ARRL Awards — Nominate Volunteers for Their Contributions to Amateur Radio | 62

QST

DIGITAL EDITION

ARRL The National Association for Amateur Radio®
February 2023 www.arrl.org
DEVOTED ENTIRELY TO AMATEUR RADIO

Snow on the Ground, Antennas in the Air!

QST Reviews

Xiegu XPA125B 1.8 – 50 MHz 100 W Amplifier

Ham Radio Solutions CW Hotline

microHAM ARCO Smart Antenna Rotator Controller

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**

*Multi-signal receiving characteristic: 14MHz band/2kHz separation
*TX Phase Noise: 100W, CW mode

- **AESS** (Acoustic Enhanced Speaker System) with included SP-40 speaker to create High-fidelity audio output
- **3DSS**, real-time 3-Dimentional 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

- 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.
- FT-710AESS includes External Speaker SP-40.

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

FT-710 Aess

Acoustic Enhanced Speaker System

YAESU
The radio

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

Smart New Operating Features

Touch & Go

Simply Touch the displayed Channel Bar to Quickly Start Communications

High-resolution Full-color LCD touch panel, and Ultra-High-Speed PLL Real-time Scope

PMG (Primary Memory Group) Activity Monitor

- Register the current display frequency into PMG with one press of the "PMG" key.
- Simply press the "PMG" key to instantly display the receive status of the registered frequencies in a Bar Graph (Activity Monitor).
- Touch & Go Operation allows quickly starting communication by touching the displayed target channel bar.

79 channel Band Scope

- Displays a bar graph of up to 79 channels, in high-speed real time, centered on the current VFO frequency.
- Select the number of channels from 79ch/39ch/19ch by touching the displayed channel number.
- Touch & Go Operation allows immediately moving to the frequency and starting communication by touching a displayed channel bar.

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

FT5DR

C4FM Clear and Crisp Voice Technology

AMS

WIRES-X

Touch & Go

microSD Card

Bluetooth

Comfortable Grip with Full Flat-Back and Quick Release Holster (Supplied)

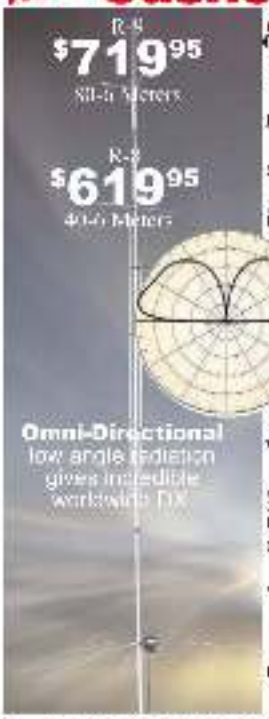
- Comfortable size and form with no protrusions provides excellent grasp, even when wearing gloves for outdoor activities.
- Quick Release Holster that easily attaches and releases the FT5DR and allows operation with an excellent hold and feel.

YAESU The radio

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

New! Cushcraft R9 . . . *80-6 Meters*



80 Meters . . . No Radials . . . 1500W

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

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

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

Use full *1500 Watts* SSB/CW when the going gets tough to break through pileups/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, $619.95. Like R9 antenna but less 75/80 Meters

R-8TB, $109.95. Tilt-base lets you tilt your antenna up/down easily by yourself to work on.

R-8GK, $89.95. Three-point guy kit for high winds.

MA-5B *5-Band* Beam

Small Footprint -- Big Signal

The MA-5B is one of Cushcraft's most popular HF antennas, delivering solid *signal-boosting directivity* in a lantern-weight package. Mounts on roof using standard TV hardware. Perfect for exploring exciting DX without the high cost and heavy lifting of installing a large tower and full-sized array. Its 7 foot 3-inch boom has less than 9 feet of turning radius. Contest tough -- handles 1500 Watts.

The unique MA-5B gives you 5-bands, automatic band switching and easy installation in a compact 26-pound package. On 10, 15 and 20 Meters the end elements become a two-element Yagi that delivers solid power-multiplying gain over a dipole on all three bands. On 12 and 17 Meters, the middle element is a highly efficient trap dipole. When working DX, what really matters are the interfering signals and noise you *don't hear*. That's where the MA-5B's impressive side rejection and front to back ratio really shines. *See cushcraftamateur.com for gain figures.*

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 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!

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. $569.95.** 12/17 M. **30/40 Meter** *add-on kits* available.

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 *Ringo* 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, lightning 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
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Forward Power
Reflected Power
SWR
All At Once!

DAIWA

Testing, Tuning, Matching, Monitoring - Made Easy!

	CN-501H	CN-501HZ	CN-501V/N
Frequency	1.8~150MHz	1.8~150MHz	140~525MHz
Power Range: Forward	15/150/1.5KW	20/200/2KW	20W/200W
Power Rating	1.5KW (1.8~60MHz) 1KW (144MHz)	2KW (1.8~60MHz) 1KW (144MHz)	200W (140~525MHz)
Tolerance	±10% at Full Scale	±10% at Full Scale	±10% at Full Scale
SWR Measurement	1:1~1:∞	1:1~1:∞	1:1~1:∞
SWR Detection Sensitivity	4W MIN	4W MIN	4W MIN
Input/Output Impedance	50 ohms	50 ohms	50 ohms
Input/Output Connectors	SO-239	SO-239	SO-239 or N-Type

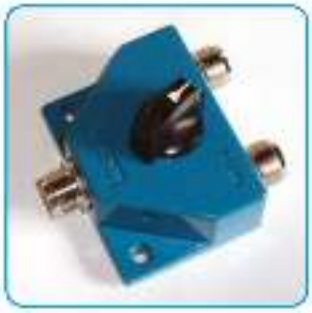
CN-501
Economy Series

Compact HF/VHF AVG reading SWR/Power Meter Cross needle technology displays:
• FORWARD POWER • REFLECTED POWER • SWR - Simultaneously!

	CN-901HP	CN-901HP3	CN-901V/N	CN-901G
Frequency	1.8~200MHz	1.8~200MHz	140~525MHz	900~1300MHz
Power Range: Forward	20/200/2KW	30/300/3KW	20/200W	2/20W
Tolerance	±10% at Full Scale	±10% at Full Scale	±10% at Full Scale	±10% at Full Scale
SWR Measurement	1:1~1:∞	1:1~1:∞	1:1~1:∞	1:1~1:∞
SWR Detection Sensitivity	5W MIN	5W MIN	5W MIN	0.4W
Input/Output Impedance	50 ohms	50 ohms	50 ohms	50 ohms
Input/Output Connectors	SO-239	SO-239	SO-239 or N-Type	N-Type

CN-901
Professional Series

AVG & True PEP power meter 5 second PEP delay to dampen the needle movement with on/off switch:
• FORWARD POWER • REFLECTED POWER • SWR - Simultaneously!



CS-201

Frequency Range (up to): 800MHz
Power Rating: 2.5 kW PEP, 1 kW CW
VSWR: Below 1.2:1
Insertion Loss: Less than 0.2 dB
Isolation: 60 dB @ 300 MHz
Connector: SO-239
Output Port: 2

CS-201GII

Frequency Range (up to): 2 GHz
Power Rating:
1.5 kW CW (up to 30 MHz)
250 W CW (up to 1 GHz)
150 W CW (up to 2 GHz)
VSWR: Below 1.3:1 at 1.3 GHz
Insertion Loss: Less than 0.2 dB at 2 GHz
Isolation: 50 dB @ 1 GHz
Connector: Gold Plated N-type
Output Port: 2

NCG company

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QST

Contents

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Columns

Digital and Mobile Editions

ARRL members can access the digital edition via a link at **www.arrl.org/qst**, download our iOS app from the iTunes Store, and download our Android app from the Google Play Store.

Write for QST

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

Departments

Our Cover

A world blanketed in snow provides the perfect opportunity for staying indoors and fixing up your station. Remember, any contacts you upload to Logbook of The World this year count toward your point totals for the year-long Volunteers On the Air (VOTA) event (**www.arrl.org/volunteers-on-the-air**). Winter is also a time for planning projects, and this issue has fodder for you in the form of antenna and station projects, as well as a look at what remote operating has to offer. [Henryk Kotowski, SM0JHF, photo]

QST (ISSN: 0033-4812) is published monthly as its official journal by the American Radio Relay League, Inc., 225 Main St., Newington, CT 06111-1400, USA. Periodicals postage paid at Hartford, CT, USA and at additional mailing offices.

POSTMASTER: Send address changes to: QST, 225 Main St., Newington, CT 06111-1400, USA. Canada Post: Publications Mail Agreement #40-0601437. Canada returns to be sent to IMEX Global Solutions, 1501 Morse Ave., Elk Grove Village, IL 60007.

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Indexed by Applied Science and Technology Index, Library of Congress Catalog Card No. 21-9421.

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LEARNING KIT
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Begin coding even before your hardware arrives.

Explorer Edition

PROTOTYPING PLATFORM

TEST FIXTURE
Easily accessible & probe friendly pins.

DEBUGGER
Quickly troubleshoot hardware vs. code issues.

As seen in QST Magazine January 2021

Page 48 Product Review Section

«The Dr.Duino Explorer Edition is a well-designed development, prototyping and troubleshooting platform»

Revied by Glen Popiel, KW5GP

SPECIAL HOLIDAY BONUS

GET A FREE ARDUINO CRASH COURSE WITH EVERY KIT!

AVAILABLE AT **www.DoctorDuino.com**

YAGI URBAN BEAM

The distinctive shape and small footprint of the UrbanBeam makes it excellent for use in high density population areas or properties with small lot sizes, where a full-sized Yagi may not be an option.

SMALL FOOTPRINT BIG DELIVERY

Chantal Villeneuve, upon seeing husband VA2PV Pascal Villeneuve's new UrbanBeam Yagi installed exclaimed, "What a beautiful antenna, it looks like a butterfly"!

The OptimizIR electronic controller is available as an upgrade for all SteppIR antenna products or as a standalone purchase. The perfect pairing with a space saving Yagi Urban Beam!

BI-DIRECTIONAL MODE
Simultaneous gain in opposite directions

180 MODE
Reverse directions at the click of a button

3/4 MODE
Turns the BigIR vertical into a 3/4 wave antenna on 21-54 MHz

MAXIMUM GAIN MODE
Optimized for max gain

MAXIMUM FRONT-TO-REAR MODE
Optimized for best front to rear

OptimizIR

steppIR
COMMUNICATION SYSTEMS

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www.steppir.com 425-453-1910

DIAMOND ANTENNA

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!

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!

Here is a small sample of our wide variety of antennas

Model	Bands	Length Ft.	Max Pwr. Rating	Conn.
Dualband Base Station/Repeater Antennas				
X700HNA (4 section)	2m/70cm	24	200	N
X510HD (3 Section)	2m/70cm	17.2	300/250	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	5.5	200	UHF or N
X30A (1 Section)	2m/70cm	4.5	150	UHF
Monoband Base Station/Repeater Antennas				
F23H (3 Section)	144-174 MHz (W Cut Back)	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
Dualband Mobile Antennas				
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 Comac
AZ504FXH	2m/70cm	19.5 in.	50	UHF
AZ504SP	2m/70cm	19.5 in.	50	UHF
NR7900A	2m/70cm	57 in.	300/250	UHF
Monoband Mobile Antennas				
NR22L	2m	96.8 in.	100	UHF
M285	2m	52.4 in.	200	UHF or NMO

The Standard By Which All Others Are Judged

RF PARTS™ COMPANY

Diamond Antenna is a division of RF Parts Company

David A. Minster, NA2AA, ARRL Chief Executive Officer, na2aa@arrl.org

Second Century

YEAR of the VOLUNTEERS

Finding the "Why" that Leads You to Volunteer

The most precious gift, the most valuable asset you have, is time. Giving of your time demonstrates commitment — commitment to a friendship, to a passion, to a cause. I give generously of my time to my team, the ARRL Board, the ARRL Foundation, and our members. At the same time, I have become very frugal about wasting my time suffering through the foolish gripes and snipes posted online about ARRL. There is so much to do, and there are so many wonderful possibilities in giving one's time to our cause — our noble cause — of promoting and protecting amateur radio.

Those two words, *promote* and *protect*, neatly and succinctly define ARRL's mission. As we embark on a new 5-year strategy for ARRL, what is your vision of what ARRL and amateur radio will look like in 5 – 10 years? How much farther will we reach with digital modes? How much higher will we experiment into the GHz range? How will ARRL deliver its products and services, having moved well into its digital transformation? Many of the underlying technologies and capabilities ARRL will be relying on will come from you: the member-volunteer. We need to know your thoughts.

Since graduating from Cornell, my daughter has devoted her life to one cause: curing breast cancer in our lifetime. That is a powerful vision that took just six words to articulate. Her organization, the Breast Cancer Research Foundation, raises in excess of $40 million per year with a small staff to fulfill their mission: funding world-class researchers and encouraging collaboration in finding treatments and cures. Again, that mission is very simply stated. The devil is in the details; for the many volunteers and donors, their passion — their *why* — comes from having been touched by breast cancer in one way or another, and their commitment to the mission — to the cause — has radically improved the survivability of breast cancer today.

I have stated in this space that amateur radio is in a critical place with leadership and volunteerism. We have begun a succession of watching hamfests die, clubs wither away, Field Organization positions become difficult to fill. Those that remain struggle to rebuild something meaningful for their amateur radio community. The need to reverse this pattern is no longer something of a soft ask. It is time to look around you and decide how *you* can contribute to our avocation and to our cause. How important has amateur radio been to your life? How many of the people you count as friends today came directly or indirectly from our global community? How important is it to you to build a legacy for amateur radio that will lead younger generations, as they contemplate their future and the use of their time, to join amateur radio to drive experimentation and exploration that may influence the next generations of commercial products and services?

These are questions for you to ponder, and to answer for yourself. I cannot answer them for you. Here's what I know about ARRL and our mission: volunteers are critical, financial support is critical, being positive and making the community welcoming to, and embracing of, everyone is critical, and the actions that detract from those things become friction, poison, and even cancer to amateur radio.

Where we go this year, the Year of the Volunteers, is completely up to you. I will do my part. We will do our jobs. But now is the time to do those things we softly encourage all the time: be radio active in whatever form that can mean to you; be that connector with the people who you know inside and outside of amateur radio; reach one rung higher in the giving of personal time and financial support in whatever ways you can — remember, "If not me, then who?" It is your actions that will define how *you* will answer, "Why?" And when you know why, tell me. Even better — show me.

David A. Minster, NA2AA
Chief Executive Officer

hy-gain Antennas and Rotators

HF Verticals

Work amazing DX with these extremely low radiation angle omnidirectional antennas. All self supporting, 1500 Watts PEP SSB, low SWR. Heavy duty, slotted, tapered, swaged, aircraft quality aluminum tubing. Stainless steel hardware. Two year limited warranty.

AV-680, $739.95. 9 Bands: (6, 10, 12, 15, 17, 20, 30, 40, 80 Meters). 26 ft., 18.5 lbs. *Our most popular vertical now has 75/80 Meters! Lets you work exciting DX with a low 17 degree radiation angle!* Easily mount on decks, roofs, patios. *No ground or radials needed.* Extra wide 2:1 SWR bandwidths. *Each band tunable.* Auto band-switching, handle 1.5kW. 80 MPH wind survival, low 2.5 sq. ft. wind surface. Aircraft aluminum tubing, stainless steel hardware.

AV-640, $659.95. Like AV-680 less 80M. 25'/2". 17½ lbs.

AV-620, $599.95. Like AV-640 less 40M. 22'/2"/10'/2 lbs.

AV-14AVQ, $289.95. (10, 15, 20, 40 Meters). 18 ft., 9 lbs. *Classic* AV-14AVQ uses same trap design as famous Hy-Gain Thunderbird beams. 3 air dielectric Hi-Q traps with oversize coils give superb stability and 1/4 wave resonance on all bands. Automatic bandswitching.

AV-12AVQ, $219.95. (10, 15, 20 Meters). 13 ft., 9 lbs. Lowest priced *automatic bandswitching* tri-band vertical! Uses Thunderbird beam design air dielectric traps for extremely hi-Q performance in limited space.

AV-18VS, $199.95. (10,12,15,17,20,30,40,80M). 18 ft., 4 lbs. hy-gain's lowest priced vertical gives you 8 bands. Easily tuned to any band by adjusting base loading coil.

See our website for even more hy-gain vertical antennas!

HF Beams

Hy-gain beams are *stronger, light-er, have less wind surface and last years longer.* Why? *Hy-gain* uses durable *tooled* components – massive boom-to-mast bracket, heavy gauge element-to-boom clamps, thick-wall swaged tubing – no failures!

TH-11DX, $1799.95.
11-element, 4.0 kW PEP, 10,12,15,17,20 Meters. *The choice of top DXers.* With 11-elements, excellent gain and 5-bands, the super rugged TH-11DX is the *"Big Daddy"* of all HF beams! Features low loss log-periodic driven array on all bands with mono-band reflectors. BN-4000 high power balun, corrosion resistant wire boom support, hot dipped galvanized and stainless steel parts.

TH-7DX, $1599.95. 7-Element, 1.5 kW PEP, 10, 15, 20 Meters. 7-Elements gives you *the highest average gain of any Hy-gain* tri-bander! Dual driven for broadband operation without compromising gain. SWR less than 2:1 on all bands. Combined monoband and trapped parasitic elements give you an excellent F/B ratio.

TH-3MK4, $769.95. 3-Element, 1.5 kW PEP, 10, 15, 20 Meters. Gives most gain for your money in full-power, full-size *hy-gain* tri-bander! Impressive gain and a whopping average front-to-back ratio and still fits on an average size lot. 95 MPH wind survival.

TH-3JRS, $529.95. Compact 3-Element, 600 W PEP, 10, 15, 20 Meters. *Hy-gain's most popular and lowest-priced tri-bander fits smallest lot.* 14.75 ft turning radius, 21 lbs. Excellent gain and front-to-back let you compete with the "big guns"! 80 MPH wind survival.

hy-gain Rotators . . . the first choice of hams around the world!

HAM-IV . . . $799.95

The most popular rotator in the world! For medium communications arrays up to 15 sq. feet wind load area. 5-second brake delay! Test/Calibrate function. Low temperature grease permits normal operation down to -30° F. Alloy ring gear gives extra strength up to 100,000 PSI for maximum reliability. Indicator potentiometer. Ferrite beads reduce RF susceptibility. Cinch plug plus 8-pin plug at control box. Dual 9B ball bearing race for load bearing strength and electric locking steel wedge brake prevents wind induced antenna movement. North or South center of rotation scale on meter, low voltage control, max mast size of 2 ⅜".

HAM-VI, $1299.95. For medium arrays up to 15 sq. ft. wind load. Like HAM-IV but has *new DCU-2 Digital Rotator Controller.* Just dial in your beam heading or let your computer control your antenna.

HAM-VII, $1399.95. Like HAM VI but with ***DCU-3*** digital controller with *six programmable memories.*

Tailtwister T-2X . . . $1099.95

For large medium antenna arrays up to 20 sq. ft. wind load. Choose ***DCU-2*** *digital* controller (T-2XD2) or *analog* control box (T-2X) with *new* 5-second brake delay and *new* Test/Calibrate function. Low temperature grease, alloy ring gear, indicator potentiometer, ferrite beads on potentiometer wires, *new* weather-proof AMP connectors plus 8-pin plug at control box, triple bearing race with 13B ball bearings for large load bearing strength, electric locking steel wedge brake, N or S center of rotation scale on meter, low voltage control, 2"/16" max. mast.

T-2XD2, $1299.95. Tailtwister with ***DCU-2*** *digital* controller.

T-2XD3, $1249.95. Tailtwister with ***DCU-3*** digital controller with *six programmable memories.*

AR-40, $499.95. For compact antenna arrays and FM/TV up to 3.0 sq. ft. wind load. Dual 12 ball-bearing race. Fully automatic.

CD-45II, $599.95. For antenna arrays up to 8.5 sq. ft. Bell rotator design gives total weather protection. Dual 5B ball bearing race.

Digital Rotator Controller with 6 Programmable Beam Headings

DCU-3
$639.95

New **DCU-3** Digital Controller lets you program 6 beam headings! Gives you fully automatic or manual control of your hy-gain HAM or Tailtwister Rotators.

Push a memory button or dial in your beam heading or let *Ham Radio Deluxe* (or other program) control your DCU-3. Your antenna automatically rotates precisely and safely to your desired direction.

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Member Spotlight

YEAR of the VOLUNTEERS

Bob Heil, K9EID

As a young theatre organ musician, Bob Heil, K9EID, always had an ear for sound. This talent, along with his ham radio experience, led him to build the sound-equipment empire known as Heil Sound, creating high-quality professional audio equipment well beyond its time. His love of ham radio provided him with the knowledge needed to develop groundbreaking equipment that has transformed the sound experience for musicians and hams alike.

Young Love

Bob discovered his passion for music and radio in his early teens. He earned his Novice license in 1956 at the age of 15, and received his Technician license just a few weeks later. At this time, he was also a house player of the Wurlitzer theatre organ for Fox Theatre in St. Louis, Missouri. It was through these two hobbies that Bob learned the skills needed to become a world-renowned pioneer of sound. He believes that music and ham radio go hand in hand, and has found that many high-speed CW operators have some type of musical background, because Morse code "sings a song and has rhythm."

Bob has always enjoyed building things and working with electronics, and it was ham radio that gave him his engineering knowledge. "Ham radio was my college professor," he said, adding that he has no professional training. He's been building electrical equipment since he was young, and the AM transmitter that he built in 1955 is what he still operates with every morning. Amplitude modulation has always been his favorite mode because of the technical skill it requires.

Going on Tour

In 1966, Bob created his own company that sold amateur radio and organ equipment, and repaired amplifiers.

Word traveled quickly, and soon he was providing and repairing equipment for musicians like Michael McDonald, Jimi Hendrix, Janis Joplin, The Who, and the Grateful Dead. In fact, it was the Grateful Dead lead guitarist Jerry Garcia who gave Heil Sound its name. Garcia didn't like the company's original name, Ye Olde Music Shop, so he began referring to it as Heil Sound, and it stuck.

In the music industry, Bob is most known for the talk box, which he created in 1973 for Joe Walsh and Peter Frampton. It allows musicians to modify the sound of an instrument.

Making His Mark in Radio History

After 12 years, Bob stopped touring, earned his Amateur Extra-class license, and got back into operating. But he was disappointed with the audio on the new radios. So, in 1981, Bob built what he refers to as "the most important thing I've ever done in ham radio" — the very first equalizer. Prior to this, equalization had never been talked about in ham radio. Since then, his equalizer has been in all of Icom's radios and Yaesu's transmitters.

Bob also noticed that ham radio companies weren't building their own microphones, nor were any on the market specifically made for amateur radio, so he decided to build some that were. "Our gold line of microphones was the most important at that time. We built tens of thousands, and we're still building them," Bob said. He added that the more recently made PR 40 microphone has also been extremely well accepted, not only by hams but also by recording and commercial radio studios.

Heil Sound is the only sound-equipment company in the Rock & Roll Hall of Fame, and Bob credits this to his ham radio background, mentioning his knowledge of antenna theory and phasing, in particular. This has allowed him to build groundbreaking sound equipment, such as his quadrophonic mixer, the first modular power amplifiers, his talk box, and more, all of which can be found on display in the Rock & Roll Hall of Fame.

Lending a Hand

Designing and building equipment for Heil Sound isn't the only way Bob has contributed to the hobby. In 2010, he was asked to do *Ham Nation*, a ham radio podcast, and Bob was eager to help make radio more known to the public. "I just love sharing this hobby, and not enough of it is done," he said. On the podcast, Bob has taught listeners how to build his Pine Board Project — a 5 W AM transmitter (read "The Pine Board Project" in the January 2018 issue for more information on how to build this project).

The only thing Bob loves more than building radio equipment is teaching other hams, and he has no intentions of slowing down any time soon. "It's truly amazing what amateur radio can do for people."

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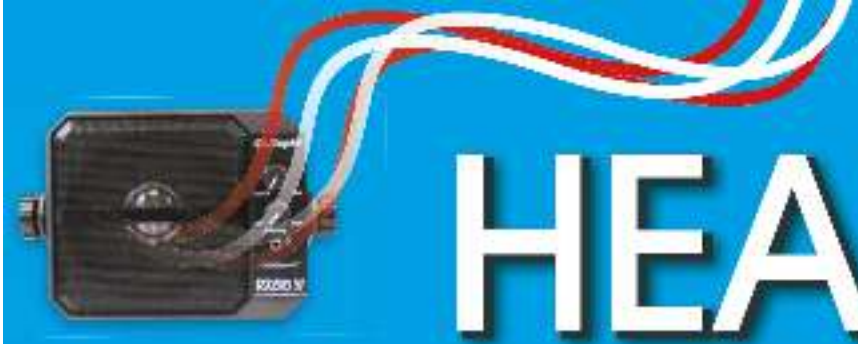

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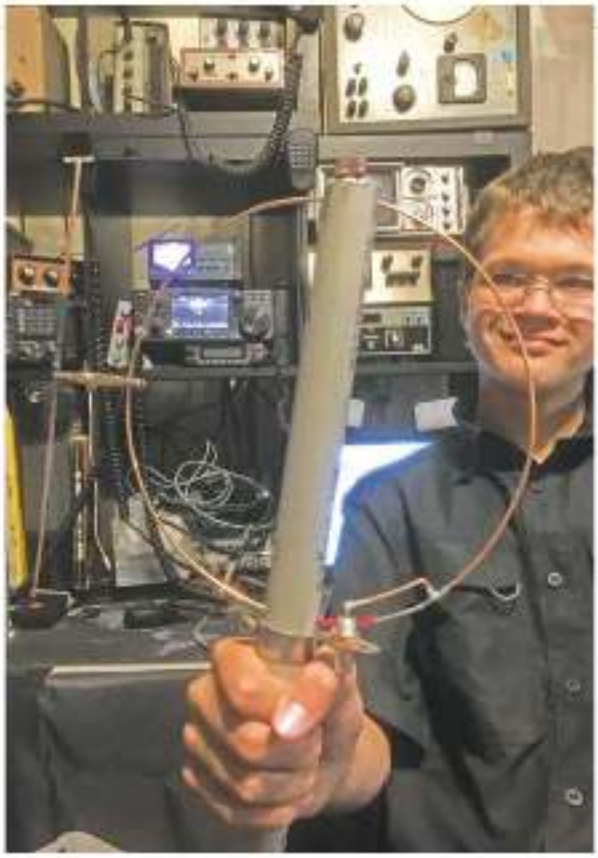
Up Front

A Full Day of Mentoring

Fourteen-year-old General-class licensee Sam Lovett, KI5RSV, and his dad, David, KI5RSX, an Amateur Extra-class licensee, spent the day assembling and testing various antennas with Steve Smith, KG5VK. After assembly, they reviewed the antenna analyzer, checking standing wave ratio (SWR) and resonance, and quickly realized that SWR is not always the touchstone of antenna operation, as sometimes suggested.

In addition to numerous other radio shack chores, the trio ended the day by participating in the Youth Amateur Radio Club's "Worked All YARC Zones" contest (**www.yarc.world**). They logged about 150 contacts in three 1-hour sessions. Operating modes used and compared were FT8, CW, and voice. All in all, the day was a rewarding mix of theory and practical operation.



Sam, KI5RSV, with the antenna he built during his mentoring session. [David Lovett, KI5RSX, photo]

Radio Valentine

While sorting through family estate items, Randy Skirvin, N8KHO, came across a large collection of old Valentine cards. This one of a young girl with a ham radio caught his attention.

A New Way to Learn Code

Mitch Wolfson, DJ0QN/K7DX, saw these delightful "coded" medallions at his local Whole Foods store in Naples, Florida.

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-Tony KJ7RNV

Correspondence

Letters from Our Members

QSL Card Back to the Future

In the "Correspondence" column in the November 2022 issue of *QST*, Scott van Tonningen, K3VAN, talked about QSL cards. His submission reminded me of the time I found one of my old cards.

I was browsing eBay, not looking for anything in particular. I decided to key in my old call letters, WA2AE. One of my old QSL cards popped up for $13, and it was located in Canada. The seller indicated the card was from a ham in New York. I was astounded to find my old card. I had no idea how it ended up in Canada or why it was for sale.

I bought it, but as it turned out, the card was not from a ham in New York, but from Gerald Perry, WA4AGD, in Georgia. On the back of the still-pristine card, my handwriting noted the contact was on 6-meter AM. When I checked my cards, I found that the ham reciprocated with his card in 1972. I am amazed that the card started in New Jersey, went to Georgia, then Canada, and found its way back to me 50 years later.

This is the weirdest thing that has happened in my 52 years of being a ham.

William Gerhold, K2WH
Hewitt, New Jersey

Reminder of the History Made in 1922

Kudos to the cover of the December issue of *QST*. The vintage station is a great alternative to covers depicting a Christmas tree, Santa Claus, and a transceiver under the tree. No doubt I'm getting nostalgic when I say I still remember the smell of the old transceiver tubes in the darkness of contest nights.

I was also interested in the cover of the December 1922 issue shown in the "100, 50, and 25 Years Ago" column. The issue highlighted the preparation for the Transatlantic Tests that culminated in the first contact between France and the United States. On the night of November 27, 1923, Léon Deloy, 8AB, of Nice, France, and Fred Schnell, 1MO, of West Hartford, Connecticut, made contact on 103 meters. Fred Schnell wrote an article about his preparations for the historic contact in the 1922 issue of *QST*.

It's a real pleasure to read *QST* each month, because it's on the cutting edge of technology without forgetting our common roots. I hope that next year there will be events to celebrate this famous contact on the air together. The French are very likely to initiate this.

Jean-Marc Idée, F5SGI
Vannes, France

Liquid Solution for Static

In the "Correspondence" column in the December 2022 issue of *QST*, Kraig Krist, KG4LAC, discussed how to stop getting static shocks when using plastic floor mats. It's not just getting zapped by static electricity that is a problem. In a broadcast studio, static electricity can reset timers critical to operation, inappropriately fire off automation systems, and stop what's on the air. One time, a DJ wiped out half of an audio console by receiving a static shock from plugging his headphones into the board.

While the author explains a solution to the problem, it seems that, should he forget about the cable attached to his chair, he could get himself in an awful lot of trouble with the trip hazard. For this reason, others might not have an interest in sitting in a grounded chair while dealing with electrical things.

I'd like to pose another fix. Instead, get a spray bottle with a nozzle that can mist. It should not squirt a hard stream. Fill it with one part liquid fabric softener and four parts water. Mist the carpet. Don't soak it or you'll find yourself ice-skating, as fabric softener can be slippery. In most broadcast studios, we do it twice per day. In the ham shack, you can mist before you sit down for a session. Not only will this method reduce or eliminate static shocks, but it will add a bonus of making the shack smell April fresh!

Thomas Ray, W2TRR
New Windsor, 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**. 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.

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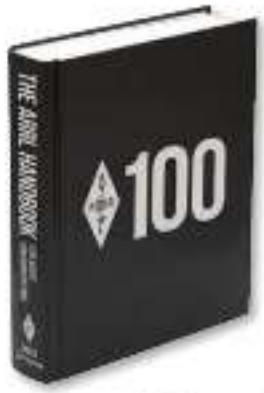

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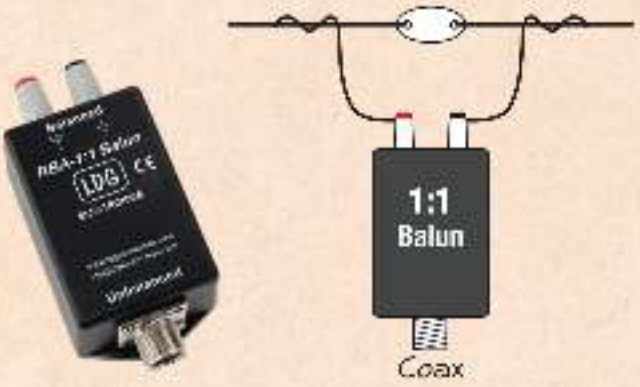

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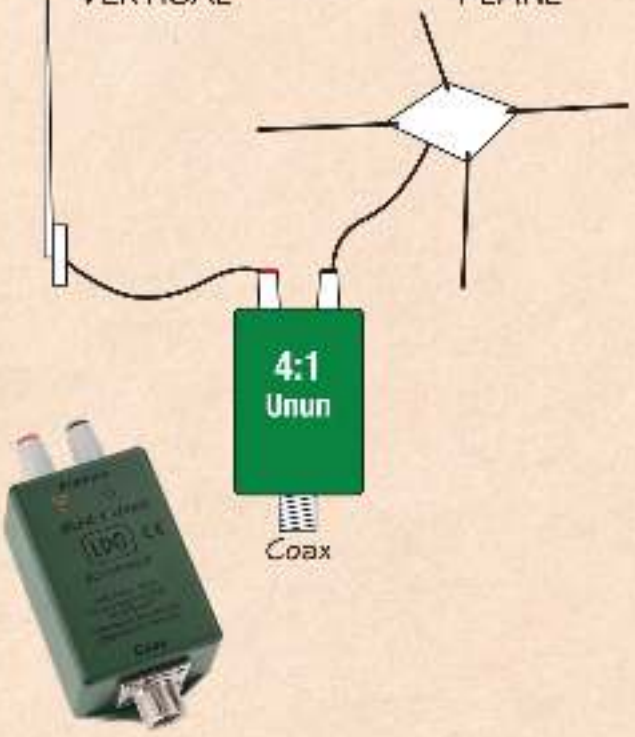

END FED WIRE
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W1AW Schedule

PAC	MTN	CENT	EAST	UTC	MON	TUE	WED	THU	FRI
8 AM	9 AM	10 AM	11 AM	1500		FAST CODE	SLOW CODE	FAST CODE	SLOW CODE
9 AM–12 PM	10 AM–1 PM	11 AM–2 PM	12 PM–3 PM	1600–1900	VISITING OPERATOR TIME				
1 PM	2 PM	3 PM	4 PM	2100	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE
2 PM	3 PM	4 PM	5 PM	2200	CODE BULLETIN				
3 PM	4 PM	5 PM	6 PM	2300	DIGITAL BULLETIN				
4 PM	5 PM	6 PM	7 PM	0000	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE
5 PM	6 PM	7 PM	8 PM	0100	CODE BULLETIN				
6 PM	7 PM	8 PM	9 PM	0200	DIGITAL BULLETIN				
6:45 PM	7:45 PM	8:45 PM	9:45 PM	0245	VOICE BULLETIN				
7 PM	8 PM	9 PM	10 PM	0300	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE
8 PM	9 PM	10 PM	11 PM	0400	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

♦ 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.

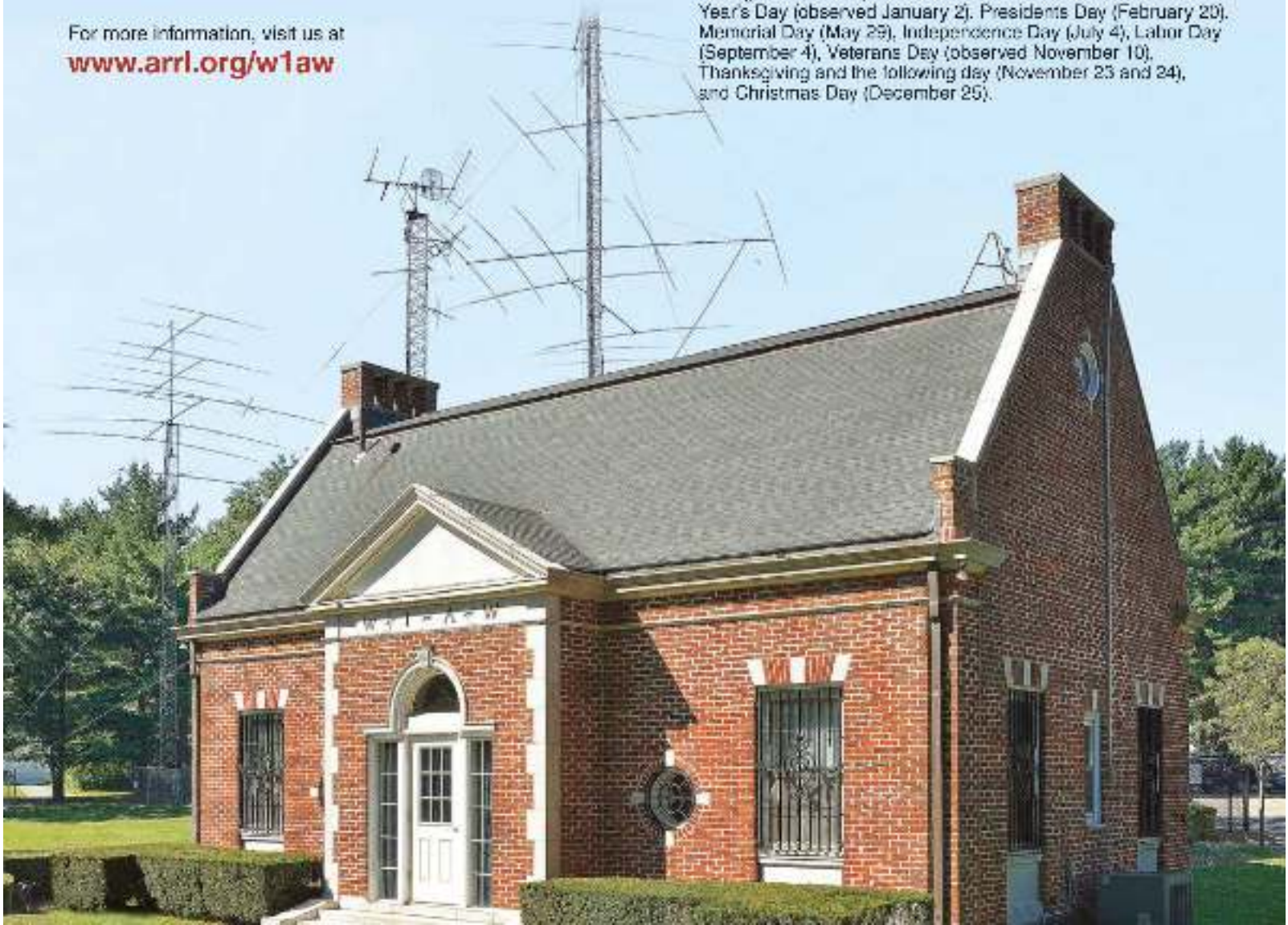
Keplerian elements for many amateur satellites will be sent on the regular digital frequencies on Tuesdays and Fridays at 6:30 PM Eastern time using Baudot and PSK31.

♦ 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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A Multi-Band End-Fed Antenna

Dan Wiley, W6AZI

After receiving my Technician-class license in 2021, I soon realized that an antenna would be the most important station component to consider for effective operations from my small backyard.

I started by making a list of performance requirements and practical considerations for the design. I wanted to have reasonable DX performance on the CW and digital portions of the 80-, 40-, and 20-meter bands at low power (below 20 W). I also wanted it to be low cost and lightweight, be easy to assemble and disassemble, only require a few alterations to my property, and have minimal grounding requirements and visual impact (see Figure 1).

The Vertical End-Fed Idea

I scoured the web for compact multi-band antenna designs that can operate down to 80 meters. I came across a popular sloped inverted-L design by Steve Nichols, GØKYA, that I thought might be a good starting point. On *GØKYA's Amateur Radio Blog*, Steve wrote an article titled "A shortened multi-band End-Fed Half Wave (EFHW) antenna for 80-10m" (**https://g0kya.blogspot.com/2017/01/a-shortened-multi-band-end-fed-half.html**). His design includes a loading coil near the far end of the antenna to accommodate 80-meter operation.

My idea was to adapt his design to be vertical. This would allow the takeoff angle to be lower for improved DX operation and would meet my space and aesthetic requirements. The high impedance of a resonant end-fed antenna meets my minimal grounding requirement, as a 12-foot counterpoise is all that's required. I started modeling the antenna with *EZNEC* (**www.eznec.com**) to work out the dimensions. After a number of iterations, I converged on an overall antenna length of 75.6 feet, which informed my choice for a mast later on. The original GØKYA loading coil value of 110 µH proved to be a good compromise of overall length, impedance, and bandwidth for 80-meter operation.

I found that the Spiderbeam 18-meter (60-foot) telescoping fiberglass mast (**www.spiderbeam.us/product_info.php?info=p232_Spiderbeam%2018m%20fiberglass%20pole.html**) best met my requirements for length, cost, weight, ease of assembly, and aesthetics. Some additional parts that I needed included:

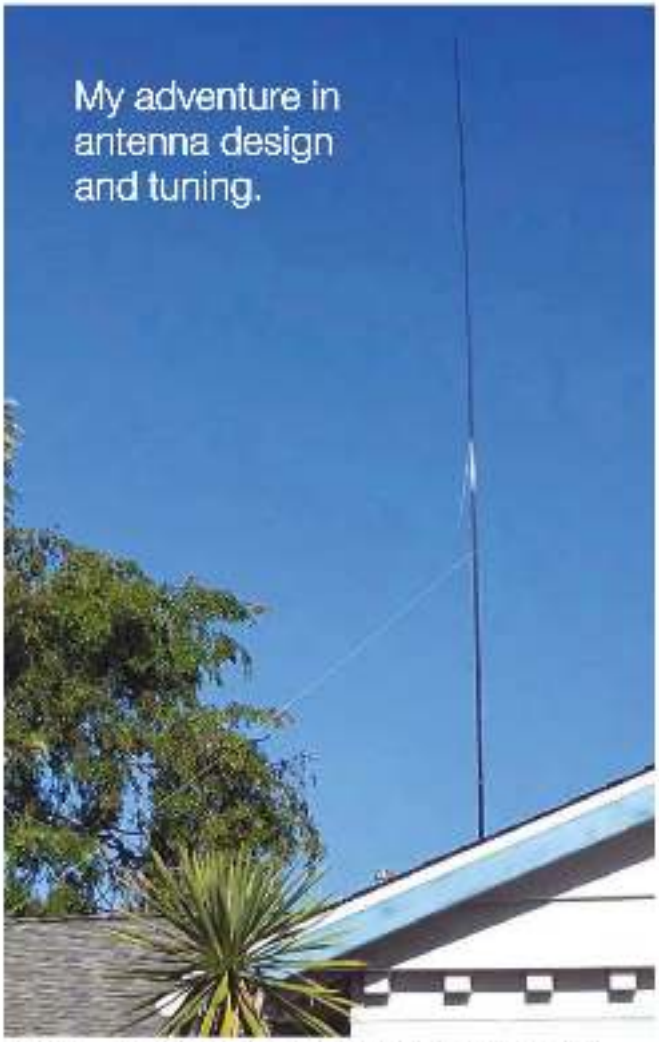

Figure 1 — The view of the antenna from my front yard. The narrow, black, single-mast design is unobtrusive. So far, no neighbors have complained. The tiny black blob near the top of the mast is the loading coil.

1. A 150-foot spool of #18 AWG braided bare copper wire.
2. A loading coil form. I purchased a 1.5 × 12-inch sink tailpiece from ACE Hardware (item number 4223392).
3. #20 AWG loading coil magnet wire (36 feet).
4. Heat shrink for the loading coil that was 7 inches long and had an inside diameter of 2 inches.

▲ **Figure 2** — On the left, the loading coil is shown uncovered, and the right image shows it covered with heat shrink.

▶ **Figure 3** — A close-up view of the loading coil is on the left, and the right image shows it installed on the mast.

The Loading Coil Assembly

I made the 110 µH loading coil by close-winding 83 turns of #20 AWG magnet wire around a plastic sink drain tailpiece that was 1.5 inches in diameter and 5 inches long. I drilled holes near the ends of the tube to hold the windings in place and to provide strain relief. After checking the inductance with an LCR meter, I covered the coil with heat shrink to protect it from the elements. I then filled the wire holes from inside the tube with epoxy to keep out moisture (see Figure 2). When installed, the mast runs through the tube, and the coil is secured to the mast with zip ties (see Figure 3).

Mounting the Mast

The mast must be mounted and guyed safely and securely. I mounted my mast to the corner eaves of my house, about 8 feet above the ground, using two 0.375-inch eye bolts, a 0.5-inch crossbolt, washers, and nuts (see Figure 4). The base of the mast is held in place by a heavy stack of concrete patio bricks. The antenna wire is zip-tied to the mast above the

Figure 4 — What the mast looks like once it's mounted to the eaves. Note the stack of heavy patio bricks holding the mast in place.

eaves and sloped diagonally down to my window, where it's fed through and connected to my antenna-matching network (see Figure 5).

Impedance Matching

I used a homebrew L network with a tapped inductor and a variable capacitor to impedance-match the antenna to 50 Ω (see Figure 6). The schematic can be seen in Figure 7.

Tuning the Length

Tuning the antenna involves alternately adjusting the length of the short wire between the loading coil and the top of the mast for resonance at 80 meters, and the long wire between the impedance-matching network and the loading coil for resonance at 40 meters. The end result is maximum resistive impedance and minimum reactance at 80 and 40 meters.

I used a RigExpert antenna analyzer with a dual banana adapter connected to the antenna wire and a 12-foot counterpoise to measure the antenna impedance directly. When using this method, it's important to have the antenna wire connected to a bleeder resistor, or temporarily to ground, to discharge any static electricity prior to connecting the antenna to the antenna analyzer. Otherwise, the analyzer can be damaged by electrostatic discharge (ESD), as I once discovered the hard way.

Tuning the length is a tedious process. I had to collapse most of the telescoping sections of the mast every time I needed to adjust the short wire length at the top. Reaching resonance on both bands required several iterations, but this is a necessary step for achieving optimal performance.

Testing the Antenna

The measured impedances of the antenna range from 2.2 to 5.9 kΩ at resonance. The SWR plots for the 40- and 20-meter bands are fairly flat, with an SWR of 1.5 or less at each end of the CW and digital portions of each band. The 80-meter 2:1 SWR bandwidth is about 40 kHz wide, due to shortening the antenna with a loading coil. This means the matching network needs to be readjusted if the transmit frequency is changed significantly.

On-air testing met or exceeded my expectations on all bands. From my southern California location (DM04), I am repeatedly able to reach the Neumayer Station III, DP0GVN, in Antarctica on WSPR with only 5 W. After 5 months of FT8 operation, I've reached a DXCC count of 90, including a contact with Justin Furner, ZS5KT, in South Africa, which is near my antipode. On-air test results and additional details can be found on the *QST* in Depth web page (**www.arrl.org/qst-in-depth**).

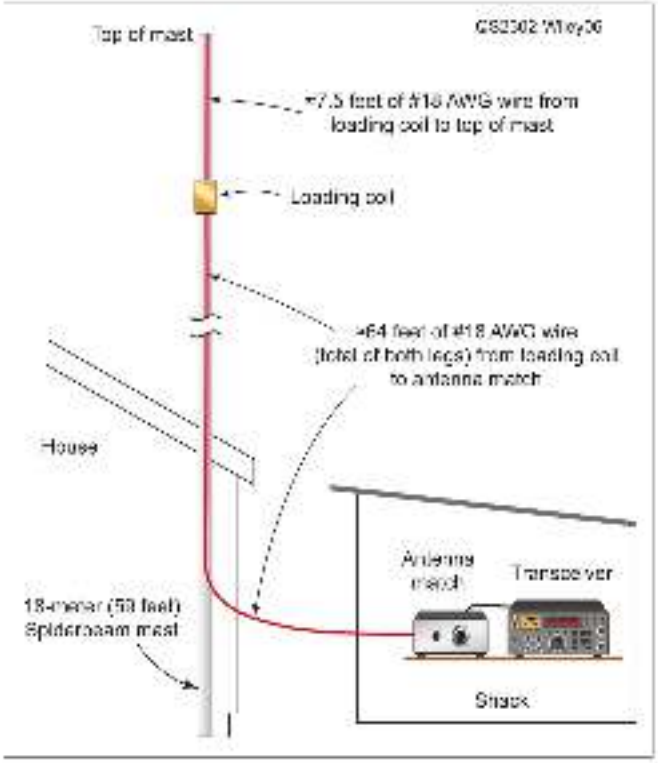

Figure 5 — A diagram of my antenna. Your wire lengths may vary, depending on the geometry and the proximity to structures when tuned to resonance. The lengths shown here are a reasonable starting point.

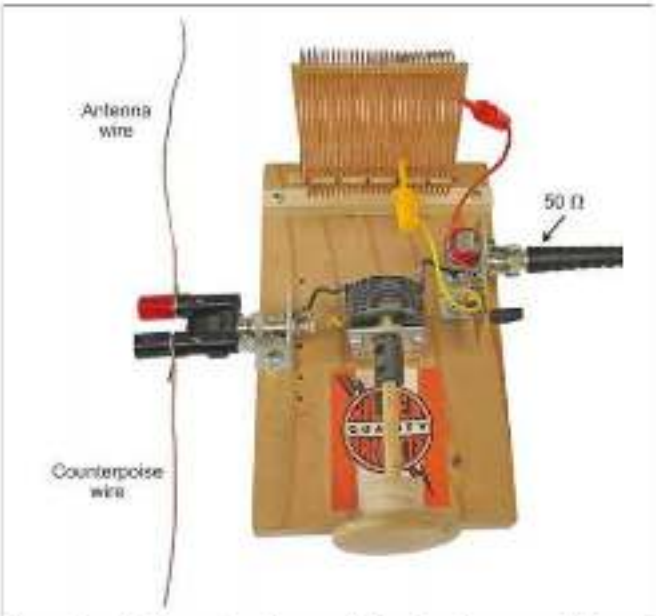

Figure 6 — My homebrew L network for impedance-matching the antenna.

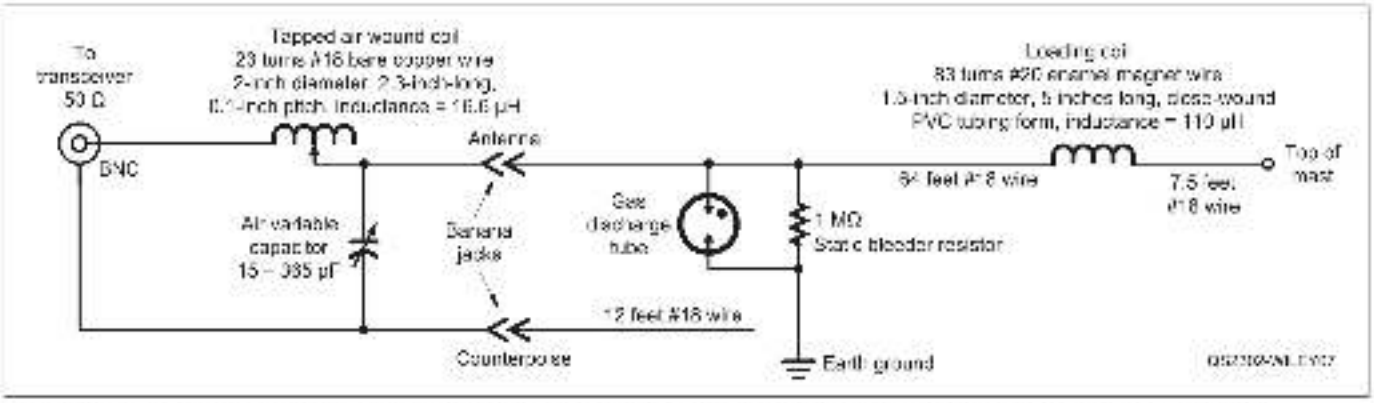

Figure 7 — The full antenna system schematic showing the matching network, lightning and ESD protection, counterpoise, and antenna connections. A gas discharge tube is used for lightning protection, and a 1 MΩ resistor bleeds off static charges.

Final Comments

As a newly licensed ham, I couldn't have asked for a more educational project. The process of designing, modeling, constructing, and testing this antenna involved learning about antenna theory and modeling, impedance matching, antenna analyzers, construction techniques, solar weather, radio propagation, the Reverse Beacon Network, FT8, and WSPR. This antenna design met all of my original design goals, and it's been quite satisfying to see it perform well on 80, 40, and 20 meters.

I wish to thank my good friend and mentor Anthony Felino, WN6Q, for his help and support, and for urging me to write this article.

See QST in Depth for More!

Visit www.arrl.org/qst-in-depth for the following supplementary materials and updates:

- ✔ On-air test results
- ✔ Antenna and station improvements

Dan Wiley, W6AZ, worked as an electronic engineer for 43 years, designing image processing and video systems for industrial and medical applications. He is now retired. He received his Technician license in December 2020, and his Amateur Extra-class license in January 2022.

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

All ARRL members can now enjoy the online edition of *QEX* as a member benefit. Coming up in the January/February 2023 and future *QEX* issues are articles and technical notes on a range of amateur radio topics. These are at the top of the queue.

- Steven Davidson, K3FZT, designs and builds a Radio Message Server Winlink Gateway.
- Peter DeNeef, AE7PD, estimates diffracted fields inside a building near a window.
- Richard L. Quick, W4RQ, builds a horizontally polarized triangular VHF loop.
- In his essay series, Eric Nichols, KL7AJ, explains filters.
- Brian R. Callahan, AD2BA, and Zhemin "Hisen" Zhang, KD2TAI, combine artificial intelligence and machine learning in a bot that transcribes heard audio into text.
- Lynn Hansen, KU7Q, reveals a unique method of constructing custom front panels.
- Steve Geers, KA8BUW, uses a microcontroller to build a CW audio filter.

QEX, a forum for the free exchange of ideas among communications experimenters, is edited by Kazimierz "Kai" Siwiak, KE4PT (**ksiwiak@arrl.org**), and is published bimonthly. The printed edition annual subscription rate (six issues per year) for members and non-members in the US is $29. First-class delivery in the US is available at an annual rate of $40. For international subscribers, including those in Canada and Mexico, *QEX* can be delivered by airmail for $35 annually; see **www.arrl.org/qex**.

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RF Measurements Using Homemade Equipment

Many measurements can be made with simple, homebuilt RF probes.

Ken Pollock, WB3JOB

Though I have accumulated many different meters for measuring RF voltage, there was still a gap in what I was able to measure. Thanks to years of experience in building such devices, I easily filled the gap by putting together what I needed. My measurement needs could be satisfied by probes for various applications, such as RF voltages, field strength, and a simple wavemeter. Additionally, a measurement head could be constructed to display the readings.

Probes

I designed and constructed four basic probes: a series detector probe, a shunt detector probe, a field strength probe, and a wavemeter probe. The accompanying schematics and parts list can be found at **www.arrl.org/qst-in-depth**. The shunt probe uses a capacitor in series with the probe to block dc and respond only to ac. The series detector probe passes dc and is used for calibration. The wavemeter probe covers the lower HF bands, and the field strength probe is useful for HF and VHF. Each probe uses a 1N34A germanium diode.

Once the RF is detected, the signal is passed through series resistors to the measurement device. When a sine wave ac is detected, a dc voltage is produced that is 1.414 times the rms voltage. The series resistances will have a voltage drop equal to the peak voltage minus the rms voltage. For example, if 10 V rms is measured, the peak voltage will be 14.14 V. Selecting the proper resistance will result in a 4.14 V drop, and 10 V would be measured by the instrument. This acts as a voltage divider with the probe as one resistor, and the input resistance of the measurement device as the other resistor.

I needed to measure higher voltages, so I added another probe (see Figure 1) that was switchable for 1X or 10X. The 10X allows me to measure voltages up to 200 V. Use carbon composition or noninductive resistors for the divider.

Measurement Devices

I opted to build my own measurement heads with input resistances of 10 MΩ. I built an analog meter and a more accurate digital readout meter. Both are portable, and each can use a standard 9 V battery or a wall wart.

The analog dc meter circuit (see **www.arrl.org/qst-in-depth**) is based on an analog 0 to 1 mA meter (see Figure 2). My meter had a scale that was already labeled with 0 to 15 V. I used an LM324 quad op-amp because it is designed for operation at lower-supply voltages, and it has four indepen-

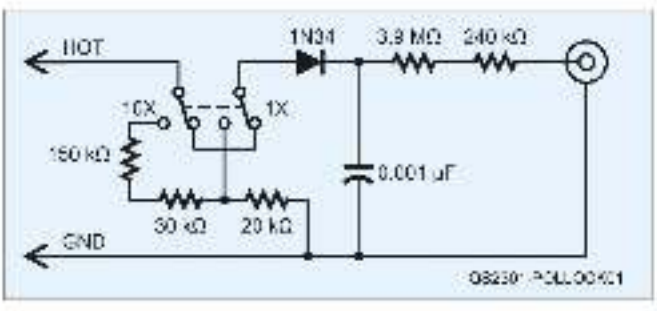


Figure 1 — Schematic diagram for the 10X probe.

dent op-amps. One section of the op-amp is configured as an inverting amplifier. The gain is set at 0.1 by the 10 MΩ input resistor and the 1 MΩ feedback resistor. A second op-amp is used as a divider for the power supply and generates an artificial ground. If the battery is 9 V, the ground will be at one-half of this, or 4.5 V. This is necessary, as the input amplifier will invert the signal and the output swing will be a negative voltage referenced to this ground. I constructed this via point-to-point wiring on perf board mounted to the back of the meter. Only dc signals are present, so wiring is not critical.

The digital measurement meter circuit (see **www.arrl.org/qst-in-depth**), with the front face shown in Figure 3, employs an Arduino Nano microcontroller to increase accuracy. The Nano has several analog inputs that are 10-bit SAR ADCs. Even though the input resistance is several MΩ, the impedance of the analog input must be less than 10 kΩ. This is because one input is sampled at a time through an analog switch, as used by the SAR. Measurements are in microseconds, and are affected by the internal capacitances. The output impedance of an LM324 op-amp is low and can easily drive the microcontroller. A 0.001 µF capacitor eliminates any RF.

A general-purpose silicon rectifier is in series with the 9 V battery negative terminal in order to obtain a small negative voltage for the op-amp. One section from the LM324 is used in this circuit as a voltage follower for the input divider. A voltage follower has a high input resistance and does not load the divider. The output level of this stage is applied to a trimmer that is used for calibration. It is important for the analog voltage applied to the Nano to be between 0 V and 5 V, as voltages outside of these limits can destroy the microprocessor. Arduino Nano code is available at **www.arrl.org/qst-in-depth**.

Construction

All of the resistors are either ¼ or ½ W units. I used point-to-point wiring on a piece of perf board cut to fit inside a tube with a ¾-inch opening. The capacitors are either ceramic or Mylar® and were also selected for size. I placed a piece of heat-shrink tubing around the circuit board, then inserted the board into the tube before sealing the ends of the tube with silicone. I placed the wavemeter and field strength probes in small boxes.

I constructed the analog measuring meter on perf board mounted on the back of the meter (see Figure 4). Then I secured the battery with pieces of hook-and-loop fastener that had adhesive backing.

For the digital meter, I used perf board that was large enough to hold the 14-pin IC op-amp and the edge-mounted LCD display (see Figure 5). I also used a small development board to remove and reinsert the Nano with ease. This board has screw terminals to simplify wiring.

Calibration

The meters are easy to calibrate, requiring only a dc variable power supply and an accurate voltmeter. To calibrate the analog meter, insert a new battery and set the calibrate trimmer to the center of its range. Adjust the calibrate trimmer depending on the maximum reading desired. I calibrated my meter for a full-scale maximum reading of 15 V, so I adjusted the external power supply for 21.21 V. The peak of the rms voltage is 15 V × 1.414. Connect the series detector probe, then connect to the variable power supply. Adjust the calibrate trimmer for a meter

Figure 2 — Front face of the analog measurement meter. [Charles Morreale, N3TBK, photo]

Figure 3 — Front face of the digital measurement meter. [Charles Morreale, N3TBK, photo]

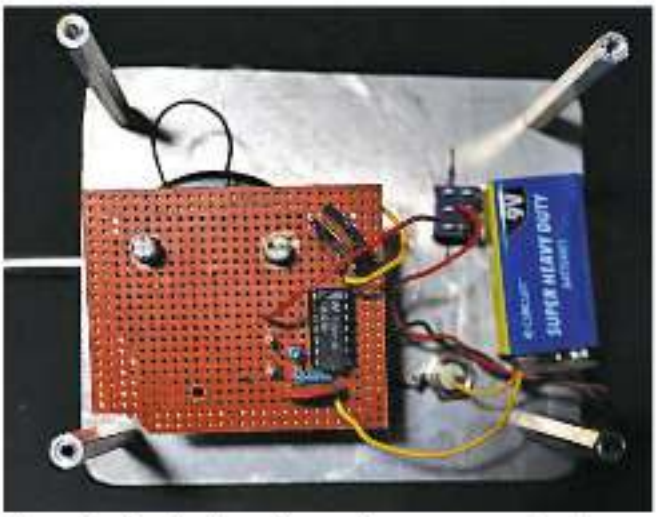


Figure 4 — Construction of the analog measurement meter on perf board. [Charles Morreale, N3TBK, photo]

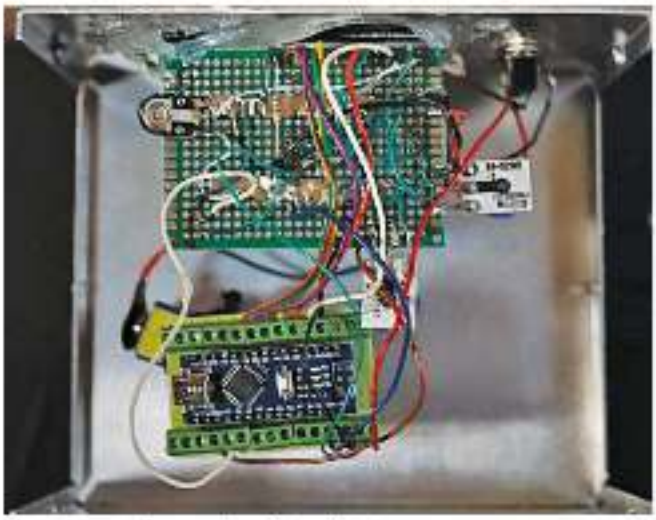


Figure 5 — Construction of the digital measurement meter. [Charles Morreale, N3TBK, photo]

reading of 15 V. After this, the analog meter will be calibrated and ready to use.

The digital meter calibration is almost as simple as that of the analog meter. Begin by turning on the meter — the display will light up, and you should see writing on the display. Adjust the contrast control for visibility. Next, connect the adjustable power supply through the series probe, and adjust the supply for a voltage of 21.21 V. While watching the display, slowly adjust the calibrate trimmer until a reading of 15.0 is displayed. This completes the calibration.

Calibration is useful for both the series and the shunt probes. There is no calibration required for the wavemeter or the field strength meters, as these show relative readings. Using a frequency generator, mark the dial indications for the wavemeter.

Results

The battery life is good because the analog meter draws less than 5 mA, and the digital meter uses less than 15 mA. The meter is low-loading, and the field strength probe can easily detect a handheld transceiver from more than 5 feet away. The probes can also be used with any digital voltmeter or multimeter, as long as the series resistance of the resistors in the probes are 0.414 times the internal resistance of the meters. Measuring meter resistance is explained in the sidebar at **www.arrl.org/qst-in-depth**.

If you wish to operate the digital meter from voltages higher than 9 V, a 9 V regulator should be used to supply the power to the Nano. This is because the microcontroller's internal regulator can overheat when supplied with voltages higher than 12 V.

I had a spare T200-2 ferrite core on hand and made a simple probe consisting of 20 turns of #30 AWG wire, a series 1N34 detector, and a 0.002 µF capacitor. I can slip this over a coax line to detect any currents flowing on the coax shield. This allows me, for example, to determine if a current choke or balun is working properly.

See *QST* in Depth for More!

Visit www.arrl.org/qst-in-depth for the following supplementary materials and updates:

- ✔ Schematics and parts list for the series detector, shunt detector, field strength, and wavemeter probes
- ✔ Analog dc meter circuit
- ✔ Digital measurement meter circuit
- ✔ Arduino Nano code
- ✔ Sidebar explaining how to measure meter resistance

Amateur Extra-class licensee Ken Pollock, WB3JOB, obtained his Novice-class license, WN3RCH, around 1974, then earned his Advanced-class license as WB3JOB. He graduated from Penn Technical Institute of Pittsburgh, Pennsylvania, in 1968. Ken worked at Western Electric in Columbus, Ohio, for 5 years before teaching electronics at Penn Technical Institute for 19 years. He retired from Dominion Transmission, where he was working as a senior measurement, communications, and control technician. His hobbies are ham radio, equipment construction, motorcycling, hunting, and fishing. You can reach Ken at **pollok|5@verizon.net**.

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

A 15-Meter Portable Oval Moxon Antenna

This portable version of the Moxon antenna has a small footprint, good gain and F/B, and a decent takeoff angle, even when mounted at modest heights.

Toivo Mykkanen, W8TJM

The May 2003 issue of *QST* has an excellent article that describes a portable Moxon antenna: "The Black Widow — A Portable 15 Meter Beam," by Allen Baker, KG4JJH. This antenna appealed to me, as I often operate portable. Because the rod support hub mentioned in the article was a bit beyond my woodworking skills, I came up with a more easily implemented solution (see Figure 1).

Figure 1 — The oval Moxon in my backyard.

The 10-foot, three-section telescoping Black Widow fishing rods (available from Amazon) that KG4JJH used are mounted onto 24-inch sections of 1 × 4-inch pine lumber, and are then attached to the antenna boom. The wire elements bend the telescoping rods, keeping the antenna wires under tension and forming an oval shape. Antenna modeling demonstrated that the oval Moxon performance is nearly identical to that of a rectangular Moxon. The driven element and reflector element lengths, rather than the shape, have the most affect on the antenna performance.

Building the Oval Moxon

Cut two 1 × 4-inch wooden supports to be 24 inches long, and paint them with exterior house paint for weather protection. Install the telescoping rods on the wooden rod supports using ½-inch two-hole strap clamps (see Figure 2). Mount the element plates on an 8-foot aluminum or fiberglass tube (or a wooden rod) using U bolts and nuts.

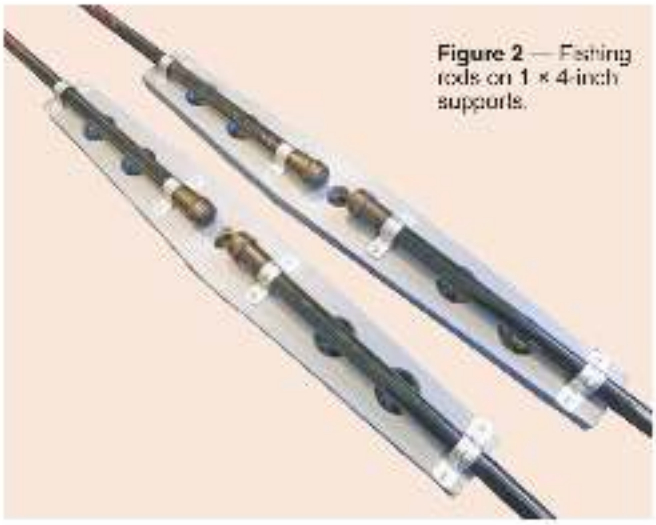


Figure 2 — Fishing rods on 1 × 4-inch supports.

Fabricate a boom-to-mast plate using wood or aluminum, and then attach your mast and antenna boom together. Plates like this can also be found online and at ham radio stores.

Fashion a feed-point insulator from a small piece of plastic or Lexan (see Figure 3). Drill holes for tie wraps to provide coax strain relief. Add RG-58 coaxial cable that's long enough to reach the ground at your desired mounting height to the feed-point insulator.

Figure 3 — Feed-point insulator.

Figure 4 — Gap insulator with keyhole slot.

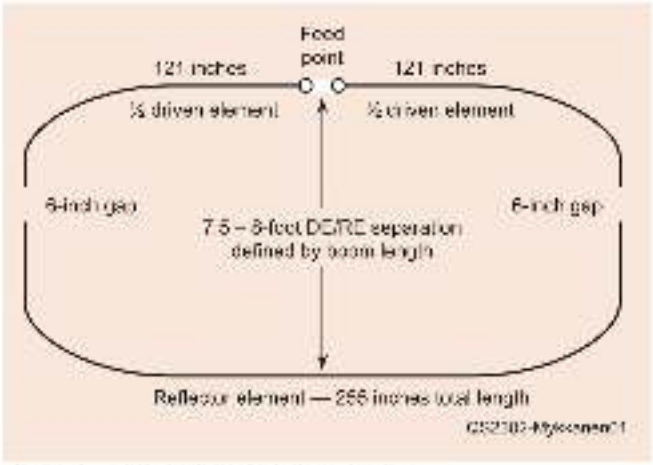


Figure 5 — Dimensions of the oval Moxon.

The 6-inch element insulators are made from an 8-inch piece of ¾-inch PVC pipe cut lengthwise. I milled a keyhole-shaped slot with a Dremel rotary power tool to allow quick antenna assembly and disassembly using model airplane wheel collars (see Figure 4). The wheel collars facilitate antenna tuning, as you can easily shorten elements and secure the ends with the set screws.

Next, cut 14-gauge insulated wire using the measurements shown in Figure 5. Terminate one end of each driven element half with a ring terminal to connect to the feed-point insulator. Crimp the ring terminals with pliers, and then solder to ensure a strong physical and electrical connection.

Installing the Driven Element Halves and Reflector

Extend the telescoping poles to their full length, and ensure the joints are tight. Terminate the driven element halves on the feed-point insulator, and tape them to the fully extended telescoping poles on one end of the antenna boom. The feed-point insulator can be tie-wrapped to the boom to keep it secure (see Figure 6). Apply sealant to the end of the coax and the ring terminals to prevent rainwater from seeping into the coax. The ends of the driven elements should overhang the ends of the fishing rods by a few inches. Measure the overhang to make sure it's the same on each side. Tape the reflector to the remaining set of telescoping poles, taking care to ensure that the middle of the reflector is aligned with the middle of the antenna boom (the reflector wires will have a longer overhang). Again, measure the overhang to ensure it's the same on both sides. Finally, install the wheel collars to the ends of the four wires at the end of the poles, and pass the collars through the gap insulator keyhole slots on each side. The antenna will pull into its oval shape. Allow the coax to droop toward the mast support, and attach it with a few tie wraps.

Tuning

Raise the antenna at least 8 feet for initial tuning. The SWR should be better than 1.4:1 at the bottom of the band. Cut off ¼-inch pieces of each side of the director wire to move the resonant frequency upward. Once you're centered on your desired frequency, raise the antenna to its desired height for final testing and

Figure 6 — Driven element on boom.

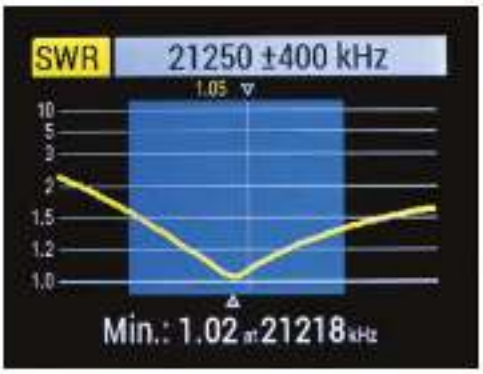


Figure 7 — Final SWR curve.

tuning. There shouldn't be a need to trim the reflector element, and an SWR of less than 1.3:1 should be achievable (see Figure 7). I didn't use a current choke at the antenna, but one can be added, if desired.

Final Installation

Use two 8-foot sections of fiberglass push-up antenna support mast to raise the antenna 16 feet above the ground. The antenna is light enough that push-up masts can be used without guy wires on a calm day, but guy wires are recommended when it's windy. The antenna is also easy to transport to portable sites, and setting up takes only 15 minutes. Directivity and F/B were apparent when turning the antenna, and many contacts were made on the first call.

In Summary

Building your own antenna is a fun aspect of amateur radio. This oval Moxon is a very capable and easy-to-set-up antenna for portable operation.

Toivo Mykkanen, W6TJM, earned his BSEE from Michigan Technological University. He was an RF design engineer and manager at numerous companies, including Rockwell Collins, Hewlett-Packard (HP), and Agilent Technologies. Toivo is a NIST-certified strategic planner and is the author of *Project Management for Strategic Results*. Now retired, he enjoys ragchewing on 15- and 20-meter SSB, and operating portable in the back-countries of Montana and Idaho. Toivo can be reached at **toivo.mykkanen@gmail.com**.

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

Product Review

Xiegu XPA125B 1.8 – 50 MHz 100 W Amplifier

Reviewed by Phil Salas, AD5X
ad5x@arrl.net

Besides my main station Elecraft K-Line (K3/KPA500/KAT500), I also own some QRP rigs — namely Elecraft KX3, Xiegu X5105, and Xiegu G90 transceivers — which I use primarily for portable operations. The Xiegu XPA125B 100 W amplifier is an interesting addition for those who want to use their QRP radios as part of their higher-power fixed station. While the XPA125B is clearly designed to seamlessly interface with the Xiegu X108G, X5105, X6100, and G90 transceivers, it will also work with any QRP rig. And an internal wide-range automatic antenna tuner provides antenna system flexibility when necessary.

XPA125B Amplifier Technical Details

The XPA125B is powered directly from a standard 13.8 V dc power supply capable of 20 – 25 A. There is no fan (i.e., the heavy metal case provides the necessary thermal protection), and a handle on the left side provides ease of transport. The amplifier is specified to output 100 W on 160 – 10 meters, and 80 W on 6 meters, typically with less than 5 W of drive. Transmit and receive switching is provided by an internal relay. There is an amplifier bypass switch, and the XPA125B is also bypassed when it is powered off. The XPA125B provides manual band changing for non-Xiegu transceivers, and auto band switching when used with Xiegu transceivers.

The XPA125B Display and Fault System

There is significant control, monitoring, and display information available on the XPA125B's LCD front panel display. Displayed functions include input and output SWR, input and output RF power, voltage and current, PA stage temperature, and band and ATU status. Four buttons provide manual control of the amplifier: the one on the left is an **ON/OFF** power button, the **PA** is used to switch between standby and operating, the **BAND** button is for band selection, and **ATU/TUNE** enables the automatic antenna tuner. The XPA125B also monitors multiple parameters to protect it from damage. These include high SWR (>3:1), high current (≥25 A), high voltage (≥15 V dc), and high temperature (≥100 °C). A fault condition suspends normal operations, normally by bypassing the amplifier. Faults clear automatically when the amplifier is unkeyed. The full XPA125B specifications are shown in Table 1.

Setting Up the Amplifier

Begin by installing the 30 A fuse in the fuse holder if it is not pre-installed. Connect the following: a ground wire, the antenna coax into the SO-239 **ANT** con-

Figure 1 — The Xiegu XPA125B rear panel.

Bottom Line

The XPA125B is a compact 100 W amplifier that is designed to work with any QRP transceiver. The built-in automatic antenna tuner adds to its operating flexibility. However, there are technical issues that one needs to be aware of.

nector, the coax from the transceiver to the SO-239 **TRX**, and the power amplifier (PA) key cables from the **COMM** 3.5-millimeter port to your transceiver. The PA key interface is not necessarily compatible with all transceivers. A ground enables the amplifier. However, if 3.2 V dc or more is applied to the XPA125B PTT port, the internal processor will be permanently damaged. The optional CE-19 interface provides ALC, PTT, and band-changing information for the Xiegu X5105 and G90 transceivers, and the correct PTT interface for non-Xiegu transceivers. The Xiegu X108 and X6100 transceivers interface directly with the XPA125B without requiring the CE-19. If you are using Xiegu transceivers, set the input power to 5 W, as the ALC interface will adjust the driving power as required. For non-Xiegu transceivers, the input power should be initially set to 1 W. Finally, connect the 13.8 V dc into the **DC IN** port, and turn on the amplifier by pressing the power button for 2 seconds (see Figure 1 for the rear panel connection ports).

Performance Measurements

Because the XPA125B will typically be used with 5 W QRP transceivers, I tested it up to a maximum of 5 W drive, as the specifications note that this is the typical drive level needed for full power. Table 2 details the measured amplifier input versus output. The XPA125B display power readings are compared to a NIST-traceable Array Solutions PowerMaster (input), and Mini-Circuits PWR-6GHS+ sensor and calibrated attenuators (output).

The first thing I noticed was that there was about a 0.5 to 0.6 V dc voltage drop through the dc connector on the XPA125B at the higher current levels. There was another 0.3 V drop along the 3-foot dc power cable supplied with the unit. The XPA125B power connector is a six-pin Molex, but only two tin-plated pins are used for power. Also, the power cable appears to be about 16 gauge, but 14- or 12-gauge wire would be more appropriate. To keep the voltage at 13.8 V dc on the XPA125B display, I had to set my power supply to 14.6 V dc. This resulted in 100 W output on 20 meters. Setting my power supply to 13.8 V dc resulted in the maximum output on 20 meters dropping to 94 W. Also, the XPA125B internal wattmeter appears centered in accuracy on 20 meters. It reads low below 20 meters, and high above 20 meters. So, while the internal wattmeter appears to show that you are close to the typical 80 W specification on 6 meters, the actual power is 62 W with 5 W drive. Also, the input power monitor reading is significantly in error. Finally, I found that the input and output SWR and power readings do not work unless the amplifier is on-line and being keyed. Of course, when this is the case, the input SWR

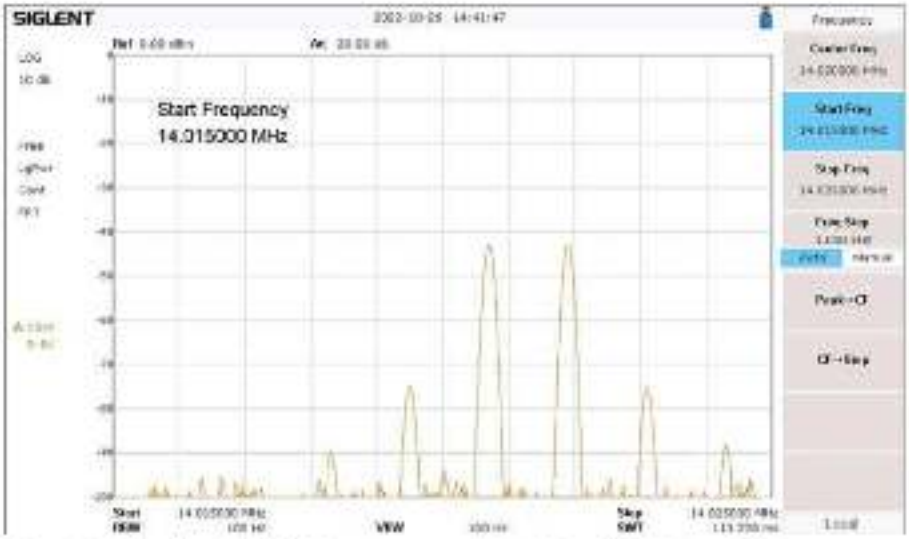


Figure 2 — The Xiegu XPA125B two-tone test with the Elecraft KX3 set at 5 W output.

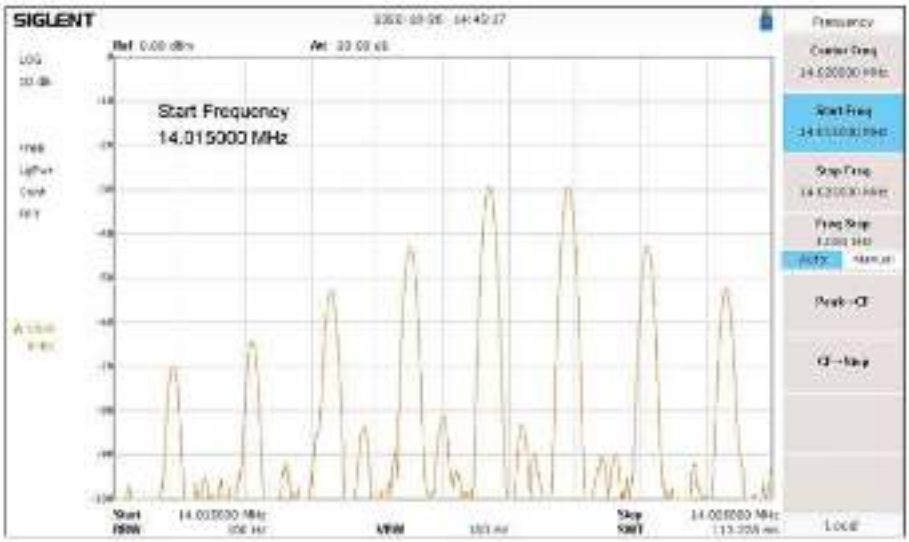


Figure 3 The Xiegu XPA125B resultant two-tone output.

always shows 1:1, as it is looking into the input of the on-line amplifier.

Finally, the gain drops as you increase drive. This indicates that the amplifier is going into compression at the higher power levels. This implies that you are degrading IMD as you near the amplifier's rated output. My KX3 has a built-in two-tone generator, so I looked at the barefoot KX3, and then the KX3 driving the XPA125B to 94 W on 20 meters (external power supply set to 13.8 V). As you can see in Figures 2 and 3, there is significant degradation of IMD performance when the amplifier is used.

The XPA125B Automatic Antenna Tuner

The XPA125B internal ATU provides manual (user-initiated) tuning. Tuning is initiated when the **ATU/TUNE** button is pressed for several seconds, and 5 W of RF carrier is applied. The ATU can be used whether the amplifier is on-line or not. If your QRP transceiver doesn't include an ATU, the XPA125B will take care of this for you. However, as mentioned earlier, the XPA125B SWR meters do not work unless the amplifier is on-line and keyed. The automatic tuner will tune, but you have no indication of the final SWR unless your QRP transceiver has an SWR meter.

Tuner Matching and Loss Measurements

Resistive matching range and loss testing was performed with the precision setup described in the "Product Review" column in the August 2012 issue of *QST* (see **www.arrl.org/qst-in-depth** for details). Tuning power was set at 5 W, per Xiegu recommendations. All measured losses are subject to the ±3% accuracy of my NIST-traceable test equipment. The XPA125B tuning range is specified at 14 – 500 Ω resistive, though

Table 1
Xiegu XPA125B, serial number X02DG22210070
FCC ID number 2ANLH-XPA125B.

Manufacturer's Specifications	Measured in the ARRL Lab
Frequency range: 1.8 – 30 and 50 – 54 MHz.	160-, 80-, 60-, 40-, 30-, 20-, 17-, 15-, 12-, 10-, 6-meter bands, as specified.*
Power output: 100 W PEP with 12 V – 15 V dc on 160 – 10 meters; 80 W on 6 meters.	100 W, as specified on 160 – 12 meters. 79 W on 10 meters, 62 W on 6 meters with 13.8 V dc.
Driving power required: Max 5 W.	1.8 – 54 MHz, 0.2 – 5.0 W (see Figure A).
Spurious and harmonic suppression: >50 dB.	HF, >61 dB; 6 meters, 50 – 76 dB. All bands except 6 meters meet FCC requirements.
Third-order intermodulation distortion (IMD): Not specified.	3rd/5th/7th/9th-order products (dB below PEP at full output): 14 MHz, –20/–29/–41/–46 dB. See Figure B. (dB below PEP at 80 W output): 14 MHz, –28/–39/–38/–46 dB. See Figure C.
Transmit-receive switching time: Not specified.	Key to RF output: 31 ms. Unkey to receive: 30 ms.

Power requirements: 12 – 15 V dc, 30 A max.

Size (height, width, depth, excluding knobs, handles, and connectors): 2.8 × 5.3 × 10.3 inches. Weight: 5.88 pounds.

*In the US, the legal power limit on 30 meters is 200 W PEP output, and on 60 meters it is an ERP of 100 W PEP relative to a half-wave dipole.

Table 2
Xiegu XPA125B Amplifier Measurements, 13.8 V dc amplifier display. Standby: 0.16 A, key down, no drive, 2.1 A.

Band	True Input	XPA125B Mon In	XPA125B Mon Out	True Output	Gain	DC Amps Act/Mea
160 M	1.0 W	0.1 W	61 W	62 W	17.9 dB	10/11
	2.0 W	0.3 W	86 W	89 W	16.5 dB	11.8/14
	3.0 W	0.5 W	94 W	98 W	15.1 dB	12.4/14
	4.0 W	0.7 W	98 W	103 W	14.1 dB	12.6/14
	5.0 W	0.9 W	100 W	108 W	13.3 dB	12.7/14
20 M	1.0 W	0 W	73 W	72 W	18.6 dB	7.9/8
	2.0 W	0 W	85 W	85 W	16.3 dB	8.7/9
	3.0 W	0.1 W	92 W	91 W	14.8 dB	9.3/9
	4.0 W	0.2 W	95 W	96 W	13.8 dB	9.7/10
	5.0 W	0.3 W	100 W	100 W	13.0 dB	10/10
10 M	1.0 W	0.1 W	68 W	63 W	16.0 dB	8.5/7
	2.0 W	0.1 W	86 W	82 W	16.1 dB	8/8
	3.0 W	0.2 W	91 W	87 W	14.6 dB	8.5/9
	4.0 W	0.3 W	93 W	89 W	13.5 dB	8.8/9
	5.0 W	0.4 W	97 W	94 W	12.7 dB	9.1/9
6 M	1.0 W	0.1 W	37 W	30 W	14.8 dB	7.5/8
	2.0 W	0.3 W	52 W	44 W	13.4 dB	9.3/10
	3.0 W	0.7 W	63 W	51 W	12.3 dB	10.2/11
	4.0 W	1.0 W	72 W	57 W	11.5 dB	11.1/12
	5.0 W	1.4 W	76 W	62 W	10.9 dB	11.8/13

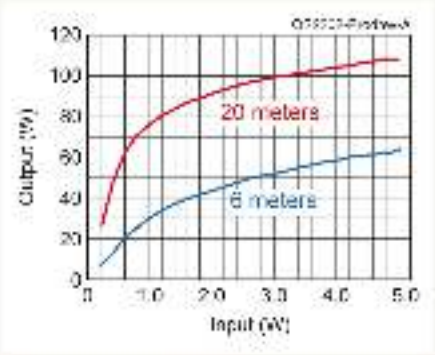


Figure A — Xiegu XPA125B amplifier input versus output power.

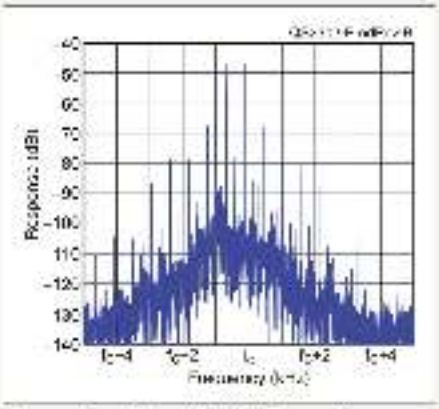


Figure B — Xiegu XPA125B amplifier transmit IMD at 100 W on 20 meters.

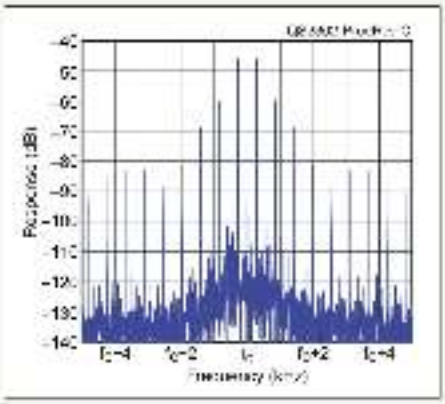


Figure C — Xiegu XPA125B 20 meter band IMD performance at 80 W. Third-order products are −26 dBc, and fifth-order products are −39 dBc. Overall, throttling back to 80 W will transmit a cleaner signal on the bands.

Lab Notes: Xiegu XPA125B 1.8 – 50 MHz 100 W Amplifier

The Xiegu XPA125B amplifier presented quite the challenge for the ARRL Lab to test. We had originally obtained a slightly older version of this amplifier. It worked well enough, except for the problem that the RF power output was low on the upper bands. This might not have been a problem in and of itself, but when we pushed it hard to get closer to the rated power, the transmit IMD performance was not good at all. We then found that Xiegu had a new and improved version of the amplifier, so the editors decided to review the new unit.

When we received the new version, we saw the same problem with power output on the 10- and 6-meter bands. Worse, this unit did not meet the FCC limits for spurious emissions on 6 meters. We had purchased the amplifier through HRO, so we contacted them. HRO immediately agreed to exchange the amplifier for us. The replacement arrived promptly. It was a bit low on power on the upper bands, but not as bad as the older version had been. But the unit would not go into transmit on 80 meters and displayed a **LOW EFFICIENCY** error message. Again, HRO immediately agreed to help, and we soon had a third unit. (Kudos to HRO for its excellent customer service!)

Like the previous two amplifiers, this amplifier, again, did not meet its power output specification on both the 10- and 6-meter bands (see Table 1). The harmonics on 6 meters did not meet the FCC limits for spurious emissions. If this amp is to be used on 6 meters, an external filter must be used.

The transmit IMD, measured at full available power on all applicable bands, was marginal, but a noticeable improvement was observed when the output power was reduced to around 80 W (see Figures B and C). If users of this amplifier want to be good neighbors on the bands, on SSB it is best to throttle the output back from full power to achieve the cleanest signal from the amplifier on any band.

The amplifier showed another unexpected anomaly. The input power was reading significantly low on the amplifier's input power meter compared to the input power measured on the Lab's wattmeter. For example, on 20 meters, the input power read 0.5 W, with an input power of 5 W measured using an external wattmeter. The amplifier is specified for an input power of 5 W, so to prevent damaging the amplifier with overdrive, note the setting of your transceiver, which produces a 5 W RF output, and be sure not to exceed that while operating with this amplifier. We did not see this problem on the other amplifiers we tested, so the unit that customers receive may or may not have this problem, but it is something that customers should look out for.

It might just be the bad luck of the draw, but the Lab found problems with each of the amplifiers it tested. It makes a good HF CW amplifier for your QRP rig. It can be used on FM, although it did get quite warm during testing, so it would be best to throttle it back a bit. It works on SSB, but it will be quite a bit cleaner if it is operated at about 80% of the power it will achieve on all bands. And on 6 meters, a low-pass or band-pass filter will be a must to avoid exceeding the FCC limits on harmonics. — *George Spatta, W1GKS, ARRL Assistant Laboratory Manager*

I went outside the low range for these tests (see the results in Table 3).

The XPA125B couldn't match extreme resistive impedances on 160 meters. However, it was able to provide matches on all other bands, though the losses could be high in some cases. Also, I often had to force a re-tune several times to achieve an SWR less than 2:1, as measured by my external SWR meter (the XPA125B internal SWR meter is inoperative). The XPA125B antenna tuner does not have any memories, so you must re-tune each time you change frequencies, depending on the mismatch. When the tuned match is greater than 2:1, there is no indication of tuning failure, though the PA will fault if the SWR is greater than 3:1.

Table 3
Xiegu XPA125B Resistive Load and Loss Testing

VS WR/Impedance		160 M	80 M	40 M	20 M	10 M	6M
10:1/5 Ω	Loss (%)	66%	28%	20%	20%	20%	28%
	VSWR	2.2:1	1.6:1	1.6:1	1.4:1	1.2:1	1.5:1
6:1/8.25 Ω	Loss (%)	46%	17%	9%	9%	16%	22%
	VSWR	3.9:1	1.8:1	1.6:1	1.5:1	1.4:1	1.5:1
4:1/12.5 Ω	Loss (%)	20%	12%	9%	9%	12%	12%
	VSWR	2.2:1	1.7:1	1.4:1	1.7:1	1.8:1	1.2:1
3:1/16.7 Ω	Loss (%)	16%	12%	10%	10%	10%	10%
	VSWR	1.7:1	1.8:1	1.4:1	1.5:1	1.8:1	1.2:1
2:1/25 Ω	Loss (%)	12%	12%	12%	8%	8%	10%
	VSWR	1.7:1	1.8:1	1.8:1	1.6:1	1.5:1	1.8:1
1:1/50 Ω	Bypass Loss	0%	0%	0%	0%	0%	0%
	Bypass VSWR	<1.1:1	<1.1:1	<1.1:1	<1.1:1	<1.1:1	<1.1:1
2:1/100 Ω	Loss (%)	<5%	8%	7%	7%	6%	8%
	VSWR	1.6:1	1.6:1	1.6:1	1.7:1	1.6:1	1.6:1
3:1/150 Ω	Loss (%)	<5%	10%	10%	8%	8%	10%
	VSWR	1.2:1	1.5:1	1.7:1	1.4:1	1.6:1	1.6:1
4:1/200 Ω	Loss (%)	<5%	<5%	<5%	<5%	<5%	8%
	VSWR	1.1:1	1.4:1	1.6:1	1.5:1	1.6:1	1.2:1
8:1/400 Ω	Loss (%)	15%	6%	6%	10%	11%	12%
	VSWR	2:1	1.5:1	1.6:1	1.6:1	1.5:1	1.1:1
10:1/500 Ω	Loss (%)	20%	<5%	<5%	12%	26%	28%
	VSWR	2.5:1	1.4:1	1.4:1	1.3:1	1.4:1	1.3:1

Operating

I was able to test the XPA125B with my Xiegu G90, Xiegu X5105, and Elecraft KX3, and a QRP Labs QCX-mini 20-meter transceiver. I used the optional CE-19 interface with the Xiegu radios, and it worked well by providing keying and automatic band changing for the XPA125B. The XPA125B control interface is a miniDIN6 connector, so I built interface cables for the KX3 and the QCX-mini using a mini-DIN6P cable. The KX3 keys the XPA125B directly. As the QCX-mini PTT output is 5 V dc on transmit, and 0 V dc on receive, I originally built a special interface for this. However, as the QCX-mini only operates full break-in, this was a problem due to the slow transmit/receive relay in the XPA125B. So, I just made a manually switched amplifier keying cable for when I used this radio.

My HF antenna is a 43-foot vertical, and the XPA125B autotuner easily handles the SWR on 60 – 10 meters. I made one SSB contact on 20 meters and received a good audio report. However, I refrained from making additional SSB contacts due to the high IMD when running full power. I felt much better using CW and made several contacts with each of my four QRP rigs on 40, 30, and 20 meters.

Conclusion

The XPA125B is a compact 100 W amplifier that integrates perfectly with Xiegu transceivers and, to a slightly lesser extent, with virtually all other QRP transceivers. The internal antenna tuner provides all the antenna system flexibility most hams will ever need. However, there are several items to consider:

The Good — The XPA125B is compact and rugged, requires no fan, monitors many parameters, and is well protected.

The Bad — The XPA125B doesn't meet its typical output power level specification on 10 and 6 meters. Also, the input voltage must be set almost 1 V dc higher in order to meet the typical power output specification on the other bands. And the input power and input SWR readings are useless.

Additionally, the XPA125B seriously degrades the IMD performance of the driving transceiver. Lastly, the XPA125B does not meet FCC spectral output requirements on 6 meters (an external low-pass filter would be needed).

Manufacturer: Xiegu. Distributed and supported in the US by select US distributors. Price: $619.95; CE-19 Expansion Port, $34.95.

Ham Radio Solutions CW Hotline

Reviewed by Sean Kiechak, W9FFF
sean.klechak@gmail.com

To advance my Morse code skills, I've continuously tried different learning methods. I eventually felt I was ready to get on the air and make CW contacts. My code transmission was slow, my code reception was worse, and I barely made it through my first few contacts.

Regardless, I came out very proud of my accomplishments that day. However, I have acquired a case of "key fright" that has prevented me from getting back on the air to practice. Instead, I have been studying, and I am now at a crossroads. I feel I can only improve so much, without someone to practice with. I need to practice Morse code with others for a more real-world scenario.

Building the Kit

Recently, I was introduced to the CW Hotline from Ham Radio Solutions, a budget-friendly electronics kit that, according to their website, is "designed to provide a way to key a remote station in CW mode, but can also be used as a private Morse code link to friends." That intrigued me, as I wasn't aware it would work as a remote station key (two CW Hotline devices are required). Although my main goal was to get on the air and operate CW comfortably, I am never opposed to putting together an electronics kit to help me improve my soldering skills.

First, I proudly consider myself an amateur — in every sense of the word. I am dedicated to learning new things, experimenting with technology, and making correctable mistakes. Electronics projects and soldering are no different. I enjoy building these kits, and I always gain some knowledge when assembling them. The CW Hotline is sold in an assembling kit, and recently the manufacturer started offering a fully assembled and tested device. The kit contains all the parts to build either the straight key or the paddle version, and the instructions seem easy to follow. Many people may want to practice with their own paddle or key. For this, the CW Hotline has included a trace on the printed circuit board (PCB) to a jack input for your key.

There aren't any surface-mounted parts, which is good for new hobbyists. Altogether, there are just over 20 parts to solder in this kit, all of which attach to an included PCB and are enclosed in a plastic case. My experience of building this kit was relatively easy. The kit walks through the setup and explains the use of the CW Hotline as both a practice key and a remote key.

Much of the kit comes delivered in a ziplock baggie (see Figure 4), with most of the electrical components placed inside the black plastic electronics kit box. I removed the components from my kit and separated everything in my work area. This allowed me to visualize the kit build. I read the online instructions first while confirming I had everything I needed to complete the build. The case itself needs to be drilled. To drill for the correct hole spacing and fitting, you'll need a printer. I failed to realize this and had to go to my local library to print the template, which is readily available on the CW Hotline website. The manufacturer now offers designs for 3D-printed cases on their website for those who wish to print their own cases instead of drilling.

Otherwise, the kit was an easy build. A few tips to remember: The orientation of the resistors on the PCB doesn't matter. The placement of the resistors, however, does. There are five resistors in this kit, and the parts list clearly labels where each resistor should be placed and provides the band color codes for each. If you do not place the resistors in the correct spot, you will have issues later. Subsequently, the diodes, like the LEDs provided with the kit, have a

Bottom Line

The CW Hotline is an inexpensive and fun kit to build. It is well designed and easy to understand, and it provides an online portal that enables you to connect with other learners and instructors. This is not only an excellent way to practice CW with people online, but with two devices it's also a great tool to use with friends, or even as a remote key to activate your transceiver.

Figure 4 — The contents of the CW Hotline electronics kit.

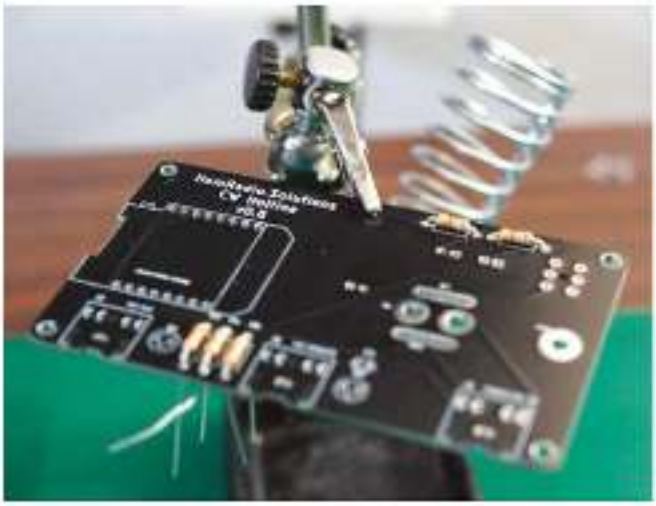


Figure 5 — Using a vise may be beneficial while assembling this kit. Here is an alligator clip holding up the PCB. The alligator clip has rigid edges that, if placed on a trace, may cause damage.

polarity, and their orientation matters. Make sure you read the instructions to determine the polarity. The instructions are not included with the kit but can easily be found on the CW Hotline website. I failed to ensure the spacing of specific electrical components from the PCB. Ensuring proper distance before soldering these components is important; without the appropriate spacing, your built kit may not fit appropriately into your freshly drilled kit box.

During my build, I used a flux pen while soldering the electrical components to the PCB. I have found flux to be critical in properly soldering components. Even with the solder-containing change, I added some via my flux pen. Finally, it could be difficult to solder components on a PCB without holding the PCB in place. I used an inexpensive soldering stand with alligator clips and a magnifying glass (see Figure 5). This allowed me to keep the PCB in place and look through the magnifying glass to confirm that my soldering joints were acceptable. Josh Nass, KI6NAZ, uses a vice grip/block and seems to have satisfactory results. I would venture to say Josh's way of securing the PCB is sturdier and easier to work with, and I will test that method in the future. After about 45 minutes, I completed the build (minus the case drilling). If you have experience in soldering, this might take you only 30 minutes, and if you are less experienced, don't worry about time. Your focus on patience and proper techniques will be most critical. In time, you'll get faster and more proficient with different techniques.

I chose to build an iambic paddle. It requires a center post so that either paddle may tap the center area, creating a short and thus activating a dit or a dah. My center post was not high enough off the PCB, and I was not making electrical contact with the paddles. Ultimately, I used an additional nut (screw) on the center post. One nut was below the PCB, and one nut was above the PCB, followed by a washer on top for grounding. I have found this solution to work efficiently and have yet to feel the need to tighten the extra nut. Additionally, I have not run into any issues with the paddles mistakenly grounding out. The best recommendation I have is to give the extra nut a try and determine if you like it or not. Part of the spirit of amateur radio is tinkering and experimenting.

Three jacks are installed on the side of the kit. These jacks are meant to hook up your own key/paddle, or use an external speaker or a key out (see Figure 6). It is nice to have the option to use my key, as there may be times when I want to learn a straight key over the paddles — not to mention the added convenience of practicing with the paddle I'll primarily be using. The key out serves as a useful tool to activate a radio to which the device is connected. Whenever I hear

Figure 6 — A nearly assembled board ready to be soldered into place. But wait! The ESP8266 shown here is placed incorrectly. Always double-check that you have the electronics part in the correct orientation prior to soldering the components in place.

people discussing the CW Hotline, it is usually to practice code over the internet. However, having the ability to operate CW remotely with a key is intriguing. To operate remotely and drive a connected computer, two CW Hotline kits are required (more on this later).

CW Hotline Connections

After building the kit, I plugged the device in to see if I let the smoke out. The CW Hotline plugs into a micro-USB connection, which needs to have data-passing capabilities. Not all micro-USB cables are the same. I plugged my CW Hotline device into the computer and navigated through the brief configuration of settings on the CW Hotline portal (under the **CONNECT** tab at **www.hamradio.solutions/cwhotline**). You can also update the unit firmware from this web page. Although I thought I had done everything correctly, I heard "dah dit - dah dit dah dit," or NC. This error code means the device could not connect to Wi-Fi with the settings I provided. For me, the issue was the Wi-Fi name not being case-sensitive. With a quick correction, a save of the locations, and a device reboot, there it was again: "dah dah dah - dah dit dah," or OK. This means the Wi-Fi is synced correctly.

The CW Hotline user manual lists all error codes and their meanings. After a brief skim through the user manual, I was able to correct the error.

Using the CW Hotline

The next step is to go on the CW Hotline website and access their VBand (**www.hamradio.solutions/vband**), a different portal from the settings configuration. At this portal, I connected to VBand and started practicing my code in the "Practice Channel," a private channel to practice code. This is nice because I could practice on my own or practice with QSO bot, an automated bot that simulates regular contact on CW. After some practice, I tried to make contact and practice code in one of the public channels. No one was on any public channels that morning, but there I waited, practicing calling CQ and thinking of how I would respond. To my surprise, someone was on within a few moments and suggested I slow down my speed. I located the CW Hotline's Discord server and found it full of individuals willing to offer suggestions. One tip was to use the pushbutton for the speed adjustment. This easy tip had me coding at a speed I was far more comfortable with. Then, I went back into the Practice Channel to practice keying with the new speed. I found the speed to be acceptable, not only for sending but also for receiving. I chose 12 words per minute, knowing this is below the recommended standard when starting with code.

Linking Two Units for Remote Operations

The real fun began when I built a second kit (see Figure 7). I chose not to solder in a straight key or iambic paddle. This works fine if you plan on using your key or not using the critical portion of that kit. The second kit allows for multiple options. I can now go through the device configuration and set a "link key." This link key allows for multiple devices to connect directly with each other without the need for a computer. It is meant to be unique so that no one unauthorized is keying up your other devices. This is important if you use the CW Hotline as a remote key to your ham radio transceiver. I practiced sending Morse code between units and noticed a slight delay

Figure 7 — Two CW Hotline kits working together. For my second kit, I chose not to install a straight key or paddle, as it will be used with an external key.

as the signal traveled through Wi-Fi. Both units were on the same network, so I turned my phone into a hot spot and configured one of the CW Hotline devices for the phone's Wi-Fi.

Does this work over multiple computer networks? The answer is yes. After that, I didn't notice any additional delay being on the same network. This is not only an excellent key to practice with people or QSO bot on VBand, but also (with two devices) a great tool to use with friends, or even remotely as a key to activate your transceiver.

Conclusion

The CW Hotline was a great kit to build. It provided me with hours of educational value — from building out the kit, configuring the ESP8266 to work with VBand, and directly communicating with other CW Hotline kits for the purpose of practicing Morse code, to utilizing it to work as a key while operating away from my station. At $50 per kit, it is well designed and easy to understand, and it provides an online portal that enables you to connect with other learners and instructors. I highly recommend this kit to clubs looking for a build with a purpose. After building, club members can practice together until they feel more proficient in getting on the air. Plus, this kit is entry-level, so it should be straightforward for beginners to learn a variety of tasks, including soldering and Morse code. Since building this kit and using it in different ways, my Morse code proficiency has improved, and I expect it to continue to improve as I keep practicing and testing myself online against others in the VBand.

Manufacturer: Ham Radio Solutions, **www.hamradio.solutions**. Price: kit version: $50 each, plus shipping; assembled version: $100 each, plus shipping.

microHAM ARCO Smart Antenna Rotator Controller

Reviewed by Pascal Villeneuve, VA2PV
va2pv@arrl.org

A rotator controller is an essential accessory in an amateur radio station that uses a directional Yagi antenna. Most controllers are basic, and some enable you to operate remotely. The microHAM Antenna Rotator Controller (ARCO) is different. First, this is an eye-catching unit, and I must admit that this is the best-looking rotator controller I have ever seen. It almost looks like another radio on the shelf. It's bigger than the Icom IC-7300 and has a large color touchscreen. It also has many cool features, and operating an antenna rotator has never been easier than with this controller.

According to the manufacturer, the ARCO controller was created to replace all other rotator control units, and is supposed to work with virtually any rotator. Although I was unable to test an azimuth/elevation type of rotator, according to the manufacturer it features several ways of controlling azimuth or elevation heading. While this controller is compatible with most rotators, double-check with your local dealer to ensure full compatibility before buying.

Bottom Line

The microHAM ARCO with the 7-inch color touchscreen is an eye-catching antenna rotator controller, but it's not only a good-looking controller for the station; it's one of the most advanced controllers. Its fully customizable configurations can ease the operations of any complex antenna setup.

The unit is standalone, but it can be operated remotely via a computer, tablet, or phone (more on this later).

Description

There are two versions of this controller. The 200 W unit is the standard version, and the 400 W unit is meant to be used with larger rotators. I have the Yaesu G-450A, and the 200 W version (the reviewed unit) is more than enough.

This rotator controller is huge, at 10.4 × 4.9 × 5.9 inches (without protrusions). It's slightly taller than my Icom IC-7610. On the front panel, it has a 7-inch color touchscreen with intuitive functions. With a touch on the map, it turns. It has an infinite rotary knob to select an exact bearing by turning in either direction. After 3 seconds, the rotator moves to the desired bearing. You can cancel the rotation just by pushing the rotary knob. Under the rotary knob, there are traditional direction buttons — CCW and CW — for each direction to manually turn the rotator holding the selected pushbutton.

There are three LED indications on the front panel: **POWER** (amber when on), **FAULT** (normally off, red when a fault is detected), **MOTOR** (turns green when it's moving), and an on/off switch.

What makes this unit different is that there are rack-mount-style handles on each side of the front panel. It's useful when you need to transport it, because the ARCO weighs 6.28 pounds.

There are many ports on the rear panel (see Figure 8). This controller can be plugged into a standard ac outlet using the included standard power cord. If you order from the US, you will get the 115 V ac unit. It's internally switchable to 240 V ac, and you can confirm your pre-wired version by looking at the rear panel. Above the AC **LINE** connection is a 3.5-millimeter (⅛-inch) stereo jack, which can be used to link multiple ARCO controllers together. There's a legacy DB9 **SERIAL** RS-232 computer control port, a **LAN** Ethernet RJ-45 port to control the unit over IP, a USB B port (**USB**) for computer control, a USB A port (**FW**) for keypad connection or local firmware update, and a DB15 female (**D-SENSOR**) socket for digital position sensors. There are two different types of rotator connector, a 10-position removable terminal, and a rotator connection port connected in parallel with six conductors to connect directly to a Yaesu rotator. There's also a ground (**GND**) terminal bonded to the chassis, a fuse holder, and the cooling fan that I never heard running. The unit is always on, but goes into standby after a while.

Figure 8 — The microHAM ARCO Smart Antenna Rotator Controller rear panel.

Optional Accessories

While I was writing this review, microHAM launched three optional ARCO External Control (ARXC) accessories for the ARCO controller. These options appeared in the **SYSTEM** menu after upgrading the controller to the latest firmware (reviewed version 3.1.E). The three optional accessories are: the ARXC RELAY, which adds a user-programmable relay output for antenna and polarization switches control, or mast preamplifier bypass control; the ARXC MAGNETIC, which adds an antenna slippage watchdog and electronic compass sensor function to ARCO; and the ARXC LoRa, which consists of two LoRA communication modules paired for a wireless link between ARCO and ARXC modules (the operating frequency is 868 MHz). Note that this information was taken from the manufacturer's website, and none of the listed accessories were tested in this review.

Rotator Connections and Setup

In the manual setup section, the first thing mentioned is "Do not connect any rotator cables to the ARCO and make sure the power is switched to off." They also ask you to check that your unit is wired for your region AC voltage. After confirming the voltage, you can connect the power cord into the **LINE** socket.

Figure 9 — The ARCO Rotator settings menu tab.

Before connecting your rotator to the controller, ensure you have the correct pinout for your specific model. If you've just installed a new rotator, you will need to do a rotator centering. Everything is well explained in the manual. If you're just swapping a controller of an existing rotator, you can skip the centering procedure. The next step is the calibration procedure. This is to ensure that the controller knows where the limits are for each direction.

After turning on the ARCO, it may take a few moments to boot. It's less than 10 seconds when a rotator is connected. At the bottom left of the screen, there's a gear logo that you just touch to enter the settings menu. To set up your rotator, you will need to go to the **ROTATOR** tab. You can see my settings in Figure 9.

The settings menu has six tabs. The first one (**GENERAL**) is for setting up your location with your grid square, the distance unit (kilometers or miles), time and date, the screensaver, the park position, and a few control options (see Figure 10).

The second tab is **APPEARANCE**, which has five sub-tabs (see Figure 11). In the first sub-tab (**GLOBAL**), you can set your preferred look of the display. You have a day and night brightness adjustment, two background settings (light and dark — I prefer the dark look), and a few heading settings. The four other sub-tabs are for the map customizable presets (more on this later).

In the **HEADING** tab, you will find two sub-tabs, one for the calibration and the other to define three individual antennas installed on the same rotator (see Figure 12). You can also set the mounting offset of the additional antennas versus the main antenna (antenna #1).

The **LAN** tab is for setting your IP network. You can remotely control this unit via any VNC software. You will find VNC software for free on any platform, including Windows, macOS, Linux, iOS, and Android, so you can remotely control the ARCO on any smart device. In my opinion, the VNC solution is the best for remote operations, as it doesn't require any proprietary software. Note that all the screen captures used in this review were taken from my MacBook using free VNC software. With the VNC software, you see the same thing as the ARCO touchscreen simultaneously with the unit.

The last tab is **SYSTEM**, with six sub-tabs. The first one is **SYSTEM** (see Figure 13), and the five others are to set up the optional accessories (not tested in this review). In the **SYSTEM** sub-tab, you can upgrade the ARCO firmware directly if the unit is connected to the internet. From there you touch the **LOAD** button to see if there's new firmware available. A pop-up screen will open and show you the currently running and latest available versions. To upgrade, there will be another **LOAD** button beside the version. Touching it will automatically download the new version and upgrade the device.

Figure 11 — The ARCO **APPEARANCE** settings menu tab.

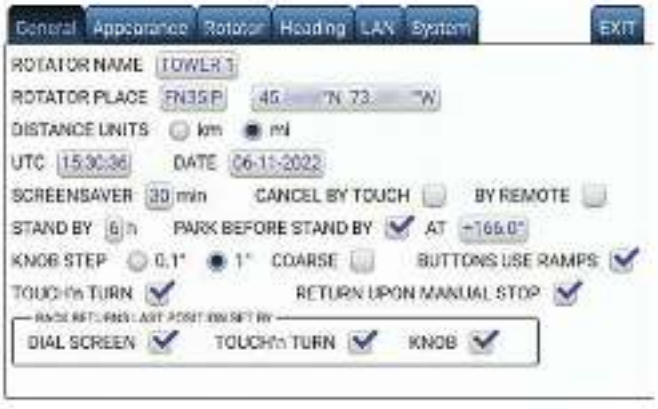


Figure 10 — The ARCO **GENERAL** settings menu tab.

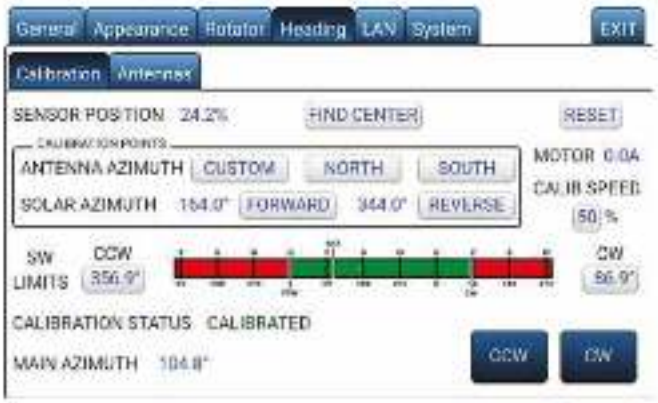


Figure 12 — The ARCO **HEADING** (calibration) settings menu tab.

Figure 13 — The ARCO **SYSTEM** settings menu tab.

Figure 14 — The main screen map recall for different customizable altitude views.

Operating the ARCO Controller

The front panel touchscreen is very intuitive. Just touch somewhere on the map, and 3 seconds later it will turn. You can configure up to four different customizable maps in the **APPEARANCE** setting tab. Having different maps depending on your operation is very useful. With the different altitude views, you can see the full world map (at 12,000 miles altitude) for chasing DX on 20 meters, but you may want to see only the North American continent while operating on 6 meters (2,400 miles altitude), or a low altitude view for 2 meters operation (300 miles altitude). The altitude is completely customizable. You can toggle between your customized maps by touching the **MAP ZOOM** on the touchscreen (see Figure 14). It's better to set up the four presets in advance, as they will be recalled instantaneously, because generating a new map can take about 1 minute.

You can use the infinite rotary knob to select an exact bearing manually by turning in either direction. After 3 seconds, the rotator will move in the desired direction to the selected bearing. You can cancel the rotation by pushing the rotary knob. Under the rotary knob, there are traditional direction buttons — CCW and CW — for each direction to manually turn the rotator.

Touching the azimuth number on the top right of the screen will bring you to the **HEADING DIAL SCREEN**, which allows you to enter the desired heading with the large on-screen keypad (see Figure 15). It also allows you to set the heading based on your location to a specific DXCC country or prefix, or particular WAZ or ITU zone, to turn your antenna in the proper direction. Touching the **NEW** azimuth will toggle between the short and long path bearing. It shows that this controller was designed with the DXers in mind, as it's complete and easy to operate.

You can program six memory presets that can be recalled just by touching them on the touchscreen.

Figure 15 — The **HEADING DIAL SCREEN** allows you to enter the desired heading with the large on-screen keypad. It also allows you to set the heading for the QRA locator by specific DXCC country or prefix, or particular WAZ or ITU zone, to turn your antenna in the proper direction.

You also personalize the memory name. For example, I have one named "PARK," which I use to place my antenna so it will be best positioned for the lesser wind load against my QTH-predominant wind direction. But even if I forget to park my antenna manually, I programmed the controller to automatically park to the correct bearing after a certain time (programmable between 1 and 99 hours; see Figure 10).

In Conclusion

This may seem like a long review for an antenna rotator controller, and I didn't cover everything the ARCO controller can do. This is a complex unit, but it makes your operations very simple, and I just love it. I have used this unit for the past 7 months without any issues or bugs, so this one is a keeper for me.

Manufacturer: microHAM, Maticna 28, Galanta, 92401, Slovak Republic, **www.microham.com**. Price: $799.99 for the 200 W version (as reviewed). $899 for the 400 W version. Available for purchase in the US via DX Engineering, **www.dxengineering.com**.

Dave Casler, KF2QG, askdave@arrl.org

Ask Dave

Get more information from the "*QST* Ask Dave" YouTube playlist at **https://bit.ly/3z2MBMI**.

Lightning Protection Matters, and Accounting for Cable when Calculating SWR

High SWR Can Trip a Lightning Surge Protector

Q Howard Rensin, KC3D, asks: Will my Ameritron ALS-1306 1200 W PEP amplifier get damaged by high standing wave ratio (SWR) caused by PolyPhaser lightning surge protectors? The amplifier manual says, "The most common causes of amplifier failures or erratic fault protection alarms is installation of antenna switches, lightning protection devices, or baluns with lightning spark gaps in high SWR lines. If your antenna system has an SWR high enough to require an antenna tuner, do not use 50-ohm lightning protection devices after the tuner." This concerned me because I have PolyPhasers on all of my coax lines. Should I remove my PolyPhasers or ignore the manual? I have a multiband Yagi, and it needs the tuner on some of the bands.

A Having both the forward and reverse, or reflected, voltages on the same line simultaneously in your feed line is called a *standing wave*. In real systems, this wave is not standing, but is pushing RF toward your antenna. However, the combination wave is constantly pulsating in value. The SWR is defined as the maximum voltage of the combination wave divided by the minimum voltage of the combination wave. In the situation of a 3:1 SWR, the maximum voltage of the combination wave is 1.5 times that of the incident wave. The minimum voltage is half that of the incident wave. This gives an SWR of 1.5 divided by 0.5, which is 3:1. The higher the SWR on the line, the higher the maximum voltage will be. The reflected voltage cannot be higher than the incident voltage. For example, even with an SWR of infinity, the reflected voltage equals the incident voltage. This means that the combined forward and reflected voltage will reach a peak of twice the incident voltage. Even with an infinite SWR and power of 1500 W, you would need a lightning protector that can handle 6000 W. Of course, your operating SWR is nowhere near infinity, so a 3000 W unit should do.

To figure out how much your lightning arrester can handle, look at the specification from the manufacturer. Sometimes this will be in watts, which can be converted to volts, or whatever units your manufacturer uses. If you are worried about arcing with a high SWR, Alpha Delta's 2000 W lightning surge protector can handle significantly more than a 3:1 SWR with a large reserve. PolyPhaser and Morgan Systems both make a 3000 W unit.

The easy way to fix the SWR problem lies with your Yagi. At my station, I make sure all of my antennas have an SWR less than 2:1, because I have a 500 W amplifier without a high-power tuner.

Calculating the SWR at the Antenna

Q Andrew Mitz, WA3LTJ, asks: Do you know of an online calculator for correcting SWR readings of an antenna after taking the cable into account? My portable dipole has an SWR reading of 1.5:1 at 7.25 MHz, but the meter is connected through 40 feet of RG174 coaxial cable. I used an SWR to return loss online calculator to get the return loss in decibels (dB). Then, I subtracted two times the rated loss of the coax (0.85 dB times two). Finally, I used a return loss to SWR calculator to get a corrected SWR (about 1.6:1). Is that right?

A There seems to be an online calculator for everything. In your search engine, type in "SWR to return loss" and you will be presented with several.

A lossy cable can hide a high antenna SWR. Normally, RG174 cable is used inside transmitters and receivers to move small amounts of power around short distances internally. It's rare to see it used as a transmission line. However, if you are willing to put up with the losses, you certainly can do so. This might be convenient in a POTA or SOTA operation. Typically, I would recommend RG-8X cable instead.

I looked through the tables and formulas in the 23rd chapter of the 23rd edition of *The ARRL Antenna Book for Radio Communications*, and you are in the ballpark. One thing you have not included is the additional loss in the coax cable due to an SWR that is higher than 1:1.

In this month's supplemental video, I show how the for-ward and reflected waves interact with each other. You can find this in the "QST: Ask Dave" playlist at **https://bit.ly/3z2MBMI**.

A Better Place for Lightning Surge Protectors

Q Scott Rhoads, N3CRS, asks: To add lightning surge protectors to coax, should I put the lightning surge protectors in the PVC box in the woods, and a ground rod there, or should I put it at the house before it goes into the house and put a ground rod there? I have three feed lines that come out of my house through the foundation, and then below grade in 3-inch PVC conduit. Currently, the only thing that is grounded is my station equipment. If I add them at the house, I will have to reconfigure the PVC conduit and add an enclosure for them so that I can add the surge suppressors and grounding, which won't be a problem.

A Amateur best practices for grounding have evolved considerably in recent years. The method I'm going to describe here is called *minimal grounding*.

The most important place to put a ground rod is right outside your station. Figure 1 shows that you have a ground right outside your station consisting of three ground rods 4 feet apart, and a solid wire going to your indoor station ground. Let's take advantage of these ground rods. The drawing shows the LMR-400 coax is unbroken from your station all the way out to your antennas. I suggest that you reroute your buried coax, as shown by the blue line in Figure 1. Once you withdraw them from your station, there should be plenty of room to reroute them in your PVC pipe to your present ground rods. Install lightning surge protectors on the ground rod closest to your station above ground to give yourself maintenance access to them. Then, run LMR-400 jumpers to your station. This has a much higher probability of keeping lightning out of your house. The cables should not come into the house until after they have gone through the lightning surge protectors.

For extra credit, install a ground rod where the cables come out of the ground. The drawing shows that you have three coaxial cables attached to a bulkhead. Add a ground rod and lightning surge protectors (see Figure 1), and then ground the bulkhead. Run a buried bare #6 copper line from your station ground rods around the front of the house to the utility ground. If you really want to go all out, put 8-foot ground rods every 15 feet or so along this buried line, and securely connect or copper weld these to the bonding line. You can repeat this by taking a bonding line from your station ground all the way out to your antenna ground with the same caveat about intermediate ground rods. You can consult with an electrician who is familiar with radio installations for additional protection ideas.

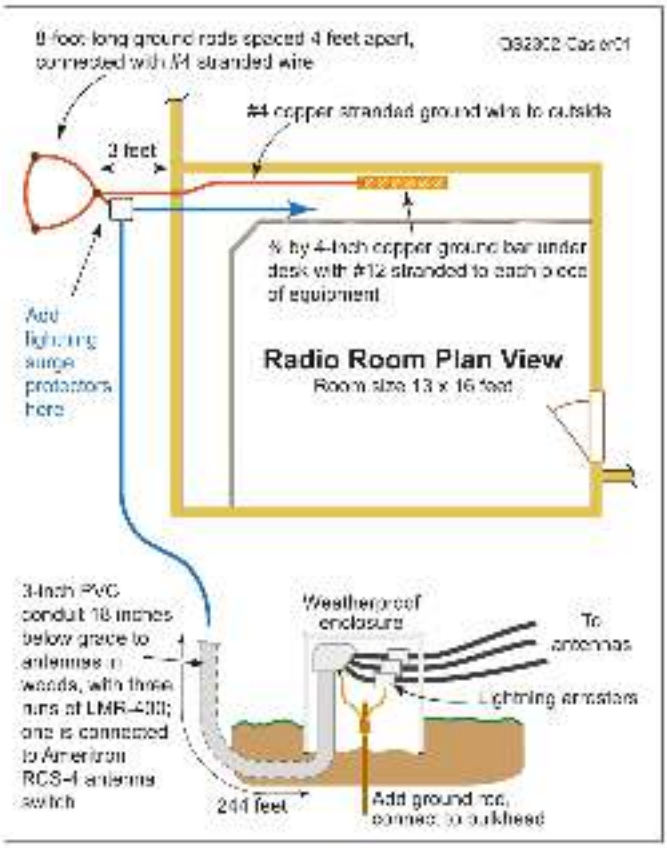


Figure 1 — The blue lines show an alternate routing of cables from the antenna farm. This allows the cables to terminate at lightning surge protectors attached to the ground rod closest to the house. Jumpers go from the surge protectors into the building and then to the station. The main station ground rod should be bonded to the utility ground rod. Additional lightning protection can be added where the coaxial cables come out of the ground at a bulkhead where they connect to the antennas.

The current standard for amateur best practices for grounding can be found in the second edition of *Grounding and Bonding for the Radio Amateur*. One ground rod is cheap, but a lot of them (to meet the requirements in this book) can get expensive.

Warning: Unless you go whole hog with your grounding, all bets are off in the event of a direct lightning strike. During lightning season, always disconnect your gear when you are not operating. I suffered a direct strike once, and a few things in the house were ruined. Fortunately, my radio was completely disconnected.

There are commercial cable entrance panel boxes to mount your lightning protectors on the wall outside your shack. These are available from DX Engineering, **www.kf7p.com**, and others.

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

The Benefits of Leasing a Remote Station

This ham sold his gear to pay for a subscription that allows him to operate remote stations located all over the country.

Craig Anderson, W9CLA (SK)

Recent health issues forced me to make the difficult decision to sell my home and move to a place that I can more easily maintain. I needed to simplify my life, but I didn't want to give up my hobby of 60 years. From conversations I've had with other hams, I learned that many are inactive due to similar circumstances. Thankfully, we now have the technology and resources to access remote stations, regardless of our living situations. And it doesn't require a large investment if you choose to take a minimalistic approach.

Going Remote

Deed restrictions at my new home prevented me from having any antennas except a stealth flagpole vertical. I'd done enough remote operating using Remoterig boxes and Icom's remote software that I felt comfortable using a computer-based remote station.

I researched my options and came across Remote Ham Radio, or RHR (**www.remotehamradio.com**). I signed up for a trial membership and was impressed. There are quite a few remote websites like this, many of which are running solid-state 1,500 W amplifiers. An excellent overview of RHR's offerings can be found on their website.

RHR has updated their entire system to FlexRadio equipment. No client-side hardware or software is required. However, to access advanced features, RHR provides their own desktop app. This also allows the use of the Flex Maestro desktop console. I found that this console gives you the same tactile feeling of having a local radio. The Flex Maestro control console is not required, but I chose to buy it because it's easy and fun to operate. The only hardware you need is a PC.

This RHR station in the Catskill Mountains in Summit, New York, offers 24 antennas across 24 towers for its remote operators. [Photo courtesy of Remote Ham Radio]

Subscription Prices

I made the financial decision to sell all of my radio equipment (except for a Drake C-Line and Icom IC-7100) and use the proceeds from the sale ($12,000 – $15,000) to fund my use of a subscription to RHR.

RHR offers a PremiumDX subscription that's $99/year plus $20/month for airtime, and a free youth network with unlimited airtime. They have per-minute usage fees based on the specific station you're connected to that vary depending on the level of sophistication of the station being accessed. For example, premium stations could have a rotating Big Bertha pole with multi-stacked Yagis and an SPE Expert 1.3K-FA or Elecraft KPA1500 linear amplifier, and the cost could be as high as $0.99/minute for full access. Or you could use the listening-only feature for as low as $0.05/minute. Typically, what you get is a station that's either overlooking the ocean, in the mountains, or in other remote areas. You could have access to 7/7/7/7 stacked Yagis, a 160-meter four-square antenna, and everything in between. The stations are scattered across the country, and more join every year.

More Remote Station Options

Many hams are finding new ways to work around their operating restrictions or challenges. One option is to lease remote stations using services like Remote Ham Radio and BeLoud (**https://beloud.us**). If hams are able to keep some amount of equipment at home, they can use the RemoteTx ham radio remote control system (**https://remotetx.net**), a cloud service allowing hams to control their stations through the internet. Or they can build their own remote station. Ken Norris, KK9N, did so after he moved to the city 10 years ago. Read his article, "Remote Contesting from a City Apartment — or Anywhere!" in the Special Contest Insert from the November 2022 issue to learn more about how he took on this project. The photo on the right shows the workings of Ken's remote station.

[Ken Norris, KK9N, photo]

Operating the Stations

Using RHR, I can hear stations that I couldn't hear at all from my on-site station running a Hy-Gain TH-11DX antenna at 1,134 feet mean sea level. Contacting Europe on 6 meters from my location in Wisconsin was next to impossible, but through a remote station in Maine that overlooks the ocean with a stack of 6-meter Yagi antennas using 1,500 W, it's now possible. You can easily switch locations to see which one gives you the best signal path.

I have never seen more than half the stations being used at one time, even during a contest. There are always remote stations open for access. If you're concerned about having access to a station, membership allows you to reserve slots ahead of time. This could be useful for those interested in operating during contests.

I love how it feels like I'm operating my own station and not a remote computer somewhere. I bought the client hardware (Flex Maestro control console) because I prefer to use a remote piece of hardware that's more like operating a real radio. With the spectrum display and the full functionality of the controls on the Maestro, it's no different than having my own station, and it provides me with flexibility, portability, and enjoyment.

In Conclusion

Leasing a remote station is a good option for those who have antenna restrictions. For me, RHR is my only access to ham radio. Even though I earned the DXCC Honor Roll, I still want to chase the rare ones for band slots. Because of that, my ham radio activity will be rather minimal, and I'll only be paying for what I use, instead of investing a lot of money in my own equipment that I won't be able to use because of my new residential deed restrictions. I can remain active with minimal hardware.

See the sidebar, "More Remote Station Options," for additional possibilities based on your wants and needs. If you are apartment-bound, are deed-restricted, have physical impairments, or travel a lot, leasing a radio station provides you with a chance to continue enjoying the hobby. If you're older and are concerned that it will be too complicated, consider reaching out to your local ham club for help. Clubs can provide a valuable resource by helping those with limited computer skills to get set up.

Craig Anderson, W9CLA (SK), earned his first license, with the call sign KN9AZB, in 1960 when he was in ninth grade. He held a Bachelor of Science in Engineering Technology (BSET), a Master of Science (MS), and an Education Specialist Degree (EdS). Craig spent 21 years in the semiconductor industry before going back to grad school. He spent 20 years in higher education and retired in July 2012, after serving 17 years as Vice President of Administration for a community college. Craig passed away on September 23, 2021, at the age of 75.

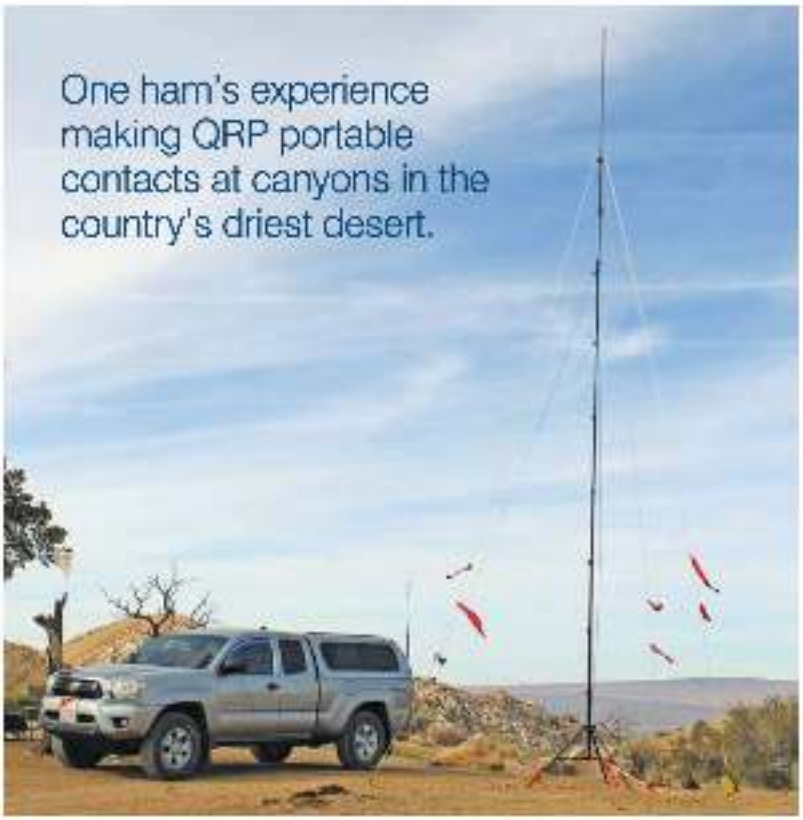
For updates to this article, see the *QST* Feedback page at www.arrl.org/feedback.

Low-Power Desert Operations

Chuck Bunn, AI6OZ

In January 2022, I traveled to Sawtooth Canyon and Owl Canyon for QRP portable operations. Both canyons are located in California in the Mojave Desert and are managed by the Bureau of Land Management (BLM).

One ham's experience making QRP portable contacts at canyons in the country's driest desert.



My operation setup at Owl Canyon, where I was able to work 20 meters with my Buddipole antenna. I added red streamers to my guidelines so people wouldn't walk into them.

Safety First

The Mojave Desert is known for being the driest desert in the US, and it has the hottest air temperature and surface temperature recorded on Earth. I've been visiting this desert for nearly 50 years and have learned how important it is to be safe when I'm there, even when staying at an established campground. See the sidebar, "The Wilderness Protocol," to learn more about an important safety recommendation for hams operating in the wilderness.

Before visiting the desert, talk to your doctor and family to let them know about your trip. If you've never visited the desert before, consider talking with someone who has, or, ideally, find someone with experience to go with you. Some other safety precautions to take prior to traveling to the desert include:

1. Having a game plan. Do your research and know where you're going before leaving for your trip.
2. Making sure someone knows how long you will be gone. If you're late and they can't reach you, advise them to call 911.
3. Staying with your vehicle if you break down, as it will provide shelter.
4. Bringing a first aid kit and enough food and water to last a few days longer than you plan to stay.
5. Checking the weather and being aware of any changes.
6. Being alert on the trails. This includes being aware of wildlife (and leaving it alone) and always checking what's ahead of you — some trails end at cliffs or large caverns.

Preparing for My Trip

I planned my trip around the weather because I wanted to make sure I would have good propagation conditions. The week prior to my QRP portable trip, a coronal mass ejection was expected to pass near the planet sometime around January 22 and possibly deliver a glancing blow to the atmosphere. Plus, there had already been two solar storms earlier in the week.

My portable station consisted of my Buddipole™ antenna with an extra-long whip, a Yaesu FT-817, a new LDG Electronics Z-817 antenna tuner, a Bioenno Power solar panel for power suppy, an MFJ-269 analyzer, my end-fed multi-band antenna for 40 – 10 meters, and a telescopic pole.

Visiting the Canyons

I began my trip early in the morning to avoid traffic and arrived at Sawtooth Canyon around 7:15 AM. Overall, Sawtooth is one of the nicer BLM campgrounds, with the only downside being that it's tucked into a small canyon surrounded by high rocky hills.

On this particular day, most of the campsites were taken, so I decided it wasn't a good location for my QRP radio. Campsites were deep-seated against the rocky hills, and I felt this would block my radio signals. While at the campground, I scanned for Jet Propulsion Laboratory (JPL) Amateur Radio Club and Keller Peak Repeater Association repeaters. I found that JPL repeaters had fair reception, but I didn't find reception for Keller Peak. By 7:30 AM, I was back on the road heading to the Owl Canyon campground.

By the time I made it to Owl Canyon, the weather report for Victorville, California, said it was 43° F, and it was a bit windy, but not too bad. The Keller Peak and JPL repeater coverages were back, and I arrived at campsite number one. Even though I had to deal with vehicle traffic at this site, my antennas were away from most foot traffic — not that this mattered, as the campground was desolate.

Setting Up My Station

I wanted access to more than just the 20-meter band, so I set up my end-fed wire antenna using an old milk crate to keep my feed point at least 1 foot off the ground. This also gave me the chance to use my new LDG Electronics Z-817 antenna tuner on more than just my Buddipole, and it worked like a champ. This gave me access to the 40 – 12-meter bands.

The last time I used my telescopic pole, the wind caused it to collapse. This time I used hose clamps, and they helped tremendously. I also mounted the telescopic pole to a metal garden stake. This seemed to work well, until the wind got too strong, and my telescopic pole started to flex more than I felt comfortable with. I set up the stakes and tie-down straps that I use for my Buddipole, and those helped stabilize the pole for a while.

Time on the Air

During my operations on Friday afternoon, I heard a lot of traffic — mostly nets, a few Parks on the Air® (POTA) operators, and lots of DX activity on 17 meters. For the first time, I heard a couple of South Africa stations!

After about 4.5 hours of operating 5 W, I managed to make seven contacts, working through some fairly large domestic traffic jams. I attempted contacts with South Africa several times, a couple of other DX stations, and a B-17 special event station.

Later that evening, I made three contacts on 40 meters — 20 and 17 meters had no traffic, and Asia commercial stations were on the upper portion of the 40-meter band. After making 10 QRP portable contacts, I felt good about Friday's efforts.

The Wilderness Protocol

The Wilderness Protocol was designed to help ensure emergency communications for those who might be outside of repeater range while in the backcountry. Hams are requested to monitor standard UHF/VHF simplex channels at specific times for emergency calls. The suggested time frame to monitor is near the top of the hour (i.e., 0700 – 0705 UTC). The suggested simplex frequencies are 146.520, 446.000, and 223.500. During all of my trips to the Mojave Desert, including this one, I monitor the suggested frequencies full-time once I've passed a major town like Victorville, California, as well as when I'm at my campsite and not on the air.

That night, Los Angeles and San Bernardino were expected to get winds of 35 to 45 mph, with gusts of up to 80 mph. When I got up Saturday morning, I expected my antenna to have vanished and my equipment to have departed down into the dry wash next to my campsite. Mercifully, there were no runs, drips, or errors. That morning was cold enough that I needed to turn on my truck for heat. The weather forecasted 11 mph winds, but at that time the winds were already well north of that.

While not very happy about the windy conditions, I was still in high spirits and looking forward to another great day of QRP portable operations. The first band I scanned was 40 meters, and it was incredibly busy! The 20- and 15-meter bands weren't so bad, and I managed a few POTA contacts and one CQ contact.

In Summary

After more than 12 hours of operating time using 5 W, I managed to make about 31 QRP portable contacts. It was nice to have 40, 20, and 17 meters available for operations. I also tried 15 and 12 meters and found no traffic. Going forward, I'll definitely use my end-fed antenna a lot more. Overall, this was one of my better QRP portable trips.

All photos by the author.

Chuck Bunn, AI6OZ, is a graduate of the Long Beach Naval Shipyard Fire Control Apprentice Program, as well as of Long Beach City College, where he received his AS in Electronics. He spent 33 years working for the Department of Defense, where he was assigned various duties. He served 3 years in the US Army, worked as Naval Fire Control in the US Navy, and worked in Defense Contract Management for 25 years. Since he retired, Chuck has been happily engaging in various activities, such as perusing ham radio, traveling across the US with his wife, and volunteering. He can be reached at **chuckgbunn@gmail.com**.

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

Wild West Rove

How does a ham radio couple navigate a 2-week vacation with several priorities? This duo activated nearly twenty grid squares in eight states, and learned some lessons along the way.

Sean Kutzko, KX9X

I've operated portable hundreds of times, and being able to transmit from a new location is one of the primary factors I think of when planning vacations. My partner, Nancy, N9NCY, earned her Technician-class license in January 2021, and she dove into portable operating because it couples with her love of driving and traveling.

Though she enjoys ham radio, her interest is not as intense as mine. I can become downright obsessive when a portable operation is being planned. "When Sean suggested we combine our vacation to Glacier National Park [Montana] this year with a rove, I was all in," Nancy said. "We spent a ton of time planning the vacation, with me handling the actual vacation part and Sean handling the roving part… Sean gets immersed in how much radio time he can pack into any opportunity that presents itself."

Forming the Plan

We planned to leave directly from our home in Urbana, Illinois. This trip would be taking us through eight states and nearly 40 grid squares; in the parlance of satellite and VHF operators, this would be a rove of epic proportions.

We agreed that the first part of the trip, driving to and spending 6 days in Glacier National Park, would mainly be a vacation. Leaving Glacier and driving home would be more radio focused.

But it would take 3 10-hour days to get to Glacier from Illinois. I knew I couldn't pass through so many grids without operating, so I decided to operate 6-meter FT8 and do linear satellite passes while mobile on the trip out. It was not an ideal circumstance; after hours of grounding and bonding, my gear was still picking up a significant amount of noise from Nancy's SUV. FM satellites proved impossible to use in pre-trip testing while mobile, so I focused on the linear (SSB) satellites instead. FT8 tests on 6 meters also proved modestly successful despite an S6 noise level.

For satellites, I used my standard rover kit: two Yaesu FT-817s and a 10 Ah battery. I also added two 19-inch, dual-band mobile whips spaced as far apart as possible. On 6 meters, I used a four-magnet mount base with a 6-meter hamstick. In the end, I had a storage tub full of gear in the back seat along with a 13-foot, collapsible painter's pole to use as a mast for a two-element, 6-meter beam. I also packed two Arrow Antenna dual-band Yagis for satellite work when we weren't in motion. It was a lot of gear for a 2-week trip, despite the initial emphasis on traveling light.

The Rove Begins

At 6:00 AM on July 13, 2022, Nancy and I began our "Wild West Rove." The drive out to Glacier was full of excitement. We had 3 days to get to our campsite, and we had plans to meet up with a few ham friends along the way, including Minnesota satellite rover Randy

Shirbroun, ND0C; his wife, Amy; and their daughter, Kylee, KE0WPA; and Dwayne Allen, WY7FD, and Katie Allen, WY7YL, in Wyoming. The noise level while I tried to operate satellites was so high that I worked only a few stations on my first attempts. I insisted we stop so that I could work a few passes with the Arrow satellite antennas. Though I made a lot of contacts, this put us way behind schedule on the first day. What was supposed to be a lunch date with the Shirbrouns turned into an early dinner meetup instead. "The thing I like most about the hobby is how it connects people — not just via radio waves, but also socially via media sites such as Twitter," Nancy said. "We spent more than an hour getting to know Randy and relating ham radio stories over Dairy Queen onion rings and ice cream, and this simple get-together became one of my favorite memories from this trip."

After working them on satellite passes for years, finally meeting Randy, ND0C; Kylee, KE0WPA; and Amy was a highlight of our trip. [Amy Shirbroun, photo]

Whenever you plan a rove, Murphy always tags along; it's just a question of when he'll make his presence known. For us, Murphy showed up on I-90 just outside of Rapid City, South Dakota. There were signs of life on 6 meters, so I tried mobile FT8 on 50.313 MHz. The winds had increased substantially in western South Dakota, and as we crested a hill, a strong gust hit. The gust blew the mag mount off the car in the middle of four-lane traffic, and it was dragging behind us by the coax. Before we could pull off to the side of the highway, the coax snapped and the mag mount skidded across the highway before landing in a ditch. We got the remains back into the SUV as we thanked the powers that be that nobody was hurt, but the mag mount was gone. We were done with 6 meters while mobile. After another day on the road without incident, we arrived at Glacier National Park, where we set up camp and spent the next 2 days hiking. Even in the middle of this great national park, all I could think about was getting on the air.

We eventually drove up the park's major artery, Going-to-the-Sun Road, dubbed by many as one of the most scenic drives in the country. Until this point, I was more focused on radio than the incredible beauty of our surroundings. The views along this stretch of road in Glacier are absolutely breathtaking, and I was caught completely off guard. I got National Parks on the Air (NPOTA), ARRL's operating event, off the

I worked the AO91 FM satellite from Logan Pass in Glacier National Park. Weather changes quickly at that altitude. 2 days after taking this photo, we returned to Logan Pass and were met with sunny skies.

ground in 2016, yet I had forgotten my own advice from that time: take your headphones off and learn something about the places from which you transmit. I started paying more attention to the beauty of the park after that drive. I still managed two satellite passes on the evening of July 18 from the DN28/DN38 grid line, which fell on the approach road to our campsite. We were even visited by a fellow ham, Tom, N2TSR, who happened to be driving by.

Sperry Chalet

July 19 was the day Nancy had been waiting for: the hike up to Sperry Chalet for an overnight stay. Constructed in 1913, Sperry is one of nine chalets in Glacier National Park that were built by the Great Northern Railway company. Today, only two remain functional. Sperry Chalet sits nearly 6,600 feet above sea level, and the only way to get there is to hike 6.7 miles up a steep trail with 3,300 feet of elevation gain. It took us 7 hours to reach the top, where the sunset was spectacular. I was unable to make any HF contacts while we were at Sperry. Nancy made two contacts while we were there, both via the AO91 satellite. "It felt pretty amazing that I could combine my love for the mountains with this hobby," Nancy said.

Several other lodgers inquired what we were up to with our antennas, and were intrigued by the notion of talking to others through a satellite. With no light pollution, the sky was intense; the Milky Way was clear despite a nearly full moon, and the number of visible stars was greater than we'd seen in years. We even caught a glimpse of the International Space Station around 1:00 AM.

After coming back down from Sperry and spending our last night in the Lake McDonald Lodge, we left Glacier via Going-to-the-Sun Road. We stopped at Logan Pass, where Nancy worked 10 stations via the FO29 satellite within Glacier National Park's boundaries — this qualified her for her first Parks on the Air® (POTA) activation using her own call sign.

We then began a 3-day drive to Minneapolis through Montana and the Dakotas. This was the designated ham radio portion of the trip. We had budgeted time for satellite passes from these exceptionally rare grids, and we were both happy to give out all-time new ones to several satellite operators. One pass that stands out occurred on July 22 via the RS-44 satellite from DN87 in North Dakota. We had a common footprint with western Europe for about 8 minutes. I was able to give a new grid to several Europeans, including G0ABI, G0IIQ, 2M0SQL, EB1AO, and F4BKV, among others. By the time we arrived in Minneapolis on July 24, Nancy and I had activated 18 grid squares via satellite from five different states and three national parks (Glacier, Badlands, and Theodore Roosevelt).

Final Thoughts

We learned some lessons on how to negotiate a vacation with ham radio. "Whereas my usual modus ope-

Sperry Chalet is one of nine chalets built by the Great Northern Railroad company. It is one of two Glacier National Park chalets that are still functioning. (Nancy Livingston, N9NCY, photo)

Nancy, N9NCY, worked stations on the AO91 satellite from Sperry Chalet at an elevation of nearly 6,600 feet. [Sean Kutzko, KX9X, photo]

randi on a road trip is to drive as far as I can each day while stopping only for gas, food, and photos. Sean's modus operandi is to stop wherever he can find an optimal spot to work every satellite that will pass overhead," Nancy opined. "Thankfully, most of the time this happened in areas that provided some scenic respite from the rigors of driving, though far too many times it included us becoming feeding grounds for the local mosquito and biting fly population."

It was clear that I overestimated the amount of time and energy I would have for ham radio on this trip. I did not use most of the gear I'd brought. Doing a ham radio rove is tremendous fun, but I needed to focus on one aspect of radio rather than trying to do HF, 6 meters, and satellite on what was, at least for the first half of the trip, a vacation. I ended up focusing my radio time on satellite operating; had I anticipated that before we left, I could have saved packing around 30 pounds of gear.

We both learned the importance of balance when going on vacations together. I'll always want to bring gear no matter where we go — the trick is to set expectations before you leave and be willing to compromise. I saw a lot of amazing scenery once I stopped to appreciate where we were. Nancy made nearly 80 contacts over several FM satellite passes, handing out new grids to operators from British Columbia to Mexico City while hiking in her favorite place. She also broke the 10-QSO mark on a single FM satellite pass for the first time, from EN24 in Minnesota. Both of us enjoyed our time while giving ground to the other person's interests and needs.

We're already planning our next trip. It probably won't be as intense as the Wild West Rove, but we'll have just as much fun. Thanks for all the contacts!

Sean Kutzko, KX9X, is a freelance social media and public relations consultant. An avid portable HF and satellite operator, he was the creator and co-administrator of ARRL's 2016 National Parks on the Air (NPOTA) program. You can follow him on Twitter and Instagram at @SeanKutzko.

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

Feedback

■ In the November 2022 issue's "Technical Correspondence" column, the submission "GFCI Operation" contains a serious safety issue. It is stated that the GFCI will work even if the third wire is not a grounding conductor. If a three-wire device is plugged into the outlet in the context described (that is, a two-wire ac system), it would be possible for the neutral wire to float to the full 120 V potential at the metal case of the outlet in question. The result can be potentially lethal due to insufficient limits to the current flow. *QST* regrets this error.

■ In the December 2022 issue's "Celebrating Our Legacy" column, the first paragraph of "The Age-Old Antenna Effort" by Doug Hardie, WA6VVV, contains an incorrect call sign. In the sentence, "When my license arrived, my call sign was WA6VVV — a great call for CW," the call sign should be WV6VVV.

■ In the December 2022 issue's "2022 Field Day Results," the caption for the photo at the top right of page 62 should read, "The Saturday-night sunset over the Great Salt Lake Contest Club's, K7KC, 3A Field Day site at the Uinta National Forest in Utah. [Mark Richardson, W7HPW, photo]."

Nominate a Volunteer for 2023 ARRL Awards

YEAR of the VOLUNTEERS

Do you know someone worthy of an award? These awards have upcoming nomination deadlines.

The nomination period is now open for several ARRL annual awards. The awards honor members for excellent service in furthering the association and amateur radio through their volunteer efforts. ARRL Year of the Volunteers is the ideal backdrop to recognize members from your radio club and community who go above and beyond. Don't let them go unnoticed! For more information on each award, qualifications, nomination instructions, and selection criteria, please visit **www.arrl.org/arrl-award-nominations**.

Education Awards

Hiram Percy Maxim Memorial Award

Named for the Founding President of ARRL, this award goes to a licensed radio amateur under age 21 who has made exemplary contributions to amateur radio and the local community. Nominees must be current ARRL members. **Nomination deadline: March 31, 2023.**

ARRL Herb S. Brier Award for Instructors and Teachers

Honoring Herb S. Brier, W9AD (SK), ARRL sponsors this award in conjunction with the Lake County Indiana Amateur Radio Club to recognize the very best in amateur radio instruction and recruitment. The award goes to a licensed radio amateur and ARRL member who is an ARRL-registered volunteer instructor or ARRL-registered professional classroom teacher. **Nomination deadline: March 15, 2023.**

Technical Awards

ARRL Microwave Development Award

This award recognizes a radio amateur or group of radio amateurs who contribute to the development of the amateur radio microwave bands. **Nomination deadline: March 31, 2023.**

ARRL Technical Service Award

This award recognizes a radio amateur or group of radio amateurs who provide amateur radio technical assistance or training to others. **Nomination deadline: March 31, 2023.**

ARRL Technical Innovation Award

This award recognizes a radio amateur or group of radio amateurs who develop and apply new technical ideas or techniques in amateur radio. **Nomination deadline: March 31, 2023.**

Public Relations Awards

ARRL Philip J. McGan Memorial Silver Antenna Award

Honoring Phil McGan, WA2MBQ (SK), this award recognizes a radio amateur and ARRL member who has demonstrated leadership in successfully promoting amateur radio to the public. **Nomination deadline: March 31, 2023.**

ARRL Bill Leonard Award

Honoring Bill Leonard, W2SKE (SK), three annual awards are given to professional journalists or journalistic teams whose outstanding coverage highlights the enjoyment, importance, and public service contribution of the Amateur Radio Service. The award is given in three media categories; audio, visual, and print. **Nomination deadline: March 31, 2023.**

Distinguished Service Award

Knight Distinguished Service Award

Honoring Joe T. Knight, W5PDY (SK), the award recognizes exceptional contributions by a Section Manager to the health and vitality of ARRL. **Nomination deadline: March 31, 2023** (for consideration during July ARRL Board meeting).

Calling Nominees | Know someone worthy of an award? Visit **www.arrl.org/arrl-award-nominations** to nominate them today!

John Ross, KD8IDJ, kd8idj@arrl.net

Happenings

ARDC Awards Grant for New Amateur Radio Station

Amateur Radio Digital Communications (ARDC) has awarded a $16,495 grant to fund a modern amateur radio station in the soon-to-open Museum of Information Explosion (MIE) in Huntsville, Alabama.

ARDC Communications Manager Dan Romanchik, KB6NU, said the amateur station will be staffed and maintained by members of local amateur radio clubs, including the Huntsville Amateur Radio Club (HARC), who will install and operate the equipment and serve as docents for the station. "Licensed amateurs can use the station to try out new modes and techniques without making a major financial commitment. Specialized tools and test equipment will be available to use on-site," said Romanchik.

The station will demonstrate the contrast between modern digital technology and historic pieces that can be visited in the museum's other exhibits. The decision to feature both old and new is intended to illustrate the accelerating evolution of amateur radio.

AMATEUR RADIO DIGITAL COMMUNICATIONS

MIE Executive Director Dr. Marcus Bendickson said they expect to open in spring 2023, and visitors will be able to explore the history of communication, computing innovation, and how these technologies have shaped our modern way of life.

Amateur Radio Operators and the National Weather Service Mark SKYWARN Alliance

Saturday, December 3, 2022, was SKYWARN Recognition Day (SRD), an event that recognizes SKYWARN volunteers for their contribution to public safety. SRD was observed by several National Weather Service (NWS) locations across the US. Amateur radio volunteers set up temporary operations from forecasting headquarters to make contacts with other stations. This demonstrated their readiness to operate in emergency conditions and act as observers for the NWS. More than 4,700 SKYWARN spotters participated in SRD.

Near Los Angeles, California, at the NWS office located in Oxnard, volunteers set up six stations on different radio frequencies and operated throughout the day under simulated emergency conditions. Several members of the public visited the NWS office during the exercise.

SKYWARN event coordinator Rick Tate, KQ6NO, operates from the Ventura County, California, Sheriff's Emergency Operations trailer. (Jeff Reinhardt, AA6JR, photo)

ARRL Headquarters, participating as WX1AW, was activated by ARRL Emergency Management Assistant Ken Bailey, K1FUG, during SRD. WX1AW was active on 40 – 10 meters on SSB and FT8, while monitoring local VHF and UHF repeaters.

Radio amateurs participating as SKYWARN volunteers assist the NWS with real-time observations of adverse weather conditions that pose an imminent threat to life and property. Alerts may be made for tornadoes, waterspouts, hail, blizzard conditions, sleet, strong winds, heavy rainfall, flooding, dust storms, damage assessment, and other significant anomalies. NWS personnel can utilize information from ham radio operators to issue alerts or assess threat levels to areas that may be affected by abnormal conditions.

The 2022 NWS Spotter of the Year Award was given to Bryan Loper, WX5CSS, of Atlanta, Texas. The award noted that Loper is active with the amateur radio network and weather community within his region, and he is always reliable in providing weather reports. Loper is also an ARRL member.

Dr. Ulrich Rohde, N1UL, Inducted into the Indian National Academy of Engineering

The Indian National Academy of Engineering (INAE) inducted Dr. Ulrich Rohde, N1UL, as a fellow during ceremonies held in December 2022. Dr. Rohde is only the third foreign fellow elected by the INAE, preceded by Dr. Jeffrey Wineland, who won a Nobel Prize in Physics, and Dr. Philip H. Knight.

Dr. Ulrich Rohde, N1UL

In their formal announcement issued on November 19, 2022, the INAE thanked Dr. Rohde for his "outstanding contributions to engineering and dynamic leadership in [the] engineering domain, which have immensely contributed [to] the faster development of the country."

The INAE was founded in 1987 and describes itself as including "India's most distinguished engineers, engineer-scientists, and technologists covering the entire spectrum of engineering disciplines."

Dr. Rohde has been an avid amateur radio operator since 1956, holding several licenses in the US and Germany. In 2015, he won first place in the ARRL International DX Contest in the Northern New Jersey Section. He also operates as N1UL/MM on his yacht, the *Dragonfly*, and is Trustee of the Marco Island Radio Club, K5MI. ARRL Laboratory Manager Ed Hare, W1RFI, said,

> It is great to see Ulrich get this award. His contributions to technology have been global in scope, and even though his accomplishments have clearly been professional, amateur radio has also played a role in his being a world-class engineer. The ARRL Lab has appreciated his help and support over [the] decades, and we join in offering our congratulations for another important achievement.

ARRL recognized Dr. Rohde as the 2022 recipient of the Institute of Electrical and Electronics Engineers (IEEE) Photonics Society Engineering Achievement Award. The award is for outstanding engineering achievement in the field of optoelectronic signal generation and optical measurement equipment for next-generation intelligent optical networks. Dr. Rohde is an ARRL Maxim Society and Life Member.

Quarter Century Wireless Association to Celebrate 75 Years

The Quarter Century Wireless Association (QCWA) celebrated its 75th anniversary on December 5, 2022. Founded in 1947, QCWA's mission statement promotes "friendship and cooperation among Amateur Radio (Wireless) operators who were licensed as such at least a quarter of a century ago."

Today, QCWA has 230 chapters in the US. During the organization's 75 years, it has accumulated nearly 40,000 members. The Cleveland, Ohio, chapter was the first chapter chartered in 1951, and it now has more than 100 members.

To celebrate its 75th anniversary, the QCWA Special Event Station, W2MM, operated from 0001 UTC on December 3 to 2359 UTC on December 10, 2022. Only QCWA members in the US and its territories had the opportunity to activate W2MM for this event.

QCWA is also hosting the members-only Worked 75/75 Members Contest from December 5, 2022, through February 18, 2023. The contest encourages QCWA members to contact a minimum of 75 QCWA members during the contest period. All contest entrants will receive a special certificate.

Amateur Radio Emergency Service Members Support Nevada County Office of Emergency Services

Ten Nevada County Amateur Radio Emergency Service® (NC-ARES®) members were sworn in as Nevada County Office of Emergency Services (NC-OES) Disaster Service Worker Volunteers during their December 1, 2022, meeting in California.

Nevada County Safety Officer and Emergency Operations Coordinator Lt. Sean Scales administered the oath. NC-ARES and NC-OES signed a Memorandum of Understanding in May to establish the cooperative relationship.

"NC-ARES volunteers are another local resource Nevada County OES can call upon to support our community," said Lt. Scales. NC-ARES Emergency Coordinator Peter Mason, N6ERL, added, "ARES members use their radio equipment and training to provide radio communications support to local agencies during emergencies, including Nevada County OES and the American Red Cross."

NC-ARES sponsors a free educational program for local neighborhoods called Neighborhood Radio Watch. "In three in-person meetings, households learn the benefits of, and how to use, handheld General Mobile Radio Service (GMRS) radios to communicate during emergency situations when internet, phone, and cell services become unavailable or fail," said NC-ARES GMRS Program Leader Mark Triolo, N6PVI.

Dodge County Amateur Radio Emergency Service Receives Serve-Nebraska Award

The Dodge County Amateur Radio Emergency Service® (ARES®) received the 2022 Disaster Volunteer Award at the ServeNebraska Step Forward Awards Luncheon on November 4, 2022.

Presented by Nebraska First Lady Susanne Shore, the award recognizes Dodge County ARES for its critical role in responding to the 2019 flooding in Fremont, Nebraska, and the surrounding areas. Dodge County ARES continuously ensures that the Fremont community is prepared for emergency scenarios. Amateur radio operator Steve Narans, WB0VNF, was cited for his role in retrofitting a county communications trailer for use by first responders.

The group completed a disaster drill with the Nebraska Army National Guard, Fremont Police, and Fremont Fire Department. Their goal was to demonstrate how their services fit in among other disaster response efforts. Dodge County ARES monitors weather conditions for the National Weather Service, which helps them issue severe weather warnings for Dodge County.

The group was nominated for the award by Dodge County Emergency Manager Tom Smith, and they were selected for the award by Nebraska Governor Pete Ricketts.

Nebraska First Lady Susanne Shore presented the 2022 Disaster Volunteer Award to Steve Narans, WB0VNF; Wesley Payne, KE0WHA; and Wes Chrisman, KD0PGV. (Dave Theophilus, W0NRW, photo)

Colonel Jerry Wellman, W7SAR, Receives Top Honors

Colonel Jerry Wellman, W7SAR, former ARRL Utah Section Emergency Coordinator (SEC), was recently named the National Volunteer Emergency Manager of the Year — the highest honor given to a volunteer emergency manager — by the International Association of Emergency Managers (IAEM).

Wellman served as the Utah Wing Civil Air Patrol commander from September 2009 to May 2013. He also served as the emergency services training officer for the Salt Lake Senior Squadron, and he currently serves as the Phoenix Cadet Squadron's assistant officer for communication, education, and training.

At the award ceremony held on November 14, 2022, Wellman was cited for being "active in enhancing his own emergency management professional development while relentlessly contributing to his community." Wellman taught emergency management communications classes in several states, and additionally served as chair of the Kearns, Utah, Metro Township Emergency Planning Commission.

Wellman was on the Utah State Emergency Response Team and volunteered for the state Emergency Operations Center. He also served as an air operations coordinator on three search and rescue (SAR) missions.

Wellman was licensed in 1972 and holds an Amateur Extra-class license. He is an ARRL Life Member and a Life Member of REACT International.

Youth on the Air Camp 2023 Application Period Now Open

Applications are being accepted for campers interested in attending Youth on the Air (YOTA) Camp 2023. Licensed amateur radio operators ages 15 – 25 are encouraged to apply online at **https://youthontheair.org**. Radio Amateurs of Canada (RAC) will be the local host for the camp. It is scheduled to take place July 16 – 21, 2023, at the Carleton University campus in Ottawa, Ontario, Canada.

Applications will be accepted through May 31, 2023, but for the best chance at being selected, applications should be submitted by 2359 UTC on January 15, 2023.

The application process is free. However, a $100 deposit is required upon acceptance. If a camper is unable to pay the deposit, they may be able to apply for a scholarship or waiver. Travel during camp events is provided.

Campers will be selected by the working group and notified of their selection by February 1. To encourage attendance from across the Americas, allocations for campers are being held open for various areas of North, Central, and South America. If countries do not use their allocation, or should someone within an allocation decline acceptance, those positions will be filled from the remaining pool of applicants. As this will be an ongoing process, not everyone will receive their notification of acceptance at the same time. Preference will be given to first-time attendees.

A YouTube video about the 2023 YOTA camp is now available at **https://youtu.be/V7nJn6QFxF0**. For additional information, contact **director@youthontheair.org**.

ARRL Delegates Attend IARU Region 2 General Assembly

An ARRL delegation led by President Rick Roderick, K5UR (Head of Delegation), and including Chief Executive Officer David Minster, NA2AA, attended the International Amateur Radio Union (IARU) Region 2 General Assembly. The 2022 meetings concluded on Friday, November 4. ARRL International Affairs Vice President Rod Stafford, W6ROD, also participated, serving as the Area B Director for Region 2.

The triennial General Assembly is the formal decision-making body of IARU Region 2, which comprises the Americas, and delegates are the representatives of each member-society. The President of IARU Region 2 is Ramón Santoyo, XE1KK.

The meetings began on October 31, 2022, with five virtual evening sessions that each lasted approximately 3 hours. The virtual meetings were necessary because of COVID-19 travel concerns.

At the meetings, the delegates reviewed challenges to amateur radio, debated proposals from member-societies, and received reports from coordinators and elected volunteers. A selection will also be made for the host society of the next General Assembly in 2025. IARU Region 2 Secretary George Gorsline, VE3YV/K8HI, stated,

> Having a virtual conference has allowed many of our societies with limited means to participate in the triennial governance process of IARU Region 2 for the first time. Twenty-six member-societies are represented with 117 registered attendees from across Region 2, as well as representatives from Region 1 (Europe, Africa, the Middle East, and Northern Asia), [Region] 3 (Asia-Pacific), and the IARU Officers. The [reports from the] Wednesday evening committee were especially well received and stimulated much discussion. A full summary will be published after the General Assembly, including videos of each Plenary session.

The IARU is the worldwide federation of national amateur radio organizations. ARRL is a member-society and IARU International Secretariat, participating in matters that promote and protect the interests of the Amateur Radio Service worldwide.

Section Manager Nomination Notice

To all ARRL members in Maryland-DC, Nevada, New Hampshire, Northern New Jersey, Rhode Island, San Joaquin Valley, Utah, and West Texas. You are hereby solicited for nominating petitions pursuant to an election for Section Manager (SM). Incumbents are listed on page 16 of this issue.

To be valid, a petition must contain the signatures of five or more full ARRL members residing in the Sections concerned. It is advisable to have a few more than five signatures on each petition. A sample nomination form is available on the ARRL website at **www.arrl.org/section-terms-nomination-information**. Nominating petitions may be made by facsimile or electronic transmission of images, provided that upon request by the Field Services Manager, the original documents are received by the manager within 7 days of the request. It is acceptable to submit signatures that have been sent via e-mail or mail under the following guidelines: The petition copies must be made from the original form supplied by ARRL or downloaded from the ARRL website. The form must be exactly the same on both sides (i.e., autobiographical information should appear exactly the same on all copies). All forms/copies must be submitted together.

Candidates may use any of the available electronic signature platforms such as DocuSign, HelloSign, and Signed PDF. Candidates who use an electronic signature platform to be nominated, as described above, do not have to send in original paper copies of the nominating documents. The packet that is sent to ARRL Headquarters must be complete. Multiple files or emails for a single petition will not be accepted.

We suggest the following format:

(Place and Date)

Field Services Manager, ARRL
225 Main St
Newington, CT 06111

We, the undersigned full members of the _____ ARRL Section of the _____ Division, hereby nominate _____ as candidate for Section Manager of this Section for the next 2-year term of office.

(Signature _____ Call Sign _____ City _____ ZIP _____)

Any candidate for the office of Section Manager must be a resident of the Section, an Amateur Radio licensee of Technician class or higher, and a full member of the League for a continuous term of at least 2 years immediately preceding receipt of a nominating petition. Petitions must be received at Headquarters by 4 PM Eastern Time on March 10, 2023. If more than one member is nominated in a single Section, ballots will be mailed from Headquarters no later than April 3, 2023, to full members of record as of March 10, 2023, which is the closing date for nominations. Returns will be counted May 19, 2023. Section Managers elected as a result of the above procedure will take office July 1, 2023.

If only one valid petition is received from a Section, that nominee shall be declared elected without opposition for a 2-year term beginning July 1, 2023. If no petitions are received from a Section by the specified closing date, such Section will be resolicited in the July issue of *QST*. A Section Manager elected through the resolicitation will serve a term of 18 months. A Section Manager vacancy occurring between elections is filled through appointment by the Field Services Manager. — *Mike Walters, W8ZY, Field Services Manager*

Rick Palm, K1CE, <k1ce@arrl.org>

Public Service

Notes from a Catastrophe: Hurricane Ian

On September 28, Hurricane Ian made landfall near Fort Myers, Florida, as a Category 4 storm. After crossing over the Florida peninsula, where it had weakened to a tropical storm, it strengthened again to a Category 1 hurricane, and made a second landfall near Georgetown, South Carolina. Ian was the deadliest hurricane to hit Florida since 1935.

One of the most affected areas was the ARRL West Central Florida Section, where Christine Duez, K4KJN, serves as Section Emergency Coordinator (SEC). After the hurricane, Duez conducted a Section Amateur Radio Emergency Service® (ARES®) hotwash with attendees — county ECs and others — presenting gripping reports of critical problems and how they solved them with valor, determination, and common sense. Here are the highlights and discussion of her report:

Duwain Hunt, W8JJV, called Hurricane Ian the event of a lifetime — one he never wants to repeat. Hunt operated from his home emergency station, where more than 25 inches of rain fell. A shelter in Charlotte had 2 inches of rising water, so ARES operators got on top of tables to keep communications going. Another shelter operator couldn't transmit from inside the building, so he trained the shelter manager on the radio's operation so he could go outside for antenna maintenance. Another shelter lost its roof and had to be evacuated. Hunt's conclusion: Shelters must be staffed by operators who can think on their feet. Drills and exercises alone cannot replace critical thinking during real events like Hurricane Ian.

A Report from the Sarasota Agricultural Response Group

Chuck Johnston, W4CWJ, heads the Sarasota Agricultural Response Group (SARG) net, and reported that prior to Hurricane Ian, SARG ran two extensive drills that prepared members for dam breaks and flooding. Counties on the east side of the I-75 corridor are rural and have large herds of horses and cattle, as meat and dairy are huge industries in the region. SARG chose Next Generation Digital Narrowband (NXDN) radio equipment because it works well in fringe areas. Operators also used NXDN equipment to connect Sarasota and Charlotte counties without tying up other repeaters, and to notify the sheriff and assist with clearing a blocked roadway that would later be open only to emergency vehicles. After the storm, they worked with the state to service a three-county area and set up resource staging.

In Myakka City, more than 700 head of cattle were lost due to flooding. SARG helped with six animal emergencies, five human welfare checks and rescues, and six road closures. They also worked with Sarasota ARES to establish communication between the North Port Emergency Operations Center (EOC) and the Sarasota EOC. When electricity and the P25 link went down, there was no way to communicate without radio amateurs. A dam breach flooded about 40 homes, and water quickly rose up to windowsills in the Hidden

ARRL EC for Hardee County ARES Darrell Davis, KT4WX, operates from the Hardee County EOC radio room 3 hours before Hurricane Ian made landfall in Charlotte County. [Darrell Davis, KT4WX, photo]

River area. SARG operators responded to a local church and set up a communications point there, where they issued situation reports (SITREPs) on road conditions to assist those bringing supplies and aid into disaster areas.

Sarasota EC Gary Wells, WB9AYD, said North Port was without communication, internet, and water. Dispatch was handled from a motor home outside city hall, with messages running from Wells' car through a linked repeater system. Rising water closed major roadways. Sarasota has no radio room at the EOC, so operators swiftly set up in the lobby and used runners to handle messages to and from the staff for 3 days.

Charlotte County EC Tom Chance, K9XV, reported that three shelters were set up, and two of them lost their roof. One shelter with dialysis

patients had to be evacuated. Four of seven communications towers were down, and P25 was disabled. Two repeaters suffered major damage, and operators moved to backup systems. The NXDN radios and protocol gave clear, dependable communications.

Paul Toth, NB9X, worked with the National Oceanic and Atmospheric Administration (NOAA) to transmit invaluable hourly weather briefings to the EOC and over the NI4CE repeater system. SARG communicated SITREPs on cut-off rural areas using radio amateurs to support emergency workers in east Sarasota and rural areas of Charlotte, Sarasota, and DeSoto counties.

Bob Meyer, WA6NZI, in Highlands County, was the special needs shelter operator. He operated from a hot spot in his car. The generator failed at the EOC, and internet access was lost, so staff were evacuated to the Health Department for internet access. Some staff remained, along with Larry Hughes, W4LEH, and county EC Randy Payne, K4EZM, who stayed to keep ARES on the air with commercial power.

Hillsborough County had 28 active amateur radio operators and opened four special needs shelters. One major problem they noted was that the school server was housed in a flood zone, which was closed for safety reasons. The shelters had only amateur radio communication. The location of an ambulance was identified to transport an infant in an incubator to St. Joseph's Children's Hospital.

Commentary and Praise

Gordon Gibby, KX4Z, a leading practitioner and educator in amateur radio data systems for emergency management, said, "[SARG used] a non-proprietary type of data encoding that handles voice and data well, developed by a couple of companies working together." Gibby said that NXDN outperforms analog FM in weak-signal responses.

He lauded the operators:

> The hams showed ingenuity and ability to quickly rearrange and repair busted systems; they had practiced lots of times. As you can see in these examples, operators can end up having to be much more creative in meeting communication system needs — operating from a lobby, repairing rooftop antennas, and cross-banding through a vehicle to connect two different authorities who have lost all communications.
>
> Our current techniques (weak-signal data, voice, Winlink, among others) are just that: current techniques. We have tried to use the best-in-class and the most open, available, cheapest, widespread, and easily adopted systems — they can change! That's why getting our folks high on the learning curve is important. The emergency operator's skill in managing issues associated with coax, batteries, data, computers, etc., is important, too.

Duez also praised the amateur radio response teams, saying, "I am very proud of, and thankful for, all who trained and prepared through previous courses and exercises, and then for their herculean Ian response and recovery efforts." She continued on to say, "It gave them invaluable experience, which helped all of us face the events as they unfolded."

Field Organization Reports

November 2022

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**

948 WA2[illegible]M
485 WA[illegible]
384 KK6GXG
305 N9VO
300 K3EAM
275 N2LC
272 W7[illegible]
268 KD1KUS
260 KT2D
257 W7EEB
250 W3PZD
245 N0NW
225 AC?NP
220 NI2W
218 MW8X
205 KD2NWG
200 K1XFC
198 W[illegible]
195 K[illegible] N8SY
183 WB8YYS
180 KC8PBU
176 K[illegible]

175 K[illegible] N9WKY
170 W8DJG
166 K?OED W[illegible]
161 KV8Z
160 N4CNX WMD?A
156 KL5YTA KF5CMH
153 AD6CM KD[illegible]
152 KP5RGY
150 WD8UGA
148 KN8V
146 KE8YRU
145 KC8FXE
143 W[illegible]
141 N2DW
140 AG9G KK3F K1[illegible]
135 KC8T
135 WB4RJN W?TAX KW1U N1ILZ
134 W?IN

138 KC[illegible]
131 KD?LPM
130 W8QLN WK4WC N2JPA N1UWL W?XC KD8ZCM
125 W8GWM K[illegible]
129 KB[illegible]
120 WC?GJ AC?KQ K1[illegible] WMUFG W2AH W?DDD KC1HHO
117 W8YVO
116 K?TT
115 W?PNKO KE4RS
113 W8WNC
111 K?MDA
110 K[illegible] KD4CL KD0HFN K[illegible] W4CMH K[illegible] KY2C WA8DS K[illegible] KC8W? N1[illegible] W1RVY K?JAF W??XN WB8TQZ
106 KB1TOE

108 K[illegible]
105 KG5NNA KR4?I W[illegible]
103 KC?MAL
101 KIHEJ
100 KZ8C W1KX KX9K AA3BB N[illegible] K8YAK KA[illegible] KA2?ZP KL7RF W[illegible] AC8RV KB?CUN WD5GUN N1LAH AK?? KB2YAA KD2?OF K[illegible]
99 K8OB KF?BPN
98 KE?DON
96 W1[illegible]
95 WA[illegible]
91 W4?TC
90 AD4?C KM4[illegible] KB?GO KC?JC W[illegible] WB4ZDU W4EDN W4KX K8KRA N8M[illegible] KB8HJJ KC1KVY WA?LPM K8ED

89 KC[illegible] N1FZP WB8R
88 NB[illegible] K8RDN
87 KB1NMO W[illegible] AB1[illegible]
86 K6JT WB?VUF
85 W[illegible]
84 KP[illegible]
82 W7PHX N4ZM
81 KA?MH
80 KF?ST NDGL KA?DBK K2EAG
78 WW8S
77 KD2VZA
76 K?MTO
75 KA1G KE8[illegible]
73 N8ET
72 W8ZR
71 K?DAU N?CMD
70 KT?8F KB?N K??DT W8XX

The following stations qualified for PSHR in October 2022, but were not acknowledged in the column last month: K[illegible], N1LL 180, W8EEJ 127, KA9QWC 120, AB0ZA 80.

Section Traffic Manager Reports

The following Section Traffic Managers reported: AR, AZ, CO, [illegible], MA, [illegible], GA, IN, KS, KY, LA, LAX, [illegible], MI, MO, MS, NE, NFL, NH, NLI, NNJ, NNY, NTX, OH, OR, SFL, STX, TN, [illegible], WI, WMA, WNY, WPA, WV, WWA, WY.

Section Emergency Coordinator Reports

The following Section Emergency Coordinators reported: AL, ENY, EPA, EWA, GA, KY, ME, MI, MN, MO, MS, NC, NFL, NLI, NM, NNJ, NV, OH, PAC, SC, SDG, SNJ, STX, VA, VI, WCF, WPA, WTX, WY.

Brass Pounders League

The BPL is open to all amateurs in the US, Canada, and US possessions who report to their STM a total of 500 or more points or a sum of 100 or more origination and delivery points for any calendar month. Messages must be handled on amateur radio frequencies within 48 hours of receipt in standard ARRL radiogram format. Call signs of qualifiers and their monthly BPL totals points follow.

WE0WKO 1,642, K8HTY 980, KI8F 628, NX0K 605, AG0G 514.

Contest Corral

February 2023

Check for updates and a downloadable PDF version online at **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				Bands	Contest Name	Mode	Exchange	Sponsor's Website
1	2000	1	2100	3.5	UKEICC 80m Contest	Ph	6-char grid square	www.ukeicc.com/80m-rules.php
2	0000	2	0300	7	Walk for the Bacon QRP Contest	CW	13 WPM; RST, SPC, name, mbr or pwr	qrpcontest.com/pigwalk40
2	1800	2	2200	28	NRAU 10m Activity Contest	CW Ph Dg	RST(); 6-char grid sq.am	nrrlcontest.no
2	2000	2	2200	1.8-28,50	SKCC Sprint Europe	CW	RST, SPC, name, mbr or none*	www.skccgroup.com
4	0000	5	2359	1.8-28, VHF/UHF	Vermont QSO Party	CW Ph Dg	RST(), VT county or SPC	www.ranv.org/vtqso.html
4	0001	5	2359	28	10-10 International Winter Contest, SSB	Ph	Name, mbr or "0", SPC	www.ten-ten.org
4	0600	4	1600	1.8-28	EuRoad HF Championship	CW Ph	RST(), 6-char grid square	www.euroad-contest.com
4	1200	5	1200	3.5-28, 144	FMA Cup, CW	CW	RST, serial	www.site.urc.asso.fr
4	1300	5	2359	3.5-28	Mexico RTTY International Contest	Dg	RST, XE state or serial	www.rtty.fmre.mx
4	1400	4	2359	1.8-28	Minnesota QSO Party	CW Ph Dg	Name, MN county or SPC	www.w0ae.org/mnqp-rules
4	1400	4	2359	1.8-28	FYBO Winter QRP Sprint	CW Ph Dg	RST(), SPC, name, power, temperature	arizonasocqrpions.apps-1and1.com
4	1800	5	2359	1.8-28	British Columbia QSO Party	CW Ph	RST(), BC district or SPC	www.orcadxcc.org/bcqp_rules.html
4	1900	5	1800	1.8-28	European Union DX Contest	CW Ph	RST(), EU union region or ITU zone	www.eudx-contest.com/rules
4	2300	5	0300	3.5-14	North American Sprint, CW	CW	Others call, your call, serial, name, SPC	ncjweb.com/Sprint-Rules.pdf
5	1830	6	1729	3.5,7	OK1WC Memorial (MWC)	CW	RST, serial	memorial-ok1wc.cz
6	2000	6	2130	3.5	RSGB 80m Club Championship, SSB	Ph	RS, serial	www.rsgbcc.org/hf
7	0300	7	0400	3.5-28	ARS Spartan Sprint	CW	RST, SPC, power	arsqrp.blogspot.com
8	0150	8	0330	3.5-14	NAQCC CW Sprint	CW	RST, SPC, mbr or pwr	naqcc.info
11	0000	12	2359	3.5-28	CQ WW RTTY WPX Contest	Dg	RST, serial	www.cqwprtty.com/rules.htm
11	1100	11	1200	7,14	Asia-Pacific Spring Sprint, CW	CW	RST, serial	jsfc.org/apsprint/aprule.txt
11	1200	12	1800	1.8	4O3 Togoland Contest	CW	RST, JA prefecture or district code	www.kcj-cw.com
11	1200	12	1200	1.8-28	Dutch PACC Contest	CW Ph	RST(), PA province or serial	pacc.veron.nl
11	1200	12	2359	1.8-28,50	SKCC Weekend Sprintathon	CW	RST, SPC, name, mbr or none*	www.skccgroup.com
11	1400	13	0300	AL, except WAPC	YLRL YL-OM Contest	CW Ph Dg	serial, RST(), SPC	ylrl.org/wp/yl-om-contest
11	1500	12	1600	1.8-28	OMISS QSO Party	Ph	RS, SPC, mbr (if any)	www.omiss.net/Facelift/qsoparty.php
11	1600	11	1600	3.5-28	FISTS Sea to Key Sprint	CW	RST, SPC, mbr or "0"	fistsna.org/operating.html#sprints
11	1900	11	2300	1.8	RSGB 1.9 MHz Contest	CW	RST, serial, UK district, code (if UK)	www.rsgbcc.org/hf
12	1300	12	1700	3.5,7	Balkan HF Contest	CW Ph	RST(), serial	arabih.ba
12	0100	13	0259	3.5-14	CQC Winter QSO Party	CW	RST, SPC	www.coloradoqrpclub.org
13	0100	13	0300	1.8-28	4 States QRP Group Second Sunday Sprint	CW Ph	RST(), SPC, mbr or pwr	www.4sqrp.com
13	1300	17	2359	AL, except 50,30,17,12	ARRL School Club Roundup	CW Ph Dg	RST(), class (I/C/S), SPC	www.arrl.org/school-club-roundup
13	1630	13	1729	3.5,7	OK1WC Memorial (MWC)	CW	RST, serial	memorial-ok1wc.cz
14	0000	14	2359	1.8-7	PODXS 070 Club Valentine Sprint	Dg	Name, OM or YL, SPC	www.podxs070.com
15	1400	16	2100	1.2G	VHF-UHF FT8 Activity Contest	Dg	4-char grid square	www.ft8activity.eu/index.php/en
15	1800	15	2000	3.5	AGCW Semi-Automatic Key Evening	CW	RST, serial, 2-dig yr 1st used bug	www.agcw.de/contest/sta
15	2000	15	2130	3.5	RSGB 80m Club Championship, Data	Dg	RST, serial	www.rsgbcc.org/hf
16	0000	17	0300	14	Walk for the Bacon QRP Contest	CW	13 WPM; RST, SPC, name, mbr or pwr	qrpcontest.com/pigwalk20
18	0000	19	2359	1.8-28	ARRL International DX Contest, CW	CW	RST, SP or power	www.arrl.org/arrl-dx
18	1200	19	1159	1.8-28	Russian PSK WW Contest	Dg	RST, 2 letter oblast or serial	rdrclub.ru/russian-ww-psk-contest
18	1900	19	2059	1.8-28	Field Hell Sprint	Dg	RST, mor, SPC, grid	sites.google.com/site/fieldhellclub
19	2100	19	2300	3.5-28	FISTS Sunday Sprint	CW	RST, SPC, mbr or "0"	fistsna.org/operating.html#sprints
19	2200	20	0100	1.8-28	Run for the Bacon QRP Contest	CW	RST, SPC, mbr or power	qrpcontest.com/pigrun
20	1630	20	1729	3.5,7	OK1WC Memorial (MWC)	CW	RST, serial	memorial-ok1wc.cz
22	0000	22	0200	1.8-28,50	SKCC Sprint	CW	RST, SPC, name, mbr or "0"	www.skccgroup.com
22	2000	22	2100	3.5	UKEICC 80m Contest	CW	6-char grid square	www.ukeicc.com/80m-rules.php
23	2000	23	2100	3.5	RSGB 80m Club Championship, CW	CW	RST, serial	www.rsgbcc.org/hf
24	2200	25	2200	1.8	CQ 160m Contest, SSB	Ph	RS, SP or CQ zone	www.cq160.com/rules.htm
25	0600	25	1800	3.5-28	R-DF Contest, SSB	Ph	RS, French department or serial	concours.r-e-f.org/reglements
25	1300	25	1500	3.5-28	UBA DX Contest, CW	CW	RST, ON section or serial	www.uba.be
25	1500	26	0159	1.8-28,50	South Carolina QSO Party	CW Dg Ph	SC: RST(), SC county or SPC	scqso.com
25	1900	26	0059	3.5-28	North American QSO Party, RTTY	Dg	Name, SPC+DC	www.ncjweb.com
25	1900	26	0559	3.5-28	NA Collegiate Championship, RTTY	Dg	Name, SPC+DC	www.w9smc.com/nacc
26	1400	26	1700	3.5-28	High Speed Club CW Contest	CW	RST, mor or "MM"	www.highspeedclub.org
26	1500	27	0100	3.5-144	North Carolina QSO Party	CW Ph Dg	NC county or SPC	ncqsoparty.org/rules
27	1830	27	1729	3.5,7	OK1WC Memorial (MWC)	CW	RST, serial	memorial-ok1wc.cz
27	2000	27	2130	3.5-14	RSGB FT4 Contest	Dg	4-char grid square	www.rsgbcc.org/hf

There are a number of weekly contests not included in the table above. For more info, visit: **www.qrpfoxhunt.org**, **www.noccsprint.com**, and **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** *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.*

Rus Healy, K2UA, k2ua@arrl.net

2022 ARRL 10 GHz and Up Contest Results

This year's ARRL 10 GHz and Up Contest weekends took place August 20 – 21 and September 17 – 18, 2022.

Logs Received by Call Area

Call Area	Entries
W0	19
W1	23
W2	14
W3	5
W4	3
W5	4
W6	22
W7	5
W8	21
W9	3
VE	2

Top Ten Scores

10 GHz Only		10 GHz and Up	
Call	Score	Call	Score
WB8_IC	75,860	K6PW	80,199
AC0RA	75,701	VA3LLL	76,161
VA3TO	56,167	W9XA	50,505
N3BJ	16,373	AF1T	56,386
VE3KH	14,412	W1MKY	56,215
N5UNC	36,368	K6ML	54,387
WA2VOI	36,348	K9TMS	50,219
KB3OZN	36,349	K2UA	49,721
N8HMJ	36,289	K2DH	46,403
VE3SST	35,154	W6DW	46,372

Top Unique Call Leaders

10 GHz		10 GHz and Up	
Call	Unique Calls	Call	Unique Calls
VE3KH	55	AF1T	69
VA3TO	53	W1MKY	65
N2MK	45	K2DH	63
N2JMH	43	K2UA	60
KC3NT	41	VA3ELE	60
VE3SST	41	K1RZ	59
AA1I	38	KD4MIC	57
N1DPM	38	KI2R	52
WA6ODR	38	W1GHZ	48
		W2FU	45

Full Results Online

You can read the full results of the contest online at **http://contests.arrl.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.

During the 2022 ARRL 10 GHz and Up Contest, Brad Fuller, WQ5S, operated between thunderstorms from Maidenhead grid square EM02, with James McMasters, KM5PO; Jerry Sarver, KI5EMN, and Keith Berglund, WB5ZDP. Together, they were able to nearly double their score from last year. (Brad Fuller, WQ5S, photo)

Call Area Leaders

10 GHz Call	Score	10 GHz and Up Call	Score
Area 0		**Area 0**	
WB0LJC	73,850	K0PW	82,190
AC0RA	73,701	W0XA	58,835
KE0CZN	35,840	WA0TT	41,110
W0ZQ	31,411	AF4JF	9,248
N0KP	23,556	WA0CNS	1,478
Area 1		**Area 1**	
KC8YT	21,900	AF1T	65,898
W1AIM	19,917	W1MKY	65,210
K1CA	19,903	W1GHZ	41,310
N1DPM	19,810	K1OR	22,190
AA1I	16,842	W1RKF	20,426
Area 2		**Area 2**	
N2WK	31,695	K2UA	48,724
N2LMH	31,550	K2DH	49,900
K2CS	15,218	W2FU	35,078
NR2C	9,875	K2SM	31,254
N2ZN	7,676	WA2TVC	25,418
Area 3		**Area 3**	
WA3GFZ	12,754	K1RZ	41,272
W3HMS	11,797	K3WHC	39,244
NC3W	9,211		
W3PA	8,406		
W3HMS	3,740		
Area 4		**Area 4**	
W3IP	11,517	N9ZL	5,790
N0EDV	794		
AG4V	637		
N4KH	101		
Area 5		**Area 5**	
W5ZOP	12,036	WO5B	25,532
W5VY	8,116	W5LUA	13,516
K5LLL	2,558	AA5C	12,020
WA5TKU	2,497	AA5AM	9,032
		KM5PO	9,246
Area 6		**Area 6**	
WA6CDR	84,229	K6VI	54,327
AF6RI	29,010	W6OIW	48,372
N6RF	25,802	N6JIM	41,828
N6SI	19,814	W6BY	13,893
W6DL	19,615	NC1LD	11,010
Area 7		**Area 7**	
N6RVJ	85,286	KJ7UG	1,036
K6VHF	14,547		
N7AV	4,138		
AC7JC	1,206		
KB7IOG	241		
Area 8		**Area 8**	
KF8U	48,870	K8ZR	44,994
N0LNO	39,936	WB8TGY	42,610
WA2VCI	35,648	WA8VPC	35,414
N0UTF	33,217	KB8VAO	24,792
K8OP	10,200	K2YAZ	18,156
Area 9		**Area 9**	
W9DYA	27,108	K9TMS	53,218
		AA9IL	45,148
		K2KFC	32,932
		W9GZ	32,151
Area 15 (Canada)		**Area 15 (Canada)**	
VA3TO	53,157	VA3ELE	75,451
VE3KH	44,432	VL4MA	12,352
VE3SST	35,104	VE3ADO	11,239
VL3FN	9,710	VE3KRP	11,138
VE3SMA	9,846	VE2UG	9,756

Top Ten QSO Leaders

10 GHz

Call	Total QSOs
WB0LJC	279
AC0RA	279
KR6L	204
VA3TO	188
VE3SST	179
VE3KH	162
KE0CZN	149
N3LNC	146
WA2VOI	141
N2WK	135

10 GHz and Up

Call	Total QSOs
K0PW	411
VA3ELE	289
K9TMS	245
W0XA	244
K2UA	239
K2DH	233
AA9IL	229
K6ML	229
WB8TGY	203
W6OIW	185

Entries by Year

Year	GHz	Entries
2022	10 GHz	85
2022	10 GHz and up	58
2021	10 GHz	91
2021	10 GHz and up	45
2021	Checklog	1
2020	10 GHz	75
2020	10 GHz and up	48
2019	10 GHz	110
2019	10 GHz and up	34
2018	10 GHz	93
2018	10 GHz and up	45
2017	10 GHz	85
2017	10 GHz and up	42
2016	10 GHz	89
2016	10 GHz and up	42
2015	10 GHz	85
2015	10 GHz and up	37
2014	10 GHz	85
2014	10 GHz and up	35
2013	10 GHz	73
2013	10 GHz and up	27
2012	10 GHz	75
2012	10 GHz and up	37
2011	10 GHz	87
2011	10 GHz and up	29
2010	10 GHz	89
2010	10 GHz and up	31
2009	10 GHz	77
2009	10 GHz and up	31
2008	10 GHz	77
2008	10 GHz and up	27
2007	10 GHz	77
2007	10 GHz and up	39
2006	10 GHz	75
2006	10 GHz and up	39
2005	10 GHz	85
2005	10 GHz and up	38
2004	10 GHz	94
2004	10 GHz and up	42
2003	10 GHz	105
2003	10 GHz and up	37
2002	10 GHz	108
2002	10 GHz and up	39

Best DX by Band in Kilometers

10 GHz

Call	Best DX
W3HMA	865
N3UK	802
W8BYA	802
W8DL	779
K1RZ	776
K3WHC	775
AF1T	775
W1MKY	775
WA6CDR	748
VA3TO	720

24 GHz

Call	Best DX
K6ML	358
W6OIW	358
N6JIM	343
AF1T	229
K2DH	229
K2UA	225
W1MKY	225
K0PW	225
K9TMS	225
W0XA	225
WA0TT	225

47 GHz

Call	Best DX
AA9IL	159
K0PW	159
K8ZR	159
WB8TGY	159
K2UA	139
VA3ELE	139
K2DH	113
KB8VAO	94
W1GHZ	89
AF1T	89
N1SAI	89
W1MKY	89

75 GHz

Call	Best DX
K2DH	85
K8ZR	85
WA1MBA	85
K2UA	85
VE4MA	35
VE4SA	38
KB8VAO	14

123 GHz

Call	Best DX
K6JEY	7

300+ GHz

Call	Best DX
AF1T	8
K3WHC	8
K1RZ	9
W1MKY	9

Best Terrestrial DX by Band

Call	Band	Distance (km)	Call	Band	Distance (km)
W3HMA	10 GHz	865	K8ZR	75 GHz	85
K6ML	24 GHz	358	WA1MBA	75 GHz	85
W6OIW	24 GHz	358	K2UA	75 GHz	85
AA9IL	47 GHz	159	K6JEY	123 GHz	7
K0PW	47 GHz	159	AF1T	300+ GHz	8
K8ZR	47 GHz	159	K3WHC	300+ GHz	8
WB8TGY	47 GHz	159	K1RZ	300+ GHz	8
K2DH	75 GHz	85	W1MKY	300+ GHz	8

The next ARRL 10 GHz and Up Contest will be held August 20 – 21 and September 17 – 18, 2022.

Paul Bourque, N1SFE, n1sfe@arrl.org

2022 ARRL 222 MHz and Up Distance Contest Results

This year's ARRL 222 MHz and Up Distance Contest was held August 6 – 7, 2022.

Regional Winners

Regions are defined in the contest rules (www.arrl.org/222-mhz-and-up-distance-contest). Category key: R — Unlimited Rover; S — Single Operator, Fixed; and M — Multioperator, Fixed.

Region	Category	Call	Score
1	S	VA7SQ	5,420
2	No entries		
3	R	N5UTC/R	6,546
	S	K5MI	14,134
4	No entries		
5	R	K5CW/R	1,013
	S	K7CNT	571
	M	KC5VVZ	1,222
6	No entries		
7	S	W0OP	18,911
8	R	W6VYX/R	20,067
	S	AA5AM	2,202
9	R	K9PW/R	8,379
	S	K9DH	65,532
	M	WD9EXD	32,483
10	R	KC0P/R	34,561
	S	K0AWU	34,009
11	S	N2JMH	38,202
	M	VE3MIS	27,537
12	S	K4XXX	10,009
	M	AG4V	22,646
13	R	NV4B/R	27,990
	S	WA4GPM	2,108
	M	N4SVC	16,240
14	R	KO4ECD/R	10,168
	S	N4LAZ	3,837
15	R	K0BAK/R	10,174
	S	WB2SIH	21,808
	M	N3NGE	57,580
16	R	W1RGA/R	39,048
	S	K1TEO	151,800
	M	W1FM	140
17	No entries		
18	No entries		

Affiliated Club Competition

Club	Score	Entries
Medium		
North East Weak Signal Group	305,201	8
Northern Lights Radio Society	123,186	5
Mt. Airy VHF Radio Club	116,871	8
Society of Midwest Contesters	71,221	4
Rochester VHF Group	65,398	5
Pacific Northwest VHF Society	17,229	5
Ontario VHF Association	11,742	4

Top Ten Scores

Rover		Single Operator		Multioperator	
W1RGA/R	39,048	K1TEO	151,800	N3NGE	57,580
KC0P/R	34,561	K2DFH	69,532	WD9EXD	32,483
N3-ZO/R	34,561	K1KG	51,813	VE3MIS	27,537
NV4B/R	27,960	AF1T	46,364	AG4V	22,546
W6VYX/R	20,067	N1JEZ	40,589	WW2Y	17,415
WA9TFH	15,707	W2TV	40,283	N2SLN	16,364
K0BAK/R	10,174	N2JMH	38,202	N4SVC	16,240
KO4ECD/R	10,169	W1FKF	36,725	KC5VVZ	1,222
K9PW/R	8,379	K0AWU	34,009	W1FM	140
N5UTC/R	6,546	W8GHZ	30,732		

The next ARRL 222 MHz and Up Distance Contest will be held August 5 – 6, 2023.

Full Results Online

You can read the full results of the contest online at **http://contests.arrl.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.

Operating from Contest Region 1, third-place Single Operator winner Peter Vizy, AF7GL, participated from a vehicle-accessible portable location at Quartz Mountain in western Washington state. While operating for more than 6 hours, Peter achieved a new personal distance record on 1296 of 302 kilometers, while making 23 contacts on three bands (222, 432, and 1296) with 11 stations. [Peter Vizy, AF7GL, photo]

Volunteers On the Air

By the time you get this, the 2023 ARRL Volunteers On the Air (VOTA) state activations and volunteer station operations will be off to a brisk start.

To follow state activation dates and related activities, visit **https://vota.arrl.org**

Event Highlights

Earn points for contacting W1AW portable stations. Each state will be activated twice. Weeks will begin on a Wednesday and end on a Tuesday. Some weeks are displayed as off weeks to avoid other major operating events. The schedule of when which states will be activated is posted on the dashboard. It will be updated as changes/additions occur. See the Points Table at **https://vota.arrl.org** for the full list of points.

ARRL volunteers or members can be contacted on the air. ARRL Officers, Directors, Section Managers (and their appointees), staff, and even members domestically (and DX) can be contacted for points.

Those who join in on this year-long VOTA activity are encouraged to participate in, and upload their logs to, ARRL's Logbook of the World (LoTW). To join LoTW, visit **https://lotw.arrl.org/lotw-help/getting-started/**. Uploads to LoTW by W1AW portable stations and by the volunteers will feed the points scoring system.

Dashboard features for the leaderboard and certificates will be enabled as the event evolves. Check the VOTA web page for updates (**https://vota.arrl.org**).

We will present monthly updates in *QST*. We would love to hear your stories and see your photos.

New Books

Heathkit: A Guide to the Amateur Radio Products

Chuck Penson, WA7ZZE

Review by Chip Lohman, NN4U

Heathkit: A Guide to the Amateur Radio Products (Third Edition) contains a lot more than the anticipated inventory of everything the Heath Company ever produced. It's packed full of amateur radio history.

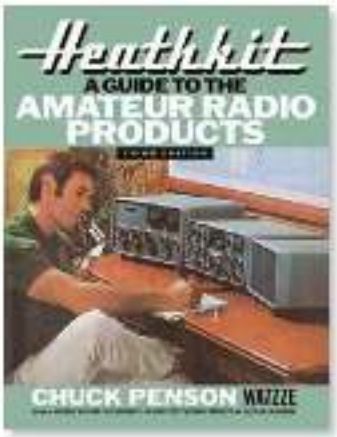
I purchased Chuck Penson's, WA7ZZE, latest Heathkit book to learn more about my collection of these iconic radios, and I quickly became a fan of his easy-to-read writing style.

There is no shortage of entertaining and unexpected facts in the history section. For example, the first Heathkit was an airplane, not a radio, and after years of selling airplane parts, the first Heath Company amateur radio kit was a QRP rig, shown in the January 1948 issue of *Radio News*.

I also learned that the Novice-class license was created in 1951, and the expectation of more licensed radio amateurs led to Heath's introduction of the AT-1 transmitter. There are also mentions of other ham radio electronics companies and their impact on the evolution of amateur radio and, thus, on the Heath Company as well. For instance, the Collins Radio Company's introduction of the first mobile transceiver in 1957 broke the mold of the transmitter-receiver matching sets. Yaesu's introduction of the FT-101 in 1968 was the first "suitcase radio," which was significant in its inclusion of a built-in power supply.

Penson covers how the Heath Company helped pioneer the early days of home computers with its release of the Heathkit H8 computer in 1977 — the same year as the introduction of RadioShack TRS-80 and Apple microcomputers. You'll have to read the book to find other intriguing gold nuggets, including how Rockwell International's purchase of Collins indirectly led to the first Heathkit solid-state radio.

For Heathkit purists, the book takes the reader behind the scenes of what it was like to work for Howard Anthony. With quotations from retired Heath employees, the book explains that engineers were allowed to take prototypes home to encourage innovation, and in the early years, engineers — not management — led the company's marketing and product decisions. By 1963, more than 50 hams held positions within the Heath Company.



Penson delivers a full view of Heath's demise. Competition with Kenwood, Yaesu, and Icom led to an unfortunate comparison between other companies that delivered affordable, complete radios, rather than a "box full of headaches." The Heath Company was sold to Zenith in July 1979.

If you're a fan of history and Heathkits, this book is well worth the read. You'll learn more than a few interesting facts. The book is available at **https://wa7zze.com/amateur-radio** for $34.95 plus $5 shipping.

Mike Walters, W8ZY, mwalters@arrl.org

Club Station

Keeping Members Active through Creative Club Events

When it comes to organizing fun club events throughout the year to keep members active and engaged, the San Francisco Radio Club (SFRC) has more than a century of experience. In this month's column, SFRC Vice President Jeff Curry, KK6JJZ, shares how their club successfully tackles this challenge each year.

Having been in operation since 1916, the SFRC has weathered many storms, but has always found success in maintaining the interest and participation of a sizeable membership. Although many amateur radio operators in remote locations use their radio gear to connect with others, radio clubs help provide an organized environment for an exchange of ideas in a group setting.

Part of being a successful club means you must be able to adapt with the times. During COVID-19, the SFRC was faced with finding different ways to keep members engaged through club events. We found that utilizing award programs, such as Parks on the Air® (POTA), Summits on the Air (SOTA), the US Islands Awards Program (USI), and Boats on the Air (BOTA), as the framework for these new club events helped provide some additional credibility, as well as a bit of competitiveness via point scoring for members who enjoy that aspect of ham radio.

Resourceful On-Air Events

It was shortly after the suspension of the 2020 ARRL Field Day that some of the SFRC members began to work on ideas to continue maximizing membership participation while abiding by the COVID-19 restrictions put in place in San Francisco. The first event we came up with was the Angel Island On-the-Air Trifecta, as described in the August 2022 issue of *QST*. For this event, three teams of three or four operators were assembled to travel to Angel Island in San Francisco Bay and simultaneously activate it for SOTA, POTA, and USI. All volunteers furnished their own gear, paid their own ferry fees, and agreed to abide by the social distancing and masking requirements set forth by the California State Parks system and the ferry operators. It was a multi-band and multi-mode event, allowing our club's Technician-class operators to participate, and even get some HF experience under their belts by working with General and Amateur Extra operators.

Jeff Curry, KK6JJZ, activates Mount Davidson (W6/NC-423) during the SFRC 2022 Sinrul-SOTA event. (San Francisco Radio Club, photo)

We acquired a special event call sign (W6P), as well as event QSL cards. Although we were restricted in the number of team members we could bring to the island, club membership was encouraged to contact the Angel Island teams and receive a QSL card. For some SFRC members (especially the Technicians), the QSL card from this event was the first one they ever received. The event was quite successful in engaging club membership, as well as other operators worldwide. It's become an annual event for the club, with members trying to reserve a team slot months in advance.

After the success of the Angel Island On-the-Air Trifecta, the SFRC decided to create another, similar event, in 2021. As COVID-19 restrictions loosened, SFRC members were able to get back to supporting marathons and field events, although they now did so as individual operators from locations throughout the city. These exercises provided the inspiration for our 2021 Parks-Polyfecta event, where 10 registered POTA sites from around the San Francisco Bay Area were activated simultaneously

by teams or individuals. Similar to the Angel Island event, it was a multi-band, multi-mode event to maximize participation at the sites and from member locations.

June 2021 also saw another novel SFRC event — BOTA — which garnered a high level of club participation. The BOTA inaugural event was featured in the September 2022 issue of *QST* and showcased one multi-band, multi-mode team under sail in San Francisco Bay being chased on the air by SFRC members and Bay Area operators.

In spring 2022, a fourth innovative SFRC concept was put into action: the Simul-SOTA. For this event, small teams and individual operators simultaneously activated nine registered SOTA sites around the Bay Area. Like the Parks-Polylecta, this event allowed the activators, and SFRC members who had decided to act as chasers, to rack up some on-air points, while keeping the club active on the air.

Planning and Organization

These types of activities are not difficult to organize, nor are they expensive. Yet, they enable a club's membership to participate on a large scale, whether as an event site operator with portable gear or as a chaser working from their home shack. These participatory events put a microphone in your membership's hands for some club activity throughout the year, rather than waiting for ARRL Field Day. Not all events have to be large — miniature events like these can also build a sense of community, while educating and encouraging those who are new to amateur radio. The portable nature of the events also allows participants to sharpen their emergency communications skills.

Planning and organization are key to making sure these events achieve their goals in a safe, timely, and efficient manner. The SFRC began using Slack (a messaging app that connects people to information) in 2016, and it soon became the club's main form of internal communications. All of the above-mentioned events were planned using a workspace within the Slack app, by setting up a specific channel for each event to provide information such as maps, site locations, operator lists, and the operating plan. The information required for these events is similar to that of ARRL Field Day. We used our general information Slack channel to direct interested parties to the event channel and to call for operators.

Slack has proven itself invaluable in organizing club events and keeping the membership informed in real time, while expanding the SFRC's reach well beyond our immediate membership. We have even opened up our Slack workspace for use by other Bay Area radio clubs and communications organizations. In addition to the SFRC's membership of more than 100 people, we've also invited individual operators from outside the club to join, and we now have more than 800 US and international participants on our various Slack channels. Radio clubs can achieve the same level of outreach and internal organization with other messaging platforms as well, and we've found such platforms to be more effective tools than the passive formats of email blasts or website updates. These platforms also allow clubs to host numerous special interest channels on a broad range of radio-related topics.

Keep Your Club Moving Forward

Our overall goal in organizing these various events and in expanding our outreach is to keep SFRC membership as engaged as possible in all aspects of amateur radio worldwide, no matter what challenges we face.

All radio clubs should consider organizing their own multi-mode events throughout the year and soliciting ideas for those events from their membership. This will keep radio clubs moving forward, while attracting a new set of operators to become part of amateur radio expansion. The SFRC was founded over a century ago, but it is staying ahead of the curve through innovation built on tradition. For more details on organizing events, visit **www.sfarc.org**.

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** 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** for more information about this program. Below is a list of new and renewing SSCs as of November 30, 2022.

New SSCs

Louisiana Delta Radio Club, KC5DR	West Monroe, LA
South West Idaho ARC, K7SWI	Nampa, ID

Renewing SSCs

Top of Panhandle ARC, K5PH	Booker, TX
Kitsap County ARC, KC7Z	Silverdale, WA
Reelfoot ARC, K4RFT	Union City, TN

Steve Goodgame, K5ATA, sgoodgame@arrl.net

Ham Media Playlist

KM4ACK — Videos through an EmComm Lens

If you asked a room full of amateur radio operators why they decided to get licensed, most would indicate they had an interest in starting a new hobby. A few would say they did it to make someone else — such as a father, a teacher, etc. — proud of them. Jason Oleham, KM4ACK, has a different reason. Jason would say he did it as a necessity.

Running digital operations in the field. See the KM4ACK video titled "POTA Fail K 3924 | Portable Radio Challenge April 2021" for more information (**https://tinyurl.com/km4ack-pota**). [Jason Oleham, KM4ACK, photo]

A Focus on Emergency Communications

Jason's YouTube channel is titled simply KM4ACK. While many HamTubers cover a broad range of topics on their channels, Jason tends to be much more focused — specifically on emergency communications (EmComm). He does reviews, Parks on the Air® (POTA) activations, etc., but he usually looks at everything through the lens of an EmComm application.

Jason realized that amateur radio was a critical tool to have in his toolbox after a devasting EF-4 tornado ripped through his hometown of Murfreesboro, Tennessee, on April 10, 2009. The Good Friday Tornado Outbreak devastated the southeast and damaged the communications infrastructure. The tornado ripped a 23-mile path through the area. Phone, internet, and power services were all down. From a communications standpoint, Jason was dead in the water.

That started his mission to become better prepared for such situations. He made basic home preparations and started developing a communications plan. Eventually, that planning process took on a life of its own. He shares many of the skills and lessons he learned, and continues to learn, on his YouTube channel. After struggling to find good information on using Pat Winlink, he finally figured out how to implement it, and realized others might benefit from video tutorials.

YouTube Channel Details

KM4ACK has grown to more than 21,000 subscribers. Jason's purpose for creating YouTube content has always been to help other amateur radio operators learn more about digital modes and portable operations. For portable operations, Jason has videos detailing a variety of modes of communication. For example, in "APRS Digipeater Test," Jason discusses the usefulness of handheld radios and APRS digipeaters for safety on a camping trip (**https://tinyurl.com/km4ack-aprs**).

Jason quickly developed an interest in the Raspberry Pi computer. He developed a script for the Raspberry Pi that he dubbed "Build-a-Pi," which includes a collection of amateur radio software. Jason's video tutorials show hams how to get their Raspberry Pi up and running.

Perhaps you are just getting started with Raspberry Pi computers. Not to worry! Jason has a video to help get you started. "Raspberry Pi Ham Radio | Where to Start" can be found at **https://tinyurl.com/km4ack-pi**.

Here, Jason steps viewers through the beginnings of setting up a new Raspberry Pi.

His videos look at things broadly as well as provide thorough walkthroughs of each step in the process. Jason gives practical advice about equipment choices and issues users might encounter, along with possible solutions.

If you are in the market for new gear for the field, several KM4ACK videos provide honest reviews of portable equipment, ranging from LiFePO4 batteries (**https://tinyurl.com/km4ack-miady**) to backpacks (**https://tinyurl.com/km4ack-backpack**). You are bound to find good information to help you decide what gear would work best for your needs.

Working 2-meter simplex from a mountaintop during an ice storm. See the KM4ACK video titled "114 Miles on 2M Simplex | Elk Log Periodic" for more information (**https://tinyurl.com/km4ack-snow**). [Jason Oleham, KM4ACK, photo]

Portable Operating and Other Activities

Jason enjoys portable operations, and he tries to get out and operate in that fashion at least monthly. He encourages his viewers to do the same so they stay in practice. Part of operating portable means that sometimes we don't have access to the internet or other means of communication. Jason discusses ways to stay in touch with others, and he demonstrates a variety of ways to be aware of weather conditions while in the field. These methods range from the very basic for newcomers, to using tools such as APRS or those included in his Build-a-Pi script for hams who feel more adventurous.

We can never know for sure what the weather may be on an extended outing, so it is best to have a way to keep tabs on Mother Nature. In his video titled "Off grid Weather | Ham radio" (**https://tinyurl.com/km4ack-weather**), Jason provides his viewers with a relatively simple way to do just that. Maybe you are looking for more ways to use APRS to get your weather information. In that case, you will want to check out APRS Ham Radio Weather WXBOT & WXYO (**https://tinyurl.com/km4ack-aprswx**). These are just a couple examples of ways to stay safe and be prepared for your portable operations.

Jason's channel has numerous videos of POTA activations and other operating activities, such as ARRL Field Day. With videos ranging from activities in the heat of the summer, to snowy days in the woods, Jason regularly practices what he preaches. In addition to actual operations, Jason discusses the various tools that might be needed to be successful. Whether you are looking for advice on backpacks, batteries, solar power, or just general tips and tricks to make your outing the best it can be, KM4ACK likely has a video that covers it for you.

An Interactive and Responsive HamTuber

Jason is responsive to the needs and wants of his viewers. He often creates videos based on requests made in the comments section of previous videos. Viewers regularly ask questions, and whenever possible, Jason takes the time to answer them.

If you are looking for information that contributes nicely to your EmComm and portable operations, KM4ACK might be the channel for you. You can find it at **www.youtube.com/km4ack**.

Strays

Looking for Navy Cryptologists

Jim, K9JT, is attempting to locate former or current Navy cryptologists. The Great Lakes Chapter of the Naval Cryptologic Veterans Association will be hosting the Association's 44th annual reunion in Milwaukee, Wisconsin, June 13 – 18, 2023, and he would like to locate as many alumni — many of whom are radio amateurs — as possible. Email Jim at **k9jt@videoterm.com**.

Bernie McClenny, W3UR, w3ur@arrl.org

How's DX?

2023 Bouvet Island DXpedition

In this month's column, guest author Mike Crownover, AB5EB, describes the rigorous behind-the-scenes preparation for the 3Y0J team's DXpedition to Bouvet Island.

In January 2023, 12 amateur radio operators and four crew members will start the trek toward the second most-wanted DXCC entity. Located more than 2,200 miles east of the Falkland Islands, roughly 1,100 miles north of Antarctica, and about 1,600 miles southwest of Cape Town, Bouvet Island is one of the most remote islands in the world. Given Bouvet's remoteness, the treacherous seas surrounding it, and its frequent storms, it is no surprise that the island holds second place on the list. The team has been planning the trip for well over 2 years. The co-leaders are Ken, LA7GIA; Rune, LA7THA; and Erwann, LB1QI.

Setup and Understanding the Challenges

Unlike many DXCC entities, Bouvet's rarity has nothing to do with the disapproval of a park official, or a restrictive government. The challenge is simply due to its place on the map and the logistics of getting there. Over recent years, the circumstances around Bouvet have kept prior DXpeditioners from reaching their activation goals. The 3Y0J team has closely studied past efforts, and we have found that even with solid planning, nothing on Bouvet is guaranteed.

As such, 3Y0J's organizing has been less about radio and more about other potential challenges, both along the way and at the destination. Planning for eight SSB/CW/RTTY stations and four FT8 stations all out of one tent is complex. In April 2022, the team met at the contest station LN8W to focus on station setup. For 3 days, we put together antennas, tents, and the mast before getting on the air. Hours were spent merely cutting the guy ropes for the mast. Following this exercise, we tested and labeled every piece of equipment — we found some issues with the new equipment, which we had to replace.

The vessel that will take us to Bouvet is the *Marama*, a 101-foot ocean ketch that spends her summers in the Arctic and Antarctic regions. One of the team members, Peter Madej, is a professional expeditioner who has spent decades supporting remote trips like 3Y0J. He helped find the *Marama* and has been involved in multiple inspections, making sure that every shipping barrel will fit. He assisted in logging the weight, contents, and placement of each barrel to guarantee that she will be properly loaded.

The remaining logistics for this trip could fill a book; medical preparations, landing, food, water, sanitation, emergency rationing, geological considerations, and wildlife concerns have involved countless hours of planning and re-planning. Team members have been to Norway for the station build, rock climbing, and glacier training. Preparation efforts have left the team exhausted before we've made even one step toward Bouvet. However, this past September, the container carrying the hopes of many DXers worldwide left Oslo on its way to Port Stanley in the Falkland Islands. With much of the work done, our focus returned to the journey itself.

Implementing the Plan

The team plans to meet in London on January 10 and get ready for the flight to Port Stanley on January 12. The plane will leave a little after midnight and refuel in Cape Verde. The team will arrive on January 13, and after spending a day or two loading the *Marama*, we will start to head toward Bouvet. The first step of this trip will be a roughly 5-day journey to South Georgia Island. Stopping in South Georgia will be our last chance to take shelter and rest from issues like seasickness before continuing. For 2 days, we will sail east from South Georgia to the South Sandwich Islands. Once beyond these islands, it will take a week to sail the Southern Ocean toward Bouvet. The team has anticipated that, upon arrival (around January 26), it may take at least a day for us to regain strength from the trip.

Once the team is in proper condition, the next hurdle will be waiting for weather windows so that we can make the beach landing. The team has three Zodiacs to deploy during the short weather openings. Prevailing winds on Bouvet come from the west and northwest, and our campsite is Cape Fie, which is on the southeast coast — a favorable location for landing. Once on the beach, the team will need to get equipment up a 30-foot cliff. We developed a motor-driven lift system for this purpose beforehand, and we have multiple backup options if the system fails.

Due to requirements on the landing permission form outlined by the

Norwegian government, the team must ensure that adequate supplies are available for us to survive 28 days on Bouvet. Therefore, the landing is tiered so that the number of team members on the island does not outpace the materials needed for survival. Weather conditions can change quickly on Bouvet, and we cannot risk any team members being stranded on the island without proper supplies. Our landing plan assumes that this may occur, and it may be a week before resupply can take place.

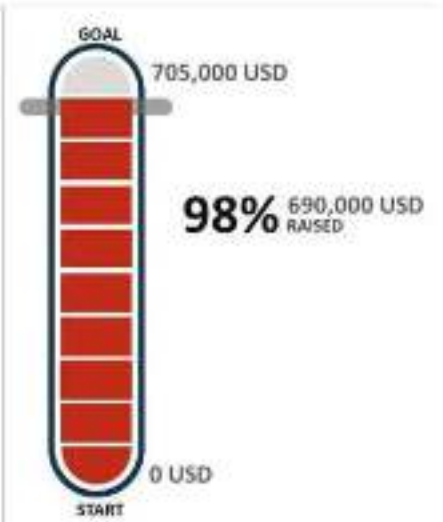
The initial camp build will be focused on putting together a safe shelter. The tents we will be using are made in Norway, and are used extensively in northern Norway. After our discussions with the company, they produced a tent that was even more fortified than the typical tent they sell. This was done with the expectation of excessive winds on Bouvet. The antennas are also reinforced for the wind; we plan on multiple antennas getting damaged regardless. Backup systems are limited by the amount of supplies we can bring, but there are multiple alternate plans in place for each step.

The number of stations on the air will progressively increase as we reach different tiers of the landing process. Staying on Bouvet is not just about keeping the radios on the air, as there will be many daily duties dedicated to keeping the camp functional. After what will hopefully be a successful 20-day operation and more than 200,000 contacts, we will still have to find our way back to civilization via about 1,600 miles to Cape Town. We anticipate being back to the mainland around late February or early March.

Throughout all the planning, our main focus has been safety. In such a remote environment, the consequences of a sprained ankle or a broken bone are considerably amplified. Foodborne illness could bring the team to a grinding halt, making sanitation vital. The team has had to accept the reality that certain medical conditions will be untreatable, and that medical evacuation would take a week. Despite the risks, the team is ready for the challenge of Bouvet. The budget of this expedition is more than $700,000. There have been numerous clubs and individuals around the world that have donated to 3Y0J. This trip would not be possible without the very generous support of the worldwide DX community. We hope to hear you on the air!

Additional 3Y0J Information

The 3Y0J website (**www.3y0j.no**) has more details about the upcoming Bouvet Island DXpedition, including biographies of each of the operators, the latest news, details about the *Marema*, the DXpedition pilot stations, the team's band plans, propagation forecasts, QSL details, and information about the team's budget. As of the submission of this article, the team has secured 98% of the funding (see **www.3y0j.no/funding**), thanks to many individuals, clubs, and corporate sponsors. The last Bouvet Island activity was in February 2008. You will not want to miss this one, as it could be many years before we see another 3Y/B activity. For more information about Bouvet Island, check out "The Unique History of Bouvet Island" in the November 2021 "How's DX?" column.



The 3Y0J DXpedition team is close to reaching their financial goal. They raised 98% ($690,000) of their $705,000 target amount.

Wrap-Up

That's all for this month, with special thanks to Mike, AB5EB, for helping to make this month's column possible. Don't forget to send any news, tidbits, photos, and club newsletters to your editor at **bernie@dailydx.com**. Until next month, see you in the pileups! — *Bernie, W3UR*

Life Members

Elected December 5, 2022

James S. Altman, W4UCK
David J. Anderson, KG6NUC
Lawrence W. Banks, W1DYJ
William G. Bennett, W4WGB
Cliff W. Beltz, WD4OBP
John P. Boos, K9HVS
William H. Boutwell, Jr., KB3GK
Andrew C. Buglione, AB3J
Thomas T. Cook, KA8LTC
Steven R. Coney, KK7UP
Michael S. Daly, KC2SBR
Nathaniel J. Drexler, KV4RD
Robert L. Gessner, Jr., KE6EDU
Leslie J. Gifford, Jr., K9ACR
Christian R. Glad, KK7ADI
Dennis L. Haarsager, N7DH
William F. Hobbs, III, KN1QJ
Steven M. Jones, KA6PHW
David E. Lesso, AC1K
George R. Long, II, KK7AHR
Peter L. Michaelson, KD2EW
Drew Mortensen, AC3DS
Tuan Nguyen, AI2C
Tyler D. Nicholas, N3UC
Rob S. Osterin, KI4UTY
Jeremiah Pope, NE9Z
Christopher P. Prioli, AD2CS
Matthew J. Ryan, W2MJR
Myron R. Schaffer, WV6H
Stan Szyryj, KS9S
Joseph L. Thibodeau, Sr., K4JLT
John D. Van Sickle, KK4ENL
David Welch, K4HDW
Apostoli Zafiriadis, KB1WHW

Jon Jones, N0JK, n0jk@arrl.org

ZL1RS to North America on 6 Meters on November 29, 2022

Bob Sutton, ZL1RS (RF64), worked North America on the evening of November 29 on 6 meters. Greg Gabry, N9PGG (FM05), worked ZL1RS at 2314 UTC, running 100 W and a single Yagi with –7 dB signals on FT8. He had received ZL1RS earlier on a dipole antenna (see Figure 1). ZL1RS also worked stations along the Gulf Coast, such as N5DG and K5YT. ZL1RS then worked stations in Mexico — including XE1KK and XE3N — and HC2FG in Ecuador. Chip, K7JA (DM03), worked ZL1RS later that evening at 0354 UTC, followed by ZL1AKW (RF82) at 0357 UTC. He runs 150 W and a seven-element Yagi.

From EM84, Gary, K9RX, worked ZL1RS, ZL3NW, ZL3RC, and XE2NK (which would confirm a sporadic-E link) for this opening. Gary's contact with ZL1RS was unusual. He stated,

> I was looking around the bands and viewing spots. Then I saw ZL worked on 6 meters in to the US. So, I popped up there and started to rotate [my vertical stack of four, seven-element Yagis] pointed at 50 degrees. He popped in at –18… I called, even though the antenna [array] was slowly rotating around — [at this point, it was] on Africa at best… Bob gave me a report and we completed [the contact]. When [FT8] was sending the 73, I noticed on the amp display that the SWR was 1.6:1. [I wondered], "Wow, is the array not working?" I looked over at the amp and realized… I haven't worked 6 meters for some time — the last [time was when I] worked W7GJ at FH on EME.
>
> I decided to move the 80-meter ground-plane antenna, fed with RG8X, to the second port of the amp. I had forgotten about this and worked ZL [by] using it!

When Gary switched to his Yagi array and pointed it toward Bob, his signal was +10 dB. This opening was like past New Zealand to North America openings during late December and early January. The propagation mode is thought to be sporadic E on both ends, linking to trans-equatorial propagation (TEP) across the geomagnetic equator. The November 29 opening was unusual because it was a month early; perhaps the higher solar flux from Solar Cycle 25 played a role. Sporadic E helped as well, and this may bode well for more openings in December and January.

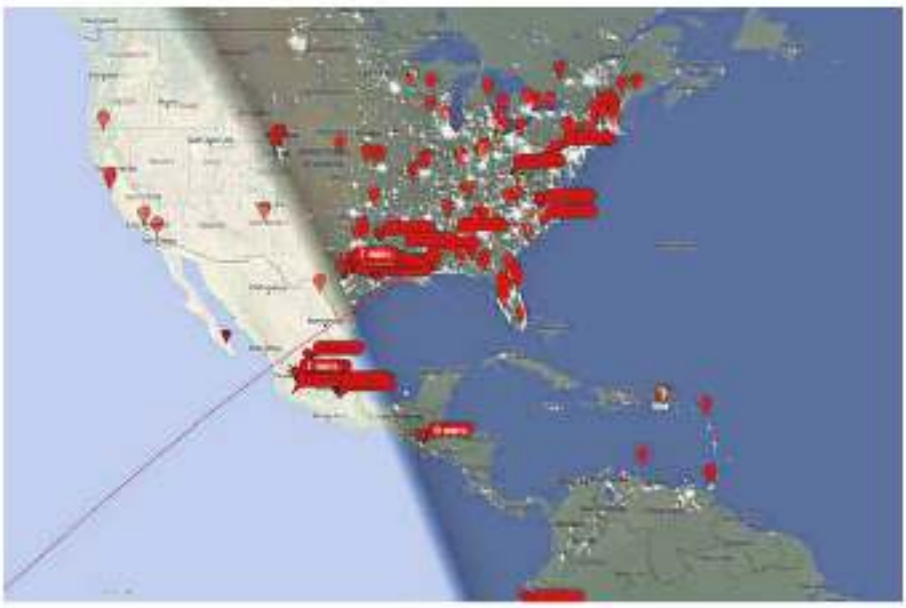


Figure 1 — The PSK flag of Greg Gabry's, N9PGG, 6-meter reception of Bob Sutton, ZL1RS, on November 29, 2022, via a dipole antenna. **[www.pskreporter.info/pskmap]**

Rare 6-Meter Sporadic-E Opening on Saturday Morning, November 19

A strong and unexpected sporadic-E opening took place early Saturday morning on November 19. E_s stations appeared here in eastern Kansas shortly after sunrise. From FN20, WA2GFN found the 6-meter band "full of signals, and mostly digital." On SSB, he worked W9ZX (EM58), N3LHQ (EM45), and W0RT (EM27). Larry Lambert, N9LL/P, was active from DN90. The rare E_s opening let Larry log 72 sporadic-E contacts via FT8 — a fortuitous opening and grid expedition.

From EM28, I logged NY3C (FM29), K3SX (FM19), AI3Z (FM19), and N9PGG (FM05) on FT8. On that morning, a solar flare may have

sparked the opening. Sunspot AR3150 produced an M1-class solar flare at 1256 UTC. A strong pulse of extreme UV radiation from the flare ionized Earth's upper atmosphere over North America, and the sporadic E appeared around 30 minutes later.

50 MHz EME with Only a Dipole

EME is a demanding mode due to high path loss. On 6 meters, making a contact usually requires that both stations run the maximum legal power limit and large antenna arrays. But can such a contact be made with a dipole? On November 17, ZL1RS completed a 6-meter EME contact with Dave, KJ9I, using a dipole antenna that was up 3 meters (10 feet) on a pole. Dave's station helped a lot, as he runs four 10-element LFA Yagis. The moon reflects only 7% of a radio signal that strikes it. Steve, NN4X, informed me of this contact, noting that he could copy stations calling ZL1RS with his single, seven-element LFA Yagi that was up 40 feet. This was an amazing contact that should encourage those with long, single Yagis to try 6- and 2-meter EME.

Leonids Meteor Shower

The Leonids meteor shower peaked on November 17. N0LL operated portable on 6 meters from rare grid DN80 with 80 W and a five-element Yagi on a 15-foot mast. He found good meteor conditions and put 43 stations in his log via MSK144. Tom, KN4JX, and Leslie Teague, KC4PDN, put rare grid EL28 on during the Leonids, too. They made 15 MSK144 meteor-scatter contacts, and the first one was with N0LL/P in DN90! They ran 200 W on solar power, and sometimes 600 W with a generator, to a four-element LFA Yagi on a 15-foot mast. I, N0JK (EM28), noted some

Figure 2 — The PSK flags of my 6-meter MSK144 signals on November 18, 2022. **[www.pskreporter.info/pskmap]**

6-meter signals via MSK144 the next day (see Figure 2).

On the Bands

50 MHz. On November 7, Steve, NN4X (EL98), reported 7Q6M again, with loud signals up to +27 dB. He also worked CT1EHX (IM67) and received EA8 and D4 stations. On November 9, KP4EIT worked 9G1SD on FT8 via F2. On November 28, Earl, KD5XB (DM84), reported a sporadic-E opening. He said,

> In the span of 68 minutes, I worked eight stations, from Houston to Bay St. Louis, then down into Mexico City and Victoria, Tamaulipas, [as well as] Loreto, Zacatecas. Distances were anywhere from about 800 to 1,100 miles. I was beyond excited! I missed this past E_s season because the tower wasn't ready yet. At that time, I tried working some 6-meter mobile, but while I could hear the FT8 signals at sometimes 20 over S9, there just wasn't anybody to talk to — they were all on FT8. I even tried CW a couple of times. My tower is mostly done now, and tonight, I worked the following stations from my home here in Clovis, New Mexico (DM84): K3FM, N4UPX, N5HHS, K5TIA, W3UUM, XE1KK, XE2WK, and XE2YWH (DL92).

That same evening, N0LL (EM09) copied TG9AJR (EK44) on FT8. On November 29, WA2GFN found another E_s opening, this time to K4LI (EM85), KO4NMU, W5SPH (EM50), NQ4I, and W5ZM.

144 MHz. Ron Klimas, WZ1V (FN31), reported tropo on the morning of November 9 to K1MAP (FM14) on SSB. The tropo was more widespread the next morning, and he worked WA1CQG (EM72), K1MY (EM74), and W4IMD (EM84) at a distance of 1,284 kilometers.

222 MHz. Also on November 9, WZ1V worked N1GC (EM95) on SSB. Peter, KA6U, was on November 11 from Louisiana, and he made four contacts on EME.

1296 MHz. Gene Shea, KB7Q, reported working 56 stations on 23-centimeter EME in the ARRL EME Contest with a 2.4-meter dish antenna. He said being "accurate on the moon" made the difference. This information is from the *EME Newsletter* via Al Katz, K2UYH, and Matej Petrzilka, OK1TEH.

Here and There

Lance Collister, W7GJ, provided a link to an interesting amateur radio documentary that appeared on Montana PBS. It can be watched at **www.montanapbs.org/programs/ham**. Lance also notes that the WSJT-X 2.60-rc5 beta is ready for download. By the time you read this, the regular version may be available.

Mario Somma, AB1FM, msomma@arrl.org

ARRL VEC Volunteer Examiner Honor Roll

ARRL VEC

It's been nearly 40 years that ARRL has been authorized by the FCC to give amateur radio exams. Prior to today's volunteer-based examination system, the FCC conducted testing at its field offices around the country on specified schedules. In late 1982, the Goldwater-Wirth Bill was passed by Congress and signed into law by President Ronald Reagan. This bill, known as Public Law 97-259, amended the Communications Act of 1934, permitting the FCC to accept the voluntary and uncompensated services of licensed radio amateurs to serve in preparing and administering examinations. The amateur community would conduct the testing itself, under a new Volunteer Examiner (VE) program drafted by ARRL with the FCC staff.

On July 21, 1984, ARRL and the FCC signed the Volunteer Examiner Coordinator (VEC) Memorandum of Agreement at the ARRL National Convention in New York City. The agreement officially authorized ARRL to accredit VEs and coordinate amateur radio exam sessions. More than 4,000 Advanced- and Amateur Extra-class licensees applied to serve. The first ARRL VEC exam session was held on September 2, 1984, at the ARRL Pacific Division Convention in California.

ARRL VEC Volunteer Examiners

ARRL's VEC program has a long-standing tradition of serving the amateur radio community and the FCC with integrity and expertise. As the largest VEC in the nation, the ARRL VEC and our VEs have had a positive effect on our community's growth and have truly made a difference in the future of amateur radio.

To give you an idea of what the ARRL VEC and our VEs have accomplished, here are some statistics. In the first 40 years, we have accredited more than 78,000 licensees as VEs. These VEs have conducted more than 175,000 test sessions. At these sessions, approximately 1.1 million individuals have taken 1.4 million examinations.

Yes, our VEs have been busy!

Serving the Amateur Radio Community

Volunteering is important to our organization and the community. There are approximately 30,000 VEs currently accredited in our program. More than 5,800 of those VEs have been accredited for 20 years or more. ARRL VEs generously devote their time, energy, and skill to help expand our community. They support us around the country by offering exam opportunities for our community and by helping exam candidates fulfill their amateur radio aspirations.

During the ARRL Year of the Volunteers, we want to recognize and honor our VEs for the amount of time they have dedicated to our VEC program. Your contributions truly make a difference. In addition to displaying the number of sessions participated in, the ARRL VE session counts page will now also display the examiner's accreditation start date. Visit the ARRL VEC VE session counts web page (**www.arrl.org/ve-session-counts**) to view your ARRL VE accreditation start date.

Become an ARRL VE

If you haven't already, we hope you will embark on this rewarding journey and become an ARRL Volunteer Examiner. If you are interested in becoming an ARRL VE, it's easy! Visit **www.arrl.org/VE** for more information.

Special Event Stations

Working special event stations is an enjoyable way to help commemorate history. Many provide a special QSL card or certificate!

Dec. 5 – Feb. 18, 0000Z – 2359Z, member call, various locations. Quarter Century Wireless Association. **75/75 Contest Celebrating Our 75th Anniversary.** Phone/CW only on 6, 10, 15, 20, 40, 80, and 160 meters. Certificate. Lou Maggio, NO2C, 390 Cedarhurst St., Islip Terrace, NY 11752. *This is an operating event.* **www.qcwa.org/1-worked-75-75-members-contest.htm**

Jan. 27 – Jan. 28, 0200Z – 0200Z, W5ND, Orange, TX. Orange Amateur Radio Club. **75 Years of ARRL Affiliation.** 40, 20, 15, and 10 meters: 7.175 – 7.300, 14.225 – 14.350, 21.275 – 21.450, 28.300 – 28.800. QSL. Orange Amateur Radio Club/75 Years, P.O. Box 232, Orange, TX 77631-0232. *Operating on General-class frequencies.* **orangearc@live.com**

Feb. 1 – Feb. 28, 0000Z – 2359Z, N9SES, Lake Station, IN. Arab QRZ Club. **JY1 Memorial Special Event.** 14.025 14.076 14.250 21.025. QSL. Ayman Azar, N9SES, 2861 Decatur St., Lake Station, IN 46405. *Comments or questions, email* **admin@n9sea.com. www.arabqrz.com/jy**

Feb. 3 – Feb. 5, 1800Z – 2100Z, W0WND, Clear Lake, IA. North Iowa Amateur Radio Club. **The Day the Music Died.** 10.136. Certificate. Donald Johnson, 665 W. 6th St., Garner, IA 50438. **www.thedaythemusicdied.w0wnd.net**

Feb. 6 – Feb. 14, 0001Z – 0001Z, W7ASC, Phoenix, AZ. Center for Amateur Radio Learning. **Super Bowl 57 Special Event.** 7.265 14.265 21.465 146.52. Certificate & QSL. Direct to W7ASC, c/o Thomas Boza, NE7X, 13609 N. 49th Pl., Scottsdale, AZ 85254-3505; eQSL via QRZ and LoTW. **www.qrz.com/db/w7asc**

Feb. 9 – Feb. 12, 1323Z – 1323Z, K4ICA, Venetta, OR. YL International Single Sideband System. **60th Anniversary.** 7.230 – 7.260, 14.240 – 14.340. QSL. John Ellis, W5PDW, 26231 Huffsmith Conroe Rd., Magnolia, TX 77354. **www.ylsystem.org**

Feb. 10 – Feb. 14, 2100Z – 0200Z, W4OLB, Maryville, TN. Smoky Mountain Amateur Radio Club. **75th Anniversary Celebration.** SSB: 7.220 14.250; CW: 7.030 14.030. QSL. SMARC, c/o Paul Galentine, 103 Hatcher Ln., Maryville, TN 37803. **www.w4olb.org**

Feb. 11, 1400Z – 2000Z, N2I, Edison, NJ. New Jersey Emergency Communications Team. **2023 National Inventors' Day.** 7.275 14.315. Certificate. *This location is also a Parks on the Air designated park; all QSOs will receive POTA contact credit.* **www.qrz.com/db/n2i** or **http://nject.us**

Feb. 11, 1700Z – 2359Z, NI6IW, San Diego, CA. USS *Midway* Museum Ship. **Commemorating the First US Navy Carrier Air Strike in World War II.** 7.250 14.320; 14.070 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/ni6iw**

Feb. 14, 1700Z – 2200Z, WE7GV, Sahuarita, AZ. Green Valley Amateur Radio Club. **GVARC Ladies Valentine Special Event.** 14.242. Certificate & QSL. Tom Lang, 1085 W. El Toro Rd., Sahuarita, AZ 85629. *This event will be held at the Titan Missile Museum Discone antenna site.* **we7gv1@gmail.com**

Feb. 14 – Feb. 19, 0001Z – 2359Z, N4DAB, Daytona Beach, FL. Daytona Beach CERT ART2023. **Daytona 500 Speedweeks.** 14.055 14.071. Certificate & QSL. Steve Szabo, 536 Central Park Blvd., Ponce Inlet, FL 32127. *See website for QSL details.* **www.n4dab.com**

Feb. 17 – Feb. 19, 1400Z – 1900Z, N4HLH, Sullivan's Island, SC. **Trident Amateur Radio Club. *H.L Hunley* Commemoration and Special Event.** 7.262 14.262. QSL. QSL Manager, N4HLH, P.O. Box 60732, North Charleston, SC 29419. *Check website for specific days, times, and frequencies.* **www.tridenthams.org/hl-hunley**

Feb. 18 – Feb. 20, 1600Z – 2300Z, W0JH, Stillwater, MN. Stillwater Amateur Radio Association. **Ice Station W0JH — Frozen Minnesota Lake Portable.** 3.860 7.260 14.260 21.360. eCertificate. Send QSL information to: **IceStation2023@outlook.com**. *Grid square EN34.* **www.radioham.org** or **www.qrz.com/db/w0jh**

Feb. 19 – Feb. 26, 0000Z – 0000Z, K4C, McDonough, GA. Worldwide Antarctic Program. **Antarctic Activity Week.** 7.170 14.270 21.270 28.470. QSL. Robert Hines, K4MZU, 1978 Snapping Shoals Rd., McDonough, GA 30252. **www.qrz.com/db/k4c**

Feb. 20 – Feb. 22, 1800Z – 2359Z, WS7G, Moses Lake, WA. Columbia Basin DX Club. **George Washington's Birthday.** 3.855 3.960 7.222 7.260 14.255 14.322. Certificate & QSL. Brian Nielson, 11650 Road 1 SE, Moses Lake, WA 98837. **www.cbn.homestead.com/ws7g.html**

Feb. 22, 1500Z – 2100Z, W7ASL, Mesa, AZ. Sunlife Amateur Radio Club. **Snowbird Field Day.** 7.200 14.230; CW FT8 JS8Call; DMR Talkgroup 31041. QSL. Tom Goforth, 1321 E. Dragoon Cir., Mesa, AZ 85206. **www.sunlifearc.org**

Feb. 25, 1400Z – 2200Z, WØEBB, Leavenworth, KS. Kickapoo QRP Amateur Radio Club. **19th Annual Freeze Your Keys Winter Operating Event.** CW: 7.035 14.058; SSB 7.240 14.325. QSL. Gary Auchard, 34058 167th St., Leavenworth, KS 66048. **w0mna74@gmail.com**

Feb. 25 – Feb. 26, 1600Z – 0400Z, W7EK, Bothell, WA. Cascade Radio Club. **75th Anniversary of ARRL Affiliation.** 3.925 7.250 14.250 21.250. QSL. Cascade Radio Club, 5505 189th St. SE, Bothell, WA 98012. **www.cascaderadioclub.org**

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**, or email information to **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 ***May QST*** would have to be received by **March 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.

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
Tl = Talk-in frequency
Adm = Admission

ARRL ALABAMA SECTION CONVENTION

March 3 – 4, Trussville, Alabama

D F R S T V

Fri. 4 PM – 7 PM, Sat. 8:30 AM – 4 PM. *Spr:* Birmingham ARC. Trussville Civic Center, 5381 Trussville Clay Rd. *Tl:* 146.880 (88.5 Hz). *Adm:* $10. **www.birminghamfest.org**

Arkansas (Dardanelle) — Mar. 4 D F H Q R S V
7:30 AM – 2 PM. *Spr:* Arkansas River Valley Amateur Radio Foundation. Dardanelle Community Center, 2059-2099 State Hwy 22. *Tl:* 146.82 (131.8 Hz). *Adm:* $10. **www.arvarf.com**

Colorado (Brighton) — Feb. 19 D F H R V
9 AM – 1 PM. *Spr:* Aurora Repeater Association and Rocky Mountain Ham Radio. Adams Co. Fairgrounds Exhibit Hall, 9755 Henderson Rd. *Tl:* 147.15 (100 Hz). *Adm:* $6. **www.rmham.org/swapfest**

Florida (Brooksville) — Feb. 18 D H Q R T V
8 AM – 4 PM. *Spr:* Hernando Co. ARA. Sand Hill Scout Reservation, 11210 Cortez Blvd. *Tl:* 146.715 (no tone). *Adm:* $6. **www.hcara.org**

Florida (Sebring) — Feb. 18 F H R T
8 AM – 1 PM. *Spr:* Highlands Co. ARC. First Baptist Church, 111 Lake Josephine Dr. *Tl:* 147.045 (100 Hz). *Adm:* $5. Email: **rbg695@hotmail.com**

Florida (Tampa) — Feb. 24 – 25 H R S
Fri. 1 PM – 5 PM, Sat. 9 AM – 5 PM. *Spr:* ARRL West Central Florida Section. Hillsborough Co. Public Safety Operations Complex, 9450 E. Columbus Dr. *Tl:* 146.790 (146.2 Hz). *Adm:* Free. **www.arrlwcf.org/wcf-special-events/wcftechconference**

Georgia (Dalton) — Feb. 25 D F H R T V
8 AM – 2 PM. *Spr:* Dalton ARC. North Georgia Ag Fairgrounds, 500 Legion Dr. *Tl:* 145.230 (141.3 Hz). *Adm:* $5. **www.facebook.com/DaltonAmateurRadioClub**

Indiana (Danville) — Feb. 11 D F H
9 AM – 2 PM. *Spr:* Hendricks County ARS. Hendricks Co. 4H Fairgrounds Conference Center, 1900 E. Main St. *Tl:* 147.015 (88.5 Hz). *Adm:* $7. **www.n9hc.org**

Indiana (Dugger) — Feb. 25 D F H R V
8 AM – 12:01 PM. *Spr:* Dugger ARC. Dugger Community Center, 834 Hicum St. *Tl:* 146.775. (136.5 Hz). *Adm:* $5. Email: **jonolvey@gmail.com**

Iowa (Perry) — Feb. 18 D F H Q R S V
8 AM – noon. *Spr:* Hiawatha ARC. National Guard Armory, 2930 Willis Ave. *Tl:* 145.190 (114.8 Hz). *Adm:* $10. **www.qsl.net/kd0neb**

Kansas (La Cygne) — Feb. 4 D F H
9 AM. *Spr:* Mine Creek ARC. LaCygne Community Building, 204 N. Commercial St. *Tl:* 147.285 (91.5 Hz). *Adm:* Free. Email: **kb0dti@arrl.net**

Kentucky (Cave City) — Mar. 4 D F H R T V
7:30 AM. *Spr:* Mammoth Cave ARC. Cave City Convention Center, 502 Mammoth Cave St. *Tl:* 146.94 (no tone). *Adm:* $5. **www.ky4x.org**

Maine (Augusta) — Feb. 11 F H R V
8 AM – noon. *Spr:* ARC of Augusta. Calumet Club, 334 West River Rd. *Tl:* 146.52 (no tone). *Adm:* Free. Email: **grszadis@aol.com**

Massachusetts (Marlborough) — Feb. 18 F R V
9 AM – 1 PM. *Spr:* Algonquin ARC. 1Lt Charles W. Whitcomb School, 25 Union St. *Tl:* 446.675 (88.5 Hz). *Adm:* $5. **www.n1em.org**

Michigan (Livonia) — Feb. 18 D F H R
8 AM – noon. *Spr:* Livonia ARC. Monaghan Banquet Center, 19801 Farmington Rd. *Tl:* 145.35 (100 Hz). *Adm:* $5. **www.livoniaarc.com/larc-annual-swap-and-shop**

Michigan (Traverse City) — Feb. 11 D F H Q R V
8 AM – noon. *Spr:* Cherryland ARC. St. Francis High School, 123 E. 11th St. *Tl:* 146.86 (114.8 Hz). *Adm:* $5. **www.cherrylandarc.com**

Minnesota (St. Cloud) — Feb. 18 D F H Q R S V
9 AM – 1 PM. *Spr:* St. Cloud ARC. St. Cloud National Guard Armory, 1710 Veterans Dr. *Tl:* 147.015 (100 Hz). *Adm:* $10. **www.w0sv.club**

New York (Hicksville) — Feb. 26 D F H Q R S V
8:45 AM – 12:30 PM. *Spr:* Long Island Mobile ARC. Levittown Hall, 201 Levittown Pkwy. *Tl:* 146.850 (136.5 Hz). *Adm:* $6. **www.limarc.org**

North Carolina (Concord) — Mar. 10 – 11 D F H R S
Fri. 3 PM – 7 PM, Sat. 8:30 AM – 4 PM. *Spr:* Mecklenburg ARS. Cabarrus Arena and Events Center, 4751 State Hwy 49. *Tl:* 146.655 (no tone). *Adm:* $12 Advance. $14 door. **www.charlottehamfest.org**

North Dakota (Bismarck) — Feb. 25 F H R S V
7:30 AM – 12:30 PM. *Spr:* Central Dakota ARC. Bismarck State College Career Academy, 1221 College Dr. *Tl:* 146.850 (no tone). *Adm:* Free will offering. **www.cdarcnd.com/hamfest-2023.html**

Oregon (Rickreall) — Feb. 18 F H V
9 AM – 3 PM. *Spr:* Salem Repeater Association. Polk Co. Fairgrounds, 520 S. Pacific Hwy West. *Tl:* 145.33 (100 Hz). *Adm:* $10. **www.w7sra.org**

Pennsylvania (South Park Township) — Feb. 26
D H Q R V
8 AM – 1 PM. *Spr:* Wireless Association of South Hills ARC. Home Economics Building, 2050 Buffalo Dr. *Tl:* 146.955 and 443.650 (131.8 Hz). *Adm:* $5. **www.n3sh.org**

Texas (Orange) — Feb. 25 D F H R S T V
7:30 AM – 2 PM. *Spr:* Orange ARC and Jefferson Co. ARC. Orange Co. Convention and Expo Center, 11475 FM 1442. *Tl:* 147.180 (103.5 Hz). *Adm:* $10. **www.qsl.net/w5nd/Index_files/HAMFEST%20INFO/hamfest%20info.htm**

ARRL TEXAS STATE CONVENTION

March 3 – 4, Rosenberg, Texas

D F H Q R S T V

Fri. 2 PM – 8 PM, Sat. 8 AM – 3 PM. *Spr:* Brazos Valley ARC, Fort Bend Co. Fairgrounds, 4310 TX-36 S. *Tl:* 146.940 (167.9 Hz). *Adm:* $10 Advance, $15 door.
www.houstonhamfest.org

ARRL VERMONT STATE CONVENTION

February 25, Colchester, Vermont

D F H Q S T V

8 AM – 2 PM. *Spr:* Radio Amateurs of Northern Vermont. Hampton Inn Convention Center, 42 Lower Mountain View Dr. *Tl:* 145.15 (100 Hz). *Adm:* $6 Advance, $10 door.
www.ham-con.org

Virginia (Elkton) — Feb. 18 F H R T

7 AM. *Spr:* Page Valley ARC, VFW Post 9292, 13958 Spotswood Trail. *Tl:* 146.625 (131.8 Hz). *Adm:* $5.
sites.google.com/view/pvarc/home

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.arrl.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.arrl.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 **March 1** to be listed in the **May** 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@arrl.org**.

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 November 2022 activity report of the VM Program.

♦There were 10 actions for the month. Four notices were sent to Technician operators in Vermont, Arizona, Alabama, and California regarding FT8 transmissions on 40 and 20 meters. Technicians have no FT8 privileges on those bands.

♦Notices concerning excessive bandwidth were sent to operators in South Carolina (transmissions up to 7 kHz wide) and Florida (transmissions 10 kHz wide). Section 97.307(a) of the FCC rules requires that a signal not occupy more bandwidth than necessary for the information rate and emission type, in accordance with good amateur practice.

♦A notice was sent to an operator in Texas concerning an unattended beacon operating on 29.600 MHz, causing interference to normal operations on that frequency.

♦Commendations were issued to operators in Sumter and Columbia, South Carolina, for net operations on 146.715 MHz during Hurricane Ian. Both operators volunteered for shifts exceeding 12 hours and handled over 100 messages for their county EOC, ARES, and AUXCOMM, and the South Carolina Healthcare Emergency Team (SCHEART).

♦An operator in Delaware was issued a notice for operation under an expired license.

♦The Program Administrator participated in one FCC meeting, attended VM Program forums at the Fort Wayne, Indiana, Hamfest and the Gloucester County Amateur Radio Club in Mullica Hill, New Jersey, and participated in a virtual meeting concerning the VM Program with the Overlook Mountain Amateur Radio Club in West Hurley, New York.

♦The final totals for VM monitoring during October 2022 were 1,770 hours on HF frequencies, and 2,669 hours on VHF frequencies and above, for a total of 4,439 hours.
— Thanks to Volunteer Monitor Program Administrator Riley Hollingsworth, K4ZDH

New ARRL Foundation Scholarships and Grant Recipients

The ARRL Foundation Board of Directors is pleased to announce two new scholarships to be awarded in the spring for the 2023 – 2024 academic year.

The Fort Myers Amateur Radio Club Scholarship

The Fort Myers Amateur Radio Club has established an annual $1,000 scholarship. Applicants must be full-time undergraduate students pursuing a degree in any area of study at an accredited college or university. Applicants from Florida will be given preference.

The Free Family (N3TG [SK], K3MAF, KC3YO, K4FRE, KB4HGU [SK], KB4HGV [SK]) Scholarship

The Free family has established an annual $1,000 scholarship. Applicants must be full-time undergraduate students pursuing a degree in any area of study at an accredited college or university. Applicants from Virginia will be given preference, followed by students attending Rice University in Houston, Texas, and Virginia Tech in Blacksburg, Virginia.

Applicants who apply for scholarships by January 4, 2023, will automatically be considered for these new scholarships.

Full eligibility requirements for all scholarships can be found at **www.arrl.org/scholarship-descriptions.**

ARRL Foundation Grant Recipients

Following the October 2022 grant submission period, the ARRL Foundation Board of Directors voted to approve funding for six grant proposals.

The Alabama School of Cyber Technology and Engineering (ASCTE) in Huntsville, Alabama, received a $2,000 award. The award will establish an amateur radio station for the ASCTE Amateur Radio Club and supply the school with learning materials to aid students in earning their ham radio license.

A $3,000 award was given to the Joplin Amateur Radio Club in Joplin, Missouri, to develop an amateur radio station on the Frank Childress Scout Reservation. The project's vision is to introduce the benefits of ham radio operations to the community and grow interest — starting with local scouting groups, by leading activities such as Field Day, Radio Merit Badge classes, and Jamboree-on-the-Air events.

The McKenzie Center for Innovation & Technology in Indianapolis, Indiana, received a $3,000 award to expand the current amateur radio program to non-Civil Air Patrol students with equipment and establish an amateur radio club. The club's goal is not only to expand to non-Civil Air Patrol students, but also to draw in alumni and adults to evening training sessions to prepare them for licensing, as well.

A $2,000 award was given to the Oro Valley Amateur Radio Club in Tucson, Arizona, to build go-kits to support field operation opportunities at parks, museums, schools, etc. The project provides the opportunity for antenna-restricted operators to operate in public places with an organized and professional setup.

The Randolph Technical Career Center in Randolph, Vermont, received a $3,000 award. Due to students' growing interest in the hobby, the award will support their club in building an amateur radio station. The station will be open to all students in grades 9 – 12 and faculty during the school year.

A $3,000 award was given to West Monroe High School Amateur Radio Club, WM5HS, in West Monroe, Louisiana. The award will provide handheld units to students who pass their licensing test to get them active immediately. Members of the Northeast Louisiana Amateur Radio Club mentor the high school club throughout the year.

To learn more about the ARRL Foundation Grant Program and the next time the Foundation will be accepting proposals, please visit **www.arrl.org/amateur-radio-grants** or email **foundation@arrl.org**.

Certificate of Code Proficiency

Recipients

Sponsored by
VIBROPLEX
www.vibroplex.com

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.

September 2022

Stephen T. Stollmeyer, KD9VKZ	10
Raymond F. Gurney, KD0FYF	15
Glenn E. Schnell, KC3LBI	15
Greg J. Von Bokern, WA6NTM	20
Joseph W. Chapman, NV1W	20
Michael W. Kelly, AA6MK	35
Paul D. Marioli, KB1NCD	40

October 2022

Donald Chu, KB3JMT	10
Jeffrey D. Herman, KH6O	10
Steven M. Jones, KA6PRW	10
John H. Kelly, WA2CHV	10
Ron Kinney, KC3ZPS	10
John W. Wilson, K5BOI	10
Michael F. Born, W9JXT	15
Jack W. Bumgarner, WS5D	15
William C. Johnson, KB4DE	15
John H. Kelly, WA2CHV	15
Lance B. Salmonsen, WA1IWI	15
Sean Walberg, N3RTW	20

November 2022

Ryan M. Ernest, KF0GVX	10
Donald A. Cutshaw, KO4KYN	15
John S. Hickman, WW3B	15
Thomas J. McGuire	15
David A. Rose, N8GZ	15
Jack W. Bumgarner, WS5D	20
Keith A. Marang, W4AFB	20
Paul W. Peterson, K1HIS	20
Niece Haynes, KA1ULN	35
Dennis A. Mills, NT4U	40

Congratulations to all of the recipients.

February 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.

February 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 KH6TU on Wednesday, February 22, at 7 PM HST (0500 UTC on February 23) on 7047.5 and 14047.5 kHz. Unless indicated otherwise, sending speeds are from 10 to 40 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.

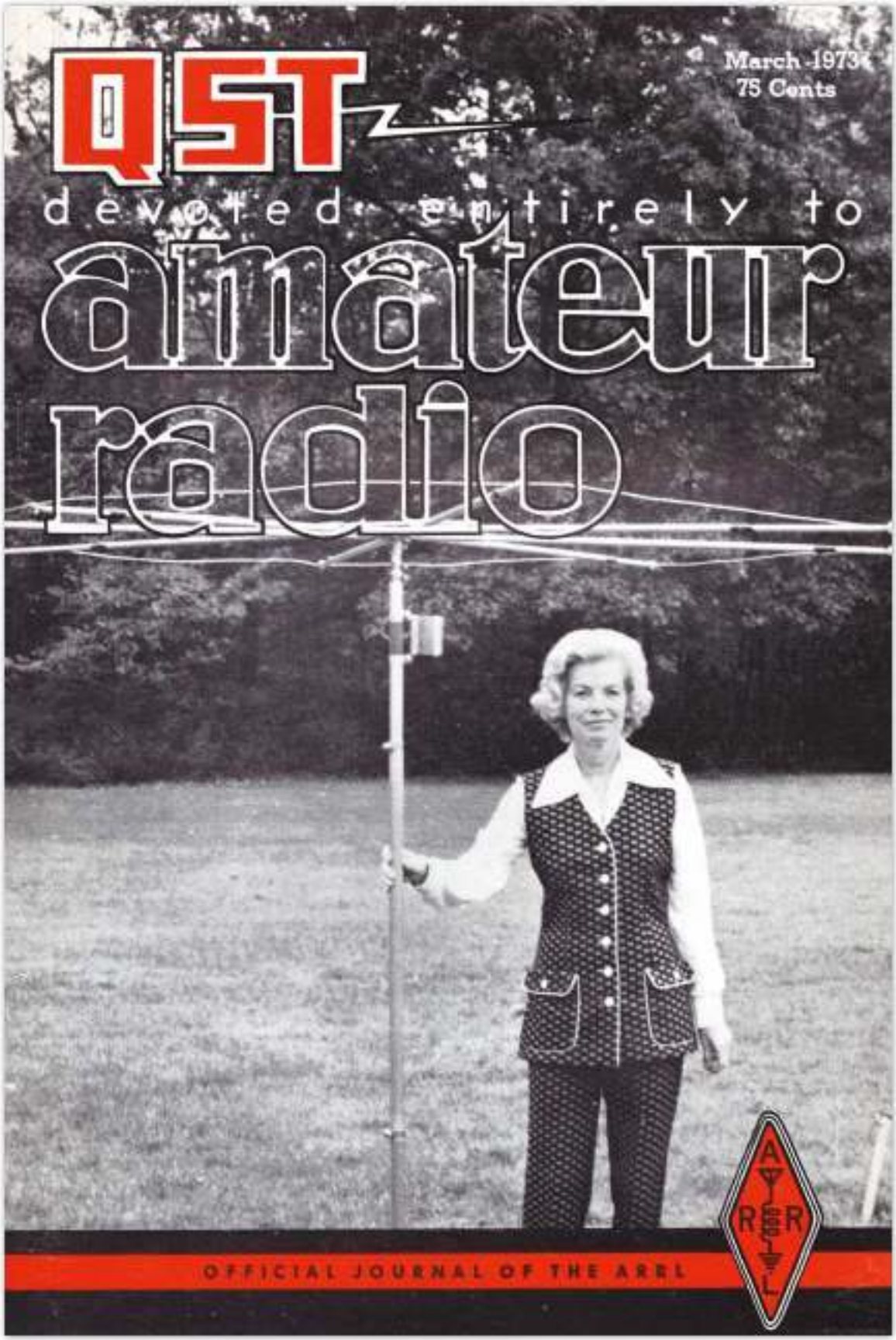
For more information about Qualifying Runs, please visit **www.arrl.org/qualifying-run-schedule**.

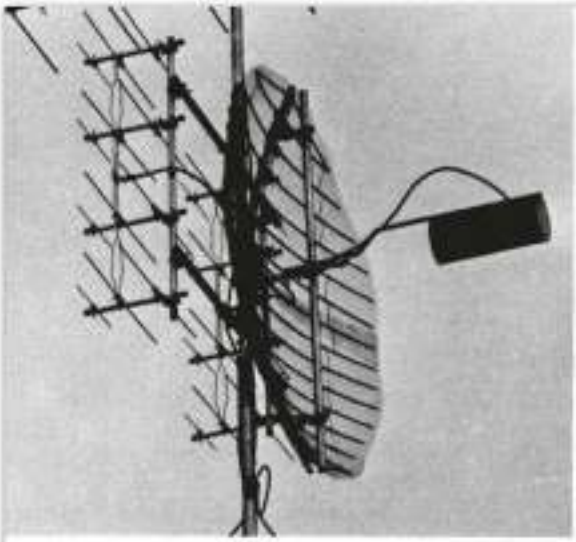
For information about how to qualify for the Certificate of Code Proficiency, please visit **www.arrl.org/code-proficiency-certificate**.

W1AW Qualifying Runs — February 2023
(All times are in Eastern Standard Time.)

Monday	Tuesday	Wednesday	Thursday	Friday
		2/1 4 PM – 2100Z 10 – 35 WPM	2/2 10 PM – 0300Z (2/3 – UTC) 10 – 40 WPM	2/3 9 AM – 1400Z 10 – 35 WPM
	2/7 4 PM – 2100Z 10 – 35 WPM	2/8 7 PM – 0000Z (2/9 – UTC) 10 – 40 WPM	2/9 9 AM – 1400Z 35 – 10 WPM	2/10 10 PM – 0300Z (2/11 – UTC) 10 – 35 WPM
2/13 10 PM – 0300Z (2/14 – UTC) 35 – 10 WPM		2/15 9 AM – 1400Z 10 – 35 WPM	2/16 7 PM – 0000Z (2/17 – UTC) 10 – 35 WPM	2/17 4 PM – 2100Z 10 – 40 WPM
Presidents Day	2/21 10 PM – 0300Z (2/22 – UTC) 10 – 40 WPM		2/23 4 PM – 2100Z 35 – 10 WPM	2/24 7 PM – 0000Z (2/25 – UTC) 10 – 35 WPM

A Look Back


QST
March 1973
75 Cents
devoted entirely to
amateur
radio
OFFICIAL JOURNAL OF THE ARRL
ARRL



Converted uhf TV dish, with wave-guide-transition feed, used at WA2LTM on 1296 MHz.

Simple and Efficient Feed for Parabolic Antennas

Low-Cost Waveguide Transition Feeds for 1215 and 2300 MHz

BY DOLPH VILARDI,* WA2VTR

MANUALS ORDINARILY AVAILABLE to amateurs do not discuss simple antennas for frequencies above 1000 MHz in full detail. The writer described conversion of readily available parabolic TV antennas about three years ago in *QST*.[1] Since that time much information has been accumulated regarding the performance of these converted antennas. Many 1296-MHz stations have used them with good results. Example: WA2LTM, the current 1296-MHz states-worked leader, is using such an antenna, with the feed system about to be described. What appeared at first to be rather fragile construction has been shown, over several years, to be adequate for amateur use. Performance has been outstanding, and the only difficulties encountered have been with the feed systems originally described.

Experience shows that coaxial transmission line is practically a necessity for reliable performance. The uhf characteristics of available coaxial lines are discussed in a *Ham Radio* article by the writer,[2] and will not be reviewed here. A fair idea of the merits of various lines can also be obtained from the information given for 50 through 450 MHz in *The Radio Amateur's VHF Manual*, Chapter 8.

With coaxial line, matching of the feed point to the line at frequencies above 450 MHz becomes a bit more complicated than on lower frequencies, where the flexible-coax balun is practical. For this reason, and in order to achieve better illumination of the parabola, some form of waveguide transition is highly recommended. Instructions for construction of this type of feed given in the 1969 article were somewhat sketchy, as readily available and inexpensive materials were not specified.

The wave-guide-transition feed is precisely what its name implies: nothing more than a transition from coaxial line to wave guide, of suitable cutoff frequency for the band in question. Length of the wave guide section so used, for probe-type transition and proper illumination, has been determined by W2CCY to be at least two wavelengths. Some useful information regarding dish illumination was given by WA9HUV in *QST*.[3] A major advantage of the wave-guide feed, in addition to more effective illumination, is that it is very easy to match perfectly to the transmission line, a factor of extreme importance at these frequencies.

* 14 Oakwood Terrace, Spring Valley, NY 10977

1 Vilardi, "Easily Constructed Antennas for 1296 MHz," June, 1969, *QST*.

2 Vilardi, UHF Transmission Lines, May, 1971, *Ham Radio*.

3 "World Above 50 Mc.," June, 1971, *QST*, p. 101.

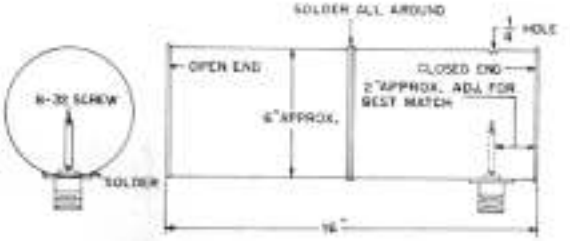


Fig. 1 — Dimensions for the wave-guide-transition feed for 1296-MHz use. The wave guide is made from two antifreeze cans soldered end to end.

Tin-Can Wave Guides

Construction of a wave guide-transition feed is easy, as can be seen from the drawings. Materials are no problem. The guide itself can be made from two anti-freeze cans (Zerex and others) soldered together, end to end. The overall length of the cans when joined should be approximately 16 inches, or about two wavelengths at 1296 MHz. Dimensions for a 2300-MHz feed are also given. Diameter, for the 1215-MHz band, should be about 6 inches, though there is considerable latitude here. It is important only that the wave guide be of sufficient diameter to pass the frequency for which it is being used.

After the cans are soldered together they should be given several coats of paint to make them as weather-resistant as possible. Primer paint for automotive use, plus two coats of epoxy, does a very good job. There are other rust-resisting finishes that work well.

The probe is 1/4-inch brass or copper tubing, approximately 1-7/8 inches long. One end is threaded internally for an 8-32 screw, which will be used as a tuning adjustment. The other end is soldered to the tip of an N-type coaxial fitting, the body of which is soldered to the wall of the can, before painting. Mask the probe and fitting, so that they are kept free of paint during the spraying operations. Silver plating of the probe is desirable, but not absolutely necessary.

Adjustment and Use

Before the can is painted and the N fitting is fastened in place permanently, the position of the probe with respect to the closed end of the can must be adjusted, along with the length of the probe, for optimum impedance match. As shown in Fig. 1, this will be very close to a quarter-wavelength, or about two inches in the 1296-MHz feed. The hole in the can wall can be made oblong, to permit movement of the probe while maintaining contact between the fitting flange and the can wall. The screw in the probe end is reached with a small insulated screwdriver, through a 1/4-inch hole drilled in the can above the probe end. By careful adjustment of the position and length of the probe, it is possible to get a practically perfect match. Openings in the can wall can be covered with plastic tape or epoxy putty when the process is completed, and the fitting has been soldered in place.

The SWR indicator should be one that is adequate for the frequency,[4] and it should be connected through a short length of cable, near to the antenna. The adjustment of the probe should be made with the feed illuminating the parabola, in or near the position in which it will be used. Several types of mountings are usable, and two commonly used mountings are shown in Fig. 2. With either, a wrap-around clamp of sheet metal is used to hold the feed in position, loosely at first and firmly, once the exact position desired has been determined.

[4] Uhf barrels for the Micromatch are on the surplus market occasionally. For other uhf SWR-measuring equipment, usable to 1300 MHz, see Burhans, June, 1960, *QST*, p. 30; Tilton, January, 1969, *QST*, p. 36; or Fisher and Turrin, September, 1970, *QST*, p. 26.

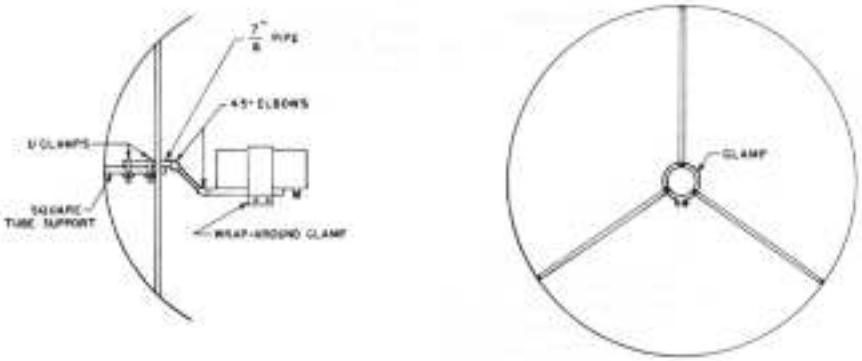


Fig. 2 — Two ways of mounting the wave-guide feed, gooseneck (left) and tripod (right). Open end of the guide assembly is approximately three feet from the center of the dish surface, with its position adjustable for focusing.

Homemade 5-foot dish, with wave-guide feed, used by WA2VTR. Mechanical construction was by W2DWJ, to specifications by W2CCY.

The center line of the feed assembly should line up exactly with the center of the parabola. This can be done visually with reasonable accuracy, but the ideal result is obtained by checking the rf level around the periphery of the dish, for uniformity. A loop, diode, and low-range milliammeter used in the manner of a field-strength meter will serve this purpose. Whatever mounting method is used, provision should be made for focusing, to get the feed at the focal point of the dish. The focal point should be somewhere around one inch inside the mouth of the feed. A final check should be made with a field-strength indicator 40 or 50 feet in front of the dish, moving the feed along the dish centerline for maximum indication. Remember that energy at these frequencies is reflected very readily. Do the work in an open area, with no large trees, buildings, cars or other reflecting objects in the field of the antenna.

Use low power (3 to 5 watts) for the tests. Be sure that the antenna is positioned so that people will not be submitted to main-lobe radiation at distances less than 50 feet, when very high power levels are used. *Never look into a wave guide that is carrying rf power.* The eyes and head are particularly sensitive to injury from exposure to uhf radiation.

Mounting

The converted TV dish tends to lean backward slightly, because of its weight distribution. In most other installations the dish tends to lean forward, causing some loss of efficiency. It is recommended that the dish, when finally mounted on the tower, be tilted so that it aims about five degrees above the horizon.

The mount shown at the left of Fig. 2 is adapted to use with the antenna mounting described in the June, 1969, *QST* article. The supporting arm is made of 7/8-inch copper pipe, two 45-degree elbows, and a short connecting piece of such length as to bring the center line of the feed in line with the center of the dish. The clamp around the feed is bolted to the support, with the nuts being tightened firmly once the desired position for the feed is found.

A somewhat similar arrangement is used for the tripod mount, at the right. The ends of the supporting members are bent parallel to the wall of the feed, to clamp under the wrap-around strip, as shown.

2300-MHz Version

Two No. 2-1/2 fruit or vegetable cans soldered together can be used for a 2300-MHz feed. The probe for this frequency is 7/8 inch long, and it should be located about 7/8 inch from the closed end of the can. Most SWR bridges will not work well at 2300 MHz. Be sure that an instrument suited to the frequency is used in adjusting the match, as near-perfect matching is increasingly important as the frequency increases. QST

Strays

Registration for Repeater Directory

We encourage annual registration of all repeaters with ARRL for listing in the *Repeater Directory*. Repeaters and remote base stations should register by May 1, using the special registration card CD85A. Registration cards are available on request from ARRL. To expedite mailing, please enclose an addressed stamped envelope. People who have registered repeaters in the previous edition of the Directory have already received registration cards.

If repeater call has changed since the previous listing, please indicate the former call on the registration card. This is important so the old call can be deleted from the new Directory. Please submit the present repeater call. If the call should change before the May 1 deadline because of the new repeater regs., postcard notification of old and new call is all that is necessary. QST

Moonbounce receiving tests with amateurs will be conducted by the Naval Research Laboratory using a 150 foot parabolic dish. See January *QST*, page 58 for background info. Here is the schedule for reception:

April 1973 — **1296.000 MHz**

Date	*Start* GMT	*Stop* GMT	*Area*
March 31	1000	1030	Europe
	1030	1100	E. Coast USA
	1100	1130	Midwest & W. Coast
	1930	2000	Australia

432.000 MHz and 144.050 MHz

April 1	1200	1230	Europe
	1230	1300	East Coast US
	1300	1330	Midwest and W. Coast
	2030	2100	Australia

Producer VE3BQN stands behind the camera ready to film "Fine Business." Stars VE3MJ and VE3GYL (to be) in the car, while the shooting crew gets things in order.

"Fine Business"

VE3BQN, Ted Sparrow, has produced a first-rate motion picture on amateur radio using the above title. VE2MS, VE3SU, and VE6FK have prints for loan to nearby Canadian clubs; Hq. can supply U.S. clubs. Here Ted shares with us some of the trials and tribulations he encountered in production.

The initial draft of the script was written on Easter weekend at my cottage on an island in Parry Sound. Field Day was our first day of shooting. We arrived early but the weather was overcast with possibilities of rain. We filmed for about 2 hours but the camera man called a half due to bad lighting. We tried to rig up lights so we could film in the tents but to no avail, so we quit for the day hoping for better weather the next day. We arrived Sunday to find the park covered with fog so thick visibility was less than 10 feet. It was then necessary to have a simulated Field Day which was scheduled 2 weeks later at the same park. Marty, VE3MR, then decided he did not want the lead part, so then Mort Wolfson, VE3MJ, was recruited. We had set up the antenna and tents the night before, and just as we were preparing to leave a local motorcycle gang rode through the park; since they were suspiciously eyeing our equipment and since we could picture our antenna being pushed over the edge of the cliff, we decided to hire a guard for the night. At Field Day we called a large number of stations and made tape recordings, and these were used at our simulated Field Day. The weather for our second Field Day was perfect.

Filming resumed on September 15 at the Department of Communications. At this time it was necessary to train my receptionist Pat Watts to do the sound recording since my sound man was out of town. At the D.O.C. we had problems with the elevators – we finally had to hide one of the inspectors in the elevator with a walkie talkie to tell us when the elevator would arrive! The scene with Patsy walking from the elevator lasts about 50 seconds in the movie, but it took about 2-1/2 hours to shoot.

The following weekend we did the shooting at Mort's shack, where we ran into an interesting problem with the light dimmer which introduced a great deal of noise into the recorder; it took a while to find the source of the noise, but when we did it was only necessary to turn off the switch to rectify the situation. After 7 hours at Mort's shack the film was sent to the lab for processing; but due to an error at the lab, the film was returned undeveloped! Luckily the film had been opened in a dark room and there was no damage done to it. The prospect of reshooting another eight hours left us cold.

"Ham and His World" was being held at the Ontario Science Center on the 18th of October, and filming finished on the 15th of September. We started madly editing; at one point my editor, Murray Wallace, edited for 26 hours straight – then we had to cut the work print and transfer it to the master print. Murray then spent another 30 hours cutting the negative in order to have the film ready. The film was a great success at the Science Centre where it was shown for 5 days. In November, at the Radio Society of Ontario Convention, the film was shown at least 6 times, but was originally scheduled to be shown only twice. The distributor has requested more prints to keep in his library since there has been a great deal of interest shown in this movie. Marty Rosenthal took a copy to Israel and the gang over there enjoyed it very much.

Patsy took the part seriously enough to study in earnest for her license, and surprised us all by obtaining it in time to have it presented to her at the premiere of the movie – and she is now known as VE3GYL. QST

Celebrating Our Legacy

Getting My Start in Ham Radio

One night in 1955, I found my father building a 2-meter receiver. My dad was not licensed at the time, but he explained to me what ham radio was. I wanted to find out more, so I borrowed old copies of *QST* from the library, and used them to learn about code, electronics, and what was required to pass a license exam. I searched for local hams in my town, and this led me to the Watchung Valley Radio Club, now the New Providence Amateur Radio Club.

Mainly, the club was made up of engineers from Bell Labs in Murray Hill, New Jersey. Letting a 15-year-old kid join their club caused great consternation, but they eventually welcomed me. One of the members took me under his wing, and after I passed the Novice exam, I volunteered as an operator for the local civil defense office. The 2-meter Gonset radios were in use at that time. I still remember watching the green "eye" tune frequencies.

My dad and I later put up an 80-meter dipole antenna in our backyard. I used an old Navy RAL-7 receiver to build my first transmitter. It was made on a wooden chassis with two coils that moved up and down for maximum brightness on a 15 W bulb.

After I made my first successful contact, my mother yelled from upstairs, "You are blowing up all the TVs and the neighbors are calling!" Thus, I was forced to operate late at night, after Channel 2 went off the air at midnight.

Not long after, a few of my buddies and I went to New York City to the FCC to take the General license test. Afterward, we celebrated by going to Radio Row, where I made my first big equipment purchase — an ARC-5 receiver for $5.

In order to quiet the disgruntled neighbors, my dad purchased a Heathkit AT-1. We built an antenna and fed it with coax, and I was able to operate whenever I felt like it. I started working DX and caught the bug that still excites me today.

Marty Green, K2PLF, 1955. His Gonset radio is at the upper left.

Throughout all of this, my dad was quietly working on his Novice license. One evening after dinner, he proudly showed me his license with the call sign KN2TEO. Subsequently, my dad went to New York City and got his General license. For the past 23 years, I have funded the K2PLF Martin J. Green, Jr. Memorial Scholarship through the ARRL Foundation in his honor.

Martin J. Green, Jr., K2PLF (SK)
Silver, Maryland
Life Member

Multi-Generational Call Sign Legacy

My late father, Robert Cassidy, W2LTY, got his first amateur radio license at the age of 16 in 1938. He proudly served as a radio operator on Liberty ships in the US Merchant Marine during World War II.

When I was growing up, my father had his "radio room" in the basement of our home. It was verboten for my siblings and me to go in there, but we could observe him while he was on the air. My father held an Extra-class license and preferred CW. It amazed me how he made the Vibroplex bug sing. He could receive CW so quickly that he couldn't write it down fast enough. He proudly maintained his active amateur radio and Merchant Marine status until he passed away in 2004.

My brother Brian, originally WB2PIZ, had been an amateur operator since he was in high school in the 1970s. When our father passed away, Brian applied for his call sign. He was granted W2LTY in January 2006, and was proud to carry on our father's call sign legacy until his passing in 2012.

After my brother passed away, I wanted to do something to keep his, as well as my father's, amateur radio legacy alive. Finally, I got my Technician license in October 2014. I immediately set out to get the W2LTY call sign, and was granted it the next month.

The W2LTY call sign has been a celebrated legacy in the Cassidy family for over 80 years!

Sean Cassidy, W2LTY
Montgomery, Alabama
Life Member

Send reminiscences of your early days in radio to "Celebrating Our Legacy," ARRL, 225 Main St., Newington, CT 06111 or **celebrate@arrl.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.

Jerry Spring, VE6TL, ve6tl@yahoo.com

Classic Radio

Restoration of the SST-1-E Suitcase Transmitter

During World War II, the US intelligence agency, known as the Office of Strategic Services, used one of the most famous clandestine radios — the SSTR-1 (Strategic Service Transmitter Receiver-Model 1). This spy set was developed in 1942 and was extensively used by resistance agents operating in occupied (European) territory and in the China Burma India Theater.

The set consisted of a separate receiver, transmitter, and power supply, all designed to fit in a suitcase-style storage case. A variety of models were produced, including receivers (models A to G) and transmitters (models A to E).

Rebuilding the Transmitter

The transmitter I restored was the SST-1-E model, which saw service until 1953. Blair Shaw, VE6AGH, one of the premier military radio collectors in Canada, loaned me this unit to repair. Unfortunately, Blair has been unable to locate a matching receiver or an original power supply, but he has found a suitcase, should these units be recovered one day (see Figure 1).

The unit was in fairly good cosmetic shape and included a schematic glued to the inside of the case bottom. Figure 2 shows the inside of the unit. The 6L6 pentode vacuum tube has been removed to show the underside of the crystal holder and the built-in Morse code key, which Blair repaired. The crystal holder supported a variety of crystal sizes. The lower right of the photo shows the roller inductor, which was patented in 1944 and first used in this model. Use of the air variable capacitor, along with the roller inductor, allowed continuous coverage of frequencies between 3 and 15 MHz.

Figure 1 — The SST-1-E transmitter in its original suitcase.

I discovered that the transmitter had several missing components and a few disconnected wires. After sketching out the circuit that was in the radio, I was able to compare my drawing to several single-tube 6L6 transmitter schematics I found online — most notably, the Stancor 25-B Transmitter, which was printed in the fifth edition of *Stancor Hamanual*. The first thing I noticed was that the values of the resistors in the voltage divider circuit between the plate and screen grid were off. I replaced both with tested new old stock resistors. Second, I noticed that the transmitter was missing the two radio frequency chokes (RFCs) designated as L1-A and L1-B, per the SST-1-E schematic. The Stancor book indicated values of 2.5 mH for both. Suitable chokes were soldered in place. Heat-shrink tubing was used to isolate these components, as space was at a premium. The last repair at this stage was to re-solder the disconnected wires.

Testing and Troubleshooting

With everything in place, I checked the values of the remaining components before applying power. This led to the replacement of one additional resistor that had cracked. The two FT-243-style crystals (for 80 and 40 meters) worked properly with a commercially made crystal tester. The 6L6 also tested well, as did the tuning lamp, variable capacitor, roller inductor, etc. The circuit was slowly brought to life using a variac, or variable transformer. The tube's filament lit up, and after some fiddling with the tank circuit, the tuning lamp began to glow. Unfortunately, the output was not on the crystal frequency, but measured on my oscilloscope around 40 MHz. After additional experimentation with the two crystals, I discovered that the 40 MHz output could be obtained without any crystals. This suggested a problem with parasitics.

Figure 2 — The bottom of the transmitter when I received it.

The suspect parasitic choke in the plate circuit had an inductance of 1.5 µH. This value seemed far too small, so I looked it up. According to "A 6L6 Classic" by William Wiegand, WØVLZ (**www.prismnet.com/~nielw/6l6/6L6.htm**), the choke could be fabricated using a 2 W resistor (47 to 100 Ω) wound with eight turns of #20 wire. I used a 100 Ω resistor, and after winding it, measured 500 nH of inductance — a huge difference from the original inductor. The 40 MHz signals were gone, and the transmitter worked nicely on the crystal frequency.

My wattmeter measured a maximum of 2 W into a 50 Ω dummy load. The tuning lamp would glow brightly at this level; however, it was on the dim setting of a toggle switch. By shunting in additional resistance in the bright position, higher output power should be achievable without burning out the lamp. As for the low output power, the power supply was not original, and this one provided only 170 V dc B+, which is about half of the 350 V dc that would have come from the original power supply. Thus, with higher voltage, the output would have been significantly greater.

Figure 3 shows the two new RFCs (green inductors), as well as the two replacement resistors in the voltage divider circuit. In Figure 4, the 2 W, 100 Ω, wire-wound parasitic choke can be seen mounted behind the tube socket.

The signal appeared clean on the oscilloscope and also sounded good on my modern transceiver. After checking all the connections one final time, the case was put back together, and the radio continued to work nicely.

Transmitter Operations

I put the SST-1-E on the air on the 40-meter band and attached it to an inverted-V antenna, with the apex at 40 feet. I used my refurbished World War II Marconi R1155 receiver for the test. From my location in Calgary, Alberta, Canada, using 2 W output, it was encouraging to see the signal picked up on the Reverse Beacon Network by Edward Gisske, K9IMM, in Wisconsin, as well as the Anderson Island Amateur Radio Club, WA7AI, and John Petrich, W7FU, in Washington. The following night, Jim Leslie, VE6JF, who lives about 10 kilometers away, provided a live QRP contact.

Figures 3 and 4 — These two figures show the modifications performed. Figure 3 (on the left) shows the two new RFCs and two replacement resistors in the voltage divider circuit. Figure 4 (on the right) shows the 2 W, 100 Ω, wire-wound parasitic choke mounted behind the tube socket.

With the successful tests, the SST-1-E restoration was ready for Blair to pick up. The suitcase transmitter is still awaiting the original power supply and matching receiver. If you know the whereabouts of these important pieces of radio history, contact Blair at **ve6agh@yahoo.ca**.

All photos by the author.

100, 50, and 25 Years Ago

February 1923

- The February cover shows Uncle Sam congratulating "The Transatlantic Hero." K. B. Warner gives a detailed account of the transatlantic tests in "The Transatlantic Triumph."
- Hiram Percy Maxim outlines the process used to formulate amendments to the White Bill to make reasonable provisions for the future of amateur radio communications in "The Hearings on the White Bill."
- W. B. Shulte shows how to estimate battery life in "Hours of Service of 'B' Batteries."
- S. Kruse edited a compilation of letters on "Synchronous Rectifiers for Plate Supply," an idea that began in California.
- The Editorial asks "Does This Shoe Fit You?" in response to the hundreds of letters received during the Transatlantic Tests concerning QRM from American amateurs.
- "The Junior Operator: Broadcast Comments Needed" relates interference issues between broadcast and amateur stations, and what amateurs can do to help create awareness and a solution.

February 1973

- Our cover shows HQ staffer Judy Mann, WA1JCN, putting the final touch on her QRP transmatch that is described in "A Transmatch for QRP Rigs," by Doug DeMaw, W1CER.
- "It Seems to Us...Disaster in YN" discusses the efforts of hams following the December 22, 1972, earthquake in Managua, Nicaragua.
- Edward Tilton, W1HDQ, comments on two versions of "An Efficient 2-Meter Amplifier — At Moderate Cost" designed by Guy Howe, K5KHA.
- Thomas P. Riley, WA1BYM, builds "An IC Keyer with Programmable Erasable Memory" using MOS shift registers.
- A. P. Marsh, W3MJ, shares his hint for "Antenna Insulators and Spreaders from Plastic Clorox Bottles" in "Hints and Kinks For the Experimenter."
- J. M. Smith, W4BP, shares some "Notes on the Extra Class Examination."
- Have you worked Oscar 6? "Oscar News" by David Sumner, K1ZND, is looking for projects, experiments, or interesting DX that came through the satellite.
- Traveling with ham equipment? Edward Sleight, K4DJC, and Charles Voss, K5DNH, offer suggestions in "Correspondence From Members: Airline Safety."

February 1998

- Put a network analyzer to work and gain circuit insight by measuring your designs in "Build Your Own Network Analyzer — Part 2" by Steve C. Hageman. Steve's homebrew network analyzer is featured on the cover.
- David Sumner, K1ZZ, offers some lessons learned from the 1997 World Radiocommunications Conference in "It Seems to Us...What WRC-97 Means For Us." A summary of the conference appears in "WRC-97 — An Amateur Radio Perspective" by Larry E. Price, W4RA, and Paul Rinaldo, W4RI.
- Amateur radio volunteers assisted local disaster agencies when a flood submerged two Red River Valley communities in "The Grand Forks Flood" by Morgan H. James, KF0EN; Gerry Nies, N2NGW, and John Engel, WA0LPV.
- If you've never used a MOSFET-powered transmitter before, give this one a try! "A Simple CW Transmitter for 80 and 40 Meters" by Charles Kitchin, N1TEV.
- Jeff M. Gold, AC1HF, describes some inexpensive and easy-to-make keys in "Build Your Own Code Keys!"
- Anticipation for the launch of two future satellites, SEDSAT-1 and ASUSat-1, is reflected in "Amateur Satellites: Two More Satellites for 1998?" by Steve

Silent Keys

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

K1BA **Bacon**, Allan L., Hingham, MA
KY1C **Gooch**, Paul E., Wells, ME
KA1DTA **Rezendes**, David A., Taunton, MA
♦◆AB1GL **Lillenstein**, George D., Manchester, CT
vN1GRC **Kilmartin**, Michael M., Westbrook, ME
vW1IB **Baker**, Francis A., Deerfield Beach, FL
N1LZH **Pietrowsky**, Patricia C., Pittsfield, MA
*K1NOR **Denoncour**, Harold "Joe," Concord, NH
KB1RZM **Kempe**, Gordon P., Bristol, NH
*W1SSF **Manson**, Ronald J., Winslow, ME
WB2CNS **Gallerie**, Roland A., Halfmoon, NY
KC2MFL **Kessler**, Irma, Convent Station, NJ
vK2VYY **Jann**, Andrew E., Del City, OK
N2PPC **Busalachi**, Joseph J., Cheektowaga, NY
AG2R **Filipponi**, Gene, Broadview Heights, OH
KC2SQL **Marsh**, Judith A., Albany, NY
vKC2UMX **Ireton**, Richard W., Tuckerton, NJ
v♦N2WW **Imhof**, John D., Westampton, NJ
vKC2XN **Sax**, Raymond L., North Syracuse, NY
vW3ALD **Powers**, Myron C., Sebring, OH
vWB3CZG **Carley**, Raymond G., Brockway, PA
W3DJW **Mahoney**, John "Jack" III, Wayne, PA
KM3E **Taylor**, Elmer, Montrose, PA
N3GHI **Murray**, Bruce A., Pittsburg, PA
vKA3HPM **Buzon**, Jack J., Cheswick, PA
KA3KPM **Belles**, Catherine J., Dunmore, PA
N3LPO **Seyboldt**, Suzanne, Erie, PA
K3LPR **Raymond**, Ronald K., Bethlehem, PA
WA3MCP **Teasdale**, Dick, Bangor, PA
KA3VOE **Pavlochik**, Arline, Melville, NY
KU3Q **Waszak**, Conrad C., Brewster, NY
vK3RKO **Ostrum**, Dexter N., Pittsburgh, PA
vW3SYR **Quinn**, Robert L., McKeesport, PA
KC3TO **Fao**, Samuel R., Mount Airy, MD
KY3W **Stout**, David A., Berwick, PA
vN4ANW **Tyree**, James F., Jr., Apopka, FL
W4CW **Jones**, Lee J., Dandridge, TN
K4DGF **Hall**, Douglas C., Raleigh, NC
vN4EC **Brown**, Jerry M., Columbia, TN
KC4EZM **Stone**, Doris H., Hendersonville, NC
N4FF **Durant**, Grover A., Jr., Hattiesburg, MS
v♦WB4FXD **Simonds**, Terry M., Jr., Edenton, NC
K4IV **Coleman**, Gerald J., Theodore, AL
*KD4JFT **Garcia**, Robert C., Alpharetta, GA
W4MVA **Stock**, Carl G., Vinton, VA
KG4QNR **Welch**, Steven R., Prattville, AL
*KD4QWD **Smith**, Michael H., Martinsville, VA
vKD4R **Chapman**, Paul F., Maryville, TN
vK4SWK **Shinn**, Thomas E., Boca Raton, FL
KA4TOM **Emerson**, Thomas L., Collinsville, VA
KC4TT **Hindman**, Perry C., Chatsworth, GA
vW4TTF **Stevens**, Willard D., Cocoa, FL
vKE4TVX **Borum**, Richard E., Warner Robins, GA
vK4ULV **Jones**, William E., Jr., Amelia Court House, VA
K4VHV **Onley**, Albert E., Elizabeth City, NC
vN4VYR **Griffin**, David L., Cornelius, NC
vW4WM **Rinks**, Marcus E., Old Hickory, TN
vKJ4WS **Staggs**, Wade M., Hapeville, GA
KC5AKI **Barber**, James R., Southaven, MS
v*WB5AZP **Goff**, John R., Branson West, MO
N5BUD **Brown**, Richard H., Jr., Baton Rouge, LA
vW5DHB **Bradley**, Donald H., Live Oak, TX
vKC5EF **Barron**, Paul C., Dickinson, TX
K5ELO **Sanders**, Jackie, Edmond, OK
W5FPT **Tullier**, Francis P., Jasper, TX
vKE5FVY **Springer**, Paul A., Rio Rancho, NM
vAA5IW **Renfro**, Robert E., Ardmore, OK
K5JRP **Pitcock**, Jack R., Baytown, TX
vW5NJJ **Olivier**, Gerald J., Madisonville, LA
N5OJP **Richardson**, Linda, Oklahoma City, OK
vW5TZ **Wehrung**, George W., IV, Chappell Hill, TX
vW5GJW **Crusenberry**, Louis R., Pineville, LA
♦AB5W **Cecil**, Robert L., Sr., Shreveport, LA
vK6AYZ **Mahone**, Gary R., Banks, OR
AC6BW **Miller**, Roger W., San Jose, CA
vKE6BXK **Hill**, Robert A., Irvine, CA
v*KH6DHK **Bartz**, John K., Alexandria, VA
K6GFB **Lewis**, Lyle E., Novato, CA
♦W6HAT **Switzer**, Robert A., Scottsdale, AZ
vW6LHC **Corbaley**, Leonard H., Carmichael, CA
WA6POU **Pitts**, Robert D., Medford, OR
K6VIF **Hickish**, William W., Prescott, AZ
vKB7ALE **Rohn**, Douglas G., Yakima, WA
K7BIL **Lloyd**, William D., Brigham City, UT
KB7CZZ **Churchill**, Keith L., Wellsville, KS
N7DXY **Kozora**, Kathleen F., Canyon Creek, MT
♦AG7HM **Forsythe**, Kevin, Eugene, OR
*AL7G **Vansant**, James P., II, Cordova, AK
vK7IL **Parks**, Dean, Sequim, WA
vK7IXS **Mannings**, Alfred A., Kent, WA
AB7JF **Bollinger**, Fred C., Mesa, AZ
vNL7JT **Cassel**, Joseph M., Danbury, CT
vK7OCA **Thompson**, Richard C., Sandy, UT
v♦N7OM **Linkous**, Rodney L., Seattle, WA
vWA7ONU **Verley**, Duane A., Riverton, WY
WA7PVC **Hellwig**, Louis H., Seattle, WA
W7QJ **Rasmussen**, Sal, Silverton, OR
KF7RM **Matt**, Radar S., Phoenix, AZ
vKA7RNX **Hooper**, Gerald L., Coeur d'Alene, ID
vK7RO **Potter**, Harold F., Mulino, OR
vN7SIF **Howard**, Harvey L., II, Clarkston, WA
KC7SJC **Kimmel**, Erma R., Yakima, WA
♦K7TAJ **White**, Terry A., Canby, OR
K8AES **Pugsley**, Leland J., Jr., Rocky River, OH
N8EMI **Scott**, Larry N., Bowling Green, OH
N8GVC **Kanat**, Steven J., Royal Oak, MI
WD8MHL **Masko**, Raymond G., Medina, OH
vNF8N **Sherman**, Robert E., Leesburg, FL
♦WB8OP **McCully**, Robert B., Canfield, OH
W8OZM **Russo**, Phil, Willoughby, OH
KW8T **Hoffer**, James R., Calhoun, GA
N8YR **Shine**, Andrew J., Cortland, OH
♦WB8ZEJ **Kahn**, William H., Cleveland, OH
N9BBV **Heuermann**, Robert C., Jr., Washington, IL
vKA9BLW **Smith**, Ronald L., DeKalb, IL
vN9GJV **Nielsen**, John C., Sr., Kiel, WI
vKA9GLA **Molitor**, Mark E., Menomonee Falls, WI
W9HWQ **Fruechte**, Duane R., Trempealeau, WI
K9LPX **Deering**, Jerome W., Cornucopia, WI
vKA9NLX **Paskevicz**, John E., Arlington Heights, IL
vWB9NNS **Barr**, Ronald L., Sparland, IL
vWA9NYO **Sobkoviak**, James E., Plainfield, IL
K9OIC **Wallace**, Samuel L., Alsey, IL
vN9PSN **Widish**, Robert J., Milwaukee, WI
vKA9RGJ **Leischner**, James C., Cisco, IL
W9SP **Fearman**, Roy K., Hennepin, IL
vKC9T **Hammer**, James T., Cherokee, IA
vWD9WSO **Reed**, Marion E., Evansville, IN
WA9YXK **Steffen**, Ronald W., Springfield, IL
KA0CBZ **Northrup**, Mel E., Lincoln, NE
KB0CON **Rainbolt**, Kevin, Lawrence, KS
N0EWN **Kent**, Lee Roy, Dexter, MO
vWB0JGT **Thorne**, James G., Columbia, MO
K0JZB **Leduc**, Jim, Lockridge, IA
KE0SI **Altman**, Douglas V., Longmont, CO
vW0SIO **Majerus**, John B., Cedar Rapids, IA
K0VET **Howard**, John H., Warrensburg, MO
vN0VXN **Paris**, William B., Saint Louis, MO
*KA0WWV **Homme**, Donald W., Saint Paul, MN
♦VE7FO **Smith**, James M., Vancouver, BC, Canada
vK4CC/G3HCT **Bazley**, John, Toowoomba, QLD, Australia
DJ8ZB **Langner**, Franz, Ettenheim, Germany

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For information on how to list a Silent Key in QST, please visit **www.arrl.org/silent-key-submission-guidelines.**

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

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• Hybrid SDR Configuration • Unparalleled 70 dB Max. Attenuation • Quick-Tune • New Generation Scope Display SDSS • ABI (Active Band Indication) & MPVD (Multi-Purpose VFO Color 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 via Optional LAN Unit, ISCU-LAN10U

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 The Universal Multi-Signal Receiving Characteristics • Unparalleled - 70dB Maximum Attenuation (Quick-Tune • 15 Separate (HAM IC + GEN 5) Powerful Band Pass Filters • New Generation Scope Displays 3-Dimensional Spectrum Stream

NEW

FT-710 Aess | *HF/50MHz 100W SDR Transceiver*

• Unmodified SUP 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-10 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, RTTY/PSK Control

FTM-300DR | *C4FM/FM 144/430MHz Dual Band*

• 50W Output Power • Real Dual Band Operation • Full Color TFT Display • Bond Source • Built-in Bluetooth • WIRES-X Portable Digital Node/Feed Node with HRI-200

FT-2980R | *Heavy-Duty 60W 2M FM Transceiver*

• 60 watts of RF power • Large 5 digit backlit LCD display for excellent visibility • 200 memory channels for various 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

FTM-400XD | *2M/440 Mobile*

• Color display-green, blue, orange, purple, gray • GPS/APRS • Packet 1200/9600 bps ready • Spectrum scope • Bluetooth • WiresII slot • 500 memory per band

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 • Internal 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 with 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 • 5.5 Hour Rapid Charge in Cradle • Large White LED Flashlight, Alarm and Quick Home Channel Access

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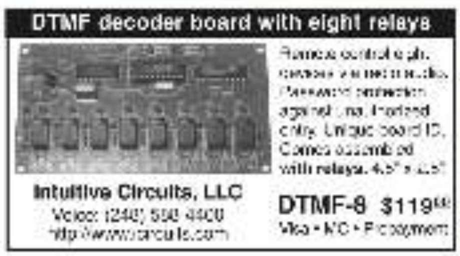
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For medium communications arrays up to 15 sq. ft. wind load area. 5-second brake delay. Test/Calibrate function. Low temperature grease permits normal operation down to -30° F. Alloy ring gear for extra strength up to 100,000 PSI for maximum reliability. *Precision* indicator potentiometer. Ferrite beads reduce RF susceptibility. Cinch plug 8-pin plug at control box. Dual 9B ball bearing race for load bearing strength, electric locking steel wedge brake prevents wind induced movement. North/South center of rotation scale on meter, low voltage control, max mast 2⅛".

HAM-VI **$1399.95** with DCU-2

HAM-VII **$1399.95** with DCU-3

HAM IV and HAM V Rotator Specifications	
Wind Load capacity (side tower)	15 square feet
Wind Load (w/mast adapter)	7.5 square feet
Turning Power	900 in. lbs.
Brake Power	5000 in. lbs.
Brake Construction	Electric Wedge
Bearing Assembly	dual race/9 ball bearings
Mounting Hardware	Clamp plate with U-bolts
Control Cable Conductors	8
Shipping Weight	76 lbs.
Effective Moment (in tower)	2800 ft.-lbs.

TAILTWISTER SERIES II

T-2X **$1099.95**

T-2XD2 **$1299.95** with DCU-2

T-2XD3 **$1249.95** with DCU-3

For large mechanical antenna arrays up to 20 sq. ft. wind load. 5-second brake delay. Test/Calibrate functions. Low temp grease, tough alloy ring gear, indicator potentiometer, ferrite beads on potentiometer wires, weatherproof AMP connectors plus 8-pin plug at control, triple bearing race (13B ball bearings) for large load bearing, electric locking steel wedge brake, North/South center of rotation scale meter, low voltage control, 2⅛" mast.

MSHD, $159.95. Above tower heavy duty mast support. Accepts 1⅞-2⅛" OD.

TAILTWISTER Rotator Specifications	
Wind load capacity (side tower)	20 square feet
Wind Load (w/ mast adapter)	10 square feet
Turning Power	1200 in. lbs.
Brake Power	9000 in. lbs.
Brake Construction	Electric Wedge
Bearing Assembly	Triple race/13B ball bearings
Mounting Hardware	Clamp plate with U-bolts
Control Cable Conductors	8
Shipping Weight	81 lbs.
Effective Moment (in tower)	3400 ft.-lbs.

CD-45II

CD-45II **$599.95**

For antenna arrays up to 8.5 sq. feet mounted inside tower or 5 sq. ft. with mast adapter. Low temperature grease good to -30 F degrees. New Test/Calibrate function. Ball rotator design gives total weather protection, dual 5B ball bearing race gives proven support. Die-cast ring gear, stamped steel gear drive, heavy duty, trouble free gear train, North center scale, lighted directional indicator, 8-pin plug/socket on control unit, snap-action control switches, low voltage control, safe operation, takes maximum mast size to 2⅛ inches. MSLD light duty lower mast support included.

CD-45II Rotator Specifications	
Wind load capacity (side tower)	8.5 square feet
Wind Load (w/ mast adapter)	5.0 square feet
Turning Power	600 in. lbs.
Brake Power	800 in.-lbs.
Brake Construction	Disc Brake
Bearing Assembly	Dual race/4B ball bearings
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	8
Shipping Weight	22 lbs.
Effective Moment (in tower)	1200 ft.-lbs.

Hy-Gain Programmable DCU-3
Digital Rotator Controller
DCU-3 -- $639.95

Hy-gain DCU-3 Digital Controller lets you program 6 beam headings! Gives you full automatic or manual control of your hy-gain HAM or Tailtwister Rotators.

Press a memory button or dial in your beam heading or let Ham Radio Deluxe (or other) take control. Your antenna auto rotates precisely and safely to your DX.

DCU-3 automatically jogs your antenna free and safely unlocks it before rotating begins (great for older rotators with "sticky" brakes) then turns off your motor before reaching its final heading. Your antenna gently coasts to a stop before the brake re-locks -- greatly reducing damaging overshoots and extending rotator life. Simply press Left and Right buttons for full manual control and fine tuning. Bright blue LCD shows current, dialed-in and computer controlled beam headings in one degree increments and your call.

Calibrate lets you accurately match your display to your true beam heading. Has USB/RS 232 ports for computer control. Adjustable LCD dead time. Field upgradeable for years. 8.5"Wx4.5"Hx8"D. 110 VAC. Order DCU-3X for 220 VAC.

DCU-2 Digital Rotator Controller --$519.95
Like DCU-3, but less programmable memories. 110 VAC.
Order DCU-2X, for 220 VAC.

AR-40 -- $499.95

For compact antenna arrays and large FM/TV up to 3.0 square feet wind load area.
Dual 12 ball bearing race. Automatic position sensor never needs resetting. Fully automatic control -- just dial and touch for desired location. Solid state, low voltage control, safe, silent operation. 2 ⅛" max mast. MSLD low mast included.

AR-40 Rotator Specifications	
Wind load capacity (side tower)	3.0 square feet
Wind Load (w/ mast adapter)	1.5 square feet
Turning Power	250 in. lbs.
Brake Power	450 in.-lbs.
Brake Construction	Disc Brake
Bearing Assembly	Dual race/12 ball bearings
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	5
Shipping Weight	14 lbs.
Effective Moment (in tower)	300 ft.-lbs.

Replace your Yaesu Rotator Controller

YRC-1 - $429.95

Hygain YRC-1 – more features, more robust, far less prone to lightning damage. Costs less than repairing!

Easy-to-use – dial in your beam heading and tap GOTO button. Exclusive 180 degree *AutoReverse*® for fast, longest path operation. All DCU-2 features. Bright blue LCD shows current, dialed-in, computer controlled beam headings, call. USB port for computer control. Extra heavy-duty AC power supply. Fast, reliable DC motor minimizes overshoot. Intuitive menu. Field upgradeable. For Yaesu G-800/1000/2800/5400/5600. AC or DC motors.

YRC-3, $519.95. Like YRC-1 and adds 6 memories.

AR-500 Rotator/Controller -- $199.95

UHF/VHF/6-Meter, MFJ-1886 Rotator/Controller and Remote. For use of a small VHF/UHF/6M, TV, FM, the MFJ-1886 wide band receiving loop and other lightweight ham antennas. Rotator is built in a weather proof and sleek cast aluminum housing with precision metal gears, steel thrust bearings and automatic braking. Includes rotator, controller, remote, clamps, and all hardware. AR-500 remembers up to 12 directions even after a power outage! Use remote control or direct console. Displays location and relative position.

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MFJ-4275MV high-current switching power supply gives 75A max/70A continuous. Great for ALS-500M amplifier. Adjustable output 4-16 VDC/ 110/220 VAC. Binding posts, quick connects, *PowerPoles*™, cigarette lighter socket on front. Battery charger gives charging current of 20A max, 5A continuous. 9¾Wx5½H x9½D". Only 10.5 lbs.

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25-Amps, $164.95

MFJ-4225MV Switching power supply gives 25A surge, 22A continuous. Adjustable 9-15 VDC output, 85-260 AC input. Large 3" dual Amp/Volt meters, binding posts, cigarette lighter socket. 3.7 lbs., 5½Wx4½Hx6D".

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MFJ-4230MVP is ham radio's best compact switching power supply -- just 5Wx2½Hx6D" and 3 lbs. Takes up little room on your operating position and perfect for home station, field day, DXpeditions, camping, hiking or for your next business trip or vacation. Gives 25A continuously or 30Amps surge at 13.8 VDC. Voltage is front panel adjustable 4-16 VDC. Selectable input voltage of 120 or 240 VAC at 47-63 Hz lets you carry it with you and use it worldwide. Front panel rocker switch lets you choose Amp/Volt meter for continuous monitoring. Cool operation with excellent 75% efficiency. Extra low ripple and noise is less than 100 mV. It's quiet! Continuous air flow gently cools the power supply and a heat sensor increases fan speed if the temperature rises above 70 degrees celsius. Over-voltage and over-current protection fully protects your transceiver and has ALARM LED. DC output is 5-way binding posts on front ***and*** *PowerPoles*™ on back. Power your HF, VHF, UHF rig and accessories with ease.

MFJ-4230MV, $154.95 *Binding Posts* on back.

MFJ-4230MPF, $149.95 *PowerPoles*™ on front of unit.

MFJ-4230DMP, $179.95 Like MFJ-4230MVP but has bright orange digital Volt/Amp display.

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MFJ-4235MV switching power supply. 35A surge, 30A continuous. 4-16 VDC, 1% voltage regulation. <9 mV peak-to-peak ripple. AC in: 90-125 or 200-240V. 7Wx4 ⅞Hx8½D". 4 lbs.

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MFJ-4125 gives 25A surge, 22A continuous. 13.8 VDC switcher has 5-way binding posts on front and quick connects on back. 3.5 lbs.

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MFJ-4035MV 19.2 lb. transformer, 35A max, 30A continuous. 1-14 VDC out. 110 VAC in. Highly regulated, 1% load, 1 mV ripple. 5-way posts, cig lighter. 9¼Wx6Hx9½D".

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MFJ-4125P. 25A surge, 22A continuous. 13.8 VDC switcher has 2-pair *PowerPoles*™, 5-way posts, quick connects. 3.5 lbs.

15-Amps, $94.95

MFJ-4115. 17A surge, 15A cont. 13.8 VDC. 110/220 VAC. 3¾Wx2½Hx7¾D", 1.5 lb. 5-way posts. **MFJ-4215MV, $94.95.** Like MFJ-4115 but has backlit volt/amp meters.

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MFJ-4128. 28A surge, 25A cont. 13.8 VDC. AC: 85-135/170-260 VAC. 5-ways, cig sock. **MFJ-4218MV, $139.95.** 0-24 VDC,18A@13.8/9A@24VDC.

MFJ *PowerPole*® Splitters

MFJ-1104, $69.95 *PowerPole*® Splitter, 30 Amp fused input, outputs fused at 25, 10, 5A. Open fuse indicator. 2¾Wx3½Hx1½D".

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Power multiple transceivers/accessories from a single DC power supply

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MFJ-1112, $69.95 Like MFJ-1116 but 6 pairs 5-way posts, no meter/switch. 12½Wx2¾Hx2½D".

MFJ-1117, $94.95 **High-current.** Powers four HF/VHF radios simultaneously -- 2 at 35A each, 2 at 35A combined. 6Wx2Hx3D".

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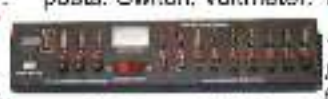

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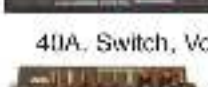

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MFJ-550
$34.95 Key only.

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MFJ Curtis-Keyer has all modes, dot-dash memories, jam-proof spacing, weight, sidetone, built-in speaker. Speed, weight and tone controls and tune, semi-auto and on/off are on front panel.

MFJ-401E *Econo* CW Keyer $119.95

Front-panel volume/speed controls (8-50 wpm), tune switch. Internally adjust weight/tone. Solid state keying. Tiny 4x2x3½ inches.

MFJ-564 Iambic Paddles $134.95

Deluxe Iambic paddles. Tension/contact spacing adjustments, steel bearings, precision frame, non-skid feet. Crome (MFJ-564) or Black (MFJ-564B).

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MFJ *CW keyer and Iambic Paddle* combo lets you send smooth, easy CW. Front panel volume/speed (8-50 WPM), built-in dot-dash memories, speaker, sidetone.

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Use as an adjustable phasing network. Combine two antennas to give you a powerful receive station and have a variety of directional patterns.

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MFJ-1026 simply plugs between your transmitting antenna and your transceiver. To null, you adjust the amplitude and phase potentiometer controls for a minimum S-meter reading or low noise. To peak, push reverse.

Use built-in active or external antenna. *Constant Amplitude Phase Control™* makes nulling super easy -- snag that rare DX you have missed.

RF-sense T/R switch auto bypasses your rig when you transmit. Adjustable T/R delay time. Use 12 VDC or 110 VAC with **MFJ-1312D, $26.95.** 6½X1½X6¼ inches.

MFJ-1025, $239.95. Like MFJ-1026, less the built-in active antenna. Use external antenna connection.

MFJ *Ultrasonic* Receiver with parabolic reflector *pinpoints* power line noise

HF and VHF operation can be affected by noise, makes it hard to hear weak stations, adds to fatigue. Often, noise comes from power lines. Power companies are willing to help with issues, but don't have equipment or trained personnel to locate it. MFJ aids in finding noise generated by corona discharge and arcing components. Acoustic receiver is tuned to 40 KHz. 18" diameter plastic dish gives a narrow beamwidth to pinpoint noise sources less than 12" at 50 feet. Also listen to nature: bats, birds, and insects!

MFJ-1918 **$249.95**

MFJ Power Line Noise Finder

Walk or drive around with these *handheld* power line noise meters to search out leaky insulators, loose hardware and corroded ground lines quickly. Track noise right down to the pole,transformer or insulator, or other source. Operates in 135 MHz region where activity is minimum and radiation from corona/arcing is more localized. 0.3 uV sensitivity and wide-range AGC for noise level meter -- *over 70 dB!*

MFJ 852 **$159.95**

MFJ-1767, $129.95. Adds 3-element beam to MFJ-852.

MFJ-856, $209.95. Combination of MFJ-852 noise finder and MFJ-1767 three-element beam antenna.

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 the 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 GaAs MMICs preamplifier gives high dynamic range, low IMD and 25 dB of low noise gain. Use inside or outside.

MFJ-1886 **$319.95** Receive Loop with Biastee

Reduce Harmonics, Avoid TVI with MFJ Low Pass Filters

Suppress TVI, RFI, telephone, other interference by reducing unwanted harmonics to your antenna. Your HF signal still passes through with low loss so you snag that rare DX! *Keep the wife and neighbors happy!*

MFJ-702B, $59.95. 200W. SWR below 1.5 to 30 MHz.

MFJ-704, $124.95. 1500W. SWR below 1.3 to 30 MHz.

MFJ-705, $179.95. 2500W. SWR below 1.3 to 30 MHz.

MFJ Clamp-on RF Ammeters

MFJ-854 **$159.95**

Clamp-On RF Ammeters quickly snap over wires and cables to measure RF currents flowing in antenna elements, radials, ground wires and on outside of coax. Tune counterpoises, radials, ground systems. Study/optimize antennas for peak performance. Find peaks/nulls. MFJ-854 has five calibrated ranges to 3 Amperes, including sensitive 30 mA range.

MFJ-853, $99.95. Like MFJ-854, Ranges: 0.3, 1, 3 A. Mini size.

MFJ-853H, $99.95. 3/10/30 A ranges.

MFJ-805, $139.95. Check RFI on cables up to 1/4" dia. VLF to VHF.

MFJ AC Line Filter/Protector

MFJ-1164B **$104.95**

Filters and reduces AC power line RFI, hash, noise, transients, surges generated by computers, motors, RF transmitters, static/lightning by 30 db and up to 60-80 dB with ground. Fast, *nano-second* overvoltage protection. Provides inductive isolation, capacitive decoupling, RFI rejection, overvoltage protection of common mode, differential signals. Rejects/shunts undesired signals to ground. 12Wx3½Hx2D".

Ferrite RFI Suppression Chokes

MFJ-70044, $21.95, .275" diameter 4-Pack
MFJ-70084, $21.95, .402" diameter 4-Pack
MFJ-70024, $24.95, .529" diameter 4-Pack
MFJ-70034, $28.95, .750" diameter 4-Pack

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MFJ ANTENNAS

MFJ Wire Antennas

G5RV – *Most popular antenna in the world!*

Operate 80-10 or 40-10M with tuner. 14 gauge, 7-strand copper antenna wire. 1.5kW. 32.5' ladder line matching section with SO-239 for coax.
MFJ-1778, $89.95. 80-10M. 102 feet long.
MFJ-1778M, $79.95. 40-10M. 52 feet long.

End Fed Half Waves

Operate 80-10 or 40-10M with one support/no tuner.
80-10 Meters, 132 feet:
MFJ-1982HP, $129.95. 800 Watts.
MFJ-1982MP, $99.95. 300 Watts.
MFJ-1982LP, $79.95. 30 Watts.
40-10 Meters, 66 feet:
MFJ-1984HP, $109.95. 800 Watts.
MFJ-1984MP, $89.95. 300 Watts.
MFJ-1984LP, $69.95. 30 Watts.

Off Center Fed Dipoles

Lightweight, virtually invisible. Gives you directivity and gain (*see MFJ website*).
MFJ-2012, $109.95, 40/20/10/6 Meters, 1500 Watts. 67 ft.
MFJ-2010, $89.95. 40/20/10/6 Meters, 300 Watts. 67 ft.
MFJ-2014, $139.95. 75/40 Meters, 1500 Watts. 122 ft.
MFJ-2016, $169.95. 160/75/40 Meters, 1500 Watts. 240 ft.
MFJ-2013, $109.95. 60/30 Meters, 300 Watts. 86 ft.

Dual Band 80/40 or 40/20 Dipoles, 1.5 kW

MFJ-17758, $129.95. 80/40 Meters, 95 feet long, ultra-efficient end-loading on 80 Meters. No tuner needed. Super-strong center insulator, built-in SO239, hanghole.
MFJ-17754, $89.95. 40/20M, 42 ft.

MFJ All Band Doublet

MFJ-1777, $99.95. 102 foot, 160-6 Meters with tuner/balun. *Extremely low feedline loss.* Super strong fiberglass center insulator provides stress relief for included 100 feet ladder line. *Ceramic* end insulators. 1500 Watts SSB/CW/Digital.

MFJ 1.5 kW Dipoles

7-strand, 14-ga. copper wire.*Ceramic* insulators. Center insulator with SO-239
MFJ-1779C, $59.95. 20-6M, 35 feet.
MFJ-1779B, $79.95. 80-40M,135 feet.
MFJ-1779A, $99.95. 160M, 265 feet.

20M Extended Double Zepp

MFJ-1742, $109.95. See web for gain. 90 ft. long, 100 ft. ladder line. 7-strand, 14-ga. wire. 80-10M with tuner/balun. 1500 Watts SSB/CW/Digital.

80M End-Fed Zepp

MFJ-1748, $109.95. 125 feet long, 100 foot ladder line included. 7-strand, 14-ga. wire. Use tuner/balun. 1500 Watts SSB/CW/Digital.

MFJ-915, $59.95 RFI Isolator

Prevents unwanted RF from traveling on your coax shield into your expensive transceiver. Prevents painful RF "bites" and erratic operation. 1.5 kW. 1.8-30 MHz.

MFJ-918, $59.95 4:1 Balun

True 1:1 current balun/center insulator. High-permeability ferrite beads on RG-303 *Teflon®* coax. 2" dia.x6" long. 14 gauge 7-strand copper wire. 1.5 kW 1.8-30 MHz.

MFJ-913, $59.95, 300W
MFJ-919, $84.95, 1.5 kW

True 4:1 current baluns/antenna center insulators transform 200 ohms to 50 ohms. 1.8-30 MHz. Transmission line transformer, low permeability ferrite cores. SO-239, stainless steel hardware with direct 14 gauge stranded copper wire to antenna.

MFJ Vertical Mounted Antennas

MFJ 6-Band Cobweb Antenna

MFJ-1836H, $319.95. Six-bands: 20/17/15/12/10/6 Meters, 1.5 kW. *Perfect for restricted space.* Nearly invisible. 9x9x½ feet, 8 lbs. Outstanding performance! Horizontally polarized gives less noise, more gain over verticals. Omni-directional. No radials needed! Works great at low heights. Low SWR.
MFJ-1836, $299.95. Like MFJ-1836H, but 300 Watts.

MFJ *4-Band* Dipole Octopus Antenna

***Octopus** antenna hub turns hamsticks into four balanced HF/VHF/UHF dipoles!* Rotate for maximum signal, minimum QRM/noise. Mount low for local NVIS, high for DX. Perfect for portable, limited space, HOAs, camping, ARES. Balun. No tuner needed.
MFJ-2104, $319.95. Includes 8 hamsticks for 75/40/20/15 M.
MFJ-2100, $139.95. Hub only. Use eight hamsticks.

MFJ Multi-Band Verticals, no radials needed!

Low angle radiation lets you easily work far-away, rare DX!
Efficient end loading gives maximum radiated power.
1500 Watts SSB/CW/Digital. Low SWR. Omni-directional. No radials or antenna tuner needed.
Low profiles blend into any surroundings. Mount them anywhere ground level, roof tops, apartments, houses, small lots.
Efficient high-Q coils. High power air-wound choke balun.
Built-to-last. Solid fiberglass rod, aircraft aluminum tubing.
5 models: Choose your bands 80-2 Meters
MFJ-1796, $359.95. 6 bands: 40/20/15/10/6/2M, 12 feet.
MFJ-1797, $399.95. 7 bands:40/30/20/17/15/12/10M. 23 ft.
MFJ-1797LP, $379.95. Like MFJ-1797, but only 9 feet tall. Narrower bandwidth on 40 Meters.
MFJ-1799, $699.95.10 bands: 80/40/30/20/17/15/12/10/6/2M. 20 ft.
MFJ-1799X, $639.95. Like MFJ-1799, but less 80M.

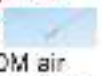
MFJ 43-foot Vertical, 160-6 Meter

MFJ-2990,$469.95. High performance 43 foot vertical operates 160-6 Meters, 1500 Watts SSB/CW/Digital. 2 square feet wind load. Self-supporting, no guy wires needed. 6063 aircraft aluminum tubing, bottom section 2" OD, .120" wall thickness. 20 lbs. Requires antenna tuner, ground/counterpoise.

BigStick ™ Vertical

MFJ-2286, $149.95. 7-55 MHz, *full 1/4 wave* 20-6M, 40M coil. 17 ft. extended, 28" collapsed. 2 lbs. 1 KW. Mount, radial kit included.

BigEAR ™ Dipole



MFJ-2289, $249.95. 7-55 MHz. *Full-size* 20-6 Meter dipole, 40M air loading coil. Two 17 ft. telescopic whips, 28" collapsed.

Lightning surge protectors

MFJ-270, $34.95. 400W.
MFJ-272, $49.95. 1500W.
Gas discharge tube shunts 5000 amps peak.< 0.1 dB loss. 1 GHz. SO-239s.

2-Position Antenna Switch

MFJ-1702C, $79.95. 2-position antenna switch, lightning surge protection, center ground.

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MFJ Dummy Loads & SWR/Wattmeters

Dummy Loads

World's most popular Dry 300 Watt HF /VHF Dummy Load

Air-cooled, non-inductive resistor in a perforated metal housing: Has SO-239 connector. Full 300W for 30 seconds. Derating curve to 5 minutes. SWR below 1.1:1 to 30 MHz, 1.5:1 30 to 650 MHz. Compact 2¼x2¼x7 inches. MFJ-260C **$59.95**

MFJ-260CN, $69.95. With type 'N' connector.

Dry 1.5 kW HF/VHF/UHF Dummy Load

Ham radio's most versatile 1.5 kW 50 ohm *dry* dummy load covers DC to 650 MHz. SWR 1.1:1 to 30 MHz, 1.3:1 to 650 MHz. Handles 1500W for ten seconds, 100W for 10 minutes. 3Wx3Hx9D in. SO-239 connector. **MFJ-264N, $119.95.** With type 'N' connector. MFJ-264 **$109.95**

Oil-Cooled 1 kW CW, 2 kW SSB 50-Ohm VersaLoad™

Run 1KW CW or 2 KW PEP for 10 minutes. Run *continuous duty* with 200 Watts CW or 400W PEP. Transformer oil included. SWR 1.2:1 to 30 MHz. Low SWR to 400 MHz. SO-239 connector. Safety vent with cap, carrying handle. 7½Hx6½D in. **MFJ-250X, $89.95.** No transformer oil. MFJ-250 **$109.95**

500 MHz, 100 Watt Dummy Load

Connects directly with built-in PL-259. Finned aluminum air-cooled heatsink. 15 Watts continuous, 100W peak. SWR < 1.5:1, DC-500 MHz. 1½ inch round by 3 inches long. **MFJ-262B, $84.95.** PL-259. 35 Watts continuous, 200W for 5-seconds. SWR< 1.2:1 DC-1 GHz. MFJ-262 **$44.95** *With PL-259* DC to 500 MHz

MFJ 2500W *fan-cooled* Dry Load

MFJ's 2500 Watt *fan cooled* load handles legal limit amps, 2500W average one minute on, ten minutes off, 300W continuous. DC- 6 Meters. SWR <1.25, 30 MHz; <1.4, 30-60 MHz. Detailed power curve. 12 VDC or 110 VAC. 8¼Wx4Hx9½D in. SO-239s. 5 pounds. MFJ-266 **$279.95**

Switchable RF Dummy Load

Select 16.6, 25, 50, 100, 150 Ohm dummy loads. Test/calibrate your wattmeters, SWR accuracy. At 50 Ohms it handles 300 Watts for 30 seconds with SWR < 1.1, 60 MHz. SO-239. 4½Wx2¼Hx6½D in. Optional 12 VDC/110 VAC adaptor, MFJ-1312D, $24.95. MFJ-251 **$189.95**

3 GHz, 300 Watts Dry Dummy Load

New high-tech metal film resistor on large heavy-duty air-cooled heatsink. 300 Watts for ten seconds and 125W *continuously*. SWR < 1.1, 1 GHz; <1.2, 1.5 GHz; <1.5, 3 GHz. N-connector. 10½Wx2¼Hx5½D inches. MFJ-261 **$159.95**

1.5kW Dry DummyLoad/SWR/Wattmeter

Tune up your transceiver, linear amplifier or antenna tuner into a safe 50 Ohm dummy load at *full power*. Then instantly switch to your antenna and monitor SWR, forward and reflected power on lighted cross-needle meter. 300/3000 Watt ranges. DC-60 MHz. Test/tune Xceivers, amps, tuners, baluns, filters, coax, stubs. MFJ-267 **$219.95**

SWR/Wattmeters

Compact Cross-Needle SWR/Wattmeters

Large 3-inch *lighted* Cross-Needle meter covers 1.8-200 MHz in 30/300W power ranges. Read forward, reflected power, SWR *simultaneously*. 3¼Wx3¼H x3¼D in. SO-239 connectors. **MFJ-842, $84.95.** 140-525 MHz, 15/150W. MFJ-822 **$84.95**

High-accuracy 1.8-60 MHz Digital SWR/Wattmeter

Highly accurate! Auto-ranging select 25W, 250W, 1500W ranges with *full 10-bit* resolution. Frequency compensated data insures highest accuracy. *True* peak/average forward/reflected power, SWR and frequency are *simultaneously* displayed on backlit LCD and large 3-inch lighted cross needle meter. Peak hold, LED, buzzer, amplifier-bypass alerts and protects your amplifier when SWR is high and toggles extra relay. 6½Wx2¼Hx6D". **MFJ-826B, $229.95.** No meter, ampr bypass, control relay. MFJ-826 **$299.95**

MFJ *GrandMaster*™ SWR/Wattmeters

GrandMaster™ SWR/Power Meters are *the Cadillacs of ham radio!* Large 3¼x1¼ inch precision illuminated meter gives easy wide-angle viewing of SWR, forward or reflected power. 7½Wx3¼Hx4¼D in. SO-239s. **MFJ-870, $119.95.** 1.8-60 MHz. 30/300/3000 Watt ranges. **MFJ-874, $159.95.** 1.8-525 MHz. 5/20/200 Watt ranges. MFJ-870 **$119.95**

MFJ *giant* 6.5 inch SWR/Wattmeter

World's *largest* HF+6M SWR/Wattmeter has *giant* 6½ inch meter! Extra-long scales gives highly accurate SWR/power 1.8-54 MHz. Huge numbers make reading easy. *True* peak or average forward and reflected power. 20/200/2000 Watt ranges. 9 Volt battery. 12 VDC or 110 VAC with MFJ-1312D, $24.95. 7Wx5½Hx5D in. SO-239s. MFJ-868B **$199.95**

VHF SWR/Wattmeter plus Field Strength

World's most popular -- and most affordable -- VHF SWR/Wattmeter. Read SWR, forward and reflected power over 144-220 MHz in two ranges, 30/300W. Built-in field strength meter for 1-220 MHz. 4½Wx2¾Hx3D". MFJ-812B **$64.95**

Compact Digital SWR/Wattmeters

Displays forward, reflected power, SWR (1.6-60 MHz) and battery *all in a single glance!* Large 1/2" forward power digits and 5/8" reflected/SWR digits! 0-200W. Power/backlight on/off. SO-239s. MFJ-845 **$139.95**

MFJ-847, $129.95. 125-525 MHz, 0-120W.

MFJ-849, $219.95. Large 3.5" bright orange LCD displays SWR, forward/reflected power. 1.5-525 MHz, 200W, HF/VHF-UHF switch.

MFJ HF *QRP* SWR/Wattmeter

Read forward, reflected power 1.8-50 MHz, 0-5W. Also reads SWR, relative power 100 mW to 50W. SO-239s. 4 ¼Wx 2¼ H x3D in. MFJ-813 **$64.95**

VHF/UHF SWR/Wattmeter

Lighted Cross-Needle SWR/Watts, 144/220/440 MHz, 30/300W Forward power, 6/60W Reflected power. MFJ-862 **$99.95**

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World famous MFJ-259D gives you a complete picture of your antenna's SWR and Complex Impedance.

MFJ-259D is a complete ham radio test station including frequency counter, RF signal generator, *SWR Analyzer™*, RF Resistance/Reactance Analyzer, Coax Analyzer, Capacitance/Inductance Meter and more!

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 (uH) and capacitance (pF) at RF frequencies.

Large easy-to-read two line LCD screen and side-by-side meters clearly display your information.

Built-in frequency counter, Ni-MH/Ni-CD charger circuit, battery saver, low battery warning, smooth reduction drive tuning.

Super easy-to-use! Just set the bandswitch and tune the dial -- just like your transceiver. SWR, 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, $26.95. Rugged metal cabinet, 4x2x6¾". **MFJ-249D, $329.95.**

MFJ-249D does everything MFJ-259D does with digital display only.

MFJ-269D . . . 280 KHz - 230 MHz plus 415-470 MHz, 12-bit A/D

New and improved. Now covers 280 KHz to 230 MHz and 415 to 470 MHz and 2200 Meter band!

Instantly gives you a complete picture of your antenna.

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 (Rs+jXs) or as magnitude (Z) and phase (degrees). Also reads parallel equivalent resistance and reactance (Rp+jXp).

Determine velocity factor, coax loss in dB, length of coax and *distance to short or open in feet (it's like a built-in TDR).*

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.

MFJ-269D **$449.95**

Measures inductance in uH 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.

12-bit A/D converter gives much better accuracy and resolution than common 8-bits -- *MFJ-269D exclusive!*

Built-in frequency counter, battery saver, low battery warning, Ni-Mh/NiCd charge circuit. 4Wx2Dx6¼", 2 lbs. Use ten aA batteries or 110 VAC with MFJ-1312D, $26.95.

MFJ-269DPRO™ SWR Analyzer

MFJ-269DPro, $489.95. Like MFJ-269D, but UHF range covers ***430 to 520 MHz.*** For commercial work.

300/150 Watt *Tuner*

300W (6-1600) 150W (6-3200 Ohms)

MFJ-993B **$349.95**

Automatically tunes unbalanced and balanced antennas, ultra-fast automatic tuning and has 20,000 *VirtualAntenna™* memories. Has multiple antenna connections and antenna switch, efficient L-network, select 300 Watts (6-1600 Ohms impedance matching or 150W (6-3200 Ohms). 1.8-30 MHz. 4:1 balun. analog Cross-needle SWR/Wattmeter, backlit LCD, remote control port. Handles 300/150 Watts SSB/CW and digital.

MFJ-225 1.5-180MHz *continuous* Two-Port Graphic Analyzer

Out in the field, the MFJ-225 is a compact completely *self-contained handheld graphing analyzer.* On the bench it becomes a full-fledged two-port (S21) desktop machine when teamed up with your PC. Using powerful IC-miniVNA freeware, you'll run de-tailed data analysis and print out stunning color-graphic plots to document your work! Built-in back-lighted *3-inch LCD graphic* display. Make fine adjustments using full-screen easy-to-view SWR bargraph, capture vivid swept displays for SWR, impedance, re-turn loss, phase angle, more. DDS generator.

MFJ-225 **$429.95**

SWR Analyzer Accessories

A. MFJ-29D/MFJ-39D, $49.95. Carrying Pouch for MFJ-259D/269D.

B. MFJ-92AA10, $49.95. 10-Pk 2500 mAh NI-V/H Supercells.

C. MFJ-66C, $59.95. Dip coils, set of two covers 1.8-230 MHz.

D. MFJ-731, $134.95. Tunable Analyzer Filter. 1.8-30 MHz. for strong RF fields.

E. MFJ-917, $54.95. 1:1 Current balun for SWR Analyzers to test balanced line antennas, other loads.

F. MFJ-7737, $8.95. PL-259 to BNC Female.

G. MFJ-7727, $9.95. PL-259 to SMA Female.

H. MFJ-5510C, $24.95. 12VDC cigarette lighter adapter.

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MFJ 1500 Watt Remote Auto Tuner

Place this MFJ-998RT remote tuner at your antenna to match high SWR antennas/long coaxes – greatly reduce losses for high efficiency

. . . Match 12-1600 Ohms, 1.5 kW, SSB/CW/Digital, 1.8-30 MHz . . . Match coax/wire antennas . . . Weather-sealed . . . Remotely powered thru coax . . . Amplifier, radio, tuner protection . . . Output static/lightning protection . . . StickyTune™ always tunes when power folds back . . . DC power jack . . .

MFJ-998RT
$919.95

Bottom Chassis

Inside View

Tune your antenna at your antenna

Get greatly reduced losses and high efficiencies with long coax runs and high SWR antennas with this new MFJ-998RT 1.5 kW Remote Antenna Tuner.

Weather-Sealed

A tough, durable weather-sealed ABS cabinet with over-lapping lips, sealing gasket and stainless steel chassis protects the MFJ-998RT from all kinds of weather.

No Power Cable Needed!

No power cable needed -- remotely powered through coax. Includes MFJ-4117 Bias Tee with on/off switch for station end of coax. Has 12 VDC jack for power cable, if desired.

Fully Protected

MFJ exclusive algorithms protect your tuner, radio and RF power amplifier from damage.

Automatic inductor and capacitor limiting prevents tuning extreme loads which can destroy your tuner.

Your tuner will not tune if more than 75 Watts with SWR greater than 3:1 is applied or if more than 125 Watts is applied.

Tuner output is static electricity and lightning induced surge protected.

MFJ exclusive StickyTune™

Very high SWR can fold back transmitter power and prevent tuning caused by extreme differences in loads (example: changing bands and other conditions).

But MFJ exclusive StickyTune™ always tunes with a simple on/off power cycle and re-transmit.

Tunes Coax fed and Wire Antennas

Tunes both coax fed and wire antennas. Has ceramic feed-through insulator for wire antennas. 2 kV Teflon® insulated SO-239 – prevents arcing from high SWR.

High Power, Highly Efficient

A highly efficient L-network matches 6-1600 Ohms at full 1500 Watts legal limit SSB/CW and Digital, 1.8 to 30 MHz with Hi-Q Ls. Cs.

MFJ-998RT Learns as you Operate

As you operate, the MFJ-998RT automatically tunes for minimum SWR and remembers your frequency and tuner settings. The next time you operate on that frequency and antenna, its tuner solution is restored in milliseconds and you're ready to operate!

Highly Intelligent, Ultra-fast Tuning

MFJ InstantRecall™ recalls stored tuning solutions from 10,000 memories. For new frequencies, MFJ Intelli-Tune™ measures your antenna impedance and instantly determines the correct matching components. If antenna impedances cannot be measured, MFJ AdaptiveSearch™ searches only the relevant components that can match your antenna giving you ultra-fast tuning.

Field upgradeable Timware. Requires 12-15 VDC at 1.4 Amps maximum or 110 VAC with optional **MFJ-1316, $39.95**. Weighs 9.5 lbs. 13¼W x 6¾H x 17½D inches.

600W Remote IntelliTuner™

MFJ-994BRT perfect for 600 Watt SSB/CW amplifiers like American's AL-811/ ALS 600/ALS-500M. Matches 12-600 Ohms. Coax/wire antennas, 1.8-30 MHz. Fully weather-sealed for outdoor use. Remotely powered through coax. Tough, durable, built-to-last cabinet. 9¾W x 3H x 14¼D inches, 4 lbs. Includes MFJ-4117 BiasTee Power Injector.

MFJ-994BRT
$509.95

200W Remote IntelliTuner™

MFJ-926B, 200 Watts SSB/CW/Digital, 6-1600 Ohms, Coax/wire antennas, 1.8-30 MHz. Includes BiasTee.

MFJ-926B $379.95

300W Remote IntelliTuner™

MFJ-993BRT handles 300 Watts SSB/CW and digital.Has extra-wide 6-1600 Ohm impedances. Coax/ wire antennas, 1.8-30 MHz. Fully weather-sealed for remote outdoor or marine use. Remotely powered through coax. Tough, durable, built-to-last cabinet measures 9¾W x 3H x 14¼D inches. Weighs just 4 pounds. Includes MFJ-4117 BiasTee Power Injector.

MFJ-993BRT
$389.95

MFJ No Matter What™ Warranty

One year **No Matter What™** Warranty
30 Day Money Back Guarantee
(less s/h) on orders direct from MFJ.

160-6 Meters 43 foot Vertical Antenna

Operate all bands 160-6 Meters at full 1500 Watts with this self-supporting, 43 foot high performance vertical! Assembles in less than an hour. Low profile blends in with sky and trees -- barely see it. Entire length radiates. Exceptional low angle DX performance on 160-20 Meters and very good performance on 17-6 Meters. Telescope 1 shorter for more effective low angle radiation on 17-6 M if desired. One of these wide range MFJ automatic tuners at the antenna easily matches all bands 160-6 Meters. There's no physical tuning adjustments on the antenna – you simply put it up! Requires ground system, at least one radial, more the better. Includes balun and base mount. **MFJ-1932, $44.95**. All band ground radial system.

MFJ-2990
$399.95

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MFJ Tuners

Ham Radio's Most Popular 300 Watt Antenna Tuner

MFJ-949E **$249.95**

More hams use MFJ-949s than any other antenna tuner in the world!

Why? Because the world's leading tuner has earned a worldwide reputation for being able to match just about anything.

Full 1.8-30 MHz Operation

Tune your antenna for minimum SWR! Works 1.8-30 MHz on dipoles, verticals, inverted vees, random wires, beams, mobile whips, shortwave receiving antennas...Use coax, random wire, balanced lines. Has heavy-duty 4:1 balun for balanced lines.

Custom Inductor switch

Custom designed inductor switch, 1000 volt tuning capacitors, Teflon® insulating washers and proper L/C ratio gives you arc-free no worries operation up to 300 Watts PEP transceiver input power.

The MFJ-949E inductor switch was custom designed to withstand the extremely high RF voltages and currents that are developed in your tuner.

8-Position Antenna switch

Antenna switch lets you select two coax fed antennas, random wire/balanced line or dummy load through your MFJ-949E or direct to your transceiver.

Lighted Cross-Needle Meter

Full size 3-inch lighted Cross-Needle Meter. Lets you easily read SWR, peak or average forward and reflected power simultaneously. Has 300 Watt or 30 Watt ranges.

QRM-Free PreTune™

MFJ's QRM-Free PreTune™ lets you pre-tune your MFJ-949E off-the-air into its built-in dummy load! Makes tuning your actual antenna faster and easier.

Plus Much More!

Full size built-in non-inductive 50 Ohm dummy load, spatter-proof Lexan multi-colored front panel, 10"H x 13½ x 7 inches. Super rugged cabinet construction and more!

MFJ-948, $219.95. Econo version MFJ-949E. Has all features except for dummy load.

No Matter What™ Warranty

Every MFJ tuner is protected by MFJ's famous one year **No Matter What™** limited warranty. We will repair or replace your MFJ tuner (at our option) for a full year.

More hams use MFJ tuners than all other tuners in the world!

MFJ-989D Legal Limit Tuner

MFJ-989D **$499.95**

New improved MFJ-989D legal limit antenna tuner gives you better efficiency, lower losses and a new true peak reading meter. Easily handles full 1500 Watts SSB/CW, 1.8-30 MHz, including WARC/WARC bands. Six position antenna switch, dummy load. New 500 pF air variable capacitors. New improved AirCore® Roller Inductor. New high voltage current balun. New crank knob. 12"W x 8"H x 11½"D inches.

MFJ-986 Two knob Differential-T™

MFJ-986 **$449.95**

Two knob tuning (differential capacitor and AirCore™ roller inductor) makes tuning foolproof and easier than ever. Gives minimum SWR at only one setting. Handles 3 KW PEP SSB amplifier input power (1.5 KW output). Gear-driven turns counter, lighted peak/average Cross-Needle SWR/Wattmeter, antenna switch, balun. 1.8 to 30 MHz. 10"W x 4"H x 15 in.

MFJ-962D Compact kW Tuner

MFJ-962D **$399.95**

A few more dollars steps you up to a KW tuner for an amplifier. Handles 1.5 KW PEP SSB amplifier input power (1000W output). Ideal for American's AL-811H! AirCore® roller inductor, gear-driven turns counter, plus-lighted Cross-Needle SWR/Wattmeter, antenna switch, balun. Lexan front. 1.8-30 MHz. 10"W x 4"H x 10"D in.

MFJ-969 300W Roller Inductor Tuner

MFJ-969 **$299.95**

Superb, AirCore® Roller Inductor tuning. Covers 6 Meters thru 160 Meters! 300 Watts PEP SSB. Active true peak reading lighted Cross Needle SWR Wattmeter, QRM-Free PreTune™, antenna switch, dummy load, 4:1 balun. Lexan front panel. 10"W x 5¼"H x 9"D inches.

MFJ-941E Super Value Tuner

Most for your money! 300 Watts PEP, 1.8-30 MHz, lighted Cross-Needle SWR/Wattmeter, MFJ-941E **$199.95**

8 position antenna switch, 4:1 balun, 1000 volt capacitors. Lexan front panel. 10"W x 2½"H x 7"D in.

MFJ-941EK, $179.95. 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 8 x 2 x 8 in. Lighted Cross-Needle SWR/Wattmeter. Lamp and bypass switches. Covers 1.8-30 MHz and 6 Meters. 300 Watts PEP. MFJ-945E **$189.95**

MFJ-20, $13.95, 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 transceivers. Tiny 6 x 6.3 x 2"H in. MFJ-971 **$179.95**

MFJ-901B Smallest Versa Tuner

MFJ-901B **$149.95**

MFJ's smallest (5 x 2 x 6 in.) and most affordable wide range 200 Watt PEP Versa tuner. Covers 1.8 to 30 MHz. Great for matching solid state rigs to linear amps.

MFJ-902B Tiny Travel Tuner

Tiny 4½ x 2¼ x 3 inches, 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"L x 2¼ x 2¾ inches.

MFJ-902B **$149.95**

MFJ-16010 Random Wire Tuner

Operate all bands anywhere with MFJ's reversible L-network. Tunes random wire into powerful transmitting antenna. 1.8-30 MHz, 200 Watts PEP. Tiny 2 x 3 x 4 in.

MFJ-16010 **$104.95**

MFJ-9201 QRPocket™ Tuner

80-10 Meters, 25 Watts, 12 position inductor, tune/bypass switch, wide-range T-network, BNCs. 4"W x 2"H x 1½"D inches.

MFJ-9201, $74.95

MFJ-9201 **$74.95**

MFJ-921/924 VHF/UHF Tuners

MFJ-921 covers 2 Meters/220 MHz. **MFJ-924** covers 440 MHz. SWR/Wattmeter. 6 x 2½ x 5 in.

MFJ-921/924 **$139.95**

MFJ-931 Artificial RF Ground

Eliminates RF hot spots, RF feedback, TVI/RFI, weak signals caused by poor RF grounding. Creates artificial RF ground or electrically places far away RF ground directly at rig. **MFJ-934, $289.95,** Artificial Ground/300 Watt Tuner/Cross-Needle SWR/Wattmeter.

MFJ-931 **$149.95**

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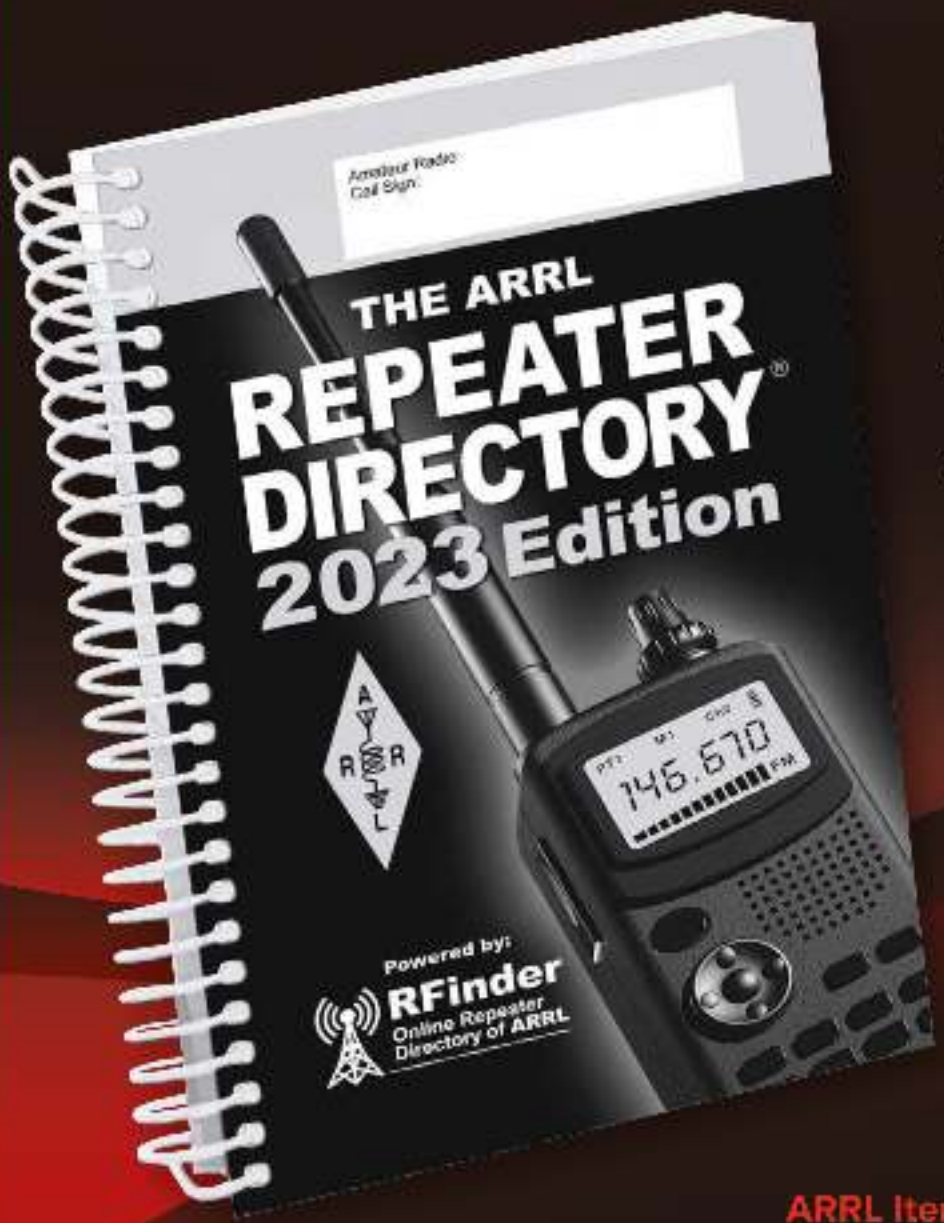

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Reach for the Sky Mister!

MFJ Get that antenna up where it belongs, high in the sky with MFJ *heavy-duty* Telescopic Masts and accessories. We got all you need for temporary, portable or permanent antenna installations.

Portable, telescoping high-strength fiberglass masts extend way up into the sky! Just pull out sections and lock.

Choose Lightweight Light-Duty or Super-Strong Thick-Wall models – 10 to 50 feet long. Each collapses to an easy-to-carry size for true portability.

For quick put-up and take-down, light-duty models have Twist & Lock sections and heavy-duty thick wall models use military style QuickClamps™ or stainless steel hose clamps.

Use them for traveling, camping, at hotels, hamfests, field day, DX-peditions. Put up full size full performance inverted Vee, dipole or vertical antenna in minutes at heights that will snag you real DX.

Use multiple telescoping masts to make loops, quads, rotatable dipoles even beams.

Light Duty Lightweight Fiberglass Masts

So lightweight you can take them anywhere!

MFJ's most popular MFJ-1910 is 33 feet long, 3.3 lbs.

MFJ-1910, $119.95. 33 ft., light duty w/top tie ring.
MFJ-1911, $129.95. 20 ft., light duty w/top tie ring.
MFJ-1913, $129.95. 28 ft., lightweight w/top tie ring.
MFJ-1915, $159.95. 25 ft., for heavier duty use.
MFJ-1916, $199.95. 34 ft., for heavier duty use.
MFJ-1917, $209.95. 43 ft., heavier duty w/top tie ring.

Super-strong .125" Thick-Wall Fiberglass Masts

Use for temporary or permanent wire antennas, small beams or verticals. **Best seller** is 48 ft. long, just 24 lbs.

Heavy Duty Models: All have QuickClamps™

MFJ-1908HD, $309.95 is 42' ext., 7.75-ft. collapsed, has 2½" OD bottom, 1" OD top, seven 7.75 ft. sections, 24 lbs.
MFJ-1906HD, $269.95 is 38' extended, 6 feet collapsed, has 2½" OD bottom, 1" OD top, seven 6-foot sections, 24 lbs.
MFJ-1904HD, $199.95 is 25' extended, 4 feet collapsed, has 2½" OD bottom, 1" OD top, seven 4-foot sections, 14 lbs.
MFJ-1904H, $179.95. 22' ext., 5' collapsed, 9 lbs. 2½" OD.
MFJ-1902H, $159.95, 10' ext., 32" collapsed, 5 lbs. 2½" OD

Standard Models: H models have QuickClamps™

MFJ-1906, $179.95/MFJ-1906H, $239.95, 33 feet ext., 6 ft. collapsed, six 6-ft. sections, 13 lbs. 2" bottom, ¾" top OD.
MFJ-1908, $219.95/MFJ-1908H, $279.95, 41' ext., 7.75-ft. collapsed, six 7.75-ft. sect., 16 lbs. 2" bottom, ¾" top OD.

Mast Accessories

MFJ-1900, $99.95. Mount clamps mast to mounting pipe.
MFJ-13, $84.95. 5 Military QuickClamps™. Fit ¾" to 2" OD.
MFJ-13HD, $84.95. Extra set clamps. 1- 2½" masts.

Mast Guy Ring Sets

Fits masts ¾" to 1¼" dia OD. **MFJ-2830X, $13.95,** *fiberglass.* **MFJ-2840X, $19.95,** *aluminum.*

18' Telescopic Mast/Tripod

MFJ-1919EX, $199.95. *Put your antennas up high anywhere with this super-strong* 18 foot telescoping fiberglass mast and MFJ-1919 heavy duty steel tripod. *QuickClamps™ lower mast to 5 feet. Mast has thick 1/8 in. wall, .75" top, 1.5" bottom dia. 15 lbs. Steel tripod has braced triangle base, non-skid feet, mast lock.*

MFJ-1918EX, $129.95. MFJ-1918 *tripod with 9.5 ft. telescoping fiberglass mast.* 3.8 feet collapsed. 6.5 lbs.

Tripods Only

MFJ-1921, $219.95, *Giant tripod* base spreads to 8 feet! Supports massive antennas. Adjustable length non-skid legs accommodates uneven ground surfaces. Optional foot anchors, *see bottom right.* 14 lbs.

MFJ-1919, $129.95, *Large tripod* base spreads to 4.8 ft. Support 100 pounds. 7.6 ft, 9.75 lbs.

MFJ-1918, $84.95, *Smaller tripod* base spreads to 2.75 ft. Support 66 lbs. 6.75 lbs.

80-6 Meter Antenna

3.8 ft. fiberglass mast telescopes to a 31ft. self-supporting *high performance* 80-6 Meter vertical antenna in minutes!

1/4 wave performance on 40M, 1/2 wave on 20M. High-Q air wound loading coil. Use antenna tuner for 30/ 20/15/12/10/6 M. 600W SSB/CW.

Use as temporary, portable or permanent antenna for home, RVs, camping, field day, hamfest, DX-pedition.

Includes four 12 foot radials. Current balun reduces feedline radiation and pattern distortion.

MFJ-2880 **$139.95** 40/6 Meters

MFJ-2882 **$199.95** 80-6 Meters

MFJ "HamStick" Isolated Dipole

Build your own 80-6 Meter mini-dipole using two HF mobile whips! MFJ-347 *isolates* dipole elements. Lets you use a balun to give a *true balanced dipole.* Prevents pattern distortion, noise pickup and RFI radiation from RF on coax shield. Solid aluminum. Use masts up to 1½" OD.

MFJ-347 **$34.95**

3/8-24 Hamstick Mount

MFJ-342T **$24.95** Mount 3/8-24 HF/VHF hamsticks vertically or horizontally on masts to 1 inch. Built-in SO239.

MFJ Balcony Mount

MFJ-1987 **$69.95**

Mount multiple HF/VHF ham sticks, verticals, dipoles vertically or horizontally on your balcony. High-strength aircraft aluminum extends out 14". Two U-bolts mount to 1½" dia.

Tripod Anchors

MFJ-1905, $44.95. Securely anchor your tripods to the ground with these 3 stainless steel foot braces and your stakes. For high winds, unlevel ground. Fits legs to 1½" OD.

Portable Mast Supports

MFJ-1912, $129.95. Just drive your car or truck tire over the stainless steel base of the mount. You're ready for virtually any antenna. Fits up to 2.25" masts.

MFJ-1914, $119.95. Stainless steel antenna mast mount includes four heavy duty galvanized ground stakes to hold your antenna up safely in the field. Use up to 2.25" masts.

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The familiar, rugged ANC-4 now with:

- External TX/RX control - great for QRP operation
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- TX LED indicator
- SMT construction w/ gold-plated PCB
- Heavy steel laser-cut housing for precise tuning and mechanical stability

ANC-4+ Antenna Noise Canceller

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

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The Premier Sound Card Modem!

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- Quiet - hear what others miss!
- Proven USB Sound Card built-in
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- Works well with HRD, M110A, Fldigi, FT8 & many more software programs
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*Upgrade any PK-232 to the PK-232SC with New Lower Combo Pricing for SC & DSP Upgrade!

Customize your PK-232 installation with our complete line of upgrades, accessories and cables.

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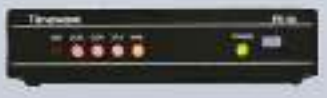

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Work DX and ragchew even through horrendous noise!

Pull weak signals out of static crashes, atmospheric, man-made and power line noise!

Clearly hear signals 50 KHz to 30 MHz you never knew existed. Power line noise and static just disappears.

MFJ-1886 drastically reduces noise and interference by receiving the magnetic field and rejecting the electric field. Rotate MFJ-1886 receiving loop to totally eliminate interfering signals or greatly peak desired signal.

Excellent antenna and preamplifier balance gives deep null.

State-of-the-art push-pull GaN MMICs preamp gives you high dynamic range, low IMD and 25 dB of low noise gain.

Gives excellent strong and weak signal performance without overload.

Fully protected preamplifier -- magnetically coupled voltages up to 40V and capacitively coupled voltages up to 20V will not damage preamplifier.

Output is protected from transmission line surges induced by distant lightning.

Use anywhere, inside or outside. RF signal and power goes through your 50 Ohm coax.

Ruggedly built to withstand extreme weather. 1-inch OD diameter 6061 aluminum tubing. 36-inch diameter. 2¼ lbs. SO-239. Use masts up to 1¾ inches.

MFJ-1886, $319.95. Includes receive loop and MFJ-4116 bias-tee to power MFJ-1886 through coax.

MFJ-1886TR, $369.95. Includes MFJ-1886 and MFJ-4113TR Bias-Tee/Transmit/Receive switch. MFJ-4113TR powers MFJ-1886 through coax and switches between transmitting antenna and receiving loop. For radios with only one antenna connector.

MFJ-4116, $54.95. Bias-Tee provides RF signal and power through coax transmission line. Send up to 1A DC up to 50 Volts.

MFJ-4113TR, $129.95. Bias-Tee with built-in Transmit/Receive switch. Switches between transmitting and receiving antenna. For radios with only one antenna connector. Provides RF signal and power through coax.

Multi-coupler/Bias-Tee

New! **MFJ-1888MC, $299.95.** Connect four receivers to one antenna. Receivers are fully isolated. Each receiver port has 1-12 dB adjustable gain. IP3 is +15 dB. 2dB noise figure. Built-in Bias-Tee powers receiving loop through coax. SO-239s. Use 12 VDC or 110 VAC with MFJ-1312D, $29.95. RF tight. 7.5Wx1¾Hx5D inches.

Super High Dynamic Range High Gain Receiving Loop

New! **MFJ-1888, $499.95.** 32 dB gain from 50 KHz to 30 MHz. 20 dB gain at 80 MHz. IP3 is + 30 dB, 1 dB compression point is 23 dB, noise figure is 1.7 dB. Built-in BCB input filters to reduce overloading. Includes MFJ-1888MC remote multi-coupler. Can be used with MFJ-4113TR Bias-Tee/T/R switch and/or MFJ-4116 bias tee. 36-inch diameter. 2¼ lbs. SO-239. Use masts up to 1¾ inches.

Antenna Rotator

Perfect for MFJ-1886/1786/1788 loop, VHF/UHF, small HF beams, TV, FM antennas.

AR-502 **$199.95**

Weather-proof one piece cast aluminum housing with precision all metal gears, steel thrust bearings and automatic braking. Includes rotator, controller, remote control, clamps, hardware. Memories for 12 directions! Digitally displays position. 110/220 VAC.

Wipe out RFI

Wipe out RFI, noise, interference from any direction at any frequency with a 60 dB notch before it gets into your receiver!

MFJ-1026 **$269.95**

Eliminate power line noise, fluorescent lamps, light dimmers, computers, TVs, lightning, motors, industrial processes.

Null out QRM on rare DX and work him! Null out local ham or AM station to prevent receiver overload. Works on SSB, AM, CW, FM, digital BCB to lower VHF. Plugs between antenna and transceiver. 12VDC, 110VAC with MFJ-1312D, $19.95.

MFJ Super High-Q™ Transmitting Loop Antennas

MFJ 36-inch diameter transmitting loop antenna lets you operate 10-30 MHz continuously including WARC bands!

Ideal for limited space, HOA.

Work DX with low angle radiation and local close-in contacts with high angle radiation when mounted vertically. 150 watts.

Super easy-to-use! MFJ remote control auto tunes to your desired band. Fast/slow tune buttons. Cross-Needle SWR/Watt-meter lets you quickly 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 for highest 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-stop DC motor gives smooth precision tuning. Heavy-duty ABS plastic housing has ultraviolet inhibitor.

Cover 40-15 Meters. MFJ-1788, $719.95. Like MFJ-1786 but covers 40-15 Meters continuous. Includes remote control.

Portable Loop

MFJ-1780, $419.95. *Box fan loop with carrying handle, 24x24x 5½". 20-10 Meters continuous, 150 Watts. Fast/slow tune remote control. Highly efficient all-welded construction.*

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