Build a Multiband Vertical for 80, 40, and 30 Meters Page 33

QST
DIGITAL EDITION

ARRL the national association for amateur radio®
October 2020 www.arrl.org
DEVOTED ENTIRELY TO AMATEUR RADIO

# HAM BOOT CAMP

## Breaking down the barriers new hams face

**QST Reviews**

**Four Station Power Supplies**

**Low-Power Attenuator Kits**

**HybridDX** Antenna for 160 - 6 Meters

**Cushcraft** AR-270 Dual-Band Antenna

YAESU
The radio

# C4FM/FM 144/430MHz Dual Band Mobile

## High Visibility and Resolution QVGA Display with Exceptional Operability

## Real Dual Band Operation V+V/U+U/V+U/U+V & Simultaneous C4FM Monitoring

## FM Friendly Digital : AMS (Automatic Mode Select)

## System Fusion II Compatible

## WIRES-X Portable Digital Node Function

- ***Wide Range RX Coverage : 108 ~ 999.99 MHz***
- ***Easy to Operate II (E2O-II) : New User Interface for Easy Operation***
- ***New Memory Auto Grouping (MAG) Function***
- ***New Multi-Channel Standby (MCS) Function***
- ***High-Speed 61 Channel Band Scope***
- ***Easy Hands-Free Operation with Built-in Bluetooth® Unit***

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

# FTM-300DR


Bluetooth
AMS
Automatic Mode Select
micro SD Card
C4FM
Clear and Crisp Voice Technology
WIRES-X

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**

YAESU
The radio

# High Visibility and Operation with a High-Resolution Full Color TFT & Touch Screen Display Superior Performance in a Compact C4FM Digital Transceiver

- System Fusion II Compatible
- Compact & Reliable 5W RF Power Output
- 700mW of C4FM Exceptional Quality Audio
- Dual band Simultaneous Receive
- High Visibility Full-Color TFT touch panel Display
- Built-in High Precision GPS Receiver
- Easy Hands-Free Operation with Built-in Bluetooth® unit
- High-Resolution and High-Speed 79 channel Band scope
- CAM (Club channel Activity Monitor) Function
- FM Friendly Digital by AMS (Automatic Mode Select)
- WIRES-X Portable Digital Node Function


《Actual Size》


C4FM/FM 144/430MHz DUAL BAND DIGITAL TRANSCEIVER

# FT3DR

Bluetooth® · microSD Card · C4FM Digital Clear and Crisp Voice Technology · AMS Automatic Mode Select · 66 ch GPS

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**

**Free Catalog/Dealers/Manuals Online – Visit: www.cushcraftamateur.com or call toll-free 662-323-9538**

**Cushcraft...Keeping You in Touch Around the Globe**


# MA-6B 6-Band Beam

## Small Footprint – Big Signal

### 2-Elements on 20/17/15/12/10/6 Meters!!!

**Cushcraft's** latest MA-6B gives you *2-elements on six bands!* You get solid *signal-boosting directivity* in a bantam-size and weight.

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

**The** unique MA-6B is a *two-element Yagi* on 20/17/15/12/10/6 Meters. It delivers solid power-multiplying gain over a dipole on *all* bands.You get automatic band switching and a super easy installation in a compact 26-pound package.

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

**MA-5B, $579.95.** Like MA-6B but five bands: 20/17/15/12/10 Meters. 12 and 17 Meters is a single element trapped dipole.
***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, $529.95,** 12/17 M. **30/40 Meter** *add-on kits* available.

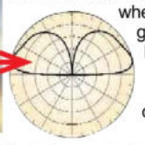
# Cushcraft R9...80-6 Meters 80 Meters...No Radials...1500W


***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!*

**Its** 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.

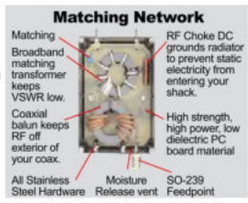
**Use** full 1500 Watts SSB/CW when the going gets tough to break through pileups/ poor band conditions.

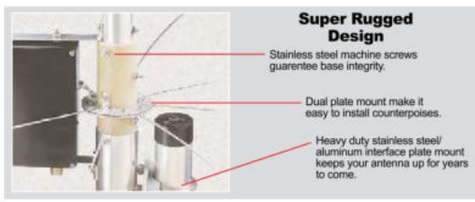


**The R9** is super easy to assemble, installs just about anywhere, and its low profile blends inconspicuously into the background in urban and country settings alike.

**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, $569.95.** Like R9 antenna but less 75/80 Meters.

**R-8TB, $99.95.** Tilt-base lets you tilt your antenna up/down easily by yourself to work on.

**R-8GK, $79.95.** Three-point guy kit for high winds.

# Cushcraft Dual-Band Yagis



### One Yagi for Dual-Band FM Radios

**Dual-bander** VHF rigs are the norm these days, so why not complement your FM base station with a dual-band Yagi? Not only will you eliminate a costly feed line, you'll realize extra gain for digital modes like high-speed packet and D-Star! Cushcraft's A270-6S provides three elements per band and the A270-10S provides five for solid point-to-point performance. They're both pre-tuned and assembly is a snap using the fully illustrated manual.

# Cushcraft Famous Ringos Compact FM Verticals




**W1BX's** famous Ringo antenna has been around for a long time and remains unbeaten for solid reliability. The Ringo is broad-banded, 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!

**Your New MFJ 2019 Ham Radio Catalog is HERE!**

140 Pages of MFJ, Ameritron, Hygain, Cushcraft, Mirage and Vectronics Products! Visit **www.cushcraftamateur.com** to download your copy!

**Cushcraft** **Amateur Radio Antennas** 308 Industrial Pk Rd, Starkville, MS 39759 USA
**Sales/Tech:** (662) 323-9538 ■ **FAX:** (662) 323-5803 Open 8-4:30 CST, Mon.-Fri.

COMET®

# Life is a JOURNEY. Enjoy the ride!


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




## Base Antennas

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

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

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

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

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

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

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

**NEW**
**CAA-500MarkII**
*1.8-500MHz Antenna analyzer*

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

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

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

**CAA-5SC**
Protect your CAA-500MarkII from moisture, shock, dents and dings!
Shoulder strap included.

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

COMET®

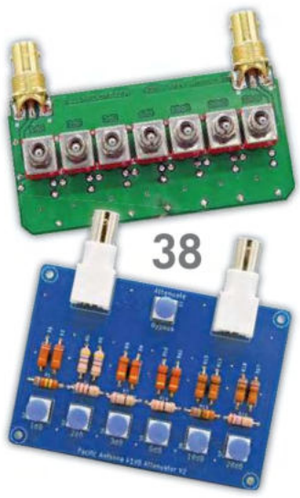
QST

# Contents

October 2020 ♦ Volume 104 ♦ Number 10








## Columns



## Write for *QST*

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

## Departments

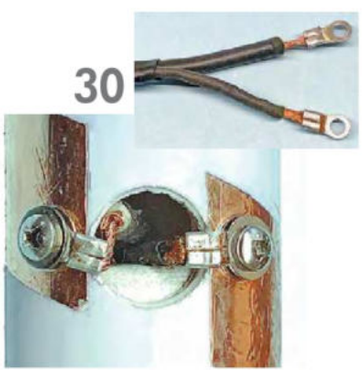


## Digital and Mobile Editions

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.


**Our Cover**

Getting started in ham radio can be tough without help from a mentor. The Nashua Area Radio Society decided to create a "ham bootcamp" mentoring program to train new and upgraded hams, so they could feel confident getting on the air. Read more about this successful program in Fred Kemmerer's, AB1OC, article, "Ham Bootcamp: Getting Hams On the Air," on page 58 of this issue.







*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 #90-0901437. Canada returns to be sent to IMEX Global Solutions, 1501 Morse Ave., Elk Grove Village, IL 60007.

**US & Possessions:** Membership in the ARRL, including a 1-year subscription to *QST*, is available to individuals at $49. Licensed radio amateurs age 21 and under and the eldest licensee in the household may qualify for the rate of $25. Life Membership, including a subscription to *QST* is available at $1,225.* Membership includes $21 per year for subscription to *QST*. Membership and *QST* cannot be separated. Libraries and institutions, $49 per year. Single copies $6.95.

**International**
To compensate for additional postage for mailing outside the US, the following rates apply:

**Canada:** Membership in the ARRL, including a 1-year subscription to *QST*, $62, payable in US funds. Life Membership, including a subscription to *QST* is available at $1,550.* Libraries and institutions, $62 per year.

**All Other Countries:** Membership in the ARRL, including a 1-year subscription to *QST*, $76, payable in US funds. Life Membership, including a subscription to *QST*, is available at $1,900.* Libraries and institutions, $76 per year.

Membership without *QST* is available to the immediate family of a member living at the same address, and to anyone who is legally blind, for $10 per year.

Foreign remittances should be by international postal or express money order or bank draft negotiable in the US and for an equivalent amount in US funds.

Membership in the ARRL, including a 1-year subscription to Digital *QST* only, is available to Canadian and International members at $49.




*QST* is available to blind and physically handicapped individuals from the Library of Congress, National Library Service for the Blind and Physically Handicapped. Call 1-800-424-8567 or go to **www.loc.gov/nls/**.


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

*Payment arrangements available. Please write for details.

In order to ensure prompt delivery, we ask that you periodically check the address information on your mailing label. If you find any inaccuracies, please contact the Circulation Department at **circulation@arrl.org** or **860-594-0200** immediately. Thank you for your assistance.

Reprints and permissions:
**permission@arrl.org**

Details of our Online Privacy Policy can be found at **www.arrl.org/online-privacy-policy**.

Telephone: **860-594-0200**
Fax: **860-594-0259**

# LEGENDS NEVER DIE

## Elite 750

The Classic, Clear-Sounding
AM/FM/LW/SW/SSB/VHF,
Listen to it All Radio



Unbelieveable Memory


The classic look & style to match


On every wavelength

For more information please visit etoncorp.com

universal radio inc.

Ham Radio Outlet

Radioworld

Hammacher Schlemmer

Abt

Authorized Dealers

eton
EMPOWERED BY NATURE

# You can't hear the music, without the speakers.

**Translated: It's a lot easier to hear the DX, with a SteppIR!**

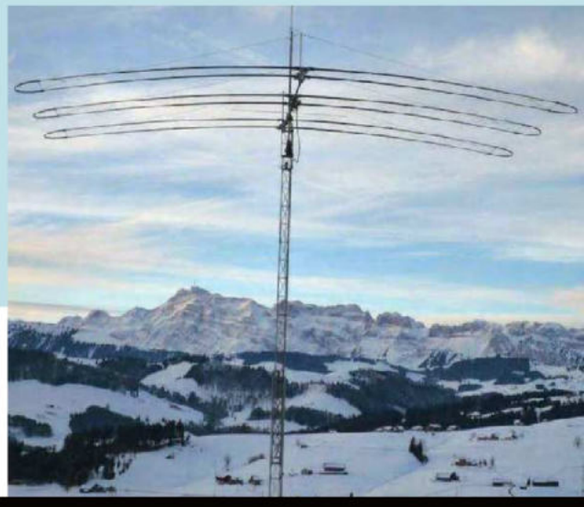
# DB18E YAGI

**The DB18E Yagi offers incredible performance with a small profile – the boom is only 18 feet in length.** The DB18E is optimized at every frequency between 6.8 and 54 MHz – it employs two active elements from 6.8-13.3 MHz and three active elements from 13.3-54 MHz Each element is 39 feet long and utilizes our patented loop technology, which allows for a 40% reduction in physical length, with minimal sacrifice in performance. The DB18E has inherent SteppIR Yagi features such as 180 degree mode (reverse the direction of the Yagi 180 degrees in just 1.5 seconds), bi-directional mode (enjoy gain in opposite directions, simultaneously) and of course element retract – so you can keep your antenna safe during extreme weather events!

## An Optimized, Single-Frequency Antenna on Every Frequency Within its Range

steppIR TECH

Yagis are single-frequency devices (the signal starts to degrade as the radio is tuned away from that frequency). Fixed length, yagi antennas utilize traps or interlacing to "trick" the radio into thinking it is resonant. With a SteppIR Yagi, the antenna is resonant with nearby 1:1 SWR on all frequencies within its range – no tricks, no compromises. SteppIR Yagis are remotely tuned using an electronic controller and stepper motors – each element tunes to the exact length required for any given frequency.



steppIR COMMUNICATION SYSTEMS

**FOR PRODUCT DETAILS AND ORDERING:**

**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!

*The Standard By Which All Others Are Judged*

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 | 330/250 | UHF or N |
| **X300A** (2 Section) | 2m/70cm | 10 | 200 | UHF or N |
| **X200A** (2 Section) | 2m/70cm | 8.3 | 200 | UHF |
| **X50A** (1 Section) | 2m/70cm | 5.6 | 200 | UHF or N |
| **X30A** (1 Section) | 2m/70cm | 4.5 | 150 | UHF |
| **Monoband Base Station/Repeater Antennas** | | | | |
| **F23H** (3 Section) | 144-174 MHz (W/ Cut Chart) | 15 | 350 | UHF |
| **F22A** (2 Section) | 2m | 10.5 | 200 | UHF |
| **CP22E** (Aluminum) | 2m | 8.9 | 200 | UHF |
| **F718A** (Coax Element) | 70cm | 15 | 250 | N |
| **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 Combo |
| **AZ504FXH** | 2m/70cm | 15.5 in. | 50 | UHF |
| **AZ504SP** | 2m/70cm | 15.5 in. | 50 | UHF |
| **NR7900A** | 2m/70cm | 57 in. | 300/250 | UHF |
| **Monoband Mobile Antennas** | | | | |
| **NR22L** | 2m | 96.8 in. | 100 | UHF |
| **M285** | 2m | 52.4 in. | 200 | UHF or NMO |


RF PARTS™ COMPANY

Diamond Antenna is a division of RF Parts Company

Kathleen Callahan, KC1MBY, kcallahan@arrl.org

## Second Century

# Change is In the Air

*I'm writing this weeks before you're reading it, sitting in COVID isolation, in the sweltering heat during a tropical storm-induced blackout, hoping that life will be very different come October. Despite the circumstances that have many of us feeling stuck and looking forward to a "new normal," amazing changes are taking place at ARRL during this time. From new benefits, to online engagement opportunities, to new technologies and communications, change is in the air, actively reimagining possibilities, developing opportunities, and pushing us to innovate.*

Change is nothing new to ARRL, having weathered many world-altering events over the last 106 years and proving time and time again to be adaptable and resilient. In looking at our history, it is clear to see that change, while daunting, can be an opportunity and driver of improvement and growth. Welcoming change is how I see membership, marketing, and communications helping to advance ARRL throughout the next century. Unlike the disruptive changes occurring in our lives today, strategic, incremental changes are planned to help ARRL grow in membership size and member experiences, and get all members more active and involved in ham radio. We're also planning ways to increase our revenues, so we're better equipped to serve members and give back to the community. We look *to advance the art, science, and enjoyment of amateur radio* among those of you who are our most loyal, long-time members as well as those who are new to the ham radio community.

These changes began well before the pandemic, when various departments collaborated on a series of new benefits that help you get more value out of your ARRL membership. Early 2020 brought new offerings such as the *On the Air* magazine, podcast, and blog, which provide resources for those with a beginner-to-intermediate level of experience. Member access to the digital editions of all four ARRL magazines was launched in spring 2020, giving members a look not only at *QST* and *On the Air*, but also the advanced theory and projects available in *QEX*, as well as the radiosport commentary, interviews, and contest results that *NCJ* presents for more seasoned hams.

This summer, we added the benefit of the *ARRL Learning Network*, featuring a series of member-volunteer-led educational webinars, both live and recorded for convenient listening; and *The Current*, a monthly email communication highlighting articles from all four ARRL magazines, along with news about new and featured ARRL products and benefits, upcoming events, and more. Speaking of events, in response to the changing comfort level with attending in-person events, this summer we began testing virtual platforms and investigating hybrid event options for future opportunities to engage with you, should face-to-face events not be possible.

Coming later this fall, a host of online member service enhancements will take place, including an updated e-commerce system that will allow you to renew your membership, donate to ARRL, and buy a book — all in one transaction. This new system will also connect you to the ARRL Learning Center in the future, providing online learning on a variety of radio communication and technology topics.

The investment in this new technology will also allow us to launch a digital membership option to accommodate those of you who prefer digital delivery of your magazine membership benefit. Other upcoming developments include an onboarding program to better engage new members and re-engage lapsed members, new strategies to assess and revise products and publications, enhancements to ARRL's social media presence, and improvements to the email communications you elect to receive through your online profile.

Even with the disruptions of the past few months, many positive changes have sprouted and grown and are working to transition ARRL through these uncertain times. As more of you become active and engaged, your involvement will continue to help ARRL evolve and thrive well past the next century.

*Kathleen Callahan, KC1MBY*
*Marketing & Communications Manager*

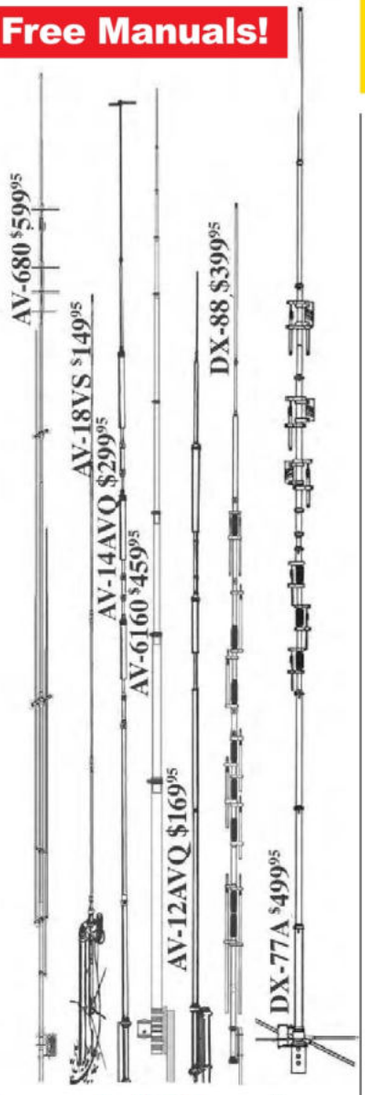
Free Catalog/Dealers/Manuals Online – Visit: www.hy-gain.com or call toll-free 800-973-6572

**The First Choice of Hams Around the World!**

# hy-gain® HF Verticals

**Free Manuals!**

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




## hy-gain® Classics

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

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

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

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

**Includes** all stainless steel hardware. Recessed SO-239 prevents moisture damage.

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

**Two-year** limited warranty.

**AV-680, $599.95. (80, 40, 30, 20, 17, 15,12, 10, 6 Meters). 26 ft., 18.5 lbs.**
**No ground or radials needed.**
Low 17 degree radiation angle and omni-directional gives world-wide DX. 2-minute 1500 Watts key down. 1/4 wave stubs on 6/10/12/17 M and efficient end loading coil/ capacity hats on 15/20/30/40/80 M gives automatic band switching. Wide SWR bandwidth. Teflon® wire broadband matching unit. Low 2.9 sq. ft. wind surface. Mounts on decks, roofs, patios. 65 mph wind survival. Aircraft aluminum tubing, stainless steel hardware.
**AV-640, $499.95.** (40, 30, 20, 17, 15, 12, 10, 6 Meters). 25.5 feet, 17.5 pounds.
**AV-620, $399.95.** 20/17/15/12/10/6M. 22.5 ft.

**AV-18VS, $149.95. (80, 40, 30, 20, 17, 15, 12, 10 Meters). 18 ft., 4 lbs.**
**Covers 80-10 Meters continuous, 1500 Watts PEP.**
Easily change bands by manually moving bandchange wire at base loading coil. Also ideal for shortwave listening. Sleek, low profile. Tiny footprint mounts anywhere on 1.5-1.625" diameter mast driven into ground. Requires at least one radial. Tapered 6063-T6 aircraft aluminum. Stainless steel hardware. 80 MPH wind survival.

**AV-14AVQ, $229.95. (40, 20, 15, 10 Meters). 18 ft., 9 lbs.**
**Quickly work DX instantly with automatic bandswitching!**
Omni-directional low angle DX antenna is self supporting. 1500 Watts PEP. Air dielectric Hy-Q™ traps give full 1/4 wave performance with broadbanding top hat. SWR< 2:1. Ground or roof mount. Requires radials. 6063-T6 aircraft aluminum tubing, stainless steel hardware. 80 MPH wind survival. DC ground. Heavy duty bracket with recessed SO-239 mounts on 1.5-1.625" dia. mast.
**MK-80, $99.95**. 80M add-on kit. **AV-14RMQ, $119.95**. Roof mount kit.

**AV-6160, $459.95. (160, 80, 40, 30, 20, 17, 15, 12, 10, 6 Meters). 43 ft., 20 lbs.**
**Low profile, self-supporting 43 foot vertical assembles in less than an hour!**
Blends in with sky and trees. Entire length radiates to give exceptionally low angle 160-20 Meters DX, great performance on 17-6 M. Wide range automatic or manual antenna tuner at rig easily matches all bands. No physical adjustments. Optimized balun design allows direct coax feed. **AV-6110, $349.95**. 1.5 kW matching network improves efficiency on 160/80 Meters.

**AV-12AVQ, $169.95. (20, 15, 10 Meters). 13 ft., 9 lbs.**
**Automatic bandswitching, omnidirectional, low angle DX antenna. self-supporting. 1500 Watts.**
Hy-Q™ traps give full 1/4 wave performance with broadbanding top hat. SWR less than 2:1. Ground or roof mount. Requires radials. **AV-14RMQ, $119.95** roof mount.

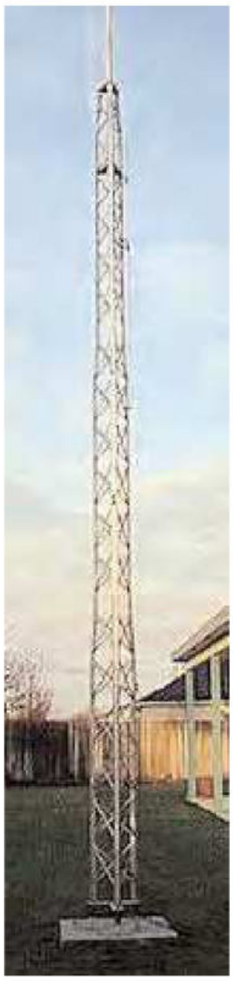
**DX-88, $399.95. (80, 40, 30, 20, 17, 15, 12, 10 Meters, 160 M optional). 25 ft., 18 lbs.**
**All bands are easily tuned with exclusive adjustable capacitors.**
80/40 Meters tuneable from ground without lowering antenna. Heavy-duty construction. **KIT-160-88, $249.95**.160 Meter add-on. **GRK-88, $129.95**. Ground Radials. **RRK-88, $119.95**. Roof Radial System.

**DX-77A, $499.95. (40, 30, 20, 17, 15, 12, 10 Meters). 29 ft., 25 lbs.**
**No ground radials required!**
Off-center-fed Windom has 55% greater bandwidth than competitive verticals. Tiltable base. Each band independently tunable.

hy-gain®

## HyTower

### Stands 53 feet tall!



**AV-18HT**

**$1099.95**

**Standing 53 feet tall, the famous hy-gain® HyTower is the world's best performing vertical!**

**Covers** 80, 40, 20, 15, 12, 10 Meters (and 160, 17 M with optional kits) at full 1500 Watts.Self-supporting, no guys needed.

**Extra-wide** 250 kHz 80 Meter bandwidth with less than 2:1 SWR.

**The AV-18HT** features automatic band selection using hy-gain's unique stub-decoupling system. This isolates various sections of the antenna so an electrical 1/4 wavelength (or odd multiple) exists on all bands.

**All rugged** construction is hot-dip galvanized steel and all hardware is iridited for corrosion resistance.

**A special** tilt-over hinged base makes it easy to raise and lower. All you need is a 4x4 foot area for the world's best performing vertical!

**114 lbs.** Call for truck shipping cost.

**Add LC-160Q, $149.95**, base loading coil for exceptional 160 Meter performance.

**MK-17, $119.95.**
Add-on 17 Meter kit.

**For a Free hy-gain® Catalog**
**and nearest Dealer...800-973-6572**
**Call your dealer for your best price!**

hy-gain® **Antennas, Rotators & Towers** 308 Industrial Pk Rd, Starkville, MS 39759 USA
**Sales/Tech:** (662) 323-9538 ■ **FAX:** (662) 323-5803 Open 8-4:30 CST, Mon.-Fri.

# Select the Ideal Mag Loop Antenna for Your Next QSO

## SOTA-1 PreciseLOOP

**$435**


- QRP 15W
- 40-10 meter
- Quick deployment
- Compact & light
- Ideal for SOTA operations
- Complete with deluxe bag

## HG-1 EXPEDITION PreciseLOOP

**$535**


- 45W PEP
- 80-10 meter*
- Compact & light
- Quick deployment
- Ideal for expedition
- Complete with deluxe bag



## HG-3 STEPPER PreciseLoop

**$895**


- 100W PEP
- 80-10 meter*
- Remote tuning
- SWR auto tune*
- Quick band change
- Aluminum mast*
- Ideal for fixed deployment

# Add This Essential Lab Grade Test Gear to Your Shack

**SALE $775**

### DPM6000 Power Meter

The DPM6000 SWR 2 channel power meter measures forward and reflected power over a 70dB range. A 0dBm 50MHz reference ensures high repeatability and accuracy. Range is .01uW to 2kW with a frequency response of 50KHz - 6 GHz depending on sensor. It displays SWR, Watt/dBm, peak power, return loss RL, RC (c), frequency and a bar graph.

**$895**

### PG50PS Pulse Generator

The PG50PS delivers ultra high (8,000V/uS) slew rate 35ps tr steps. Use it for mm TDR and oscilloscope/amplifier frequency response tests. Apply the step to a scope and the rise-time is measured using the BW=.35/rise-time formula (printed on the case) allowing bandwidth checks to 6GHz.

**SALE $775**

### TDR-Cable Radar®

This time domain reflectometer (TDR) features a fast pulse generator to check transmission lines & cables by analyzing reflections on an oscilloscope. It computes distance to fault (DTF) 2.5 cm - 15km, return loss (RL), velocity factor (Vf) & line loss dB @ 100'. It covers 50 - 600 Ω with 25 ps resolution using isolated samplers and separate (DUT) outputs.

### T150 Step Attenuator


Attenuation covers 41dB in 1 dB steps, using Pi-Pad attenuators from DC to 1 GHz. It features a 50 Ω 2W strip line design with UHF switches. Great for ham radio tests of receivers and general signal conditioning.

**$275**

### SMT Station Monitor

The monitor provides all connections, plus the demodulator, to drive an oscilloscope in XY (drive v. output) mode, resulting in a trapezoid waveform, revealing non-linear operation of a transmitter in real time.


**$259**

### TTG1 Two Tone Generator

The generator has two low distortion (700Hz and 1900Hz) sources to analyze SSB & AM transmitter linearity and overdrive for IMD distortion and harmonic splatter.


**$279**

### DDS-1 Dual Directional Coupler


The coupler measures forward and reflected power with an oscilloscope. The transmitter connects to RF IN, the load connects to RF OUT. When the load absorbs all the energy, virtually no power is reflected, resulting in very little REFL power (SWR 1:1). The FWD port shows power (– 30 dB) to the load.

**$175**

### HFS-1.5 HF Sampler -30dB


The sampler inductively samples high power (up to 1.5kW) RF passing from the RF IN to RF OUT ports. The sampled RF is at a calibrated -30 dB level which is compatible with most oscilloscopes for precise measurements based on the displayed waveforms.

**$175**

### RLB-E 500MHz Return Loss Bridge


The bridge compares an unknown Z to a reference Z. A test oscillator connects to the RF IN. An oscilloscope connects to the DET OUT. The tested device such as an antenna or coax, connects to the DUT. Equal Z result in essentially zero output and very high RL.

**$205**

preciserf.com

* Some items optional

preciseRF® www.preciserf.com

13690 Wisteria Dr. NE Aurora, OR 97002 • ph: 503-915-2490 • preciserf.com • 

# Array Solutions

Your Source for Outstanding Radio Products

## Professional Grade Equipment from Array Solutions


## OM Amplifiers for Amateur and Commercial Service


Call us or see the Array Solutions website for details. Now is the time to get the most powerful and reliable amp for Contesting, DXing, Ragchewing and those Digital Heavy Duty Modes!

## Tubes

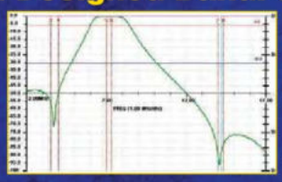
**GU-74b**
**GU-84b**
**FU-728F**

Tested singles and matched pairs available, 1 year warranty

## Amplifier Repairs

- We service ACOM, OM Power, Alpha, ETO, and most brands.
- Fast turnaround, and communication with our test Technicians
- Service report and test data included
- Tube testing for some common tubes www.arraysolutions.com/amplifier-service

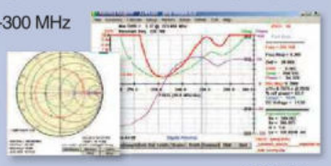
## Famous W3NQN Designed BandPass Filters



Several types to choose from in multiple filter systems and mono-band filters. Singles and boxed sets.

## AIM-4300 and VNA-UHF Back in Stock!


5 kHz -300 MHz



| | |
|---|---|
| AIM 4300 | $899.00 |
| VNA UHF | $1,295.00 |

## Surge Arrestors

**AS-302, AS-303** Coaxial cable arrestors. DC to 500 MHz. N-type or SO-239 connectors. **AS-300SB** Stacking fixture available. **AS-309H**, ladder line arrestor. All have static bleed function. **AS-8SP**, **AS-12SP** and **AS-16SP** control cable arrestors. Protect your rotator's and other control cables.

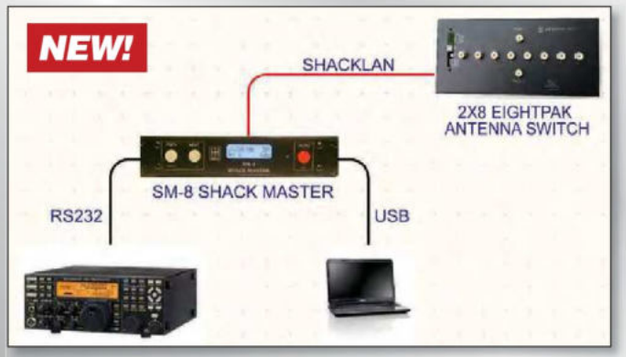
## Baluns & RF Transformers

Ratios 1:1, 1:2, 2:1,4:1 and more. RF line isolators. Ratings 3, 5, 10 kW+. Get the most out of your antenna by stopping the coaxial cable from becoming part of it.

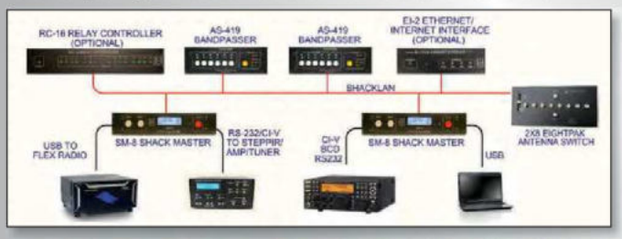
## Hamation Station Automation

Hamation remote and Local Station Control products allow you to automatically or manually select antennas, bandpass filters, and control accessories. Accessories can be StackMatches, Antenna switches, antenna phasing systems, SteppIR controller, turning radios on and off, etc. All of this can be done directly from the Ethernet as well!

Wiring are simple phone cables that daisy chain to all the devices. Wireless control is also available to your tower-located switches. Call us to learn how to set up simple or complex systems. Below is a simple basic system that can switch antennas as you change bands. We can interface to any radio CAT port, not just RS232.




A more complex system could be a SO2R contest station as shone.




## The Shared Apex Loop Array™!

Capture the whole band or the whole HF spectrum at once with the Shared Apex Loop Array 2nd Generation. Can be remote controlled over the internet or in your station. 8 directions of directivity.

The Shared Apex Loop Array™ is a revolutionary receiving antenna that will change the way that you listen to the radio! The patented design provides performance in a size and over a wide range of frequencies that will please both the rag-chewer and DXer alike.

Three models to choose from:

- AS-SAL-30 - optimized for VLF, BCB, 1.8-10 MHz
- AS-SAL-20 - optimized for BCB, and 1.8-30 MHz
- AS-SAL-12 - optimized for 3-30 MHz

## StackMatch

The original, not the imitations. For phasing 2, 3, 4 and even 6 antennas. Also it can be used to combine vertical and horizontal polarized antennas to diminish fading.


## PowerMaster II

RF Power and SWR meter. Couplers for 3 kW, 10 kW or higher available for HF/6 m. VHF and UHF couplers for 1.5 kW. You can connect up to 5 couplers to the display to monitor RF power on different TX lines.


**www.arraysolutions.com**

**2611 North Beltline Rd., Suite 109**
**Sunnyvale, Texas 75182 USA**
**sales@arraysolutions.com**
**Phone 214-954-7140 Fax 214-954-7142**


***Check our Website for more new products!***

Array Solutions' products are in use at top DX and Contest stations worldwide as well as commercial and governmental installations. We provide RF solutions to the DoD, FEMA, Emcomm, UN, WFO, FAA and the State Dept. for products and installation of antennas systems, antenna selection, filtering, switching and grounding. We also offer RF engineering and PE consulting services.

Leanna Zwiebel, lzwiebel@arrl.org

## Member Spotlight

# David Godfrey, NY5A

Five years ago, Dave Godfrey, NY5A, started utilizing the knowledge of electronics he'd gained through his amateur radio hobby and a career in microwave maintenance to start a retirement business repairing sewing machines. His business grew as expected, until March of this year. He couldn't have anticipated the effects of a global pandemic. COVID-19 has kept Dave busy since March, repairing sewing machines that contribute to the creation of masks that help lessen the risk of infection.

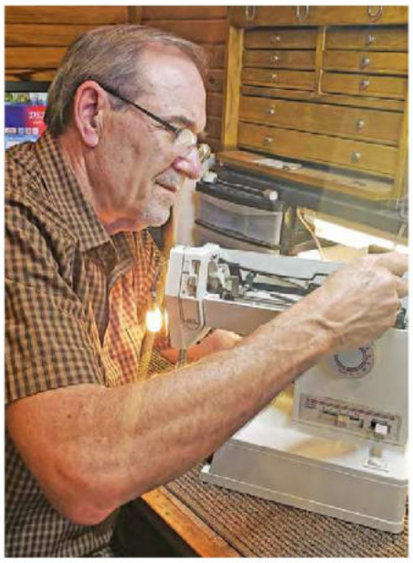
### Electronics and Radio

Dave earned his Novice-class license, WN7DAI, back in 1965, when he was a sophomore in high school. His fascination with electronics has grown ever since. In 1967, he earned his General-class license and focused most of his efforts on DXing.

Dave went on to work in microwave maintenance for Pacific Telephone. "My ham radio experience helped me get the needed commercial license," he said. However, over the years he had fallen in and out of the hobby, until 10 years ago, when he became "hooked" again. For the past 2 years, he has been president of the Walker County Amateur Radio Group in Walker County, Texas. "We have a great group in the club and work well together to teach each other the many aspects of radio," he shared.

### A Busy Retirement

Dave's knowledge of electronics came in handy when he decided to start a business repairing sewing



machines during his retirement. His business grew as he expected it to. "I live in a rural area, so most of my customers come from a five-county area," he explained. In March of this year, he noticed a drastic change in business, when the coronavirus pandemic began to spread across the US.

> ***"This whole experience has given me great honor in being able to provide this service to so many people that are just trying to do their part to help in this time of need."***

With the pandemic at an all-time high, many people wanted to help make masks for their communities. "People started taking their old sewing machines out of the attic after 10 years, expecting to start making masks," he said. Unfortunately, many of these volunteers discovered their machines needed repairs before they could begin producing masks. Dave explained that some of his customers committed to making 100 masks or more by a certain date, before realizing their machines needed repairs. Needless to say, business has been booming in light of this new demand.

As a result of Dave's thriving business fixing sewing machines, he hasn't had much time for amateur radio, but he's happy to help. "This whole experience has given me great honor in being able to provide this service to so many people that are just trying to do their part to help in this time of need," he said.

### Looking Ahead in Radio

When Dave first got into amateur radio, he enjoyed DXing and having long conversations with other operators. However, after his experience helping people give back to their communities during a global time of need, he wants to become more involved in emergency services. The Walker County Amateur Radio Group now has a small group that joined forces with their local Amateur Radio Emergency Service (ARES) group to learn emergency service skills, such as digital and packet communications procedures. "Boy, do I love this hobby and [I'm] so thankful I got into it so long ago," Dave said.

# Guide to Member Benefits

**Join or Renew**
www.arrl.org/join

**Donate**
www.arrl.org/donate

**Benefits**
www.arrl.org/benefits

**Shop**
www.arrl.org/shop

### ARRL Online | www.arrl.org/myARRL

Create an online ARRL Member account, and get access to members-only benefits. Register at **www.arrl.org/myARRL**. Already registered? Log in at the top of the ARRL website.

- **Magazines | www.arrl.org/qst** and **www.arrl.org/ota**
  Members in the US receive a choice of print magazine: *QST*, ARRL's membership journal (12 monthly issues), or *On the Air*, our new magazine for new and beginner-to-intermediate-level radio amateurs (6 bimonthly issues). All members can access the digital editions of *QST*, *On the Air*, *QEX*, and *NCJ* from a web browser and apps available for iOS, Android, and Kindle Fire devices. Members need a valid ARRL account to access ARRL's digital magazines, the Archives and Periodicals Search, and the Product Review Archive.
- **E-Newsletters | www.arrl.org/myARRL**
  Subscribe to the weekly **ARRL Letter** and a variety of other ARRL e-newsletters and announcements.
- **New! The ARRL Current E-Mail Newsletter**
  Members can elect to receive this monthly email within their online profile. Each issue provides a reminder of the available digital magazine issues and highlights articles from all four digital publications, along with podcast overviews, benefit updates, product and publication specials, and more.
- **New! ARRL Learning Network**
  **www.arrl.org/arrl-learning-network**
  This 30-minute webinar series features member-volunteers covering a variety of topics: technology, operating, and public service. Live presentations are recorded for viewing later.
- **Email Forwarding Service**
  Email sent to your **arrl.net** address will be forwarded to any email account you specify.

### Technical Information Service | www.arrl.org/tis

Call or email our expert ARRL Technical Information Service specialists for answers to all your technical and operating questions.

### Advocacy | www.arrl.org/regulatory-advocacy

ARRL supports legislation and regulatory measures that preserve and protect meaningful access to the radio spectrum. Our **ARRL Regulatory Information Branch** answers member questions concerning FCC rules and operating practices. **ARRL's Volunteer Counsel** and **Volunteer Consulting Engineer** programs open the door to assistance with antenna regulation and zoning issues.

### Group Benefits* | www.arrl.org/benefits

- **ARRL Ham Radio Equipment Insurance Plan**
- **Liberty Mutual Auto and Home Insurance**
  *US only

### Find...

…a License Exam Session | **www.arrl.org/exam**
…a Licensing Class | **www.arrl.org/class**
…a Radio Club (ARRL-affiliated) | **www.arrl.org/clubs**
…a Hamfest or Convention | **www.arrl.org/hamfests**

### Interested in Becoming a Ham?

**www.arrl.org/newham**
**newham@arrl.org** | Tel. 1-800-326-3942 (US)

### Connect with ARRL

**ARRL, the national association for Amateur Radio®**
225 Main Street, Newington, CT 06111-1400 USA
1-860-594-0200, Mon. – Fri. 8 AM to 5 PM ET except holidays
FAX 1-860-594-0259, email **hqinfo@arrl.org**
Contact ARRL: **www.arrl.org/contact-arrl**

Website: **www.arrl.org**
Facebook: **@ARRL.org**
Twitter: **@arrl, @w1aw, @arrl_ares**
Instagram and Instagram TV: **@arrlhq**
YouTube: **ARRLHQ**
LinkedIn: **https://www.linkedin.com/company/american-radio-relay-league/**

### The American Radio Relay League, Inc.

ARRL, the national association for Amateur Radio® in the United States: supports the awareness and growth of amateur radio worldwide; advocates for meaningful access to radio spectrum; strives for every member to get involved, get active, and get on the air; encourages radio experimentation and, through its members, advances radio technology and education; and organizes and trains volunteers to serve their communities by providing public service and emergency communications *(ARRL's Vision Statement, adopted in January 2016).*

ARRL is an incorporated, noncommercial association without capital stock chartered under the laws of the State of Connecticut, and is an exempt organization under Section 501(c)(3) of the Internal Revenue Code of 1986. Its affairs are governed by a Board of Directors, whose voting members are elected every 3 years by the general membership. The officers are elected or appointed by the Directors.

ARRL is noncommercial, and no one with a pervasive and continuing conflict of interest is eligible for membership on its Board.

"Of, by, and for the radio amateur," ARRL numbers within its ranks the vast majority of active amateurs in the nation and has a proud history of achievement as the standard-bearer in amateur affairs.

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

Membership inquiries and general correspondence should be addressed to the administrative headquarters: ARRL, 225 Main St., Newington, Connecticut 06111-1400 USA.

# Officers, Division Directors, and Staff

As an ARRL member, you elect the Director and Vice Director who represent your Division on ARRL policy matters. If you have a question or comment about ARRL policies, contact your representatives listed below.

## Officers

**Founding President (1914-1936)**
Hiram Percy Maxim, W1AW

**President**
Rick Roderick, K5UR*
P.O. Box 1463, Little Rock, AR 72203
(501-988-2527); **k5ur@arrl.org**

**First Vice President**
Michael N. Raisbeck, K1TWF*
85 High Street
Chelmsford, MA 01824
(978-250-1235); **k1twf@arrl.org**

**Second Vice President**
Bob Vallio, W6RGG
18655 Sheffield Rd.
Castro Valley, CA 94546
(510-537-6704); **w6rgg@arrl.org**

**International Affairs Vice President**
Rodney J. Stafford, W6ROD
5155 Shadow Est.
San Jose, CA 95135
(408-238-4671); **w6rod@arrl.org**

**Interim Chief Executive Officer and Secretary***
Barry J. Shelley, N1VXY
225 Main St.
Newington, CT 06111
(860-594-0212) **bshelley@arrl.org**

**Treasurer**
Rick Niswander, K7GM

**Chief Financial Officer**
Diane Middleton, W2DLM

## Staff

**Communications Manager**
Vacant

**Development Manager**
Melissa Stemmer, KA7CLO

**Director of Operations**
Norm Fusaro, W3IZ

**Laboratory Manager**
Ed Hare, W1RFI

*Assistant Laboratory Manager*
Bob Allison, WB1GCM

**Product Development Manager**
Bob Inderbitzen, NQ1R

**Marketing Communications Manager**
Kathleen Callahan, KC1MBY

**Marketing & Sales Manager**
Yvette Vinci, KC1AIM

**Membership Manager**
Diane Petrilli, KB1RNF

**Publications & Editorial Manager**
Becky R. Schoenfeld, W1BXY

**Advertising Sales Manager**
Janet Rocco, W1JLR

**Regulatory Information Manager**
Dan Henderson, N1ND

**VEC Manager**
Maria Somma, AB1FM

**Lifelong Learning Manager**
Kris Bickell, K1BIC

**Radiosport & Field Services Manager**
Bart Jahnke, W9JJ

***Business Staff***
**Controller**
Thomas Bell, KC1MHQ

**Information Technology Manager**
Michael Keane, K1MK

*Executive Committee Member

## Atlantic Division

**www.atldiv.org**
**Tom Abernethy, W3TOM***
P.O. Box 73, Accokeek, MD 20607
(301-257-6225); **w3tom@arrl.org**

*Vice Director*: **Robert B. Famiglio, K3RF**
P.O. Box 9, Media, PA 19063
(610-359-7300); **k3rf@arrl.org**

## Central Division

**www.central.arrl.org**
**Kermit Carlson, W9XA***
1150 McKee St., Batavia, IL 60510
(630-879-0983); **w9xa@arrl.org**

*Vice Director:* **Carl Luetzelschwab, K9LA**
1227 Pion Rd., Fort Wayne, IN 46845
(260-637-6988); **k9la@arrl.org**

## Dakota Division

**www.arrldakota.org**
**Matt Holden, KØBBC**
400 Marquette Ave., Apt. 3006
Minneapolis, MN 55401
(952-232-1984); **k0bbc@arrl.org**

*Vice Director:* **Lynn Nelson, WØND**
3204 Willow Ln. SE, Minot, ND 58701
(701-833-1000); **w0nd@arrl.org**

## Delta Division

**arrldelta.org**
**David A. Norris, K5UZ**
907 Evening Sunset Cir., Redfield, AR 72132
(870-613-1606); **k5uz@arrl.org**

*Vice Director:* **Ed B. Hudgens, WB4RHQ**
1441 Wexford Downs Ln., Nashville, TN 37211
(615-333-9859); **wb4rhq@arrl.org**

## Great Lakes Division

**arrl-greatlakes.org**
**Dale Williams, WA8EFK***
291 Outer Dr., Dundee, MI 48131
(734-529-3232); **wa8efk@arrl.org**

*Vice Director:* **Thomas Delaney, W8WTD**
4632 Glenway Ave., Cincinnati, OH 45238
(513-921-7423); **w8wtd@arrl.org**

## Hudson Division

**www.hudson.arrl.org**
**Ria Jairam, N2RJ**
P.O. Box 73, Sussex, NJ 07461
(973-594-6275); **n2rj@arrl.org**

*Vice Director*: **William Hudzik, W2UDT**
111 Preston Dr., Gillette, NJ 07933
(908-580-0493); **w2udt@arrl.org**

## Midwest Division

**www.arrlmidwest.org**
**Rod Blocksome, KØDAS**
690 Eastview Dr., Robins, IA 52328-9768
(319-393-8022); **k0das@arrl.org**

*Vice Director:* **Art Zygielbaum, KØAIZ**
6601 Pinecrest Dr., Lincoln, NE 68516
(402-421-0839); **k0aiz@arrl.org**

## How to Contact ARRL Staff

To send an email to any ARRL Headquarters staff member, put his or her call sign (or first initial and last name) in front of **@arrl.org**. For example, to send to Hiram Maxim, First President of the ARRL, use **w1aw@arrl.org**, or **hmaxim@arrl.org**.

## New England Division

**Fred Hopengarten, K1VR***
6 Willarch Rd., Lincoln, MA 01773
(781-259-0088); **k1vr@arrl.org**

*Vice Director:* Vacant

## Northwestern Division

**www.arrlnwdiv.org**
**Mike Ritz, W7VO**
33643 Burma Rd., Scappoose, OR 97056
(503-987-1269); **w7vo@arrl.org**

*Vice Director:* **Mark J. Tharp, KB7HDX**
P.O. Box 2222, Yakima, WA 98907
(509-952-5764); **kb7hdx@arrl.org**

## Pacific Division

**pacific.arrl.org**
**Jim Tiemstra, K6JAT**
13450 Skyline Blvd., Oakland, CA 94619
(510-569-6963); **k6jat@arrl.org**

*Vice Director:* **Kristen McIntyre, K6WX**
900 Golden Wheel Park Dr., #85, San Jose, CA 95112 (510-703-4942); **k6wx@arrl.org**

## Roanoke Division

**arrl-roanoke.com**
**George W. "Bud" Hippisley, W2RU***
981 Circle Creek Rd., Penhook, VA 24137
(540-576-2527); **w2ru@arrl.org**

*Vice Director:* **Bill Morine, N2COP**
101 Windlass Dr., Wilmington, NC 28409
(910-452-1770); **n2cop@arrl.org**

## Rocky Mountain Division

**www.rockymountaindivision.org**
**Jeff Ryan, KØRM**
9975 Wadsworth Pkwy. K2-275
Westminster, CO 80021
(303-432-2886); **k0rm@arrl.org**

*Vice Director:* **Robert Wareham, NØESQ**
300 Plaza Dr., Suite 200
Highlands Ranch, CO 80129
(720-592-0394); **n0esq@arrl.org**

## Southeastern Division

**www.facebook.com/ARRLSoutheasternDivision**
**Mickey Baker, N4MB**
14764 Black Bear Rd., West Palm Beach, FL 33418 (561-320-2775); **n4mb@arrl.org**

*Vice Director:* **James Schilling, KG4JSZ**
44 Joel Massey Rd., Haines City, FL 33844
(407-504-2629); **kg4jsz@arrl.org**

## Southwestern Division

**www.kkn.net/n6aa**
**Richard J. Norton, N6AA**
21290 West Hillside Dr., Topanga, CA 90290
(310-455-1138); **richardjnorton@yahoo.com**

*Vice Director:* **Edward Stearns, AA7A**
7038 E. Aster Dr., Scottsdale, AZ 85254
(480-332-8255); **aa7a@arrl.org**

## West Gulf Division

**westgulfdivision.org**
**John Robert Stratton, N5AUS**
P.O. Box 2232, Austin, TX 78768-2232
(512-445-6262); **n5aus@n5aus.com**

*Vice Director:* **Lee H. Cooper, W5LHC**
2507 Autrey Dr., Leander, TX 78641
(512-658-3910); **lcooper@arrl.org**

# ARRL Section Managers

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

### Atlantic Division (DE, EPA, MDC, NNY, SNJ, WNY, WPA)

*Delaware:* Bill Duveneck, KB3KYH, 18682 Sunny Sky Blvd., Milton, DE 19968-2486 (302-537-4755); **kb3kyh@arrl.org**
*Eastern Pennsylvania:* George Miller, W3GWM, 293 Woods Rd., Wyalusing, PA 18853 (570-250-1007); **w3gwm@arrl.org**
*Maryland-DC:* Marty Pittinger, KB3MXM, 4 Pegram Rd., Owings Mills, MD 21117 (410-356-7899); **kb3mxm@arrl.org**
*Northern New York:* Thomas Dick, KF2GC, 11 Jenkins St., Saranac Lake, NY 12983 (518-891-0508); **kf2gc@arrl.org**
*Southern New Jersey:* Tom Preiser, N2XW, 177 Bowsprit Rd., Manahawkin, NJ, 08050-5001 (609-618-0224); **n2xw@arrl.org**
*Western New York:* Laura Mueller, N2LJM, 2011 E. Main St., Falconer, NY 14733 (716-338-3122); **n2ljm@arrl.org**
*Western Pennsylvania:* Joe Shupienis, W3BC, P.O. Box 73, Falls Creek, PA 15840-0322 (814-771-3804); **w3bc@arrl.org**

### Central Division (IL, IN, WI)

*Illinois:* Thomas Beebe, W9RY, 3540 Market Rd., Marion, IL 62959-8940 (618-534-6282); **w9ry@arrl.org**
*Indiana:* James Merry, Jr., KC9RPX, 7332 W. Mustang Dr., Ellettsville, IN 47429 (812-391-2661); **kc9rpx@arrl.org**
*Wisconsin:* Patrick Moretti, KA1RB, W349S3970 Waterville Rd., Dousman, WI 53118-9786 (262-354-2997); **ka1rb@arrl.org**

### Dakota Division (MN, ND, SD)

*Minnesota:* Bill Mitchell, AEØEE, 2120 Aldrich Ave. S., Apt. 208, Minneapolis, MN 55405 (510-529-5658); **ae0ee@arrl.org**
*North Dakota:* Richard Budd, WØTF, 4951 64th St. NE, York, ND 58386-9304 (701-466-2028); **w0tf@arrl.org**
*South Dakota:* Chris Stallkamp, KIØD, P.O. Box 271, Selby, SD 57472-0271 (605-848-3929); **ki0d@arrl.org**

### Delta Division (AR, LA, MS, TN)

*Arkansas:* James D. Ferguson, Jr., N5LKE, 1500 Lauren Dr., Searcy, AR 72143-8477 (501-593-5695); **n5lke@arrl.org**
*Louisiana:* John Mark Robertson, K5JMR, 201 Madewood Ct., Bossier City, LA 71111-6325 (318-572-7917); **k5jmr@arrl.org**
*Mississippi:* Malcolm Keown, W5XX, 64 Lake Cir. Dr., Vicksburg, MS 39180 (601-636-0827); **w5xx@arrl.org**
*Tennessee:* David Thomas, KM4NYI, 205 Linford Rd., Knoxville, TN 37920 (865-654-5489); **km4nyi@arrl.org**

### Great Lakes Division (KY, MI, OH)

*Kentucky:* Steve Morgan, W4NHO, 1124 W. 12th St., Owensboro, KY 42301-2975 (270-926-4451); **w4nho@arrl.org**
*Michigan:* Jim Kvochick, K8JK, 10366 Greystone Ct., Brighton, MI 48114-7650 (810-229-5085); **k8jk@arrl.org**
*Ohio:* Scott D. Yonally, N8SY, 258 Valley Hi Dr., Mansfield, OH 44904-9792 (419-512-4445); **n8sy@arrl.org**

### Hudson Division (ENY, NLI, NNJ)

*Eastern New York:* John K. Fritze, Jr., K2QY, 4 Normanskill Blvd., Delmar, NY 12054-1335(401-261-4996); **k2qy@arrl.org**
*NYC-Long Island:* Jim Mezey, W2KFV, 38 Appletree Ln., Carle Place, NY 11514-1336 (516-315-8608); **w2kfv@arrl.org**
*Northern New Jersey:* Steve Ostrove, K2SO, 249 Keats Ave., Elizabeth, NJ 07208-1059 (908-403-8943); **k2so@arrl.org**

### Midwest Division (IA, KS, MO, NE)

*Iowa:* Lelia Garner, WAØUIG, 145 Front St., Robins, IA 52328-9718 (319-213-3539); **wa0uig@arrl.org**
*Kansas:* Ronald D. Cowan, KBØDTI, P.O. Box 36, LaCygne, KS 66040 (913-757-3758); **kb0dti@arrl.org**
*Missouri:* Cecil Higgins, ACØHA, 27995 County Rd. 220, Hermitage, MO 65668-8493 (417-399-5027); **ac0ha@arrl.org**
*Nebraska:* Matthew N. Anderson, KAØBOJ, 14300 NW 98th St., Raymond, NE 68428-4254 (402-480-5515); **ka0boj@arrl.org**

### New England Division (CT, EMA, ME, NH, RI, VT, WMA)

*Connecticut:* Charles I. Motes, Jr., K1DFS, 22 Woodside Ln., Plainville, CT 06062 (860-747-6377); **k1dfs@arrl.org**
*Eastern Massachusetts:* Tom Walsh, K1TW, 9 Wildwood Dr., Bedford, MA 01730 (781-275-5882); **k1tw@arrl.org**
*Maine:* Bill Crowley, K1NIT, 150 Maple St., Farmingdale, ME 04344-4809 (207-512-0312); **k1nit@arrl.org**
*New Hampshire:* John Gotthardt, K1UAF, P.O. Box 2298, Wolfeboro, NH 03894-2298 (603-569-3633); **k1uaf@arrl.org**
*Rhode Island:* Bob Beaudet, W1YRC, 30 Rocky Crest Rd., Cumberland, RI 02864 (401-333-2129); **w1yrc@arrl.org**
*Vermont:* Paul N. Gayet, AA1SU, 11 Cherry St., Essex Junction, VT 05452 (802-878-2215); **aa1su@arrl.org**
*Western Massachusetts:* Raymond Lajoie, KB1LRL, 245 Leominster Rd., Lunenburg, MA 01462-2031 (978-549-5507); **kb1lrl@arrl.org**

### Northwestern Division (AK, EWA, ID, MT, OR, WWA)

*Alaska:* David Stevens, KL7EB, 8521 Golden St., Apt. 4, Anchorage, AK 99502 (907-242-6483); **kl7eb@arrl.org**
*Eastern Washington:* Jack Tiley, AD7FO, 1806 S. Fawn Dr., Spokane Valley, WA 99206-3318 (509-951-7214); **ad7fo@arrl.org**
*Idaho:* Dan Marler, K7REX, 6525 W. Fairfield Ave., Boise, ID 83709 (208-914-8939); **k7rex@arrl.org**
*Montana:* Paul Stiles, KF7SOJ, 5427 Deadwood Dr., Billings, MT 59105 (406-671-7092); **kf7soj@arrl.org**
*Oregon:* David Kidd, KA7OZO, 21760 S. Larkspur Ave., Oregon City, OR 97045-9164 (503-320-3484); **ka7ozo@arrl.org**
*Western Washington:* Monte L. Simpson, W7FF, P.O. Box 3008, Silverdale, WA 98383 (360-633-7665); **w7ff@arrl.org**

### Pacific Division (EB, NV, PAC, SV, SF, SJV, SCV)

*East Bay:* Jim Siemons, W6LK, 2308 Lomond Ln., Walnut Creek, CA 94598-3705 (925-330-0049); **w6lk@arrl.org**
*Nevada:* John Bigley, N7UR, 2420 Palora Ave., Las Vegas, NV 89121-2157 (702-673-0904); **n7ur@arrl.org**
*Pacific:* Joe Speroni, AHØA, 278 Kapiolani Blvd. #502, Honolulu, HI 96826 (808-955-2496); **ah0a@arrl.org**
*Sacramento Valley:* Dr. Carol Milazzo, KP4MD, P.O. Box 665, Citrus Heights, CA 95611-0665 (916-259-3221); **kp4md@arrl.org**
*San Francisco:* Bill Hillendahl, KH6GJV, P.O. Box 4151, Santa Rosa, CA 95402-4151 (707-544-4944); **kh6gjv@arrl.org**
*San Joaquin Valley:* John Litz, NZ6Q, 1434 Douglas Rd., Stockton, CA 95207-3536 (209-331-3078); **nz6q@arrl.org**
*Santa Clara Valley:* James Armstrong, NV6W, 2048 Paseo Del Sol, San Jose, CA 95124-2048 (408-679-1680); **nv6w@arrl.org**

### Roanoke Division (NC, SC, VA, WV)

*North Carolina:* Marvin K. Hoffman, WA4NC, P.O. Box 2208, Boone, NC 28607 (828-964-6626); **wa4nc@arrl.org**
*South Carolina:* Marc Tarplee, N4UFP, 4406 Deer Run, Rock Hill, SC 29732-9258 (803-327-4978); **n4ufp@arrl.org**
*Virginia:* Joseph Palsa, K3WRY, 9101 Arch Hill Ct., Richmond, VA 23236-2725 (804-350-2665); **k3wry@arrl.org**
*West Virginia:* Dan Ringer, K8WV, 18 W. Front St., Morgantown, WV 26501-4507 (304-292-1999); **k8wv@arrl.org**

### Rocky Mountain Division (CO, NM, UT, WY)

*Colorado:* Robert Wareham, NØESQ, 300 Plaza Dr., Suite 200, Highlands Ranch, CO 80129 (720-592-0394); **n0esq@arrl.org**
*New Mexico:* Bill Mader, K8TE, 4701 Sombrerete Rd. SE, Rio Rancho, NM 87124 (505-250-8570); **k8te@arrl.org**
*Utah:* Mel Parkes, NM7P, 2166 E. 2100 North, Layton, UT 84040 (801-547-1753) **nm7p@arrl.org**
*Wyoming:* Rick Breininger, N1TEK, 11 E. 2nd North St., Green River, WY 82935 (307-707-4010); **n1tek@arrl.org**

### Southeastern Division (AL, GA, NFL, PR, SFL, VI, WCF)

*Alabama:* JVann Martin, W4JVM, 16 Baron Dr., Chelsea, AL 35043-6607 (205-281-4728); **w4jvm@arrl.org**
*Georgia:* David Benoist, AG4ZR, 190 Fox Hall Crossing East, Senoia, GA 30276 (404-290-0470); **ag4zr@arrl.org**
*Northern Florida:* Kevin J. Bess, KK4BFN, 908 Flagler Ave., Edgewater, FL 32132-2124 (386-547-2838); **kk4bfn@arrl.org**
*Puerto Rico:* Oscar Resto, KP4RF, HC 77 Box 8743, Vega Alta, PR 00692-9660 (787-883-6878); **kp4rf@arrl.org**
*Southern Florida:* Barry M. Porter, KB1PA, 14555 Sims Rd., Apt. 251, Delray Beach, FL 33484 (561-499-8424); **kb1pa@arrl.org**
*Virgin Islands:* Fred Kleber, K9VV, P.O. Box 24275, Christiansted, VI 00824-0275 **k9vv@arrl.org**
*West Central Florida:* Darrell Davis, KT4WX, 6350 Mills Rd., Fort Meade, FL 33841 (863-245-9923); **kt4wx@arrl.org**

### Southwestern Division (AZ, LAX, ORG, SDG, SB)

*Arizona:* Rick Paquette, W7RAP, 1600 W. Sunkist Rd., Tucson, AZ 85755-9561 (520-425-6877); **w7rap@arrl.org**
*Los Angeles:* Diana Feinberg, AI6DF, P.O. Box 4678, Palos Verdes Peninsula, CA 90274-9618 (310-544-2917); **ai6df@arrl.org**
*Orange:* Carl Gardenias, WU6D, 20902 Gardenias St., Perris, CA 92570 (951-490-2270); **wu6d@arrl.org**
*San Diego:* Dave Kaltenborn, N8KBC, 630 Alber St., Chula Vista, CA 91911 (619-616-8758); **n8kbc@arrl.org**
*Santa Barbara:* John Kitchens, NS6X, P.O. Box 178, Somis, CA 93066 (805-216-2569); **ns6x@arrl.org**

### West Gulf Division (NTX, OK, STX, WTX)

*North Texas:* Steven Lott Smith, KG5VK, 125 Contest Ln., Ben Franklin, TX 75415-3830 (318-470-9806); **kg5vk@arrl.org**
*Oklahoma:* Kevin O'Dell, NØIRW, 1718 South Fairgrounds, Stillwater, OK 74074 (580-220-9062); **n0irw@arrl.org**
*South Texas:* Paul Gilbert, KE5ZW, 1209 Doris Ln., Cedar Park, TX 78613-7067 (512-940-0441); **ke5zw@arrl.org**
*West Texas:* H. Dale Durham, W5WI, P.O. Box 375, Buffalo Gap, TX 79508 (830-719-9000); **w5wi@arrl.org**

# Ameritron 160-6M 1.2kW FET Amplifier

**1.5-54 MHz...1200 Watts PEP Output...Auto bandswitching, no tuning, no warm-up, SWR protected, Quiet Variable-Speed Cooling... Fwd/Ref PEP, PA Balance, ALC, V, I Metering**


**ALS-1306 $3499**
Suggested Retail

**AMERITRON new ALS-1306 1.5-54 MHz solid state FET no-tune Amplifier gives you 1200 Watts PEP output on all bands, including 6 Meters. Automatic bandswitching! No tuning! No warm-up! No tubes! Quiet!**

**Eight** rugged MRF-150 power FETs insure reliability. They are mounted on dual heavy duty heat sinks and properly arranged to spread heat out over a large surface.

**Other** amplifiers using a single power device *cannot* do this. Some power FETs are a package of several transistors in a single case and concentrate all the heat in one small area -- making them difficult to cool. If one transistor fails, they all fail. The ALS-1306 RF deck operates at 50 Volts for efficient, low distortion linear RF power service. It's cooled by a whisper quiet fan. Fan speed is regulated by temperature sensors, assuring minimum noise.

### 1200 Watts PEP Output on all bands 1.5-54 MHz including 6 Meters

**ALS-1306** runs up to 1200 Watts of clean SSB output power (just 100 Watts drive gives you the full rated 1200 Watts output) for *continuous* coverage between 1.5-54 MHz. 10/12 Meters is included. This compact operator-friendly and attractive desk-top amplifier fits neatly into any station. Just 10W x 6 1/2H x 18 1/2D inches. Weighs only 22 pounds.

**SWR** Protection prevents amplifier damage if you switch to a wrong band, use the wrong antenna or have high SWR.

**If** forward or reflected output power exceeds a safe level then output power is automatically reduced to prevent amplifier damage by controlling ALC to exciter.

**LED-illuminated** Cross-Needle SWR/Wattmeter lets you read SWR, forward and reflected *peak* power simultaneously. You also get ALC, SWR, PA balance and current metering with LED backlight. An Operate/Standby switch lets you run "barefoot", but you can instantly switch to full power if needed.

### Front-panel ALC control!

**This** exclusive Ameritron feature lets you adjust output power conveniently from the front panel.

**Has** bandswitch, ALC, SWR, PA and TX LED indicators.

### Automatic Bandswitching!

**Place** your amplifier and power supply out-of-the-way and control your amplifier directly from your rig!

**ALS-1306** automatic bandswitching reads band data from your transceiver and automatically changes bands as you change bands. An optional interface cable is required for your particular radio.

### Clean, Modular Construction

**Ameritron** ALS-1306 amplifier has modular construction for easy-servicing, unlike other amplifiers that are so tightly packed they are un-serviceable.

### ALS-1306 Power Supply

**The** ALS-1306 is powered by a 50 VDC switching power supply. Comes with a pre-wired cable to plug into the ALS-1306.

This hash-free fully regulated swtiching power supply is only 12 lbs. and measures a compact 10W x 6 1/2H x 9 1/2D inches. It can be placed conveniently out-of-the-way. Output is 50 VDC at 50 Amps to the ALS-1306. Wired for 220 VAC, selectable to 110 VAC. Draws less than 25 Amps at 110 VAC; 12 Amps at 220 VAC.

**Peek inside and see Ameritron's beautiful craftsmanship.**

## ALS-606S – $2099
Suggested Retail
**600 Watt 160-6M Amp**

**600 Watts** PEP/500W CW output, 160-6 Meters with automatic instant bandswitching from your transceiver. Fits on your desktop. 9.75W x 7H x 14.5D inches and weighs 14.2 lbs., but is only 4 dB below 1500 Watts – less than an S-unit!

**ALS-606 – $2299,** like ALS-606S but has transformer power supply.

**NEW LOWER PRICE!!!**

**ALS-600S, $1899**. 160-10M with switching power supply.
**ALS-600, $1999**. 160-10M with transformer power supply.

## ALS-500M – $999
Suggested Retail
**500 Watt Mobile Amplifier**

**500 Watts** PEP/400W CW output, instant bandswitching, no tuning, no warmup. SWR, load fault, thermal overload protected. On/Off/Bypass switch. Remote on/off control. DC current meter. Very quiet fan. 1.5-22 MHz (10/12 Meters with MOD-10M, $29.95). Requires 13.8 VDC. 9W x 3 1/2H x 15D in., 7 lbs.
**ALS-500RC – $64.95**, Remote Head.
**SPS-75MV – $289.95**. 110VAC input, 75A at 13.8 VDC output power supply for using ALS-500M at home.

## ALS-1300 – $3099
Suggested Retail
**1200 Watt FET Amp**

**Save $400**...if you don't need 6 Meters or auto bandswitching. Has most features of ALS-1306.

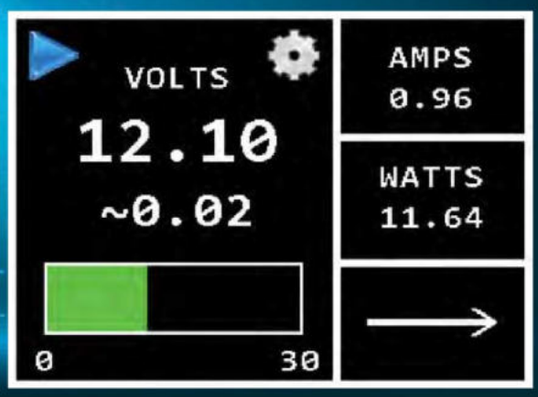
**Call your favorite dealer for your best price today!**

AMERITRON® **The World's High Power Leader** 116 Willow Rd, Starkville, MS 39759
■ **Tech:** (662) 323-8211 ■ **FAX:** (662) 323-6551 8 a.m.-4:30 p.m. CST, Monday-Friday

# INTRODUCING THE IMPROVED PWRcheck+

## Your Power Monitoring Solution!


## NEW VIBRANT LCD COLOR TOUCHSCREEN!




**West Mountain Radio's IMPROVED PWRcheck+ is the ultimate solution for your power monitoring needs.**

- Measures up to 60VDC at 40A continious load
- 10mV,10mA Resolution
- Bi-directional high side monitoring

## Access Unique Software Features:

- ***8 Display Modes: current, voltage, wattage and amp-hours in real time***
- ***Deep Internal non-volatile log,Over 100,000 points, Exports to Excel***
- ***USB Interface and included PC charting software for real time or history***
- ***Easily configure every aspect of PWRcheck operation such as datalogging rate, display formats, alarm conditions***
- ***User settable high/low voltage/ current alarms***

## Order Online or from Our Distributors!

WEST MOUNTAIN RADIO

262-522-6503
sales@westmountainradio.com
**westmountainradio.com/QST1020**

# KX Line: KX3/KX2

## Elecraft® Full-Featured Ultra-portables 100W with Matching Amp

ELECRAFT **KX3**

***SSB/CW/Data/AM/FM • 160-6 m • 15 W***


**NEW!**
**KX Line Packages**
**Visit Elecraft.com for details**

**The KX3** has become the compact, 160-6 meter, all-mode transceiver of choice for thousands of hams, for home, travel, and portable use. Its versatility has been demonstrated at countless Field Day and DXpedition operations.

- Matching PX3 panadapter with fast, full-color spectrum/waterfall*
- 7.4" x 3.5" x 1.7" (weight: 1.5 lbs.)
- Best-in-class performance
- 160-6 meters plus 2 or 4 m*
- SSB, CW, AM, FM, Data
- Up to 15 W TX
- Weighted, free-spinning VFO knob
- Precision roofing filter*
- Wide-range internal ATU*

ELECRAFT **KX2**

***SSB/CW/Data/AM/FM • 80-10 m • 12 W***


**NEW!**
**AX1 20/17 Whip Antenna for the KX2!**
**Call for details**

**Our KX2** "stealth" transceiver can go wherever your imagination takes you. It's pocket sized, yet it transmits at up to 12 watts, covers 9 bands, and shares many features with the KX3. It also works with the KXPA100 amp.

- 5.8" x 2.8" x 1.5" (weight: 13 oz.)
- Ultralight grab-and-go station, perfect for SOTA and field operation
- 80-10 meters (9 bands)
- SSB / CW / Data/ AM / FM
- Up to 12 W TX
- Internal 2.6 Ah Li-ion battery*
- Built-in mic for HT-style operation
- Wide-range internal ATU*
- New KXPD2 compact keyer paddle*

*Option

# Make Waves in Style with the New K-Line.

## K4 Direct-Sampling SDR and KPA 1500 Legal-Limit Amp



**K4 Features**

Direct sampling SDR • Modular, hybrid architecture • Single or dual panadapter • High resolution tuning aid • Comprehensive I/O • Full remote control via Ethernet • 7" color screen with touch and mouse control • ATU with 10:1+ range • 3 antenna jacks • Up to 5 receive antenna sources

**KPA1500 Features**

1500 W • Very compact design • Fast, silent PIN diode T/R switching • Built-in ATU with dual antenna jacks • Compatible with nearly any transceiver – custom cables available • 160-6 meters • CE for Europe

ELECRAFT®

**elecraft.com • 831-763-4211**

Steve Ford, WB8IMY, wb8imy@arrl.net

# Up Front

## Rare Novice Transmitters


On April 22, 2020, Jon Jesse, WS1K, and Steve Miller, WA3JJT, made their first contacts using their World Radio Labs CW-7 Novice transmitters. Jon's transmitter was a rare original (left), while Steve's (right) was a modern clone. The CW-7 debuted in the early 1950s and used 70L7 and 50L6 tubes. Steve is looking for original manuals and other CW-7 owners. You can contact him at **stevemillererie@hotmail.com**.

## Railroad Telegraphy

While visiting Oakland, Maryland, in the extreme western region of "The Old Line State," Al Rabassa, NW2M, came across the Oakland B&O Railroad Museum. According to Al, it is one of the better train museums he has visited and has the best working telegraphy setup he has ever seen.

## 3D-Printed Cover

During the coronavirus lockdown, Mark Erbaugh, N8ME, purchased a 3D printer and spent some of his time making new creations for his station. One of his favorites is a cover for the terminals on his Vibroplex® iambic paddles. Mark said, "I never liked the look of the wires coming directly off the posts and wanted some form of strain relief. I also wanted the ability to easily disconnect the paddles. I sketched up the paddle jack cover in *FreeCAD* and printed it, then installed a panel mount 3.5-millimeter TRS jack in the hole on the front and attached short wires with crimp-on ring terminals. I installed the ring terminals on the paddle posts, placed the cover over the terminals, and used the binding nuts to hold the cover in place."

**TURN YOUR RADIO INTO A LEGAL LIMIT BEAST.**

Our Power Genius XL solid state, software defined amplifier is exceptionally clean and delivers full 1.5kW ICAS duty cycle on all bands and modes including RTTY & FT8. The only fully SO2R/Multi-Single capable amplifier on the market, it has 70dB nominal isolation between transceiver inputs, diplexed filters, and ultra-fast high SWR protection. Like our entire transceiver product line-up, the PGXL is Ethernet connected and fully integrated with SmartSDR for remote operation. Making all controls and meters available from anywhere. Just one more way to help you find everywhere. **flexradio.com/PowerGenius-XL**

FlexRadio

Find Everywhere

# HERE'S AN IDEA: LET'S CREATE SOMETHING SO POWERFUL IT'S BARELY LEGAL.


Ham Radio Saves Lives!
Turn-Key Public Service
Repeater Systems
2m, 1.25m, 70cm
"If you need EmComm,
you need BridgeComm!"
-T.H. Merritt, KL5YJ
Brewton, AL
Visit the link or call the
number below to learn more!
BridgeCom SYSTEMS
816-532-8451
sales@bridgecomsystems.com
TO LEARN MORE VISIT:
www.BridgeComSystems.com/systems

# SKYBRIDGE

## Introducing the New Dual-Band Digital Hotspot

NEW


### What Hotspot Will You Own?

When you innovate, you don't make more of the same. You would make something better. You would make your hotspot packed with accessories. You would make your hotspot cross-mode capable. You would make it dual-band. Yes, you would even add an OLED screen to see your QSO's contact info!

### DMR Made Easy.

We can't deny it. We've made it easy. Hams enjoy this remarkable SkyBridge *Plug and Play package* because it comes programmed out of the box. In fact, whether you're a Technician or an Amateur Extra, there's one fact you can be sure of: the SkyBridge hotspot is your key to success!


BridgeCom SYSTEMS
816-532-8451
sales@bridgecomsystems.com

TO LEARN MORE VISIT:
bridgecomsystems.com/skybridge

# Correspondence

# Letters from Our Members

## A Classic Article for an Old-School Operator

In February 1965, at 18 years old, I enlisted in the Army to train in radio communications. I trained on Morse code for 18 weeks at Fort Devens, but never got past 13 WPM, so I was diverted to radio telegraph schools and then shipped out to Japan and Vietnam. Fifty years later, in 2015, I became a new amateur radio licensee. CW had always been my passion, so with a new radio, a J-37 telegraph key from the army, and a wire antenna, I was on the air on 40 meters. I now operate on the same HF bands that I monitored with Collins R-390 receivers while stationed in Japan. I'm now able to send Morse code at up to 15 WPM.

After 5 years in ham radio, as a lifetime ARRL member and a casual but exclusively CW operator, I found an article that got my attention right out of the mailbox. In the August 2020 issue of *QST*, I was drawn to an old article in the "A Look Back" section, about the "Junker" amplifier by Lew McCoy, W1ICP (SK). The use of tubes appealed to me, and I was grateful to read an article that spoke my language. Thank you for republishing it!

**Vern Maine, AI1I**
Rindge, New Hampshire
Life Member

## Upgrading After Coronavirus

In March, I contracted the coronavirus from one of my students. I had received *The ARRL Amateur Extra-Class License Manual* and *ARRL's Extra Q&A* in 2018, but I didn't begin to seriously study for the exam until I was quarantined during the 18 days that I was sick. Social distancing guidelines and other policies have caused many cancellations of license and upgrade exams here in Michigan. However, once I had recovered from the virus, I was able to find an exam location in another city. When I met with the Volunteer Examiners (VEs), they were very helpful and professional. After I finished the exam and earned my Extra-class license, a newly licensed Technician-class examinee asked if it was worth it to pursue the Extra-class license. My response was, "It was worth the 11 weeks of study!" Becoming a VE is my next challenge, along with possibly introducing the world of amateur radio to my elementary afterschool students.

**John Rhodes, Jr., KE8JHB**
Flint, Michigan

## Transmitting from Californian to Hawaiian Beaches

Larry Paola's, KC2EQA, article, "A Tale of Two Catches," in the August 2020 issue of *QST*, made me recall one of the most satisfying events in my ham radio experience. Around 1980, I brought a Heathkit HW-7 2 W, three-band transceiver to the beach, along with an 8 W solar panel that I had built. I also took a roll of thin wire from a flyback transformer, a kite, and a homemade antenna tuner, which was made from a tapped coil and two open-air variable capacitors.

I set up on the beach just as Larry did in the article; however, I then had to fly a kite and tune it on 40 meters, to the frequency of one of several 40-meter crystals that I had from the early 1960s. I plugged in the solar panel and started listening to the 40-meter CW band. I heard someone calling CQ from Hawaii at my crystal frequency, and I responded. I couldn't believe it when I heard my call sign being broadcast back to me. I was on a beach in Playa del Rey, California, transmitting using an 8 W solar panel and about 1 W of output transmit power, and the other station was 2,550 miles away. That year was near the peak of Solar Cycle 21, so sunspot conditions were at their maximum, which helped.

A small crowd gathered around me when they heard me cheering. One of them even took a photo and mailed it to me a month or two later from Texas. It is incredible to think about the unique opportunities of meeting people, near and far, through radio.

**Greg Glenn, WB6MPH**
Pacific Palisades, California

## International Mail Suspensions Due to COVID-19

I recently received a returned QSL card from Jordan. A note on the envelope stated, "Mail service suspended." The postal service is temporarily suspending international mail acceptance for certain destinations due to the COVID-19 pandemic. Other hams might want to check for suspended service at this time, before mailing a QSL card to a DX station. You can find more info about suspended service on the USPS website, at **https://about.usps.com/newsroom/service-alerts/international**.

**Jim Crisco, WA4YIZ**
Lincolnton, North Carolina

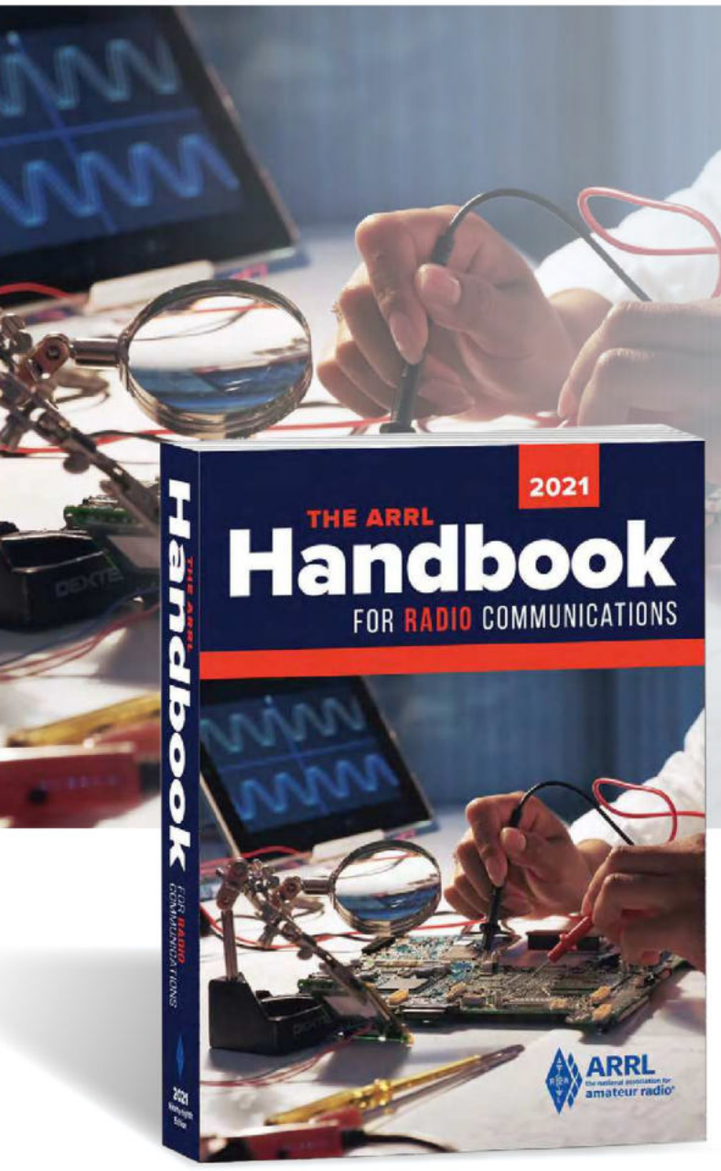
Send your letters to "Correspondence," ARRL, 225 Main St., Newington, CT 06111. You can also submit letters by fax at 860-594-0259, or via email to **letters@arrl.org**. We read every letter received, but we can only publish a few each month. We reserve the right to edit your letter for clarity, and 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.

# THE ARRL Handbook FOR RADIO COMMUNICATIONS

New

**2021 Edition**

*The ARRL Handbook for Radio Communications* is your complete guide to radio experimentation, discovery, and innovation. It is the *Handbook* -- written by radio amateurs for everyone with a desire to advance the pursuit of wireless technology.




## New Projects and Content Covering...

- PIN diode RF switching circuits
- Transverters
- Waveguides
- Soldering tools
- Digital modes — FT8, FT4, and MSK144
- Feedline choke designs for receiving and transmitting
- CAD software from Tonnesoft

**BONUS** - Download the fully searchable digital edition, as well as expanded supplemental content, software, PC board templates, and other support files.

**Six-Volume Book Set**

ARRL Item No. 1403 / Only $59.95

**Softcover Book**

ARRL Item No. 1397 / Only $49.95

**Shipping early October!**

**www.arrl.org/shop**

ARRL
the national association for
amateur radio®

# ENJOY WATCHING EVERYONE ELSE SUDDENLY SECOND-GUESS THEIR RADIOS.

**EVERYWHERE MEANS EVERYWHERE.**

We're for every corner of the earth. So much so, it's led to revolutionizing the ham radio industry as the leader in design of software defined radios (SDRs). Because when you're looking to connect with people and places that may or may not even be on the map, you better have the best partner in technology on the planet. To learn more about our boundary-pushing products, visit **flexradio.com/FindEverywhere**

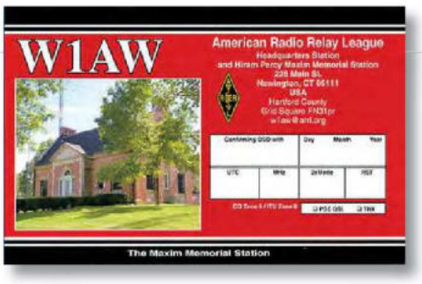
FlexRadio

Find Everywhere

6400 | 6400M | 6600 | 6600M |6700 | Maestro | Power Genius XL | SmartSDR

# W1AW's QSL File

Every month, W1AW receives hundreds of QSL cards from hams all over the world, confirming contact with the Hiram Percy Maxim Memorial Station at ARRL Headquarters. Maybe you'll recognize an on-air friend — or even yourself — among these recent cards.




KENWOOD

3rd IMDR 110 dB*

RMDR 122 dB*

BDR 150 dB*

# Performance Exceeding Expectations.

The most happy and sublime encounters happen in the worst circumstances and under the harshest conditions.

There are enthusiasts who know this all too well because of their love of HF radio.

Results born of certainty and not circumstance. Delivered through impeccable performance. This is our offering to you.


"The Kenwood TS-890S has the highest RMDR of any radio I have ever measured."
*- Rob Sherwood - NC0B - December 2018*

HF/50MHz TRANSCEIVER
## TS-890S
NEW

**Top-class receiving performance**

3 kinds of dynamic range make for top-class performance.

- Third order intermodulation Dynamic Range (3rd IMDR) 110dB*
- Reciprocal Mixing Dynamic Range (RMDR) 122dB*
- Blocking Dynamic Range (BDR) 150dB*

*Values are measured examples. (2kHz spacing:14.1 MHz, CW, BW 500 Hz, Pre Amp OFF)

- Full Down Conversion RX
- High Carrier to Noise Ratio 1st LO
- H-mode mixer

**4 kinds of built-in roofing filters**

500Hz / 2.7kHz / 6kHz / 15kHz (270Hz Option)

**7 inch Color TFT Display**

- Roofing frequency sampling band scope
- Band scope auto-scroll mode
- Multi-information display including filter scope

**Clean and tough 100W output**

**Built-in high-speed automatic antenna tuner**

**32-bit floating-point DSP for RX / TX and Bandscope**

*: 2 kHz spacing measurement standard - Receiver frequency 14.2 MHz, MODE CW, BW 500 Hz, PRE AMP OFF

**Customer Support:** (310) 639-4200

www.kenwood.com/usa

ISO9001 Registered
JVCKENWOOD Corporation

ADS#02019

# Spirally Loaded Copper Tape and PVC Dipole

This easy-to-build 2-meter-band vertical dipole is only 40% as tall as a J-pole.

**John Portune, W6NBC**

Here is a simple starter antenna — especially for a new ham — that offers good performance, and would be a good radio club build-it-yourself project. It's stealthy and low visibility to neighbors and homeowners associations. It's also a good temporary base station antenna for net control at parades and marathons.

Not many hardware store do-it-yourself materials are more attractive to homebrew hams than PVC pipe and copper. The spirally loaded copper tape and PVC dipole is the simplest 2-meter antenna using only these ham favorite materials.

This little gem is an 18-inch tall corkscrew of 1-inch adhesive-backed copper foil tape, wrapped spirally around a 3-foot length of 1¼ inch PVC pipe. The tape is available at many hardware stores. Equally suitable adhesive copper tape, used for RF shielding, is also available from online suppliers. Be sure to purchase it in a 1-inch width.

## How It Works

The entire antenna length is just a stretched-out loading coil, a helix of 1-inch by 1.5-mil copper. The wide tape has low resistance, which is important in a small antenna. Aluminum tape can also be used; although, you should select a slightly thicker gauge. The 1-inch-wide turns are separated by a further 1 inch to minimize losses common in loading coils. The result is an antenna with better than 90% efficiency.

## Performance

Figure 1 shows the *EZNEC Pro-4* radiation patterns. Our barber pole antenna is vertically polarized and omnidirectional toward the horizon, with a maximum gain of 1.64 dBi. In comparison, the much taller 5-foot copper-pipe J-pole has essentially the same radiation pattern and only a half-decibel more gain.

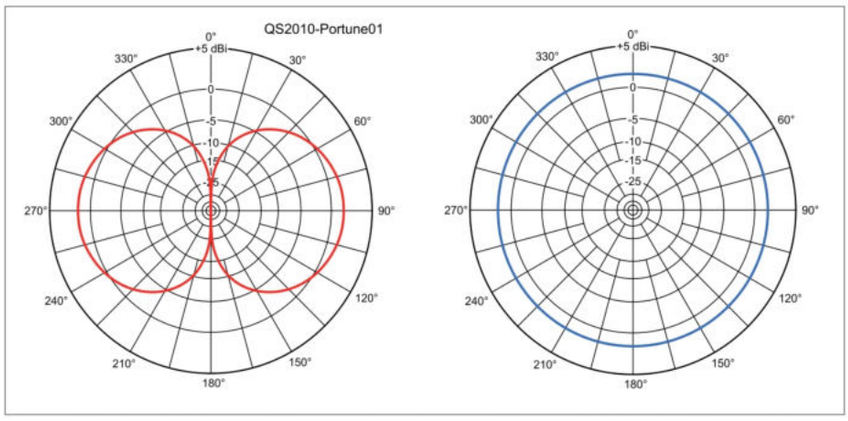



**Figure 1** — Elevation (red), azimuth (blue) free-space radiation patterns.

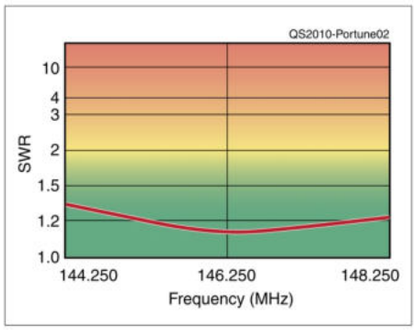



**Figure 2** — SWR in the 2-meter band measured with a Rig Expert A-1400.

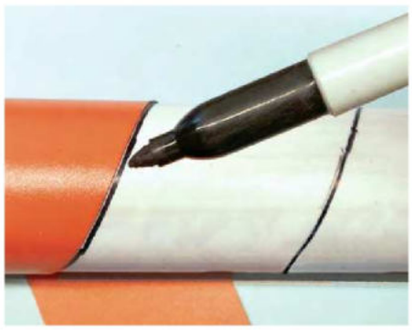


**Figure 3** — Drawing the guideline for accurately applying the copper tape.

Figure 2 shows the SWR and bandwidth at 2 meters plotted with a Rig Expert A-1400 antenna analyzer. The wide copper tape contributes significantly to the bandwidth shown — excellent SWR of less than 1.5:1 across the entire band.

## Cost

I purchased a 45-foot roll of 1-inch by 1.5-mil copper RF shielding tape from Amazon for $10.99. Only 5 feet are needed, but the remaining tape is useful for other radio projects. A 10-foot length of 1¼-inch PVC pipe is roughly $20. Some stores sell shorter lengths; this antenna requires 3 feet of pipe. Six feet of mini RG8 on the internet costs $1.20 at $0.20 a foot. A PL-239 connector is about $2 to $4. Considering only the fraction of materials used, this antenna has a modest price tag of about $10.

## Construction

Begin with a 36-inch length of 1¼-inch Schedule 40 PVC pipe. Schedule 80 or ABS DWV pipe is okay too. The top 20 inches are for the helix, and the space at the bottom is for mounting. Alternately, a unique possibility is to seamlessly integrate the antenna with its mast for no visible mounting brackets.

Adhesive-backed materials are difficult to position accurately, therefore, you should make up a temporary guide strip for drawing an accurate guideline on the PVC pipe and mast. This can either be a 54 × 2 inch strip of card stock or flexible plastic material. If necessary, align and tape together shorter strips. I cut mine carefully to 2 inches on a paper cutter, from the front covers of heavy 8½ × 11 inch plastic report folders.

## Marking the Guideline

Initially, tightly wrap a single turn around the PVC pipe at the lengthwise center of the guide strip, and likewise at the lengthwise center of where the helix will be on the pipe. Butt the strip edges together and temporarily secure this single turn with household tape. Then complete the wrap, being careful to keep the edges butted together. Secure the entire wrap with tape.

Next, draw the guideline along the edge of the strip with a permanent marker, unwrapping one end a little at a time (see Figure 3). Using the guideline marked on the PVC pipe, carefully adhere 54 inches of copper tape along the guideline. Begin 1 inch from the top, progressively folding back the paper backing that protects the copper tape's adhesive, only in short lengths as you proceed.

## Feed-point and Feed-line Pigtail

Next, remove 1 inch of foil at the lengthwise center of the helix and then drill a ¾-inch hole through the PVC pipe in the gap (see Figure 4). The feed coax runs coaxially up through the PVC pipe from the bottom and exits at this hole to connect to the helix.

Next, prepare a 6-foot RG58 or Mini-8 coax feed-line pigtail. Separate the center conductor and shield wires into two individual conductors (see Figure 5). Weatherproof the ends with heat-shrink tubing.

Add #6 ring terminals for the feed-point screws, leaving roughly ½ inch of the conductors exposed to facilitate a sharp bend at the feed point. Drill and tap the

◀ **Figure 4** — Feed point detail.

▼ **Figure 5** — Coax pigtail ends.

PVC pipe, through the helix ends, for 6-32 × ⅜-inch stainless-steel screws and flat washers. Stainless sheet metal screws can also be used.

It is advisable to use heavier coax, such as RG8, RG213, or LMR400, for the downstream run from the pigtail to the shack to minimize losses.

## Feed-line Spacer

We also need to keep the coax centered inside the helix and PVC pipe to prevent it from adversely affecting the antenna. Plastic foam is suitable as a spacer. A better choice is 12 inches of ¾-inch PVC pipe with end caps, and centered end holes for the coax. Use end caps that will fit and hold the spacer snugly inside the main pipe. Some caps may require a little filing or a drop of PVC cement. Push the spacer snugly right up to the feed point. It is just visible at the bottom of the hole in Figure 4.

*A note of caution:* Be sure to connect the coax shield wire to the bottom helix turns, and the center conductor to the top turns. If these connections are reversed, tuning will be difficult.

## Balun

The antenna needs a 1:1 current choke balun just below the helix. You can use a stack of VHF-mix ferrite beads on the pigtail inside the PVC mast or an external six-turn 1-inch ring of bundled coax secured with zip ties.

## Tune and Match

My antenna tuned up at 146 MHz with a good SWR when trimmed to three and a half helix turns on top and four and a half turns below the feed point. The reason for a non-centered feed point is this. A shortened dipole has a natural center feed-point impedance of less than 50 Ω. A 1:1 match will be found slightly off-center on either side.

To allow for initial adjustment, the 54-inch length of the copper tape is intentionally too long. The initial frequency will be low. One merely removes small amounts until the desired frequency and SWR are achieved. The number of turns on top compared to the number at the bottom adjusts the SWR. The total length adjusts the frequency. Consequently, remove or add foil only at the top to adjust the SWR. Add or remove similar amounts simultaneously at both ends to change the frequency.

The rule of thumb for trimming antennas is to adjust the SWR first and then the frequency. SWR will change little when you next adjust the frequency.

Begin the tuning of your helix by removing copper tape until there are three and a half turns at the top and four and a half at the bottom. From there, fine-tune for the best SWR. If you remove too much foil, add back a short piece, overlapping the ends by 1 inch, so the capacitive coupling of the overlap prevents the adhesive from interfering with the coupling.

## Final Issues

Cut off excess PVC pipe at the top and install a cap to keep out the weather. You can enclose the antenna in a radome of 2-inch PVC. If left exposed, at least the feed point should be weatherproofed with self-curing plastic tape, heat-shrink tubing, or RTV clear silicone sealant.

John Portune, W6NBC, is an ARRL member and frequent contributor to *QST*. He has been licensed for 54 years and has held an Amateur Extra-class license since 1972. John has a BS in physics and also holds an FCC Commercial General Radiotelephone Operator license and an FCC Radiotelegraph license. He retired as a broadcast television engineer and technical instructor at KNBC in Burbank and then from Sony Electronics in San Jose, California. John has published many articles in *QST* and other amateur radio journals, and is a frequent speaker at ham radio clubs. You can reach John at **jportune@aol.com** or through his website at **www.w6nbc.com**.

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

# High-Performance 80 – 40 – 30 Meter Vertical Antenna

## This triband vertical antenna can also include 160-meter band operation.

**Randy Rhea, N4HI**

For the first time in 18 years, I moved to a home where I could put up a tower to support my homebrew log-periodic array. I still needed something for the low bands, so I hung a 72-foot wire vertical in a tree and matched it on 80 and 40 meters using a dual-band network first described by Hayward, W7ZOI, in the June 1977 issue of *QST* and later by Richardson, K6MHE, in the September 2005 issue of *QST*. I laid three 82-foot radials on the ground. The wire vertical antenna was ⅝ wavelengths on 40 meters and just over ¼ wavelength on 80 meters.

Surprised and encouraged by the vertical antenna performance, I began considering an improved vertical.

### The Objectives

I had five objectives for the vertical antenna: 1) a more permanent installation than a wire in the trees, 2) addition of 30 meters for 80 – 30 meter coverage, 3) nearly ⅝-wavelength height on 40 and 30 meters for reduced ground losses and a lower radiation angle, 4) a single coax feed line to the antenna with no control wires or relays, and 5) provisions for a dc ground to eliminate static buildup on the antenna.

A network to match three frequency bands to an antenna with multiple resonances would be a challenge, but I had access to *Genesys* RF/microwave synthesis and simulation software (**www.keysight.com**) to attack the problem.

I had recently acquired about 47 feet of Rohn 25G tower that had been sawed from a concrete ground foundation. I buried the remaining base in concrete, which left 43½ feet of the tower above ground. The rest of the vertical antenna would be telescoping aluminum tubing.

### The Concept

The elevation pattern for an antenna that is ⅝ wavelengths on 40 meters is lobed and undesirable on 30 meters, so I added a trap at 60 feet, in the form of a shorted 10.1 MHz coaxial stub trap, which easily hangs in the tubing and tower. The final concept was a 43½-foot tower, a 16½-foot tubing section, a coaxial-stub trap, and a 12-foot top tubing section.

***I had recently acquired about 47 feet of Rohn 25G tower that had been sawed from a concrete ground foundation.***

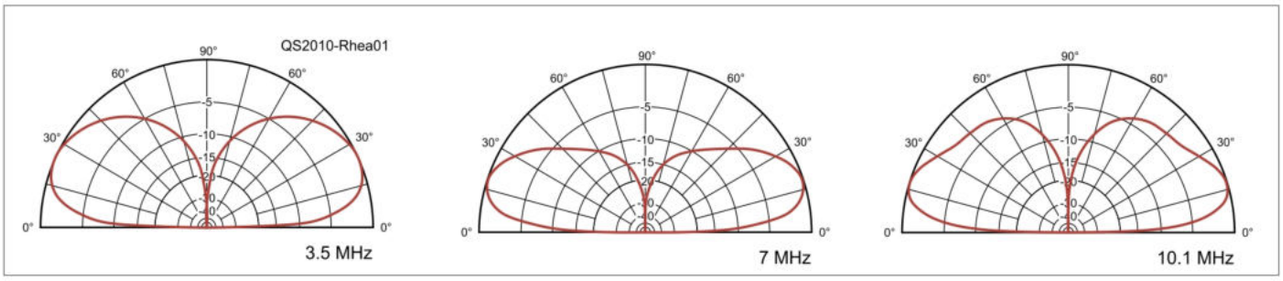



**Figure 1** — *EZNEC*-simulated elevation patterns for the vertical over a medium ground.

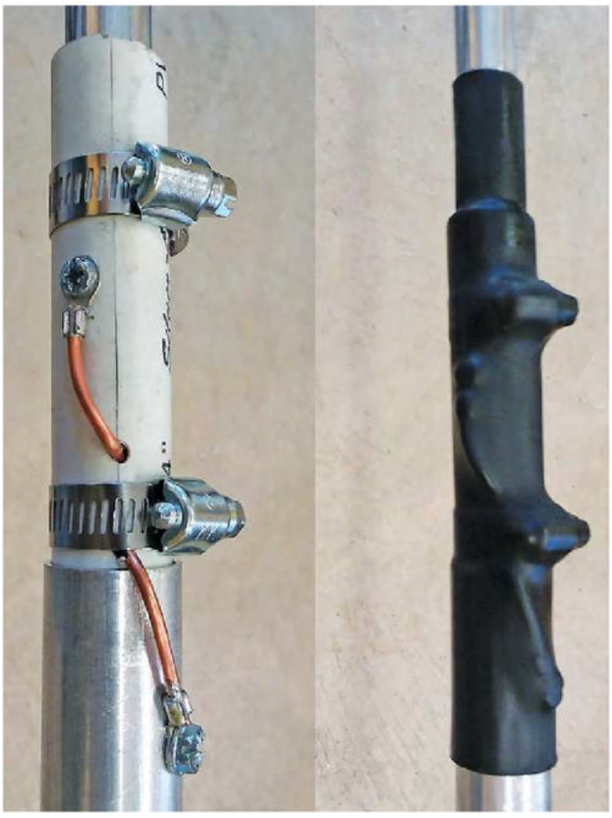


**Figure 2** — PVC section terminating the 10.1 MHz coaxial-stub trap at 60 feet, before (left) and after (right) applying heat-shrink tubing.

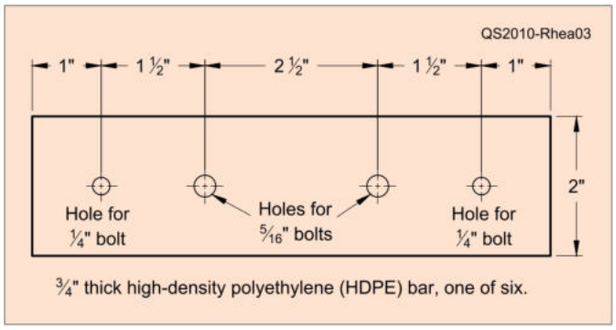



**Figure 3** — Drill-hole pattern for a ¾ × 2 × 7½ inch high-density polyethylene (HDPE) hinge. Six hinges are needed.

I ran a simulation using *EZNEC* (**www.eznec.com**) to verify the patterns (see Figure 1) and estimate the base impedance. The antenna is near resonance on 3.5 MHz, but the 7 and 10.1 MHz impedances are reactive. I planned to finish the network design using measured data.

## Construction of the Antenna

The 16½-foot section was 1½-, 1⅜-, 1¼-, and 1⅛-inch ID telescoping aluminum tubing. With a table saw, I ripped a slot along the length of an 18-inch section of 2-inch Schedule 40 PVC pipe. When compressed, it fit tightly within the top tube of the tower. I slipped the bottom 1½-inch aluminum tube inside the PVC and secured it with two bolts through the tower and aluminum tubing at right angles to each other.

The 10.1 MHz stub is 20½ feet of LM400 coaxial cable that has a velocity factor of 0.84. It hangs within the 16½-foot middle tubing section and it protrudes a few feet down into the Rohn 25G tower section.

Figure 2 shows the PVC pipe and stub termination assembly that connects the bottom aluminum section to the top aluminum section. A 12-inch piece of ¾-inch Schedule 40 PVC pipe was also ripped. I drilled two holes in the PVC pipe for the coaxial stub at the slot while the pipe was compressed in a vise. The top copper wire is the center conductor of the coaxial line, and the bottom copper wire is soldered to the outer shield of the coax. The PVC pipe was then compressed and slipped into the top 1-inch ID tube of the lower aluminum tube section.

The upper section of the vertical is 12 feet of ¾-, ⅝-, and ½-inch telescoping aluminum tube. The bottom of this section slips inside the PVC terminating section. The total height of the antenna is 72 feet.

My ground system comprises two 8-foot ground rods and 24 82-foot-long evenly spaced radials of insulated


**Figure 4** — The base of the high-performance vertical shows the insulating base hinges, the matching network enclosure mounted on one of the ground rods, and a portion of the radial system.

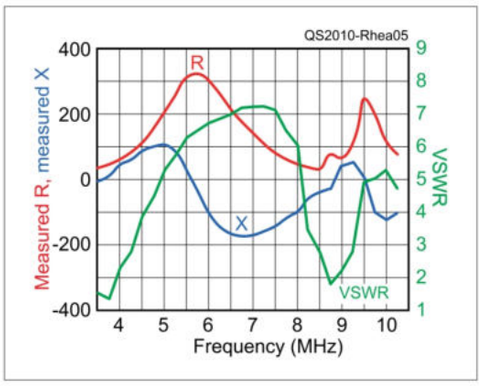



**Figure 5** — Measured impedance at the base of the high-performance vertical antenna. Resistance is shown in red, reactance is shown in blue, and SWR is shown in green.

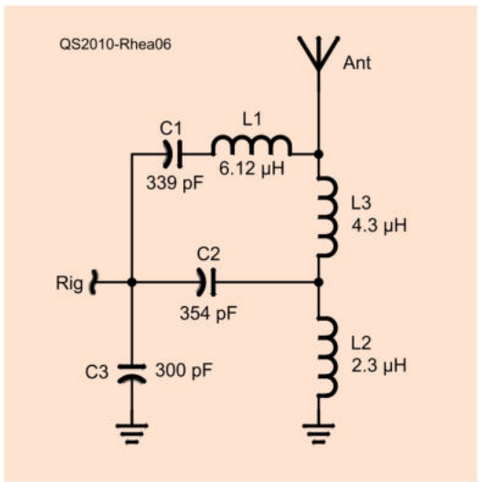



**Figure 6** — Antenna-matching network for the 80-, 40-, and 30-meter bands.

solid #16 AWG wire (dog fence wire) laying on the ground and held down with landscaping pins.

## The Insulating and Hinge Base

I opted to insulate the base of the tower. This offered the opportunity to use a hinge system at the base to erect the antenna. I cut six hinge bars, 7½ inches long, from 4-foot stock of ¾ × 2 inch high-density polyethylene (HDPE) bar. Figure 3 shows the dimensions and drill-hole pattern for a typical hinge bar.

For strength, I cut out 6½-inch sections of each tower leg so that the end of each leg was short and close to a cross bar (see Figure 4). The holes in the tower legs must be placed so the cross bars do not interfere with the hinging tower. Also, careful alignment is required in the holes drilled in the tower leg for easier insertion of the bolts when the tower is erected. Galvanized ¼-inch and 5⁄16-inch bolts secure the tower to the hinge bars. The insulating hinge bars, matching network enclosure, and ground system are seen in Figure 4. Once erected (see the lead photo), the tower is guyed at 35 feet with non-conducting cable. The guys are attached to the tower before erection to avoid climbing the tower.

## The Matching Network

After the antenna was completed, I measured the base impedance using an AA-35 Zoom Antenna and Cable Analyzer by RigExpert (**www.rigexpert.com**). The base impedance from 3.5 to 10.25 MHz is shown plotted in Figure 5. I designed the network by trial and error using the *Genesys* circuit theory simulator. The schematic of the final network is shown in Figure 6. Because the measured base impedance was capacitive and higher than 50 Ω on both 40 and 30 meters, I began with an inductive stepdown transformer consisting of L2 and L3. This also provides a dc ground.

Capacitor C2 improves the SWR on 40 and 30 meters, while C1 and L1 are near resonance on

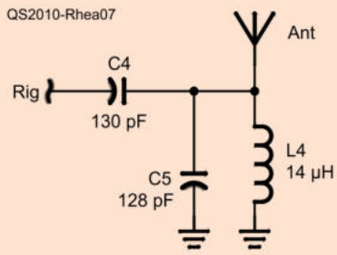



**Figure 7** — Antenna-matching network for the 160-meter band.

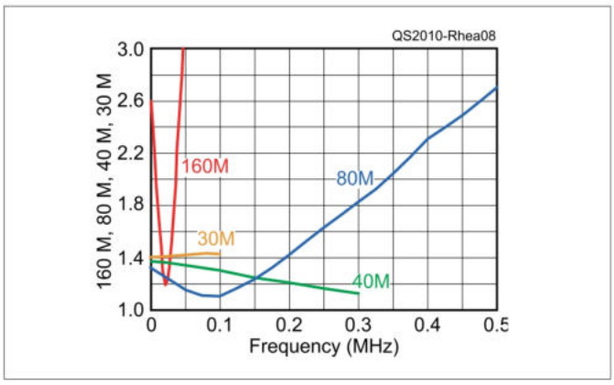



**Figure 8** — SWR of the matched antenna measured in the shack through 120 feet of LM400 coax cable. Frequency shown is from the bottom of each band.

80 meters and bridge the antenna directly to the input. The value of C3 is not a critical, but it improved the match on all bands. I used *Genesys* to optimize all the component values, resulting in a good match on 80 through 30 meters.

## The 160-Meter Bonus Band

With a 72-foot radiator and an extensive radial system in place, I tested the vertical on 160 meters. The base impedance measured with the AA35 was (13.5 – *j*237) Ω.

I constructed the matching network for 160 meters, shown in Figure 7. The final values of the matching network were empirically adjusted. C4 is not sensitive and may be fixed. Tune capacitor C5 to place the SWR minimum at the desired frequency.

I elected to use two inputs on top of the matching network box and two SO-239 bulkhead connectors on the sides, and then select networks manually.

## Construction of the Matching Network

The matching network is enclosed in a 12 × 12 × 6 inch weatherproof plastic electrical junction box. Mount the box on one of the 8-foot copper ground rods using two small U bolts, as seen in Figure 4. The U bolts serve as the ground reference inside the box. The antenna has a 12-inch jumper to a ¼-inch brass bolt on top of the box. Inductors L1, L2, and L3 are #14 AWG enamel magnet wire closely spaced and tightly wound on ½-inch thin wall PVC, with 26, 12, and 19 turns respectively. L4 is 27 turns on 1-inch Schedule 40 PVC. The magnet wire may be straightened before winding by slightly stretching the wire. The windings are stabilized by wrapping with electrical tape.

The matching network is tuned after installation. I accomplished this using variable capacitors for C1 and C2. The value of capacitor C3 is not critical, and it may be a fixed capacitor. C1 and C2 may also be used to obtain the lowest SWR to the phone portions of the bands if desired. Centering the lowest SWR for each band should result in a reasonable match on 80 through 30 meters. The bandwidth on 30 meters is wide, and once C1 and C2 are tuned, the SWR on 30 meters should be low. However, the bandwidth of the 160-meter network is small, so C5 must be tuned for the desired segment. I operate without a linear amplifier, so closely spaced variable capacitors are suitable. Fixed capacitors, and parallel capacitors to reduce required variable capacitance, can be doorknob variety or 1,000 V silver-mica capacitors.

## Performance

Figure 8 shows SWR under 1.5:1 is achieved across the entire 40- and 30-meter bands, as well as the CW and digital portion of 80 meters. The bandwidth of the 160-meter network is narrow. The antenna is more of a compromise on 160 meters.

Randy Rhea, N4HI, was first licensed in 1962. He worked as an electrical engineer at Boeing, Goodyear Aerospace, and Scientific Atlanta. In 1985, Randy founded Circuit Busters, later renamed Eagleware, which was acquired by Keysight Technologies in 2005. The Eagleware RF/microwave software design suite *Genesys* is still supported by Keysight and used by thousands of engineers worldwide. Randy is the author of several engineering reference books covering oscillators and filters. He operates exclusively HF CW. He is married and has two children and five grandchildren. You can reach Randy at **oscillatordesign@gmail.com**.

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


## Feedback

In the July 2020 issue of *QST*, the list of Legacy Circle Members should have included Ron Pollack, K2RP. *QST* regrets the omission.

Steve Ford, WB8IMY, wb8imy@arrl.net

## Eclectic Technology

# Mapping Your Contacts with QSOmap.org

With the advent of Google Maps and other software, it has become possible for several websites to place data in a mapped format. PSKReporter shows how well your digital signal is getting out, DX Maps shows where E-skip is happening, the Reverse Beacon Network (RBN) shows CW operators which stations are hearing their signals, and WSPRNet displays the reach of *WSPR* transmissions.

Another website that uses Google Maps to display data is **QSOmap.org**. Created by Michael Saeger, N9MS, this website takes in an ADIF file from your electronic logbook and displays those contacts in several types of Google Maps formats. It is a free website that operates almost entirely on donations from its users.

QSOMAP can retain your ADIF information in its extensive database and plot the data by coloring the map markers by either mode or band, showing which CQ or ITU zone, or in which Maidenhead grid squares, those contacts reside.

Additional maps are available for hams that participate in the various state QSO party contests. These maps highlight each of the counties that you worked — even listing the call signs of each station worked as you hover your mouse over that county on the map. If you would like to see how many counties you worked in the US, that map is also available.

If you grow tired of exporting ADIF files and then importing them into QSOMAP, the website has an additional feature that receives forwarded contacts from several logbooks, including *Ham Radio Deluxe*, *N1MM Logger*, *N3FJP*, and *Log4OM*. Each time you add a contact to one of those logbooks, it can be automatically forwarded to QSOMAP and added to its database.

### Maps for Many Occasions

A popular map with the Parks on the Air (POTA) group is the Polyline map. For this map, hams generally delete all of their contacts from the QSOMAP database and only upload those contacts made during a POTA operation.

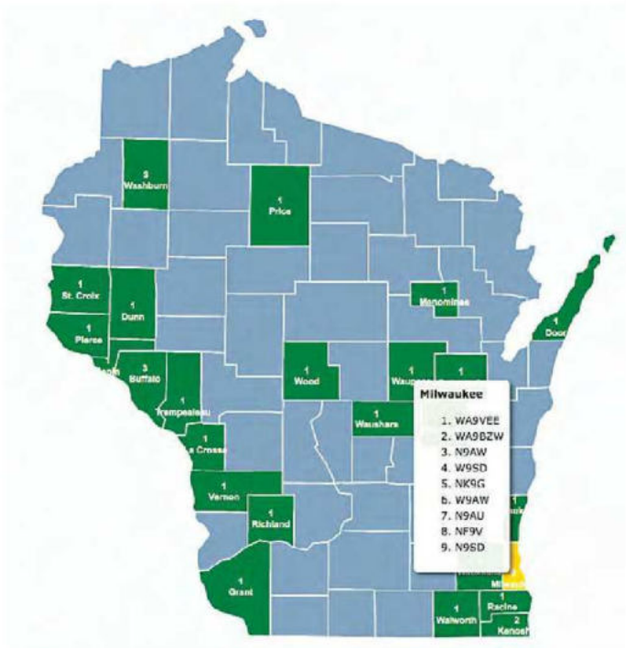



**Figure 1** — This map shows the author's operation in the Wisconsin QSO Party, and shows the call signs of each station worked in Milwaukee County.

Another popular activity is working the state QSO parties. After the contest, you can upload an ADIF file to one of QSOMAP's State QSO Party maps — currently, there are around 40 state county maps. Each county worked will be highlighted in green and hovering your mouse over a county will display each call sign worked in that county (see Figure 1).

QSOMAP also has code you can insert on your own web page to display your interactive map.

Because Google Maps charges a fee for using their maps, the RBN and the *WSPR* network are sometimes unable to display their maps. QSOMAP can take the data displayed on their databases' web pages and paste it into a QSOMAP that displays reporters' locations.

For more information, visit **www.QSOmap.org**.

## Product Review

# Four Station Power Supplies

*Reviewed by Mark Wilson, K1RO*
**k1ro@arrl.org**

A typical 100 W HF transceiver needs a power supply that can provide 13.8 V dc at about 20 A. The four power supplies reviewed here will easily power a transceiver plus a few station accessories. You can find previous reviews of other suitable station power supplies in the online Product Review archive (**www.arrl.org/product-review**).

### Lab Testing

The accompanying tables show the results of testing in the ARRL Lab. All of the supplies measured close to 13.8 V output with no load. To simulate typical use during SSB or CW operation, the Lab tested dynamic regulation by switching rapidly between 1 A and 20 A loads. The test results appear as *Dc variation during dynamic testing* in the tables. The *Low line dropout voltage* is the line voltage at which a power supply's output drops to 11.4 V dc, the minimum specified operating voltage of most transceivers. This test was done with a 20 A load.

### Bottom Line

The power supplies in this group provide more than enough current to power transceivers and station accessories.

### Conducted Emissions Testing

Some electronic devices, including switchmode power supplies, intentionally generate RF as part of their normal operation. This RF is not intended to be radiated as it would be by a transmitter. Under Part 15 of the FCC rules, such devices are defined as *unintentional emitters*.

Radio amateurs are concerned about RF noise generated by the switching regulators, and the power supplies reviewed here are designed and built with shielding and other techniques to suppress noise that could be heard in a station receiver.

Part 15 rules establish absolute limits for two types of emissions from unintentional emitters:

- *Conducted emissions* are conducted onto the house wiring and power lines via the device power cord. Part 15 provides absolute limits for conducted emissions from 150 kHz to 30 MHz. Conducted emissions are the primary problem below 30 MHz because ac power wiring provides a physically large "antenna" at HF and lower frequencies.
- *Radiated emissions* are radiated by the device itself. The absolute limits in this case are specified at 30 MHz and higher. Power lines are relatively inefficient transmission lines at VHF and higher frequencies, so radiated emissions are the primary problem at those frequencies.

FCC Part 15, Section 15.107, sets the limits for conducted emissions based on frequency:

- 0.15 – 0.5 MHz, 66 to 56 dBµV (decreases with the logarithm of the frequency);
- 0.5 – 5.0 MHz, 56 dBµV;
- 5.0 – 30.0 MHz, 60 dBµV;
- Above 30.0 MHz, no limits.

Limits are expressed in dBµV, or dB relative to a microvolt. In this case, 1,000 µV of signal equals +60 dBµV.

#### Power Supply Tests

The ARRL Lab uses a line impedance stabilization network (LISN), a Tektronix RSA306B spectrum analyzer, and Tektronix *EMCVu* software to measure conducted emissions. The device under test is plugged into the LISN, which separates the unwanted RF from the desired 60 Hz ac power. The conducted emissions are then measured using CISPR quasi-peak detection as specified in FCC Part 15. (This technique uses AM and a 9 kHz bandwidth and is designed to assess the effect of interference of a received signal to the human ear.)

Figures 2, 4, 6, and 8 in the review show conducted emissions from 150 kHz to 30 MHz for each power supply operating with a 1 A load, typical of a transceiver during receive. The red lines at the top of each plot represent the FCC limit of conducted emissions based on frequency. Larger versions of the plots are available from **www.arrl.org/qst-in-depth**.

It is important to note that Part 15 limits are not low enough to eliminate the possibility of interference. Interference from a supply that is near the limits may show up as a buzzing noise or as discrete signals, particularly at the lower end of the spectrum. The severity of the interference can also depend upon other factors, such as the placement of power cords and distance from the antenna. Using a properly grounded ac outlet may help. See the *ARRL RFI Book* for information on techniques to help with interference problems. — *Bob Allison, WB1GCM, and Paul Cianciolo, W1VLF, ARRL Lab*

Next, the Lab tested each supply under a 20 A load and used an oscilloscope to observe ripple on the dc output, as well as the presence of high frequency switching spikes while under load. All of the supplies exhibit low ripple and low amplitude switching spikes.

Finally, each supply was tested for conducted emissions (noise that the device conducts into the ac house wiring and power lines via the device power cord). See the sidebar, "Conducted Emissions Testing," for details.

## Alinco DM-430T

Alinco's compact DM-430T switchmode power supply is about the same size as a typical VHF mobile transceiver, yet it's rated for 25 A continuous and 30 A maximum. The supply has a front-panel switch to select 13.8 V fixed output or 4 to 15 V variable output using the **VOLTAGE ADJUST** knob. The supply is protected against short circuits at the output, as well as current overload and excessive temperature.

The front-panel LCD shows output voltage and current simultaneously with large, easy-to-read characters. The front panel includes a set of 30 A Anderson Powerpole connectors, and the rear panel has a pair of binding posts. The rear-panel line cord is detachable, and there is no external fuse holder. A cooling fan on the rear panel turns on automatically if the supply's internal temperature reaches about 110 °F, although I never saw it come on during indoor operation with a 100 W transceiver. Test results for the Alinco DM-430T are shown in Table 1 and Figures 1 and 2. The supply operated well down to about 90 V ac, dynamic regulation was in line with other switchmode supplies we have tested, and spikes due to switching are low. The DM-430T tested well below the Part 15 levels on the amateur bands, but was just above the FCC conducted emission limit around 160 kHz.

The brief instruction sheet includes illustrations of the front and back panels with a short description of each feature, a table of specifications, and a lot of safety information.

*Manufacturer*: Alinco, Osaka, Japan; **www.alinco.com**. Distributed in the US by REMTronix Inc., Lathrop, California; **remtronix.com** and available from amateur radio dealers. Price: $145.

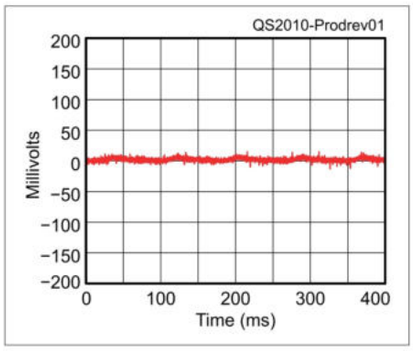



**Figure 1** — An oscilloscope trace of the dc output of the Alinco DM-430T with a 20 A load. The vertical scale is 50 mV/div, and the horizontal scale is 5 ms/div.

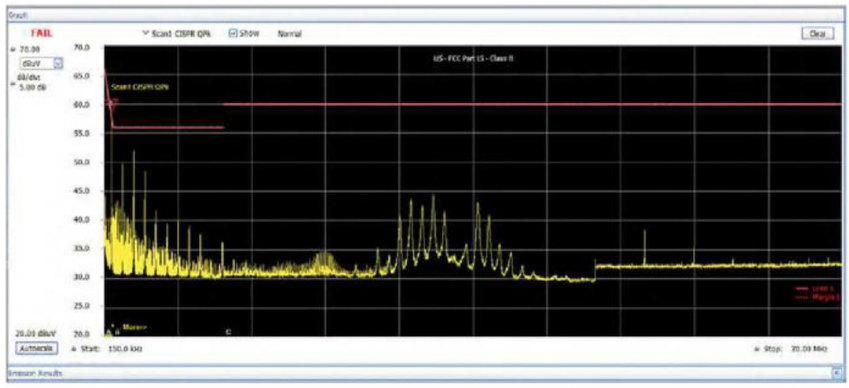



**Figure 2** — Alinco DM-430T conducted emissions from 150 kHz to 30 MHz with a 1 A load. The red lines at the top of each plot represent the FCC limit of conducted emissions based on frequency.

### Table 1 — Alinco DM-430T

***Manufacturer's Specifications***

| | |
|---|---|
| Power supply type: | Switchmode. |
| Power requirements: | 120 V ac. |
| Output voltage: | 5 to 15 V dc. |
| Output current: | 25 A continuous (30 A max). |

Size (HWD, with protrusions): 2.5 × 5.1 × 7.7 inches. Weight: 3.5 lbs.

***ARRL Lab Measurements***

| | |
|---|---|
| Output voltage, no load: | 3.76 to 15.59 V dc (13.85 V dc with switch set to 13.8 V). |
| Output voltage, 20 A load: | 3.70 to 15.40 V dc (13.66 V dc with switch set to 13.8 V). |
| Low line dropout voltage: | 93 V ac. |
| Dc variation during dynamic testing: | 180 mV. |
| Efficiency: | 82% at 20 A. |

## Kenwood PS-60

The Kenwood PS-60 switchmode power supply is styled to match Kenwood's TS-590S/SG HF transceiver. The sturdy package is the same height as the radio, and it has the same size bale on the bottom to match the transceiver when the front panel is tilted up. The PS-60 can operate with a wide range of ac line voltages. Output is a fixed 13.8 V dc at 22.5 A continuous current. There is no output metering, and the only control on the front panel is a **POWER** switch with a red LED indicator.

The rear panel has a set of screw terminals for the transceiver power cable and a removable ac power cord. No adjustment is needed to switch between 120 V and 240 V ac line voltage. The temperature-controlled internal cooling fan on the rear panel draws air through vents in the front left side panel, so it's best placed to the left of the transceiver for best airflow. I never heard the fan start during normal operation with a 100 W transceiver.

Test results for the Kenwood PS-60 are shown in Table 2 and Figures 3 and 4. The supply operated well down to about 90 V ac, and dynamic regulation was excellent with just 80 mV variation between no load and 20 A. At about 150 mV peak-to-peak, spikes due to switching were higher than the other supplies reviewed here, but they were in line with switchmode supplies we have tested previously. Conducted emissions (see Figure 4) were exceptionally low for a switchmode supply.

Documentation is on a single sheet with features, specifications, installation, operation, and troubleshooting information. It also includes a list of certifications, including FCC Part 15 compliance.

*Manufacturer:* JVCKENWOOD USA, Communications Sector, 1440 Corporate Dr., Irving, TX 75038; **www.kenwood.com/usa**. Price: $440.

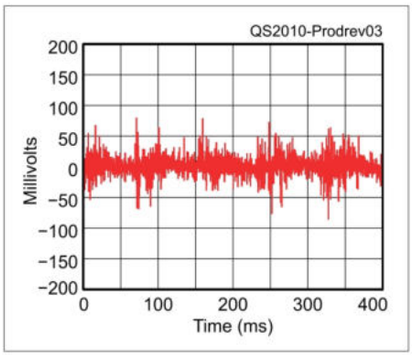



**Figure 3** — An oscilloscope trace of the dc output of the Kenwood PS-60 with a 20 A load. The vertical scale is 50 mV/div, and the horizontal scale is 5 ms/div.

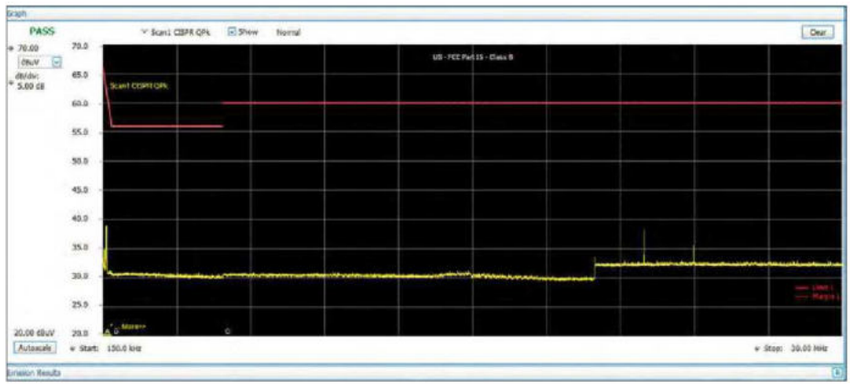



**Figure 4** — Kenwood PS-60 conducted emissions from 150 kHz to 30 MHz with a 1 A load. The red lines at the top of each plot represent the FCC limit of conducted emissions based on frequency.

### Table 2 — Kenwood PS-60

***Manufacturer's Specifications***

| | |
|---|---|
| Power supply type: | Switchmode. |
| Power requirements: | 100 to 240 V ac. |
| Output voltage: | 13.8 V dc (fixed). |
| Output current: | 22.5 A continuous. |

Size (HWD, with protrusions): 4.2 × 6.9 × 9.0 inches. Weight: 5.5 lbs.

***ARRL Lab Measurements***

| | |
|---|---|
| Output voltage, no load: | 13.80 V dc. |
| Output voltage, 20 A load: | 13.72 V dc. |
| Low line dropout voltage: | 90 V ac. |
| Dc variation during dynamic testing: | 80 mV. |
| Efficiency: | 92% at 20 A. |

## MFJ-4230MV

The MFJ-4230MV switchmode power supply is the smallest and lightest in this group, slightly smaller than the Alinco DM-430T. Output voltage is adjustable from about 3.5 to 16.5 V dc using a front-panel **ADJUST** knob. There is no 13.8 V dc fixed output switch, but the knob has a center detent for 13.8 V output (this setting measured about 13.5 V in the Lab). Be sure the supply is adjusted correctly before connecting your equipment. Current rating is 25 A continuous or 30 A maximum. Input voltage is specified at 85 to 135 V ac, and a version for 170 to 260 V ac is available as well.

The supply features overvoltage and overcurrent protection, and a front-panel **FAULT** indicator illuminates if there is a problem. Turn the supply off for 20 seconds to reset. The illuminated analog front-panel meter is switchable between output voltage (0 – 16 V) and current (0 – 32 A). The temperature-controlled cooling fan draws air through holes in the side panels. The output connectors are red and black binding posts on the rear panel.

Test results for the MFJ-4230MV are shown in Table 3 and Figures 5 and 6. The supply operated well down to about 90 V ac, dynamic regulation was in line with other switchmode supplies we have tested, and spikes due to switching were very low. Conducted emissions tested well below the Part 15 levels throughout the spectrum.

Documentation is a single sheet with operating instructions, specifications and warranty terms.

*Manufacturer:* MFJ Enterprises, P.O. Box 494, Mississippi State, MS 39762*;* **www.mfjenterprises.com.** Price: $100.

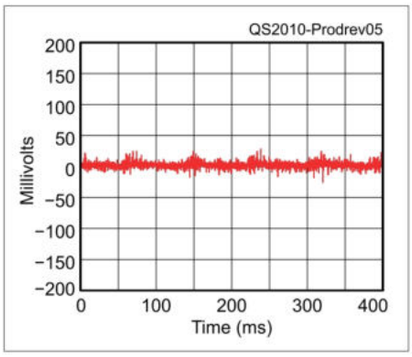



**Figure 5** — An oscilloscope trace of the dc output of the MFJ-4230MV with a 20 A load. The vertical scale is 50 mV/div, and the horizontal scale is 5 ms/div.

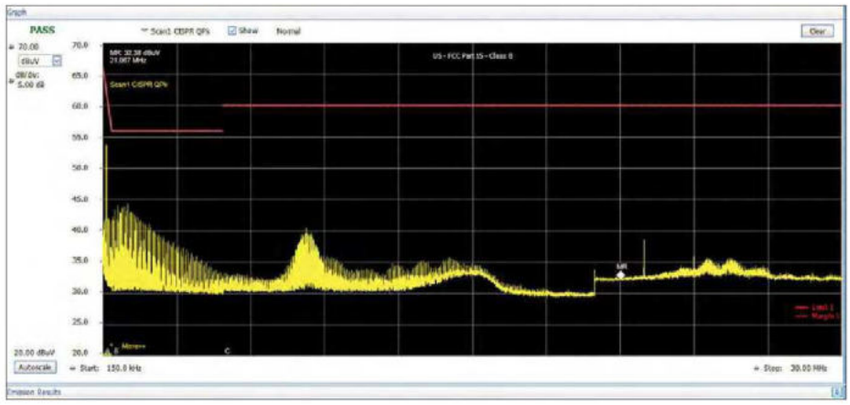



**Figure 6** — MFJ-4230MV conducted emissions from 150 kHz to 30 MHz with a 1 A load. The red lines at the top of each plot represent the FCC limit of conducted emissions based on frequency.

### Table 3 — MFJ-4230MV

***Manufacturer's Specifications***

| | |
|---|---|
| Power supply type: | Switchmode. |
| Power requirements: | 85 to 135 V ac. |
| Output voltage: | 4 to 16 V dc. |
| Output current: | 25 A continuous (30 A max). |
| Size (HWD, with protrusions): 2.5 × 5.1 × 7.4 inches. Weight: 3.0 lbs. | |

***ARRL Lab Measurements***

| | |
|---|---|
| Output voltage, no load: | 3.37 to 16.55 V dc (13.46 V dc with knob at detent). |
| Output voltage, 20 A load: | 3.34 to 16.37 V dc (13.27 V dc with knob at detent). |
| Low line dropout voltage: | 90 V ac. |
| Dc variation during dynamic testing: | 190 mV. |
| Efficiency: | 86% at 20 A. |

## Yaesu FP-1030A

Yaesu's FP-1030A is the only supply in this group that uses a conventional transformer, filter, and linear regulator. That means it is larger and heavier than the switchmode supplies. Output voltage is fixed at 13.8 V dc at 25 A continuous. The supply operates from 120 V ac.

Two large analog meters on the front panel display output voltage and current simultaneously. They are not backlit, and may be difficult to read under some lighting conditions.

There are three power connections. Red and black binding posts handle up to 25 A. There are two sets of spring terminals for up to 6 A total, and a cigarette-lighter type socket for up to 10 A. The total available current is 25 A, and the various connections are handy for powering accessories.

The internal fan runs continuously at low speed, increasing in speed as the supply heats up. There are plenty of ventilation slots on the side, rear, and bottom panels. A current foldback circuit protects the power supply from excessive current draw, and a red LED on the front panel lights if the protection circuit activates.

Test results for the Yaesu FP-1030A are shown in Table 4 and Figures 7 and 8. The supply operated well down to about 100 V ac, dynamic regulation was outstanding, with just 10 mV variation between no load and 20 A. As expected with an analog power supply, there are no visible spikes due to switching, and conducted emissions are extremely low.

Instructions are on a single 8.5 × 11 sheet and include a general description, installation and use instructions, safety precautions, and specifications.

*Manufacturer*: Yaesu USA, 6125 Phyllis Dr., Cypress, CA 90630; **www.yaesu.com**. Price: $270.

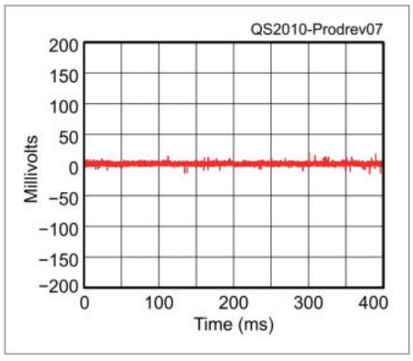



**Figure 7** — An oscilloscope trace of the dc output of the Yaesu FP-1030A with a 20 A load. The vertical scale is 50 mV/div, and the horizontal scale is 5 ms/div.

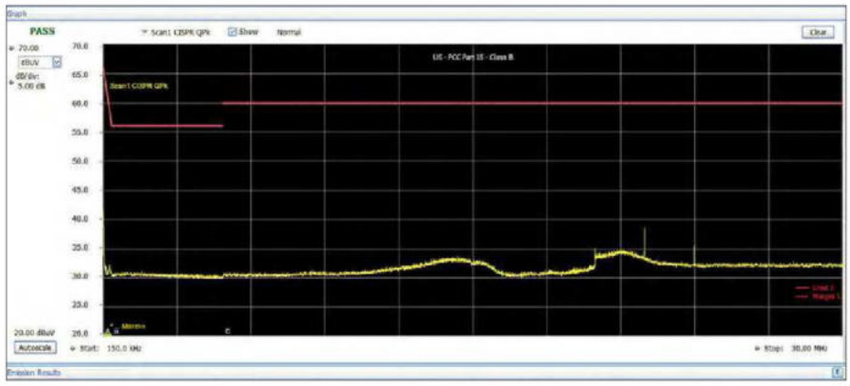



**Figure 8** — Yaesu FP-1030A conducted emissions from 150 kHz to 30 MHz with a 1 A load. The red lines at the top of each plot represent the FCC limit of conducted emissions based on frequency.

### Table 4 — Yaesu FP-1030A

***Manufacturer's Specifications***

| | |
|---|---|
| Power supply type: | Linear regulator. |
| Power requirements: | 120 V ac. |
| Output voltage: | 13.8 V dc (fixed). |
| Output current: | 25 A continuous. |
| Size (HWD, with protrusions): | 6.0 × 9.9 × 9.5 inches. Weight: 21 lbs. |

***ARRL Lab Measurements***

| | |
|---|---|
| Output voltage, no load: | 13.89 V dc. |
| Output voltage, 20 A load: | 13.88 V dc. |
| Low line dropout voltage: | 101 V ac. |
| Dc variation during dynamic testing: | 10 mV. |
| Efficiency: | 60.2% at 20 A. |

# Low-Power Attenuator Kits

*Reviewed by Paul Danzer, N1II*
**n1ii@arrl.net**

A few years ago, I decided to test a new 2-meter antenna design by comparing a signal with my old standby, a simple ground plane. The test signal was the local repeater, but my 2-meter transceiver had no S-meter — just five bars showing relative signal strength. I made a switchable attenuator and carefully compared the attenuation needed to bring the repeater signal down to the squelch threshold with each antenna.

This simple test showed me a few things about attenuators. First, 1 dB steps may not be always needed, but they are very handy. Also, a design that is mostly immune to changes in attenuation caused by the proximity of your hand while making adjustments is helpful. Finally, bilateral connections — the ability to use either end as input or output — can simplify the test setup.

## HecKits 62 dB Step Attenuator Kit

The HecKits step attenuator shown in Figure 9 allows selection of attenuation values up to a maximum of 62 dB. From left to right, the seven toggle switches control attenuation values of 1, 2, 3, 6, 10, 20, and 20 dB. These values allow you to select attenuation from 1 to 62 dB in 1 dB steps. The gold-plated BNC connectors can be used for either input or output in a 50 Ω system.

The attenuator uses ¼ W, 2% metal-film resistors. No power rating is specified for the attenuator, but the use of ¼ W resistors would seem to limit it to receiving applications or low-level oscillator or amplifier stage testing. No frequency range is specified. The included aluminum case is predrilled for the seven miniature double-pole, double-throw (DPDT) toggle switches and BNC connectors.

In common with most small kits, the assembly manual is supplied as a PDF. The manual is emailed upon purchase (and not available on the HecKits website). I usually print the manual, so I can physically check off each step as I complete it. Using a color printer for a few of the illustrations for this kit will make parts placement a bit easier. Although not explicitly stated, the resistors mount on the side of the board seen in a photo in the instructions. This side of the board has

**Figure 9** — The HecKits attenuator is packaged in a small die-cast aluminum case. Although the PC board is labeled, no decal or label for the front panel is provided.

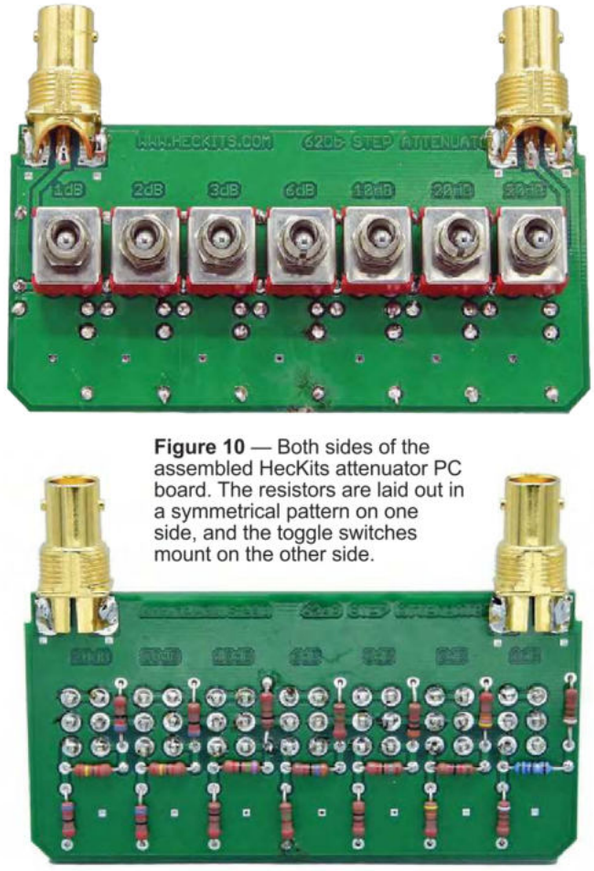



**Figure 10** — Both sides of the assembled HecKits attenuator PC board. The resistors are laid out in a symmetrical pattern on one side, and the toggle switches mount on the other side.

### Bottom Line

These inexpensive attenuator kits operate into the VHF region and could be useful for receiver testing, S-meter calibration, hidden transmitter hunting, and other applications.

two solder pads on the two top corners; the reverse side, where the resistor leads are soldered, has three pads near each corner. Figure 10 shows the assembled board.

There are almost two dozen resistors. As I was preparing to sort out the resistors, I found this kit had something very helpful — paper tags with the resistor values written on them. No measuring or reading color codes were needed. After placing and soldering the resistors on the board, the manual gives very clear instructions for mounting the two BNC connectors and the seven switches.

Both the top cover and the bottom section of the enclosure have black arrows inside. The assembly is correct when the BNC connectors and the two arrowheads all are on the same side. First, do a test fit by installing the two end switches and make sure the board and switches line up with the holes in the case. If all is okay, you may find it easier to remove one of test switches and then install and tighten the inside nut on each remaining switch in series with a very thin 5/16 open-end wrench, finishing up with the end switch you removed.

*Manufacturer*: HecKits, 1302 Highland Dr., Cedar Park, TX 78613; **www.heckits.com**. Price: $65 plus shipping.

## Pacific Antenna 41 dB Step RF Attenuator

The Pacific Antenna attenuator kit shown in Figure 11 provides up to 41 dB of attenuation, selectable in 1 dB steps. It's not supplied with a case, but a base fixture design for 3D printing is available from **www.thingiverse.com/thing:3728178**.

This compact 2.8 × 3.9 inch board has all components mounted on one side. BNC connectors are used for input and output, and it's bidirectional, so either end can be the input or output. Six pushbutton switches, mounted along the bottom of the board, select attenuation values of 1, 2, 3, 5, 10, and 20 dB. One switch at the top of the board controls a bypass function.

The attenuator sections use 2 W resistors, with three per section for a total of 18. Maximum continuous dissipation is specified as 5 W, and up to 10 W for intermittent use, so it can be used for low-power transmitting, as well as receiving applications. The manual specifies operation from dc to more than 200 MHz.

In order to speed up the assembly process, I copied the parts list for the resistors at a 2× enlargement and mounted the copy on a piece of foam backing board. Then I measured the resistors and stuck them into the parts list on the foam board. When I built the unit, I did not have to hunt for the proper value resistor at each step. They were already sorted and sticking out of the foam (see Figure 12).

Some identical resistors come taped together, which simplified the sorting. Instead of pulling the tape off the resistor leads, it's better to cut the lead below the tape, so you won't have to clean glue residue from the leads. The final assembly step is placing a top cap on each switch. I suggest doing this in an area where you can


**Figure 11** — All components mount on one side of the Pacific Antenna attenuator PC board. The top switch bypasses the attenuator. Either BNC connector can be used as input or output.

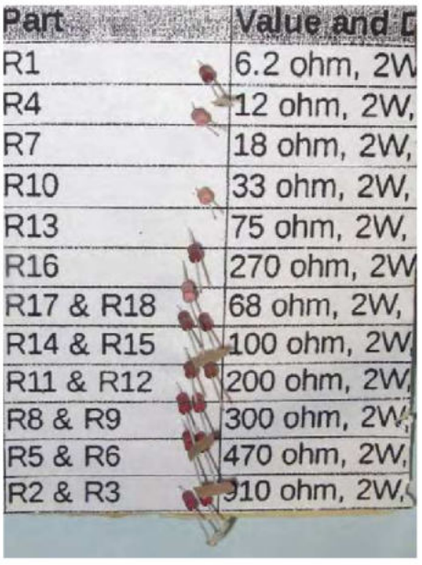



**Figure 12** — Presorting the resistors will speed up the assembly.

easily find a cap if it pops off (which happened to me several times).

A set of four soft plastic feet completes this one-evening project. The assembly manual, downloaded from the manufacturer's website, includes a resistive checkout procedure. The resistance of each attenuator section selected by the switches is given, so you can check your wiring with an ohmmeter connected to either of the BNC connectors.

*Manufacturer*: Pacific Antenna, P.O. Box 10301, Fayetteville, AR 72703; **www.qrpkits.com**. Price: $25 plus shipping.

## In Summary

The accompanying sidebar, "Testing the Attenuators," presents swept-frequency measurements of each unit with 6 dB attenuation selected. These measurements were made using a vector network analyzer, but if you have a suitable signal source and an accurate microwattmeter, you can calculate power loss from:

Attenuation in dB = $10log\,(P_1/P_2)$,

where $P_1$ is the power input, and $P_2$ is the power output.

Many workshops are not equipped with accurate low-level power measuring capability, but most do have

## Testing the Attenuators

*Phil Salas, AD5X*

These inexpensive attenuators are useful for amateur applications. The Pacific Antennas 41 dB attenuator is specified up to 200 MHz. The HecKits 62 dB attenuator has no specified frequency range, but it is mounted in a die-cast metal case and would seem to be suited for use at higher frequencies.

I measured the SWR and insertion loss of each attenuator by sweeping them up to 500 MHz with an Array Solutions VNAuhf vector network analyzer. Measurements were made with 0 dB (bypass), and then the sequential addition of each attenuator section. Just the 6 dB attenuation step for each attenuator is shown here (equivalent to one S-unit). Larger versions of the plots for additional attenuation steps are available online from **www.arrl.org/qst-in-depth**.

In each plot, the vertical dark blue line is in the 2-meter band, the dashed horizontal light blue line is 1.5:1 SWR, the green trace is attenuator insertion loss, and the red trace is SWR.

### HecKits 62 dB Attenuator

This attenuator consists of seven sections of attenuation: 1, 2, 3, 6, 10, 20, and 20 dB giving a maximum of 62 dB attenuation in 1 dB steps. The sections are selected with toggle switches, and it can be bypassed (0 dB attenuation) with all switches off. Measurements were made by cascading each stage sequentially, providing data at 0, 1, 3, 6, 12, 22, 42, and 62 dB attenuation levels. As shown in Figure A, with 6 dB selected, SWR is very close to 1:1 through the 2-meter band. Attenuation is flat through the HF range, rising to about 6.4 dB in the 2-meter band, and is still within 1 dB at 400 MHz.

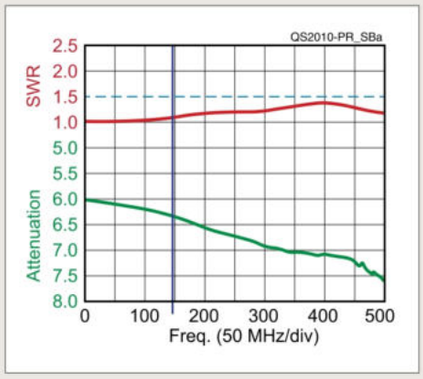



**Figure A** — SWR and insertion loss sweep of the HecKits attenuator with 6 dB attenuation selected.

### Pacific Antennas 41 dB Attenuator

This attenuator consists of six sections of attenuation: 1, 2, 3, 5, 10, and 20 dB. This gives a maximum of 41 dB attenuation in 1 dB steps. The sections are selected with pushbutton switches. There is also a full bypass position. Measurements were made by cascading each stage sequentially, providing data at 0, 1, 3, 6, 11, 21, and 41 dB attenuation levels. As shown in Figure B, with 6 dB selected, SWR is 1:1 and attenuation is within a few tenths throughout the HF range. SWR rises to 1.5:1 and attenuation rises to 7 dB in the 2-meter band.

Both attenuators provide quite usable performance through 2 meters. In all cases, as the attenuation level is increased, the SWR improves at higher frequencies. The HecKits attenuator does provide lower SWR, higher attenuation accuracy, and better performance, especially at VHF.

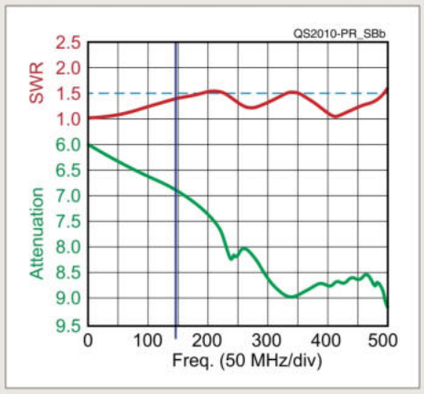



**Figure B** — SWR and insertion loss sweep of the Pacific Antenna attenuator with 6 dB attenuation selected.

reasonably accurate voltmeters. You can calculate the power loss at dc from:

Attenuation in dB = $20log\,(V_1/V_2)$,

where $V_1$ is the voltage input, and $V_2$ is the voltage output.

I measured the attenuators at dc, and the results are available online from **www.arrl.org/qst-in-depth**. A good explanation of decibels can be found in "Untangling the Decibel Dilemma," by Ward Silver, NØAX, in the January 2020 issue of *QST*.

# HybridDX Antenna for 160 – 6 Meters

*Reviewed by Norm Fusaro, W3IZ*
**w3iz@arrl.org**

The HybridDX is a 135-foot doublet configured to fit into a smaller space. I wouldn't say it is a revolutionary design, but it does take a different approach to the idea of compressing a full-sized dipole into a tight space. The assembled HybridDX is 79 feet long and designed to work on 160 through 6 meters with an antenna tuner.

The manufacturer designed the bare copper radiating wire to be suspended from a supplied catenary line of heavy-duty dacron/polyester rope. The kit includes large and small spreaders that you attach to the support rope using cable ties (see Figure 13). After attaching the spreaders to the catenary line, you then thread the light-gauge solid antenna wire through the lower portion of the spreaders. In this configuration, the manufacturer claims to have an advantage over a typical doublet antenna.

## Assembly

The HybridDX antenna is a kit. Assembly was rather easy. The main rope is clearly marked with colored tape at the intervals where you attach the spreaders. The red and white markers show the location of where large or small spreaders get attached to the rope. The instructions say to remove the tape before tightening the cable ties. I believe paint markings would have eliminated the tedious process of removing the tape, but there is no doubt that the premeasured markers made assembly a breeze. I had the entire antenna together in about an hour and a half.

### Bottom Line

The HybridDX antenna is a 79-foot alternative to the typical 135-foot center-fed multiband dipole for operation on 160 through 6 meters.

The instructions suggest laying the antenna on the ground at the place where the antenna is going to be installed, or suspending it at shoulder height between two supports. I chose the latter because it put the work in front of me and eliminated the need for bending down. The instructions are very detailed and easy to follow. They suggest visiting the website for a diagram of the assembled antenna. It would have been nice if they had included a diagram on the back of the instruction sheet, so I would not have had to refer to the small picture on my phone. As this review wrapped up, Quicksilver Radio told us that an illustration is now included with antennas that are currently shipping.

The instructions offer a standard configuration and a configuration for maximum performance. Minimum suggested antenna height is 35 feet. The standard configuration lets the ends of the radiating wires dangle. These ends are almost 28 feet long, and you will have to use weights or some rope to keep the stiff wire straight and vertical.

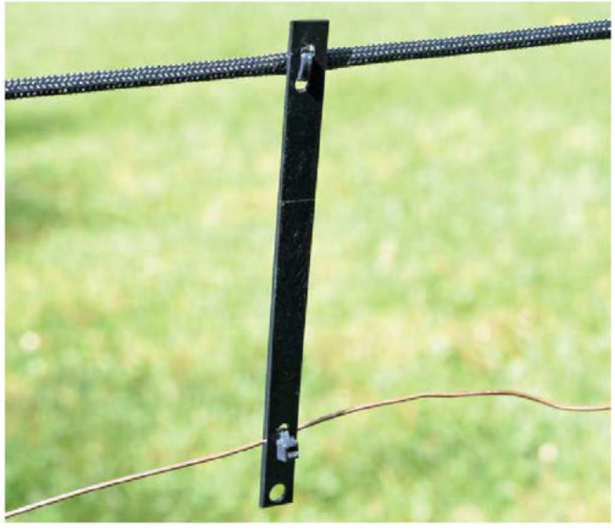


**Figure 13** — Sturdy 3⁄16-inch UV-resistant dacron/polyester rope supports the #18 AWG solid antenna wire. The wire is quite stiff, and it takes some experimentation to get it to look like the photo at **www.hybriddx.com**.

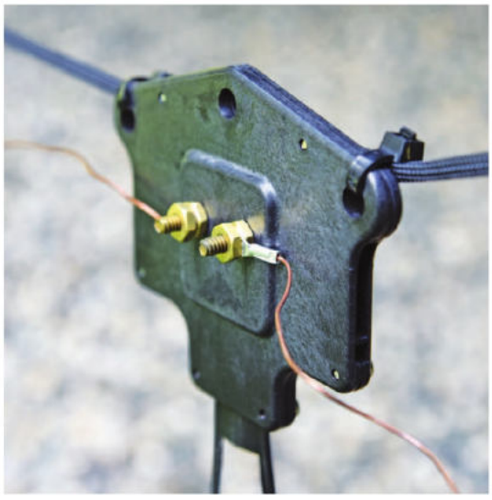


**Figure 14** — The center insulator and 75-foot, 450 Ω feed line are preassembled.

The maximum performance configuration uses plastic clips and nylon fishing line to bring the end back under the element to form "precisely calculated loops created by the wire and fishing line." I configured the antenna for maximum performance not so much for the performance, but to get the ends off the ground. Again, it may take a little work to get the loops to stay in the shape shown in the drawing online.

The design of the antenna is for those with limited space, and many hams in that situation also lack supports of any great height. I was able to get the antenna up just over 40 feet above the ground, which prevented the loops from catching anyone by the neck.

The HybridDX antenna includes a 75-foot piece of 450 Ω window line preassembled to a center insulator (see Figure 14). Unlike some doublet designs, such as G5RV, the length of the parallel feed line is not important with the HybridDX antenna design, so you may trim or add to the feed line as needed to fit your installation. I was able to use the feed line as supplied.



## Tuner Required

Antenna systems of this design require an antenna tuning unit (ATU). Most ATUs built inside transceivers do not have enough range to match the broad range of impedances presented by this antenna system, so an external unit is required. In addition to being able to match impedance over a wide range, the antenna tuning unit used must also have a balanced output connection, otherwise an external balun will be needed so that the unbalanced-to-balanced transition is present. If your tuner is not designed for use with balanced feed lines, the instructions recommend connecting the supplied 450 Ω feed line to a 1:1 current balun, and then connecting to the antenna tuner with less than 20 feet of high-quality coaxial cable.

For this review, I used an SGC-239 automatic antenna coupler located outside on a table in the garden as far as the twin-lead from the antenna would reach, and then I used RG-8X coax to connect the tuner to the radio inside the house. After clearing the memories in the auto tuner, I was able to achieve SWR readings of less than 1.5:1 on all amateur bands from 160 through 10 meters. (The tuner does not cover 6 meters.)

## Making Contacts

On-air performance was what I expected from the doublet antenna when used with my 100 W transceiver. I was able to make contacts on 40- and 80-meter SSB, and I even contacted some European stations on 20-meter CW. Having an automatic antenna coupler made band changes quick and easy.

I changed tuners to the ubiquitous MFJ-941 manual antenna tuner. Changing bands was easy by tuning for maximum receiver noise before making final adjustments while transmitting.

## Bottom Line

Time will tell if the HybridDX antenna materials will withstand wind, snow, and ice, but for this test, everything stayed up. I can't say if the HybridDX worked any better or worse than the doublet that I normally use at my site, but if you have a tight space and two tall-enough supports, the HybridDX could be a solution to your antenna needs. Support is available online **https://www.hybriddx.com**.

Available from Quicksilver Radio, **www.qsradio.com**. More information is available from **www.hybriddx.com**. Price: $119.73.

# Cushcraft AR-270 Dual-Band Antenna

*Reviewed by Steve Ford, WB8IMY*
**wb8imy@arrl.net**

The Cushcraft AR-270 is essentially a ground-plane vertical antenna for both 2 meters and 70 centimeters. At just slightly more than 4 feet in length, the AR-270 functions as a ⅝-wavelength radiator on 2 meters. A coil assembly creates an electrical ⅝-wavelength for 70 centimeters as well. At the base of the antenna you find a small loading coil and three 6¾-inch radials (see Figure 15). The antenna weighs just two pounds and is rated for 250 W on both bands.

## Assembly and Tuning

The AR-270 assembles quickly. I needed only 15 minutes to attach the radial rods and join the upper and lower sections. The rods simply screw into the base, but the instructions caution against over tightening. They aren't kidding; I've seen rods like these instantly snap off with the overzealous application of a wrench.

The vertical radiator pieces slide into each other and are held in place by a small hose clamp. Any tuning that may be necessary is accomplished by loosening the clamp and adjusting the overall length. Following the guidance in the instructions, I adjusted for a total length of 20 inches between the base and the bottom of the upper coil. When I swept the AR-270 with an antenna analyzer, I was pleased to see no more than a 1.4:1 SWR across the entire 2-meter band, and a maximum of 1.5:1 between 438 and 450 MHz.

## Up and On the Air

The AR-270 replaced a ¼-wavelength dual-band ground plane that I have been using for many years. I removed the battered antenna from its 10-foot PVC mast and attached the AR-270 using the two large hose clamps supplied. Ten feet isn't much altitude for a VHF/UHF antenna and to make matters worse, the location was surrounded by trees in full bloom. (Dense vegetation can be deadly to signals on these frequencies.)

### Bottom Line

The Cushcraft AR-270 is a rugged dual-band VHF/UHF home station antenna that is easy to assemble and install.

**Figure 15** — A close-up view of the base of the AR-270.

With low expectations, I attached the feed line and returned to my transceiver. To my surprise, I heard local signals that were significantly stronger than before. The big test would be with the W1AW repeater on 2 meters. My home is 30 miles from the repeater, and I had never been able to reach it with the old antenna, regardless of the transceiver I was using. When the repeater was in use, I could barely hear it and, as you'd expect, it was steadfastly deaf to my transmissions.

I squeezed the push-to-talk button on the microphone, announced my call sign, and the machine instantly responded with an S-4 signal. According to reports, my signal was full quieting. I was impressed.

The AR-270 is not designed for use with amateur satellites, but I couldn't resist trying. During an OSCAR 91 pass, I heard signals from the bird when it was at maximum elevation, and I even managed to make a contact. I'll be interested to see how the AR-270's performance changes in late fall when the trees have finally shed their leaves.

*Manufacturer:* Cushcraft, 300 Industrial Park Rd., Starkville, MS 39759; **www.cushcraftamateur.com**. Price: $150.

## Workshop Tip: Soldering Iron Tip Cleaner

I recently ran across an inexpensive addition to my workbench. The Hakko 599B soldering iron tip cleaner replaces the wet sponge that many amateurs use to keep a soldering iron tip shiny while working on a project. Inside the two-part container there are coils of brass similar to steel wool. To clean the soldering iron tip, you stab the tip into the brass coils. The coils slide oxidation or excess molten solder off the tip. The removed material falls through the brass to the bottom of the container, and very occasionally you can open the container and empty out the fallen material. The entire assembly is very light, so you will have to hold the unit in one hand while stabbing the iron tip with your other, or else use double-sided tape or another means of securing the tip cleaner to your workbench. Various similar units are available online, as are brass coil replacements. The Hakko 599B is readily available online for about $12. — *Paul Danzer, N1II*

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

## The Doctor is In

# End-Feeding Antennas Can Make Installations, But Not Connections, Easier

**Q David, WA4DSP, asks: What is meant by "end-feeding" an antenna? Are the standard SO-239 UHF coax antenna connectors on my transceiver amenable to end feeding? Is there a practical difference between a 4:1 voltage balun and a 4:1 current balun?**

A Amateur radio operators are perhaps most used to center-fed antennas, such as dipoles, but there are many other possibilities. A local AM broadcast station, for example, likely has one (or more) monopole elements fed from the bottom against a radial ground field. This is one type of "end-fed" antenna and is the most commonly used, often with a horizontal wire on top as an end load.

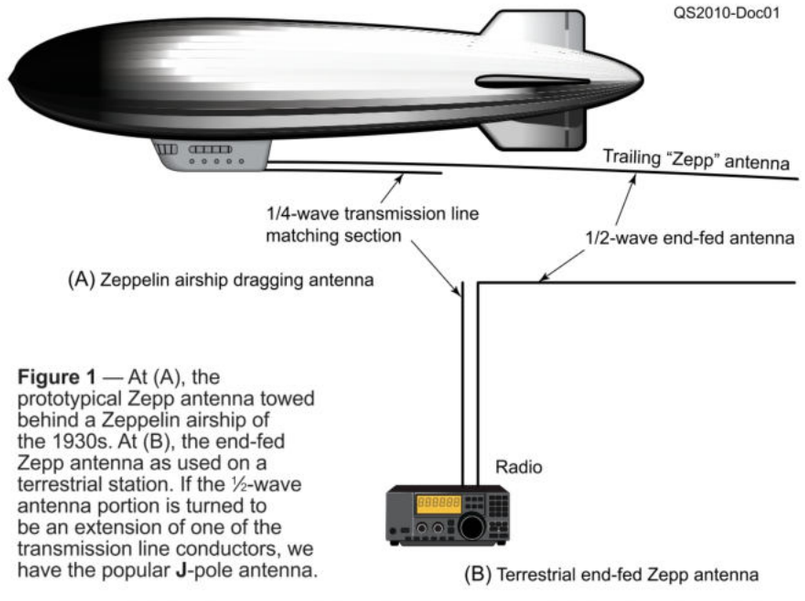



**Figure 1** — At (A), the prototypical Zepp antenna towed behind a Zeppelin airship of the 1930s. At (B), the end-fed Zepp antenna as used on a terrestrial station. If the ½-wave antenna portion is turned to be an extension of one of the transmission line conductors, we have the popular **J**-pole antenna.

In the early days of radio, when frequencies below the AM broadcast band were most commonly used, most amateurs used a top-loaded antenna, often with multiple horizontal wires serving as the load. The ubiquitous VHF ¼-wave mobile whip is another application of the end-fed ¼-wave monopole, so they are not just low-frequency structures.

It is important to note that the monopole is only part of the antenna. The ground, against which it is fed, is another important part. Every antenna connected to the radio needs connections to both the inner conductor and the shield of the SO-239 connector. Still, some will just stick the end of a piece of wire into the center pin and think they have an end-fed wire without a ground — but ground is always somewhere. In this case, the coax shield connection is tied to the transceiver chassis, which should be tied to your power ground system, either directly or through your power supply.

A popular elevated end-fed antenna is the end-fed Zepp. This is a traditional antenna that goes back to its use as a trailing-wire antenna from a Zeppelin air ship (see Figure 1). It is a ½-wave dipole fed from one end through a ¼-wave matching section of open-wire line. The matching section was used to transform the high impedance at the end of the ½-wave antenna to the low-Z that the transmitter wanted to see. This looks strange, because one side of the open-wire line at the antenna end appears not to be connected to anything. This also happens if a wire is stuck into the center conductor of an antenna tuner's coax socket. Note that a banana plug is a good fit for a single wire and provides a better connection.

The old argument was that the impedance at the end of the antenna was so high that no current flowed, so there was no need for a return path. In reality, the other side becomes a common-mode current that flows back toward the radio. Perhaps because the cabinets were often wooden, no one noticed on their airship — but this is not the case for most amateurs, so be careful. This is the same configuration as the popular 2-meter **J**-pole antenna, which is notorious for common-mode current problems, unless the current is choked off below the matching section.

Regarding the difference between a current and voltage-type balun, if we are matching to a balanced load (impedance of each side to ground equal), as intended with a balun, both

the current and the voltage on each side will be equal for either type of balun. On the other hand, if the load is not balanced, perhaps because an antenna is lower on one side than the other, the current and voltage on each side will be unequal. The balun can be designed to force either the current or the voltage to be equal, but not both if the impedances are not the same. If the antenna or load is truly balanced, the type of balun doesn't matter. If not, it is almost always better to force the currents to be equal with a current balun to eliminate common-mode current on the transmission line. Note that for the 1:1 case, a common-mode choke does the same thing — usually for less money and weight.

**Q Ed, K6SDW, asks: Due to severe antenna restrictions, I use an end-fed antenna. My antenna uses the commonly available 9:1 transforming ratio balun and seems to work pretty well, given it's only 20 feet in the air with about 48 feet of wire. I've heard that some hams use a 49:1 balun for matching an end-fed antenna to 50 Ω coax, instead of the more common 9:1 balun. Is there an advantage to the 49:1 balun over the 9:1 unit?**

A The impedance of a resonant end-fed ½-wave antenna, fed against ground, is in the thousands of Ohms resistive, so a 49:1 transformer can provide a close match to 50 Ω coax. Your antenna, by itself, isn't ½ wave long on any band, except perhaps 30 meters, and isn't particularly resonant, so it's a different situation.

You don't say what bands you are using it on, or how it is fed — against ground with a 20-foot ground wire? Then it is not really end-fed, but the 20-foot ground wire is part of the antenna and you are feeding a grounded wire 30% above ground. That is fine, but the impedance will be very different.

If you don't have a ground wire at the balun, the coax shield will act like one and also act like part of the antenna. It's best if it's well grounded as it enters the house to avoid radiating into household systems, as well as picking up noise from systems within the house.

The impedance that the balun sees will be very different on each band and will result in a fairly high SWR on the coax with either ratio balun on most bands. If the coax is good quality, low loss, and especially if short, the loss won't be too high. If your tuner can deal with it, it should work. But note that the impedance will be all over the place and, ideally, you would likely want a different ratio balun for each band (nobody that I know does that) — probably 1:1 for 80 and 40 meters, where the impedance is quite low, and higher on each of the other bands. So, 9:1 may be a good compromise. Providing more details on your configuration and your planned usage could make it possible for me to provide a more detailed answer.

**Q Joseph, N3TTE, asks: I want to check the receive functionality of my solid-state HF transceiver. I'm wondering if, with a suitably large 50 Ω attenuator, I can use my antenna analyzer to verify that the receiver part of the radio is working correctly. I'm thinking that I can use the antenna analyzer to generate a frequency to inject into the radio. I don't want to overdrive it, hence using an attenuator, or perhaps rig up a transformer. Any suggestions?**

A Unfortunately, you didn't identify the model of your analyzer, but the units I discussed in my ARRL book, *Understanding Your Antenna Analyzer*, ranged in output power from 0.5 mW (–3 dBm) to 20 mW (+13 dBm), most within the 10 dBm known safe range, based on ARRL Lab Product Review testing at that level. Most analyzers should be safe, even if connected directly to the receiver input. Even the strongest output units won't require much attenuation. If you look up the *QST* Product Review of your analyzer, or perhaps the specification page of your analyzer's manual, you can likely find the actual power output of your analyzer (see the Product Review archive at **www.arrl.org/qst-product-review-and-short-takes-columns**).

Of more concern to me would be the safety of the analyzer, if directly connected. If your transceiver's key, PTT, or VOX is accidentally activated, you could easily put 100 W into the analyzer, and that would be a problem. Please either turn the power output down to zero, or switch the **TRANSMIT** off, if your transceiver can do that, before you connect the analyzer.

Some analyzers have a frequency counter, which may be accurate enough to give you a good indication of your transceiver's frequency calibration. Other analyzers may not be as good for that, but you can get an idea by checking the frequency of a broadcast station, W1AW or WWV, and seeing how the analyzer frequency read-out compares.

If you don't have an attenuator on hand and want a lower level signal than the analyzer provides (while +10 dBm should be safe, it will be quite strong at about an S-9 +83 dB on a calibrated S-meter), just put a small loop on the analyzer output and another on the transceiver antenna connection and then couple them with a variable distance, starting a few feet apart. I would suggest keeping the input level close to S-9 (50 uV, –73 dBm) to minimize overloading.

---

Do you have a question? Ask the Doctor! Send your questions to "The Doctor," ARRL, 225 Main St., Newington, CT 06111, or email your question to: **doctor@arrl.org**.

Listen to the archives of the *ARRL The Doctor is In* podcast on iTunes, Blubrry, Stitcher, or on the ARRL website at **www.arrl.org/doctor**.

## Hints & Hacks

# Soda-Can Straight Key; Decoding DX Postal Addresses, and Upgrading Vintage Equipment

### The Soda Can Key

To create this key, you need to cut the top of the beverage container free, just below the lip, exposing sharp edges. The best way I found to deal with this hazard was to carefully cut all around the can and about ½ inch below the rim with a sharp utility knife (see Figure 1). Metal cutting shears or scissors may work as well. Once the top has separated, make a single cut through the metal to the rim at the top. Then, using long-nose pliers, grip the metal at this cut and roll the pliers around the circumference of the lid, removing all the metal (see Figure 2). The goal is to have a can top with none of the can sides remaining, so it can be handled safely and fit properly into the wooden base.

To fashion the wooden base, you'll need a piece of pine at least ¾ inch thick, 2¾ inches wide, and a foot or so long (the length is just to give you an area to apply pressure with your hand while drilling). Draw a circle on the wood using a compass with its diameter just less than the width of the board (in this case, about 2¾ inches) and mark its center. At the center point, drill a hole all the way through using a 3/32-inch-diameter bit. This hole will accurately spot the center of both circles onto the opposite side. With a 2-inch-diameter Forstner drill bit (which you can find at any home improvement store), drill the side that will be the top of the base to a depth of 3/16 inches. Test fit the can top to this drilled hole to make sure it seats properly. Turn the board over and, using the same 2-inch-diameter bit centered in the 3/32-inch hole you drilled previously, drill to a depth of about 7/16 inches. What should be left is about ⅛-inch thickness of wood. Choose the point where you want the wire cable to be brought into the side of the lower part of the base and drill a hole for it to pass though.


**Figure 1** — Cut away the top of the can with scissors or any other suitable tool. [Karl Schwab, KO8S, photo]

**Figure 2** — With pliers, grip the remaining metal at the top of the can and roll the pliers around the circumference of the lid, removing all the metal. [Karl Schwab, KO8S, photo]

The can top is retained in the base with two 6-32 × ½ inch long machine bolts. In addition to securing the top, they also function as electrical contacts (see Figure 3). One bolt must be insulated from the metal and located under the movable arm so that when the arm is depressed it touches the head of the bolt. The other bolt is not insulated.

**Figure 3** — The can top is secured to the base with two 6-32 × ½ inch long machine bolts. [Karl Schwab, KO8S, photo]

Place the top in the base and, using an ice pick or equivalent, punch through the aluminum under the arm just enough to mark a drill location in the wood. Do the same 180 degrees on the opposite side.

The hole under the arm (in the top only) needs to be 3/16 inches in diameter to electrically clear the bolt. The opposite bolt is at the junction of the can opening and the rest of the top. This hole is made by filing a ⅛-inch-diameter notch, or just large enough for the 6-32 bolt to pass through.

Drill two ⅛-inch-diameter holes through the base, at the two previously marked positions for the two 6-32 bolts. Now you can cut off the


**Figure 4** — The finished key. [Karl Schwab, KO8S, photo]

**Figure 5** — You can enhance the electrical safety of older gear by replacing the two-wire ac cord with a socket to accommodate a three-wire cord. Both filtered and unfiltered sockets are shown here. [Patrick Hamel, W5THT, photo]

surplus wood and leave it in a square shape or round off the edges into a circular shape, as I did. Once the sanding was complete, I stained the wood with varnish (see Figure 4).

As you install the bolts in the can top to attach it to the base, be sure to insulate the bolt underneath the arm. You don't want it making electrical contact with the top or bottom. I used clear plastic washers and placed a tiny length of heat-shrink tubing on the threads of the bolt itself.

With the cable attached to the bolts on the underside of the base, use a digital voltmeter to make sure there is no continuity between the two bolts until the arm is pressed down (touching the bolt head). — *73, Karl Schwab, KO8S,* **ko8s@arrl.net**

## Getting DX Addresses Right

I've had times when I tried to send a QSL card to a DX station, but I found myself confused by the address I'd been given. It can be hard to decipher the town name, or which line shows the name of the street, or why there are no numbers in the address.

The Universal Postal Union (UPU) is the worldwide organization that coordinates international mail. Each of their 192 member countries have their own standards for mail items and address formats, and the UPU has posted them online.

To find a DX station's address format, go to **www.upu.int/en/Postal-Solutions/Programmes-Services/Addressing-Solutions**. Scroll down the page until you see "Postal Addressing Systems (PAS)." Select the country using the dropdown menu, then click the **DOWNLOAD** button to the right. You will be presented with a standards sheet, usually one or two pages long. It will not give you the correct address, but it will tell you how to format it correctly. Fewer QSLs lost in the mail means more countries confirmed. — *73, Bill Principe, K1NS,* **k1ns@comcast.net**

## Making Vintage Gear Safer

To bring vintage equipment up to modern electrical standards, you can replace the dangling two-conductor ac cord with a three-conductor socket with the third conductor grounded to the chassis (see Figure 5). You can install either a standard socket or a filtered model to help reduce RFI.

Once you remove the old cord, you'll need to widen and reshape the opening to accommodate the new socket. Steel will resist nibbling tools, so you may need to use a power tool. With the socket installed, you can now power the equipment with a modern, three-wire cord. This simple change will ensure a safety ground on gear that may otherwise present a potential hazard. Before you perform this modification, however, check the equipment to make sure that one side of the ac line is not grounded to the chassis. Some older types of gear used this approach and, if so, this modification should not be attempted.— *73, Patrick Hamel, W5THT,* **w5tht@arrl.net**

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

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

Paul Wade, W1GHZ, w1ghz@arrl.org

## Microwavelengths

# The Rise of Rain-Scatter Contacts

There has been a surge in 10 GHz rain-scatter activity in the northeast and Midwest over the past year, with contacts spanning impressive distances (more than 500 kilometers). A number of stations were able to make long rain-scatter contacts last August during the 2019 ARRL 10 GHz and Up Contest. After the contest, many operators realized that rain-scatter contacts don't need mountaintops, and we could have fun from home or more easily accessible locations, or even just from the driveway (see Figure 1).

### Enjoying Rain-Scatter Contacts

Peter Prabucki, VA3ELE, is one of the instigators behind this activity. From his home station in Mississauga, Ontario, at the western end of Lake Ontario, Peter is ideally situated to reach stations to the east, in western New York, Quebec, and New England, as well as into the Midwest and Ontario. There isn't much elevation at the lakefront, but rain scatter from large thunderheads helped him work 35 grids on 10 GHz, including my station in FN34 at 603 kilometers, a new grid for both of us. Peter also does a lot of roving, generating more activity and helping others work new grids.

**Figure 1** — Gedas Vysniauskas, W8BYA, celebrated his first 10 GHz contact, made by snow scatter, with Russ Dwarshuis, KB8U. [Nancy Vysniauskas, KC9MOM, photo]

Rain-scatter prospects have been improved by software written by Andy Flowers, KØSM, making it possible to quickly locate and utilize promising storms for rain- and snow-scatter propagation. The latest version is an interactive website, **www.rainscatter.com**, which amalgamates weather radar data from multiple locations to show storms over the continental US and Canada. Storm intensity is displayed in various colors, and promising storm cells are highlighted with small circles. Available stations are also displayed — some are home stations, while others are ready to set up at a nearby site.

A contact I made in June for a new grid using the website is shown in Figure 2. Active stations and storms are shown on the map. Contacts are started by clicking on the chosen station. In this example, I clicked on W1FKF, Don Twombly. Once a station is clicked on, a direct path line is displayed, with heading and distance. This direct path had serious obstructions making propagation unlikely, so I looked for a storm in a favorable direction for both stations. Clicking on the storm adds the scatter path to the display, with headings for both stations to aim their antennas (remember that 10 GHz antennas are quite sharp, so accurate headings are important).

Showing the heading for both stations is useful because the heading can be relayed to rovers that may not have internet access to view the website. These contacts usually take some liaison to set up, either on 2 meters or by internet or text message.

### Rain Scatter Explained

Many of us have made contacts using reflection: bouncing the signals off a hill or large structure. Scattering is a different phenomenon — the energy is absorbed by a material, in this case water, and re-radiated (see **www.wa1mba.org/papers/WA1MBA%20Scattering%20Super%202019%20Paper.pdf** for a more detailed explanation). The falling raindrops, often just the right size for 10 GHz, re-radiate like a dipole in the same polarization as they are illuminated. For horizontal polarization, the radiation pattern is like a dipole facing the

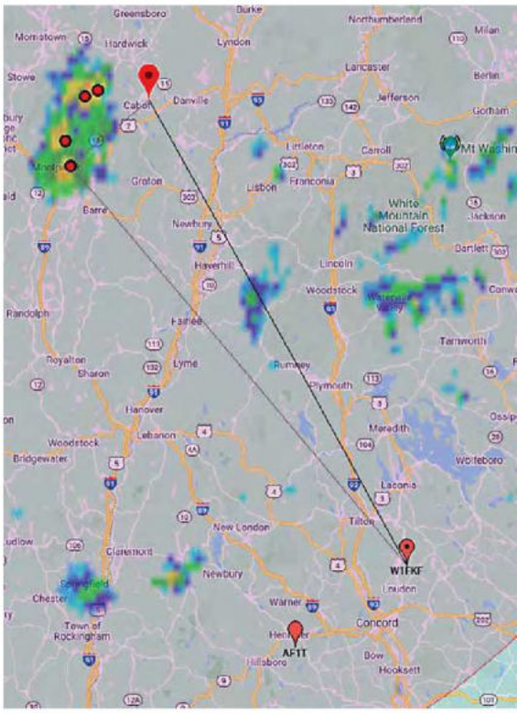



**Figure 2** — An example of a rain-scatter contact between Paul Wade, W1GHZ, and Don Twombly, W1FKF, using **www.rainscatter.com**. [Paul Wade, W1GHZ, photo]

**Figure 3** — A 10 GHz dish with a cordless screwdriver and threaded rod for elevation adjustment. [Bill Davis, KØAWU, photo]

**Figure 4** — Gary Danelius, WBØLJC, and Jim Hermanek, KØKFC, worked rain scatter across Lake Superior from the Minnesota shoreline during the 2007 ARRL 10 GHz and Up Contest. [Donn Baker, WA2VOI, photo]

incoming energy, with the strongest radiation on the front and back, but very little off to the sides. Because we all use horizontal polarization, the best scattering path is closer to the direct path between stations. It's possible to work stations off to the side, but signals are typically much weaker as the angle approaches 90°. The path shown in Figure 2 is close to 90°, but I tried anyway, and the signals were still strong. Vertical polarization might work better, but I don't know of anyone who has tried it.

The best rain for DX is an intense rainstorm near the middle of the path. Severe thunderstorms can reach high altitudes (50,000 feet or more), providing RF visibility to stations over a large area. On the other hand, heavy rain near a station can absorb too much of the energy, making contacts more difficult. A relatively clear path to a distant storm is best. The website helps to locate these storms and potential stations to work.

A signal is scattered from falling raindrops being blown by wind. There's likely to be a predominant storm velocity giving an overall Doppler shift in frequency. But there can be turbulence, causing the Doppler effect to slightly shift the frequency on each scattered signal. The result is a rough sound, easily spread over several hundred hertz in frequency during moderately turbulent rainfall. This makes SSB extremely difficult to copy, and most digital modes nearly impossible. Most contacts use CW, though FM works well for strong signals. But the interesting DX contacts are usually the weak ones, and the CW doesn't have to be fast. Beginner speeds are fine — microwave operators are happy to make the contact.

A curious effect is that signals sound stronger than the actual peak signal strength. On my panadapter, I can find and copy weak signals with peak levels that would be extremely difficult to copy for a pure CW tone. One reason for this is the rain-scatter signal has less short-term fading than a typical 10 GHz signal. Another reason might be that the power that's spread in frequency is integrated by the ear.

## Operating During Rain Scatter

When someone observes a potential storm on **www.rainscatter.com**, they notify a potential contact on a lower band or by internet, text message, phone, or chat page. The operators coordinate headings and decide who will initiate transmission to get started, usually sending dashes to differentiate the signal from noise. If a signal is not found, operators might take turns adjusting the antenna heading slightly, or even adjusting elevation to find higher rain or to clear local obstructions or trees.

Rain scatter is a good way to overcome obstructions or lack of altitude (see Figure 3). Slightly adjusting the dish elevation can sometimes increase signal strength enough to make a contact. Our rain scatter attempts aren't always successful, but we have fun trying. Sometimes we even get wet, as shown in Figure 4.

## Summary

If you have a 10 GHz station, give rain scatter a try — you might work some new contacts. Rain scatter is also possible on lower microwave bands, though 10 GHz seems best. There have even been reports of 24 GHz contacts, and we hope to try 47 GHz rain scatter soon.

# Technical Correspondence

# DX Performance of 43-Foot Verticals; Wind Noise and Mobile Antennas

## Takeoff Angles of 43-Foot Vertical Antennas

Many stations include ground-mounted 43-foot verticals as their primary low-elevation takeoff angle (TOA) antennas for DX work. Modeling the antenna for TOA on several commonly used bands allows a simple comparison. As it turns out, a 43-foot vertical is approximately ⅝ wavelength on 20 meters. On higher bands, however, it offers less than ideal TOAs.

The 20-meter plot (see Figure 1) shows maximum gain occurring at 15 degrees elevation. The other elevation plots (as shown in Figures 2 – 6) are not meant to be absolute in terms of gain; they only depict relative TOA between bands. The primary lines in the comparison plots represent the 20-meter plot for the sake of comparison. The green shaded area below 45 degrees represents where the antenna is most effective in reaching out to DX stations. The lower the TOA, the fewer Earth bounces the signal must suffer on the long DX journey. Each bounce touches land and reduces the signal strength. Note that on the 160-meter band, the plot indicates significant power below 45 degrees elevation. The maximum gain on 160 meters is about 8 dB lower than on 20 meters. The approximately 1.5 S-unit reduction still qualifies as a DX antenna. Of course, for best performance, any vertical antenna requires a low-loss RF ground return path. — *73, Joe Ostrowski, KI5FJ*, **ki5fj@arrl.net**

## Wind Noises Generated by Mobile Antennas

The electrical performance of a through-chassis roof-mounted antenna is fantastic. On the VHF and UHF bands, there is no better ground plane available.

I drilled a hole in the metal roof of my car for an NMO (New Motorola Mount) to achieve this ultimate performance. I then installed a traditional 19-inch ¼-wavelength antenna for 2 meters. The antenna had very low wind resistance and exhibited a broad standing-wave ratio (SWR) curve across the band. Everything

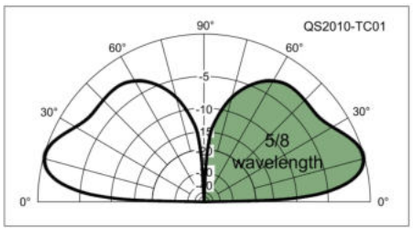



**Figure 1** — On 20 meters, the elevation plot of the 43-foot vertical antenna is labeled with its fraction of a wavelength: ⅝. In my estimation, this is the gold standard for takeoff angles (TOA).

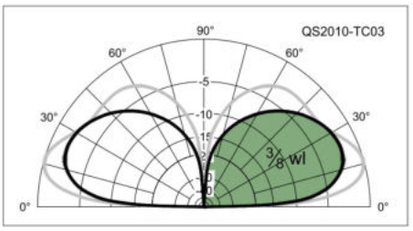



**Figure 3** — The 43-foot vertical antenna is ⅜ wavelength on 40 meters for a 3 dB gain reduction.

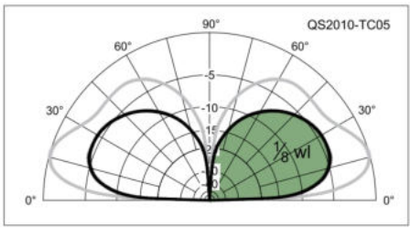



**Figure 5** — The 43-foot vertical antenna is ⅛ wavelength on 80 meters.

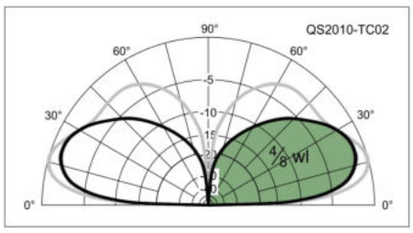



**Figure 2** — The 43-foot vertical antenna is ½ wavelength on 30 meters. This results in about a 2 dB reduction in maximum gain.

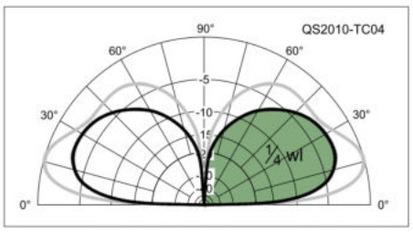



**Figure 4** — The 43-foot vertical antenna is ¼ wavelength on 60 meters, with gain comparable to 40 meters.

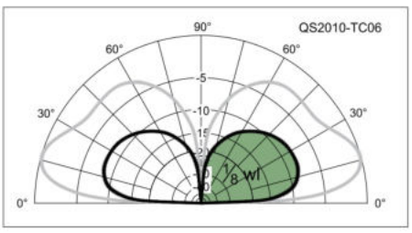



**Figure 6** — On 160 meters, the plot indicates the 43-foot vertical has the lowest DX gain.

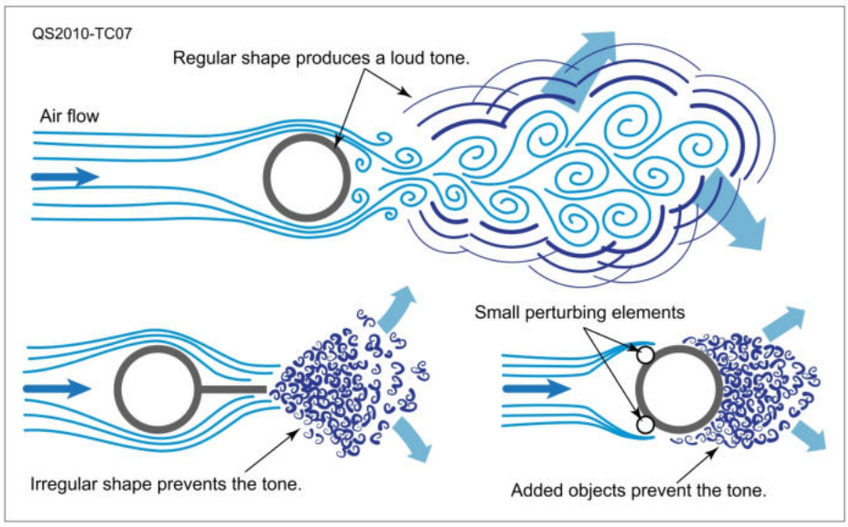



**Figure 7** — Acoustic tones can occur as air flows around a smooth, regular shape, such as a mobile antenna. By adding irregularly shaped elements to the antenna, it is possible to disrupt the downstream air flow and prevent the production of tones.

seemed fine — until my car reached 70 MPH.

At highway speeds, the wind produced a strong, 1,000 Hz tone heard inside the vehicle. At lower speeds, the tone would randomly toggle between 1,000 and 2,000 Hz. The entire roof became a sound box for this cacophony of musical tones.

Hearing the harmonic relationship between the tones, my first response was to change the mechanical resonance of the antenna at the ⅓ mark by attaching a lead fishing weight to add mechanical mass at one of the nodal maximums. It didn't work, so clearly something else was going on.

In fluid dynamics, a Kármán Vortex Street is a repeating pattern of swirling vortices caused by a process known as vortex shedding across a blunt object, and it is responsible for such phenomena as the "singing" of suspended telephone or power lines, guy wires, and the vibration of a car antenna at certain speeds (see Figure 7). For more information about Kármán Vortex Streets, visit **https://en.wikipedia.org/wiki/Karman_vortex_street**.

Based upon my findings, I needed a quick trip to the hobby shop for a 19-inch piece of square plastic tubing. I intended to disrupt the airflow across the antenna by using sharp edges. I simply slid the hollow plastic square tubing (from the bottom up) over the length of the antenna while keeping the top ball as a physical stop. There was no change to the SWR, and it worked perfectly. I no longer heard the acoustic effects of trailing vortices carried inside the car.

This is a widely known problem, with many articles published and solutions discussed. So the next time you see spiral windings around a smokestack (with a linear or non-linear taper/pitch), or the spirals around your AM/FM antenna on your car, you'll know that the engineers are purposefully addressing the negative effects of this fluid dynamics phenomenon. — *73, Al Rabassa, NW2M,* **nw2m@arrl.net**

Technical Correspondence items have not been tested by *QST* or ARRL unless otherwise stated. Although we can't guarantee that a given idea will work for your situation, we make every effort to screen out harmful information.

Materials for this column may be sent to ARRL, 225 Main St., Newington, CT 06111; or via email to **tc@arrl.org**. Please include your name, call sign, complete mailing address, daytime telephone number, and email address on all correspondence. Whether you are praising or criticizing a work, please send the author(s) a copy of your comments. The publishers of *QST* assume no responsibility for statements made herein by correspondents.

# Ham Bootcamp

A beginner-friendly program to mentor new and upgraded hams, developed by the Nashua Area Radio Society.


# Getting Hams On the Air

**Fred Kemmerer, AB1OC**

For the last 5 years, the Nashua Area Radio Society (NARS) in Nashua, New Hampshire, has been actively providing licensing classes and training to help new amateur radio operators develop their skills. Our club has helped over 420 people earn or upgrade their licenses.

The Nashua Area Radio Society has spent quite a bit of time trying to understand why so many of the people who earn a license or an upgrade don't get on the air. The number one reason we discovered is that the amateur radio community isn't providing the mentoring that many hams need to get active. Some examples of the necessary mentoring include:

- Help getting a handheld transceiver or base radio programmed for repeater use
- Guided practice making contacts on the air
- Help to overcome "mic fright"
- Help choosing equipment for their first VHF/UHF or HF station
- Help setting up an effective first HF station

Beyond these basic items, the club has also found that mentoring in the following areas helps boost interest in getting on the air among new and upgraded hams:

- An introduction to foxhunting
- An introduction to low-Earth orbit (LEO) satellite operations
- An introduction to operating on the 6-meter band
- Getting set up and learning how to use *WSJT-X* and FT8/FT4 modes
- A basic introduction to contest participation
- A guide to working DX and confirming receipt of transmissions
- Help with basic physical station-building issues such as grounding, getting cables into a building, and putting up simple antennas and feed lines

Above: Mackenzie Pooler, KE1NZY, and her father, Dan Pooler, AC1EN, mentor hams by explaining how to get started with satellites at Ham Bootcamp.

## Creating Ham Bootcamp

Our solution was a new program created by our club, called Ham Bootcamp. This program was designed to address the barriers preventing newly licensed and upgraded hams from getting on the air. The addressed barriers were shared by the club's license students via surveys.

Creating this type of program is not difficult. Before agreeing to launch Ham Bootcamp, the concept was discussed among license-class instructors. The initial program was taught by three volunteers from our instructor pool.

We took the most noted feedback items and scheduled a three-session inaugural Ham Bootcamp. It was taught at our station (AB1OC-AB1QB) in New Hampshire. Ham Bootcamp is free to anyone who wants to participate. The club learns more about what topics best meet the needs of attendees each time the program is offered, and the items covered are continuously improved upon.

Effective mentoring needs to be hands-on and personal. This requires spending time with hams to understand what they want to do with amateur radio, and each Ham Bootcamp begins with this discussion.

## Program Structure

Ham Bootcamp includes hands-on demonstrations of the on-air activities that new licensees seem to enjoy most. This is done so that attendees can figure out what interests them. We also spend time talking about and demonstrating the basics of building VHF/UHF and HF stations.

*Effective mentoring needs to be hands-on and personal. This requires spending time with hams to understand what they want to do with amateur radio, and each Ham Bootcamp begins with this discussion.*

New and recently upgraded hams are interested in a broad range of topics. With this in mind, NARS created specific activities for each level of ham radio licensees. The topics are taught via demonstrations and hands-on activities. For example, instructors conduct a practice repeater chat net on a UHF simplex channel, where all program attendees can check in and practice participating in a net. During the program, hams assemble and work with demonstration HF stations and the associated computer and software applications for logging and digital operation. This approach gives them a chance to work with similar gear that they'll be using to build and operate their own stations.

Most young and new hams come to Ham Bootcamp with a great deal of concern about making mistakes while operating on the air. To help with these problems, a focus is placed on practicing basic operating techniques to get attendees comfortable with being on the air.

James Finchum, AC1DC, explains how to assemble an HF station at Ham Bootcamp.

## Program Locations

NARS has been scheduling a Ham Bootcamp series after each set of our spring and fall license classes. This gives the Technician-, General- and Amateur Extra-class licensees (as well as other hams) a chance to participate in the program shortly after they earn their licenses or upgrades. Each Ham Bootcamp series consists of two Saturday meetings to cover the Technician-, General-, and Amateur Extra-class license items, and an evening visit to the local Ham Radio Outlet store. This

The start of Ham Bootcamp at the 2019 New England HamXposition in Boxborough, Massachusetts.

format is offered to small groups of 10 – 20 attendees and is taught at our station, where they have access to a complete set of equipment for hands-on demonstrations and use.

Ham Bootcamp is also offered at the Northeast HamXposition in a group format. The program occurs on a Saturday morning with about 80 people, and the format consists of two tracks — one for Technicians and unlicensed hams and one for Generals and Amateur Extras. After the main sessions, attendees receive a guided tour of NARS's ham radio display and vendor area at the show.

The hamfest format is delivered in a large conference room with groups of about eight hams at each table. The instructors rotate from table to table delivering their elements of the hands-on presentation and demonstration of their topics. This format requires 8 – 10 instructors, which the club staffs from our license-class instructor pool.

## Ham Bootcamp and Social Distancing

Ham Bootcamp has continued safely during the COVID-19 pandemic. The program is offered as an online activity via three Zoom sessions, structured the same way as the in-person program. The Ham Radio Outlet trip is replaced with an online shopping trip where attendees look at various equipment choices online using vendor websites. The topics for the online shopping trip are chosen through Zoom polls completed by program participants.

## Getting On the Air After Ham Bootcamp

The Ham Bootcamp program is only 2 years old, so it's still relatively new. Program results have been encouraging, however. More than half of the program attendees are building stations and getting on the air. Ham Bootcamp has a been an effective motivator for both newly licensed and upgrading hams, as well as those who had their license for a while and weren't active before attending the program.

## Conclusion

Ham Bootcamp is continuously evolving as time goes on. NARS will be opening online license classes and online Ham Bootcamp to all licensed and prospective hams in North America. Contact **classes@n1fd.org** to sign up for the next set of license classes and the next online Ham Bootcamp. For more information on Ham Bootcamp, visit **www.n1fd.org/ham-bootcamp**.

All photos provided by the author.

Fred Kemmerer, AB1OC, earned his Amateur Extra-class license in 2010. He's an electrical engineer and has held positions as a technology and business executive in the telecommunications industry. He enjoys building stations and space communications, and he has a blog dedicated to these interests, which can be found at **https://stationproject.blog**. Fred also serves as president of the Nashua Area Radio Society. He can be reached at **ab1oc@arrl.net**.

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

# ARRL Board Meets in Virtual Session

Due to travel and gathering restrictions in place because of the coronavirus pandemic, the ARRL Board of Directors met on Friday, July 17, in a remote session, using the Zoom videoconferencing platform.

At this meeting, the Board took these actions:

- Accepted the final recommendations of the Band Planning Committee. Committee chair and ARRL First Vice President Mike Raisbeck, K1TWF, introduced the motion to adopt the plan. An earlier draft of the plan was introduced at the Board's in-person January meeting. After the January Board meeting, the Committee received and considered hundreds of comments from interested amateurs. The final band plan can be viewed on the ARRL website.
- Voted, in anticipation of hiring a new Director of Emergency Management, to modify the charter of the search committee to study and, if appropriate, prepare a report on the implementation of a new Standing Committee of the Board to emphasize emergency communications and provide advice to the CEO in these matters. The report is expected to be delivered to the Board by November 24.
- Created a Standing Order that gives the Programs and Services Committee authority to approve, by vote, proposed rule changes for contests and awards.
- Accepted the financial reports from the Chief Financial Officer and Treasurer on the finances and investment portfolio of the organization.
- Modified the composition of the ARRL Legal Defense and Assistance Committee and the guidelines for what activities will be funded by ARRL.
- Amended ARRL By-Law #18 to conform with changes made at the January Board meeting regarding the election period for Division elections.
- Clarified the rules for attendance at standing committee meetings and the reimbursement of expenses incurred thereto.
- Approved the recipients of several awards, including the Hiram Percy Maxim Memorial Award.
- Acknowledged the efforts of ARRL Headquarters staff in dealing with and maintaining operations during the pandemic.
- Discussed personnel matters in a Committee of the Whole.

The meeting was unusual in that, at the end of the day on July 17, the Board recessed until August 16, when it reconvened, concluded its business, and adjourned. Meeting minutes are forthcoming.

The ARRL Board also conferred several awards and recognitions.

## The Hiram Percy Maxim Award

The ARRL Board conferred the 2020 ARRL Hiram Percy Maxim Award on Jacob M. Nagel, ADØJA, of Wright City, Missouri. Licensed since 2012, the Board cited Nagel for exemplifying the spirit of amateur radio by learning new technologies, providing community service, and helping with emergency communication. ARRL's top youth honor, the Hiram Percy Maxim Memorial Award is given annually to a radio amateur and ARRL member under the age of 21. The award consists of a $1,500 stipend and an engraved plaque, to be presented at an ARRL convention or event.

Jacob M. Nagel, ADØJA

The Board cited Nagel's involvement in providing technical assistance to the Okaw Valley Amateur Radio Club and the Egyptian Radio Club of Illinois for the installation and upgrading of their club repeaters; advising the Germantown, Illinois, Fire Department on upgrading its communication systems; speaking at the 2016 Dayton Hamvention® Youth Forum; sharing his expertise in online forums, and active involvement in projects that allow him to integrate his amateur radio knowledge with other technical ventures in electronics.

## Knight Distinguished Service Award

The Board named veteran ARRL Rhode Island Section Manager Robert G. "Bob" Beaudet, W1YRC, of Cumberland, Rhode Island, as the recipient of the Knight Distinguished Service Award, given to an ARRL Section Manager. Beaudet has been Rhode Island SM since 2002.

Robert G. "Bob" Beaudet, W1YRC

The Board cited Beaudet's active promotion of ARRL activities in his Section, including visiting hundreds of Field Day operations; participating in many Volunteer Examiner test sessions; attending countless club meetings; staying active as a contester, DXer, and mentor, and serving as a model to other Section Managers. The Board said "Beaudet's leadership of the ARRL Rhode Island Section Field Organization has led to a strong working cadre of volunteers within the Section."

## Doug DeMaw, W1FB, Technical Excellence Award

The Board named Al Rabassa, NW2M, of Rockville, Maryland, as the recipient of the Doug DeMaw, W1FB, Technical Excellence Award. The Board cited Rabassa's frequent contributions to the *QST* "Hints & Hacks" column, and his *QST* technical articles,

Al Rabassa, NW2M

including "The Basics of Fan Cooling." The Board also noted that Rabassa has served as a subject-matter expert of the Yaesu FT-101 transceiver, maintaining a website devoted to the technical aspects of the vintage transceiver series.

## ARRL Technical Service Award

The Board named James W. Brown, K9YC, of Santa Cruz, California as the recipient of the 2020 ARRL Technical Service Award. The Board cited Brown's frequent contributions to, and presentations at, amateur radio forums at conventions including Dayton Hamvention, Pacificon, and the International DX and Contesting Convention in Visalia, California; his collaborations with the ARRL Lab; his work on various ARRL publications, including *The ARRL Handbook*, *The ARRL Antenna Book*, and others; and his sharing of his technical and educational expertise in the fields of audio engineering, RFI, and other aspects of electronics and engineering with the amateur radio community at large, particularly in terms of the informational website he maintains, which is available at no charge. The Board said, "Brown continues to provide his expertise as a means of 'giving back' to the amateur community, in the spirit of the amateurs that worked with him when he was first licensed at the age of 13."

James W. Brown, K9YC

## Recognitions

The Board recognized:

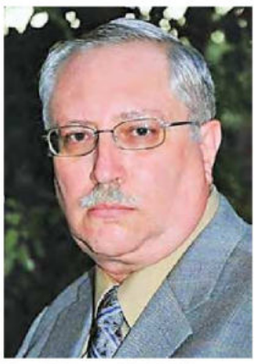
- the Fort Wayne Radio Club on its centennial and 90 years of ARRL affiliation.
- the Radio Club of Tacoma for 100 years as an ARRL-affiliated club.
- the Marietta Amateur Radio Club of Ohio for 100 years as an ARRL-affiliated club.

Rick Lindquist, WW1ME, ww1me@arrl.org

# Happenings

# ARRL Welcomes Paul Z. Gilbert, KE5ZW, as Director of Emergency Management

ARRL has named Paul Z. Gilbert, KE5ZW, of Cedar Park, Texas, as its first Director of Emergency Management. The appointment marks another step in ARRL's increased focus on strengthening its emergency communications capabilities and long-standing working relationships with federal and state agencies and private emergency response organizations.



Paul Gilbert, KE5ZW

Gilbert brings more than 30 years of professional and amateur radio experience in public service to the table. Following his appointment as an Emergency Coordinator in 1987, he has held multiple positions within the ARRL Field Organization, and served for more than a decade as West Gulf Division Assistant Director for Public Service. At the time of his appointment, Gilbert was in his second term as South Texas Section Manager.

Professionally, Gilbert most recently served as Radio Officer, HQ Staff, for the Texas State Guard, where he was responsible for planning and implementation of the organization's communications capabilities for the past 6 years.

An Amateur Extra-class licensee, Gilbert is a member of Army MARS and holds numerous Department of Homeland Security certifications. He is a member of the FEMA Regional Emergency Communications Coordination Working Group, a graduate of the FEMA Emergency Management Institute's Exercise Design Course, and a founding member of the Texas Division of Emergency Management Communications Coordination Group.

Gilbert will manage a team responsible for supporting ARRL Emergency Communications programs and services, including the Amateur Radio Emergency Service® (ARES®) and National Traffic System (NTS), as well as lead the continued modernization of those programs.

## QSO Today Virtual Ham Expo to Become Twice-Yearly Event

The QSO Today Virtual Ham Expo (**www.qsotodayhamexpo.com**) in early August appears to have been an unmitigated success, so much so that another virtual event will be held next March. The show was an ARRL-sanctioned event.

"It was far better than we expected," Virtual Ham Expo Chair Eric Guth, 4Z1UG/WA6IGR, told ARRL. "We had over 26,000 registered and over 14,000 on the platform both days."

Guth said event sponsors and exhibitors were "thrilled with the turnout, engagement, and response" and enthusiastic about the second QSO Today Virtual Ham Expo, set for March 13 – 14, 2021. "Our plan is to offer this twice a year," Guth added.

The show, developed on the vFairs virtual conference platform, cleverly recreated the atmosphere of a typical large hamfest, with several tracks of forum sessions on a wide array of topics.

The QSO Today Virtual Ham Expo simulated a convention center atmosphere with virtual exhibits and auditoriums.

Icom, a principal sponsor of the event, had team members from around the globe staff its exhibits. "We really enjoyed the virtual event," said Icom America Senior Sales Manager Ray Novak, N9JA. "It is our goal to see this grow and to have hams from the various countries attend in anticipation of this becoming a multilingual event, as we all are starving for ham radio events during this pandemic."

Product Development Manager Bob Inderbitzen, NQ1R, was among the ARRL representatives engaging with event attendees using text and video chat. "Our team answered questions about ARRL membership programs and services, amateur radio licensing, and even had some fun challenging visitors to our booth with ham radio trivia," he said. Working from W1AW at ARRL Headquarters, Inderbitzen treated more than 500 visitors to live, online tours.

## Chris Brault, KD8YVJ, is 2020 *Amateur Radio Newsline* Young Ham of the Year


Chris Brault, KD8YVJ

Christopher "Chris" Brault, KD8YVJ, of Liberty Township, Ohio, is the 2020 Bill Pasternak WA6ITF Memorial Amateur Radio Newsline Young Ham of the Year (YHOTY). The son of Jocelyn, KD8VRX, and Kimberly Brault, Chris, 18, was the recipient of the 2015 ARRL Hiram Percy Maxim Award. A ham since 2014, he credits his father for being his guide into amateur radio.

A senior and honor student at Saint Xavier High School in Cincinnati, Chris helped restart the school's amateur radio club, W8GYH. He has also been recognized as the 2017 ARRL Great Lakes Division Young Amateur of the Year, and he took part in the 2017 Dave Kalter Youth DX Adventure to Costa Rica with other up-and-coming young radio amateurs. He has been a Youth Forum presenter at Dayton Hamvention® and HamCation in Orlando.

Among other activities, Chris serves as social media director for the Youth on the Air organization and is a contesting mentor for young hams involved in its programs. See **www.youthontheair.org** for more information. — *Thanks to CQ Communications*

## FCC News

### US Department of Defense to Share 3450 – 3550 MHz with 5G Commercial Operations

The FCC will auction sharing rights to the upper 50 MHz of the 3300 – 3500 MHz secondary amateur radio allocation to commercial 5G interests in the wake of the Department of Defense (DoD) agreement to share spectrum at 3450 – 3550 MHz. The entire band currently supports a variety of military operations; amateur radio has a long history of peaceful coexistence with the Department of Defense as a secondary user of this spectrum.

Late last year, the FCC proposed to delete the amateur 3300 – 3500 MHz secondary allocation, as well as the amateur-satellite allocation at 3400 – 3410 MHz. ARRL strongly opposed the move in its comments on the rulemaking proposal. This latest move makes a contiguous band of spectrum from 3450 – 3980 MHz available for commercial 5G networks. The FCC could auction the 100 MHz of spectrum in early 2022.


"For a number of years, the National Telecommunications and Information Administration (NTIA) and FCC have focused on the 3450 – 3550 MHz band as the spectrum most conducive to sharing with commercial users," said ARRL Washington Counsel David Siddall, K3ZJ, adding that the August 10 action indicated that a sharing framework had been worked out.

### HobbyKing Fined Nearly $3 Million for Marketing Unauthorized Drone Transmitters

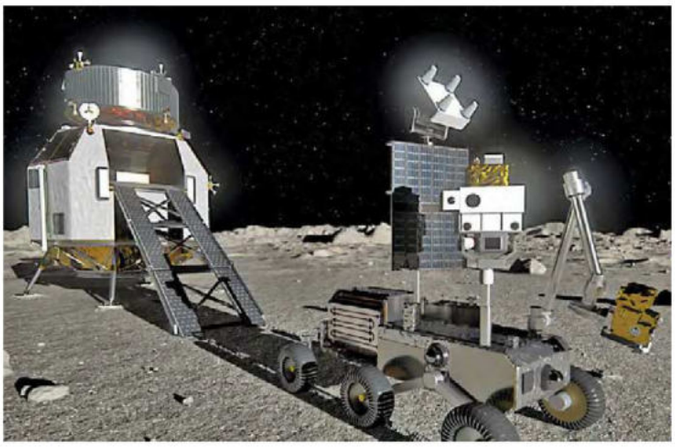
The FCC has issued a *Forfeiture Order* calling for HobbyKing to pay a fine of $2,861,128 for marketing drone transmitters that do not comply with FCC rules. An FCC Enforcement Bureau investigation stemmed in part from a 2017 ARRL complaint that HobbyKing was selling drone transmitters that operated on amateur and non-amateur frequencies, in some instances marketing them as amateur radio equipment. The fine affirms the monetary penalty sought in a June 2018 FCC *Notice of Apparent Liability*.

The FCC said its investigation found that dozens of devices marketed by the company transmitted in unauthorized radio frequency bands and, in some cases, operated at excessive power levels. "Such unlawful transmissions could interfere with key government and public safety services, like aviation systems," the FCC said. The ARRL EMC Committee and Lab also determined that potential interference to the secondary (transponder) air traffic control radar system on 1030 – 1090 MHz could occur. HobbyKing did not contest any facts in the matter.

## AMSAT-DL Submits Lunar Lander Proposal to European Space Agency

Germany's amateur satellite organization AMSAT-DL (**www.amsat-dl.org**) has submitted a comprehensive proposal to the European Space Agency (ESA) for its Lunar Amateur Radio Transponder (LunART) lunar lander — a communications platform for the European Large Logistic Lander (EL3). LunART would support communication and payload experiments. AMSAT-DL's Peter Guelzow, DB2OS, and Matthias Bopp, DD1US, say that a LunART would support direct communication with Earth via amateur radio, support university and student payloads and offer direct access to their experiments, and expand the reach of radio science. It could also provide backup communication capability and capacity during an emergency, or when the ESA network is busy.

The comprehensive radio platform would use the European frequency protocol of 2.4 GHz up and 10.45 GHz down (approximately 100 W), pioneered in the QO-100 satellite, the first geosynchronous amateur radio payload. The platform would also include a VHF/UHF transponder. AMSAT-DL would develop and build the necessary hardware and software and provide ground station support via the 20-meter dish at AMSAT-DL headquarters in Bochum, Germany. It envisions developing a smaller ground station with an approximately 1-meter dish to support groups, including schools and universities. Low-power beacons would transmit on various frequencies from VHF (145 MHz) through SHF (up to 24 GHz or even 47 GHz), AMSAT-DL's proposal says. In addition, LunART could include the capability to transmit still or slow-scan television images and video.



The European Space Agency plans to launch European Large Logistic Lander (EL3) probes on the lunar surface every 3 years from 2027 and invited proposals for interesting experiments and payloads. [European Space Agency, image]

## Section Manager Nomination Notice

To all ARRL members in Arizona, Arkansas, Iowa, Kentucky, Mississippi, Montana, North Texas, Orange, and Wyoming: 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 email 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 at the same time.

Candidates may use any available electronic signature platforms, such as Docusign, Hellosign, or signed PDF. Candidates who use an electronic signature platform to be nominated, as described above, do not need 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 ARRL 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 December 4, 2020. If more than one member is nominated in a single Section, ballots will be mailed from Headquarters no later than January 4, 2021 to full members of record as of December 4, 2020, which is the closing date for nominations. Returns will be counted February 23, 2021. Section Managers elected as a result of the above procedure will take office April 1, 2021.

If only one valid petition is received from a Section, that nominee shall be declared elected without opposition for a 2-year term beginning April 1, 2021. If no petitions are received from a Section by the specified closing date, such Section will be resolicited in the April 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. — *Bart Jahnke, W9JJ, Field Services & Radiosport Department Manager*

Rick Pam, K1CE, k1ce@arrl.net

## Public Service

# The Great ShakeOut Drill and Earthquake Communications

Participate in the 2020 Great ShakeOut earthquake drill on October 15, at 10:15 AM, and exercise your family, neighborhood, and community earthquake disaster radio communications plans. "Drop, Cover, and Hold On" is the first response to an earthquake. Drop where you are, onto your hands and knees. Cover your head and neck with one arm and hand, and crawl underneath a table or desk or to an interior wall, away from windows. Hold on until the shaking stops. This drill is supported by the National Earthquake Hazards Reduction Program (NEHRP), US Geological Survey (USGS), Federal Emergency Management Agency (FEMA), and others. Register and get more information at **www.shakeout.org**. Although October 15 is the official drill date, your drill can be conducted at any time.

### The Radio Amateur's Role

Amateur radio provides emergency communications during earthquake disaster situations and has a role in local and state emergency management drills, as well as major FEMA exercises, such as 2016's Cascadia Rising. Based on a scenario of an M9.0 earthquake off the coast of central Oregon triggering a tsunami along the entire Pacific Northwest coastline, Cascadia Rising started with a failure of all regular communication systems. ARRL leadership in the Oregon, Western Washington, and Idaho Sections (as well as ARRL Headquarters) were involved in this national exercise.

Disaster response organizations are currently evaluating how to respond to emergencies and disasters related to the COVID-19 pandemic, and earthquakes are no exception. Sheltering, emergency operations centers (EOCs) and overloaded hospital operations, feeding, damage assessment, and urban search and rescues for earthquakes will all have to be done differently. Amateur radio is unique in that operators don't have to physically be there — it's a network with built-in social distancing. The ShakeOut earthquake exercise presents amateur radio operators with an opportunity to assess how to respond during the pandemic.

### The Role of CERTs and ARES®

When aftershocks occur during the unstable aftermath of an earthquake, trained and registered radio amateurs in groups such as the Amateur Radio Emergency Service (ARES) can support Community Emergency Response Teams (CERTs) on their missions in neighborhoods and the broader community. The CERT program educates the public about disaster preparedness for hazards that may impact their area and trains them in basic disaster response skills, such as fire safety, light search and rescue, team organization, and disaster medical operations. Radio communications is an essential emergency support function for CERT members' activity and should be well-exercised and planned for.

After an earthquake, before deploying and supporting a CERT mission to the neighborhood for assessing and communicating damage, the radio amateur must ensure the structural integrity of their family residence and the safety and well-being of their own family members first.

CERT basic training was updated this year, featuring a revised Disaster Medical Operations section, and new hazard-specific annexes. The FEMA Independent Study (IS) course, IS-317A: An Introduction to the Community Emergency Response Team (CERT), was updated in May. CERT is sponsored by the US


Department of Homeland Security, FEMA, and the Ready program. For more information, visit **www.ready.gov/cert**.

## SKYWARN for Earthquakes

Like the SKYWARN program, the US Geological Survey's Did You Feel It (DYFI) system receives basic reports from residents who are experiencing an earthquake. With this crowdsourcing, the USGS gets a complete picture of the earthquake area, magnitude, damage, and extent. Affected residents send their reports over the internet (see the sidebar, "Did You Feel It Report Sample").

By providing a DYFI report when you can do so safely after an earthquake, you help ensure that your area has been represented in the compilation of the maps of shaking. In the process, you will learn more about how other communities fared and gain a greater understanding of the effects of earthquakes. For more information on the USGS Did You Feel It program, visit **https://earthquake.usgs.gov/data/dyfi**.

For radio amateurs, the reporting system can be complemented by the hybrid internet-amateur radio email system Winlink, especially when the internet is down in affected areas.

## The Winlink Connection

In the ARRL Headquarters comprehensive after-action report of the Cascadia Rising exercise, the following was noted on what worked: "Winlink was found to be extremely useful during the exercise. This allowed radio amateurs in the disaster area to send radio email to ARRL HQ, which could be received normally. When the internet and phone outage at ARRL HQ was injected to the exercise, the transition to RF-only radio email between ARRL HQ and the disaster area occurred quickly and seamlessly." Winlink continues its development path with evolving digital mode algorithms that give more throughput, robust efficiency, and effectiveness in transmission of messages and form handling.

### Did You Feel It Report Sample

- Did you feel the earthquake?
- What time did it occur?
- Where were you when it occurred?
- What was your situation during the earthquake?
- How would you describe the shaking?
- Was it difficult to stand and/or walk?
- Did you notice any swinging of doors or other free-hanging objects?
- Did objects rattle, topple over, or fall off shelves?

Reports can be made at **https://earthquake.usgs.gov/earthquakes/eventpage/tellus**.

One year after the M7.1 Ridgecrest earthquake in Southern California, the Winlink team rolled out its Did You Feel It utility for its popular *Winlink Express* software. Through cooperative efforts with the USGS, amateur radio operators worldwide can now report the effects of an earthquake at their location directly to the USGS with no internet or phone service required.

In the *Winlink Express* program (make sure you have the most up-to-date version), you can find the HTML DYFI form by accessing **MESSAGE TAB > HTML FORMS > STANDARD FORMS > USGS FOLDER**.

Get ready to drop, cover, and hold on this October, when you exercise your earthquake disaster plans.

# Field Organization Reports

## July 2020

## 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**.

635
KD8TTE

526
W7PAT

463
WA7PTM

455
WA3EZN

440
N9VC

331
KE8BYC

304
W9GRG

296
KD2LPM

275
KI5GRH

248
WA2CCN

247
KB3YRU

245
AL0Y

235
WB9WKO

232
N2WGF

210
KT2D

205
AD8CM
W0PZD
ND8W

195
KE8KOC

186
WS6P

184
KD2NMG

175
W3GWM

170
N1PZP

160
K0RCJ
KK3F

159
W9RY

155
W8DJG

151
WA2BSS

145
N1LL
WM2C

140
KC8WH
WO2H
KB8RCR
K1REZ

138
N3KRX

135
KC9FXE
W3YVQ

130
WA4VGZ
AC0KQ
WB9QPM
N2JBA
K3FAZ
K8AMH
WD8USA
N5MKY
KW1U
NA7G

128
KY2MMM

126
W7EES

125
N8SY

120
W4NWT
WC4FSU

KA9QWC
AG9G
K9LGU
K3JL
W0LAW
KY2D
N7IE

119
AC8NP
KA8ZGY

118
AI9F

115
AF4NC
W8IM
KD8ZCM
N1TF

112
N2DW

110
KO4OL
WA3QLW
K6HTN
K2TV
N3SW
WB8YLO
KA9MZJ
KA5AZK
KF5IOU
KI7TIG
K3IN
WB8TQZ
AB1AV
N1IQI
KD2JKV
W1RVY

108
K4VWK

105
WB7OSC
AD3J
NI2W

104
KV8Z

102
K1HEJ

101
WB8YYS

100
WB4RJW
AD4DO
KZ8Q
KN9P
NX9K
AC8RV
WB8SIQ
KB2QO
KE5YTA
KF5OMH
KG5NNA
W7PHX
AA3SB
K8ED
WA1MXT
N1LAH

98
K8MDA
WV5Q

97
WB6NCT
W4INK
KC1HHO

96
N8CJS

95
W9EEU
K0IBS
K1XFC

94
KE1ML

91
K1STM

90
KM4WHO
AA4XZ
AB9ZA
KB4CAU
K8KRA
KB8HJJ
KA1G
N2TSO
K3MIY
K2MJF
KA2GQQ
KA2HZP
W2AH
W3CJD
K6JT
WD0BFO
WB8WKQ
KC1KVY

WA1LPM

89
KB1NMO

88
N6IET

86
KF7GC

85
KL7RF

83
W5XX

82
W9BGJ
K8RDN

80
KD8UUB
N8MRS
KG7QWR
KJ7BHO

79
N3JET
AB3WG

78
KA0DBK
WB8R

77
N3RB
KC7ASA

75
NV1N

74
KC1MSN
KB0DTI

73
WB2VUF

72
K6RAU
K0FBS
KJ6CNO

70
K9GDF
W3ZR

The following stations qualified for PSHR in previous months but were not reported in this column: (June) WB6ZIQ 120, WF2Y 110, WS4P 106.

## Section Traffic Manager Reports

The following Section Traffic Managers reported: AL, AR, AZ, CO, CT, DE, EMA, ENY, EPA, IL, IN, KS, KY, LAX, MDC, MI, MN, MS, NC, NE, NFL, NH, NLI, NM, NNJ, NTX, OH, OR, SD, SFL, SJV, TN, UT, VA, WCF, WMA, WI, WPA, WV, WY.

## Section Emergency Coordinator Reports

The following Section Emergency Coordinators reported: AR, CT, DE, ENY, EWA, GA, IA, ID, IL, IN, KS, KY, LA, MDC, MI, MN, MO, MS, MT, ND, NFL, NLI, NNJ, NNY, NM, NV, OH, OR, PAC, SFL, SJV, SNJ, STX, SV, TN, VA, VI, WCF, WPA, WI, WPA, WTX, WWA, WY.

## Brass Pounders League

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

KK3F 2,309, NX9K 1,287, K6HTN 1,025, WB9WKO 885, KW1U 552.

Rick Lindquist, WW1ME, ww1me@arrl.org



# IARU Announces HF Digital Mode Band Plan Review

An International Amateur Radio Union (IARU) working group was formed in August to develop solutions to reduce congestion within very popular mode segments, while preventing mutual interference between "incompatible modes" as much as possible. The working group includes representatives of the three regional band-planning committees, marking the first time the three IARU regions have joined together to coordinate band-planning efforts.

"Because frequency allocations and amateur radio operating interests vary in different parts of the world, the development of band plans — voluntary guidelines on the use of the spectrum that is available to radio amateurs — is a responsibility of the three IARU regional organizations," the IARU explained in announcing the working group. "Each of the three regions has a band-planning committee to focus on this work."

The IARU says this approach to band planning has generally kept pace with the evolution of amateur radio operating, but the explosive growth in HF digital modes, particularly FT8, has led to perceived overcrowding of HF digital mode band segments.

In August, the new working group reported having had "fruitful discussions" with the WSJT Development Group led by Joe Taylor, K1JT. Additional discussions, including with other HF stakeholders, will be held as part of a fundamental review of the different HF digital modes, and how they can best be categorized and arranged to share the limited spectrum available.

In recent years, moves have been made to bring the regional band plans into alignment wherever possible. Final approval of any band plan revisions typically occurs during regional conferences of IARU member-societies, held every 3 years on a rotating basis.

## IARU Appoints New Electromagnetic Compatibility (EMC) Coordinator

The International Amateur Radio Union (IARU) Administrative Council has appointed Martin Sach, G8KDF, as global Electromagnetic Compatibility (EMC) Coordinator, succeeding Tore Worren, LA9QL.

"EMC is a major challenge for all radiocommunication services," the IARU noted. "Radio amateurs are experiencing increased interference caused by unwanted radio frequency emissions from a wide variety, and rapidly growing number, of electronic devices."

The EMC Coordinator's mission is to ensure that the concerns and needs of radio amateurs are effectively addressed in international standards bodies — particularly the International Special Committee on Radio Interference (CISPR) and the International Telecommunication Union (ITU) — as well as in regional telecommunication organizations and at national levels through IARU member-societies. Assisting in the effort is a network of volunteers with expertise in the field of EMC.

"We are fortunate that someone as qualified as Martin is willing to take the reins," IARU President Tim Ellam, VE6SH, said. "He has already represented the IARU effectively at important international meetings and we look forward to working even more closely with him."

## New IARU Video

The video "What is IARU?" is now available on the International Amateur Radio Union (IARU) Region 2 website, at **www.iaru-r2.org**.

"This video explains the mission and roles of IARU to represent, develop, and defend frequencies for amateur radio around the world," IARU Region 2 explains. "It also describes the regional organizations and the critical roles of its more than 160 member-societies." The English-language presentation was developed by the IARU Administrative Committee and approved at its meeting last October in Lima, Peru.

The short video, available in English and Spanish, was produced by IARU Region 2 Director Carlos Beviglia, LU1BCE, and Fernando Gomez Rojas, LU1ARG. It is available in MP4 format.

IARU Region 2 encourages member-societies and radio clubs to use the video to explain the role and mission of IARU to amateurs, regulators, and others.

Bruce Draper, AA5B, aa5b.corral@gmail.com

# Contest Corral October 2020

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 | | Date-Time | | Bands | Contest Name | Mode | Exchange | Sponsor's Website |
|---|---|---|---|---|---|---|---|---|
| 1 | 1700 | 1 | 2000 | 3.5 | SARL 80-Meter QSO Party | Ph | RS, serial, grid or QTH | www.sarl.org.za |
| 1 | 1700 | 1 | 2100 | 28 | NRAU 10-Meter Activity Contest | CW Ph Dig | RS(T), 6-char grid square | nrau.net/activity-contests |
| 1 | 1900 | 1 | 2100 | 1.8-50 | SKCC Sprint Europe | CW | RST, SPC, name, mbr or power | www.skccgroup.com |
| 3 | 0600 | 4 | 0600 | 1.8-28 | Oceania DX Contest, Phone | Ph | RS, serial | oceaniadxcontest.com |
| 3 | 0600 | 4 | 1800 | 3.5-28 | TRC DX Contest | CW Ph | RST, serial, "TRC" (if member) | trcdx.org/rules-trc-dx |
| 3 | 0700 | 3 | 1000 | 3.5, 7 | German Telegraphy Contest | CW | RST, LDK (if DL) | agcw.org/index.php/en |
| 3 | 1200 | 4 | 1159 | 3.5-28 | RTTYOps WW RTTY | Dig | RST, 4-digit year first licensed | rttyops.wordpress.com |
| 3 | 1200 | 4 | 1159 | 1.8-28 | Russian WW Digital Contest | Dig | RST(Q), 2-char oblast code (if UA) | rdrclub.ru/ustav-rtsrk |
| 3 | 1400 | 4 | 0200 | All | YLRL DX/NA YL Anniversary Contest | CW Ph Dig | Serial, RS(T), SPC | ylrl.org/wp/dx-na-yl-contest |
| 3 | 1600 | 4 | 1100 | 3.5, 7 | International HELL-Contest | Dig | RST, serial | www.darc.de |
| 3 | 1600 | 4 | 2200 | 1.8-28 | California QSO Party | CW Ph | Serial, county or SPC | www.cqp.org/Rules.html |
| 3 | 1700 | 3 | 2100 | 3.5-28 | FISTS Fall Slow Speed Sprint | CW | RST, SPC, name, mbr or power | fistsna.org |
| 3 | 1800 | 4 | 1800 | All | SKCC QSO Party | CW | RST, SPC, name, 4-char grid | www.skccgroup.com |
| 4 | 0500 | 4 | 2300 | 3.5-28 | RSGB DX Contest | CW Ph | RS(T), serial | www.rsgbcc.org/hf |
| 4 | 0600 | 4 | 0900 | 3.5 | UBA ON Contest, SSB | Ph | RS, serial, ON section (if ON) | www.uba.be/en |
| 4 | 2200 | 4 | 2359 | 7,14,21 | Peanut Power QRP Sprint | CW Ph | RS(T), SPC, peanut nr or power | www.nogaqrp.org |
| 5 | 1900 | 5 | 2030 | 3.5 | RSGB 80-Meter Autumn Series, CW | CW | RST, serial | www.rsgbcc.org/hf |
| 6 | 0100 | 6 | 0300 | 3.5-28 | ARS Spartan Sprint | CW | RST, SPC, power | arsqrp.blogspot.com |
| 7 | 1700 | 7 | 2000 | 144 | VHF-UHF FT8 Activity Contest | Dig | 4-char grid square | ft8activity.eu/index.php/en |
| 7 | 1900 | 7 | 2300 | 432 | 432 MHz Fall Sprint | CW Ph Dig | 4-char grid square | svhfs.org |
| 7 | 2000 | 7 | 2100 | 3.5 | UKEICC 80-Meter Contest | Ph | 6-char grid square | www.ukeicc.com |
| 10 | 0000 | 10 | 2359 | 1.8-28 | QRP ARCI Fall QSO Party | CW | RST, SPC, mbr or power | qrparci.org/contests |
| 10 | 0000 | 11 | 1559 | 3.5-28 | Makrothen RTTY Contest | Dig | 4-char grid square | pl259.org/makrothen |
| 10 | 0000 | 11 | 2359 | 50-1296 | ARRL EME Contest | CW Ph Dig | Signal report | arrl.org/eme-contest |
| 10 | 0001 | 10 | 2359 | 28 | 10-10 International 10-10 Day Sprint | CW Ph Dig | Name, mbr or "0," SPC | www.ten-ten.org |
| 10 | 0300 | 11 | 2100 | 1.8-UHF | Nevada QSO Party | CW Ph | RS(T), county or SPC | nvqso.com/contest-rules |
| 10 | 0600 | 11 | 0600 | 1.8-28 | Oceania DX Contest, CW | CW | RST, serial | oceaniadxcontest.com |
| 10 | 0800 | 10 | 1400 | 902 and up | Microwave Fall Sprint | CW Ph Dig | 6-char grid square | svhfs.org |
| 10 | 1200 | 11 | 1200 | 3.5-28 | Scandinavian Activity Contest, SSB | Ph | RST, serial | www.sactest.net |
| 10 | 1200 | 11 | 2359 | 1.8-50 | SKCC Weekend Sprintathon | CW | RST, SPC, name, mbr or "none" | www.skccgroup.com |
| 10 | 1500 | 11 | 0459 | 1.8-144 | Arizona QSO Party | CW Ph Dig | RS(T), county or SPC | www.azqsoparty.org |
| 10 | 1600 | 11 | 2200 | 1.8-UHF | Pennsylvania QSO Party | CW Ph | Serial, county or SPC | paqso.org |
| 10 | 1700 | 10 | 2100 | 3.5-28 | FISTS Fall Unlimited Sprint | CW | RST, SPC, name, mbr or power | www.fistsna.org |
| 10 | 1800 | 11 | 1800 | 1.8-144 | South Dakota QSO Party | CW Ph Dig | RS(T), county or SPC | www.sdqsoparty.com |
| 10 | 2000 | 11 | 2000 | 1.8 | PODXS 070 Club Great Pumpkin Sprint | Dig | RST, SPC | www.podxs070.com |
| 11 | 0530 | 11 | 0800 | 3.5 | UBA ON Contest, CW | CW | RST, serial, ON section (if ON) | www.uba.be/en |
| 11 | 0800 | 11 | 1000 | 50 | UBA ON Contest, 6 Meters | CW Ph | RS(T), serial, ON section (if ON) | www.uba.be/en |
| 12 | 0000 | 12 | 0200 | 1.8-28 | 4 States QRP Second Sunday Sprint | CW Ph | RS(T), SPC, mbr or power | www.4sqrp.com |
| 14 | 0030 | 14 | 0230 | 3.5-14 | NAQCC CW Sprint | CW | RST, SPC, mbr or power | naqcc.info |
| 14 | 1700 | 14 | 2000 | 432 | VHF-UHF FT8 Activity Contest | Dig | 4-char grid square | www.ft8activity.eu |
| 14 | 1900 | 14 | 2030 | 3.5 | AGCW Semi-Automatic Key Evening | CW | RST, serial, year first used a bug | agcw.org/index.php/en |
| 14 | 1900 | 14 | 2030 | 3.5 | RSGB 80-Meter Autumn Series, Data | Dig | RST, serial | www.rsgbcc.org/hf |
| 17 | 0000 | 18 | 1600 | 50, 144 | Araucaria World Wide VHF Contest | CW Ph | RS(T), 6-char grid square | avhfc.com/rules/en.pdf |
| 17 | 0000 | 18 | 2359 | 3.5-28 | JARTS WW RTTY Contest | Dig | RST, age of operator | jarts.jp/rules2020.html |
| 17 | 0001 | 18 | 2359 | 28 | 10-10 International Fall Contest, CW | CW | Name, mbr or "0," SPC | www.ten-ten.org |
| 17 | 1400 | 18 | 0200 | All | New York QSO Party | CW Ph Dig | RS(T), county or SPC | www.nyqp.org |
| 17 | 1500 | 18 | 1459 | 3.5-28 | Worked All Germany Contest | CW Ph | RS(T), DOK code or "NM" or serial | www.darc.de |
| 17 | 1500 | 18 | 1500 | 1.8 | Stew Perry Topband Challenge | CW | 4-char grid square | www.kkn.net/stew |
| 17 | 2000 | 17 | 2359 | 1.8-7, 21-50 | Feld Hell Sprint | Dig | RST, mbr, SPC, grid | sites.google.com/site/feldhellclub |
| 17 | 2130 | 17 | 2230 | 7 | Argentina National 7 MHz Contest | Ph | RS, year first licensed | lu4aa.org/wp/concurso-nacional-40m |
| 18 | 0000 | 18 | 0200 | 14-21 | Asia-Pacific Fall Sprint, CW | CW | RST, serial | jsfc.org/apsprint/aprule.txt |
| 18 | 1400 | 21 | 0800 | 1.8-144 | Classic Exchange, Phone | Ph | Name, RS, SPC, rig | classicexchange.org |
| 18 | 1700 | 19 | 0100 | 1.8-144 | Illinois QSO Party | CW Ph Dig | RS(T), county or SPC | http://www.w9awe.org/ILQP%202020%20Rules.pdf |
| 18 | 1900 | 18 | 2030 | 3.5 | RSGB RoLo CW | CW | RST, 6-char grid of previous QSO | www.rsgbcc.org/hf |
| 18 | 2300 | 19 | 0100 | 1.8-28 | Run for the Bacon QRP Contest | CW | RST, SPC, mbr or power | qrpcontest.com/pigrun |
| 19 | 1300 | 23 | 2359 | All | ARRL School Club Roundup | CW Ph | RS(T), class (I/C/S), SPC | arrl.org/school-club-roundup |
| 19 | 1800 | 20 | 0300 | 1.8-UHF | Telephone Pioneers QSO Party | CW Ph Dig | RS(T), chapter (if member), name | www.tpqso.com |
| 19 | 1900 | 19 | 2030 | 3.5 | RSGB FT4 Contest Series | Dig | 4-char grid square | www.rsgbcc.org/hf |
| 24 | 0000 | 25 | 2359 | 1.8-28 | CQ Worldwide DX Contest, SSB | Ph | RS, CQ zone | www.cqww.com/rules.htm |
| 28 | 0000 | 28 | 0200 | 1.8-28 | SKCC Sprint | CW | RST, SPC, name, mbr or power | www.skccgroup.com |
| 28 | 2000 | 28 | 2100 | 3.5 | UKEICC 80-Meter Contest | CW | 6-char grid square | www.ukeicc.com |
| 29 | 2000 | 29 | 2130 | 3.5 | RSGB 80-Meter Autumn Series, SSB | Ph | RS, serial | www.rsgbcc.org/hf |
| 30 | 1600 | 30 | 2359 | 3.5-14 | Zombie Shuffle | CW | RST, SPC, Zombie nr/area code, name | www.zianet.com/qrp |
| 31 | 1200 | 1 | 1159 | 1.8-28 | Russian WW MultiMode Contest | CW Ph Dig | RST(Q), oblast or serial | rdrclub.ru/ustav-rtsrk |
| 31 | 1200 | 1 | 1200 | 3.5-28 | UK/EI DX Contest, SSB | Ph | RS, serial, district (if UK/EI) | www.ukeicc.com |

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

Lew Malchick, N2RQ, n2rq@arrl.net

# 2019 – 2020 School Club Roundup Results

The next School Club Roundup will take place October 19 – 23, 2020.

The main purpose of the School Club Roundup (SCR) is to acquaint school-age students with the fun of amateur radio. Each of the most recent sessions had more than 400 operators reported. These included both licensed and unlicensed participants acting as operators and loggers. The average number of participants per school was between nine and 10 students taking part. Only two schools reported 40 or more operators each (W0BHS and W0LHS).

Traditionally, some clubs use various strategies to attract students, such as having food available during the event. It always helps to have support from school principals or department heads. The emphasis is on having fun getting on the air.

Jeremiah Thompson, KO4AST, operated during the February 2020 School Club Roundup at the Augusta University Amateur Radio Club's station. [Darby Wills, KK4PEQ, photo]

## The Results

Although overall we've seen a significant increase in entries, there was a decrease in February 2020. SCR is an operating event, not a contest, so you should make of it what you like and enjoy yourselves.

The full results for this and many past SCRs can be found at **contests.arrl.org/scrresults.php?cn=scrspring**. Click on the event month for the scores you want to view. The full details of all entries, along with any comments, can be viewed by clicking on the call sign of the entrant. Results are sorted by category and score, including information on where the club is located, how many contacts and multipliers they logged, and a breakdown of how they got their score.

## COVID-19 Impact

The next SCR session will be unlike any before. There's no telling what the impact of COVID-19 will have on the upcoming school year. Many clubs will have to look at alternative ways to operate during the SCR. We're looking at our most recent Field Day experience as a model.

Many special event operations use their special call sign and pass it around to different participating stations. If a school club can't operate from the school, licensed members (with permission from the club's trustee) might be able to operate from their home stations.

Many schools have been using video conferencing software. You could try operating a home station with students using platforms such as Zoom or Google Meet. Phone operation might work using VOX or coordinating push-to-talk (PTT) with the control operator, like the old-style phone patch.

In light of the poor propagation conditions in recent years, many stations are anxious to use some of the popular digital modes. FT8 doesn't readily support the full exchange of an SCR contact. A more convenient alternative is *JS8Call*. It has many of the characteristics of FT8 but supports keyboard-to-keyboard contacts and more flexible macros.

## Conclusion

Encourage your local school or university club to get on the air and make some contacts! Individual hams are also encouraged to make contacts with the students. A student might enjoy making an SCR contact from a home station, as well. If you're interested or have questions about SCR, you can join **SCR@groups.io** or email **scr@limarc.org**. The full rules are available at **www.arrl.org/school-club-roundup**.

We look forward to seeing the creative solutions you employ. Feel free to discuss them on **SCR@groups.io** and mention them on the Soapbox page with your submission. Get on the air, experiment, and have fun!

# The 2020 ARRL November Sweepstakes

## CW: 2100 UTC Saturday, November 7 – 0259 UTC Monday, November 9
## Phone: 2100 UTC Saturday, November 21 – 0259 UTC Monday, November 23

The ARRL November Sweepstakes is the premier domestic contest in the US and Canada. Join thousands of operators of all skill levels as they attempt to beat personal records, win categories, and achieve the coveted Clean Sweep by working all 84 ARRL/RAC Sections in a single weekend.

Entrants may operate for a maximum of 24 of the 30 hours during the contest period. Off-times must be a minimum of 30 consecutive minutes without listening or transmitting. Exchange is serial number, precedence, your call sign, check, and ARRL/RAC Section.


Stephen Wojton, NN2NN, searched for contacts on 80 meters during the 2019 ARRL November Sweepstakes. [Stephen Wojton, NN2NN, photo]



Logs are due 7 days after the conclusion of the event. Electronic logs must be uploaded to our web app at **https://contest-log-submission.arrl.org**. Send paper logs to ARRL November Sweepstakes, 225 Main St., Newington, CT 06111. Sweepstakes CW logs must be submitted or postmarked by 0300 UTC Monday, November 16, and Phone logs must be submitted or postmarked by 0300 UTC Monday, November 30.

If you want to convert your paper log into a Cabrillo-formatted log for electronic submission, go to **http://www.b4h.net/cabforms** and select the event. You can input your log data, which will be converted to a Cabrillo-formatted log for you (be sure to save the generated file on your computer). Then upload your formatted log to the web app at **https://contest-log-submission.arrl.org**.

For more information, visit
**www.arrl.org/sweepstakes** or email **contests@arrl.org**

## New Products

### bhi NES10-2MK4 Amplified DSP Noise-Canceling Speaker


The bhi NES10-2MK4 removes noise and interference from speech signals, enabling you to have a more enjoyable listening experience. The speaker is compact and easy to use and incorporates the latest bhi high-performance DSP noise-canceling technology. The three-position switch on the top of the speaker controls the main functions, "Off" (audio bypass), "On" (amplified audio), and "DSP" (noise canceling on). The speaker has a quality 5 W audio amplifier with DSP noise canceling from 8 to 40 dB over eight user-selectable levels, and tone reduction up to 65 dB. The NES10-2MK4 requires 10 to 18 V dc (500 mA) and has an integral 2-meter audio lead terminated with a 3.5-millimeter monaural jack plug. There is a 3.5-millimeter monaural headphone socket on the side, and this can also drive an external loudspeaker. The NES10-2MK4 speaker is supplied with a rotary filter select knob, two fixing screws, four self-adhesive rubber feet, 1 × 1030 FPL fused dc power lead, and a user manual. Distributed in the US by DX Engineering; tel. 800-777-0703; **www.dxengineering.com**. $165.99.

Bernie McClenny, W3UR, w3ur@arrl.org

## How's DX?

# The First DXpedition to Albania, 50 Years Later

*For this month's column, Martti Laine, OH2BH, reflected on his DXpedition to Albania in 1970.*


The original ZA/OH2BH QSL card from 1970. From left to right: Erkki, OH2BW (SK); Ville, OH2MM, and Martti, OH2BH, in front of the Ministry of Communication.

In 1970, Albania was the most difficult country to reach via radio. Although it is located in the center of Europe and surrounded by other countries, it had remained totally closed off and only in correspondence with distant China. In July 1970, Albania welcomed its first ever group of tourists, travelling in from Denmark (OZ), to the isolated beaches of Durres, a 1-hour ride down winding dirt roads from the capital, Tirana.

On that very first plane, there were three adventurous amateur radio operators: Erkki, OH2BW (SK); Ville, OH2MM, and myself, OH2BH. On July 10, 1970, we hit the airwaves.

In July 2020, 50 years later, Ville and I enjoyed an exclusive dinner in Helsinki, Finland, with the Albanian Honorary Consul General, Ms. Liliana Verdha, remembering those early days in her homeland. Liliana (Lili) is the person who allowed that first ZA activation to proceed after Albanian officials tried to halt the operation, because they had no laws in place regarding amateur radio. Years later, during the mysterious ZA blockage from the rest of the world, Lili had moved to Finland, where she became well known.

During our dinner party, Lili admitted that it was in fact her father, Vice Minister Sali Verdha, who had graciously allowed the first Albania radio operation, paving the way to make Albania a household DX country.

## Albania's First Amateur Training Course

It took a series of visits from 1970 through 1989, and even one failed DXpedition, to discuss amateur radio with the regime's frequency management officials, headed by Dajlan Omeri. Those decisions were consistently negative, even though Omeri was nodding during the meetings, as if in agreement. As it turns out, vertical nodding in Albania means no, and time and again I left those meetings with no success. Omeri's young engineer, Fredrick Kote, presented some positive signs that encouraged me to come back time after time.

In 1989, the head of the Albanian Telecom Administration visited Finland. Even though he was carrying a card with the name Toli Halili, he was later identified as Sokol Hoxha, the son of Enver Hoxha, the dictatorial Prime Minister of Albania. Sokol was a very warm and intelligent person, who quickly agreed to


The first IARU training course yielded a group of new operators.

allow the first-ever amateur radio training course and operating event, ZA1A, in September 1989.

This training course and the local students not only changed my direction in amateur radio, but did the same for many others, such as Wayne, N7NG/ZA1NG, and Chip, K7JA/ZA1JA, who both participated in this historic project.

Amateur radio regulations for Albania were written as part of this event and the license forms were produced. As the project director, I was able to allocate the call sign ZA1A for the event and the students, and for the IARU member-society (AARA) that was established at the time. Dajlan Omeri was among the graduates and decided to override all other call sign structures, wanting Albania to start with ZA1KAA for the students. He assigned the first call sign, ZA1KAA, to himself (today he's ZA1Z) and became the president of AARA.

## Licensing at the University of Tirana

In 2003, we agreed to have amateur radio included in the course offerings at the Technical University of Tirana. We had invited a slate of amateur radio educators to lead that historic undertaking, led by John, G3OKA, and his co-educators, including Uli, DJ2YA, and Carl, K9LA. The result of the class was 38 new amateur radio licensees. Even the university chairperson, Sonila Agako, ZA1YL, took the exam.

Along with the university course in Tirana, a large multinational team activated Albania again, along the same beaches in Durres where this story had begun with my team's DXpedition in 1970. The follow-up event to further boost amateur radio awareness was organized under the title, "First DX Convention of Albania, ZA1DX," in 2004.

## Looking Back on 50 Years

Albania has truly opened up for tourism now and is reachable through direct flights from many cities in Europe. We have not forgotten Albania, those great students, and the beautiful Durres beaches. In fact, those of us on the original DXpedition team became residents of Albania and established our radio station on the very same Durres beach with two fellow hams, Pertti, OG2M, and Pekka, OH2TA.

A recent earthquake did some damage to the Durres area, but all our fond memories are still there — standing proudly alongside the tower with the Stepper beam at 170 feet. Once we are clear from earthquake repairs and the COVID-19 pandemic, we plan to return.

*All photos provided by the author.*

From left to right: Honorary Consul General Liliana "Lili" Verdha, President of Albania Ilir Meta, and former President of Finland Martti Ahtisaari.



The Durres beach is miles long and has been the site of amateur radio activities over the past 50 years.

Jon Jones, NØJK, n0jk@arrl.org

## The World Above 50 MHz

# Rare 6-Meter Propagation Across the Geomagnetic Equator in July

July was an amazing month for propagation. Many stations in North America reported strong and frequent openings to Europe and the Far East. On July 10, at 2244Z, Skip, WS9V (EM59), worked Joel, KG6DX (QK23), in Guam. Terrestrial contacts on 50 MHz from Guam to North America have not taken place during July until this contact was reported, possibly making this the first non-F-layer terrestrial 50 MHz contact of this distance reported. During solar cycle peaks, F2 contacts between Guam and North America occur regularly on 6 meters. Rich, K1HTV, and I recall working Joel in November 1989 of Solar Cycle 22 via F2 on 6 meters. I was running only 10 W with a Kenwood TS-680, and the SSN was about 170.

On July 18, John, WA1EAZ (FN42), worked Alain, TR8CA, in Gabon. On July 25, a strong opening took place from North America to South America (see Figure 1). Contacts were made much deeper into South America than usual, with stations such as CP6UA working into Colorado. Then CE1PTT and CE3SX in Chile were received by stations in Colorado, Kansas, and the Gulf Coast states. The contacts made by Joel, Alain, and the Chilean stations share a commonality: the DX stations are either on or south of the geomagnetic equator. Mid-latitude sporadic-E contacts do not normally cross the geomagnetic equator, which makes us wonder how the 6-meter signals got over it.

During the equinoxes, the mechanism is straightforward. Sporadic-E from North American stations lands in the northern terminal of the TEP (trans-equatorial propagation) zone. Radio signals propagate by TEP by refracting off of two bulges of ionization, located 20 degrees north and south of the geomagnetic equator. The signals cross the geomagnetic equator and come down on the other side. TEP works best when the sun is directly over the geomagnetic equator (equinoxes) in the afternoon. The $E_s$-TEP contacts are often made during solar cycle peaks, when the F-layer ionization is higher.

Stations in CE, LU, and PY were worked by North American stations around the equinoxes. But these TEP contacts have occurred, though are rare, during solar cycle minimums, such as the $E_s$-TEP contacts on April 15, 2020. But in July, the sun is far north of the TEP zone, and conventional wisdom is that TEP ionization is very weak, and at the solar cycle minimum, too feeble to propagate signals at 50 MHz. Perhaps there was some help.

### Hamspeak: Geomagnetic Equator

The theoretic line around the earth where the magnetic field is horizontal. As the magnetic north and south poles change slowly over time, the magnetic equator is not fixed, and changes according to the movement of the magnetic poles.

For the WS9V – KG6DX contact, multi-hop sporadic-E put the signals out into the eastern Pacific. For the last hop to KG6DX, equatorial sporadic-E may have helped and played a role in WA1EAZ's contact with TR8CA. The sun was shining on the stations in Bolivia and Chile on July 25. A slow-moving coronal mass ejection left the sun on July 19 and hit Earth on July 24. It arrived embedded in a solar wind stream and had a strong magnetic field. This caused a geomagnetic storm with the Kp peaking at 4, with visual aurora seen in Minnesota. The geomagnetic activity boosted the MUF of the northern and southern bulges of the TEP zone to above 50 MHz, allowing $E_s$-TEP contacts.


**Figure 1** — PSK Reporter showing the opening from North America to South America on July 25, 2020. [**pskreporter.info/pskmap**]

▲ **Figure 2** — Barry Hansen's, K7BWH, portable setup from CN98. [Barry Hansen, K7BWH, photo]

▶ **Figure 3** — Gene Shea's, KB7Q, portable operation from DN58. [Gene Shea, KB7Q, photo]

## On the Bands

**50 MHz**. Six meters took a few days off as July started, then came roaring back on July 4. On the afternoon of July 4, from central Texas, Jerry, K5JC (EM00), with just 90 W and a four-element Yagi up 20 feet, logged JW7QIA.

That evening, Mike, K7ULS (DN41), worked a number of stations in Japan and BH4SCF (PM01) in Shanghai, China. K5JC found KL7HBK (BO49) for his 50th state on 6 meters. July 10 was good for NØLL (EM09) with 10 Japanese stations and HL3GOB for a new one.

July 11 was one of the best days, particularly for the central US states, which had openings to Europe all day. Nelson, KD2CYU (FN20), said it was "game on" with western Europe at 1230Z. Then I, S5, Ukraine, and eastern Europe boomed in. Nelson ended up putting 200 European stations in 20 countries in his log. From eastern Kansas, Dragan, KØAP (EM28), worked stations in Germany. N2CG (FN20) had European openings for 10 hours. Mario, K2ZD, said the band was open to Europe for him for 5½ hours starting at 1148Z. Starting at 2146Z, Mario had a 2-hour opening to Japan, working "19 different stations in all call areas." W3ATV worked JR1AIB with only a 40-meter dipole. Joe Taylor, K1JT, worked 27 Japanese stations and HL3GOB (marking Joe's 117th DXCC contact). JA7QVI worked VO2AC (in CQ zone 2) to complete the challenging 40-zone Worked All Zones award on 50 MHz, with all terrestrial contacts.

On July 12, N1AV (DM43) worked 35 stations in Japan and Korea. From Alaska, John, KL7HBK, worked "over the North Pole" into Europe with 11 contacts to YU, SP, Z3, and HA around 1200Z. KB7Q covered DN48/58/68 along the Canadian Border from Montana on several bands. On July 16, Al, K6AVP, worked EA8DBM with 70 W to a Moxon antenna. Barry, K7BWH, operated from rare CN98 and completed 254 contacts (see Figure 2).

On July 19, Lance, W7GJ (DN27), reported "the best Japanese opening ever." He worked 65 JA, two KH6, and three HL stations. On July 20, Randy, NØLD (EM15), worked DL8GP with only a loop up 30 feet. NØLL was portable in grid EN02, and he made 14 contacts on $E_s$ with FT8. Lance, W7GJ, operated portable in DN25 and DN35 and made 119 contacts on FT8.

**144 MHz**. The $E_s$ MUF rose briefly above 144 MHz on July 5. The paths intersect for an intense $E_s$ cloud located over southern Indiana. Jim, K5ND, wondered if an outbreak of Noctilucent clouds may have sparked the $E_s$. On July 12, K7ULS worked KB7Q/p in DN56 on MSK144 (see Figure 3). Two-meter $E_s$ made a brief appearance again in the CQ VHF Contest on July 18 at the start. Another short sporadic-E opening took place on July 25.

### Here and There

According to the report, "Overlapping Magnetic Activity Cycles and the Sunspot Number: Forecasting Sunspot Cycle 25 Amplitude," scientists from the National Center for Atmospheric Research, Centre for Fusion, Space and Astrophysics, University of Maryland Department of Astronomy, NASA Goddard Space Flight Center, Centre for the Analysis of Time Series, London School of Economics and Political Science, School of Engineering and Innovation have made an optimistic prediction about Solar Cycle 25. The report said Solar Cycle 25 "will have a magnitude that rivals the top few since records began…Our best estimate for the SSN amplitude of Solar Cycle 25 is 233 spots, with a 68% confidence that the amplitude will fall between 204 and 254 spots. We predict with 95% confidence that the Cycle 25 amplitude will fall between 153 and 305 spots."

# Special Event Stations

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

Because of the COVID-19 pandemic, many organizations are canceling or rescheduling events. This is the information we had at the time we went to press. We suggest you contact the event organizer to confirm. — *Ed.*

**Sep. 4 – Oct. 1, 1800Z – 2000Z, GB200FN**, Romsey, United Kingdom. RSGB. **Florence Nightingale Bicentenary 2020**. 14.200 3.665. QSL. John Wakefield, Oakhurst, Lower Common Rd., Romsey SO51 6BT, United Kingdom. **www.qrz.com/db/gb200fn**

**Sep. 10 – Sep. 14, 0000Z – 0300Z, WA2NYC**, Staten Island, NY. Wireless Association of New York City. **19th Anniversary of the Attack on the World Trade Center**. 28.450 14.390 7.238 D-STAR XRF 020B. QSL. Wireless Association of New York City, 233 Wolverine St., Staten Island, NY 10406. *We remember the more than 2,900 lives lost that day.* **www.qrz.com/db/wa2nyc**

**Sep. 18 – Sep. 20, 0101Z – 0101Z, NV7V**, Las Vegas, NV. Clark County NV ARES. **Silver State Classic Challenge**. 446.60 147.18 145.24 145.22. Certificate. Tim Duerson, 3719 Robin Knot Ct., North Las Vegas, NV 89084. **www.sscc.us** *or* **www.ccnvares.org**

**Sep. 19 – Sep 20, 0800Z – 0800Z, KF5DFD**, Henrietta, TX. Clay County Amateur Radio Club. **Clay County Pioneer Day**. 14.255 7.255. Certificate. Michael B. Boydston, 103 N. Crockett, Henrietta, TX 76365. **mbrentusa@gmail.com**

**Sep. 26 – Sep. 27, 1500Z – 2100Z, NØN**, Johnson, NE. Southeast Nebraska Amateur Radio Club. **84th Anniversary, SENARC Emergency Communication Exercise**. 14.230 7.180. Certificate & QSL. Charles Bennett, P.O. Box 67181, Lincoln, NE 68506. *From Coryell Park.* **senebrradioclub@gmail.com** *or* **www.facebook.com/SENRC**

**Oct. 2 – Oct. 3, 1500Z – 2300Z, WØD**, Macon, MO. Macon County Amateur Radio Club. **Lester Dent — Doc Savage Mystery Special Event**. 14.270 7.200 3.950. Certificate. Macon County ARC, P.O. Box 13, Macon, MO 63552. **dbagley@cvalley.net** *or* **www.maconcountymissouriarc.org**

**Oct. 2 – Oct. 12, 0000Z – 2359Z, N6D**, Healdsburg, CA. Will Pattullo, AE6YB. **Anniversary of the Dedication of Mission Dolores, San Francisco, 1776**. 14.265 7.265. QSL. Will Pattullo, 161 Presidential Cir., Healdsburg, CA 95448. **www.qrz.com/db/ae6yb**

**Oct. 3, 1300Z – 2000Z, N1EPJ**, East Greenwich, RI. Massie Wireless Club. **New England Wireless & Steam Museum Yankee Steam-Up**. 3.558 14.058 7.25 14.258. QSL. Massie Wireless Club, N1EPJ, P.O. Box 883, East Greenwich, RI 02818. **www.newsm.org** *or* **www.qrz.com/db/n1epj**

**Oct. 8 – Oct. 16, 0400Z – 2359Z, W3T**, Harleysville, PA. WV2M. **Anniversary of Towamencin Encampment**. 14.074 14.030 7.074 7.030; SSB, CW and FT8. Primary mode will be FT8. QSL. Frank Gallo, 106 Tweed Way, Harleysville, PA 19438. **www.w3t.info**

**Oct. 10, 1600Z – 2300Z, NI6IW**, San Diego, CA. USS *Midway* (CV-41) Museum Ship. **Celebrating the Birthday of the US Navy, October 1775**. 14.320 7.250 14.070 (PSK31) D-STAR on various reflectors. QSL. USS *Midway* Museum Ship (COMEDTRA), 910 N. Harbor Dr., San Diego, CA 92101.

**Oct. 10 – Oct. 11, 1500Z – 0500Z, W7A**, Tucson, AZ. Radio Society of Tucson. **Arizona QSO Party**. 14.248 14.048 7.189 3.848. Certificate. Bill, Clark, 222 N. Suntan Dr., Vail, AZ 85641. **www.azqsoparty.org**

**Oct. 10 – Oct. 18, 0000Z – 2359Z, W5I/W5K/W5E**, Sherman, TX. Grayson County Amateur Radio Club. **Eisenhower Birthday Special Event**. 14.250 14.040 7.250 7.040. QSL. Grayson County ARC, P.O. Box 642, Sherman, TX 75091. **qrz.com/db/w5i** *or* **https://graysoncountyarc.org**

**Oct. 10 – Oct. 18, 0000Z – 2359Z, various call signs**, various cities. World Wide Flora and Fauna. **Third Annual Get Your Parks ON! Earth Science Week 2020**. 14.244 14.044 10.124 7.044. Certificate. N9MM, 4245 Holstein Dr., Cleveland, TX 77328. *Operators from around the world are encouraged to participate in this year's international event. See website for details.* **www.wwff.us**

**Oct. 11 – Oct. 12, 1800Z – 0300Z, N3APS**, Orinda, CA. Expatriate Marylanders Radio Club. **140th Anniversary of the Current Maryland Flag**. 14.320 7.275 28.425 146.550. QSL. M.G. Vurek, P.O. Box 617, Orinda, CA 94563. **www.qrz.com/db/n3aps**

**Oct. 17, 1300Z – 1900Z, W1M**, Russell, MA. Western Mass. Council — BSA. **Woronoco Heights Outdoor Adventure/ SCOTA/JOTA/JOTI**. 14.290 14.060 10.115 7.190. QSL. Tom Barker, 329 Faraway Rd., Whitefield, NH 03598. *W1M will also operate on BrandMeister TG 907 and its affiliated TAC talk groups. All logging is done on paper. QSL card available on eQSL or for a 4 × 6 SASE.*

**Oct. 17, 1400Z – 2000Z, K4RC**, Yorktown, VA. Williamsburg Area Amateur Radio Club. **Yorktown Surrender Day Event**. 14.265 7.265. QSL. QSL Manager, K4RC, P.O. Box 1470, Williamsburg, VA 23187. **www.k4rc.net**

**Oct. 31, 1500Z – 2300Z, WW1USA**, Kansas City, MO. National World War I Museum and Memorial. **102nd Anniversary of the Armistice**. 14.225 14.060 7.250 7.060. Certificate. WW1USA Amateur Radio Station, World War I Museum and Memorial, 2 Memorial Dr., Kansas City, MO 64108. **ww1isa@theworldwar.org** *or* **www.qrz.com/db/ww1isa**

**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 (three 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**.

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 **January** *QST* would have to be received by **November 1**. In addition to being listed in *QST*, your event will be listed on the ARRL Web Special Events page.

You can view all received Special Events at **www.arrl.org/special-event-stations**.

# W1AW Schedule

| PAC | MTN | CENT | EAST | UTC | MON | TUE | WED | THU | FRI |
|---|---|---|---|---|---|---|---|---|---|
| 6 AM | 7 AM | 8 AM | 9 AM | 1300 | | FAST CODE | SLOW CODE | FAST CODE | SLOW CODE |
| 7 AM-1 PM | 8 AM-2 PM | 9 AM-3 PM | 10 AM-4 PM | 1400-1600 1700-1945 | VISITING OPERATOR TIME (12 PM-1 PM CLOSED FOR LUNCH) | | | | |
| 1 PM | 2 PM | 3 PM | 4 PM | 2000 | FAST CODE | SLOW CODE | FAST CODE | SLOW CODE | FAST CODE |
| 2 PM | 3 PM | 4 PM | 5 PM | 2100 | CODE BULLETIN | | | | |
| 3 PM | 4 PM | 5 PM | 6 PM | 2200 | DIGITAL BULLETIN | | | | |
| 4 PM | 5 PM | 6 PM | 7 PM | 2300 | SLOW CODE | FAST CODE | SLOW CODE | FAST CODE | SLOW CODE |
| 5 PM | 6 PM | 7 PM | 8 PM | 0000 | CODE BULLETIN | | | | |
| 6 PM | 7 PM | 8 PM | 9 PM | 0100 | DIGITAL BULLETIN | | | | |
| 6:45 PM | 7:45 PM | 8:45 PM | 9:45 PM | 0145 | VOICE BULLETIN | | | | |
| 7 PM | 8 PM | 9 PM | 10 PM | 0200 | FAST CODE | SLOW CODE | FAST CODE | SLOW CODE | FAST CODE |
| 8 PM | 9 PM | 10 PM | 11 PM | 0300 | CODE BULLETIN | | | | |

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

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

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

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

Code bulletins are sent at 18 WPM.

For more information, visit us at
**www.arrl.org/w1aw**

♦ 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.

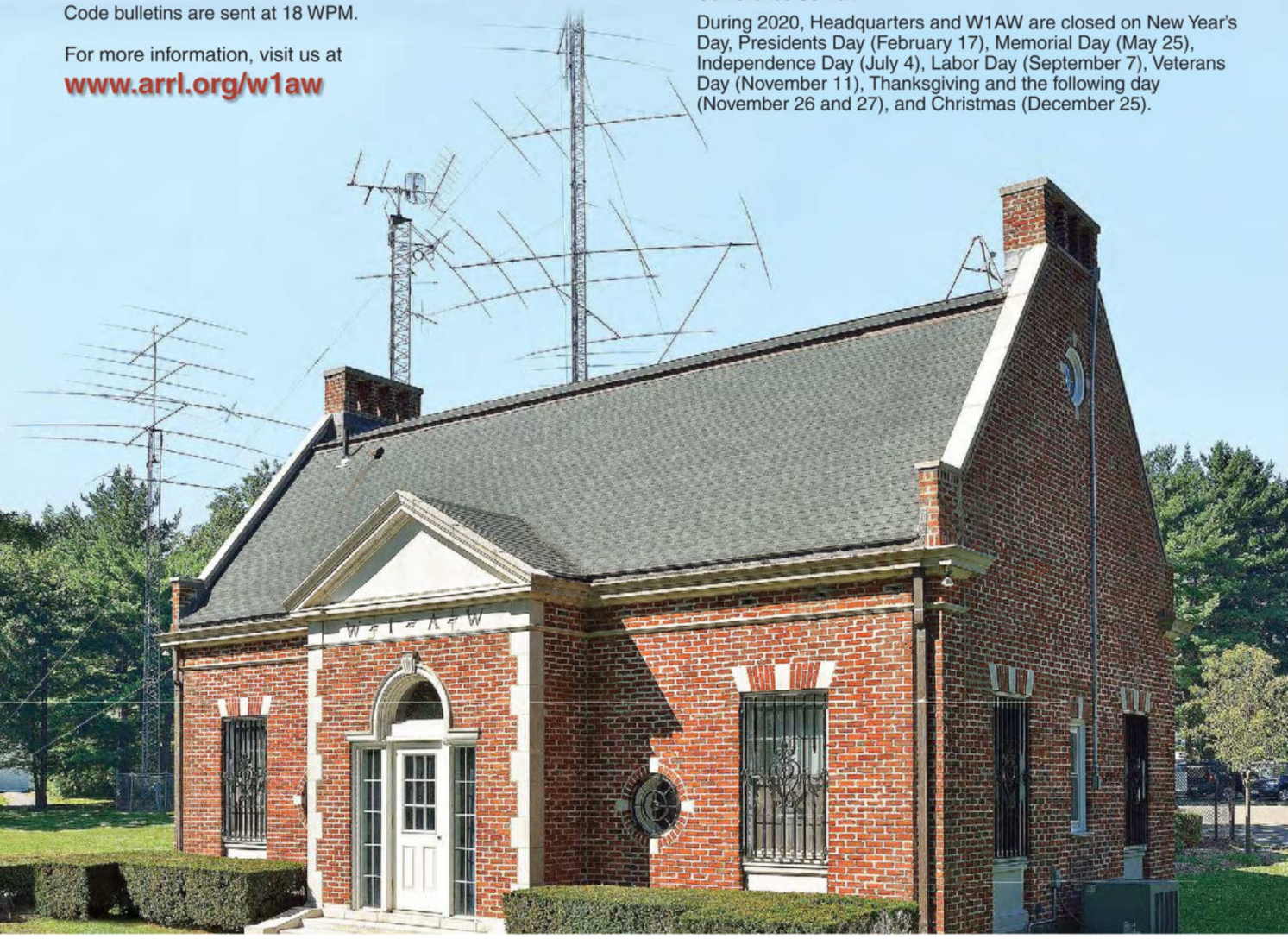
Keplerian elements for many amateur satellites will be sent on the regular digital frequencies on Tuesdays and Fridays at 6:30 PM Eastern time using Baudot and PSK31.

♦ 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 noon and 1 PM to 3:45 PM Monday through Friday. FCC-licensed amateurs may operate the station during that time. Be sure to bring your current FCC amateur license or a photocopy. In a communication emergency, monitor W1AW for special bulletins as follows: voice on the hour, teleprinter at 15 minutes past the hour, and CW on the half hour.

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 2020, Headquarters and W1AW are closed on New Year's Day, Presidents Day (February 17), Memorial Day (May 25), Independence Day (July 4), Labor Day (September 7), Veterans Day (November 11), Thanksgiving and the following day (November 26 and 27), and Christmas (December 25).



# Certificate of Code Proficiency

## Recipients

Sponsored by VIBROPLEX
www.vibroplex.com

This month, ARRL and Vibroplex recognize 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.

**May 2020**

| | |
|---|---|
| Kirk S. Goddard, AG7YM | 10 |
| James Joseph Goudy, NØJG | 10 |
| Randy E. Prescher, AC9WR | 10 |
| William A. Riches, WA2DVU | 10 |
| Gregory S. Weiler, K3MGQ | 10 |
| Benjamin M. Cahill, III, AC2YD | 15 |
| Benjamin M. Cahill, III, AC2YD | 20 |
| Richard E. DuBroff, W9XW | 20 |
| Ralph L. Irons, N4RLI | 25 |
| William J. Wrbican, K3QP | 30 |
| Philippe Givet, F5IYJ | 35 |
| Jay P. Jenkins, WE2KEY | 35 |

**June 2020**

| | |
|---|---|
| Michael P. Essi, K8WZY | 10 |
| Richard J. Gibilisco, NEØJ | 10 |
| Kenneth A. Knox, KD2KEH | 10 |
| Mark A. Rollings, N5JJC | 10 |
| Byron L. Smith, W9ELM | 10 |
| Gary G. Swenson, KA2HAN | 10 |
| Christopher H. Tenev, K2QFA | 10 |
| Richard W. Candelent, KE1RC | 15 |
| John M. Carlson, KØHD | 15 |
| Maynard L. Denny, K4WMT | 15 |
| Steven K. Jenkins, W4MGT | 15 |
| Colin K. Phoon, AE3A | 15 |
| Maynard L. Denny, K4WMT | 20 |
| Ronald J. Hollas, K8RJH | 20 |
| Steven K. Jenkins, W4MGT | 20 |
| Garth R. Kennedy, W9KJ | 20 |
| Juan P. Munoz, KC2FKM | 20 |
| Robin L. Zinsmaster, N6PHP | 20 |
| Leland R. Bond, N7KC | 25 |
| Ronald J. Hollas, K8RJH | 25 |
| Lynn R. Landin, WBØU | 25 |
| Murray A. Scott, KE8UM | 25 |
| Jay P. Jenkins, WE2KEY | 40 |

**July 2020**

| | |
|---|---|
| Andrew M. Majot, K5QO | 10 |
| John P. Scruggs, N4JRC | 10 |
| Sean Walberg, KN4ZMA | 10 |
| William J. Wilkes, Jr., K4EMU | 10 |
| Paul A. Gierow, KN4NVU | 15 |
| Robert S. Boles, W4SB | 25 |
| Garth R. Kennedy, W9KJ | 25 |
| Arnold M. Podolsky, W8DU | 25 |
| Frank P. Arciuolo, W1ZAH | 30 |

Congratulations to all the recipients.

## October 2020 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.

October Qualifying Runs will be transmitted by W1AW in Newington, Connecticut at the times shown at 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, October 28 at 6 PM HST (0400 UTC on October 29) 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.

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 Code Proficiency Schedule — October 2020**
**(All times in Eastern Daylight Time)**

| Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|
| **10/5**<br>4 PM – 2000Z<br>10 – 35 WPM | **10/6**<br>7 PM – 2300Z<br>35 – 10 WPM | | **10/8**<br>10 PM – 0200Z<br>**(10/9 – UTC)**<br>10 – 40 WPM | **10/9**<br>9 AM – 1300Z<br>10 – 35 WPM |
| **Columbus Day** | **10/13**<br>4 PM – 2000Z<br>10 – 35 WPM | **10/14**<br>7 PM – 2300Z<br>10 – 40 WPM | **10/15**<br>9 AM – 1300Z<br>35 – 10 WPM | **10/16**<br>10 PM – 0200Z<br>**(10/17 – UTC)**<br>10 – 35 WPM |
| | **10/20**<br>9 AM – 1300Z<br>10 – 35 WPM | **10/21**<br>10 PM – 0200Z<br>**(10/22 – UTC)**<br>35 – 10 WPM | **10/22**<br>7 PM – 2300Z<br>10 – 35 WPM | **10/23**<br>4 PM – 2000Z<br>10 – 40 WPM |
| **10/26**<br>10 PM – 0200Z<br>**(10/27 – UTC)**<br>10 – 40 WPM | | **10/28**<br>9 AM – 1300Z<br>35 – 10 WPM | **10/29**<br>4 PM – 2000Z<br>35 – 10 WPM | **10/30**<br>7 PM – 2300Z<br>10 – 35 WPM |

# 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

Because of the COVID-19 pandemic, many organizations are canceling or rescheduling events. This is the information we had at the time we went to press. We suggest you contact the event organizer to confirm. — *Ed.*

**Arizona (Congress) — Nov. 7 D Q R T V**
8 AM. *Spr:* Hassayampa ARK. Escapees North Ranch, 30625 AZ Hwy. 89. *Tl:* 146.58. *Adm:* Free. **www.harkaz.org**

**Arizona (Sierra Vista) — Nov. 7 D F R T V**
7 AM – 2 PM. *Spr:* Cochise ARA. Cara Green Acres, 2756 Moson Rd. *Tl:* 146.76 (162.2 Hz). *Adm:* Free. **www.k7rdg.org**

## 285 TECH CONNECT TECH FEST

**November 7, Lakewood, CO**
R
9 AM – 3 PM. *Spr.* 285 Tech Connect RC. Bridge Church at Bear Creek, 3101 S. Kipling St. Tl: 145.145 (107.2 Hz). *Adm*: Door $10 (cash only). **www.na0tc.org**

## FLORIDA STATE CONVENTION

**October 9 – 10, Melbourne, FL**
D F H Q R S T V
Friday 1 PM – 7 PM, Saturday 9 AM – 3 PM. *Spr:* Platinum Coast ARS. Melbourne Auditorium, 625 E. Hibiscus Blvd. *Tl:* 146.85 -600. *Adm:* $10. **www.pcars.org**

**Georgia (Savannah) — Oct. 24 F R T**
8 AM – 1:30 PM. *Spr:* Coastal ARS. Savannah Hilton Head Regional Airport Recreation Building, 250 Crossroads Pkwy. *Tl:* 447.2. *Adm:* Free. **www.coastalamateurradiosociety.net/wpW4LHSblog/?page_id=871**

**Indiana (Mitchell) — Nov. 7 D F H R S T V**
8 AM – 1 PM. *Spr:* Hoosier Hills Ham Club, W9QYQ. Lawrence County 4H Fairgrounds, 11265 US Hwy 50 W. *Tl:* 146.73 (107.2 Hz). *Adm:* $5. **www.w9qyq.org**

**Iowa (Davenport) — Nov. 1 D F H R S**
6 AM – 2 PM. *Spr:* WØBXR. Iowa National Guard Armory, 5300 W. Kimberly Rd. *Tl:* 146.25/88 (77 Hz). *Adm:* Advance $7, door $8.

**Kentucky (Hazard) — Oct. 24 D F H R T V**
8 – 11 AM. *Spr:* Kentucky Mountains ARC. Avawam Volunteer Fire Dept., 3680 W. Kentucky Hwy. 80. *Tl:* 146.67 (103.5 Hz). *Adm:* $5. **www.facebook.com/kymarc**

**Michigan (Madison Heights) — Oct. 25 D F H Q R V**
8 AM – 1 PM. *Spr:* Utica-Shelby Emergency Communication Assn. United Food and Commercial Workers Local 876 Hall, 876 Horace Brown Dr. *Tl:* 147.18 (100 Hz). *Adm:* $5. **www.usecaarc.com**

## NEBRASKA STATE CONVENTION

**October 31, Lincoln, NE**
D F H R S V
8 AM – 3 PM. *Spr:* Lincoln ARC. Lancaster Event Center, 4100 N. 84th St. *Tl:* 146.76. *Adm:* 16 years or older $8, LARC Members $5. **www.lincolnhamfest.org**

**New Jersey (Wayne) — Oct. 17 D F H**
8 AM – 1 PM. *Spr:* WRAET ARC. United Methodist Church, 99 Parish Dr. *Tl:* 145.21 -0.6 (79.7 Hz). *Adm:* $5. **dfreeswick@optonline.net**

**New York (Hicksville) — Oct. 25 D F H Q R S V**
9 AM – 1:30 PM. *Spr:* Long Island Mobile ARC. Levittown Hall, 201 Levittown Pkwy. *Tl:* 146.85 (136.5 Hz). *Adm:* $6. **www.limarc.org**

**Ohio (Westminster) — Oct. 10 F H R T**
8 AM – 1 PM. *Spr:* Northwest Ohio ARC. Westminster UMC (Warm Building), 6650 Faulkner Rd. *Tl:* 16.67. *Adm:* $5. **www.nwoarc.com**

**South Carolina (Conway) — Oct. 24 D F H Q R S T V**
8 AM – 2 PM. *Spr:* Grand Strand ARC. Academy of Hope School, 3521 Juniper Bay Rd. *Tl:* 145.11 (85.4 Hz). *Adm:* Advance $6, door $7. **www.w4gs.org**

**South Carolina (Gaffney) — Oct. 24 F H R S T**
8 AM. *Spr:* Carolina ARES. Southside Baptist Church, 204 W. Oneal St. *Tl:* 145.15. *Adm:* $5.

**Tennessee (East Ridge) — Oct. 16 – 17 D F H Q R S T V**
Friday 1 – 7 PM, Saturday 8 AM – 3 PM. *Spr:* Chattanooga ARC. Camp Jordan Arena, 323 Camp Jordan Pkwy. *Tl:* 146.79. *Adm:* $10. **www.hamfestchattanooga.net**

**Texas (Sinton) — Oct. 17 D F H R S T V**
8 AM – 3 PM. *Spr:* South Texas Hamfest Assn. San Patricio County Fairgrounds Event Center, 219 W. 5th St. *Tl:* 147.08 (107.2 Hz). *Adm:* Advance $5, door $7. **www.southtexashamfest.org**

## WISCONSIN STATE CONVENTION

**October 24, Wisconsin Rapids, WI**
H S
9 AM – 4:30 PM. *Spr:* WeComm, LTD. McMillan Memorial Library, 490 E. Grand Ave. *Tl:* 146.79 (114.8 Hz). *Adm:* Free. **www.wi-aresraces.org**

### 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.

The deadline for receipt of items for this column is the **1st of the second month preceding publication date**. For example, your information must arrive at HQ by **October 1** to be listed in the **December** issue. Information in this column is accurate as of our deadline; contact the sponsor or check the sponsor's website for possible late changes, driving directions, and other event details. Please note that postal regulations prohibit mention in *QST* of games of chance, such as raffles or bingo.

# ARRL Foundation Presents the 2020 Scholarship Recipients

The ARRL Foundation is pleased to present the students selected to receive scholarship awards for 2020. Scholarships are made possible through the generosity of individuals and clubs. This year, 103 scholarships totaling over $145,000 were awarded. Additionally, the non-profit Amateur Radio Digital Communications (ARDC) has generously awarded The Amateur Radio Digital Communications' Brian H. Kantor, WB6CYT, Memorial Scholarship grant to the ARRL Foundation to match each scholarship on a dollar-for-dollar basis, making the grand total of scholarships awarded $287,300. The ARRL Foundation Board of Directors offers these hams their best wishes for continued success as they pursue their college degrees. The 2021 application period is expected to open on October 1, 2020. For more information, please visit **www.arrl.org/scholarship-program**.

**Eric T. Albitz, N9ETA**
The David Knaus Memorial Scholarship

**Lydia Anderson, KE8HPZ**
The Medical Amateur Radio Council (MARCO) Scholarship

**Paul Bartolemea, KD2KDG**
The James Cothran, KD3NI, Memorial Scholarship

**Markus P. Baur, KDØVNZ**
The Paul and Helen L. Grauer Scholarship

**Ariel R. Berger, K2NYS**
The L. B. Cebik, W4RNL, and Jean Cebik, N4TZP, Memorial Scholarship

**Ryan J. Bibby, KN4RQL**
The Gwinnett Amateur Radio Society Scholarship

**Emily A. Boban, KE8ERE**
The Scholarship of the Morris Radio Club of New Jersey

**Frances E. Bonte, KE8HPA**
The ARRL Foundation General Fund Scholarship

**Kathleen S. Botterbush, KA9RLK**
The ARRL Foundation General Fund Scholarship

**Madison S. Boutwell, KG5ZAO**
The Irving W. Cook, WAØCGS, Scholarship

**Ruben B. Bunag, KD5YTI**
The Jake McClain Driver Scholarship

**Marissa D. Cartwright, KEØBGH**
The Robert D., W8ST, and Donna J., W9DJS, Streeter Scholarship

**Stephen Chung, KC3ART**
The ARRL Scholarship to Honor Barry Goldwater

**Nathan A. Ciufo, KA3MTU**
The Old Man International Sideband Society (OMISS) Scholarship

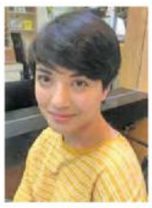
**Anthony Comanzo, KD2HJH**
The Henry Broughton, K2AE, Memorial Scholarship

**Gabrielle Corentto, KD2GAB**
The Bill Salerno, W2ONV, and Ann Salerno Memorial Scholarship

**Yettive S. Crestohl, K1YTV**
The New England Federation of Eastern Massachusetts Amateur Radio Associations (FEMARA) Scholarship

**Connor L. Dickey, KD9LSV**
The Clive Frazier, K9FWF, Scholarship

**Jacob J. Feltz, K9TVG**
The Alan G. Thorpe, K1TMW, Memorial Scholarship



**Carissa L. Ferguson, KJ4EZA**
The L. B. Cebik, W4RNL, and Jean Cebik, N4TZP, Memorial Scholarship

**William T. Ferguson, KJ4EYZ**
The Ernest L. Baulch, W2TX, and Marcia E. Baulch, WA2AKJ, Scholarship

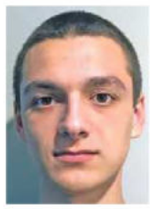
**Thomas R. Fike, KG7FXT**
The YASME Foundation Scholarship

**Garner H. Fleming, KK4CLY**
The L. Phil and Alice J. Wicker Scholarship

**Michael D. Fluegemann, KE8AQW**
The Dayton Amateur Radio Association Scholarship

**Justin T. Garbe, WA9JTG**
The Edmond A. Metzger Scholarship

**James Gavrushenko, KB3ZGX**
The East Coast Amateur Radio Service (ECARS) Scholarship



**Michael Geesaman, KJ4SST**
The Shenandoah Valley Amateur Radio Club (SVARC) Scholarship

**Leann Geiser, KB3WUD**
The You've Got A Friend In Pennsylvania Scholarship

**Weston J. Genender, KØWJG**
The Carole J. Streeter Scholarship

**Joshua W. George, W9JWG**
The Michael J. Flosi Memorial Scholarship

**Russell A. Goss, KD9FAL**
The Francis Walton Memorial Scholarship

**Daniel R. Grant, N2DRG**
The Richard W. Bendicksen, N7ZL, Memorial Scholarship

**Christopher W. Harper, KG5TIO**
The Tom and Judith Comstock Scholarship

**Andrew D. Heagle, KD2PFS**
The Frankford Radio Club Scholarship

**Rachel Heimke, KL4JY**
The Richard G. Kirkpatrick, K8WU, Memorial Scholarship

**Catherine Hendricks, KEØDUF**
The ARRL Rocky Mountain Division Scholarship

**Grace A. Howard, N1LRO**
The Central Arizona DX Association Scholarship

**Thomas C. Hubbard, KK6WRU**
The L. B. Cebik, W4RNL, and Jean Cebik, N4TZP, Memorial Scholarship

**Shefali K. Janorkar, KD2FIW**
The Dr. James L. Lawson Memorial Scholarship

**Jonathan Z. Kayne, KM4CFT**
The Northern California DX Foundation Scholarship

**Jonathan Z. Keiser, AG5SY**
The Bill Salerno, W2ONV, and Ann Salerno Memorial Scholarship

**Sarah E. Keiser, AG5TJ**
The Helen Laughlin AM Mode Memorial Scholarship

**Alexandra C. Kemp, WD4BDQ**
The North Fulton Amateur Radio League (NFARL) Scholarship

**Julie Knappik, KB1YTT**
The CTRI/Chris Seeber, KA1GEU, Memorial Scholarship

**Katarina A. Kobetitsch, KD2SJW**
The Norman F. Strohmeier, W2VRS, Memorial Scholarship

**Thomas Q. Koenig, KJ7JCD**
The Lois Manley, K7LMZ, and Randall Pitchford, WW7ZZ, Scholarship

**Morgan M. Kopecky, KM6AJF**
The Harry A. Hodges, W6YOO, Scholarship

**Wyatt R. Law, AI6V**
The ARRL Foundation General Fund Scholarship

**Faith Hanna Lea, KD3Z**
The William C. Winscott, N6CHA, Memorial Scholarship

**Zechariah J. Lea, WX4TVJ**
The Orlando HamCation® Scholarship

**Gabrielle Lee, KI5BFA**
The Carole J. Streeter Scholarship

**Daniel A. Lovorn, KG5YZK**
The Mississippi Scholarship

**Amber M. Mahler, KC4AMM**
The Louisiana Memorial Scholarship

**Ashley N. Majors, K9ANM**
The Chicago FM Club Scholarship

**Daley McMahon, KD2SVJ**
The Challenge Met Scholarship

**Christopher J. Mentele, WØLSB**
The ARRL Scholarship to Honor Barry Goldwater

**Stephen A. Moore, K5VB**
The William Gordon Buckner, WØVZK, Memorial Scholarship

**Adrianne V. Morrill, N7HYD**
The William Bennett, W7PHO, Memorial Scholarship

**James A. Morrison, KØECE**
The Fred R. McDaniel Memorial Scholarship

**Joseph F. Murray, KC1EGK**
The New England Federation of Eastern Massachusetts Amateur Radio Associations (FEMARA) Scholarship

**Garth V. Naillon, KF7KFG**
The ARRL Foundation General Fund Scholarship

**Joseph P. Noga, KC9WIC**
The Six Meter Club of Chicago Scholarship

**Dakota M. Nyberg, KK6OCG**
The Ozaukee Radio Club, W9CQO, Scholarship

**Kevin O'Brien, KK4AXG**
The Eugene "Gene" Sallee, W4YFR, Memorial Scholarship

**Haley R. O'Connor, KN4MQY**
The Wayne Nelson, KB4UT, Memorial Scholarship

**Declan M. O'Hara, KG7HTE**
The Rfinder LLC – Arthur L. Greenberg, W2LH, and Madeline Greenberg, W2EEO, Memorial Scholarship

**Nathaniel J. Ortiz, KM6TVN**
The Betty Weatherford, KQ6RE, Memorial Scholarship

**Ian L. Parker, KG5LST**
The Dayton Amateur Radio Association Scholarship

**Joseph M. Pepe-Phelps, KL3JY**
The Wilse Morgan, WX7P, Memorial ARRL Northwestern Division Scholarship

**Eric M. Poole, KI7ZRC**
The Joel R. Miller (W7PDX) and Martha C. Miller STEM Scholarship

**Jed J. Pulley, KC9WKH**
The Donald Riebhoff Memorial Scholarship

**Jeffrey R. Purchatzke, KM6UFK**
The ARRL Foundation General Fund Scholarship

**Sankarsh R. Rao, KG5VKF**
The K2TEO Martin J. Green, Sr., Memorial Scholarship

**Edward G. Ridolfi, KC1CMF**
The New England Federation of Eastern Massachusetts Amateur Radio Associations (FEMARA) Scholarship

**Jackie J. Roche, KK6OCG**
The Palomar Amateur Radio Club (PARC) Scholarship

**Preston R. Roesslet, KEØJGH**
The Ted, W4VHF, and Itice, K4LVV, Goldthorpe Scholarship

**Hannah E. Rosenfeld, W7HER**
The ARRL Foundation General Fund Scholarship

**Logan P. Selph, KN4PTA**
The Dayton Amateur Radio Association Scholarship

**Lukas J. Severinghaus, KK6AXQ**
The Charles N. Fisher Memorial Scholarship

**Justin Sheldon, KM6UHS**
The K6GO Gayle Olson and NA6MB Mike Binder Scholarship

**Renee E. Smith, KD2JEZ**
The L. B. Cebik, W4RNL, and Jean Cebik, N4TZP, Memorial Scholarship

**Matthew W. Spiker, KE8FGB**
The Dayton Amateur Radio Association Scholarship

**Samara R. Steinfeld, KC3OFN**
The Dayton Amateur Radio Association Scholarship

**Martin Sullaway, NN1C**
The Alfred E. Friend, Jr., W4CF, Memorial Scholarship

**Kathleen Teel, KI5CHL**
The Allen and Bertha Watson Memorial Scholarship

**Robert M. Tenny, KDØWEZ**
The ARRL Foundation General Fund Scholarship

**Jeremiah E. Thompson, KO4AST**
The Atlanta Radio Club Scholarship

**Kyle Tidwell, KJ7FHF**
The Mary Lou Brown Scholarship

**Benjamin W. Tyrrell, KEØAER**
The Ray, NØRP, and Katie, WØKTE, Pautz Scholarship

**Bahnou Hazel Upton, KB1OIS**
The New England Federation of Eastern Massachusetts Amateur Radio Associations (FEMARA) Scholarship

**Charles N. Van Cleve, KEØPRH**
The PhD ARA Scholarship

**Lauren I. Vidal, K6LIV**
The Dick Warren, K6OBS, Memorial Scholarship

**Megan G. Wagner, KC1FGH**
The Androscoggin Amateur Radio Club Scholarship

**Eryn P. Wagoner, KEØWEY**
The Carole J. Streeter Scholarship

**Nicholas Walter, KC9RMR**
The ARRL Foundation General Fund Scholarship

**Jonathan W. Wanzer, KK6GXG**
The Yankee Clipper Contest Club, Inc. Youth Scholarship

**Franklin Wei, KN4KUN**
The Gary Wagner, K3OMI, Scholarship

**Zachary D. Whitlock, KJ7AGP**
The Dayton Amateur Radio Association Scholarship

**Ruth Willet, KM4LAO**
The ARRL Foundation General Fund Scholarship

**Jonathan D. Williams, K5DVT**
The Walter Gallinghouse, K5DSL, Scholarship

**Zhenhao Yang, KN8U**
The Charles Clarke Cordle Memorial Scholarship

**Kirsten M. Zima, KC9RWG**
The Homer V. Thompson, W4CWV, and Annette P. Thompson, W4LKM, Memorial Scholarship

**Levi J. Zima, KN4YHS**
The ARRL Foundation General Fund Scholarship

# *Congratulations*

July 2020
*QST* Cover Plaque Award Winner

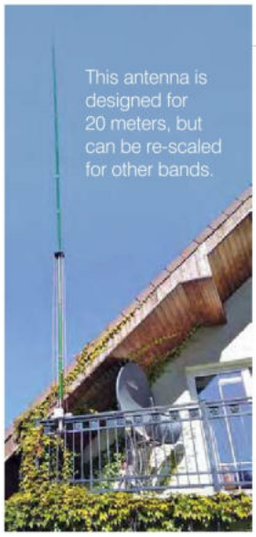
## *Jacek Pawlowski SP3L*

Jaceks's article, "A Vertical End-Fed Dipole with a Folded Stub," describes a unique antenna that fits well in limited spaces. Although it's designed for 20 meters, it can be scaled for other bands as well.

*QST* Cover Plaque Awards are given to the author or authors of the most popular article in each issue. *You* choose the winners by casting your vote online at

**www.arrl.org/cover-plaque-poll**

Log in now and pick your favorite article in this issue!



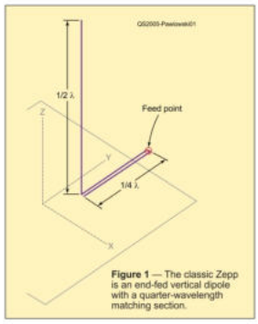




**Figure 1** — The classic Zepp is an end-fed vertical dipole with a quarter-wavelength matching section.

## A Vertical End-Fed Dipole with a Folded Stub

**Jacek Pawlowski, SP3L**

If you don't have a system of radials buried in the ground, or if you want to place a vertical dipole on a balcony (see the lead photo) or roof where an RF ground is not available, the solution could be an end-fed Zepp antenna — a century-old design. The Zepp is an end-fed half-wavelength (λ/2) dipole in which a quarter-wave stub made of a ladder line is connected to the dipole end in order to transform the very high antenna impedance to a low impedance. A classic half-wavelength Zepp with a horizontal quarter-wavelength stub is shown in Figure 1. The stub does not radiate.

Despite its advantages, the classic end-fed Zepp is not often used on HF bands. This is probably because of the length of its λ/4 stub. So, let's revisit and modify the venerable Zepp to make it more attractive.

### Folded-Stub Concept

My modification of the end-fed Zepp reduces the space needed for the antenna installation while improving its performance. To start, I folded the stub in half and rotated it to the vertical position (see Figure 2). This brought the feed point close to the bottom end of the λ/2 radiator.

The overall antenna height is λ/2 and the folded rotated stub itself is now λ/8 high. The antenna has a very small footprint because the stub is located close to the radiator. Total radiation from the stub is still almost zero. The antenna radiates the same as a center-fed dipole.

**Hamspeak**
**Stub**
A length of transmission line connected at just one end. Stubs can function as capacitors, inductors, or resonant circuits, depending on their electrical length and whether they are open or short circuits at the free end of the stub.

Free-space simulations reveal a gain of 2.13 dBi, feed point impedance $Z_0$ of 71 Ω, and a bandwidth 66% that of the center-fed dipole.

# US Amateur Radio Bands

Operator license classes: **E** = Amateur Extra **A** = Advanced **G** = General **T** = Technician **N** = Novice
CW operation is permitted throughout all amateur bands. Except as noted, all frequencies are in megahertz (MHz).

= RTTY, data, phone, image = USB phone, RTTY, data and CW = RTTY and data = phone and image
= SSB phone = CW only

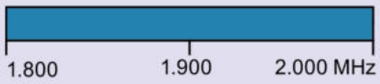
## LF – Low Frequency band

### 2200 Meters (135 kHz) E,A,G
**1 W EIRP** maximum


## MF – Medium Frequency bands

### 630 Meters (472 kHz) E,A,G
**5 W EIRP** max, except in Alaska within 496 miles of Russia where the limit is **1 W EIRP**

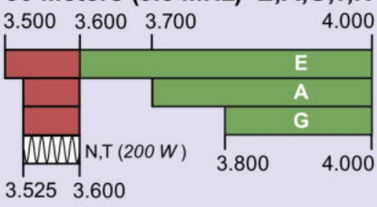

### 160 Meters (1.8 MHz) E,A,G



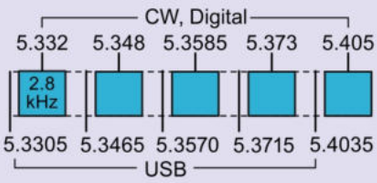

Amateurs wishing to operate on **2200 or 630 meters** must first register with the Utilities Technology Council online at **https://utc.org/plc-database-amateur-notification-process/.** You need only register once for each band.

## HF – High Frequency bands

### 80 Meters (3.5 MHz) E,A,G,T,N

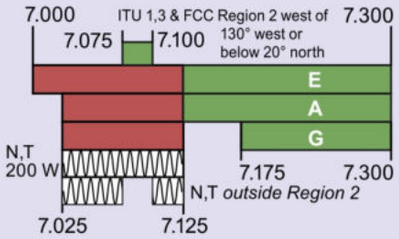



### 60 Meters (5.3 MHz) E, A, G (100 W)

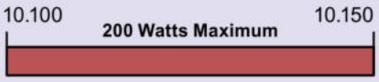



Gen, Adv, and Extra licensees may operate on a secondary basis with a maximum ERP of 100 W maximum.

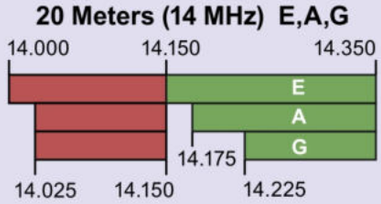
### 40 Meters (7 MHz) E,A,G,T,N



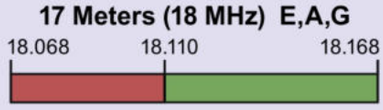

### 30 Meters (10.1 MHz) E,A,G



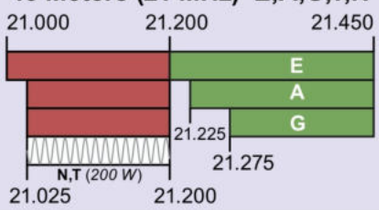

### 20 Meters (14 MHz) E,A,G



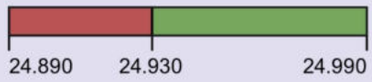

### 17 Meters (18 MHz) E,A,G



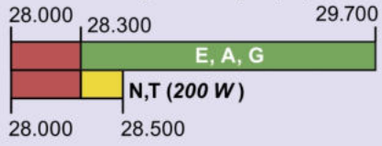

### 15 Meters (21 MHz) E,A,G,T,N




### 12 Meters (24 MHz) E,A,G

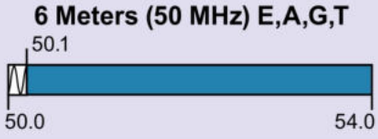



### 10 Meters (28 MHz) E,A,G,T,N

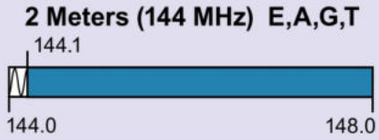



## VHF – Very High Frequency bands

### 6 Meters (50 MHz) E,A,G,T




### 2 Meters (144 MHz) E,A,G,T




### 1.25 Meters (222 MHz) E,A,G,T,N


## UHF – Ultra High Frequency bands

### 70 cm (420 MHz) E,A,G,T


### 33 cm (902 MHz) E,A,G,T


### 23 cm (1240 MHz) E,A,G,T,N


## SHF&EHF – Super and Extremely High Frequency bands

All licensees except Novices are authorized all modes on the following frequencies:

| | | | | | |
|---|---|---|---|---|---|
| 2300-2310 MHz | 3300-3500 MHz | 10.0-10.5 GHz | 47.0-47.2 GHz | 122.25-123.0 GHz | 241-250 GHz |
| 2390-2450 MHz | 5650-5925 MHz | 24.0-24.25 GHz | 76.0-81.0 GHz | 134-141 GHz | All above 275 GHz |

See www.arrl.org/band-plan for detailed band plans.


OTAbands **rev. 1-22-20**

# A Look Back


QST
December 1970
75 Cents
devoted entirely to
amateur
radio
OFFICIAL JOURNAL OF THE ARRL
ARRL

• *Beginner and Novice*

# A High-Output VFO for a Beginner's Transmitter

BY PETER ZILLIOX, WA3EQK*

Front view of WA3EQK's VFO. The unit operates on 3.5 to 4 and 7 to 7.3 MHz. Included are a 2-watt amplifier and broadband rf transformers so that the VFO can drive tube-type transmitters directly.

WHEN A Novice graduates to a higher-class license, he wants to take advantage of his new privileges as soon as possible, including the use of a variable-frequency oscillator. A VFO will permit the operator to control his transmitter operating frequency without investing in a bank of crystals. Most of the beginners' transmitters use tubes, and the first stage of such a rig requires 15 volts or more drive from a VFO. The solid-state variable-frequency oscillators described in ham publications have a number of outstanding features, but have only one or two volts output – not nearly enough to drive a tube-type transmitter.

The unit shown in the photographs is based on a collection of proven circuits from past *QST* articles.[1] It is possible to use the VFO as an 80/40-meter QRP transmitter. As such, it will deliver up to 2 watts into a 50-ohm load by omitting the output impedance-matching transformers. In a trial, the VFO was keyed by breaking the 13-volt lead from the power supply. Surprisingly, no chirp resulted. The daring may wish to try this approach, but a keying filter should be added to prevent clicks. Those interested in a QRP VFO-controlled rig, however, should add a second buffer stage such as shown in "Once More with QRP" (*QST*, August, 1970).

### *Circuit Data*

The circuit is given in Fig. 1. The VFO and buffer stages are identical to those previously described in *QST* for June, 1970. In the oscillator stage, the base bias resistor, R1, was changed to 15,000 ohms. This modification reduces the sensitivity of the oscillator to variations in supply voltage. Also, the buffer stage is coupled to the power amplifier through a .001-μF disk ceramic capacitor, instead of the 47-pF unit specified originally.

The power amplifier stage is identical to a design that appeared in *QST* (June 1969), and in the 1970 edition of *The Radio Amateur's Handbook*. The output half-wave filter is designed to match 50-ohms at each end. The input impedance of a tube operated in Class C is high, usually in the range of 5000 to 50,000 ohms. An impedance transformer consisting of L9-L10 for 7 MHz and L11-L12 for 3.5 MHz matches the low-impedance output of the VFO to the first stage of a transmitter. The capacitance of the output cable (36 inches of RG-58/U) tunes the output transformers, producing a broadly-peaked response centered at 3.7 and 7.15 MHz. If a different length of connecting cable is used, the builder will have to add or subtract turns on L10 and L12 to set the resonant frequency of the transformers at the center of the 40- and 80-meter bands, respectively.

A regulated power supply provides the positive voltage required for the transistors. A 24-volt transformer, a full-wave rectifier, and a Darlington-connected pass transistor are employed. The supply has excellent regulation and filtering, which is a necessity for any VFO.

*Room 410, Beaver Terrace Apartments, State College, PA 16801

[1]DeMaw, "The 'QRP 80-40' C.W. Transmitter," *QST*, June, 1969; DeMaw, "Building a Simple Two Band VFO," *QST*, June, 1970.

*Going General? Here is a VFO with sufficient output to drive most of the popular two- and three-tube cw transmitters.*

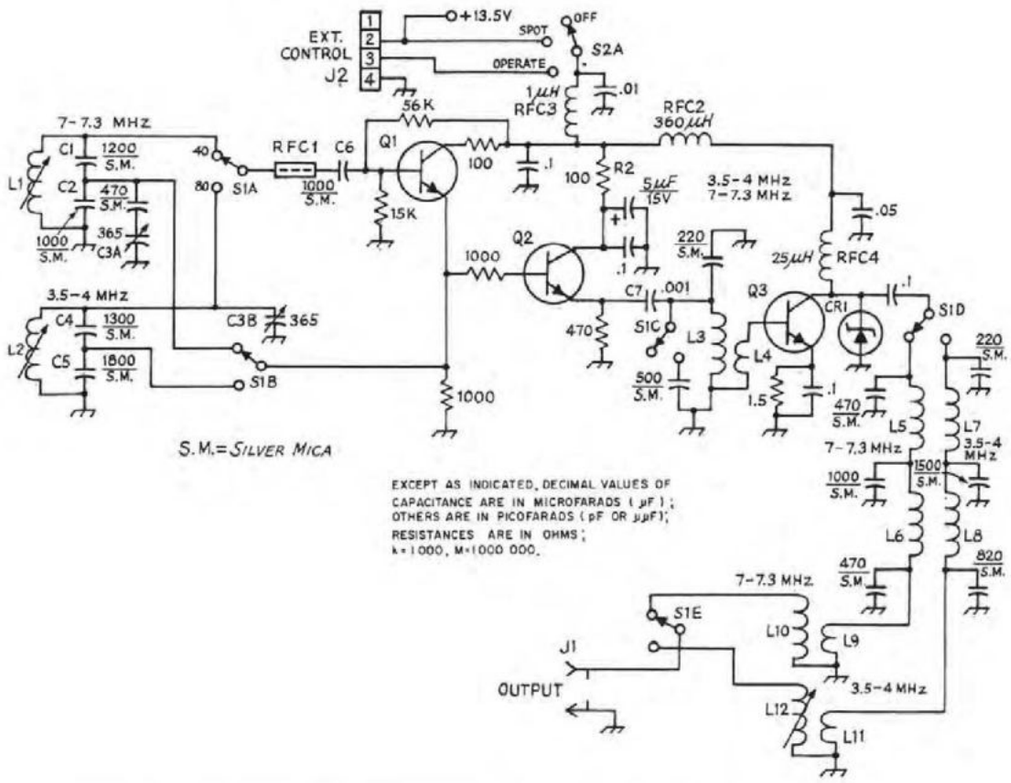
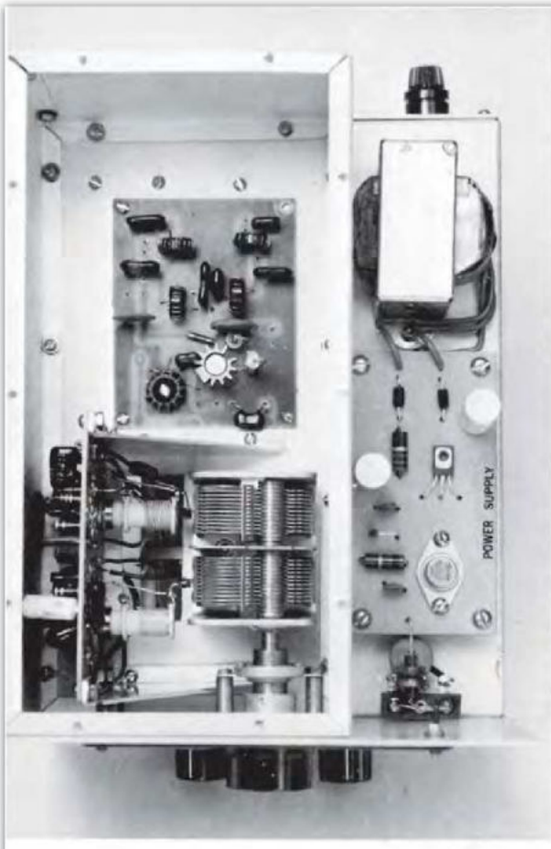



Fig. 1 — Schematic diagram of the VFO. Resistors are 1/2-watt composition; capacitors, except those marked as silver mica, are disk ceramic. Parts not listed below are marked for text reference.

C3 — Dual-section air variable, 365 pF per section (Miller 2112).
CR1 — Zener, 36 V, 1W.
J1 — Phono connector, panel mount.
J2 — 4-terminal ceramic strip (Millen E-304).
L1 — 0.68-1.25 μH, slug tuned (Miller 42A106CBI).
L2 — 2.2-4.1 μH, slug tuned (Miller 42A336CBI).
L3 — 2 μH, 25 turns of No. 24 enam. wire on Amidon T-50-2 toroid core (Amidon Associates, 12033 Otsego Street, North Hollywood, CA 91607).
L4 — 12 turns No. 22 hook-up wire over L3.
L5, L6 — 13 turns of No. 20 enam. wire on Amidon T-68-2 core.
L7, L8 — 18 turns of No. 20 enam. wire on Amidon T-68-2 core.
L9 — 7 turns of No. 26 enam wire over L10.
L10 — Approx. 3 μH, Miller 4405 with the slug and 4 turns removed.
L11 — 7 turns No. 26 enam. wire over L12.
L12 — 23 μH (Miller 4407).
Q1 — HEP-55.
Q2 — HEP-758.
Q3 — 2N2102.
RFC1 — Three Amidon ferrite beads on a 1/2-inch length of No. 22 wire. A 15-ohm resistor may serve as a substitute.
RFC2 — Miniature choke (Millen J300-360).
RFC3 — Miniature choke (Millen 34300).
RFC4 — 2.5 μH rf choke (Millen J300-25).
S1 — Home-assembled switch made from a Centralab PA-272 kit and 3 Centralab RRD sections.
S2 — Ceramic rotary switch, 2 pole, 3 position, one section, non-shorting contacts (Mallory 3223J).

### *Construction*

The VFO is built on a 7 X 9 X 2-inch homemade chassis, but a Bud AC-409 can be used. The oscillator and buffer stages are constructed on an etched circuit board. A template for the oscillator board appeared in the original *QST* article. Positioning of the circuit board is important, as short leads are necessary to the variable capacitor and band switch. Two holes are cut in the shielding box that surrounds the oscillator compartment, allowing access to the VFO tank coils for alignment purposes. The shield is cut from sheet aluminum and is bent to fit over most of the chassis, allowing a space along one side for the power-supply components. A shield is necessary to protect the low-level circuits from rf fields and to improve the mechanical rigidity of the chassis.




Top view, with the cover removed, of the rf compartment. The VFO board is mounted on two aluminum brackets. All leads from this circuit board should be made with heavy wire to minimize mechanical instability from vibration. The amplifier board is flush-mounted on the chassis. The dual-section broadcast-variable capacitor is driven by a Miller MD-4 dial. L1 and L2 are adjusted through holes cut in the left side of the shielded compartment.

A template for the power-amplifier etched board is shown in Fig. 2. This component mounts over a 2 1/2 X 3 1/2-inch hole cut in the chassis. The hole is smaller than the board to provide enough lip overhang to pass the mounting bolts. Lock washers must be employed between the board and the chassis to insure a good electrical connection.

The band switch, S1, is a custom-built assembly made up of Centralab RRD wafer sections and a PA-272 kit. One end of the switch is supported by the front panel, while the center and end sections are held rigidly in place by homemade aluminum brackets (see Fig. 5). The power supply components, with the exception of the transformer, are mounted on a third circuit board. Point-to-point wiring can be used, if desired. A template for the power-supply circuit is illustrated in Fig. 3.

Be careful when mounting the TR-23C pass transistor to insure that the bolts used do not short to ground on the circuit board. The case of the TR-23C is internally connected to its collector. One mounting screw is used as the collector connection to the foil lead on the board, while the other is left "floating." The completed supply should deliver about 13 volts, and a 20-percent variation in line voltage should not affect the 13-volt output level.

A Miller MD-4 vernier dial provides a dual rate for the TUNING capacitor. A ratio of 6-to-1 is used for quick excursions across a band, while a 36-to-1 tuning rate is available for smooth "zeroing in."

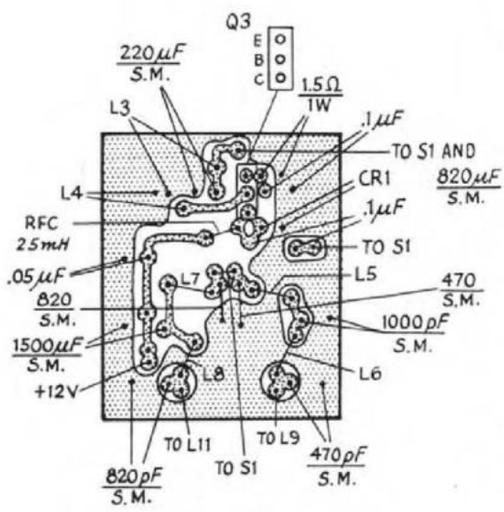



Fig. 2 — Half-scale template for the 2-watt amplifier stage, as seen from the foil side.

### *Alignment and Operation*

L1 and L2 are used to set the 40- and 80-meter dial calibration, respectively. A well-calibrated receiver can be used to spot the VFO output while marking the dial face. The 20-, 15- and 10-meter bands are reached by frequency multiplication of the 40-meter VFO output in the succeeding transmitter stages, and can be marked on the dial below the 7- to 7.3-MHz hash marks. L12 and L10 are adjusted at 3.7 and 7.15 MHz, respectively, for maximum drive to the transmitter.

If the transmitter to be VFO controlled doesn't have provisions for an external oscillator input, circuit changes may be necessary in its first stage. The feedback in the tube-type oscillator shown in Fig. 4A is supplied by the plate-to-grid capacitance in the tube. If the drive from the VFO is applied directly to this stage through the crystal socket, spurious oscillation can result. One cure for this problem is to load the grid by shunting a composition resistor, 680 to 1500 ohms, across the

*(continued on page 63)*

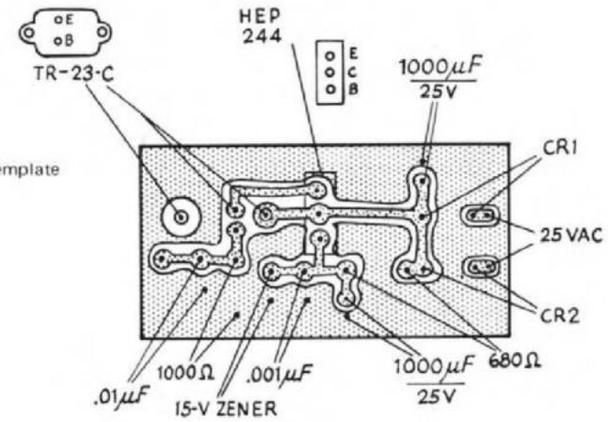



Fig. 3 — Foil side, half-scale template for the VFO power supply.

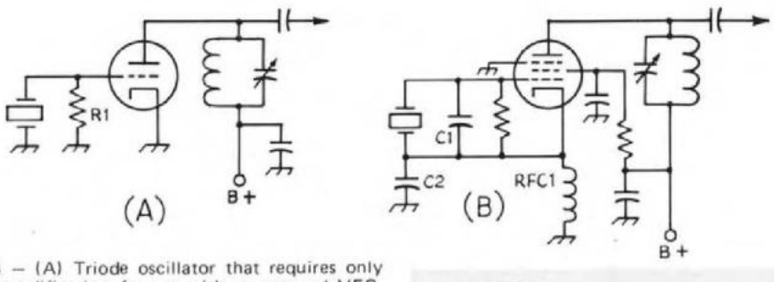



Fig. 4 — (A) Triode oscillator that requires only slight modification for use with an external VFO. (B) The circuit using a pentode tube must be modified by grounding the cathode, shorting out RFC1 and C2. Parts labeled are for text reference.

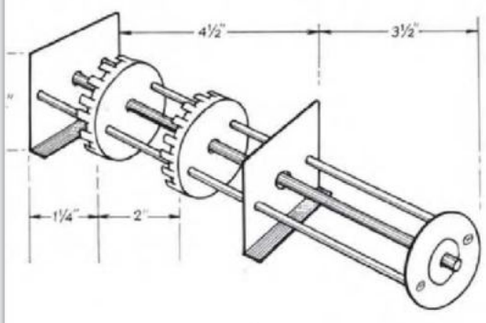
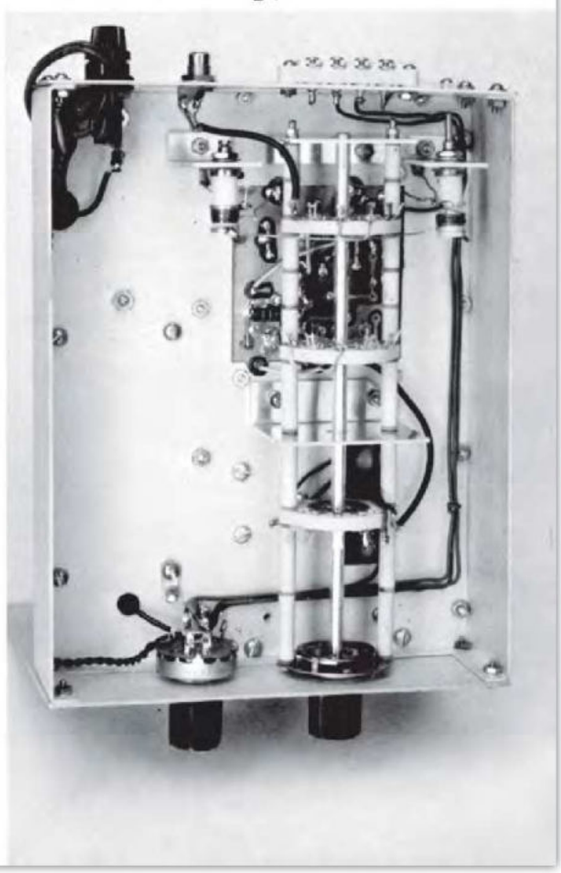



Fig. 5 — Detail of switch assembly — see text.



The bottom view of the VFO shows only the two switches and the output transformers — other components are mounted on the etched-circuit boards "topside."

December 1970

**The Drake SPR-4 Receiver**

Height: 5 1/2 inches.
Width: 10 3/4 inches.
Depth: 12 1/4 inches.
Weight: 18 pounds.
Power Requirements: 120- or 240-volts ac, or 12-volts dc.
Price Class: $450, less accessories.
Manufacturer: R. L. Drake Company, 540 Richard Street, Miamisburg, Ohio 45342.

### *Test Results*

A close examination of the receiver in the ARRL lab indicates that the age dynamic range and the frequency stability of the SPR-4 are superb. A 100-dB change in input signal produced only a 5 dB difference in the audio output level. Frequency drift over a fifteen-minute period was 10 Hz or less after a 20-minute warm-up. On several frequency-drift runs the total variation was only 2 Hz! Dropping the receiver from about five inches above the bench changed the PTO frequency 10 Hz.

The agc has a long decay time which is excellent for ssb reception but which makes the receiver difficult to use for break-in cw. Drake reports, however, that cw buffs can make a simple internal resistor change to alleviate the slow-recovery problem. Lack of dynamic range has long been the major headache in solid-state receiver design. The SPR-4 took 5000 to 7000 $\mu$V of input signal before internally-generated spurious signals were observed, better than average for the solid-state receivers that this writer has tested. Skywave signals seldom exceed 2000 $\mu$V, so overload should only be a problem for those with neighbors who are active amateurs.

The shoe-box size, lightness of weight, and low power consumption of the Drake "ear piece" are features that should appeal to traveling hams, or to those who operate portable. And, it will double as a DF for boat owners. The initial investment for the unit can be limited by purchasing only the basic receiver and then adding accessories later as financial resources permit. Also, RTTYers who like to listen to the commercial teletype bands, or vhfers who want several megacycles of continuous coverage, might consider the "programmable" feature. As the instruction book contains only operating information, hams who repair their own gear will want to purchase the maintenance manual, which is also an extra-cost item. — *W1KLK*

## High-Output VFO

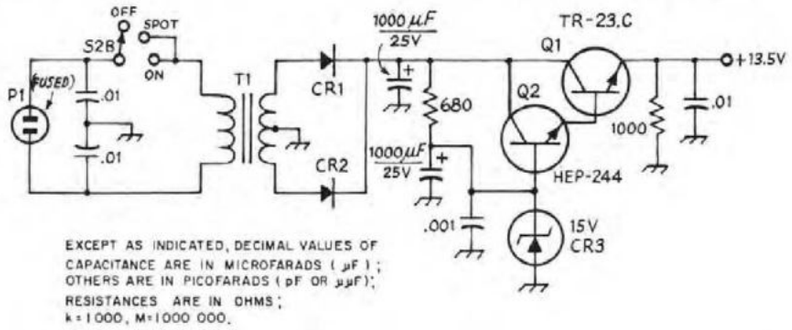
*(continued from page 48)*

existing grid-return resistor, R1 in Fig. 4A. However, circuits similar to Fig. 4B must be modified by shorting out the cathode rf choke when the VFO signal is injected at the crystal socket. In general, any component that provides feedback for the crystal oscillator should be removed or shorted out, as appropriate, when the VFO is used.

With a 5000-ohm load, the VFO has a measured output in excess of 20 volts rms. This was sufficient drive for all of the two- and three-tube transmitters tried, even on the 10-meter band. Drift tests indicated a shift of less than 30 Hz over any 15-minute period. The drift is of a random nature which can be attributed to thermal changes caused by air currents around the unit.

The solid-state VFO is somewhat more complicated than a comparable tube unit would be. But, in the near future, transmitters in the 50-watt class will use only solid-state active devices, so now is the time to experiment with the techniques of the transistor age. QST

Fig. 6 — Power supply for the solid-state VFO. Capacitors with polarity marked are electrolytic, others are disk ceramic. Resistors are 1/2-watt composition.
CR1, CR2 — 100-PRV, 1-A silicon.
CR3 — Zener, 15 V, 1 W.
P1 — Fused plug (use 1-A 3AG fuses).
Q1 — 40-watt npn power transistor (International Rectifier TR-23C).
Q2 — Motorola HEP-24.
S2 — See Fig. 1.
T1 — Filament transformer, 24 V ct at 1 A.



# Celebrating Our Legacy

## 70 Years of Happy Tinkering

I earned my Novice-class license, KN6MUX, when I was 10 years old, and am still licensed at age 79. A ham neighbor convinced me to get my license, as did a friendly a friendly TV repairman who taught me resistor color codes. I built a one-tube transmitter and converted a military surplus receiver to ham use. I lived with my grandmother, who wasn't thrilled when I strung a doublet from my window out to the garage.

At 12 years old, I was ready to upgrade to a General-class license. On my first attempt, I passed the code, but flunked the theory. Finally, on my third try, I passed both. By this time, my grandmother decided I was serious about amateur radio and bought me my first ham receiver — a Hallicrafters model. Not long after, I earned my Amateur Extra-class license and built my first voice transmitter (along with some test equipment) using a kit from Heathkit.

After earning a Bachelor's degree in electrical engineering, I went into active duty as a Navy officer. I was lucky to be able to operate from several parts of the world, including Vietnam, Japan, and the Mediterranean. After leaving the Navy, I got married and moved to Arizona, causing me to discard my old K6 call sign and get a "7" area call: W7JSW.

I've taught electronics, been heavily involved in local emergency communications, and was a member of a local ham club. However, I always enjoyed tinkering with radios more than making contacts with other operators. I'm still licensed 70 years later, tinkering and rarely talking, but happy to be part of the hobby.

**William J. Hosking, W7JSW**
Scottsdale, Arizona
Life Member

## Celebrating Over Half a Century in Ham Radio

As I celebrate 55 years in ham radio this year, I find the "100, 50, and 25 Years Ago" column more interesting. I like to reminisce as I look at the *QST* covers I saw when they were first published. I earned my Novice-class license at age 12 in 1965, and later earned my General- and Advanced-class licenses. In just a few short years, I managed to earn the Worked All States (WAS) and DXCC awards (the sunspot cycle was at about the same point as it is now).

I studied electrical engineering in college and had a 40-year career as an RF systems engineer in wireless and satellite communications. As of my retirement, I had my Amateur Extra-class license for 40 years. For my 50th anniversary as a ham radio operator, I decided to try and relive my Novice-class days and operate CW only, just like I did back in 1965.

I shared these plans with my friend, ARRL Southwestern Division Vice Director Ned Stearns, AA7A, and he told me about some digital modes to try too. I swapped JT9 and JT65 for CW. When FT8 was added, I soon found myself spending time on that mode as well.

Throughout the past 55 years, I've been limited with the types of antennas I could use because of homeowners association restrictions, so I've learned to be more creative. Today, I use various homebrew antennas and have managed to operate on all bands from 160 meters to 6 meters with reasonable success, just since my retirement.

Even though my radios have changed a lot over the years, amateur radio is still one of my favorite hobbies.

**Greg Vatt, NC7B**
Mesa, Arizona
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.


Greg Vatt, NC7B, at his current station (left) and at his 1960s high school station (right).

Michele Carlone, N2FME/MMØFME/IZ2FME

## Classic Radio

# The Unveiled Mystery of Emilio Caimi

Emilio Caimi, inventor of the Heavy Caimi Telegraph Key. [Photo courtesy of Bruna Begali]

In between the two World Wars, Emilio Caimi designed and built the Heavy Emilio Caimi Telegraph Key, which was installed in the telegraph stations of all the Royal Italian Air Force. He created another key with an aluminum lid instead of cast iron, installed on Italian Savoia-Marchetti SM.79 anti-ship aircrafts.

### The Emilio Caimi Mystery

My interest was sparked because of the heavy key's usage of expensive resources, especially during a severe wartime shortage of raw metallic materials. I also wanted to know why it was so different from other keys built in the same period, such as Ericsson, Pedersen, Amplidan, WT8AMP, JJ38, Junker, and Dyma.

After extensive research in museums, the Central Patent Office in Rome, the Historical Archive of the Italian Air Force, as well as interviews of Morse key collectors, professional telegraphers who served in World War II, prominent scholars and specialists, I found little information about the key or its inventor.

This only interested me further, so I recruited the help of Pietro Begali, KD2JON/I2RTF, and Claudio Tata, IKØXCB. After several false starts, we tracked down an Industrial Yearbook of the Province of Milan, which informed us that Emilio Caimi was the owner of a company founded in 1905. From there, we had enough information to check the Caimi Company entry at the historical archives of the Chamber of Commerce in Milan. Through further investigative work, we found where Emilio and his wife were buried, which led us to being able to track down and visit his son, Dario (now 85 years old) in Lake Como, Italy.

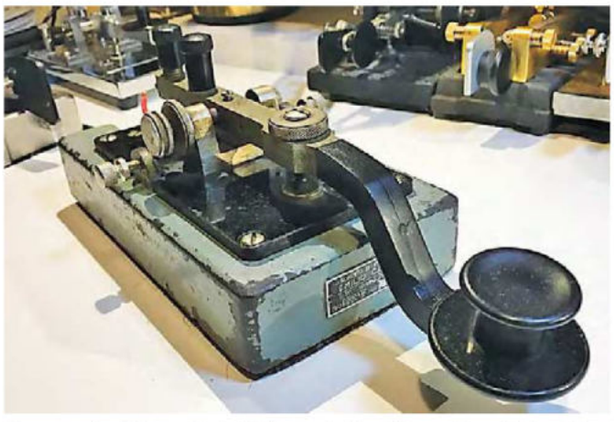
Thanks to the support and hard work from Pietro and Claudio, as well as the stories from Dario, I was able to put together a good description of Emilio Caimi's personal and professional life.

### Caimi's Early Years

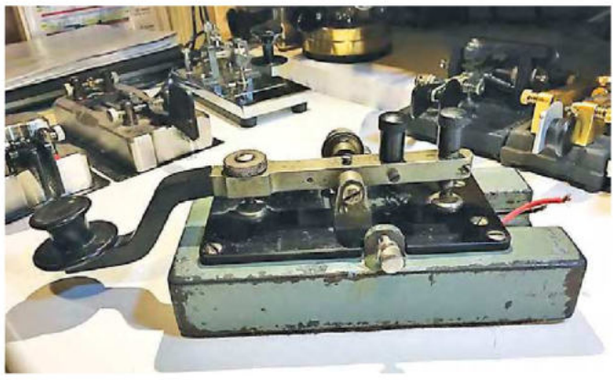
Emilio Caimi was born in Milan in 1878. Emilio was the son of a Milanese goldsmith, from whom he learned to use tools. Emilio attended the High School of Applied Arts of the Castello Sforzesco (founded in 1882) in Milan, where he learned mechanics and technical arts, including technical design.

The Emilio Caimi Enterprise, described as a "precision mechanical workshop," was enrolled in the Chamber of Commerce on June 8, 1911. Emilio set up the company with 10 workers.

In the early 1920s, the Caimi factory was at the forefront of the industrial pioneering period. They were involved in the production of sanitary



The massive Heavy Caimi Telegraph Key. [Bruna Begali, photo]



The Heavy Caimi Key was made to last. [Bruna Begali, photo]

## The Heavy Caimi Telegraph Key

The key had a massive, aeronautical blue-colored structure, and weighed 4,397 grams. It consisted of a cast-iron alloy lid (406 grams), with two holes on top. On the sides, in a symmetrical position, there were two grooves (each 6 millimeters wide) that allowed the user to fix it against the two side screw pins. Through the groove, the handling lever was grafted together with the button key, which was made of two separate parts: the button head and the underlying support disc.

The base consisted of a 19 × 3.5 × 10 centimeter box, below which a felt mat was glued. Despite not having a strong non-slip propensity, the mat, along with the considerable weight of the key, stabilized the key on its natural support plane.

Above this base, four bolts fixed a 7.7 × 14.7 × 0.5 centimeter rectangular base in black bakelite in place, on which the lever is actually mounted. The key arm was made of iron for the first part, and in bakelite for the second part.

Another feature of the Heavy Caimi was the rounded-down shape of the second half-arm, which, along with the comfortable lever ratio (0.7:1 centimeters) allowed the operator to transmit in a very relaxed and cadenced way. The key had been equipped with four adjusting pins. The first two upper ones controlled the end of the line and the tension of the spring, respectively. The third one, placed sideways on the fulcrum, allowed for a perfect alignment of the rod and the lever. The last one was placed on the contact pin for the adjustment of the amplitude of the branding.

The key was very indulgent. When operating, you had the feeling of using a very precise key. At each press, the lever transmitted with an elastic movement. The rhythm of the transmission seemed to be helped, sustained, and almost guided.

Ultimately, it was a telegraph key designed to be used in any kind of situation and in any condition, even in the hands of inexperienced operators. It was certainly made to last, as the owners of Caimi keys still in circulation can attest. Today, they seem to have just left that precision factory that ceased production in Milan in the early 1960s.

materials and equipment, armchairs for dentists and barbers, straight keys, as well as a series of bizarre but brilliant inventions, such as the so-called *ponfometro* (as Emilio called it), which was an automatic machine that, after inserting a needle, made injections by simply pressing a button.

## Wartime Productions

The reason why Emilio converted his production in favor of telegraph keys is still unknown. He probably felt that the new era of wireless had begun. Around 1912, signs of war were already present (the conflict began on July 7, 1914), and the sector of communications was in great turmoil. Emilio was aggregated to the 246th Industrial Mobilization Battalion for the duration of the first World War, and when the war was over in November 1918, Emilio was able to go back to running his enterprise at full speed. At 47, Emilio's company won an important contract, beating out the Italian Western Electric and the Allocchio Bacchini of Milan.

In 1930, at the age of 54, Emilio married Ines Baietto, who became his business partner. With orders increasing and Italian industrial production in great expansion, Emilio Caimi became an official supplier of the Royal Italian Air Force in 1932. The production of the Caimi keys should have started after this year.

A new war was on the horizon, however. In 1939, the Armies of the Reich invaded Poland. Though Emilio was discharged from service, he did not escape the impacts of World War II.

In 1943, Wehrmacht officers showed up at Caimi's headquarters and seized telegraph keys from Emilio, as well as all the wheels of the cars available on the company premises, with threats of "severe punishment" if he refused. It was at that time that the factory began to produce fuses for aerial bombs.

## The Caimi Legacy

After the war, Emilio continued to supply the Air Force with Morse keys, especially the heavy ones, until the late 1950s. The Caimi Company shut down on April 30, 1955, but on May 2, 1955, Emilio and his wife set up the Electromechanical Construction Caimi Srl., which produced and traded mechanical and electrical materials. This company shut down in 1957, when Emilio was 81. A few years later, he got sick and died in 1963. Ines Baietto died in 1977.

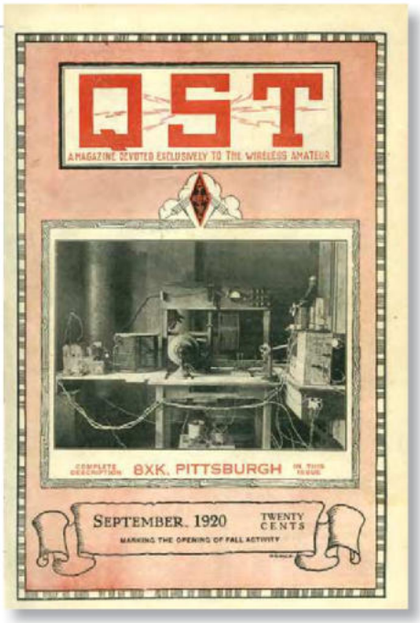
In the meantime, his son Dario founded another company, continuing his father's work, but ceased the production of the telegraph keys and dealt mostly with the construction of electrical material.

### Honoring Caimi On the Air This Fall

The special call sign II2EMCA is active to commemorate Emilio Caimi; QSL direct and/or Logbook of The World (LoTW), via IZ2FME. Listen and make contacts with us on CW only (HF/WARC/50 MHz) through the end of 2020.

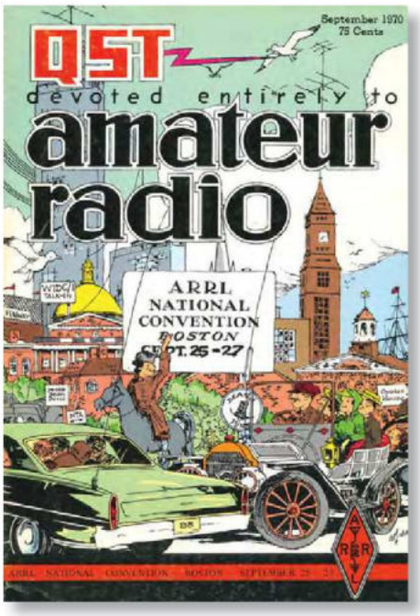
# 100, 50, and 25 Years Ago

*Due to a printing error, the "100, 50, and 25 Years Ago" column did not appear in the print edition of the September issue of* QST. *We apologize for any inconvenience.*



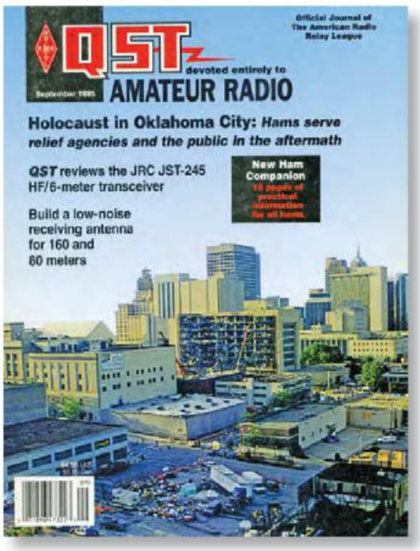

## September 1920

- The cover photo shows the excellent station of 8XK, in Pittsburgh, Pennsylvania. [A few months later, 8XK became the early broadcasting station KDKA. — *Ed.*]
- The editorial, "In Introspect," takes a look at ham radio of the time, and finds much to be pleased and hopeful about.
- The lead article, "A Few Ideas for Amateur C.W.," begins with the observation that "The number of C.W. sets is rapidly increasing."
- "Station Performance during the Bureau of Standards – A.R.R.L. QSS Tests of June and July, 1920" presents the data collected by participating stations, as we try to learn about fading and its causes.
- McMurdo Silver presents information on the "Construction of a Two-Step Amplifier" for audio signals.
- "Our Less Experienced Brothers," by former League president Hiram Percy Maxim, W1AW, warns against the exclusion of newcomers to our grand adventure by the more experienced operators.
- A. L. Groves tells us "How to Tune the Honeycombs," to get maximum results from honeycomb coils.




## September 1970

- The cover art by Gil, W1CJD, reminds us of the League's National Convention, to be held in Boston later that month.
- The editorial, "A Tough Decision," discusses the FCC's expansion of the phone subbands.
- Douglas Blakeslee, W1KLK, shows how to build "A Solid-State VOX."
- Yardley Beers, WØJF, shares Part II of "Short Antennas for the Lower Frequencies," discussing trap construction and adjustment.
- Jerry Arnold, WN6MBP, reports on building "A Two-Band Vertical for the Novice" that covers 40 and 15 meters.
- Doug DeMaw, W1CER, describes how to build "A QRP Console," a mate for the QRP transceiver described in the August 1970 issue of *QST*.
- Reed Fisher, W2CQH, and Richard Turrin, W2IMU, write about their "UHF Directional Coupler," a handy piece of equipment for UHF hams.
- Frank Walsmith, W8PHR, explains how to build a circuit to provide "Automatic Amplifier Tuning," to maintain tank-circuit resonance when changing frequency.




## September 1995

- The cover photo shows the Federal Building in Oklahoma City, and notes that hams served in several roles after it was car-bombed.
- The editorial, "Why Band Plan?", explains why today's bands require observance of the operating segments in our bands.
- "Holocaust in Oklahoma City" recounts the efforts of hams in providing essential communications support following the truck bombing in Oklahoma City.
- "Thrills, Butter Churns, and Honeycombs: A Visit to The Hammond Museum of Radio" describes the wonderful museum operated by Fred Hammond, VE3HC, in Guelph, Ontario.
- Brian Beezley, K6STI, teaches us how to build "A Receiving Antenna that Rejects Local Noise."
- Edwin Andress, W6KUT, joins in with "A K6STI Low-Noise Receiving Antenna for 80 and 160 Meters."
- "Hard-Core QRP," by Richard Arland, K7YHA, shares the tale of his enjoyment of ham radio with transmitter outputs at the milliwatt and microwatt levels.
- The article, "California Mobile Antennas and the Moment of Truth," by Doc Selman, WE6A, includes photos of the antennas used on a day when high-power mobile hams gathered to compare antennas.

Al Brogdon, W1AB

# 100, 50, and 25 Years Ago

## October 1920

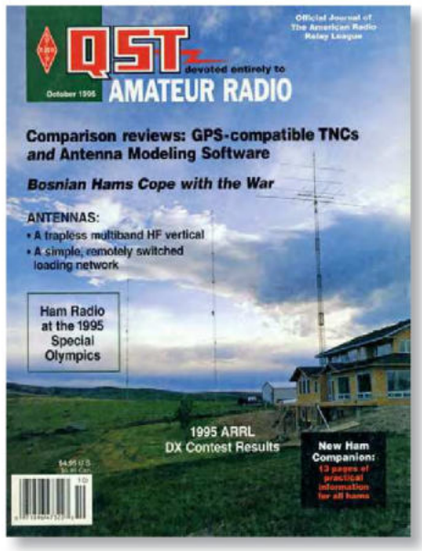
- The cover art shows a ham adjusting his rig, fashionably attired in suit and tie.
- The editorial, "An Anniversary," notes that it has now been a year since hams got back on the air after World War I and reviews a period of significant accomplishment and progress. The editorial notes that a ham had been heard in the Territory of Hawaii.
- L. A. Hazeltine discusses the usage of "Bulb Oscillators for Radio Transmission."
- In "Concerning Cages," Sumner Young, 1AE, advises on how to construct cage antennas.
- F. S. Huddy, 1II, tells us how to build "A Simple Radiophone Operating on 'B' Batteries."
- "A Paper on QRM," by John Gray, 6MZ, is introduced by the editor as "The best we have ever seen on this important topic."
- The "Amateur Radio Stations" column reports on the excellent stations of 1HAA and 5ZP, complete with photos.


## October 1970

- The cover photo shows W1EO's homebrew solid-state counter, which is described in this issue.
- The editorial, "We've Got Problems," discusses recent FCC interpretations of the amateur rules that would prohibit many of ham radio's traditional public service efforts. It explains that ARRL officials are working to clarify and rectify the situation.
- In "The Ham Builder's Nightmare," Doug DeMaw, W1CER, discusses issues in procuring parts, and suggests ways to solve that problem.
- Through a comprehensive, nine-page article, Kenneth MacLeish, W1EO, teaches how to build "A Frequency Counter for the Amateur Station."
- Lew McCoy, W1ICP, describes "The 'Junker' Amplifier," which uses a single 813 tube to provide 500 W on 80 through 10 meters.
- Douglas Blakeslee, W1KLK, and Augustus Wilson, W1NPG, share "A High-Performance HF Converter" that will improve the performance of older receivers.
- "A Frequency Multiplication Technique for VHF and UHF SSB," by Karl Meinzer, DJ4ZC, uses signal processing to eliminate distortion produced by conventional frequency multiplication methods.
- Raphael Soifer, K2QBW, presents a summary of "Australis-Oscar 5 Ionospheric Propagation Results."


## October 1995

- The cover photo shows some of the antennas of Montana's Mike Lamb, N7ML, with additional photos of Mike's station shown in "Up Front in *QST*."
- The editorial, "Thinking Strategically," discusses the Internet and how it can be used with ham radio, noting that survey results show that 48% of ARRL members have access to it.
- Brian Battles, WS1O, reports on ham radio's important support of "The 1995 Special Olympics World Games."
- Jim Cain, K1TN, writes about Fabio Lava, HB9AUS, and his "20 Years of ARRL DX Contesting From the Foot of the Swiss Alps."
- Robert Wilson, AL7KK, tells us how to build a low-cost, compact, multiband antenna that he calls "The Offset Multiband Trapless Antenna (OMTA)."
- Mitchell Lee, KB6FPW, writes about the "Twisted-Pair Controls Switchable Remote Loading Network," which minimizes the number of control wires required.
- In "Propagation Pioneers: The ARRL-Bureau of Standards Experiment," Robert Welsh, N3RW, recalls the early work on determining the causes of radio signal fading problems.
- "Heroes under Siege," by Samir Durakovic, T94ON, describes the role of ham radio in Bosnia-Herzegovina in the midst of war.



# Silent Keys

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

*Due to a printing error, the "Silent Keys" column did not appear in the print edition of the September issue of* QST. *We apologize for any inconvenience.*

N1AED **Roux**, Richard M. "Dick," Bedford, NH
K1AMS **Schindler**, Andrew M. "Mike," Niantic, CT
W1BEP **Paiva**, Bradford E., East Freetown, MA
•WA1DVU **Gray**, Rodney W., Belchertown, MA
N1DZM **Allard**, Almon R., Billerica, MA
K1EST **Osborne**, Paul H., Milford, ME
♦W1GV **Gibilisco**, Stanley P., Lead, SD
NB1HF **Blaiklock**, Neal E., Merrimack, NH
K1HFR **Kratovil**, Jonathan D., Feeding Hills, MA
N1HRM **Contois**, Stanley L., Essex Junction, VT
K1JG **Gawronsky**, John A., Athol, MA
•KA1KXQ **Blaskey**, Bernice E., Palm Coast, FL
W1MAP **Dupont**, Donald S., Farmingdale, ME
♦WA1MXN **Burnham**, David W., Concord, NH
W1QDV **Doucette**, Conrad R., Cincinnati, OH
W1TAB **Peloquin**, Robert H., Jr., Worcester, MA
KB1VAD **Russ**, Raymond, South Chatham, MA
KB1XI **MacCord**, Donald A., Derry, NH
KA2AJH **Cicirello**, James A., Wellsville, NY
K2ANJ **Frasier**, James H., Amherst, MA
•WB2BSN **Hall**, Tom, Lyons, NY
W2CRS **Super**, John P., McNeal, AZ
WT2D **Damen**, Theodoor C., Colts Neck, NJ
KC2GZY **Paul**, Allan T. "Dusty," East Aurora, NY
K2IEC **Pickering**, Bernard F. "Bernie," Susquehanna, PA
K2LP **Hall**, Marvin D. "Bud," Eastham, MA
WA2NHA **Messing**, Howard, Sparta, NJ
N2PEN **Robideau**, Paul J., Clifton Park, NY
WA2SJO **Ofshinsky**, Sam J., Dumont, NJ
KX2W **Shontz**, Freeman S. "Sam," Southampton, NJ
•KA2WYZ **Malhenzie**, Bernard, Athens, AL
KH2Z **Hildebrand**, Brent W., Loma Linda, CA
W2ZM **Raide**, Robert J., Penn Yan, NY
K3IP **Shaubach**, Henry "Kip," Jr., Quarryville, PA
♦K3IUY **Sanders**, Irvin M., Middletown, PA
K3JE **Morrison**, Edward S., Clearfield, PA
♦W3JTV **Vaccaro**, Joseph, Hermitage, PA
K3KFD **Flink**, Stephen, Penn Valley, PA
♦WN3LIF **Jones**, Walter, Duryea, PA
N3MZJ **Piper**, Robert W., Chambersburg, PA
W3NQN **Wetherhold**, Edward E., Annapolis, MD
W3NTT **Groover**, James A., Slatington, PA
KA3RNW **Murphy**, Mark G., Annapolis, MD
KB3SGX **Peach**, Robert A., Hookstown, PA
AA3VK **Minschwaner**, Walter E., Wellsboro, PA
KI4AMO **Allen**, Glenn P., Benton, TN
N4ANV **Tyree**, Gene, Fayetteville, NC
WA4AON **Hardigree**, George A. "Allan," Bishop, GA
W4AV **Vitolo**, Anthony A., Grayson, GA
AK4BE **Shipes**, Joe F., Yorktown, VA
WE4C **Stadtlander**, David, Cocoa, FL
KI4CGN **Bateman**, Bert D., Topton, NC
AI4DU **Bossert**, Raymond A., Calabash, NC
KI4DXB **Turner**, Delbert S., Floral City, FL
KE4EC **Frazier**, Donald E., Punta Gorda, FL
♦AD4F **Curle**, Charles E. "Charlie," Jr., Coltewah, TN
KV4FK **Campbell**, Donn V., Annapolis, MD
•WD4HDV **Coleman**, James C., Jr., Mechanicsville, VA
♦WB4HHN **Stevens**, Russell J., Manassas, VA
NC4HK **Martin**, Haynes K., Fuquay-Varina, NC
K4HSK **McCrary**, Clifford R., Jr., Elkin, NC
•N4JNL **Lindeman**, Linda, Coconut Creek, FL
KM4KLT **Aspinwall**, Thurman R. "T. Ray," Mobile, AL
KK4MQP **Barry**, Rebecca F., Decatur, AL
KD4ODQ **Schmauss**, Jo Anne, Lakeland, FL
KA4PCN **Murphy**, Dewey E. "Edward," Odum, GA
W4PJZ **Anderson**, Bluford J. "Andy," Louisville, KY
N4PWP **Head**, Kenneth L., Elizabethton, TN
KI4SBT **Hoppe**, Robert W., Dacula, GA
AE4SH **Hamm**, Scott B., Cherryville, NC
WA4SYZ **Smith**, Brady O., St. Petersburg, FL
W4TZQ **McCaslin**, Nick G., Arden, NC
K4UQR **Foley**, James A., Jr., Birmingham, AL
KN4Y **Palagyi**, Edward F. "Ed," Crawfordville, FL
KK5AR **Shook**, Roland S., Silver City, NM
KB5BRZ **Grisham**, Farrar, Meridian, MS
•WT5C **Edlin**, James I. "Jim," Lubbock, TX
KD5CQX **Crawford**, John R., Eads, TN
K5CRJ **Warburton**, Alan W., Long Beach, MS
•AA5EA **Foster**, Wallace C., El Paso, TX
AC5F **Hughes**, Robert L. "Leon," Willis, TX
♦N5GAR **Blackwell**, Thomas M., Dallas, TX
AB5HA **Smith**, Paul B., Bossier City, LA
KI5HBX **Bural**, Benjamin T. "Tyler," Edmond, OK
KD5HEO **Murphy**, Clifford L., Fort Worth, TX
KU5K **Phelps**, Cecil C., Ignacio, CO
KA5KBM **Strachan**, Steve S., Lavaca, AR
KF5OEB **Sly**, Benjamin C., Sherman, TX
W5SFN **Emmons**, Albert D., San Antonio, TX
•W5TDH **Gilbert**, Kenneth L., Plainview, TX
W5TYD **Allen**, Henry L., Caddo Mills, TX
•K6DPZ **Guretzky**, Harold "Hal," Richmond Hills, NY
W6GCL **Hammons**, Jerry D., Clovis, CA
•W6IWM **Popenoe**, Paul, Jr., Portland, ME
KK6JJ **Pritchard**, Grant S., Novato, CA
N6JTA **Richards**, Russell D., III, Turlock, CA
W6RUF **Tsompanas**, Emmanuel C., Modesto, CA
W6VNQ **Towle**, Harry D. "Dave," Arbuckle, CA
KK6ZTN **McLaren**, Dorothy J., Santa Barbara, CA
KE7BZD **Brassard**, Raymond A., Puyallup, WA
W7GXX **Powell**, Robert B., Taylorsville, UT
K7HEN **Gilbert**, Mack, Ephraim, UT
W7HTJ **Andresen**, David C., Lakewood, WA
♦WA7JCK **Hutton**, Merle K., Tucson, AZ
K7JGU **Korn**, Theresa M., Tucson, AZ
WA7PFR **Parker**, David H., Portland, OR
N7UKN **Metzler**, Donald E., Glendale, AZ
W7VTW **Hawley**, James N. "Jim," Newport, OR
W7YRU **Bohman**, Ronald G. "Gene," Rexburg, ID
•K8BP **Cooper**, Wyatt C. "Clarke," Muskegon, MI
♦K8DHW **Eblin**, James B. "Jim," Corvallis, OR
W8END **Geerlings**, David N., Manistee, MI
N8GCH **Warren**, Vincent A., Lima, OH
WA8HDG **Gietzen**, William D., Norton Shores, MI
N8IEA **Childers**, Calvin, Dayton, OH
N8JMK **Homer**, Bruce A., Cambridge, OH
WD8JOF **Ludwig**, David L., Swartz Creek, MI
•WB8JRW **McCloy**, Eugene, Vermontville, MI
♦•W8LTX **Knott**, Thomas E., Spring Hill, FL
•W8PJS **Thatcher**, George R., Asheville, NC
•K8RDO **Armstrong**, Donald P., Lehigh Acres, FL
W8REW **Weston**, Ross E. "Ed," II, Reynoldsburg, OH
W8WPC **Brown**, Ralph E., Greenville, OH
•W8WSR **Cowley**, Robert C., Toledo, OH
♦KD8YR **Olson**, Harold C. "Charlie," Troy, OH
W9ANT **Rudis**, Anthony J., Jr., Manhattan, IL
K9BBU **Burbey**, Lawrence A. "Larry," De Pere, WI
W9BCO **Booher**, David C., Aurora, IL
KB9CJG **Michas**, Nick W., Princeton, IN
K9CTH **Hubbard**, William H., Kokomo, IN
KA9FRM **Wilson**, Charles, Robbins, IL
W9HC **Brown**, Stephen E., Mahomet, IL
N9USM **Wessels**, Heye C., Norfork, AR
KB9KMH **Cedzo**, George S., Sheboygan, WI
KC9NEB **Beckner**, Nancy, Rensselaer, IN
WB9ORO **Daniels**, Ruthann, McGregor, IA
WA9ZYO **McCarty**, Robert R., Racine, WI
WØBDO **Huber**, Frank J., Montgomery, MN
WAØBOB **Bartholic**, Robert W., Ogden, KS
KØDXX **Moody**, Michael D., Winfield, MO
AFØF **Hisserich**, James F. "Jim," Ironton, MO
WBØHNB **Horn**, Bernard H., Nashua, IA
NØICF **Kesselring**, Pamela J., Ottumwa, IA
WAØOFO **Smith**, Thomas C., Sun City West, AZ
ACØPJ **Gardner**, James W., Ogden, IA
•WØQAP **Arbogast**, Burl T., El Dorado, KS
KØRTF **Goetsch**, J. Bruce, Decorah, IA
WAØTNA **Long**, James R., Wentzville, MO
•KØUL **Schreiner**, Thomas D., Southbury, CT
WØVLY **Haumann**, David W., Thedford, NE
WQØX **Biggs**, Rodger D., Ellendale, ND
KBØXK **Steiner**, Harold B., Holstein, NE
KCØYNS **Mesenbrink**, Corey, Hallsville, MO
VE1OP **Nichols**, Scott B., North Sydney, NS, Canada
VE3ENC **Mullen**, Bernard A., Maberly, ON, Canada
♦VE3ISJ **Murphy**, Thomas K., Dunnville, ON, Canada
VE7CRU **Leach**, Graham Rodney, Oliver, BC, Canada
VE7ETU **Walker**, Hugh, Kaslo, BC, Canada
ZL1BKE **Beets**, Robert F., Queensland, Australia

♦ Life Member, ARRL
• Former call sign

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.

Many hams remember a Silent Key with a memorial contribution to the ARRL Foundation or to ARRL. If you wish to make a contribution in a friend or relative's memory, you can designate it for an existing youth scholarship, the Jesse A. Bieberman Meritorious Membership Fund, the Victor C. Clark Youth Incentive Program Fund, or the General Fund. Contributions to the Foundation are tax deductible to the extent permitted under current tax law. Our address is: The ARRL Foundation Inc., 225 Main St., Newington, CT 06111.

# Silent Keys

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

W1AKN **Buckley**, John T. "Jack," Middleboro, MA
•W1BEG **Laurent**, John A., Lenox, MA
K1GAX **Rumery**, Bryce P., Cape Elizabeth, ME
•KA1GWF **Fitzpatrick**, Eugene E., Falmouth, ME
•K1GYA **Bradford**, Gladys W., Ellenton, FL
•K1PGF **Plaisted**, Roger C., Vienna, ME
KT1Q **Powloka**, Michael A., Shaftsbury, VT
K1SVC **Smith**, Arthur J., Jr., Bedford, MA
W1UMN **De Nunzio**, John T., Middletown, CT
K2ASG **Spair**, Richard A., Sr., Lakewood, NJ
W2AXV **Bell**, Robert L., Hinsdale, NY
N2CSA **Cole**, Frederick W., III "William," North Cape May, NJ
WA2EXP **Minott**, David, Valley Stream, NY
KA2G **Glasscott**, Eric M., Bluffton, SC
AA2HV **Capucilli**, Leonard L., Solvay, NY
WA2JVL **Murray**, Roy R., Howell, NJ
KC2MBG **Staeb**, John F., Millville, NJ
W2OLH **Ordon**, Thomas J. F., Skaneateles, NY
♦WX2P **Gealt**, Daniel R., Queensbury, NY
•WB2ROY **Blatchley**, Harold E., Painted Post, NY
WA2RWL **Newman**, Douglas R., North Las Vegas, NV
N2XNR **Hoffmann**, Roy W., North Bergen, NJ
♦KB2ZAM **Fegan**, Thomas J., Yorktown Heights, NY
K3ECD **Frank**, Lee M., Sr., Rutherford, PA
♦K3JRR **Harrison**, Lawrence T., Jr., Criders, VA
•WA3MFH **Finck**, Pierre A., Dallas, TX
•K3NNI **Tucker**, John L., Dayton, MD
W3NQN **Wetherhold**, Edward E., Annapolis, MD
N3PVP **Beeman**, John L., Clifford, PA
N3TKW **Kinnan**, Barbara P., Middlebury Center, PA
•KB3UCC **Skellen**, Richard C., Ridgway, PA
W3VG **Leonard**, Theodore M., Bradford, PA
AE3X **Amatuzio**, Thomas R., Sr., Bear, DE
•W3YRT **Baer**, Carl L., Sr., Ruscombmanor Township, PA
N4ASL **Mann**, Louis R. "Rex," Cookeville,
N4BG **Givaudan**, Ben T., Burlington, NC
WB4DLD **Baughman**, James M., Columbia, SC
KG4EEO **McLamb**, Cecil R., Wilson, NC
KJ4EJH **Hopkins**, John J., Swansboro, NC
KE4FGC **Loyd**, William I., Macon, GA
K4GOR **Church**, Craig E., Arlington, VA
KK4HEU **Ball**, Larry E., Abingdon, VA
KF4HPU **Harbold**, Michael P., Alto, GA
•K4ILI **Dye**, Kyle E., Jr., Tiger, GA
WD4IVQ **Golden**, Truman, Bremen, GA
K4JHD **Davidson**, Joseph H., Ashville, AL
WA4KHN **Brignole**, Anthony J., III, Memphis, TN
WD4KNE **Staton**, William A., Sr., Stanton, KY
KN4NMF **Demasi**, Thomas D., Trenton, SC
K4OVV **Sansbury**, Laurie P., Sr., Hartsville, SC
K4PGY **Banister**, Marvin B., Albany, GA
KC4TBS **Tyree**, Patricia H., Fayetteville, NC
KF4TP **Madsen**, Olaf J., Shelby, NC
KJ4UIE **Eldredge**, Daniel E., Alexandria, VA
AI4UL **Von Hagel**, Robert E., Clinton, NC
AI4WC **Cason**, James H., Tallahassee, FL
WB4WEQ **Allen**, Berry R., Pensacola, FL
K4WYS **Hood**, Walton R. "Sonny," Chesapeake, VA
W4YC **Engebretson**, Edward A., Raleigh, NC
KD4YFD **Hodge**, Anthony M., Gaffney, SC
•WA4YNE **Bell**, Thomas W., Mount Airy, NC
KE4YSW **Shigley**, Phyllis K., Asheville, NC
KI4ZZD **Oswalt**, Carol A., Andalusia, AL
N5BT **Wolff**, Helmut O. "Hal," Dallas, TX
•K5DOZ **Chandler**, Craig S., Bartlesville, OK
N5EUK **Goodrich**, Donald W., Albuquerque, NM
W5FU **Ferguson**, Walter G. "Grady," Houston, TX
KG5ICN **Reed**, Paul V., Jr., Crosby, TX
KC5KNV **Earley**, Allan B., Denison, TX
•KE5KZA **Dawson**, Richard E. "Rich," Georgetown, TX
KE5OG **Brooks**, William L., Alpine, TX
N5PKL **Sosa**, Mario, Jr., Laredo, TX
W5TGO **Prechel**, Thomas J., Harlingen, TX
KE5UFZ **Young**, Charles Howard, Tupelo, MS
AB5WJ **Warren**, Franklin A., Sr., "Frank," Rio Rancho, NM
♦W5WQN **Luther**, Herbert A. "Mike," College Station, TX
•W5XYL **Lane**, Evonne G., Las Vegas, NV
N6DKP **Harper**, Ray L., Granada Hills, CA
W6JLF **Frank**, Joseph L., Oakhurst, CA
•W6JTT **Kelly**, Samuel T., Garden Grove, CA
K6LQI **Grove**, Thomas L., Carson, CA
KI6LUM **McEwen**, John K., Napa, CA
K6MAR **Waterman**, Dave J., Bakersfield, CA
KC6POF **Chin**, William M. "Bill," Daly City, CA
♦K6PTL **Lyman**, Peter T., Pasadena, CA
N6QIH **Mitchell**, Larry J., Draper, UT
W6TEL **Lansing**, Theodore E., Camarillo, CA
W6WIM **Mills**, Raymond E., Dos Palos, CA
KT6Y **Caldis**, Jay D., Walnut Creek, CA
•N7ERN **Brady**, Lloyd F., Price, UT
AC7EY **Wood**, Carl E., Great Falls, MT
W7HTJ **Andresen**, David C., Tacoma, WA
K7JAN **Noland**, James A., Boise, ID
W7LTN **Hasman**, Frank A., Meridian, ID
♦K7NO **Norris**, Dean C., Mesa, AZ
K7PG **Litteer**, Glenn G. "Gary," Napavine, WA
WA7TZY **Telewski**, Frederick, Woodinville, WA
KE7VS **Bloomenrader**, Clifford N., Jr., "Neal," Casper, WY
•N8AJO **Barney**, Norman L., Waynesville, OH
KE8IM **Beitel**, Robert J., Sr., Whitmore Lake, MI
K8MEI **Meeks**, Eugene L. "Roy," Manchester, MI
KB8RFW **Newman**, Marilyn K., Holland, MI
KD8RGV **Denzer**, Douglas P., Waldo, OH
•W8RPB **Briggs**, Rollin P., Spencerville, OH
KE9D **Moore**, Roger W., Tipler, WI
KA9DDN **Douglas**, James S., Jr., "Skip," Grafton, WI
♦K9DMV **Szczubelek**, Joseph W., Jr., "Joe," Algonquin, IL
•WA9DOQ **Foesch**, James C., Sheboygan Falls, WI
•N9EHP **Rounds**, Gerald L. "Jerry," East Moline, IL
N9EWJ **Ellis**, Marc F., Evanston, IL
•W9FQC **Kujawa**, Stanley J., Jr., Fort Smith, AR
•NS9G **Gantt**, Norman S., Muncie, IN
N9GLO **Olmstead**, Gary L., Rice Lake, WI
K9KJT **Goldstein**, Robert L. "Bob," Fox Point, WI
W9NYS **Liebl**, Leo V., Stevens Point, WI
KB9OY **Wilson**, Randy D., Elkhart, IN
WA9PZL **Ley**, Roger P., Bossier City, LA
N9TA **Bennett**, John F., Crawfordsville, IN
K9UIF **Cummings**, Mark W., Hobart, IN
KA9VQF **Sorensen**, Thomas C. "Tom," Savanna, IL
KC9WQ **Rueger**, Walter, Ripon, WI
KØBAJ **Drussel**, Gary P., Garden City, KS
•NØDIZ **Disney**, Michael K. "Mike," Lincoln, NE
♦WØFCE **Hendrix**, Joseph W. "Bill," Cameron, MO
KØHFX **Maley**, Charles E. "Chuck," Clarinda, IA
KØJN **Nemecek**, Joseph F., Kansas City, MO
KAØLSM **Wagoner**, Stephen A., Davenport, IA
NØMCT **Duple**, Marjorie R., Reeds Spring, MO
♦WØOWY **Nash**, Clarence W. "Bill," Sun City West, AZ
WØRWW **Raymond**, Walter B., Fort Payne, AL
•WØVAI **Van Erem**, Harvey G., Bismarck, ND
WXØW **Janos**, Glen P., Greenfield, MN
♦WØYVZ **Glaze**, David J., Boulder, CO
•WBØZWX **Dunham**, Delmer F., Colorado Springs, CO
VE3GE **Johnston**, Walter, Amprior, ON, Canada
VE3IJK **Gardiner**, Yvonne, Windsor, ON, Canada
VE3PRL **Pettitt**, Monique, Chatham, ON, Canada
HP1AC **Castillo**, Camilo, Panama

♦ Life Member, ARRL
• Former call sign

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.

Many hams remember a Silent Key with a memorial contribution to the ARRL Foundation or to ARRL. If you wish to make a contribution in a friend or relative's memory, you can designate it for an existing youth scholarship, the Jesse A. Bieberman Meritorious Membership Fund, the Victor C. Clark Youth Incentive Program Fund, or the General Fund. Contributions to the Foundation are tax deductible to the extent permitted under current tax law. Our address is: The ARRL Foundation Inc., 225 Main St., Newington, CT 06111.

# HAM RADIO OUTLET

WWW.HAMRADIO.COM

***FREE 1 OR 2 DAY DELIVERY TO MOST OF USA!**


### FTDX101MP | *200W HF/50MHz Transceiver*

• Hybrid SDR Configuration • Unparalleled 70 dB Max. Attenuation VC-Tune • New Generation Scope Display 3DSS • ABI (Active Band Indicator) & MPVD (Multi-Purpose VFO Outer Dial) • PC Remote Control Software to Expand the Operating Range • Includes External Power With Matching Front Speaker

### FTDX3000 | *100W HF + 6M Transceiver*

• 100 Watt HF/6 Meters • Large and wide color LCD display • High Speed Spectrum Scope built-in • 32 bit high speed DSP /Down Conversion 1st IF

### FT-991A | *HF/VHF/UHF All ModeTransceiver*

Real-time Spectrum Scope with Automatic Scope Control • Multi-color waterfall display • State of the art 32-bit Digital Signal Processing System • 3kHz Roofing Filter for enhanced performance • 3.5 Inch Full Color TFT USB Capable • Internal Automatic Antenna Tuner • High Accuracy TCXO

### FTDX101D | *HF + 6M Transceiver*

• Narrow Band SDR & Direct Sampling SDR • Crystal Roofing Filters Phenomenal Multi-Signal Receiving Characteristics • Unparalleled - 70dB Maximum Attenuation VC-Tune • 15 Separate (HAM 10 + GEN 5) Powerful Band Pass Filters • New Generation Scope Displays 3-Dimensional Spectrum Stream

### FT-891 | *HF+50 MHz All Mode Mobile Transceiver*

Rugged Construction in an Ultra Compact Body • Stable 100 Watt Output with Efficient Dual Internal Fans • 32-Bit IF DSP Provides Effective and Optimized QRM Rejection • Large Dot Matrix LCD Display with Quick Spectrum Scope • USB Port Allows Connection to a PC with a Single Cable • CAT Control, PTT/RTTY Control


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

• 50W Reliable Output Power • Real Dual Band Operation (V+V, U+U, V+U, U+V) • 2-inch High-Res Full Color TFT Display • Band Scope • Built-in Bluetooth • WiRES-X Portable Digital Node/Fixed Node with HRI-200

### FT-2980R | *Heavy-Duty 80W 2M FM Transceiver*

• Massive heatsink guarantees 80 watts of solid RF power • Loud 3 watts of audio output for noisy environments • Large 6 digit backlit LCD display for excellent visibility • 200 memory channels for serious users

### FTM-7250DR | *C4FM/FM 144/430MHz Dual Band*

• 50 Watt Mobile • System Fusion-II Compatible • Operates Advanced C4FM Digital & Conventional FM Modes • 3 Watt Powerful & Clear Audio with Front Speaker

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

• Color display-green, blue, orange, purple, gray • GPS/APRS • Packet 1200/9600 bd ready • Spectrum scope • Bluetooth • MicroSD 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 • External DC Jack for DC Supply and Battery Charging

### FT-3DR *C4FM/FM 144/430 MHz Xcvr*

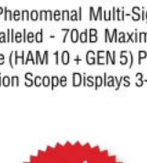
• High Res Full-Color Touch Screen TFT LCD Display • Easy Hands-Free Operation w/Built-In Bluetooth Unit • Built-In High Precision GPS Antenna • 1200/9600bps APRS Data Communications • Simultaneous C4FM/C4FM Standby • Micro SD Card Slot

### FT-65R | *144/430 MHz Transceiver*

Compact Commercial Grade Rugged Design • Large Front Speaker Delivers 1W of Powerful Clear Audio • 5 Watts of Reliable RF Power Within a compact Body • 3.5-Hour Rapid Charger Included • Large White LED Flashlight, Alarm and Quick Home Channel Access

### FT-60R | *2M/440 5W HT*

• Wide receiver coverage • AM air band receive • 1000 memory channels w/alpha labels • Huge LCD display • Rugged die-cast, water resistant case • NOAA severe weather alert with alert scan




- **RETAIL LOCATIONS – Store hours 10:00AM - 5:30PM - Closed Sunday**
- **PHONE – Toll-free phone hours 9:30AM - 5:30PM**
- **FAX – All store locations**
- **ONLINE – WWW.HAMRADIO.COM**
- **MAIL – All store locations**

YAESU
The radio

| | | | | | |
|---|---|---|---|---|---|
| ANAHEIM, CA (800) 854-6046 | OAKLAND, CA (877) 892-1745 | PORTLAND, OR (800) 765-4267 | PHOENIX, AZ (800) 559-7388 | MILWAUKEE, WI (800) 558-0411 | WOODBRIDGE, VA (800) 444-4799 |
| PLANO, TX (877) 455-8750 | SAN DIEGO, CA (877) 520-9623 | DENVER, CO (800) 444-9476 | ATLANTA, GA (800) 444-7927 | NEW CASTLE, DE (800) 644-4476 | SALEM, NH (800) 444-0047 |

**Shop Anytime From Anywhere with Our Online Superstore**
**WWW.HAMRADIO.COM**

*On most orders over $100 in the continental US. (Rural locations excluded.) Contact HRO for promotion details. Toll-free including Hawaii, Alaska and Canada. All HRO 800-lines can assist you. If the first line you call is busy, you may call another. Prices, specifications and descriptions subject to change without notice.

# HAM RADIO OUTLET

WWW.HAMRADIO.COM

## NOBODY BEATS AN HRO DEAL!


### TS-990S | *200W HF + 6M Transceiver*

• World's first dual TFT display • 200W output on all bands • ±0.1ppm TCXO ensures both high stability and reduced power consumption • Triple 32-bit DSP's dedicated to main/sub receivers and band scope • Main receiver employs full down conversion, new mixer & narrow band roofing filters • Third order intercept point (IP3) +40dBm for highest level of RX performance ( main receiver)

**Call For Special Price!**


### TS-890S | *HF/50MHz Transceiver*

• Receive performance on a whole other level from narrow bandwidth roofing filters that only full down conversion can provide • CW Morse code decode/encode possible with stand-alone unit • 150dB Blocking dynamic range (BDR) • Expanded touch operation scope • Kenwood Sky Command® II Support • Remote operation achieved without host PC Direct remote-control function (KNS)


### TS-590SG | *HF/50MHz Transceiver*

• Equipped with 500 Hz/2.7 kHz roofing filter as standard • ALC derived from TS-990S eliminating spike issues • Antenna output function (shared with DRV connector) • CW - morse code decoder function • Improved 1st mixer • New PFB key with multi-function knob • New split function enabling quick setting • LED backlight with selectable color tone


### TM-D710G | *2M/440 Dualband*

• V+V/V+U/U+U operation • Built-in GPS • Built-in TNC for APRS & DX-Cluster operation • 50W 2M & UHF • 1,000 memories • Dual receive • Green or amber backlight colors • Latest APRS firmware w/new features • Sky Command II remote functions

**Call For Special Price!**


### TM-V71A | *2M/440 DualBand*

• High RF output (50W) • Multiple Scan • Dual receive on same band (VxV, UxU) • Echolink® memory (auto dialer) • Echolink® Sysop mode for node terminal ops • Invertible front panel • Choice of green/amber for LCD panel • 104 code digital code squelch • "Five in One" programmable memory • 1000 multifunction memory

**Call Now For Your Low Price!**


### TM-281A | *2M Mobile*

• 65 Watt • 200 Memories • CTCSS/DCS • Mil-Std specs • Hi-quality audio

**Call For Special Low Price!**


### TH-D72A

*2M/440 HT w/extended RX*

• 5W TX, RX 118-524 MHz, VxU, VxV, UxU • APRS w/built-in 1200/9600 TNC • Built-in GPS, Built-in USB, digipeater • Echolink® compatible • Mil-Spec STD810

**Call For Special Low Price!**

### TH-D74A

*2M/220/440 HT w/D-STAR!*

• D-STAR compatible • APRS ready w/ built in GPS • Color weather station information • Built-in KISS mode TNC • High-performance DSP voice processing • Standard compatibility for Bluetooth

**Call For Low Price!**


### TH-K20A | *2M Handheld*

• 2M 5.5W • VOX • CTCSS/DCS/1750 Burst built-in • Weather alert

**Call For Special Low Price!**

***HRO is family owned and operated by active hams!***


- **RETAIL LOCATIONS – Store hours 10:00AM - 5:30PM - Closed Sunday**
- **PHONE – Toll-free phone hours 9:30AM - 5:30PM**
- **FAX – All store locations**
- **ONLINE – WWW.HAMRADIO.COM**
- **MAIL – All store locations**

KENWOOD

| | | | | | |
|---|---|---|---|---|---|
| ANAHEIM, CA (800) 854-6046 | OAKLAND, CA (877) 892-1745 | PORTLAND, OR (800) 765-4267 | PHOENIX, AZ (800) 559-7388 | MILWAUKEE, WI (800) 558-0411 | WOODBRIDGE, VA (800) 444-4799 |
| PLANO, TX (877) 455-8750 | SAN DIEGO, CA (877) 520-9623 | DENVER, CO (800) 444-9476 | ATLANTA, GA (800) 444-7927 | NEW CASTLE, DE (800) 644-4476 | SALEM, NH (800) 444-0047 |

**Shop Anytime From Anywhere with Our Online Superstore**
**WWW.HAMRADIO.COM**

*FIRST IN TECHNOLOGY*

# Be Active: IC-705

Your New Partner for Field Operations


## Pick Up Your Favorite SDR Today

**IC-9700**
VHF / UHF SDR Transceiver

**IC-7300**
HF / 6M SDR Transceiver

**IC-7610** HF / 6M SDR Transceiver

www.icomamerica.com/amateur
sales@icomamerica.com

For the love of **ham radio.**

ICOM®

**Free Catalog/Dealers/Manuals Online – Visit: www.hy-gain.com or call toll-free 800-647-1800**

**The First Choice of Hams Around the World!**

# hy-gain® HF Rotators

## HAM-IV – $709.95

**The Most Popular Rotator in the World!**

For medium communications arrays up to 15 square feet wind load area. Has 5-second brake delay, Test/Calibrate function. Low temperature grease permits normal operation down to -30 degrees F. Alloy ring gear gives extra strength up to 100,000 PSI for maximum reliability. *Precision* indicator potentiometer. Ferrite beads reduce RF susceptibility. Cinch plug plus 8-pin plug at control box. Dual 98 ball bearing race for load bearing strength and electric locking steel wedge brake prevents wind induced movement. North/South center of rotation scale on meter, low voltage control, max mast $2^{1}/_{16}$".

**HAM-VI – $809.95** with DCU-2

**HAM-VII – $959.95** with DCU-3

| HAM IV and HAM V Rotator Specifications | |
|---|---|
| Wind Load Capacity (inside tower) | 15 square feet |
| **Wind Load (w/mast adapter)** | **7.5 square feet** |
| Turning Power | 800 in.-lbs. |
| **Brake Power** | **5000 in.-lbs.** |
| Brake Construction | Electric Wedge |
| **Bearing Assembly** | **Dual race/96 ball bearings** |
| Mounting Hardware | Clamp plate/steel U-bolts |
| **Control Cable Conductors** | **8** |
| Shipping Weight | 26 lbs. |
| **Effective Moment (in tower)** | **2800 ft.-lbs** |

## TAILTWISTER SERIES II – $869.95

**For Large Medium Antenna Arrays up to 20 sq. ft. wind load.**

Has 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 box, triple bearing race with 138 ball bearings for large load bearing, electric locking steel wedge brake, North/South center of rotation scale meter, low voltage control, $2^{1}/_{16}$" max mast. **MSHD, $139.95**. Above tower heavy duty mast support. T2X, HAM-IV, HAM-V, HAM-VI. Accepts $1^{7}/_{8}$-$2^{5}/_{8}$" OD.

**T-2XD2 – $979.95** with DCU-2

**T-2XD3 – $1039.95** with DCU-3

| TAILTWISTER Rotator Specifications | |
|---|---|
| Wind Load Capacity (inside tower) | 20 square feet |
| **Wind Load (w/mast adapter)** | **10 square feet** |
| Turning Power | 1000 in.-lbs. |
| **Brake Power** | **9000 in.-lbs.** |
| Brake Construction | Electric Wedge |
| **Bearing Assembly** | **Triple race/138 ball bearings** |
| Mounting Hardware | Clamp plate/steel U-bolts |
| **Control Cable Conductors** | **8** |
| Shipping Weight | 31 lbs. |
| **Effective Moment (in tower)** | **3400 ft.-lbs** |

## CD-45II – $499.95

**For antenna arrays up to 8.5 sq. feet mounted inside tower or 5 sq. ft. with mast adapter.**

Low temperature grease good to -30 F degrees. New Test/Calibrate function. Bell rotator design gives total weather protection, dual 58 ball bearing race gives proven support. Die-cast ring gear, stamped steel gear drive, heavy duty, trouble free gear train, North center scale, lighted directional indicator, 8-pin plug/socket on control unit, snap-action control switches, low voltage control, safe operation, takes maximum mast size to $2^{1}/_{16}$ inches. MSLD light duty lower mast support included.

**CD-45D2 – $599.95** with DCU-2

**CD-45D3 – $659.95** with DCU-3

| CD-45II Rotator Specifications | |
|---|---|
| Wind Load Capacity (inside tower) | 8.5 square feet |
| **Wind Load (w/mast adapter)** | **5.0 square feet** |
| Turning Power | 600 in.-lbs. |
| **Brake Power** | **800 in.-lbs.** |
| Brake Construction | Disc Brake |
| **Bearing Assembly** | **Dual race/48 ball bearings** |
| Mounting Hardware | Clamp plate/steel U-bolts |
| **Control Cable Conductors** | **8** |
| Shipping Weight | 22 lbs. |
| **Effective Moment (in tower)** | **1200 ft.-lbs** |

**New!**

## Hy-Gain Programmable DCU-3 Digital Rotator Controller

### DCU-3 – $499.95

**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 sleep time. Field upgradeable firmware. 8.5Wx4.3H x9D".

110 VAC. Order DCU-3X for 220 VAC.

**DCU-2 Digital Rotator Controller – $459.95**

Like DCU-3, but less programmable memories. 110 VAC. Order **DCU-2X**, for 220 VAC.

## AR-40 – $399.95

**For compact antenna arrays and large FM/TV up to 3.0 square feet wind load area.**

Dual 12 ball bearing race. Automatic position sensor never needs resetting. Fully automatic control -- just dial and touch for any desired location. Solid state, low voltage control, safe and silent operation. $2^{1}/_{16}$ inch maximum mast size. MSLD light duty lower mast support included.

| AR-40 Rotator Specifications | |
|---|---|
| Wind Load Capacity (inside tower) | 3.0 square feet |
| **Wind Load (w/mast adapter)** | **1.5 square feet** |
| Turning Power | 350 in.-lbs. |
| **Brake Power** | **450 in.-lbs.** |
| Brake Construction | Disc Brake |
| **Bearing Assembly** | **Dual race/12 ball bearings** |
| Mounting Hardware | Clamp plate/steel U-bolts |
| **Control Cable Conductors** | **5** |
| Shipping Weight | 14 lbs. |
| **Effective Moment (in tower)** | **300 ft.-lbs** |

## Replace your Yaesu Rotator Controller

### YRC-1 – $369.95

**Hy-gain 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 *AutoReversal*™ for fast longpath 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 variable DC motor minimizes overshoot. Intuitive menu. Field upgradeable. For Yaesu G-800/1000/2800/G450/650. AC or DC motors.

**YRC-3, $449.95.** Like YRC-1 and adds 6 memories.

## AR-500 Rotator/Controller – $169.95

**UHF/VHF/6-Meter, MFJ-1886 Rotator/Controller and Remote.** For use of small VHF/UHF, 6M, TV, FM, the MFJ-1886 wide band receiving loop and other light-weight ham antennas. Rotator is built in a weather-proof one piece cast aluminum housing with precision all 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.

**hy-gain® Antennas, Rotators & Towers** 308 Industrial Pk Rd, Starkville, MS 39759 USA
**Sales/Tech:** (662) 323-9538 ■ **FAX:** (662) 323-5803 Open 8-4:30 CST, Mon.-Fri.

# 2020 ARRL Online AUCTION

**New Gear | Vintage Items | Books**

**One-of-a-kind Finds | Product Review Items**

**And so much more!**

## OCTOBER 15 – OCTOBER 22, 2020

## www.arrl.org/auction

**IMPORTANT DATES:**

**Preview & Pre-registration Begins:** October 12 through 14

**Bidding Opens:** October 15, 2020 at 1400 UTC (10 AM EDT)

**Auction Ends:** October 22, 2020 at 10 PM

ARRL the national association for amateur radio®

# MFJ – 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!**

**Eliminate** severe power line noise from arcing transformers and insulators, fluorescent lamps, light dimmers, touch controlled lamps, computers, TV birdies, lightning crashes from distant thunderstorms, electric drills, motors, industrial processes -- before it gets into your receiver.

**It's more** effective than a noise blanker! Interference much stronger than your desired signal can be completely removed without affecting your signal. Works on all modes -- SSB, AM, CW, FM, digital -- and from BCB to lower VHF.

**MFJ-281, $15.95.** Clearest speech you ever heard! 3" speaker, 8W, 8 Ohms, 6' cord, 3.5 mm plug.

**Null out** strong QRM on top of weak rare DX and work him! Null out strong local ham or AM broadcast station to prevent receiver overload.

**The MFJ-1026** is an adjustable phasing network that combines two antenna signals to give you various directional patterns. Null out a strong interfering signal or peak a weak signal at a push of a button.


**Use external** or built-in active noise antenna. RF sense T/R switch bypasses your transceiver. Plugs between antenna and transceiver. 12 VDC, 110 VAC with **MFJ-1312D, $19.95.** 6½ x 1½ x 6¼".

**MFJ-1026**
**$239.95**

**MFJ-1025, $209.95.** Like MFJ-1026 less active antenna, use external noise antenna.

## MFJ Morse Code Reader and Keyer Combo

**Plug in this MFJ Morse Code Reader with built-in keyer and watch CW turn into solid text messages as they scroll across an easy-to-read LCD**

**MFJ-464**
**$239.95**
(Keyboard, paddles not included)


**Built-in** keyer makes working high speed CW a breeze. Type-ahead buffer, message memories and adjustable speed lets you compete with the best high speed CW operators – they won't even know you never passed a code test!

**Everything** you need for ultimate CW: sends/reads 5-99 WPM, automatic speed tracking, large 2-line LCD shows send/receive messages, use single, iambic paddle or computer keyboard, front panel speed, volume controls, 4 message memories, type ahead buffer, read again buffer, adjustable weight & sidetone, RFI proof, easy menu operation, more!

**MFJ-551, $29.95.** RFI suppressed keyboard.

**MFJ-564/B, $109.95.** MFJ lambic paddles, chrome/black.

## MFJ Contest Voice Keyer

**Makes contesting easy -- Calls CQ, sends your call, does contest exchanges -- in your own natural voice**

**MFJ-434B**
**$239.95**


**MFJ Contest Voice Keyer™ makes contesting easy!** Calls CQ, sends your call and does contest exchanges for you in your own natural voice!

**Save your voice!** Record and play back frequently used phrases like "CQ Contest this is KF5C", "You're 59", "Qth is Mississippi".

**Repeat** messages continuously. Vary repeat delay 3-500 seconds. Makes a great voice beacon and calling CQ easy.

**Record** and play back off-the-air signals -- great help if you didn't get it right the first time!

**A playing** message can be halted by the Stop Button, your microphone's PTT/VOX, remote control or computer.

**All audio** lines are RF filtered to eliminate RFI, audio feedback and distortion. Audio isolation transformer totally eliminates hum and distortion caused by ground loops.

**Five** messages, 75 seconds total. Use your mic or built-in mic for recording. Can be remote or computer controlled.

**Works** with 8 pin round or modular mics. Built-in Speaker amplifier.

External speaker, phone jack. 9V battery, 12 VDC or 110 VAC with **MFJ-1312D, $19.95**. 6½W x 2½H x 6½D".

**MFJ-73, $44.95.** MFJ-434B Remote Control with cable.

## MFJ SDR T/R Protection Switch

*New!*

**MFJ-1708SDR, $89.95.** An inexpensive wide-band SDR dongle receiver lets you see an entire band on a frequency/waterfall computer display! If you want to know where the activity is, who's generating splatter, what's in the DX window, how wide your audio is or what frequencies are clear, it's all right there! While receiving on your transceiver, MFJ-1708SDR switches your SDR to your antenna showing the entire band. On transmit your SDR is switched out and grounded to protect your SDR. PTT and a failsafe RF sense circuit switches MFJ-1708SDR. For HF/VHF.

## MFJ-1270X TNC for VHF Packet/APRS

**MFJ-1270X, $149.95.** A universal self-contained KISS mode TNC that works with every Packet software program that supports KISS mode -- just connect your FM transceiver and plug into your computer USB port. Natural for emergency communications. Perfect for APRS. Fully compatible with WinLink 2000. Works with Windows, Mac OS X and Linux. Active audio filter cleans up analog signals. Uses less than 25 mA.

**MFJ-1270DG, $39.95.** X-digi board converts MFJ-1270X into a remotely configureable digipeater.

## MFJ Giant SWR/WattMeter

**MFJ-868B, $169.95.** World's largest 1.8-54 MHz SWR/Wattmeter has giant 6½ inch meter! True active peak/average forward/reflected power. 20/200/2000 Watt ranges.

## MFJ Desk Microphones

**MFJ-299, $119.95.** Tailored for SSB. Adjustable 11" boom. Silibant sound shield, graphic equalizer, compressor, VU meter, on-air indicator, PTT/lock switch.

**MFJ-297, $79.95.** SSB Boom Mic, PTT switch.

## MFJ-1702C Antenna Switch

**MFJ-1702C, $49.95.** 2-position coax switch has a new center ground protection!

## MFJ-1164B AC Line RFI Filter

**MFJ-1164B, $99.95.** Multiple Outlet, 119VAC

## MFJ 24/12 Desk Clock

**MFJ-108B, $27.95.** **Read** both UTC and local time simultaneously. BIG ⅝ inch digits! Solid brushed aluminum frame. 4¼W x 2H x 1D


## Mic Control Center

**MFJ-1263, $139.95. Instantly** switch ragchewing to DX mic to any two transceivers. Use PTT foot switch, boom mic/headset, phones, speaker, audio-in jack.

## MFJ Dry Dummy Load

**MFJ-260C, $49.95. 300 Watts**. SWR below 1.1:1 to 30 MHz. 1.5:1 from 30-650 MHz. **MFJ-264, $89.95.** 1.5kW load.


## MFJ AC Line Filter

**MFJ-1164B, $89.95. Filters** AC line RFI, surges, noise, transients, hash 30 dB, 60-80 dB with ground. Four 15A/120 VAC outlets.

**MFJ Enterprises, Inc.** 300 Industrial Pk Rd, Starkville, MS 39759
**Phone:** (662) 323-5869 ■ **Tech Help:** (662) 323-0549 ■ **FAX:** (662) 323-6551 8-4:30 CST, Mon.-Fri.



MFJ_1026_101008_QST_092019DS

TIMEWAVE TECHNOLOGY INC.

Available at:
- HRO
- Universal Radio
- R&L Electronics


# Navigator

## The Premier Sound Card Modem!

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

- Quiet - hear what others miss!
- Proven USB Sound Card built-in
- Precise FSK
- Genuine K1EL Winkeyer CW IC
- Complete - Six FTDI COM ports
- Universal Rig Control for every radio
- Works well with HRD, M110A, Fldigi, FT8 & many more software programs
- Front-Panel Audio & CW controls
- USB connected and powered
- Convenient - No annoying jumpers!


## PK-232SC+

### Multimode Data Controller*

- RTTY
- Packet
- Pactor
- CW
- PSK31 & all the Sound Card modes!

**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.**

*100,000 sold - All-time top selling data controller!*

- Single USB connection to computer
- USB Sound Card built-in
- 3-Way Rig Control built-in - logic level, RS-232 & USB!
- Computer isolated from radio
- Real FSK & AFSK
- keyboard CW - send and receive
- Dual Port - two radios at same time!


### ANC-4 Antenna Noise Canceller *See & hear a demo on YouTube!*

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


### PK-96/100 USB Packet TNC

**1200/9600 bps AX.25 Packet**
Available with USB or RS-232 connection

### HamLinkUSB™ USB-to-RS-232 Adapter

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

### HamLinkUSB™ Rig Control+

C-IV, CAT, RTS (PTT, FSK or CW) for sound card software
*Perfect for HRD owners with simple sound card adapters*

**Timewave Technology Inc.**
**360 Larpenteur Ave. W., Suite 100**
**St. Paul, MN 55113 USA**

**www.timewave.com**
**sales@timewave.com**

**651-489-5080**
**Fax 651-489-5066**

# MFJ SDR T/R Protection Switch

***Turn your SDR into a panadapter to see entire bands on frequency/waterfall displays...***

**New!**


***An inexpensive wide-band SDR dongle receiver lets you see entire bands on frequency/waterfall computer displays!***

**MFJ-1708B-SDR**
**$119.95**

**If** you want to know where the activity is, who's generating splatter, what's in the DX window, how wide your audio is or what frequencies are clear, it's all right there! While receiving on your transceiver, MFJ-1708B-SDR switches your SDR to your antenna showing the entire band. On transmit your SDR is switched out and grounded to protect your SDR. PTT and a failsafe RF sense switches MFJ-1708B-SDR. For HF/VHF/UHF. Monitor multiple bands with multiple SDRs and a multi-coupler.

**MFJ-1708B-SDR-S, $129.95.** SMA connector for your SDR.

**MFJ-1708SDR, $99.95.** Original model for HF/VHF.

***New B series improvements...***
The original MFJ-1708 series used one relay and wires to connect the SO-239s. The new B-series uses four relays and connectors on a *single* pc board. This gives you > 50 dB isolation at 300 MHz and > 68 dB at 50 MHz. SWR < 1.16:1 at 50 MHz and < 1.75:1 at 450 MHz at the transmit port. Mute output is a selectable short or open to ground. Use "boat anchors" or modern receivers or key a linear amplifier. Receiver input protection prevents overload from nearby high power signals and from receive to transmit. A hybrid splitter on SDR models reduces loading effect and gives > 15 dB isolation between the SDR REC and XCVR ports to reduce interference. The original MFJ-1708 series is still available.

## MFJ Low Noise VLF/HF Receiving Loop

***Pull weak signals out of static crashes, atmospheric, man-made and power line noise!***

**Hear** signals 500 KHz to 30 MHz cleaner, quieter than ever before! Power line noise disappears. Rotate its figure 8 pattern and its extremely deep null to completely eliminate an interfering signal or greatly peak a desired one. Fully protected state of-the-art Gali MMICs in push-pull gives you a preamp with extremely high dynamic range, low IMD and 25 dB of low noise gain. Excellent performance on strong and weak signals without overload. 36-inch dia. loop. 1-in. OD 6061 aluminum.


## MFJ *wideband* SDR *Discone* Antenna

***Receives 25-1300 MHz***

**MFJ** ultra wide-band *Discone* Antenna receives 25-1300 MHz. Perfect for all band SDR reception. Covers 10, 6, 2 Meters, 220 and 440 MHz and 33/23 CM ham bands and everything in between. It is excellent for monitoring multiple bands simultaneously using multiple SDRs and a multi-coupler. Also test any transmitter 50-1300 MHz using a single discone and single coax. Handles 200W. Includes 50 feet coax, stainless steel elements and mounting hardware.

**MFJ-1866, $59.95.** Like MFJ-1868 but transmits 144-1290 MHz. Coax and mounting hardware not included.


## Tuned Indoor SDR Active Antenna

**MFJ-1020C**
**$119.95**

Make your SDR receiver come alive with HF signals, .3-40 MHz, while rejecting interference with MFJ-1020C *tuneable* indoor active antenna! Gain control, telescoping whip.

## Untuned Indoor SDR Active Antenna

**MFJ-1022, $79.95.** Hear weak, noisy VLF to UHF signals. Noise-less feedback gives excellent low noise reception. Handles strong signals.

## Active Outdoor Antenna

**MFJ-1024**
**$179.95**

***World Radio TV Handbook*** says "MFJ-1024 is a *first rate, easy-to-operate active antenna, quiet, excellent dynamic range, good gain, very low noise factor, broad frequency coverage, excellent choice...*" **Outdoor** mounted 54-inch whip/pre-amp gives maximum signal and minimum noise. Covers .05-30 MHz. **Indoor** unit: 20 dB attenuator, gain control, 2 receiver and 2 antenna switches.

## HF SDR Preselector

**MFJ-1040C**
**$139.95**

**Tuneable** MFJ-1040C lets you copy weak, noisy SDR signals from 1.8 to 54 MHz. Greatly tunes out and reject out-of-band interference. Up to 20 dB gain. Has gain control. Cascode FET/bipolar transistor gives low noise, high gain without overloading. Switches for 2 antennas and 2 receivers. SO-239s. Has 20 dB attenuator. Automatically bypasses when transmitting or use PTT. 6½W x 2½H x 4D inches.

## MFJ LW/MW/SW SDR Preselector/Tuner

**MFJ-956**
**$79.95**

**Highly** rated series-tuned MFJ-956 boosts your desired signals while greatly rejecting interference and preventing serious overload. **Greatly** improves reception 0.15 to 30 MHz. Incredibly effective below 2 MHz. **Super** easy to operate, select band and tune! **Bypass** tuner and ground receiver switch positions. **Compact** 2 x 3 x 4 inches. SO-239 connectors.

## MFJ RF Sense Transmit/Receive Switch

**MFJ-1708B, $119.95.**

**Switches** your antenna from receiver to transmitter using a relay. Shorts your receiver to ground during transmit. Use RF sensing with adjustable delay or PTT line. Has selectable open/short mute.

## Auto switch XCVR between 2 antennas

**MFJ-1707B, $119.95.**

**Switches** switches separate transmit and receive antennas on transceivers with only one antenna port. *Example*: Efficient 75M dipole for XMIT and MFJ-1708B low noise MFJ loop for receive -- *no static crashes*!

**MFJ Enterprises, Inc.** 300 Industrial Pk Rd, Starkville, MS 39759
**Phone:** (662) 323-5869 ■ **Tech Help:** (662) 323-0549 ■ **FAX:** (662) 323-6551 8-4:30 CST, Mon.-Fri.



MFJ_1708B-SDR_032818_100819DS

# Build professional-grade projects to use in your shack every day!

NEW!

## Microcontroller Projects for Amateur Radio

By Jack Purdum, W8TEE, and Albert Peter, AC8GY

All the information you need to build fascinating projects using the Arduino, STM32 ("Blue Pill"), ESP32, and Teensy 4.0 micro-controllers.


**Unfamiliar with C or C++ programming?** No problem. *Microcontroller Projects for Amateur Radio* provides all the introduction you need to build projects such as a programmable power supply, a signal generator, a DSP mic processor, and more!

### Some of the practical hands-on projects featured:

- The Morse Code Tutor - learn and practice sending and receiving methods, with or without Farnworth encoding.
- The CW Messenger allows you to send up to 50 "canned" CW messages, that are completely changeable in the field without a PC.
- The Mini Dummy Load is small enough to fit in a shirt pocket, can handle up to 30W, includes an OLED display that shows RF power, yet can be built for around $20!
- The Double-Double Magnetic Loop antenna sets a new standard for small (3' diameter), multi-band operation and includes remote tuning.

---

ARRL Item No. 1281
**Member Price**
**Only $34.95**
Retail $39.95

**www.arrl.org/shop**

ARRL
the national association for amateur radio®

**MFJ...the World Leader in Ham Radio Accessories!**

# MFJ-1234 . . . Remotely operate your transceiver from anywhere in the world!

Apple iPhone connected to RigPi Station Server from anywhere via the Internet

*RigPi trademarked, Howard Nurse, W6HN. Raspberry Pi is a trademark of the Raspberry Pi Foundation.*

*https://www.mfjenterprises.com/Product.php?productid=MFJ-1234*

MFJ-1234

**$319.95**

**Use** nearly any transceiver with CAT control, old or new.
**Operate** all modes SSB, CW, FM, digital. WSJT-X, Fldigi are installed.
**Control** from anywhere via the internet using any browser -- radio, rotor, CW keying, VoIP, digital modes, logging, spot monitoring, callbook lookups, more.
**Look-up** calls using included FCC database or optional QRZ subscription.
**Monitor** DX spots for unworked or unconfirmed calls.
**Design**, maintain multiple logs. Upload ADIF logs to ARRL LoTW server.
**Send** CW from a mobile device, keyboard or paddle.
**32** programmable macros.
**Two** or more hams from different locations can operate different radios at the same time using one MFJ-1234.

***Remotely operate your station! Use any web browser on your mobile phone, iPad, tablet, laptop, desk-top even a Kindle!***

**Single-click** updating, I/Q Input for SDR radios, onboard VoIP server gives outstanding 2-way audio.
**Includes** email, word processing, spreadsheet programs, 1000's of Linux programs, including many for ham radio. Modify, program RigPi Station Server features using a text editor.

### HARDWARE

**RSS** is a Raspberry PiTM computer running Linux and RigPi Keyer and Audio boards. RigPi Keyer uses K1EL WinKeyer3 integrated circuit for keyboard/paddle input. RigPi Audio is used for VoIP for remote, digital modes and I/Q spectral display (Panadaptor).

### RADIO/ROTOR SOFTWARE

RSS radio/rotor control uses Hamlib, a library of over 200 radios, 30 rotors. **MFJ-1305RP, $24.95**. 5V, 3A Pwr Supl.
**MFJ-1234SD, $49.95**. RigPi operating system on SD card.

### TECH HELP

- RigPi forum is *https://rigpi.groups.io*
- RigPi website is *https://rigpi.net*

# MFJ CW *Reader and Keyer* Combination

**Plug MFJ's** CW Reader with Keyer into your transceiver's phone jack and key jack.

**Now you're ready** to compete with the world's best hi-speed CW operators – *and they won't even know you're still learning the code!* Sends and reads 5-99 WPM.

**Automatic speed** tracking. Large 2-line LCD shows send/receive messages. Use paddle or computer keyboard.

**Easy menu operation.** Front panel speed, volume controls. 4 message memories, type ahead buffer, read again buffer, adjustable weight/sidetone, speaker. RFI proof.

**MFJ-551, $29.95.** RFI suppressed keyboard, a must to avoid RFI problems.

**MFJ-464**
**$239.95**
(Keyboard, Paddle Not Included.)


## MFJ Pocket-Size *CW Reader*™ and *Code Tutor*

**MFJ-461, $109.95**. Place this tiny pocket size MFJ Morse Code Reader near your receiver's speaker and watch CW turn into solid text messages as they scroll across an easy-to-read LCD. No cables to hook-up, no computer, no interface, nothing else needed! Practice by copying along with the MFJ-461. Learn the code and increase your speed as you instantly see if you're right or wrong. Eavesdrop on interesting Morse QSOs from hams all over the world MFJ's *AutoTrak*™ automatically locks on, tracks and displays CW to 99 WPM. Serial port lets you display full screen CW text on your computer monitor with your computer and terminal program. Tiny 21/4x31/4x1", 51/2 oz. Fits in your shirt pocket, take it anywhere. Use 9 Volt battery.

**MFJ-418, $109.95.**
**Morse Code Tutor.** Learn Morse code anywhere! Copy letters, numbers, prosigns or any combina tion or words or QSOs. ARRL/VEC format. Go from zero code speed to a high speed *CW Pro*! High contrast LCD, built-in speaker.

### *Plug & Play* FT-8 and all Digital Modes!


**MFJ-1204, $119.95.**
*Plug&Play* all digital modes! Specify your radio when ordering and just plug USB cable into your computer. Download free software from internet and operate: FT-8, JT4, JT-65, JT6M, FSK441, WSPR, PSK-31, EchoLink, APRS, CW, RTTY, packet, Amtor, more. Easy-to-set transmit/receive levels. Transformer isolated audio, PTT sensing eliminates adjustments. Universal, never obsolete.

### MFJ-407E Deluxe CW Keyer $119.95

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

### MFJ-557 Code Oscillator/Key $49.95

**Practice sending** Morse code. Telegraph key, code oscillator, speaker on heavy non-skid steel base. Volume/tone controls. Use 9V battery.
**MFJ-550, $19.95.** Key only.

### MFJ-561 Tiny Iambic paddle $34.95

**Tiny *Iambic paddle*** is just 1 3/4W x 3/4H x 1 3/4D", just 2 1/2 oz. Precision paddle formed from phosphorous bronze, rugged metal base, non-skid rubber feet, wired.

### MFJ-401E *Econo* CW Keyer $94.95

**Front-panel** volume/speed controls (8-50 wpm), tune switch. Internally adjust weight/tone. Solid state keying. Tiny 4 x 2 x 3 1/2 inches.

### MFJ-564 Iambic Paddles $109.95

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

### MFJ-422E Keyer/Paddle $229.95

**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.

**MFJ Enterprises, Inc.** 300 Industrial Pk Rd, Starkville, MS 39759
**Phone:** (662) 323-5869 ■ **Tech Help:** (662) 323-0549 ■ **FAX:** (662) 323-6551 8-4:30 CST, Mon.-Fri.

# 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, $69.95.** 80-10M. 102 feet long.
**MFJ-1778M, $59.95.** 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, $109.95.** 800 Watts.
**MFJ-1982MP, $79.95.** 300 Watts.
**MFJ-1982LP, $59.95.** 30 Watts.
***40-10 Meters, 66 feet:***
**MFJ-1984HP, $89.95.** 800 Watts.
**MFJ-1984MP, $69.95.** 300 Watts.
**MFJ-1984LP, $49.95.** 30 Watts.

### Off Center Fed Dipoles

**Lightweight**, virtually invisible. Gives you directivity and gain (*see MFJ website*).
**MFJ-2012, $89.95, 40/20/10/6 Meters, 1500 Watts. 67 ft.**
**MFJ-2010, $69.95. 40/20/10/6 Meters, 300 Watts. 67 ft.**
**MFJ-2014, $119.95. 75/40 Meters, 1500 Watts. 122 ft.**
**MFJ-2016, $149.95. 160/75/40 Meters, 1500 Watts. 240 ft.**
**MFJ-2013, $89.95. 60/30 Meters, 300 Watts. 86 ft.**

### *Dual Band* 80/40 or 40/20 Dipoles, 1.5 kW


**MFJ-17758, $109.95.** 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, $69.95.** 40/20M, 42 ft.

### MFJ All Band Doublet

**MFJ-1777, $79.95.**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, $39.95. 20-6M, 35 feet.**
**MFJ-1779B, $59.95. 80-40M,135 feet.**
**MFJ-1779A, $79.95. 160M, 265 feet.**

### 20M Extended Double Zepp

**MFJ-1742, $99.95.** 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

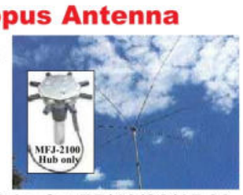
**MFJ-1748, $99.95.** 125 feet long, 100 foot ladder line included. 7-strand, 14-ga. wire. Use tuner/balun. 1500 Watts SSB/CW/Digital.

## MFJ Vertical Mounted Antennas

### MFJ 6-Band Cobweb Antenna

**MFJ-1836H, $299.95.** Six-bands: 20/17/15/12/10/6 Meters, 1.5 kW. *Perfect for restricted space*. Nearly invisible. 9x9x1/2 feet, 8 lbs. Outstand-ing performance! Horizontally polarized gives less noise, more gain over verticals. Omni-directional. No radials needed! Works great at low heights. Low SWR.
**MFJ-1836, $269.95.** 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, $289.95.** Includes 8 hamsticks for 75/40/20/15 M.
**MFJ-2100, $119.95.** 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, $339.95.** 6 bands: 40/20/15/10/6/2M, 12 feet.
**MFJ-1797, $369.95.** 7 bands:40/30/20/17/15/12/10M. 23 ft.
**MFJ-1797LP, $339.95.** Like MFJ-1797, but only 9 feet tall. Narrower bandwidth on 40 Meters.
**MFJ-1799, $449.95.**10 bands: 80/40/30/20/17/15/12/10/6/2M. 20 ft.
**MFJ-1799X, $399.95.** Like MFJ-1799, but less 80M.

### MFJ 43-foot Vertical, 160-6 Meter

**MFJ-2990,$399.95.** 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, $119.95.** 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, $209.95.** 7-55 MHz. *Full-size* 20-6 Meter dipole, 40M air loading coil. Two 17 ft. telescopic whips, 28" collapsed.

### MFJ-915, $39.95 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, $39.95 4:1 Balun

**True** 1:1 current balun/center insulator. High-permeability ferrite beads on RG-303 *Teflon*(R) coax. 2" dia.x6" long. 14 gauge 7-strand copper wire. 1.5 kW 1.8-30 MHz.

### MFJ-913, $39.95, 300W
### MFJ-919, $69.95, 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.

### Lightning surge protectors

**MFJ-270, $24.95.** 400W.
**MFJ-272, $39.95.** 1500W.
Gas discharge tube shunts 5000 amps peak.< 0.1 dB loss. 1 GHz. SO-239s.

### 2-Position Antenna Switch

**MFJ-1702C, $49.95.**
2-position antenna switch, lightning surge protection, center ground.

**MFJ Enterprises, Inc.** 300 Industrial Pk Rd, Starkville, MS 39759
**Phone:** (662) 323-5869 • **Tech Help:** (662) 323-0549 • **FAX:** (662) 323-6551 8-4:30 CST, Mon.-Fri.

# MFJ *Telescopic* Fiberglass Masts

**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, $99.95.** 33 ft., light duty w/top tie ring.
**MFJ-1911, $109.95.** 20 ft., light duty w/top tie ring.
**MFJ-1913, $109.95.** 28 ft., lightweight w/top tie ring.
**MFJ-1915, $159.95.** 25 ft., for heavier duty use.
**MFJ-1916, $179.95.** 34 ft., for heavier duty use.
**MFJ-1917, $189.95.** 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 50 ft. long, just 26 lbs.

### *Heavy Duty Models: All have QuickClamps*™ →

**MFJ-1908HD, $289.95** is 48 ext., 7.75-ft. collapsed, has 2 1/2" OD bottom, 1" OD top, seven 7.75-ft. sections, 24 lbs.
**MFJ-1906HD, $249.95** is 38' extended, 6 feet collapsed, has 2 1/2" OD bottom, 1" OD top, seven 6-foot sections, 24 lbs.
**MFJ-1904HD, $179.95** is 25' extended, 4 feet collapsed, has 2 1/2" OD bottom, 1" OD top, seven 4-foot sections, 14 lbs.
**MFJ-1904H, $159.95.** 22' ext., 5' collapsed, 9 lbs. 2 1/2" OD.
**MFJ-1902H, $139.95,** 10' ext., 38" collapsed, 5 lbs. 2 1/2" OD

### *Standard Models: H models have QuickClamps*™

**MFJ-1906, $159.95/MFJ-1906H, $219.95**, 33 feet, ext., 6 ft. collapsed, six 6-ft. sections, 13 lbs. 2" bottom, 3/4" top OD.
**MFJ-1908, $199.95/MFJ-1908H, $259.95**, 41' ext., 7.75 ft. collapsed, six 7.75-ft. sect., 16 lbs. 2" bottom, 3/4" top OD.

### *Mast Accessories*

**MFJ-1900, $79.95.** Mount clamps mast to mounting pipe.
**MFJ-13S, $69.95.** 5 Military *QuickClamps*™. Fit 3/4" to 2" OD.
**MFJ-13HD, $69.95.** Extra set clamps, 1- 2 1/2" masts.

### *Mast Guy Ring Sets*

**Fits** masts 3/4" to 1 1/4" dia OD. **MFJ-2830X, $9.95,** *fiberglass*; **MFJ-2840X, $12.95**, *aluminum*.

**Left:** *Stainless Steel Hose Clamps* recommended for permanent installations. Fiberglass is slotted.

**Right:** UV protected Military grade *QuickClamps*. Guy 2 levels when fully extended.

## *18' Telescopic Mast & Tripod*

**MFJ-1919EX, $179.95.**
***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, $109.95.**
**MFJ-1918** tripod has super strong 9.5 foot telescoping fiberglass mast. 3.8 feet collapsed. *QuickClamps*™. Thick 1/8 inch wall, .75" top, 1" bottom diameters. 6.5 lbs.

### Tripods Only

**MFJ-1921, $199.95,** Giant tripod base spreads to 8 feet! Supports massive antennas. Adjustable length non-skid legs accommodates uneven ground surfaces. Optional foot anchors **MFJ-1905, $34.95**, see **Tripod Anchors** bottom right. 5.75Hx7D feet collapsed. 14 lbs.
**MFJ-1919, $109.95,** *Large tripod* base spreads to 4.8 feet. Supports 100 pounds. 7.8 feet, 1.4 inch diameter mast. 4.5H x .5D feet collapsed. 9.75 lbs.
**MFJ-1918, $69.95,** Smaller tripod base spreads to 2.75 ft. Support 66 lbs. 6 foot, 1" dia. mast. 3.2H x .3D ft. collapsed. 6.75 lbs.

## 80-6 Meter Antenna

**3.8 foot** fiberglass mast telescopes to a 31 foot self-supporting high performance 80-6 Meter vertical antenna in minutes!

**MFJ-2980** **$115.95** 40-6 Meters

**MFJ-2982** **$169.95** 80-6 Meters

**Quarter** wave performance on 40 Meters, halfwave on 20M. High-Q air wound loading coil. Use antenna tuner for 30, 20, 15, 12, 10, 6 Meters. 600 Watts 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 *"HamStick"* Isolated Dipole

**Build** your own 80-6 Meter *mini*-dipole using two HF mobile whips! Only MFJ-347 mount *isolates* dipole elements and 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 mast up to 1 1/4" OD.

**MFJ-347** **$24.95**

### 3/8-24 Hamstick

**MFJ-342T** **$15.95**

Mount 3/8-24 HF/VHF hamsticks vertically or horizontally on masts up to 1 inch. Built-in SO239 connector.

## MFJ Balcony Mount

**MFJ-1907** **$49.95**

**Mount** *multiple* HF/VHF hamsticks, verticals, dipoles vertically and/or horizontally on your apartment/condo balcony. High-strength aircraft aluminum extends out 14". Two U-bolts mount up to 1 1/2" diameter.

## Tripod Anchors

Securely anchor tripod to ground with these 3 stainless steel foot braces and your stakes. For high winds, unlevel ground, tall antennas. Fits legs to 1 1/2"OD.

**MFJ-1905** **$34.95**

**MFJ Enterprises, Inc.** 300 Industrial Pk Rd, Starkville, MS 39759
**Phone:** (662) 323-5869 ■ **Tech Help:** (662) 323-0549 ■ **FAX:** (662) 323-6551 8-4:30 CST, Mon.-Fri.



MFJ_1910_021617_QST_092019DS

**Comet's primary tool for any antenna adjustment or diagnostic project...**

# CAA-500MarkII Antenna Analyzer

## 1.8-500MHz

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

***Functions:***
In addition to the display of antenna properties, SWR curves are plotted quickly, easily and accurately!

***Auto band-sweep function:***
Switch to the amateur band of choice and press "Sweep Center". The chosen band is swept and the SWR graphed in seconds!


***Manual band-sweep function:***
Select the band, select the center frequency, and select the bandwidth. Manually sweep the chosen frequency range and display the SWR graph.


***Multiple Manual Band-Sweeps***
*Manually graph the user defined bandwidth multiple times and see the results overlaid in 5 selectable colors! Make antenna length, position, height above ground, gamma match adjustments, etc…and graph each adjustment in seconds, in a new color, without losing the previous graph!*


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

***Features:***
Operates on 8-16VDC external power, 6 AA Alkaline or NiMH rechargeable cells • Trickle charger built in (only when using NiMH batteries) • Typical battery life: 9 hours of continuous operation • Battery level indicator • Selectable auto power-off time limit preserves battery capacity • SO-239 connector for 1.8-300MHz range • N-female connector for 300-500MHz range • Optional soft carry case sold separately: CAA-5SC

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

COMET®

**Free Catalog/Dealers/Manuals Online – Visit: www.mfjenterprises.com or call toll-free 800-647-1800**

**MFJ... the World Leader in Ham Radio Analyzers!**

# MFJ Analyzers

## MFJ-269D...280 KHz - 230 MHz plus 415-470 MHz plus 2200 Meters

**New and improved. Now covers 280 KHz to 230 MHz and 415 to 470 MHz plus 2200 Meters!**

**Instantly** gives you a complete picture of your antenna.

**Read** SWR, return loss, reflection coefficient, match efficiency at any frequency simultaneously.

**Read** Complex Impedance (280 KHz to 230 MHz plus 2200 Meters) 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 and velocity factor.

**Measure** SWR and loss of coax with *any* characteristic impedance (280 KHz to 230 MHz plus 2200 Meters) from 10 to over 600 Ohms.

**Measures** inductance in uH and capacitance in pF at RF frequencies, 280 KHz to 230 MHz plus 2200 Meters.

**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-bit A/D converters – *MFJ-269D exclusive!*

**Built-in** frequency counter, battery saver, low battery warning, Ni-Mh/NiCd charge circuit. 4W x 2D x 6¾ inches, 2 lbs. Use ten double A batteries or 110 VAC with **MFJ-1312D, $19.95**.

**New!**


**MFJ-269D**
**$419.95**

### MFJ-269DPRO™ Analyzer

**MFJ-269DPro, $459.95.** Like MFJ- 269D, but UHF range covers **430 to 520 MHz** to include commercial industrial frequencies. Rugged protective shell protects knobs, switches, meters, LCD for industrial/lab work.

**MFJ No Matter What™ Warranty**

Every MFJ Analyzer is protected by MFJ's famous one year **No Matter What**™ limited warranty. We will repair or replace your MFJ analyzer (at our option) for a full year.

## More hams use MFJ analyzers than all others in the world!

### MFJ-259D

**Now Covers 280 KHz-230 MHz plus 2200 Meters, World's most popular and improved analyzers**

**MFJ-259D**
**$319.95**

**New!**


**Super** easy-to-use – Read antenna SWR, complex impedance, return loss, reflection coefficient. Determine velocity factor, coax cable loss in dB, length of coax and distance to short or open in feet. Read inductance in uH, capacitance in pF at RF frequencies. Large easy-to-see two line LCD screen and side-by-side meters clearly display your information. Built-in frequency counter, signal generator, Ni-Cad charger circuit, battery saver, low battery warning and smooth reduction drive tuning. More!

### MFJ-223

**1-60 MHz Color Graphic VNA Analyzer**

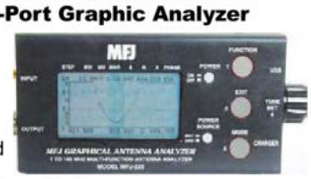
**MFJ-223**
**$319.95**

**This** *pocket-sized* wonder breaks the mold for analyzer design with user-friendly convenience, top notch accuracy, and a vivid TFT multi-color display. Don't let the size fool you, MFJ-223 is packed with all the VNA features and performance you need!

- **Single-frequency** and *swept-frequency* operating modes
- **Truly accurate** SWR, R, X, and Z measurements
- **Seamless DDS** coverage with 280-Hz resolution from 1-60 MHz
- **Smooth "skip-free"** encoder tunes fast or slow without missing a step
- **Powerful +5-dBm** stimulus generator overrides local interference
- **Field-strength meter** measures local signals, detects potential interference
- **DDS generator** precision signal source
- **Vivid 1600-pixel/inch** color graphics on a 2x2 inch non-glare TFT screen

### MFJ-225

**1.5-180MHz continuous Two-Port Graphic Analyzer**




**Out** in the field, MFJ-225 is a compact completely self-contained handheld graphing analyzer. On the bench it becomes a full-fledged two-port (S21) desktop machine when teamed up with your PC. Using powerful IG-miniVNA freeware, you'll run detailed data analysis and print out stunning color-graphic plots to document your work! Built-in back-lighted 3-inch LCD graphic display. Make fine adjustments using full-screen easy-to-view SWR bargraph, capture vivid swept displays for SWR, impedance, return loss, phase angle, more. DDS generator.

**MFJ-225**
**$339.95**

### MFJ-249D Analyzer

**MFJ-249D, $279.95**

If digital display is all you need MFJ-249D does everything MFJ-259D does without analog meters.

**Visit: www.mfjenterprises.com or call toll-free 800-647-1800**

### MFJ VNA Antenna Analyzer

***MFJ VNA Antenna Analyzer covers 1 to 230 MHz, 1Hz resolution.***

- ***Frequency sweep plots:*** *SWR, Impedance, Resistance, Reactance, Phase Angle, Complex Return Loss, Smith Chart*
- ***Sign of reactance*** positively identifies inductive or capacitive reactance
- ***Amazing accuracy with OSL (Open-Short-Load) calibration*** – calibrate through feedline/test cable at different frequencies and store in memory. Measure directly or through feedline with exceptional accuracy, correcting for line loss/phase angle. ***Smith Chart*** plots S11 magnitude/phase over any frequency span. ***Capture screens*** in 32 memories to download to PC via USB.

**MFJ-226**
**$379.95**

### MFJ SWR Analyzer Accessories


A. **MFJ-29D/MFJ-39D, $39.95.** Carrying Pouch for MFJ-259D/269D.

B. **MFJ-92AA10, $39.95.** 10-Pack 2500 mAh Ni-MH Supercells.

C. **MFJ-66D, $39.95.** Dip coils, set of two covers 1.8-230 MHz.

D. **MFJ-731, $109.95.** Tunable Analyzer Filter, 1.8-30 MHz, for strong RF fields.

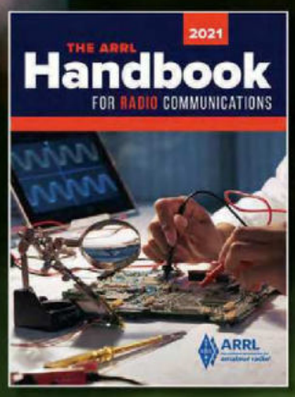
E. **MFJ-917, $39.95.** 1:1 Current balun for SWR Analyzers to test balanced line antennas, other loads.

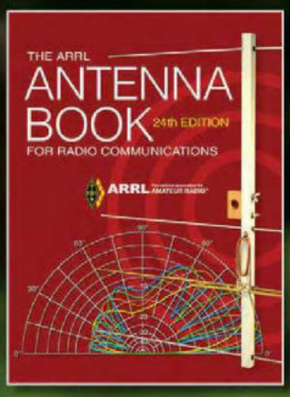
F. **MFJ-5510D, $15.95.** 12VDC cigarette lighter adapter.

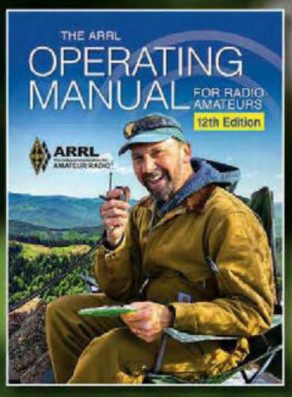
G. **MFJ-7737, $9.95.** PL-259 to BNC Female.

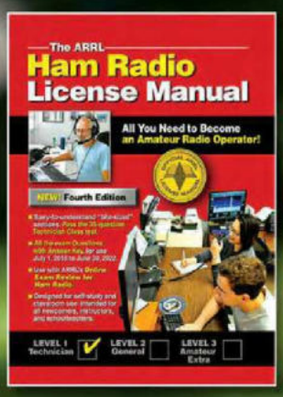
H. **MFJ-7727, $9.95.** PL-259 to SMA Female.

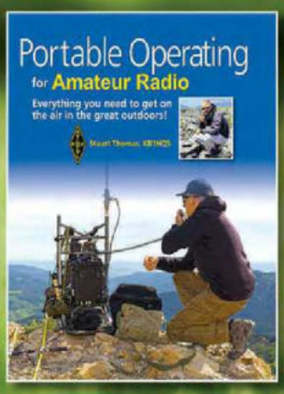

**MFJ Enterprises, Inc.** 300 Industrial Pk Rd, Starkville, MS 39759
**Phone:** (662) 323-5869 ■ **Tech Help:** (662) 323-0549 ■ **FAX:** (662) 323-6551 8-4:30 CST, Mon.-Fri.



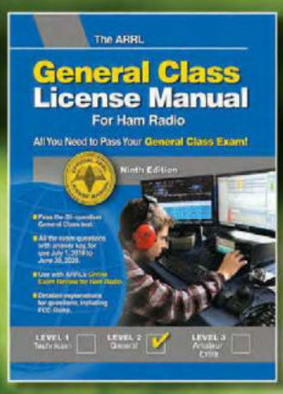



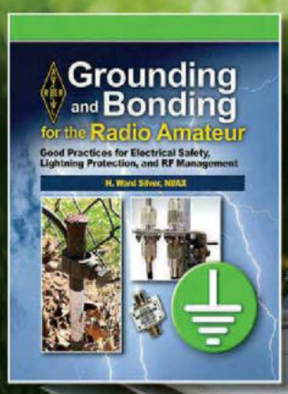




# Stay in the Know

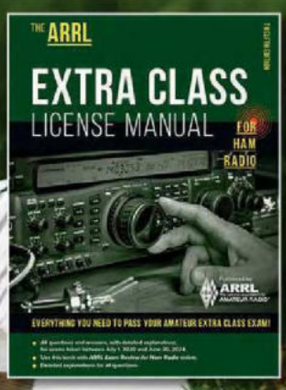
## ARRL Publications and Journals

## www.arrl.org/shop




ARRL the national association for amateur radio®







# 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**
**$869.95**

**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 firmware. Requires 12-15 VDC at 1.4 Amps maximum or 110 VAC with optional **MFJ-1316, $29.95**. Weighs 9.5 lbs. $13\frac{1}{4}$W x $6\frac{3}{4}$H x $17\frac{1}{2}$D inches.

## 600W Remote IntelliTuner™

**MFJ-994BRT** – perfect for 600 Watt SSB/CW amplifiers like Ameritron's AL-811/ ALS-600/ALS-500M. Matches 12-800 Ohms. Coax/wire antennas, 1.8-30 MHz. Fully weather-sealed for outdoor use. Remotely powered through coax. Tough, durable, built-to-last cabinet, $9\frac{1}{4}$W x 3H x $14\frac{1}{4}$D inches, 4 lbs. Includes MFJ-4117 BiasTee Power Injector.

**MFJ-994BRT**
**$459.95**

## 200W Remote IntelliTuner™

**MFJ-926B**, 200 Watts SSB/CW/Digital, 6-1600 Ohms, Coax/wire antennas, 1.8-30 MHz. Includes BiasTee.

**MFJ-926B $329.95**

## 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 $9\frac{1}{4}$W x 3H x $14\frac{1}{4}$D inches. Weighs just 4 pounds. Includes MFJ-4117 BiasTee Power Injector.

**MFJ-993BRT**
**$339.95**

## MFJ No Matter What™ Warranty

One year **No Matter What**™ Warranty
30 Day Money Back Guarentee
(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 it 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**

**MFJ Enterprises, Inc.** 300 Industrial Pk Rd, Starkville, MS 39759
**Phone:** (662) 323-5869 ■ **Tech Help:** (662) 323-0549 ■ **FAX:** (662) 323-6551 8-4:30 CST, Mon.-Fri.

# Quicksilver Radio

## In these tough times, we're here to help you with Quality, Service & Value!

## WHY CRIMP?

- ✓ Solid mechanical & electrical connection
- ✓ No melted dielectric
- ✓ Connect all the braid, not just a few strands
- ✓ High reliability
- ✓ More info on our website

## Antenna Gear

## Ultimate Crimp Kit™

## Soldering Tools

## Connectors & Adapters

## Crimp-Ons

Excellent quality, no bargain basement stuff here. Adapters & connectors for most types of connections.

## FREE SHIPPING

on all orders over $73.00 to any United States address.

## HAMMO-CAN™ Go Box

Ready to go, a complete VHF-UHF station in a box. Get them with or without radios installed. Fits most FM mobiles & several HF radios, too.

## USA Made Coax

Premium Bury Flex, USA-400 & USA-240 coax jumpers with your choice of UHF, Type N, BNC, SMA, TNC & Mini-UHF Connectors.

**New Item!! HybridDX™ HF antenna. Get on 80M in less than 80 ft.**

## www.qsradio.com

# MFJ Tuners

## New, Improved MFJ-989D 1500 Watt legal limit Antenna Tuner

**World's most popular 1500 Watt Legal Limit Tuner just got better -- much better -- gives you more for your money!**

**New,** improved MFJ-989D legal limit antenna tuner gives you better efficiency, lower losses and a new true peak reading meter. It easily handles full 1500 Watts SSB/CW, 1.8 to 30 MHz, including MARS/WARC bands.

**New,** dual 500 pF air variable capacitors give you twice the capacitance for more efficient operation on 160 and 80 Meters.

**New,** improved AirCore™ Roller Inductor gives you lower losses, higher Q and handles more power more efficiently.

**New,** TrueActive™ peak reading Cross-Needle SWR/Wattmeter lets you read true peak power on all modes.


**MFJ-989D $469.95**

**Includes** six position ceramic antenna switch, 50 Ohm dummy load, indestructible multi-color Lexan front panel with detailed logging scales and legends.

**The** MFJ-989D uses the superb time-tested T-Network. It has the widest matching range and is the easiest to use of all matching networks. Now with MFJ's new 500 pF air variable capacitors and new low loss roller inductor, it easily handles higher power much more efficiently.

**New,** high voltage current balun lets you tune balanced lines at high power with no worries.

**New,** crank knob lets you reset your roller inductor quickly, smoothly and accurately.

**New,** larger 2-inch diameter capacitor knobs with easy-to-see dials make tuning much easier.

**New,** cabinet maintains components' high-Q. Generous air vents keep components cool. $12^{7}/_{8}$W x 6H x $11^{5}/_{8}$D inches.

**No Matter What™ Warranty**

**Every** MFJ tuner is protected by MFJ's famous one year **No Matter What™** limited warranty. We will repair or replace your MFJ tuner (at our option) for a full year.

## More hams use MFJ tuners than all other tuners in the world!

### MFJ-986 Two knob Differential-T™

**MFJ-986 $419.95**

**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. 15W x $4^{1}/_{2}$H x $10^{3}/_{4}$D in.

### MFJ-962D compact kW Tuner

**MFJ-962D $359.95**

**A few** more dollars steps you up to a KW tuner for an amp later. Handles 1.5 kW PEP SSB amplifier input power (800W output). Ideal for Ameritron's AL-811H! AirCore™ roller inductor, gear-driven turns counter, pk/avg lighted Cross-Needle SWR/Wattmeter, antenna switch, balun, Lexan front, 1.8-30MHz. $10^{7}/_{8}$W x $10^{3}/_{4}$H x $4^{1}/_{2}$D in.

### MFJ-969 300W Roller Inductor Tuner

**MFJ-969 $259.95**

**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. $10^{1}/_{2}$W x $3^{1}/_{2}$H x $9^{1}/_{2}$D inches.

### MFJ-949E deluxe 300 Watt Tuner

**MFJ-949E $219.95**

**More** hams use MFJ-949s than any other antenna tuner in the world! Handles 300 Watts Full 1.8 to 30 MHz coverage, custom inductor switch, 1000 Volt tuning capacitors, full size peak/average lighted Cross-Needle SWR/Wattmeter, 8 position antenna switch, dummy load, QRM-Free PreTune™, scratch proof Lexan front panel. $10^{5}/_{8}$W x $3^{1}/_{2}$H x 7D inches. **MFJ-948, $179.95.** Economy version of MFJ-949E, less dummy load, Lexan front panel.

### MFJ-941E Super Value Tuner

**MFJ-941E $169.95**

**Most** for your money! 300 Watts PEP, 1.8-30 MHZ, lighted Cross-Needle SWR/Wattmeter, 8 position antenna switch, 4:1 balun, 1000 volt capacitors, Lexan front panel. $10^{1}/_{2}$W x $2^{1}/_{2}$H x 7D in. **MFJ-941EK, $139.95.** Tuner Kit -- Build your own!

### MFJ-945E HF/6M mobile Tuner

**MFJ-945E $159.95**

**Extends** your mobile antenna bandwidth so you don't have to stop, go outside and adjust your antenna. Tiny 8W x 2H x 6D in. Lighted Cross-Needle SWR/Wattmeter. Lamp and bypass switches. Covers 1.8-30 MHz and 6 Meters. 300 Watts PEP. **MFJ-20, $9.95**, mobile mount.

### MFJ-971 portable/QRP Tuner

**MFJ-971 $149.95**

**Tunes** coax, balanced lines, random wire 1.8-30 MHz. Cross-Needle Meter. SWR, 30/300 or 6 Watt QRP ranges. Matches popular MFJ transceivers. Tiny $6^{1}/_{2}$W x $2^{1}/_{2}$H x 6D in.

### MFJ-901B smallest Versa Tuner

**MFJ-901B $119.95**

**MFJ's** smallest (5W x 2H x 6D 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

**MFJ-902B $129.95**

**Tiny** $4^{1}/_{2}$W x $2^{1}/_{4}$H x 3D inches, full 150 Watts, 80-6 Meters, has tuner bypass switch, for coax/random wire. **MFJ-904H, $169.95**. Same but adds Cross-needle SWR/Wattmeter and 4:1 balun for balanced lines. $7^{1}/_{4}$W x $2^{3}/_{4}$H x $2^{3}/_{4}$D inches.

### MFJ-16010 random wire Tuner

**MFJ-16010 $79.95**

**Operate** all bands anywhere with MFJ's reversible L-network. Turns random wire into powerful transmitting antenna. 1.8-30 MHz. 200 Watts PEP. Tiny 4W x 2H x 3D in.

### MFJ-9201 QRPocket™ Tuner

**MFJ-9201 $54.95**

80-10 Meters, 25 Watts. 12 position inductor, tune/bypass switch, wide-range T-network, BNCs. 4W x $2^{5}/_{8}$H x $1^{1}/_{2}$D inches. **MFJ-9201, $49.95**

### MFJ-921/924 VHF/UHF Tuners

**MFJ-921/924 $109.95**

**MFJ-921** covers 2 Meters/220 MHz. **MFJ-924** covers 440 MHz. SWR/Wattmeter. 8W x $2^{1}/_{2}$H x 3D in.

### MFJ-931 Artificial RF Ground

**MFJ-931 $129.95**

**Eliminates** RF hot spots, RF feedback, TVI/RFI, weak signals caused by poor RF grounding. Creates artificial RF ground or electrically places far away RF ground directly at rig. **MFJ-934, $249.95**, Artificial ground/300 Watt Tuner/Cross-Needle SWR/Wattmeter.

**MFJ Enterprises, Inc.** 300 Industrial Pk Rd, Starkville, MS 39759
**Phone:** (662) 323-5869 ■ **Tech Help:** (662) 323-0549 ■ **FAX:** (662) 323-6551 8-4:30 CST, Mon.-Fri.



MFJ_989D_MFJ-986_100708_QST_092019DS

# 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 2¼ x 2¼ x 7 inches. **MFJ-260CN, $59.95.** With type "N" connector.

**MFJ-260C**
**$49.95**

### *Dry 1.5 kW HF/VHF/UHF* Dummy Load

***Ham radio's most versatile*** 1.5 kW 50 ohm *dry* dummy load covers DC through 650 MHz. SWR 1.1:1 to 30 MHz and 1.3:1 to 650 MHz. Handles 1500 Watts for ten seconds, 100 Watts for 10 minutes. 3W x 3H x 9D in. SO-239 connector. **MFJ-264N, $109.95.** With type "N" connector.

**MFJ-264**
**$89.95**

### *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. 7½H x 6⅝D in. **MFJ-250X, $69.95.** No transformer oil.

**MFJ-250**
**$79.95**

### 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. 15/8 inch round by 3 inches long. **MFJ-262B, $69.95.** PL-259. 35 Watts continuous, 200W for 5-seconds. SWR< 1.2;1 DC-1 GHz.

**MFJ-261**
**$34.95**
*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. 8¼W x 4H x 9½D in. SO-239s. 5 pounds.

**MFJ-265**
**$249.95**

### 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. 4½W x 2¼H x 6½D in. Optional 12 VDC/110 VAC adaptor, **MFJ-1312D, $19.95**.

**MFJ-251**
**$169.95**

### *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. 10¾W x 2¼H x 5¼D inches.

**MFJ-263**
**$139.95**

### *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**
**$179.95**

## 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*. 3¼W x 3¼H x 3¼D in. SO-239 connectors. **MFJ-842, $69.95.** 140-525 MHz, 15/150W.

**MFJ-822**
**$69.95**

### *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-by-pass alerts and protects your amplifier when SWR is high and toggles extra relay. 6½W x 2⅝H x 6D". **MFJ-826B, $199.95.** No meter, ampr bypass, control relay.

**MFJ-828**
**$269.95**

### *MFJ GrandMaster™ SWR/Wattmeters*

***GrandMaster***™ SWR/Power Meters are the *Cadillacs of ham radio!* Large 3¼ x 1¼ inch precision illuminated meter gives easy wide-angle viewing of SWR, forward or reflected power. 7½W x 3⅛H x 4¼D in. SO-239s. **MFJ-870, $89.95.** 1.6-60 MHz. 30/300/3000 Watt ranges. **MFJ-874, $129.95.** 1.8-525 MHz. 5/20/200 Watt ranges.

**MFJ-870**
**$89.95**

### 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, $19.95.** 7W x 5½H x 5D in. SO-239s.

**MFJ-868B**
**$179.95**

### 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. 4½W x 2¼H x 3D".

**MFJ-812B**
**$49.95**

### Compact Digital SWR/Wattmeters

**Displays** forward, refelected power, SWR (1.6-60 MHz) and battery *all in a single glance!* Large ½" forward power digits and 5/8" reflected/SWR digits! 0-200W. Power/backlight on/off. SO-239s. **MFJ-847, $114.95.** 125-525 MHz, 0-120W. **MFJ-849, $189.95.** Large 3.5" bright orange LCD displays SWR, forward/reflected power. 1.5-525 MHz, 200W, HF/VHF-UHF switch.

**MFJ-845**
**$114.95**

**MFJ-849**
**$189.95**

### 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. 4½W x 2¼ H x 3D in.

**MFJ-813**
**$49.95**

### VHF/UHF SWR/Wattmeter

**Lighted** Cross-Needle,SWR/Watts,144/220/440 MHz, 30/300W Forward power, 6/60W Reflected power.

**MFJ-862**
**$79.95**

**MFJ Enterprises, Inc.** 300 Industrial Pk Rd, Starkville, MS 39759
**Phone:** (662) 323-5869 ■ **Tech Help:** (662) 323-0549 ■ **FAX:** (662) 323-6551 8-4:30 CST, Mon.-Fri.



MFJ_260C_MFJ_868B_110618_QST_090619DS

# Ham Ads

**Please contact the Advertising Department at 860-594-0255 or hamads@arrl.org for further information or to submit your ad.**

**For information on placing a Classified Ad:**
**www.arrl.org/ham-ads-classified-rules-and-rates**

**Before considering a ham ad please read.**

**1.** Advertising must pertain to products and services which are related to Amateur Radio.

**2.** The Ham-Ad rate for commercial firms offering products or services for sale is $2.25 per word. Individuals selling or buying personal equipment: ARRL member 1.00 per word. Non-ARRL member $1.50 per word. **Bolding** is available for $2.50 a word. Prices subject to change without notice. You may pay by check payable to the ARRL and sent to: Ham-Ads, ARRL, 225 Main St., Newington, CT 06111. Or, you may pay by credit card sending the information by fax to 860-594-4285 or via e-mail to hamads@arrl.org. The credit card information we need is: the type of credit card, the exact name that appears on the credit card, the credit card number, the expiration date and the credit card billing address.

**3.** Remittance in full must accompany copy since Ham-Ads are not carried on our books. Each word, abbreviation, model number and group of numbers counts as one word. Entire telephone numbers count as one word. No charge for postal Zip code. No cash or contract discounts or agency commission will be allowed. Tear sheets or proofs of Ham-Ads cannot be supplied. Ads submitted in writing should be typed or printed clearly on an 8 1/2" X 11" sheet of paper.

**4. Closing date for Ham-Ads is the 15th of the second month preceding publication date. No cancellations or changes will be accepted after this closing date.** Example: Ads received December 16th through January 15th will appear in March *QST*. If the 15th falls on a weekend or holiday, the Ham-Ad deadline is the previous working day. Please contact the Advertising Department at 860-594-0255 or hamads@arrl.org for further information or to submit your ad.

**5.** No Ham-Ad may use more than 200 words. No advertiser may use more than three ads in one issue. Mention of lotteries, prize drawings, games of chance etc is not permitted in *QST* advertising.

**6.** New firms or individuals offering products or services for sale must check with us to determine if a production sample (which will be returned) should be submitted for examination. Dealers are exempted, unless the product is unknown to us. Check with us if you are in doubt. You must stand by and support all claims and specifications mentioned in your advertising.

The publisher of *QST* will vouch for the integrity of advertisers who are obviously commercial in character and for the grade or character of their products and services. Individual advertisers are not subject to scrutiny.

The American Radio Relay League does not discriminate in its advertising on the basis of race, color, religion, age, sex, sexual orientation, marital status or national origin. The League reserves the right to decline or discontinue advertising for any other reason.

7. AN IMPORTANT NOTICE TO ALL HAM AD POSTERS AND RESPONDERS, FROM THE ARRL ADVERTISING DEPARTMENT Greetings from ARRL HQ! Please note that we have received reports from many ARRL members who have placed classified ads in these listings, and have received responses from individuals proposing "creative" payment schemes. These particular instances involved offers of overpayments for goods by bank check, followed by instructions to deduct the cost of your item from the overpayment, and to transfer the overage back or to another individual. This is a well-known scam. Unfortunately, we have no control over this and other scams of this type. Once your email address is posted, you are vulnerable to those individuals seeking to provide you with questionable information.

*QST* Ham Ads on the Web
Updated Monthly!

**www.arrl.org/ham-ad-listing**

## Club/Hamfests/Nets

**CW INSTRUCTION** via internet video conference classes. VISIT longislandcwclub.org

FRIEND OF BILL W?? http://www.qsl.net/haam HF Net 12:30 Eastern Sat 14.290, Sun 14.340 Mon-Fri 14.316 QSO Net 11:30 Eastern 21:350

**MARCO** Medical Amateur Radio Council. Professionals enjoying ham radio. Free newsletter & info: secretary@marco-ltd.org

## Property/Vacation/Rentals

**A DX Apartment** available in VP9 with rigs and antennas. Email: ed@vp9ge.com for details.

COLORADO CHALET with ham gear for weekly rental, www.lostcreekcabin.com. WØLSD, Buena Vista, CO.

Hams Looking to purchase or sell real estate in Connecticut? Please contact Licensed Ham and Realtor, Claude Cousins, Sr. N1QAE, Berkshire Hathaway Home Services, claudecous@gmail.com, 860-989-2113

**IDAHO! is awesome!** Thinking of buying or selling? Contact Ron Bishop, W7IM. Keller Williams Realty Boise. 208-870-6075.

**MAINE** year round Ham Station. www.CottagebytheDam.com

Need a NEW QTH on Florida's east coast? Contact Greg Bowman, N4EN, Realtor Associate, Pioneer Properties USA, Melbourne FL. 321-305-9142

Operate N4USA in Virginia's high Blue Ridge Mountains www.n4usa.com

**SAINT KITTS "V4" CARIBBEAN DX RENTAL** See v47ja on qrz.com and/or email: w5jon@sbcglobal.net for full information. John W5JON/V47JA

**www.peidxlodge.com**

## Antique/Vintage/Classic

6 Meter legacy by K6EDX K6MIO. www.bobcoopertv.tv

ANTIQUE WIRELESS ASSOCIATION - the largest international organization for historic radio enthusiasts. Publishes the quarterly AWA Journal and annual AWA Review on all aspects of collecting and history of communications. AWA produces the famous annual AWA Convention and sponsors the world renowned Antique Wireless Museum. Only $35/year USA, $40/year elsewhere. Antique Wireless Association, PO Box 421, Bloomfield, NY 14469. Website: http://www.antiquewireless.org

Six Decades of Amateur Radio www.kk4ww.com

Vintage Radio, Ham Radio and Military Radio Repair. www.mcveyelectronics.com 845-561-8383

**WANTED PRE-1980 MICROCOMPUTERS** for historical Museum kk4ww

## QSLCards/Call Sign Novelties

Amateur License Certificates based on the commercial 1st class radio telephone license. Go to WWW.KB9AT.COM and click on the KB9AT store link.

**CALLSIGN NAME CARDS** Deputypatch.com

**CALLSIGN PLAQUES** www.HamPlaques.com

CallSign Stuff www.HamQRU.com KTØMMY

Engraving, **QSL's,** Memo's, Stamps, Plaques since 1962, Full Service Printing. Samples. WA2WAO@CornerPress.com www.CornerPress.com 425 286-5952

**Get Top Quality Full Color UV Coated QSL Cards** direct from the printer. Chester QSL Cards by Chester Press. Call 800-748-7089 for samples, email QSLinfo@chesterpressinc.com or visit the chesterpressinc.com/QSL website.

**WWW.THESIGNMAN.COM**
**RICK@THESIGNMAN.COM/225.757.1545**

## General

#1 AMATEUR CALLSIGN DVD! HamCall contains over 2,400,000 world-wide callsigns, 10,400,000 archive callsigns. Supported by most logging programs. Six FREE monthly internet updates and HamCall.net Gold online access included. Visa/MC/Discover 800-282-5628 http://hamcall.net

Amateur and High End Audio Equipment repair/test/calibration. Charles, AJ4UY - email:seecumulus@gmail.com

AMSAT - WHO DECIDES THE FUTURE OF AMATEUR RADIO IN SPACE? YOU DO! Since 1969 AMSAT has pioneered dozens of spacecraft that have brought operating enjoyment to thousands. Your membership in AMSAT will support exciting projects planned for launch in the years to come. In addition, you'll receive the bimonthly AMSAT Journal and substantial discounts on software distributed by AMSAT. Join now! From the US call toll free at (888) 322-6728. From all other locations call 1-301-822-4376. Or visit the AMSAT Web site at www.amsat.org AMSAT®, 10605 Concord St, #304 Kensington MD 20895, USA.

**ATTENTION YAESU-FT 102**18,000hrs, 25yrs, 800+ FT-102's Repaired. Have all parts. AM and Roofing Filters available. 25/hr, parts at cost. 954-961-2034 NC4L www.w8kvk.com/nc4l

CALL SIGN T-SHIRTS, COFFEE MUGS AND CAPS! See my store KA7UNW at www.etsy.com/shop/KA7UNW or just Google KA7UNW

Complete Ham Radio Antenna and Tower. 501-592-1940, Sammie.

**Custom LED Call Signs. www.ledboothsign.com 408-315-4573 Phone**

GAIN the EDGE with NARTE Certification – NARTE gives you the competitive edge with individual certification in Electromagnetic Compatibility, Electromagnetic Discharge Control and Telecommunications. Industry-recognized certification required or desired by more than 400 corporations nationwide. Call 1-800-89-NARTE or visit www.inarte.org. NARTE offers the premier EMC/EMI, ESD, Telecommunications and Wireless certification to professional technicians and engineers.

**Get the F.C.C. "Commercial" Radiotelephone License!** Fast, inexpensive home study course. Command Productions. **www.LicenseTraining.com** Free info: (800) 932-4268

Glen Martin Hazer Tower Trams & Roof Top Towers. Same Day Shipping. www.antennapartsoutlet.com

**HAM KITS** for sale at www.HecKits.com L/C Meter, SWR Bridge, ESR Meter, 2-Tone Gen, FET DIP Meter.

Help with International Goodwill www.n4usa.org

**ISOTRON ANTENNAS FOR 160 - 6 METERS!** Efficient, rugged and resonant. Please visit **WWW.ISOTRONANTENNAS.CO**M. wd0eja@isotronantennas.com 719/687-0650.

**KB6NU'S "NO NONSENSE" LICENSE STUDY GUIDES** have helped 1000's get their first license and upgrade to General or Extra. They can help you, too. KB6NU.COM/STUDY-GUIDES/

**LEARN CODE by Hypnosis, www.success-is-easy.com 561-302-7731**

**LED DESK SIGN** - www.Gifts4Hams.com

**MicroLog-By-WA0H** .. Easy to use logging program .. Free download .. **www.wa0h.com**

**NW9 ALLIANCE LLC - Adapters, coax, connectors, and Passive microwave components. NW9ALLIANCELLCCORPNW@GMAIL.COM**

**PRINTED CIRCUIT BOARDS** for projects shown in QST, QEX, HR, ARRL HB, 73 and more. Custom boards available. FAR Circuits, 18N640 Field Ct, Dundee, IL 60118; fax/phone 847-836-9148; www.farcircuits.net; mail@farcircuits.net

**RF CONNECTORS & GADGETS - Parts - Products and More! www.W5SWL.com**

**RF SUPERSTORE**
Connectors, Adapters, Antennas, Coaxial Cable and more!
High Quality, Low Cost, Ham Friendly
**WWW.RFSUPERSTORE.COM**

Rohn Tower, telescoping poles, tripods and antenna parts delivered to your door. **www.antennapartsoutlet.com**

**ROTARY FUNCTION SWITCH REPAIRS and rebuilding.** Small and large, late model and vintage types. Free estimates. **Joe, KC3JDL 215-801-4362**

Selling: Yaesu 857D Mobile $500.00, Yaesu VX7R-Handheld triband extra battery & antenna $500.00, Chimney mount 3324 Rotar Reach $125.00, Comet Duplexer CF530 $50.00, MFJ-2990 43' vertical w/foldover bracket $400.00 and Superstick Portable Antenna MP1B $125.00. Call 631-335-1105, KD2DGX

Soldering-desoldering-hand tools-ESD how can we help? www.technimark-inc.com and E-Bay store-ebay.com/str/technimarkinc

**Start to read fast CW in your head!** Begin to hear whole words sent in fast CW! Soon reading is easy! **https://www.hearcwwords.com**

**Tactical Portable Accessories** for Yaesu 817ND, 857D, 897D, 891, 991A, ICOM 7300, 7200, 7000, 706/703 and 9700. W0MSN www.portablezero.com

Xcellent **Amateur** and **Monitor Logging** from **DXtreme!** Click **www.dxtreme.com**

**MFJ...the World Leader in Ham Radio Accessories!**

# MFJ Mobile Antennas!

## Dual Band Mag Mount Antennas

### MFJ-1724B

**2-Meter/440 MHz**

MFJ-1724B **$34.95**

This antenna is perfect for your dual band mobile or HT. Powerful 3 1/2 inch magnet holds firm at highway speeds, rubber guard, 19" black stainless steel whip, low SWR, excellent gain, 300 Watts PEP, 12 feet coax with PL-259. Free BNC adapter.

MFJ-281 **$15.95**

### MFJ-281

**Clearest speech you ever heard!**

3" speaker, 8W, 8 Ohms, 6' cord, 3.5 mm plug.

### MFJ-1729

**Power*Gain™**

MFJ-1729 **$49.95**

Ham Radio's most powerful dual band antenna gives whopping gain on 440 MHz and 2-Meters! Low SWR. 27 1/2" stainless steel Slimline™ radiator minimizes wind vibration for less SWR flutter for longer range, better readability. 12' coax, PL-259, Heavy duty magnet mount.

### MFJ-1728B

**5/8 Wave 2/6 Meter Mobile**

MFJ-1728B **$34.95**

Full 50-inch 5/8 Wave gives you maximum possible gain of any single element antenna on 2-Meters. On 6-Meter "magic band" you get a powerful signal with its high-performance low SWR full 1/4 Wave. 300 Watts PEP, heavy duty magnet, 12 feet coax, stainless steel radiator.

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

### MFJ 5-inch Magnet

**Best Seller!**

These jetblack 5-inch super strong magnet mounts have 17' coaxial line terminated with PL-259 connectors. SO-239 (BS) or NMO (BM) for your VHF/UHF antennas or 3/8-24 threaded (BT) for your HF hamstick antennas with a 3/8-24 threaded connector.

**$19.95 Each**

**MFJ-335BS** – SO-239
**MFJ-335BM** – NMO
**MFJ-335BT** – 3/8 - 24 For HF sticks

### MFJ 3-inch Magnet

**3-inch Black Magnet Antenna Mounts**

17-foot coax is terminated with PL-259 connector. Choose SO-239 (BS) or NMO (BM). For VHF/UHF light-weight antennas.

**MFJ-333BS** Pictured

**$15.95 Each**

**MFJ SMA/BNC Cables**


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

**$19.95 Each**

A. **MFJ-5612S** SMA Male.
B. **MFJ-5612SF** SMA Female Wouxun/Baofeng.
C. **MFJ-5612B** BNC Male.

### MFJ Triple 5-inch Magnets

**Goliath™ – Ultimate Strength Magnet**

Three super-strong 5-Inch Magnets make up this MFJ Goliath™ Tri-Magnet Mount. 1/4" thick steel triangle base. 17' coax. Select SO-239, NMO, 3/8-24 antennas.

**Caution:** once on, it's difficult to get off!

**$44.95 Each**

**MFJ-336S** – SO-239
**MFJ-336M** – NMO
**MFJ-336T** – 3/8 x 24


### HF/VHF/UHF 200 Watt Duplexers

MFJ-916B **$34.95**

**Use separate** HF/VHF and 440 MHz UHF antennas with single transceiver OR use two separate HF/VHF and 440 MHz UHF transceivers with a single HF/VHF/UHF antenna. Heavy-duty diecast enclosure houses low/high pass networks that separate/combine HF/VHF/UHF signals. Low loss SO-239s. 50 Ohm ports. **MFJ-916BC, $59.95** 3 ft. coax pigtails on 2-port side.

### 1.8-200 MHz SWR/Wattmeter

**Compact** 1.8-200 MHz SWR/Wattmeter has HUGE 3" Cross-Needle meter. Read forward/reflected power and SWR simultaneously. Perfect for mobile/portable. 30/300 Watt ranges. Built-in meter light. SO-239s. 3 1/4W x 3 1/4H x 3 1/4D". **MFJ-842, $69.95** covers 140-525 MHz, 15/150 Watts.

MFJ-822 **1.8-200 MHz** **$69.95** **MFJ-842 140-525**

### VHF/UHF Hi-Gain Antennas

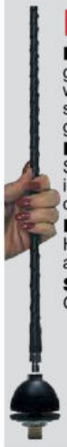

**A. MFJ-1402, $39.95.**
**VHF/UHF RuffRiderJunior™.** Premium, short 16 1/2" antenna fits in any garage on any auto. 1/4 Wave on 2 Meters, 1/2 Wave, gain on 440 MHz. 100W. No foldover. B or C.

**B. MFJ-1412, $39.95.**
**VHF/UHF RuffRider High Power™.** Just 40" long handles full 200 Watts. Great for high power mobile amp. 1/2 Wave, gain on 2 Meters, 5/8 Wave, great gain on 440 MHz. Black or chrome.

**C. MFJ-1422, $44.95.**
**VHF/UHF RuffRider High Gain™.** 41 1/2 inch long antenna gives extra gain with little height increase. Handles 150 Watts. 1/2 wave with good gain on 2 Meters, 5/8 wave, excellent gain on 440 MHz. Black or chrome.

**D. MFJ-1432, $64.95.**
**VHF/UHF RuffRider Hyper Gain™.** 62 1/2" brute gives whopping gain on 7/8 Wave 2-Meters, 5/8 Wave and a MONSTER gain on 440 MHz. MFJ will rock your ham radio world! 150 Watts. Use tri-magnet. Black or Chrome.

### MFJ Mobile HF Ham Sticks



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

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

**Includes** allen wrench and complete tuning and matching instructions. Handle 250 Watts PEP. Whips are 7 feet fully extended, and collapse to about 4 feet for easy storage.

**Simply** screws into any 3/8 x 24 female mount for quick bandchanging. Get them all for great band coverage!

MFJ-1675T - 75 Meters
MFJ-1660T - 60 Meters
MFJ-1640T - 40 Meters
MFJ-1630T - 30 Meters
MFJ-1620T - 20 Meters
MFJ-1617T - 17 Meters
MFJ-1615T - 15 Meters
MFJ-1612T - 12 Meters
MFJ-1610T - 10 Meters
MFJ-1606T - 6 Meters

**$19.95 -$21.95 Each**

60-75 Meters $29.95 each

### — 3/8-24 Ham Stick Mounts —

**MFJ-343, $15.95.** Tough 3/8-24 hard mount for permanent installation.



**MFJ-342T, $15.95.** 3/8-24 HF horizontal or vertical 1/4 or 1/2 inch pipe or mirror mount.

**MFJ-344, $15.95.** Like MFJ-342T, but horizontal pipe mount.

**MFJ Enterprises, Inc.** 300 Industrial Pk Rd, Starkville, MS 39759
**Phone:** (662) 323-5869 ■ **Tech Help:** (662) 323-0549 ■ **FAX:** (662) 323-6551 8-4:30 CST, Mon.-Fri.



MFJ_1724B_101008_QST_040819DS



**Advertising Department Staff:**

Janet Rocco, W1JLR, Advertising Sales Manager
Lisa Tardette, KB1MOI, Account Executive


# QST Index of

**Contact Information:**

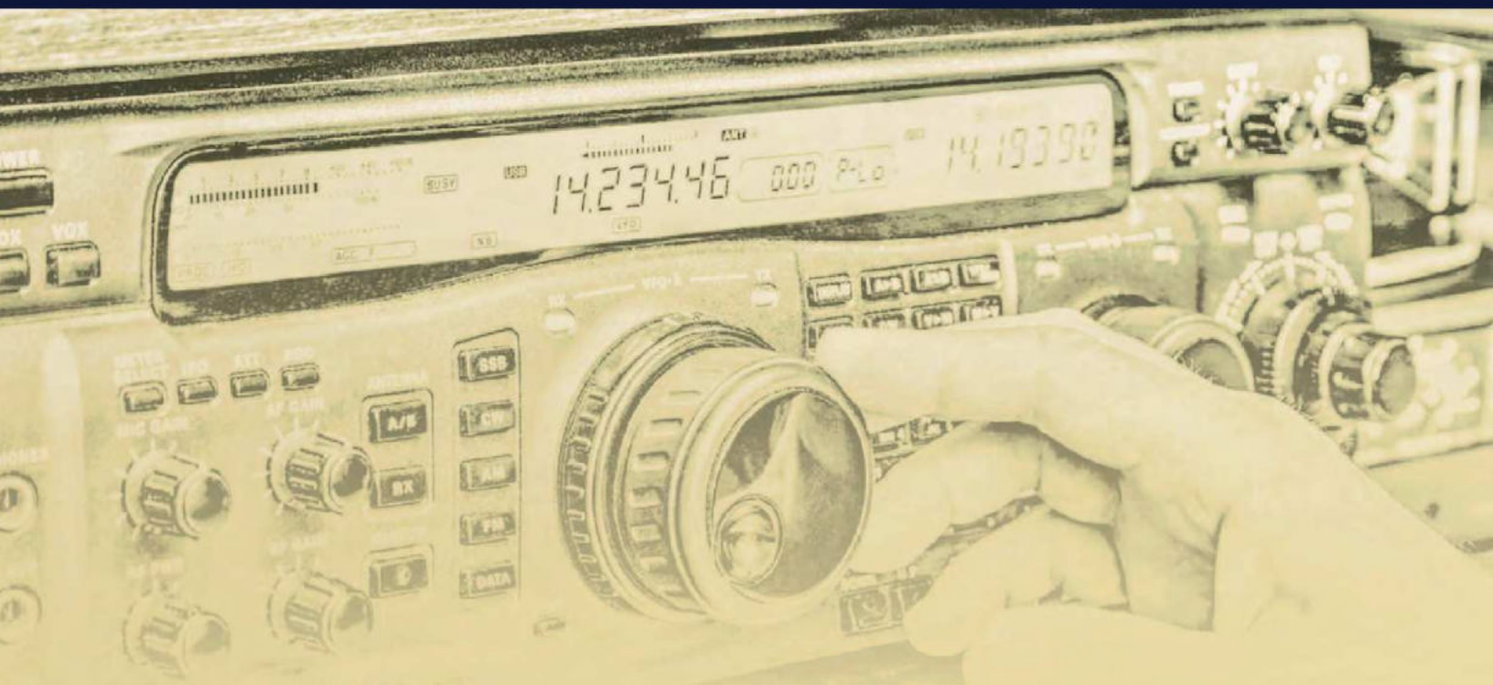
Toll Free: 800-243-7768
Fax: 860-594-4285
E-mail: ads@arrl.org
Web: www.arrl.org/ads

Additional advertising information is available on the web at:
**www.arrl.org/ads**

# Advertisers

# *Give a gift* to save the spectrum

*Make your contribution to the Spectrum Defense Fund.*



Don't let big tech companies take over your amateur frequencies! Contribute to the Spectrum Defense Fund and ensure ARRL has the resources needed to stand up to current and future threats to your operating privileges.


## Help Protect the Future of Amateur Radio

Go to **www.ARRL.org** and click the DONATE button or call **860-594-0291** to support the Spectrum Defense Fund.

- **Give now and get a limited-edition pin and mug with your $100 donation.**


For more information on the ARRL Spectrum Defense Fund, please visit
**www.arrl.org/spectrum-defense-fund**

# Good times await you with the Tri-Band AnyTone 578!


**The DMR mobile you have been dreaming about is finally here! Up to 50W of Tri-Band power.**

**Visit the link or call the number below to learn more!**

## AnyTone AT-D578UVIIIPRO

- TRI-BAND
- 50W 2m, 5W 220, 40W 70cm
- Bluetooth
- GPS
- APRS

**Free 578 Course ($97 Value) At BridgeCom University**

BridgeCom SYSTEMS
816-532-8451
sales@bridgecomsystems.com

TO LEARN MORE VISIT:
www.bridgecomsystems.com/578


# APRS® / D-STAR®

## TH-D74A 144/220/430 MHz Tribander

The TH-D74A represents the ultimate in APRS and D-STAR performance. KENWOOD has already garnered an enviable reputation with the TH-D72A handheld APRS amateur radio transceiver. Now it has raised the bar even further with the TH-D74A, adding support for D-STAR, the digital voice & data protocol developed by the JARL, and enabling simultaneous APRS and D-STAR operation – an industry first.

- APRS compliance using packet communication to exchange real-time GPS position information and messages
- Compliant with digital/voice mode D-STAR digital amateur radio networks
- Built-in high performance GPS unit with Auto Clock Setting
- Wide-band and multi-mode reception
- 1.74" (240 x 180 pixel) Transflective color TFT display
- IF Filtering for improved SSB/CW/AM reception
- High performance DSP-based audio processing & voice recording
- Compliant with Bluetooth, microSD & Micro-USB standards
- External Decode function (PC Decode 12kHz IF Output, BW:15 kHz)
- Free software for Memory and Frequency Control Program
- Data Import / Export (Digital Repeater List, Call sign, Memory Channel)
- Four TX Power selections (5/2/0.5/0.05 W)
- Dust and Water resistant IP54/55 standards

APRS (The Automatic Packet Reporting System) is a registered American trademark of WB4APR (Mr. Bob Bruninga).
D-Star is a digital radio protocol developed by JARL (Japan Amateur Radio League).

KENWOOD

**Customer Support/Distribution** Customer Support:
(310) 639-4200 Fax: (310) 537-8235

www.kenwood.com/usa

ISO9001 Registered

ADS#38419