy, KD6LVW	453	27-Jan-94	Daniel Quigley, N7HQ	793	24-Apr-20
Bruce Osmon, KE8LT	479	16-Nov-18	Gordon Fuller, WB6OVH	363	06-Sep-84	Gerald Grant, WB5R	526	04-Jan-85
Charles Hall, W8HF	286	01-Jun-92	Bill Nichols, NN7K	359	01-Sep-93	Adolph Koehler, K5VCR	514	29-Sep-95
William Bogle, Jr., KE8FZY	267	08-Jul-20	Robert Perlman, W6BP	349	26-Aug-08	David Fanelli, KB5PGY	485	01-Oct-91
Lance Harvala, AB8Y	254	06-Nov-19	Larry Loomer, K16LNB	347	03-Dec-08	Wilbert Cannonier, KK5JJ	472	03-Nov-95
Archie Mack, Sr., AF4EB	247	19-Aug-97	Jim Brunk, N6BHX	300	13-Jul-95	John Paterson, Jr., KC5LAA	456	16-Mar-09
Stanley Arnett, II, AC8W	230	06-Sep-84	Dennis Simon, KB7UTV	283	10-Dec-13	Michael Nault, W5OFT	410	06-Sep-01
Chris Anderson, K8VJ	227	09-Feb-90	Joseph Speroni, AH0A	282	20-Nov-84	Janet Crenshaw, WB9ZPH	405	02-Oct-97







Congratulations to Charles Tyrrell, KE8PCB, from Berkeley, MI (Great Lakes Division), who is the latest VE to participate in 1,000 sessions!

\*Denotes participation in over 1,000 sessions. \*\*Denotes participation in over 2,000 sessions. \*\*\*Denotes participation in over 3,000 sessions.



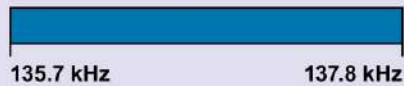
# US Amateur Radio Bands

Operator license classes: **E** = Amateur Extra **A** = Advanced **G** = General **T** = Technician **N** = Novice  
CW operation is permitted throughout all amateur bands. Except as noted, all frequencies are in megahertz (MHz).

 = RTTY, data, phone, image  = USB phone, RTTY, data and CW  = RTTY and data  = phone and image  
 = SSB phone  = CW only

## LF – Low Frequency band

### 2200 Meters (135 kHz) E,A,G 1 W EIRP maximum

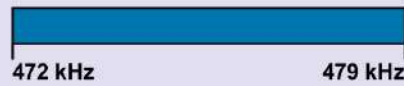


Amateurs wishing to operate on **2200 or 630 meters** must first register with the Utilities Technology Council online at <https://utc.org/plc-database-amateur-notification-process/>. You need only register once for each band.

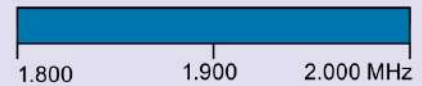
## MF – Medium Frequency bands

### 630 Meters (472 kHz) E,A,G

5 W EIRP max, except in Alaska within 496 miles of Russia where the limit is 1 W EIRP

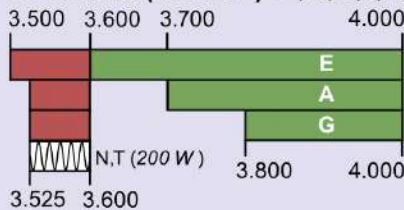


### 160 Meters (1.8 MHz) E,A,G

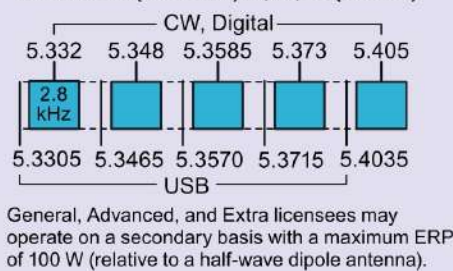


## HF – High Frequency bands

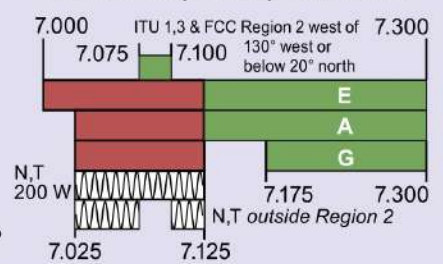
### 80 Meters (3.5 MHz) E,A,G,T,N



### 60 Meters (5.3 MHz) E, A, G (100 W)



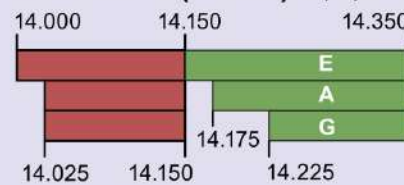
### 40 Meters (7 MHz) E,A,G,T,N



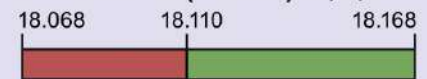
### 30 Meters (10.1 MHz) E,A,G



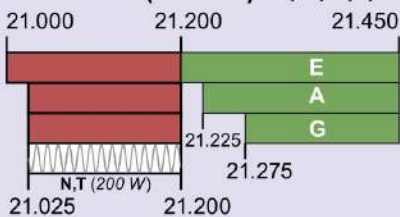
### 20 Meters (14 MHz) E,A,G



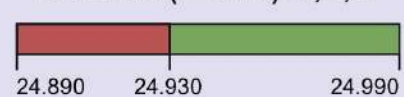
### 17 Meters (18 MHz) E,A,G



### 15 Meters (21 MHz) E,A,G,T,N



### 12 Meters (24 MHz) E,A,G



### 10 Meters (28 MHz) E,A,G,T,N



## VHF – Very High Frequency bands

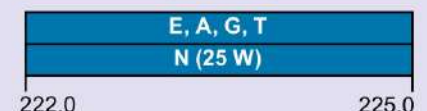
### 6 Meters (50 MHz) E,A,G,T



### 2 Meters (144 MHz) E,A,G,T



### 1.25 Meters (222 MHz) E,A,G,T,N



## UHF – Ultra High Frequency bands

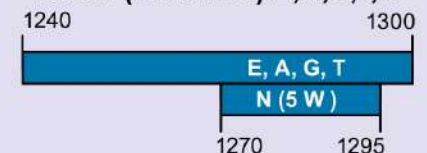
### 70 cm (420 MHz) E,A,G,T



### 33 cm (902 MHz) E,A,G,T



### 23 cm (1240 MHz) E,A,G,T,N



## SHF&EHF – Super and Extremely High Frequency bands

All licensees except Novices are authorized all modes on the following frequencies:

2300-2310 MHz 3400-3450 MHz 10.0-10.5 GHz 47.0-47.2 GHz 122.25-123.0 GHz 241-250 GHz  
2390-2450 MHz 5650-5925 MHz 24.0-24.25 GHz 76.0-81.0 GHz 134-141 GHz All above 275 GHz

See [www.arrl.org/band-plan](http://www.arrl.org/band-plan) for detailed band plans.

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OTAbands rev. 2/10/2023



# A Look Back





Exterior view of the QRP Transmatch. The cabinet is homemade from solid sheet and perforated aluminum stock. The two controls at the far left are 365-pF variables, as is the one at the lower left of the Simpson meter. At the upper left of the meter is the variable-inductance control. Directly under the meter is the meter-sensitivity potentiometer. The bridge function switch is visible at the upper right of the panel. Kurz-Kasch aluminum knobs are used on the controls.



## A Poor Ham's QRP Transmatch

BY DOUG DEMAW,\* WICER

THINGS have been going to ruination in the proverbial hand basket for some time . . . at least when it comes to obtaining small parts. Even when some of the common items needed by home constructors are located, the unit costs are so high that the desired project is scarcely worth the expenditure. This turned out to be true with respect to the QRP Transmatch described in February, 1973, *QST*. Two split-stator variable capacitors were specified, and much to the chagrin of the author (and a great many *QST* readers) the manufacturer announced after publication that his stock was depleted and that no new production run was planned in the immediate future. With QRP operation becoming the pastime of the hour, owing in part to products being sold by at least two manufacturers of amateur equipment, something had to be done to help get the train back on the tracks so that those needing a micropower Transmatch could proceed with the project. The Ultimate Transmatch configuration (used in the earlier model) seemed like the best choice again, at least in the interest of being able to match the transmitter output to a wide variety of end-fed antenna or feed-line impedances. Furthermore, the W1ICP-popularized circuit requires no adjustment of clip leads and taps to change bands. Rather, a simple system for switching in various amounts of inductance is practical.

Low-cost, readily available components were selected for the model illustrated here. The rf power bridge used in the previous QRP Transmatch has been replaced by a less complicated "old standard" resistance bridge which was described some years ago by former ARRL Technical Editor

W1DF. A version of the bridge shown here has been used for some time by QRP enthusiast Wes Hayward, W7ZOI, in combination with various low-power Transmatches of his choice. It is, therefore, the writer's intention to take the curse off the previous WICER Transmatch circuit by describing this modified version.

### Circuit Basics

For many years the ARRL *Handbook* carried details on building a simple 50-ohm resistance bridge for use in adjusting matching sections in antenna systems (chapter on measurements). If careful layout is used (short leads) the circuit works nicely from 160 through 10 meters. It is more sensitive than is the Bruene rf bridge<sup>1</sup> and will provide full-scale deflection at 50 mW when using a 0- to 1-mA meter. The need for balancing the bridge with trimmer capacitors is eliminated, and one need not wind a toroidal transformer. Eliminating the cost of a microammeter is still another highlight to consider! Only one boulder in the pathway exists — this resistance bridge has limited power-handling ability. With the resistor wattage ratings specified in Fig. 1 the safe upper rf power limit is approximately five watts. Most bona fide QRP rigs operate under that power-output figure, especially the HW-7, PM series, and the more recent Argonaut, none of which exceed the safe limit of the bridge.

A small bonus feature provided by this circuit is enjoyed during initial adjustment of the Transmatch. While the resistance bridge is switched into

<sup>1</sup> Bruene, "An Inside Picture of Directional Wattmeters," *QST*, April, 1959. Also, DeMaw, "A QRP Man's RF Power Meter," *QST*, June, 1973.

\* *QST* Technical Editor.



EXCEPT AS INDICATED, DECIMAL  
VALUES OF CAPACITANCE ARE  
IN MICROFARADS ( $\mu$ F); OTHERS  
ARE IN PICOFARADS (pF OR  $\mu$ F);  
RESISTANCES ARE IN OHMS;  
K=1000, M=1000000

S1 POSITIONS  
1-METER SET  
2-ANT. TUNE  
3-OPERATE

S2 POSITIONS  
INDUCTANCE ( $\mu$ H)  
1-0.5 5-4.0 10-11.0  
2-1.0 6-4.5 11-12.5  
3-2.5 7-6.5 12-17.0  
4-3.5 8-9.0

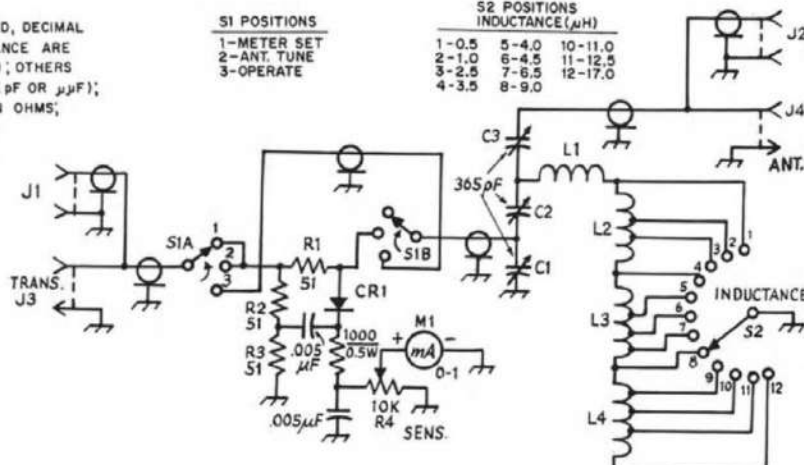


Fig. 1 — Schematic diagram of the Transmatch. Fixed-value capacitors are disk ceramic. Fixed-value resistors are composition types.

C1-C3, incl. — Miniature 365-pF variable (Archer/Radio Shack No. 272-1341 or equiv.).

CR1 — 1N34A or equiv.

J1, J2 — Phono connector, single-hole chassis mount.

J3, J4 — SO-239 style coax connector.

L1 — 15 turns No. 24 enam. wire, close-wound on 1/4-inch ID form. Remove form after winding.

L2 — 28 turns No. 24 enam. wire on Amidon T-50-6 toroid core. Tap 7 turns from each end. (Amidon Associates, 12033 Otsego St., N. Hollywood, CA 91607.)

L3 — 28 turns No. 24 enam. wire on Amidon

T-50-2 toroid core. Tap at 5, 10 and 15 turns from L2 end.

L4 — 36 turns No. 24 enam. wire on Amidon T-68-2 toroid core. Tap at 6, 12 and 18 turns from L3 end.

M1 — 0 to 1-mA dc meter, 1-1/2 inches square. See text.

R1-R3, incl. — 51-ohm, 2-watt, 5-percent tolerance.

R4 — Miniature 10,000-ohm control, audio or linear taper suitable.

S1 — Two-pole, three-position, shorting-type rotary wafer switch. See text.

S2 — Single-pole, 12-position, rotary wafer switch, shorting type (Radio Shack No. 277-1385 or Calcraft No. E-2-162).

the line the transmitter looks into a relatively constant load. This desirable condition helps to prevent damage to solid-state final amplifier stages while the process of impedance matching is underway.

### Component Selection

In place of the usual split-stator capacitor used at the input of the classic Ultimate Transmatch there are two imported subminiature 365-pF-per-section variable capacitors. The units specified measured 400 pF maximum capacitance when checked on the ARRL's RCL bridge. Minimum capacitance was measured as 15 pF. Thus, it appears that the manufacturer threw in a few extra pF to provide a baker's dozen. The use of separate capacitors at C1 and C2, Fig. 1, requires slightly more manipulation during tune-up than would be the case with ganged capacitors, but once ball-park settings are found for each operating band it is a simple matter to log them for future use. This writer simply notes the knob settings in o'clock fashion. . . 1 o'clock, 8 o'clock, and so on. C2 and C3 must be mounted so that their rotor and stator sections are above chassis ground. This was accomplished easily by assembling them on a small piece of phenolic insulating board and using insulating shaft couplers (Allied Electronics No. 920-0130).

Three small toroidal inductors and one air-wound coil comprise the variable-inductor leg of the circuit, L1-L4, inclusive, and S2. With the constants specified for the circuit of Fig. 1 the tuner will give good performance from 80 through 10 meters. S2 is a low-cost imported component.

M1 can be any 1-mA instrument. A Simpson No. 2121 is shown in the photos, but may be a trifle too dear in terms of cost for those wishing to do the job at minimum investment. Many imported meters (Radio Shack No. 22-018 for one) can be purchased at a fraction of the cost common to high-quality American made instruments. Builder's choice!

S1, in the unit pictured in this article, is a double-pole, four-position, two-section ceramic wafer switch of the subminiature species. It was gleaned for 25 cents at a flea market. Brand new, the cost would be a bit sobering perhaps. It was placed in service simply because it was on hand when the project got underway. A piece of double-clad pc board is visible between the wafer sections. It was added to function as an rf shield between the two sections of S1, thereby helping to isolate the input and output ports of the resistance bridge. Chances are that this represents an exercise in "over-engineering," and need not be done. Any shorting-type double-pole, three-position switch should be suitable, ceramic or phenolic insulation. S1 and S2 are the shorting variety, thus preventing



momentary no-load conditions from being seen by the transmitter.

### *Anatomy of the Transmatch*

Whether the finished product looks like some grotesque Ugly Duckling or a masterly work of commercial art, the performance should be the same. Here again it's the builder's option. We elected to create an "original" by making use of some sheet aluminum that was left over from a previous project. A chassis was formed to assure more than ample room for the parts. As a matter of fact there is wasted space, so the prospective builder may decide wisely to "scrunch" things slightly to realize greater compactness. The package dimensions are  $7\frac{1}{2} \times 2\frac{3}{4} \times 2\frac{3}{4}$  inches ( $18 \times 6\frac{1}{2} \times 6\frac{1}{2}$  cm). A cover was made from a section of surplus perforated-aluminum stock which was garnered at another flea market. Solid aluminum stock would be just as good. In fact, the entire enclosure could be constructed from galvanized furnace ducting, often available in scrap sizes from furnace repair shops. Rf shielding is not imperative when building housings for Transmatches, so the innovator may simply use a wooden or plastic box of his choosing.

Our knobs are the Kurz-Kasch aluminum type. Kinda "cushy," admittedly, but they were chosen to match the decor of the remainder of our QRP station. Imported knobs come in many styles from flashy to blase in appearance. Again, it's the builder's option, consistent with his personal tastes.

Battleship gray spray-on paint was used to supply the final touches to the box, and white press-on decals were added to identify the controls. There is some redundancy exhibited by the dual input and output terminals. Type SO-239 connectors are wired in parallel with phono jacks to assure flexibility when mating the Transmatch to the other station equipment. Only one style of connector need be used.

### *Preparation for Use*

It will be noted that the components for the resistance bridge are mounted on a piece of single-sided pc board. This is not mandatory. Point-to-point wiring (keeping the leads ultra short) can be used if desired. Multilug terminal strips should be fine for the latter. Whatever technique is adopted, the completed bridge should be tested prior to attaching it to the rf section of the Transmatch. This can be done easily by placing S1 in the METER SET position, adjusting R4 for minimum meter sensitivity (arm near ground), then

applying rf power from the transmitter at J1. Adjust the transmitter for peak output (5 watts maximum!), then advance R4 until full-scale deflection occurs on M1. Now, connect a 50-ohm resistive load between the CR1-R1 junction and ground. If all is well, the meter reading should drop to zero, indicating a null at 50 ohms. Values of load resistance above and below 50 ohms will cause the meter to deflect in accordance with the SWR that prevails.

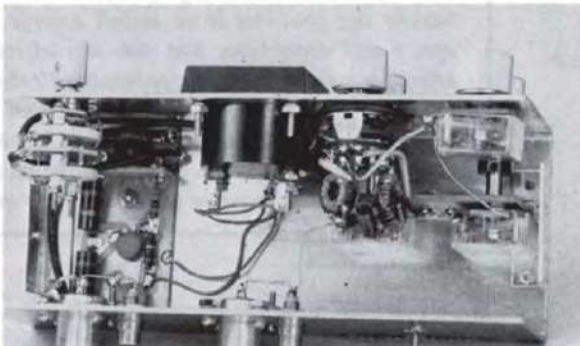
Connect the output port of the bridge to the remainder of the circuit. Attach a 50-ohm load at J2. Place S1 in the ANT. TUNE position and juggle the settings of C1, C2, C3 and S2 until zero deflection is indicated at M1. Repeat this process for each band of interest, jotting down the o'clock settings for each control. If the meter can be made to read zero on each band, all is as it should be. Tuning the circuit with the antenna or feed line connected to J2 is done in the same manner as with a dummy load. After the load is matched to the transmitter, turn S1 to the OPERATE position. This bypasses the bridge, which, if left in the line, will consume precious rf power. *A word of caution:* Always use the least amount of tuned-circuit inductance (L1 through L4) that will provide an SWR of 1. This will assure maximum power transfer to the antenna. A matched condition can be realized at several settings of the controls, but only the foregoing procedure should be followed in tuning the system.

### *Summarization*

Rf connections within the box should be made with RG-174/U subminiature coax cable to assure satisfactory isolation between the input and output ports of the bridge. Be sure to ground the shield braid at each end of each length of cable. Leads less than one inch in length need not be shielded.

Those wishing to utilize the bridge portion of this unit for adjusting antenna matching sections can add a coax connector on the rear panel and connect it to the middle terminal of S1B. This will permit the bridge to operate independently of the rf-matching network which attaches to the arm of S1B. The function switch would be placed in the METER SET position for independent use of the bridge. Similarly, with S1 in that position, the impedance-matching portion of the Transmatch can be used separately by connecting the open terminal of S1B to still another coax jack. The estimated cost of the parts used in this project is \$12, provided low-priced imported components are used where applicable. QST

Interior view of the Transmatch. The three variable capacitors are grouped at the right. Note that two of them are mounted on insulating board. Just to the right of the meter one can see the inductance switch on which three toroids and one air-wound coil are mounted. The resistance bridge and function switch are located at the far left of the chassis.



October 1973



## ● Technical Topics

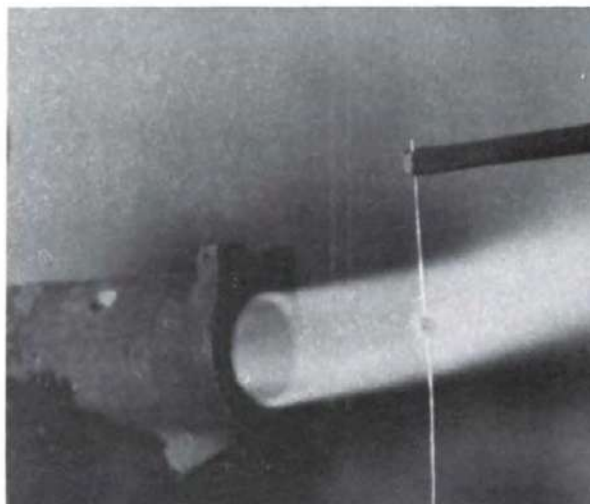
### CHIP CAPACITORS

Many amateurs have been aware of the shortcomings in the garden variety capacitor when used at vhf and uhf. Some experimenters have found that these deficiencies are even worse at shf. A few have sought to overcome the inductance of the connecting wires by removing the wires and encapsulation material from disk-ceramic units, then making connections by soldering directly to the plating which forms part of the capacitance element. This can be a laborious process, and more often than not the ceramic body breaks in one or more places before the job is done. Assuming that one is successful in keeping the capacitor in one piece, bad things happen in the ceramic substrate or dielectric during the heating and soldering operation. The value of capacitance is no longer what it should be, and losses through the dielectric can increase dramatically.

A line of capacitors is available that will circumvent these problems, and in many cases improve performance of the circuit because of increased coupling, lower losses, and greater thermal stability. This line is called Uhf/microwave porcelain and ceramic capacitors, produced by American Technical Ceramics, 1 Norden Lane,



Even though those shown here are not the smallest available, several would be needed to cover the one-cent piece.



The ability to withstand temperature extremes is evidenced by heating an ATC 100 chip capacitor to a nice glow in the flame of a blowtorch.

Huntington Sta., NY 11746. An illustration of the size and of the temperature tolerance of their ATC 100 series of capacitor is shown in the photographs.

A variety of mounting styles is available, those without leads being called a chip or pellet. One style of microstrip lead is shown here, and there are several variations of that method of mounting listed in ATC's literature. One item worth mentioning the ATC 100 units pictured on the coin are *large* by comparison with some of those available from American Technical Ceramics. About the best way to convey an impression of the size of the smaller chips is to point out that they came packaged in a plastic capsule such as that containing a popular cold remedy. Except for the difference in coloring, the contents of both capsules would appear similar.

The ATC 100 series is available from 0.1 pF to 1000 pF. An ultrastable ceramic version, called ATC 700, is available in values up to 5100 pF. The ATC 200 is a high-capacitance line, available up to 0.1  $\mu$ F (100,000 pF). Dc working voltage ratings as high as 1000 are available for some of the smaller capacitance values. However, for the larger values of capacitance the dc voltage rating is 50.

ATC has also published an *RF Capacitor Handbook* that contains much useful information about the design of rf circuits and the important part that capacitors can play in the success of vhf or microwave equipment. The price is \$4.95. Those interested should write to the address given above.

It is not recommended that you assemble your next project with the heat from a blow torch. ATC capacitors could stand it, but the heat might curl your pc board! — WISL



# 

## RULES FOR LIFE MEMBERSHIP

1. A paid-up Life Membership in the League shall be available to any Full or Associate Member, other than a Family Member, upon payment of a fee twenty times the annual dues rate, and upon approval of the application by the League's Executive Committee.
2. The Life Membership fee for U.S. applicants is currently \$150, for Canadian applicants \$170, and for other applicants \$180, all in U.S. funds.
3. An applicant may choose an alternative time-payment plan of eight quarterly installments (\$18.75 for U.S. applicants, \$21.25 for Canadians, and \$22.50 for others), to be completed within a two-year span. In such instance, he will be provided an interim two-year Full Membership certificate. Upon completion of the payments, Life Membership will be granted.
4. Life Memberships are non-transferable, and dues payments are non-refundable. In the event an applicant is unable to complete payments on the installment plan within the two-year span, he will be given a term of membership, at the annual dues rate, commensurate with payments received.
5. Other licensed amateurs in the same family, and at the same address, of a Life Member may retain or obtain Family Membership upon payment of the annual dues of \$2, but without receipt of *QST*. The dues of the Family Member may be prepaid for any number of years in advance, but there is no special rate.
6. Life Membership is also available to blind amateurs upon payment of a fee of \$40, without the receipt of *QST*.

Here is W4NK's "bare bones" set up for receiving APT (automatic picture transmissions) from the ESSA 8 weather satellite on 137.62 MHz. From left to right on the table is a Vanguard FMR-150A crystal-controlled fm receiver powered by the large dry cell battery, and a converted Western Union desk facsimile unit. The antenna is a homebrew 4-wavelength helix antenna. Received information is plotted on the large board, obtained from the National Weather Service. W1AW regularly transmits APT info relating to times and positions of ESSA 8.

October 1973

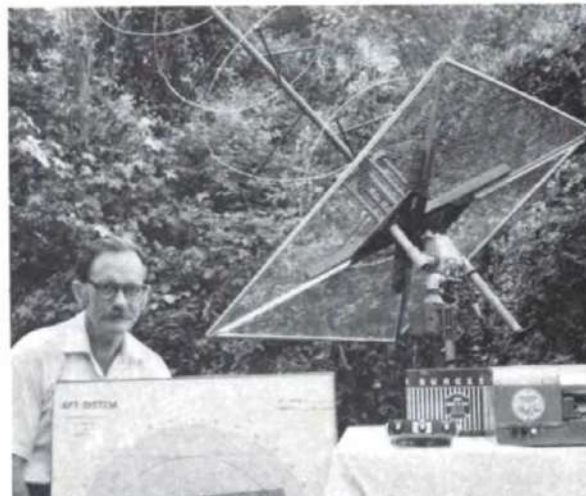


After using up the possibilities for call letter license plates on their family car and four wheel drive Scout, W6TEE and WB6PHQ obtained this personalized plate for their new camping trailer!

Edsel Murphy has struck again . . . and again . . . and again at WA3RCA, the Pennsylvania ARC (PENNARC) Explorer Post 681, but he had the time of his life on April 27-29.

First, heavy rain delayed packing of the PENNARC trailer. When they were finally ready to leave, the car's solenoid went kaput and had to be fixed up. Finally, thinking that old Murph had had his fun and left, they headed for Valley Forge Mountain only to discover that Murphy had left a trail of tacks behind. No sooner had they gone a few hundred feet, when Psssst!!! flop . . . flop . . . flop . . . the trailer had a flat! Better luck next time! — WA3FKH

Remember the "Let's Talk Transistors" series by Robert E. Stoffels, WB9ESH? We've put together a reprint booklet of this 9-part transistor primer and it is available from ARRL for \$1 including postage.





# Celebrating Our Legacy

## Bill Ball, Another Pioneer at the Dawn of ARRL

In 1910, 13-year-old Bill Ball was living with his family in Hartford, Connecticut. Bill had become close friends with a boy named Clarence, and they became interested in the new wireless technology. They started experimenting and building wireless sets, and joined a local electric experimenter's club. Soon, the boys began a partnership buying discounted Brandes headphones and reselling them to wireless experimenters for a profit.

As Bill and Clarence's technical skills developed, they built and installed wireless stations for their friends. Both boys became avid readers of *The Electrical Experimenter* and *Modern Electronics* magazines, and began to build more sophisticated wireless equipment. They discovered that Harris Parker's toy store would sell their wireless equipment for them on consignment.

In 1911, the boys designed a new wireless receiver. They constructed it in a pine box, and it had a coil wound in a hexagonal form that extended the length of the box. A single slide along the coil, a mineral detector, and a set of Brandes headphones completed the receiver. Once it was working properly, they took it to the toy store, where it was displayed in the front window.

Days later, Clarence noticed that the receiver was gone, so he went into the shop to collect the proceeds, but found the receiver on the counter. The clerk told him that a gentleman who was a well-known engineer had taken it home and brought it back, so it must be no good. Clarence immediately felt dejected because they had tested it thoroughly and it had worked.

Bill and Clarence discussed this unsettling development. Both of their mothers urged them to ask the potential buyer what the problem was. The pair

went to their prospective customer's front door and rang the bell. When the gentleman answered, the boys explained the reason for their visit and asked why he had said the receiver was no good. He told them he had not said that at all. It worked fine. He said it wouldn't do because it looked too much like a toy, and he wanted something better. Then the gentleman asked the boys what they could do if he gave them carte blanche to provide him with a station.

Bill and Clarence knew what to propose. This customer should have a receiver with a loose coupler, a tuning condenser, a silicon and a galena detector, and a pair of Brandes headphones.

The gentleman asked for a written proposal, which was soon provided and accepted. The boys purchased the components and constructed the new receiver. They installed it in the gentleman's finished attic and were paid for their work. The gentleman needed some instructions on operating the receiver and copying Morse code. Clarence spent a lot of time teaching him, and the gentleman became a father figure in Clarence's life. Three years later, in 1914, Clarence D. Tuska and the gentleman, Hiram Percy Maxim, founded the American Radio Relay League.

Bill and Clarence amicably dissolved their working partnership soon after Hiram Percy Maxim's station was installed. Bill remained interested and active in wireless technology. He served in the US Navy as a Yeoman and Radioman on the USS *Harrisburg* during World War I, and after, he still provided wireless apparatus commercially. Bill was a member of the



Bill Ball in the US Navy as a Yeoman and Radioman — 1918. [Photo courtesy of Mike Flowers, K6MKF]

Windsor Town Planning Commission, President of the Windsor Historical Society, and President and CEO of the Taylor & Fenn Company.

Bill is remembered at ARRL Headquarters with a brick in the Diamond Terrace, funded by members of the Northern California DX Club. He was truly an amateur pioneer and played an important role in supporting Hiram Percy Maxim's interest in wireless technology.

**Mike Flowers, K6MKF**  
San Jose, California

Send reminiscences of your early days in radio to "Celebrating Our Legacy," ARRL, 225 Main St., Newington, CT 06111 or [celebrate@arrrl.org](mailto:celebrate@arrrl.org). Submissions selected for publication will be edited for space and clarity. Material published in "Celebrating Our Legacy" may also appear in other ARRL media. The publishers of *QST* assume no responsibility for statements made in this column.



## Classic Radio

# Drake's Amateur Band Receivers

R. L. Drake Company began by designing receivers for amateur bands only. It wasn't until later that they made SWL and general-coverage models, and from 1991 to 1998, all of their receiver products were basically general coverage (some had the added coverage of frequencies). The Drake R-4C (built in 1973) was their last vacuum-tube receiver, and it was also the company's last receiver made for only amateur bands.

### Drake's First Receiver

Drake's first products were mostly of interest to the US military and radio amateurs and included high- and low-pass RF filters. With the advent of popular broadcast television in the late 1940s and early 1950s, the company became well-known for their RF filters.

In 1957, Robert L. Drake designed the Drake 1-A, which was a light, compact receiver for the 80/75- to 10-meter bands that received SSB and CW very well. It also included AM reception, which was the most common method of phone operation at the time. It weighed only 18 pounds and was 6.75 inches wide, 11 inches high, and 15 inches deep. It used triple conversion, with a crystal-controlled first conversion for a 2900 through 3500 kHz tunable first IF, 1100 kHz second IF, and 50 kHz third IF. The third IF used the famous Drake passband tuning system that was built with inductive and capacitive components. Later models of the Drake 1-A added an IF stage at 50 kHz, a 100 kHz crystal calibrator, and an internal speaker on the back panel. Although Collins Radio and National Radio Company beat Drake to making a receiver with a product



The Drake R-4 receiver. [Photo courtesy of [www.rigpix.com](http://www.rigpix.com)]

detector, it was Drake who started the concept of smaller and lighter radios.

### A Conventional Family of Receivers

The 2-family receivers — 2-A, 2-B, and 2-C — simplified the 1-A by moving the tunable IF to 3500 through 4100 kHz in order to cover 80/75 meters directly, and they used the common IF of 455 kHz for the second IF, but retained 50 kHz as the third IF. All three were double-conversion receivers on 80/75 meters and triple conversion on 40 to 10 meters, which was similar to the Mosley CM-1.

The Drake 2-A and 2-B both employed 10 vacuum tubes and, like the 1-A, used a vacuum-tube rectifier in the ac power supply. The 2-A and 2-B used a 6X4 rectifier, an optional plug-in 100 kHz crystal calibrator and external speaker, and a plug-in Q multiplier (2-AC calibrator, and 2-AQ or 2-BQ speaker and Q multiplier). Like the 1-A, the 2-A, 2-B, and 2-C receivers used a diode detector for AM and a product detector for SSB and CW. They covered only 28.5

through 29.1 MHz of 10 meters; the 2-A and 2-B had a place to insert seven optional crystals to add 600 kHz of the spectrum from 4 through 30 MHz. Both the 2-A and 2-B weighed 14.5 pounds and were 12 inches wide, 7 inches high, and 9 inches deep. Both had a pre-drilled hole for an SO-239 antenna jack if the owner wanted to install one. The 2-family receivers didn't transceive with any transmitter. It wasn't until 1965 that Drake built the T-4, and in 1966, they built the 2-NT CW transmitter aimed at Novice licensees and the T-4X that had a variable frequency oscillator.

That same year, Drake also updated the popular 2-B to the 2-C, which was much more solid state and matched the Drake 2-NT Novice CW transmitter, making a nice station for the somewhat affluent Novice. The 2-C used silicon diodes in place of the vacuum-tube rectifier found in earlier Drake receivers. Its crystal oscillators, product and diode detector, audio amplifier, and audio output stages became solid state; the signal



path was still made with vacuum tubes. The 2-C weighed 13.5 pounds and was 11.37 inches wide, 6.4 inches high, and 9.4 inches deep. It continued to use the Drake 2-AC plug-in 100 kHz crystal calibrator and accepted the 2-CQ Q multiplier and 2-NB noise blanker. An external speaker was needed. There was a speaker in the 2-CQ Q multiplier, or Drake's matching 2-CS external speaker could be purchased. Drake also offered the 2-LF converter that enabled the receiver to cover 160 meters.

## The 4-Line Begins

The double-conversion R-4 receiver used 13 vacuum tubes and some solid-state devices. The rectifiers were silicon diodes, but voltage regulation was achieved using a gas-filled 0B2 voltage regulator tube. Like the 2-C, the entire signal path was made

with vacuum tubes, including the audio circuitry. The R-4 could accept an optional crystal to enable the 160-meter band. It needed an external speaker, and Drake made the MS-4, which enclosed the power supply for the optional transmitters that Drake made to transceive with the R-4.

The T-4 transmitter didn't contain a variable frequency oscillator (VFO); it only transceived at a frequency determined by the receiver. Drake used a fairly wide crystal lattice filter in the first IF at 5645 kHz and ultimate selectivity at the 50 kHz IF.

The R-4A was similar to the R-4, which used 14 vacuum tubes, including a 6AU6 in the VFO and an 0B2 gas-filled voltage regulator. The R-4A used 11 vacuum tubes (the VFO was now solid state, but the 0B2 regulator was still used to regulate voltage into

the crystal oscillators). The T-4X also became available at this time, with a built-in solid-state VFO, as used in the R-4A receiver.

The R-4B was quite similar to the R-4 and R-4A, but the tube count dropped to nine, as more circuitries became solid state. Drake maintained the ability for any 4-line receiver to operate with any 4-line transmitter, just like the Collins S-line and Heathkit SB-line. Hallicrafters didn't maintain this ability between the SX-117 and HT-44 or SX-146 and HT-46 pairs of receivers and transmitters, because the signal path inside each pair was radically different from the other.

## R-7 Receivers

The R-7 receivers all provided general coverage from 10 through 30,000 kHz by the installation of the DR-7 general-coverage, digital-display circuit board. None of the R-7 receivers had only amateur band coverage. There was a solid-state TR-7 amateur band transceiver, but a T-7 or T-7X solid-state transmitter was never manufactured.

## A Return to SWL Products

From 1991 to 1998, Drake returned to manufacturing receivers for people interested in SWL activities. In 1982, the TR-5 was the last Drake amateur radio product. It was the end of an era!



The Drake TR-7 transceiver.  
[Photo courtesy of [www.rigpix.com](http://www.rigpix.com)]

## Strays

### Dismal Swamp Activation

Bob Conder, K4RLC, operated successfully from Dismal Swamp State Park in Camden County, North Carolina, and the surrounding areas in February 2023. "I set up [my] IC-706MKIIG at a picnic table on 20 CW and soon had a pileup. Someone

spotted me on the POTA site and [on the Reverse Beacon Network]. Soon, I was getting emails asking for contacts. Little did I know how rare Camden County was, especially on the 40 and 20 CW bands," Bob said. The following day, Bob made contacts from Merchants Millpond

State Park to stations in Virginia, the Midwest, New York, and New Jersey with an inverted V on 40 CW on a push-up carbon fiber mast. "Overall, it was an exceptionally pleasant trip, and I would like to go back to explore [more]," Bob concluded.



# 100, 50, and 25 Years Ago

## September 1923

- The cover shows a successful ham overwhelmed by incoming QSL cards.
- Amateur radio operators all over North America are arranging for a second continent-wide get-together. The complete program and schedule of events are listed in "The Second National A.R.R.L. Convention" by S. Kruse, 10A.
- C.R. Sawyer, 1GL, shows how inexpensive and high-quality radio masts can be made in "How to Make a Good 70-foot Mast."
- Hams agree that 200 meters is not the best amateur wave. S. Kruse, 10A, explains how ARRL and the Bureau of Standards will help in "Getting Away from 200 Meters."
- Just what is a nodal point, and why is it so important? H.F. Mason, 1ID, answers in "The Nodal Point Explained."
- Sending and receiving antennas do not follow the same rules. Ross Gunn, M.S., presents information on "The Best Dimensions for Amateur Antennas."
- How to handle traffic is outlined in "Ham Traffic in Any Old Shack" by F.H. Schnell, 1MO.
- In "Editorials: The Convention," members and amateurs in North America are encouraged to attend the Second National A.R.R.L. Convention.



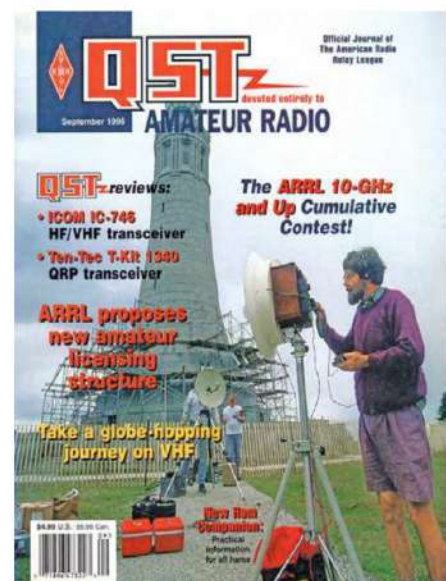
## September 1973

- The cover shows HQ Lab assistant Bob Wright's, WA7ISP, hand holding a typical support for the bite-size beam. Details for this space-saving two-band Yagi system can be found in "A Bite Size Beam" by Robert M. Myers, W1FBY, and Clarke Greene, WA1JLD.
- The formation of the ARRL Foundation and further information on the proposal to turn a portion of 220 over to CB are discussed in "It Seems to Us...Foundation" and "220 Defense."
- A simple, inexpensive, and easy-to-build mixer for UHF reception is described in "A High-Performance Balanced Mixer for 1296 MHz" by Paul Wade, WA2ZZF.
- Two amplifier designs, complete with construction information and performance data, that use the latest techniques for building broadband transformers are presented in "An HF-Band Solid-State Amplifier, Part 1" by Jack Manon, W6FIG.
- League officials made a 40-minute presentation to the FCC outlining the history, present status, and likely future of the Amateur Radio Service. The text appears in "Presentation for the Amateur Service" by Harry J. Dannals, W2TUK, President; John Huntoon, W1RW, General Manager, and Robert M. Booth, Jr., W3PS, General Counsel.



## September 1998

- The cover shows Dale Clement, AF1T, operating 10 GHz from the summit of Mt. Greylock in western Massachusetts.
- A discussion of the FCC's release of regulatory review proceedings, including a proposal to streamline the amateur licensing structure, and the Board's decision process, is explained in "It Seems to Us...Restructuring" by David Sumner, K1ZZ.
- A traveling Texan takes you around the world on VHF in "Sunspots, Moonbeams and Earth Sites" by Jimmy Treybig, W6JKV.
- You can always have power on hand with this easy-to-build project — "A Versatile, High-Capacity Battery Power Source" by Don A. Gagnon, WB8HQS.
- Enjoy an interview with a popular promoter of microwaves in "A Conversation with...Paul Wade, W1GHZ" by Steve Ford, WB8IMY.
- "A 'Sharp' PC for Ultra-Portable Packet," by Richard J. Kruis, WD8CQP, uses the latest — and smallest — hand-held computers and TNCs for a truly diminutive portable packet station.
- Tom Hammond, N0SS, describes "An Easy-Up and Easy-to-Store Field-Day Dipole" in this month's "Hints & Kinks" column.





# Silent Keys

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

<p> <b>W1BBU</b>  <b>K1BRO</b>  <b>W1BUG</b>    <b>KE1D</b>  <b>W1DAM</b>  <b>K1DPM</b>  <b>WB1DZI</b>  <b>KA1HIH</b>  <b>K1MEB</b>  <b>K1OGW</b>  <b>K1PZY</b>  <b>W1SJG</b>  <b>W1SND</b>  <b>N1TDJ</b>  <b>KB1WEI</b>  <b>KC1XM</b>  <b>N1XPB</b>  <b>N1YAF</b>  <b>WA1YLN</b>  <b>NS1Z</b>  <b>N2AQR</b>  <b>N2EDF</b>  <b>W2EJG</b>    <b>KC2GLG</b>  <b>K2GNT</b>  <b>W2JFM</b>  <b>WB2JNV</b>  <b>K2KII</b>  <b>K2OAA</b>  <b>WA2PHH</b>  <b>W2PS</b>  <b>K2QFI</b>  <b>KC2THG</b>  <b>N2VWZ</b>    <b>AA2WJ</b>    <b>N2XSU</b>  <b>AB3BY</b>  <b>W3CLA</b>  <b>W3FUT</b>  <b>KD3J</b>  <b>KB3NPM</b>  <b>KX3P</b>  <b>K3PSD</b>  <b>KB3RFY</b>  <b>W3WJN</b>  <b>W3WTD</b>    <b>K4AGC</b>  <b>KD4AGQ</b>  <b>WB4BOY</b>  <b>KD4CFS</b>    <b>W4CHF</b>  <b>WB4DRJ</b>  <b>W4DYW</b>  <b>K4EOR</b>  <b>KA4FZJ</b>  <b>KG4GEJ</b>  <b>W44HS</b>  <b>KI4IG</b>  <b>KF4IOL</b>  <b>KE4IWU</b>  <b>N4JRK</b>  <b>KD4KZY</b> </p>	<p> <b>Hales, John F.</b>, Saint Petersburg, FL  <b>Boutin, Andy</b>, Camden, SC  <b>Augustine, Armand F.</b>, New Bedford, MA  <b>Colbert, Leslie</b>, Austin, MN  <b>Molnar, Stephen M.</b>, Ocala, FL  <b>Small, Richard R.</b>, Parrish, FL  <b>Falcigno, Eunice J.</b>, North Haven, CT  <b>Tramontozzi, Louis</b>, Marlborough, MA  <b>Rivers, Howard J.</b>, Fitchburg, MA  <b>Gamsby, Otis G.</b>, Concord, NH  <b>Murphy, John F.</b>, Clearwater, FL  <b>Brown, James E.</b>, Riga, MI  <b>Percy, Sandra</b>, Laconia, NH  <b>Mugford, William R.</b>, Middleton, MA  <b>McGhie, Patrick</b>, Savannah, GA  <b>Fowler, John R.</b>, Boynton Beach, FL  <b>Ramm, Karl</b>, Hillsborough, NC  <b>May, Roger J.</b>, Waterbury, CT  <b>Curry, Harold T.</b>, Wakefield, RI  <b>Wilcox, John M.</b>, Weare, NH  <b>Regner, John C., Jr.</b>, Jamestown, NY  <b>Shelton, Robert C., Jr.</b>, Randolph, NJ  <b>Brannigan, Robert L.</b>, Daytona Beach, FL  <b>Sabbi, George</b>, Ridgewood, NJ  <b>Camishion, Rudolph C.</b>, Riverton, NJ  <b>Miller, John F.</b>, East Greenbush, NY  <b>Bolmer, Anita L.</b>, Yorkville, NY  <b>Rustako, Anthony J., Jr.</b>, Colts Neck, NJ  <b>Blanke, John</b>, Melbourne, FL  <b>Jones, Robert E.</b>, Tupper Lake, NY  <b>Bond, Benjamin</b>, Latham, NY  <b>Amodeo, Crescent A.</b>, Verona, NY  <b>Bittermann, Steven A.</b>, Catskill, NY  <b>Worthington, James C., III</b>, Binghamton, NY  <b>Jackson, Wayne A.</b>, Egg Harbor Township, NJ  <b>Kish, Robert F.</b>, Watertown, NY  <b>Evans, Norman D.</b>, Harwood, MD  <b>Cola, Leonard A.</b>, Philadelphia, PA  <b>Cordrey, Charles E.</b>, Richmond, VA  <b>Jarrett, Neil S., Jr.</b>, Sarasota, FL  <b>Wooden, Helga M.</b>, Kingston, PA  <b>Balamuth, Michael L.</b>, Alstead, NH  <b>Dimick, Paul S.</b>, Centre Hall, PA  <b>Lucy, James E.</b>, Gaines, PA  <b>Skopal, Thomas E., Sr.</b>, Bethlehem, PA  <b>Geoghegan, William Howard</b>, Easton, MD  <b>Small, Leo J.</b>, Vienna, VA  <b>Sears, Dan C.</b>, Chapel Hill, NC  <b>Edwards, Dennis L.</b>, Bartlett, TN  <b>Poindexter, Hubert E., Jr.</b>, Kernersville, NC  <b>Le Fevre, Brent M.</b>, Hinesville, GA  <b>Rogers, Lee S.</b>, Raleigh, NC  <b>Hull, Ellen M.</b>, Asheville, NC  <b>Averill, George E.</b>, Cataula, GA  <b>West, Phyllisan</b>, Cape Coral, FL  <b>Edwards, Danny</b>, Como, NC  <b>Nyman, Eric W.</b>, Arlington, VA  <b>Smith, Thomas C.</b>, Chatsworth, GA  <b>Endress, Thomas M.</b>, Clanton, AL  <b>Maze, Harold E., Jr.</b>, Hampton, KY  <b>Batey, James W.</b>, Anniston, AL  <b>Jones, Ross R.</b>, Enterprise, AL </p>	<p> <b>KA4MAP</b>  <b>AB4MB</b>  <b>AJ4ON</b>  <b>AB4QE</b>  <b>AD4RC</b>  <b>N4SQV</b>  <b>WB4TBZ</b>  <b>K4TEE</b>  <b>KD4UQY</b>  <b>KN4VNX</b>  <b>W4WWG</b>  <b>WA4ZZQ</b>  <b>KI5AL</b>  <b>KK5BZ</b>  <b>K5CAM</b>  <b>W5CGV</b>  <b>AF5DH</b>  <b>N5DOE</b>  <b>K5FF</b>  <b>K5FKT</b>  <b>K5GKJ</b>  <b>K5IFO</b>  <b>K5LTS</b>  <b>K5MZ</b>  <b>NX5O</b>  <b>K5OVC</b>  <b>K5PHB</b>  <b>K5POK</b>  <b>KA5PSG</b>  <b>K5RS</b>  <b>KD5SMP</b>  <b>KC5UNC</b>  <b>KC5UOZ</b>  <b>KC5VIP</b>  <b>WU6D</b>  <b>KM6DD</b>    <b>AA6GI</b>  <b>KI6GRU</b>  <b>NS6K</b>  <b>W6KXA</b>  <b>K6LVD</b>  <b>W6MGP</b>  <b>NX6U</b>  <b>NM6X</b>  <b>WB6YAF</b>  <b>WA6ZLO</b>  <b>W7AXH</b>  <b>KB7BXQ</b>  <b>W7DVU</b>  <b>WA7DXI</b>  <b>W7DYS</b>  <b>N7EGB</b>  <b>K7IJB</b>  <b>KJ7IQM</b>  <b>W7JAU</b>  <b>NK7P</b>  <b>KN7PF</b>  <b>W7REC</b>  <b>WA7RLL</b>  <b>N7SCT</b>  <b>KJ7SNL</b>  <b>WN7TSY</b>  <b>N7TWI</b>  <b>KK7UT</b>  <b>KB7VHR</b>  <b>KL7VT</b>  <b>WB7WSQ</b> </p>	<p> <b>Dodson, Ronald L.</b>, Webster, KY  <b>Mainesmith, D.C.</b>, Raleigh, NC  <b>Giese, Robert H.</b>, Tellico Plains, TN  <b>Smith, John R.</b>, Winfield, AL  <b>Lundberg, Ferdinand</b>, Garner, NC  <b>Dixon, Patrick K.</b>, Russell Springs, KY  <b>Whitmer, Louis A.</b>, Goshen, KY  <b>Wood, Charles R.</b>, Lexington, NC  <b>Curran, Richard F.</b>, Bristol, TN  <b>Jones, Christian M.</b>, Palm Coast, FL  <b>Childress, James S.</b>, Saint Augustine, FL  <b>Smyth, William A., Jr.</b>, Monetta, SC  <b>Jett, Herbert A.</b>, Seguin, TX  <b>South, Hugo B.</b>, Pleasanton, TX  <b>Mitchell, Alfred Cameron</b>, Cat Spring, TX  <b>Gibson, Walter R.</b>, Saint Rose, LA  <b>Heath, J. 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## FTDX101MP | 200W HF/50MHz Transceiver

- Hybrid SDR Configuration • Unparalleled 70 dB Max. Attenuation VC-Tune • New Generation Scope Display 3DSS • ABI (Active Band Indicator) & MPVD (Multi-Purpose VFO Outer Dial) • PC Remote Control Software to Expand the Operating Range • Includes External Power With Matching Front Speaker



## FTDX10 | HF/50MHz 100 W SDR Transceiver

- Narrow Band and Direct Sampling SDR • Down Conversion, 9MHz IF Roofing Filters Produce Excellent Shape Factor • 5" Full-Color Touch Panel w/3D Spectrum Stream • High Speed Auto Antenna Tuner • Microphone Amplifier w/3-Stage Parametric Equalizer • Remote Operation w/optional LAN Unit (SCU-LAN10)



## FT-991A | HF/VHF/UHF All Mode Transceiver

- Real-time Spectrum Scope with Automatic Scope Control • Multi-color waterfall display • State of the art 32-bit Digital Signal Processing System • 3kHz Roofing Filter for enhanced performance • 3.5 Inch Full Color TFT USB Capable • Internal Automatic Antenna Tuner • High Accuracy TCXO



## FTDX101D | HF + 6M Transceiver

- Narrow Band SDR & Direct Sampling SDR • Crystal Roofing Filters Phenomenal Multi-Signal Receiving Characteristics • Unparalleled - 70dB Maximum Attenuation VC-Tune • 15 Separate (HAM 10 + GEN 5) Powerful Band Pass Filters • New Generation Scope Displays 3-Dimensional Spectrum Stream

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## FT-710 Aess | HF/50MHz 100W SDR Transceiver

- Unmatched SDR Receiving Performance • Band Pass Filters Dedicated for the Amateur Bands • High Res 4.3-inch TFT Color Touch Display • AESS: Acoustic Enhanced Speaker System with SP-40 For High-Fidelity Audio • Built-in High Speed Auto Antenna Tuner



## FT-891 | HF+50 MHz All Mode Mobile Transceiver

- Stable 100 Watt Output • 32-Bit IF DSP • Large Dot Matrix LCD Display with Quick Spectrum Scope • USB Port Allows Connection to a PC with a Single Cable • CAT Control, PTT/RTTY Control



## FTM-300DR | C4FM/FM 144/430MHz Dual Band

- 50W Output Power • Real Dual Band Operation • Full Color TFT Display • Band Scope • Built-in Bluetooth • WIRES-X Portable Digital Node/Fixed Node with HRI-200



## FT-2980R | Heavy-Duty 80W 2M FM Transceiver

- 80 watts of RF power • Large 6 digit backlit LCD display for excellent visibility • 200 memory channels for serious users



## FTM-200DR | C4FM/FM 144/430MHz Dual Band

- 1200/9600bps APRS® Data Communications • 2" High-Res Full-Color TFT Display • High-Speed Band Scope • Advanced C4FM Digital Mode • Voice Recording Function for TX/RX

**NEW**



## FTM-500DR | C4FM/FM 144/430MHz Dual Band Xcvr

- Front Firing Acoustically Enhanced Speaker System • True Dual Band Operation, C4FM/C4FM Digital D-D Dual Receive • 2.4" High-Resolution Full-Color Touch Panel Display • Built-in High Precision GPS Receiver • Wireless Operation Capability with Optional Bluetooth® Headset

## FT-70DR C4FM/FM 144/430MHz Xcvr

- System Fusion Compatible • Large Front Speaker delivers 700 mW of Loud Audio Output • Automatic Mode Select detects C4FM or Fm Analog and Switches Accordingly • Huge 1,105 Channel Memory Capacity • External DC Jack for DC Supply and Battery Charging



## FT-5DR C4FM/FM 144/430 MHz Dual Band

- High-Res Full-Color Touch Screen TFT LCD Display • Easy Hands-Free Operation w/Built-In Bluetooth® Unit • Built-In High Precision GPS Antenna • 1200/9600bps APRS Data Communications • Supports Simultaneous C4FM Digital • Micro SD Card Slot



## FT-65R | 144/430 MHz Transceiver

- Compact Commercial Grade Rugged Design • Large Front Speaker Delivers 1W of Powerful Clear Audio • 5 Watts of Reliable RF Power Within a compact Body • 3.5-Hour Rapid Charger Included • Large White LED Flashlight, Alarm and Quick Home Channel Access



## FTM-6000R | 50W VHF/UHF Mobile Transceiver

- All New User Operating Interface-E20-III (Easy to Operate-III) • Robust Speaker Delivers 3W of Clear, Crisp Receive Audio • Detachable Front Panel Can Be Mounted in Multiple Positions • Supports Optional Bluetooth® Wireless Operation Using the SSM-BT10 or a Commercially Available Bluetooth® Headset

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## IC-9700 | All Mode Tri-Band Transceiver

• VHF/UHF/1.2GHz • Direct Sampling Now Enters the VHF/UHF Arena • 4.3" Touch Screen Color TFT LCD • Real-Time, High-Speed Spectrum Scope & Waterfall Display • Smooth Satellite Operation



## IC-905 | VHF/UHF/SHF All Mode Portable

• GPS-Controlled Oscillator for Ultimate Frequency Stability • Separate Controller & RF Unit Configuration • Industry First 144 MHz to Microwave Transceiver • Wideband 50 MHz Span Real-time Spectrum Scope • Full D-STAR Functions



## IC-V3500 | 144MHz FM Mobile

• 65W of Power for Long Range Communications • 4.5 Watts Loud & Clear Audio • Modern White Display & Simple Operation • Weather Channel Receive & Alert Function



## IC-7851 | HF/50MHz Transceiver

• 1.2kHz "Optimum" roofing filter • New local oscillator design • Improved phase noise • Improved spectrum scope • Dual scope function • Enhanced mouse operation for spectrum scope



## IC-705 | HF/50/144/430 MHz All Mode Transceiver

• RF Direct Sampling • Real-Time Spectrum Scope and Waterfall Display • Large Color Touch Screen • Supports QRP/QRPP • Bluetooth® and Wireless LAN Built-in



## D-Star Repeater Infrastructure

• Mix Mode Operation Can Relay Both D-STAR DV and Analog FM Signals • LTE Capable with Optional UX-262 to Connect an LTE Network and Internet • Integrated Controller Built-in and Functions with the RF Module Unit • RF Direct Sampling and FPGA Platform • 3rd Generation D-Star Repeaters with More Features & Power



## IC-7300 | HF/50MHz Transceiver

• RF Direct Sampling System • New "IP+" Function • Class Leading RMDR and Phase Noise Characteristics • 15 Discrete Band-Pass Filters • Built-In Automatic Antenna Tuner



## IC-7100 | All Mode Transceiver

• HF/50/144/430/440 MHz Multi-band, Multi-mode, IF DSP • D-STAR DV Mode (Digital Voice + Data) • Intuitive Touch Screen Interface • Built-in RTTY Functions



## IC-7610 | HF/50 MHz All Mode Transceiver

• Large 7-inch color display with high resolution real-time spectrum scope and waterfall • Independent direct sampling receivers capable of receiving two bands/two modes simultaneously



## IC-2730A | VHF/UHF Dual Band Transceiver

• VHF/VHF, UHF/UHF simultaneous receive • 50 watts of output on VHF and UHF • Optional VS-3 Bluetooth® headset • Easy-to-See large white backlight LCD • Controller attachment to the main unit



## IC-R8600 | Wideband SDR Receiver

10 kHz to 3 GHz Super Wideband Coverage • Real-time Spectrum Scope w/Waterfall Function • Remote Control Function through IP Network or USB Cable • Decodes Digital Incl P25, NXDN™, D-STAR • SD Card Slot for Receiver Recorder



## ID-5100 AD

### VHF/UHF Dual Band Digital Transceiver

• Analog FM/D-Star DV Mode • SD Card Slot for Voice & Data Storage • 50W Output on VHF/UHF Bands • Integrated GPS Receiver • AM Airband Dualwatch

## IC-V86 | VHF 7W HT

• 7W Output/Power Plus New Antenna Provides 1.5 Times More Coverage • More Audio, 1500 mW Audio Output • IP54 & MIL-STD 810G-Rugged Design Against Dust & Water • 19 Hours of Long Lasting Battery Life • 200 Memory Channels, 1 Call Channel & 6 Scan Edges



**NEW**

## IC-T10 | Rugged 144/430 MHz Dual Band

• Disaster Ready - Excellent Fit for Your Emergency Bag • Loud Audio - New Speaker Design • Long Battery Life - Up to 11 Hours • FM Broadcast & Weather Channels



## ID-52A | VHF/UHF D-STAR Portable

• Bluetooth® Communication • Simultaneous Reception in V/V, U/U, V/U and DV/DV • Enriched D-STAR® Features Including the Terminal Mode/Access Point Mode • UHF (225~374.995MHz) Air Band Reception



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**The KX3** has become the compact, 160-6 meter, all-mode transceiver of choice for thousands of hams, for home, travel, and portable use. Its versatility has been demonstrated at countless Field Day and DXpedition operations.

- Matching PX3 panadapter with fast, full-color spectrum/waterfall\*
- 7.4" x 3.5" x 1.7" (weight: 1.5 lbs.)
- Best-in-class performance
- 160-6 meters plus 2 or 4 m\*
- SSB, CW, AM, FM, Data
- Up to 15 W TX
- Weighted, free-spinning VFO knob
- Precision roofing filter\*
- Wide-range internal ATU\*

**Our KX2** "stealth" transceiver can go wherever your imagination takes you. It's pocket sized, yet it transmits at up to 12 watts, covers 9 bands, and shares many features with the KX3. It also works with the KXPA100 amp.

- 5.8" x 2.8" x 1.5" (weight: 13 oz.)
- Ultralight grab-and-go station, perfect for SOTA and field operation
- 80-10 meters (9 bands)
- SSB / CW / Data / AM / FM
- Up to 12 W TX
- Internal 2.6 Ah Li-ion battery\*
- Built-in mic for HT-style operation
- Wide-range internal ATU\*
- KXPD2 compact keyer paddle\*

\* Option

# Make Waves in Style with the New K-Line.

## K4 Direct-Sampling SDR and KPA 1500 Legal-Limit Amp



### K4 Features

Direct sampling SDR • Modular, hybrid architecture • Single or dual panadapter • High resolution tuning aid • Comprehensive I/O • Full remote control via Ethernet • 7" color screen with touch and mouse control • ATU with 10:1+ range • 3 antenna jacks • Up to 5 receive antenna sources



### KPA1500 Features

1500 W • Very compact design • Fast, silent PIN diode T/R switching • Built-in ATU with dual antenna jacks • Compatible with nearly any transceiver – custom cables available • 160-6 meters • CE for Europe



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# MFJ SDR T/R Protection Switch

Turn your SDR into a panadapter to see entire bands on frequency/waterfall displays . . .



An inexpensive wide-band SDR dongle receiver lets you see entire bands on frequency/waterfall computer displays!

**\$139<sup>95</sup>**

If you want to know where the activity is, who's generating splatter, what's in the DX window, how wide your audio is or what frequencies are clear, it's all right there! While receiving on your transceiver, MFJ-1708B-SDR switches your SDR to your antenna showing the entire band. On transmit your SDR is switched out and grounded to protect your SDR. PTT and a fail-safe RF sense switches MFJ-1708B-SDR. For HF/VHF/UHF. Monitor multiple bands with multiple SDRs and a multi-coupler.

**MFJ-1708B-SDRS, \$139.95.** SMA connector for your SDR.

## New B series improvements . . .

The original MFJ-1708 series used one relay and wires to connect the SO-239s. The new B-series uses four relays and connectors on a single pc board. This gives you > 50 dB isolation at 300

MHz and > 68 dB at 50 MHz. SWR < 1.16:1 at 50 MHz and < 1.75:1 at 450 MHz at the transmit port. Mute output is a selectable short or open to ground. Use "boat anchors" or modern receivers or key a linear amplifier. Receiver input protection prevents overload

from nearby high power signals and from receive to transmit. A hybrid splitter on SDR models reduces loading effect and gives > 15 dB isolation between the SDR REC and XCVR ports to reduce interference. The original MFJ-1708 series is still available.

## MFJ Low Noise VLF/HF Receiving Loop MFJ wideband SDR Discone Antenna

**Pull weak signals out of static crashes, atmospheric, man-made and power line noise!**

Hear signals 50 KHz to 30 MHz cleaner, quieter than ever before! Power line noise disappears. Rotate its figure 8 pattern and its extremely deep null to completely eliminate an interfering signal or greatly peak a desired one. Fully protected state-of-the-art Gali MMICs in push-pull gives you a preamp with extremely high dynamic range, low IMD and 25 dB of low noise gain. Excellent performance on strong and weak signals without overload. 36-inch dia. loop. 1-in. OD 6061 aluminum.



**MFJ-1886 \$329<sup>95</sup>**

**MFJ-1886TR \$369<sup>95</sup>**

with built-in Transmit/Receive switch

## Receives 25-1300 MHz

**MFJ ultra wide-band Discone Antenna** receives 25-1300 MHz. Perfect for all band SDR reception. Covers 10, 6, 2 Meters, 220 and 440 MHz and 33/23 CM ham bands and everything in between. It is excellent for monitoring multiple bands simultaneously using multiple SDRs and a multi-coupler. Also test any transmitter 50-1300 MHz using a single discone and single coax. Handles 200W. Includes 50 feet coax, stainless steel elements and mounting hardware.

**MFJ-1866, \$79.95.** Like MFJ-1868 but transmits 144-1290 MHz. Coax and mounting hardware not included.



**MFJ-1868 \$99<sup>95</sup>**

## Tuned Indoor SDR Active Antenna

Make your SDR receiver come alive with HF signals, .3-40 MHz, while rejecting interference with MFJ-1020C tuneable indoor active antenna! Gain control, telescoping whip.



**MFJ-1020C \$129<sup>95</sup>**

## Untuned Indoor SDR Active Antenna

**MFJ-1022, \$89.95.**

Hear weak, noisy VLF to UHF signals. Noise-less feedback gives excellent low noise reception. Handles strong signals.

## Active Outdoor Antenna

**World Radio TV Handbook**

**MFJ-1024 \$219<sup>95</sup>**  
1024 is a first rate, easy-to-operate active antenna, quiet, excellent dynamic range, good gain, very low noise factor, broad frequency coverage, excellent choice . . .

**Outdoor** mounted 54-inch whip/preamp gives maximum signal and minimum noise. Covers .05-30 MHz.

**Indoor** unit: 20 dB attenuator, gain control, 2 receiver and 2 antenna switches.

## HF SDR Preselector

**Tuneable**

**MFJ-1040C** lets you copy weak, noisy SDR signals from 1.8 to 54 MHz. Greatly tunes out and reject out-of-band interference. Up to 20 dB gain. Has gain control. Cascode FET/bipolar transistor gives low noise, high gain without overloading. Switches for 2 antennas and 2 receivers. SO-239s. Has 20 dB attenuator. Automatically bypasses when transmitting or use PTT. 6 1/2" W x 2 1/2" H x 4 D inches.



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## MFJ LW/MW/SW SDR Preselector/Tuner

**Highly rated series-tuned MFJ** boosts your desired signals while greatly rejecting interference and preventing serious overload.

**Greatly** improves reception 0.15 to 30 MHz. Incredibly effective below 2 MHz.

**Super** easy to operate, select band and tune!

**Bypass** tuner and ground receiver switch positions.

**Compact** 2x3x4 inches. SO-239 connectors.



**MFJ-956 \$109<sup>95</sup>**



**MFJ-1708B \$139.95.**

## MFJ RF Sense Transmit/Receive Switch

**Switches** your antenna from receiver to transmitter using a relay. Shorts your receiver to ground during transmit. Use RF sensing with adjustable delay or PTT line. Has selectable open/short mute.



**MFJ-1707B \$139.95.**

## Auto switch XCVR between 2 antennas

**Automatically** switches separate transmit and receive antennas on transceivers with only one antenna port. *Example:* Efficient 75M dipole for XMIT and low noise MFJ loop for receive -- **no static crashes!**



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# MFJ

# G5RV Antennas

Operate all bands 10 thru 160 Meters with a single wire antenna!



**MFJ-1778** The famous G5RV antenna is the most popular ham radio antenna in the world!

It's an efficient, all band 102 foot long antenna –

shorter than an 80 Meter dipole. Has 32.5 foot ladder line matching section ending in

SO-239 connector for your coax feedline.

Use horizontally or as Inverted Vee or Sloper with just one support. 1500 Watts.

Operate all bands 80-10 Meters with an antenna tuner and even 160M with ground.

Fully assembled with ceramic end and fiberglass center insulators. Hang and Play™ – add coax, rope to hang and you're on air!

**MFJ-1778M, \$79.95.** Half-size, 52 foot G5RV JUNIOR for limited space. 40-10 Meters with tuner. Full 1500 Watts.

## MFJ All Band Classic Doublet

**MFJ** 102 foot all band doublet covers 160-6 Meters with balanced line tuner. Super strong custom fiberglass center insulator relieves stress on 100 foot ladder line.

Glazed ceramic end insulators. 1500 Watts.



**MFJ-1777**  
**\$129.95**

## RF Isolator

**MFJ-915 RF Isolator**

**\$49.95** prevents unwanted RF

from traveling on the outside of your coax shield into your transceiver. This unwanted 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. 1.8-30 MHz, 1500 Watts. 5x2 inches.

**MFJ-919, \$84.95.** 4:1 current balun, 1.5 kW.

**MFJ-913, \$49.95.** 4:1 balun, 300 Watts.



## True 1:1 Current Balun & Center Insulator



**MFJ-918** True 1:1 **\$49.95** Current Balun/Center Insulator

forces equal radiator currents in dipoles for true dipole radiation pattern. Reduces coax radiation and field pattern distortion -- your signal goes where you want it. Reduces TVI, RFI and RF hot spots. Don't build a dipole without one! 50 hi-permeability ferrite beads on high quality RG-303 Teflon® coax and Teflon® SO-239. 1.5kW 1.8-30 MHz. Stainless steel hardware. 14 gauge stranded copper wire is directly connected to your antenna. 5x2 inches. Heavy duty weather housing.

## 2-Position Antenna Switch

**MFJ-1702C, \$69.95.** 2-position antenna switch, lightning surge protection, center ground. SO-239s.

**Lightning surge protectors. MFJ-270, \$27.95.** 400W. **MFJ-272, \$37.95.** 1500 W. Gas discharge tube shunts 5000 amps peak < 0.1 dB loss. 1 GHz. SO-239s.

**MFJ-16C06, \$9.95.** 6-pack glazed ceramic end/center ant. insulators.

**MFJ-16B01, \$39.95.** Molded high-strength center insulator. SO-239.

**MFJ-16D01, \$19.95.** 450 Ohm fiberglass end/center insulator with ladder line stress relief and SO-239 mount.

**MFJ-18H100, \$69.95.** 100 feet, 450 Ohm ladder line, 18 gauge copper clad.

# 80-10 Meter End-Fed Half Wave antenna

Cover all HF bands with one single wire and no tuner!



**MFJ-1982HP, \$129.95**

## No tuner needed!

All band 80-10M EFHW antenna

Get-on-the air on all bands 80-10 Meters with just one wire and one support (pole or tree) and no tuner or long counterpoise.

Installs anywhere in minutes! Rugged insulated-wire radiator prevents detuning when contacting limbs/branches. "No-sag" end insulator slides over branches, leaves.

Toss over a high limb for inverted-V or sloper or go vertical with an inverted-L.

Dark jacketed wire is virtually invisible -- don't let antenna restrictions keep you off the air! Great for emergencies.

EFHWs naturally resonate on the 1/2-wave fundamental frequency and odd/even harmonics. Covers 80/40/30/20/17/15/12/10 Meters without traps, stubs or resonators.

Broad-band matching transformer at feed point gives SWR so low you may

never need a tuner. Compensating inductor optimizes SWR. 800 Watts SSB/CW. 132 feet jacketed antenna wire.

## More 80-10 Meter Models

**MFJ-1982MP, \$99.95.** Like MFJ-1982HP but handles 300 Watts.

**MFJ-1982LP, \$89.95.** Like MFJ-1982MP but handles 30 Watts.

## EFHW 40-Meter Models

**MFJ-1984HP, \$109.95.** Like MFJ-1982HP but 40-10M. 66 feet jacketed wire.

**MFJ-1984MP, \$89.95.** Like MFJ-1982HP, but handles 300 Watts.

**MFJ-1984LP, \$79.95.** Like MFJ-1982MP, but handles 30 Watts.

## Dual Band Dipoles



**MFJ-17758**  
**\$129.95**  
80/40 Meters

**MFJ-17758, \$129.95.** Operate 80/40 Meters with a short 85 foot dipole. Full-size on 40 Meters

with ultra-efficient end-loading on 80 Meters. 1500 Watts. Super-strong custom molded center insulator with SO-239 connector and hang hole. Ceramic end insulators. 7-strand, 14 gauge hard copper wire. No tuner needed!

**MFJ-17754, \$89.95.** Like MFJ-17758 but is only 42 feet. Operate 40/20 Meters. Full-size on 20 Meters, ultra-efficient end-loading on 40 Meters. 1500 Watts.

## Single Band Dipoles



**MFJ-1779A**  
**\$99.95**  
160M, 265 ft.

**MFJ-1779B**  
**\$79.95**  
80-40M, 135 ft.

**MFJ-1779C**  
**\$59.95**  
20-6M, 35 ft.

Ultra high quality center fed dipoles give years of trouble-free service.

Custom injection-molded UV-resistant center insulator has built-in SO-239 and hanging hole. Glazed ceramic end insulators. 7-strand, 14-gauge hard copper antenna wire. 1500 Watts. Use horizontally or as sloper or inverted vee. Simply cut to length with provided cutting chart.

## OCFD Dipoles



**MFJ-2012**  
**\$109.95**  
1500 Watts

**MFJ-2010**  
**\$89.95**  
300Watts

**No tuner needed!** MFJ Off-Center Fed Dipoles use MFJ's exclusive ExactRatio™ RF broadband transformer to give low SWR and maximum

bandwidth on 40/20/10/6 Meters. A Guanella current balun kills feedline radiation, pattern distortion, SWR shifts, RFI and noise pickup. Install anywhere and get the same predictable performance regardless of feedline length. You get ground reinforced gain over verticals. Use horizontally, inverted vee, sloper. 98% efficient, 14 gauge, 7-strand copper wire, ceramic end insulators.

# MFJ

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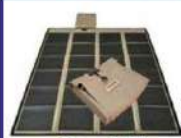
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# MFJ Cobweb Antenna

## 6-Bands: 20/17/15/12/10/6 M . . . Outstanding Performance!



**Now Includes  
6 Meters!!!**

MFJ-1836  
**\$299<sup>95</sup>**  
300W

MFJ-1836H  
**\$319<sup>95</sup>**  
1.5 kW

**40-6  
Meters**

MFJ-1838  
**\$489<sup>95</sup>**

## 40-6 Meter Cobweb Super Heavy-Duty, 1.5 kW

**New! Super heavy-duty** 40-6 Meter Cobweb Antenna. Built to survive harsh northern winters, heavy snow, ice and strong winds -- has super-strong large diameter fiberglass and heavy-duty 14 gauge stranded hard copper wire. 8-bands: 40, 30, 20, 17, 15, 12, 10, 6 Meters, 1500 Watts. 12 feet, 23 lbs.

**Restricted space spoiling your operating fun? MFJ Cobweb puts your call back on the map!**

**This** six-band (20, 17, 15, 12, 10, 6 Meters) full half-wave Cobweb Antenna is perfect for restricted space or portable operation. Sky-gray fiberglass spreaders and *nearly invisible* wire elements (flat 9x9x1/2 feet square. 8 pounds), blend in with your surroundings while standing tough against nasty weather.

**Outstanding performance!** Horizontally polarized for less local noise pickup plus solid gain over verticals will allow you to work DX easily -- even on QRP. Omni-directional. No radials needed! Works great at low heights. Low SWR is due to MFJ's exclusive Spider-Match™ broadband network. Use lightweight TV hardware to mount on your chimney, balcony, mast.

**Low in cost**, but big on performance. MFJ Cobweb Antenna turns your space problem into a stack of QSL cards from far away places.

**MFJ-1836HK34, \$159.95.** Add-on kit adds 40/30 Meters to MFJ-1836/1836H cobwebs.

## MFJ 20/17/15/12/10/6 Meter Hexbeam



**NEW!**

MFJ-1846  
**\$599<sup>95</sup>**

10/12/15/17/20M, 1.5 kW

MFJ-1848  
**\$799<sup>95</sup>**

10/12/15/17/20/30/40M,  
1.5 kW

improved bandwidth, superior front-to-back ratio and low SWR!

MFJ takes the HexBeam's unique balanced-tension framework to a new level with rugged mounting hardware, exceptionally durable spreaders and sliding antenna wire guides -- designed to ensure years of reliable service.

**MFJ-1846, \$599.95.** 6 Bands: 20/17/15/12/10/6M, 2-elements per band, full 1500W. 25 lbs. 11 ft. turning radius.

**MFJ-1848, \$799.95.** 8 Bands: 20/17/15/12/10/6M, 2-elements per band; 40/30M, single elements, full 1500W. 28 lbs. 14 ft. turning radius.

## Reach for the Sky!

**MFJ-1906H, \$239.95.**

Strong durable telescoping fiberglass pole gets your antenna up in the air fast! QuickClamps™, 33 feet extended, 6 feet collapsed. Six 6 foot sections, 13 lbs. 2" bottom OD, 3/4" top OD.

**MFJ-1919EX, \$199.95.** Strong 18 foot telescoping fiberglass mast and heavy duty steel tripod.

**MFJ-1918EX, \$129.95.** Tripod with 9.5 foot telescoping fiberglass mast.

**New MFJ HexBeams** deliver solid gain and directivity on 20/17/15/12/10/6 Meters with two elements on each band. MFJ uses an updated G3TXQ element configuration for excellent gain,

### MFJ Isolator and 1:1 Balun



**MFJ-915, \$49.95** Stop RF traveling down coax line, painful RF "bites" and erratic operation. 1.5 kW 1.8-60 MHz. 2Wx5H". SO-239s.



**MFJ-918, \$49.95** True 1:1 Current balun & center insulator forces equal antenna currents in dipole elements.

### MFJ Dry Dummy Load

**MFJ-260C, \$69.95**

Air-cooled, 300 Watt dry dummy load with a non-inductive resistor in a perforated metal housing. SO-239 connector. Full load 30 seconds. Silk-screened derating curve to 5 minutes. SWR below 1.1:1 to 30 MHz, 1.5:1 from 30 to 650 MHz.



### MFJ 2-Pos. Antenna Switch

**MFJ-1702C, \$69.95**

2-Position antenna switch has center ground, auto grounding of unused positions, handles 2.5 kW PEP and works to over 500 MHz. Lightning surge protection. Quality SO-239 connectors, heavy duty diecast.

**MFJ-1704, \$129.95.** Like MFJ-1702C but has 4 positions.



### MFJ G5RV Antenna

**MFJ-1778, \$89.95**

G5RV antenna covers 160-10 Meters with antenna tuner. 102 ft. long. Inverted vee or sloper. Use on 160 Meters as Marconi. 1500 Watts. Super-strong fiberglass center feedpoint insulators. Glazed ceramic end insulators. Hand soldered. Add coax, some rope and you're on the air!



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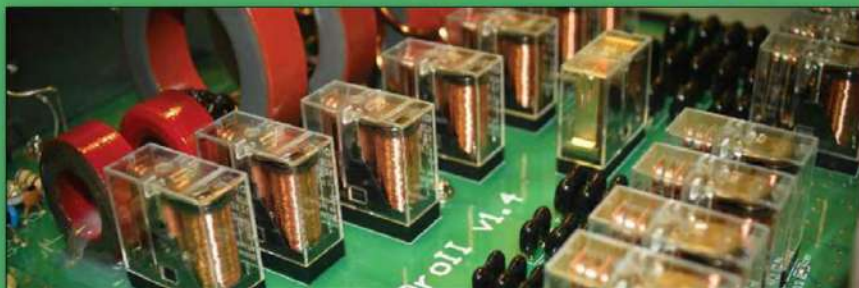
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# MFJ Magnetic Loop Antennas



**MFJ 36-inch magnetic loop antenna lets you operate 7 to 22 MHz or 10 to 30 MHz continuously -- including the WARC and MARS bands! Easily handles a full 150 Watts on SSB/CW/Digital for any transceiver.**

Ideal for limited space. Apartments, small lots, motor homes, attics, trailers.

Work exciting DX with low angle radiation and local close-in contacts with high angle radiation when mounted vertically.

Super easy-to-use! MFJ remote control auto tunes to your desired band. Fast/slow tune buttons, Cross-Needle SWR/Wattmeter lets you quick-

ly tune to your exact frequency. No control cable needed.

**World's most efficient small loop antenna has all welded construction, welded butterfly capacitor with no rotating contacts, large 1.050 inch diameter aluminum radiator -- gives you highest possible efficiency.**

Every capacitor plate is welded for extremely low loss and polished to prevent high voltage arcing. Nylon bearing, anti-backlash mechanism, limit switches, continuous no-step DC motor gives smooth precision tuning. Heavy-duty ABS plastic housing has ultraviolet inhibitor protection.

**MFJ-1782, \$599.95.** Like MFJ-1786 but fast/slow tune man. control.

**MFJ-1780, \$429.95.** 20-10 M, 150W Portable 24x24x24" box fan loop with handle. Fast/slow tune control. See QST July 2019.

**MFJ-1780XX, \$429.95.** Like MFJ-1780, auto band control.



**MFJ-1784, \$659.95.** 40-15 Meters.

**MFJ-1783, \$599.95.** 30-10 Meters.

## Build your own Mag loop!

### Motorized Butterfly Capacitors

Super low loss butterfly capacitors, no rotating contacts, all plates welded with no mechanical electrical contacts. Anti-backlash mechanism. DC motor with gear reduction box. Handles at least 150 Watts SSB/CW/Digital.

**1. p/n: 282-1786, \$189.95.** 11-128 pF.

**2. p/n: 282-1788, \$249.95.** 15-260 pF.

**3. p/n: 80-1786-2SM, \$249.95.** Auto band selecting remote controller with SWR/Wattmeter.

**4. p/n: 80-1782-2, \$79.95.** Manual remote control, fast/slow tune buttons.

### Butterfly Capacitors

**5. MFJ-19, \$114.95.** 2-67 pF.

**6. MFJ-23, \$159.95.** 18-136pF.

**7. p/n: 729-0142, \$19.95.**

6:1 vernier gear reduction drive for loop tuning capacitor.

**8. 36-inch Aluminum Circular Loop with Integrated welded capacitor and mast mounting brackets**  
p/n: 10-1786-11, \$129.95. 1.05 inch OD heavy duty tubing.



## MFJ Magnetic Loop Tuners, 150 Watts

**C Turns wire or coax into a small, high efficiency multi-band transmitting magnetic loop antenna!**

**B Work the world 3.5 to 30 MHz with a full 150 Watts SSB/CW/Digital.** No ground, radials or counterpoises needed.

**A New** larger matching capacitor is 313 pF. Increases matching range. Butterfly capacitor has no rotating contacts.

**Very quiet receiving antenna --** you'll hardly notice static crashes. High-Q reduces QRM, overloading, harmonics. Perfect for apartments, antenna restricted areas and portable operation.

A 13' wire loop covers 30-20 Meters (4' for 17-10M; 7' for 20-15M; 28' for 60-40M; 50' for 80M). Tune any shape loop -- circle, square, rectangle, etc.

A wire length gives about 1.5 to 1 frequency range (i.e. 7-10, 18-28 MHz).

Easy-Carry handle. Mount for PVC Cross loop support on cabinet top. Included tripod/mast mount.

**A. MFJ-936C, \$389.95.**

Antenna current meter, Cross-Needle SWR/Wattmeter. 9 1/4 Wx5 1/2 Hx9 1/2 D".

**B. MFJ-935C, \$299.95.**

Antenna current meter. 6 1/4 Wx5 1/2 Hx9 1/2 D".

**C. MFJ-933C, \$279.95.** 6 1/4 Wx5 1/2 Hx9 1/2 D".



## MFJ Low-Noise Receiving Mag Loop

Clearly hear signals 50 KHz to 30 MHz you never knew existed. Power line noise and static disappears. Rotating MFJ-1886 eliminates interfering signals or greatly peaks desired signals.

Excellent antenna and preamplifier balance gives deep null. Gives excellent strong and weak signal performance without overload. Fully protected state-of-the-art push-pull Gali MMICs preamplifier gives you high dynamic range, low IMD and 25 dB of low noise gain. Use inside or outside.



## QRP Mag Loop Tuner

**MFJ-9232**  
**\$69<sup>95</sup>**  
Turns wire around a bookcase, window, tree, etc. into a small, high efficiency transmitting loop antenna! Operate 40-10 Meters with included flexible wire loop (80/60 Meters with your bigger loop). No counterpoises, radials, ground needed. 25 Watts. Very quiet reception. Hi-Q reduces QRM, overload, harmonics. Great for apartments, antenna restrictions, portable ops.

VIDEOS: [https://m.youtube.com/results?search\\_query=MFJ-9232](https://m.youtube.com/results?search_query=MFJ-9232)

## Antenna Rotator

Perfect for magnetic loops, VHF/UHF, small HF beams, TV, FM antennas. Weather-proof cast aluminum housing with precision all metal gears, steel thrust bearings and automatic braking.

Includes rotator, controller, remote control, clamps, hardware.

12 Memories. Digital display. 110/220 VAC.



**\$199<sup>95</sup>**

## MFJ Tripods/Masts

Strong, black steel triangular braced base. Non-skid feet, strong mast locks.

**MFJ-1919, \$129.95.** Supports 100 lbs. Extends a whopping 7.8 ft. Base spreads up to 4.8 sq. ft. 1.4" dia. mast. Collapses to 54" by 6" diameter. 9 3/4 lbs.

**MFJ-1919EX, \$199.95.** Tripod plus mast. 18' extended. 5' collapsed. 1/8" wall, 3/4" dia. top, 1 1/2" dia. bottom. 15 lbs.

**MFJ-1918, \$84.95.** 6' extended. 38" collapsed. 6 3/4 lbs.

**MFJ-1918EX, \$129.95.** Small tripod with extension mast. 9 1/2", 3.8 ft. collapsed. 3/4" top, 1" bottom. 6.5 lbs.



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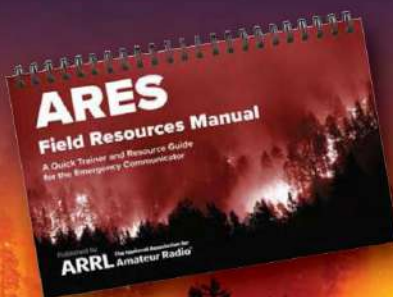


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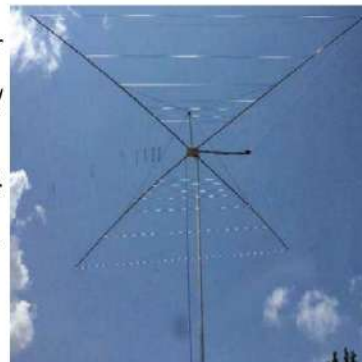
**MFJ-2104, \$299.95.** 75/40/20/15M hamsticks, hub combination.

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## MFJ-1838, \$489.95.

The Cobweb Antenna for restricted spaces covers 8-bands: 40/30/20/17/15/12/10/6 Meters. Super strong large diameter fiberglass, heavy duty 14 gauge stranded hard copper wire. 1500 Watts. 12 feet 23 lbs.



## MFJ-1836H, \$319.95.

20-6 Meters, 1500W.



## MFJ-1797, \$399.95.

SkyMaster 40-10 Meter vertical covers all of your favorite bands: 40/30/20/17/15/12/10 Meters. Handles 1000 Watts PEP. Just 7.5 lbs, 23.5 feet tall.

## MFJ-1797LP, \$369.95.

Like MFJ-1797 less the 14.5' whip, less efficient, narrow bandwidth on 40M. Weighs 6 lbs., only 9 feet tall for super low profile.

**MFJ-2982, \$179.95.** The FeatherLite is a self-support-

ing vertical antenna that sets up in minutes, collapses to 3.8 feet for easy storage. Perfect for RVs, vacations, field day. 80-6M, includes mount, balun, wire and telescopic mast.

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## MFJ-2389, \$399.95.

Compact Vertical Antenna covers 80/40/20/15/10/6/2 Meters and UHF. Weighs less than 6 lbs. and just 8.5 feet tall. Built-in ground radial system, no fooling with counterpoise wires. SWR is 1.5:1 or less, handles 200 Watts. 1/4 wave on HF, 80-6 Meters, 1/2 wave on 2-Meters and a 5/8 wave on 440 MHz. *All in one antenna!*



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Low-Noise Receive Loop lets you work DX and ragchew even through horrendous noise. Pull weak signals out of static crashes, atmospheric, man-made and power line noise. Clearly hear signals 50 KHz to 30 MHz.

**MFJ-1888, \$499.95.** Like MFJ-1886

but includes MFJ-1888MC remote multi-coupler. Connect 4 receivers.



## MFJ-1778, \$89.95.

The famous G5RV antenna is 102 feet wide

with 32.5 feet of ladder line terminating in an SO-239 connector. Operate all bands 160-10 Meters.

Use **MFJ-915, \$49.95,** RFI isolator for eliminating RF from traveling on long coax lines.

## MFJ-1778M, \$79.95.

Half-size G5RV Junior is 52 feet, covers 40-10M with tuner. 1500 Watts.

## MFJ-1779 ABC, \$99.95, \$79.95, \$59.95.

Single Band Dipole antennas have a custom injection molded UV-resistant center insulator with heavy duty 14-gauge hard copper wire. Models for 20-6M, 80-40M and 160M. Use horizontal, sloping or inverted vee. MFJ-1779A, 265 ft. 160M. MFJ-1779B, 135 ft. 80/40. MFJ-1779C, 35 ft. 20-6M.



## MFJ-2010, \$89.95.

Off Center Fed Dipole delivers ham radios most interesting DX bands, 40/20/10/6M. Long leg is 44.6 ft., short is 22.3 ft. Perfect for low profile, portable, QRP, < 2 lbs.

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**MFJ-2013, \$109.95.** For 60/30 Meters, 300 Watts.

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## Build your own!



## MFJ-2774K, \$99.95.

Deluxe dipole kit includes three multi-purpose center insulators, 100 feet of nylon rope, copper wire, two PL-259 connectors, two RG68 reducers, stainless steel screws and nuts and six ceramic insulators. Make G5RV, doublet or dipole antennas!

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**Read** SWR, return loss, reflection coefficient, match efficiency at any frequency simultaneously.

**Read** Complex Impedance (100 KHz to 230 MHz) as series equivalent resistance and reactance ( $R_s + jX_s$ ) or as magnitude ( $Z$ ) and phase (degrees). Also reads parallel equivalent resistance and reactance ( $R_p + jX_p$ ).

**Determine** velocity factor,

**New!**  
MFJ-269D  
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coax loss in dB, length of coax and distance to short or open in feet (it's like a built-in TDR).

**Coax Calculator™** calculates coax line length in feet given degrees and vice versa for any frequency, velocity factor.



**Measure** SWR and loss of coax with any characteristic impedance (280 KHz to 230 MHz) from 10 to over 600 Ohms.

**Measures** inductance in  $\mu H$  and capacitance in pF at RF frequencies, 100 KHz to 230 MHz.

**High contrast** LCD gives precision readings and two side-by-side analog meters make antenna

adjustments smooth and easy.

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**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.

**Read** SWR, return loss and reflection coefficient at any frequency simultaneously.

**Read** inductance ( $\mu H$ ) 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, Complex impedance 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, \$19.95. Rugged metal cabinet, 4x2x6 $\frac{3}{4}$ ".

**MFJ-249D, \$329.95.**

**MFJ-249D** does everything MFJ-259D does with digital display only.



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for Ameritron AL-1500/1200/82 amps



**Roam** the entire HF spectrum 1.8- 30 MHz **MFJ-998**  
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**MFJ-225**  
**\$399<sup>95</sup>**

## SWR Analyzer Accessories

**A. MFJ-29D/MFJ-39D, \$49.95.** Carrying Pouch for MFJ-259D/269D.

**B. MFJ-92AA10, \$59.95.** 10-Pk 2500 mAh Ni-MH Supercells.

**C. MFJ-66C, \$69.95.** Dip coils, set of two covers 1.8-230 MHz.

**D. MFJ-731, \$149.95.** Tunable Analyzer Filter, 1.8-30 MHz, for strong RF fields.

**E. MFJ-917, \$64.95.** 1:1 Current balun for SWR Analyzers to test balanced line antennas, other loads.

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The MFJ-998 Legal Limit IntelliTuner™ lets you tune any antenna automatically - ultra fast and handles a full 1500 Watts SSB/CW and Digital!

It's a comprehensive automatic antenna tuning center complete with SWR/Wattmeter, antenna switch for two antennas, wire connection and 4:1 current balun for balanced lines.

MFJ's exclusive IntelliTuner™, Adaptive Search™ and Instant Recall™ algorithms give you ultra fast automatic tuning with over 20,000 VirtualAntenna™ Memories. You get a highly efficient L-network, 12-1600 ohm matching at 1500 Watts SSB/CW and digital, 1.8-30 MHz coverage, Cross-Needle and digital meters, audio SWR meter, and backlit LCD. MFJ-998 automatically tunes for minimum SWR and remembers your frequency and tuner settings. The next time you operate on that frequency and antenna, these tuner settings are instantly restored and you're ready to operate in milliseconds! Use 12-15 VDC/1 amp or 110 VAC with MFJ-1316, \$29.95. 13Wx4Hx15D". Radio interface cables. See [www.mfjenterprises.com](http://www.mfjenterprises.com)

### 600 Watt MFJ Automatic Antenna Tuner

MFJ-994B, \$419.95. Like MFJ-993B but handles 600 Watts SSB/ CW/Digital, matches 12-800 Ohms. 10,000 memories. Doesn't have LCD, antenna switch, balun, audio SWR meter. 10Wx2 3/4 Hx9D inches.



MFJ-998  
**\$769<sup>95</sup>**

**Full Digital Power!**



### 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 . . .

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300W (6-1600) 150W (6-3200 Ohms)

MFJ-993B  
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**Full Digital Power!**

Automatically tunes unbalanced/balanced antennas, ultra fast and has 20,000 memories. Has antenna switch, efficient L-network, select 300 Watts (6-1600 Ohms or 150W 6-3200 Ohms. 1.8-30 MHz, 4:1 balun, backlit LCD.



### 300 Watt Extra Wide Range

SWR/Wattmeter, 10000 VA Memories



Extra wide matching range at less cost. MFJ-991B  
**\$309<sup>95</sup>**

MFJ's exclusive dual Full Digital Power! power level: 300 Watts for 6-1600 Ohms; 150Watts for 6-3200 Ohms. Cross-Needle SWR/Wattmeter.

### 200 Watt ... Compact

Digital Meter, Ant Switch, Wide Range



MFJ-929  
**\$279<sup>95</sup>**

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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. Bright LCD Display.

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Matches IC-706, FT-857D, TS-50S

Full Digital Power!  
MFJ-939KIY  
**\$199<sup>95</sup>**



200W SSB/CW and Digital. Low-profile automatic tuner is great for those tiny new rigs. Just tune and talk! Includes interface cable, 2-year warranty. 6 1/2 Wx2 7/8 Hx8 3/8 D".

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Get greatly reduced losses and high efficiencies with long coax runs and high SWR antennas. Full Digital Power!

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MFJ-993BRT, \$399<sup>95</sup>. 300W.  
MFJ-994BRT, \$499<sup>95</sup>. 600W.  
MFJ-998BRT, \$949<sup>95</sup>. 1.5 kW.

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Cover 160-10 Meters with antenna tuner. 102 ft. long. Use as inverted vee or sloper, 160 Meters as Marconi. 1500 Watts. Super-strong fiberglass center/feedpoint insulators. Glazed ceramic end insulators.



MFJ-1778  
**\$89<sup>95</sup>**

MFJ-1778M, \$79.95. 52'. 40-10M.

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# MFJ Antenna Tuners

## New, Improved MFJ-989D 1500 Watt Legal Limit Antenna Tuner

World's most popular 1500W Legal Limit Tuner just got better -- *much better* -- gives you more for your money!

New, Improved MFJ-989D legal limit antenna tuner gives you better efficiency, lower losses and a new true peak reading meter. It easily handles full 1500 Watts SSB/CW, 1.8 to 30 MHz, including MARS/WARC bands.

New, dual 500 pF air variable capacitors give you twice the capacitance for more efficient operation on 160/80 Meters.

New, improved *AirCore™* Roller Inductor gives you lower losses, higher Q and handles more power more efficiently.

New, *TrueActive™* peak reading Cross-Needle SWR/Wattmeter lets you read true peak power



### MFJ-989D, \$539.95

on all modes.

New, high voltage current balun lets you tune balanced lines at high power with no worries.

New, crank knob lets you reset your roller inductor quickly, smoothly and accurately.

New, larger 2-inch diameter capacitor knobs with easy-to-see dials make tuning much easier.

New, cabinet maintains components' high-Q. Generous air vents keep components cool.

12 $\frac{1}{2}$ "Wx6Hx11 $\frac{1}{2}$ "D inches.

Includes six position ceramic antenna switch, 50 Ohm dummy load, indestructible multi-color Lexan front panel with detailed logging scales and legends.

The MFJ-989D uses the superb time-tested T-Network. It has the widest matching range and is the easiest to use of all matching networks. Now with MFJ's new 500 pF air variable capacitors and new low loss roller inductor, it easily handles higher power much more efficiently.

### No Matter What™ Warranty

Every MFJ tuner is protected by MFJ's famous one year *No Matter What™* limited warranty. We will repair or replace your MFJ tuner (at our option) for a full year.

### MFJ-986 Two Knob Differential-T™



### MFJ-986, \$479.95

Two knob tuning (differential capacitor and *AirCore™* roller inductor) makes tuning foolproof and easier than ever. Gives minimum SWR at only one setting. Handles 3 kW PEP SSB amplifier input power (1.5 kW output). Gear-driven turns counter, lighted peak/average Cross-Needle SWR/Wattmeter, antenna switch, balun, 1.8 to 30 MHz. 15Wx4 $\frac{1}{2}$ "Hx10 $\frac{1}{2}$ "D".

### MFJ-962E compact kW Tuner



### MFJ-962E, \$399.95

A few more dollars steps you up to a kW tuner for an amp later. Handles 1.5 kW PEP/SSB amplifier input power (800W output). Ideal for Ameritron's AL-811H. *AirCore™* roller inductor, gear-driven turns counter, peak/avg lighted Cross-needle SWR/Wattmeter, antenna switch, balun, Lexan front, 1.8 to 30 MHz. 10 $\frac{1}{2}$ "Wx14 $\frac{1}{2}$ "Hx10 $\frac{1}{2}$ "D".

### MFJ-969 300W Roller Inductor Tuner



### MFJ-969, \$319.95

Superb, *AirCore™* roller inductor. Covers 6 Meters through 160 Meters! 300 Watts PEP SSB. Active true peak reading lighted Cross-Needle SWR/Wattmeter, *QRM-Free PreTune™* antenna switch, dummy load, 4:1 balun, Lexan front. 10 $\frac{1}{2}$ "Wx3 $\frac{1}{2}$ "Hx9 $\frac{1}{2}$ "D".

### MFJ-949E deluxe 300 Watt Tuner

More hams use MFJ-949s than any other antenna tuner in the world! Handles 300



Watts, full 1.8-30 MHz coverage, custom inductor switch, 1000V tuning capacitors, full size peak/average lighted Cross-Needle SWR/Wattmeter, 8 position antenna switch, dummy load, *QRM-Free PreTune™*, scratch proof Lexan front panel. 10 $\frac{1}{2}$ "Wx3 $\frac{1}{2}$ "Hx7D".

MFJ-948, \$259.95. Econ-omy version of MFJ-949E, less dummy load.

### MFJ-941E Super Value Tuner

Most for your money!

300 Watts PEP, 1.8-30 MHz, lighted



Cross-Needle SWR/Wattmeter, 8-position antenna switch, 4:1 balun, 1000 Volt capacitors, Lexan front panel. 10 $\frac{1}{2}$ "Wx2 $\frac{1}{2}$ "Hx7D". MFJ-941EK, \$209.95. Tuner Kit -- Build your own!

### MFJ-945E HF/6M mobile Tuner

Extends your mobile antenna bandwidth so you don't have to stop, go outside and adjust your antenna.

Tiny 8Wx2Hx6D". Lighted Cross-Needle SWR/Wattmeter, Lamp and Bypass switches. Covers 1.8-30 MHz and 6-Meters. 300 Watts PEP. MFJ-20, \$14.95, mobile mount.

### MFJ-971 portable/QRP Tuner

Tunes coax, balanced lines, random wire, 1.8-30 MHz. Cross-Needle Meter, SWR, 30/300 or 6 Watt QRP ranges. Matches popular MFJ rigs. Tiny 6 $\frac{1}{2}$ "Wx2 $\frac{1}{2}$ "Hx6D".



### MFJ-971, \$179.95

### MFJ-901B smallest Versa Tuner



### MFJ-901B, \$149.95

MFJ's smallest (5Wx2Hx6D") and most affordable wide range 200 Watt PEP Versa Tuner.

Covers 1.8 to 30 MHz. Great for matching solid state rigs to linear amps.

### MFJ-902B Tiny Travel Tuner

Tiny 4 $\frac{1}{2}$ "Wx2 $\frac{1}{2}$ "Hx3D", full 150 Watts, 80-6 Meters, has tuner bypass switch for coax/random wire. MFJ-904H,

\$199.95. Same but adds Cross-needle SWR/Wattmeter and 4:1 balun for balanced lines. 7 $\frac{1}{2}$ "Wx2 $\frac{1}{2}$ "Hx2 $\frac{1}{2}$ "D".



### MFJ-902B, \$149.95

### MFJ-16010 random wire Tuner

Operate all bands anywhere with MFJ's reversible L-network. Turns random wire into powerful transmitting antennas. 1.8-30 MHz. 200 Watts PEP. Tiny 4Wx2Hx3D".



### MFJ-16010, \$109.95

### MFJ-9201 QRPoacker™ Tuner

80-10 Meters, 25 Watts. 12 position inductor, tune/bypass switch, wide-range T-network. BNCs. 4Wx2 $\frac{1}{2}$ "Hx1 $\frac{1}{2}$ "D".



### MFJ-9201, \$79.95

### MFJ-921/924 VHF/UHF Tuners

MFJ-921 covers 2 Meters/220 MHz. MFJ-921/924, \$149.95 MFJ-924 covers 440 MHz. SWR/Wattmeter. 8Wx2 $\frac{1}{2}$ "Hx3D".



### MFJ-931 Artificial RF Ground

Eliminates RF hot spots, RF feedback, TVI/RFI, weak signals caused by poor RF grounding. Creates artificial RF ground or electrically places far away RF ground directly at rig.

MFJ-934, \$299.95. Artificial ground/300 Watt Tuner/Cross-Needle SWR/Wattmeter.



### MFJ-931, \$159.95



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Operates on 8-16VDC external power, 6 AA Alkaline or NiMH rechargeable cells • Trickle charger built in (only when using NiMH batteries) • Typical battery life: 9 hours of continuous operation • Battery level indicator • Selectable auto power-off time limit preserves battery capacity • SO-239 connector for 1.8-300MHz range • N-female connector for 300-500MHz range • Optional soft carry case sold separately: CAA-5SC

*The perfect combination of analog and graphic information, designed in particular for antenna diagnostics and adjustments while on the roof, tower or in the field!*

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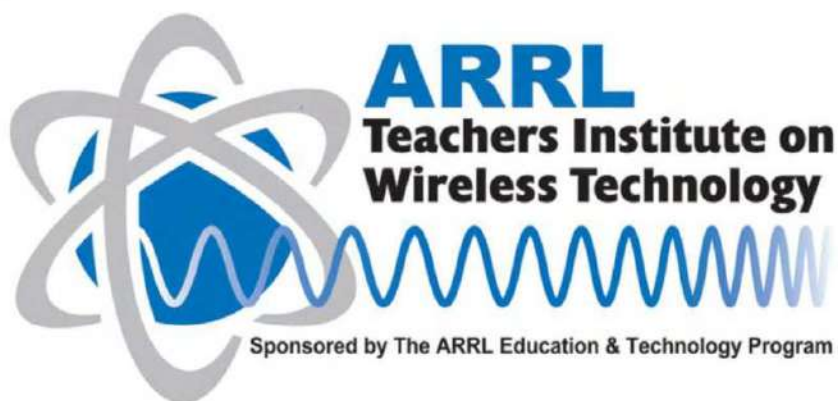




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**RMDR 122 dB\***

**BDR 150 dB\***

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3 kinds of dynamic range make for top-class performance.

- ▶ Third order intermodulation Dynamic Range (3rd IMDR) 110dB\*
- ▶ Reciprocal Mixing Dynamic Range (RMDR) 122dB\*
- ▶ Blocking Dynamic Range (BDR) 150dB\*

\*Values are measured examples. (2kHz spacing-14.1 MHz, CW, BW 500 Hz, Pre Amp OFF)

- ▶ Full Down Conversion RX
- ▶ High Carrier to Noise Ratio 1st LO
- ▶ H-mode mixer

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500Hz / 2.7kHz / 6kHz / 15kHz (270Hz Option)

#### 7 inch Color TFT Display

- ▶ Roofing frequency sampling band scope
- ▶ Band scope auto-scroll mode
- ▶ Multi-information display including filter scope

#### Clean and tough 100W output

Built-in high-speed automatic antenna tuner

32-bit floating-point DSP for RX / TX and Bandscope

\*: 2 kHz spacing measurement standard - Receiver frequency 14.2 MHz, MODE CW, BW 500 Hz, PRE AMP OFF

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