Build a Direct Conversion Receiver | 35

Youth On the Air Summer Camp Recap | 60

QST

DIGITAL EDITION

ARRL The National Association for Amateur Radio

October 2021 www.arrl.org

DEVOTED ENTIRELY TO AMATEUR RADIO

# Young Hams on the Air

## QST Reviews

**MFJ-9219** QRP Tuner, Wattmeter, and Dummy Load

**HYS** TC-YG08UV Dual-Band VHF/UHF Yagi Antenna

**iPortable** Pro2 Equipment Rack System 6UM

**SIGLENT** SDG1062X Waveform Signal Generator

**Pacific Antenna** 20/40-Meter Trap Dipole Kit

# NEW DEFINITION OF DIGITAL HANDHELD

## Meet the Advanced Technologies


《Actual Size》

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

# FT5DR

C4FM Digital Clear Voice
Clear and Crisp Voice Technology

AMS Automatic Mode Select

66 ch GPS

WIRES-X

Touch & Go Operation

microSD Card

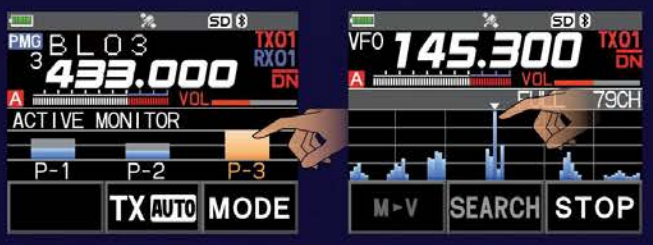
Bluetooth®

- Advanced C4FM Digital / 1W Audio Output
- Robust Tough Body with Rubber Protection
- Worldwide WIRES-X Internet Communications
- Fully Compatible with APRS
- Memory Auto Grouping (MAG) / VFO Band Skip Function

## Primary Memory Group
## Touch & Go operation

Touch & Go Operation

Quick & intuitive Touch and Go PMG key channel monitoring operation, by simply touching a bar on the LCD




## Quick Release Holster
## and Full Flat-Back Case

Comfortable size & form with no protrusions provides excellent grasp, even when wearing gloves for outdoor activities

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**

# The Best of the Best

## A Superb All-around Wide-Coverage Transceiver

### FT-991A 100W

**HF/50/144/430MHz TRANSCEIVER**

- Includes HF through UHF with one Radio
- Supports SSB/CW/AM/FM and C4FM digital
- IF Roofing Filters produce Excellent Shape Factor
- IF DSP enables Superb Interference Rejection
- Built in Real-Time Spectrum Scope Display
- 3.5-inch TFT Color Touch Panel Display
- 100 Watts (2 Meter & 70 Centimeter: 50 Watts) of Solid Performance

* External Speaker SP-10: Optional

## The New Standard High Performance SDR Transceiver

### FTDX10 100W

**HF/50MHz TRANSCEIVER**

* External Speaker SP-30: Optional

- Hybrid SDR Receiver (Narrow Band SDR & Direct Sampling SDR)
- 9MHz Down Conversion Receiver Configuration
- IF Roofing Filters produce Excellent Shape Factor
- IF DSP enables Superb Interference Rejection
- 5-inch TFT Color Touch Panel with 3DSS*1 Visual Display
- Superior Operating Performance by means of the MPVD*3

## The World Leading HF Transceiver with Hybrid SDR

*In Homage to the Founder of Yaesu – Sako Hasegawa JA1MP*

### FTDX101MP 200W

**HF/50MHz TRANSCEIVER**

*The Ultimate*

### FTDX101D 100W

**HF/50MHz TRANSCEIVER**

- Dual Hybrid SDR Receivers (Narrow Band SDR & Direct Sampling SDR)
- 9MHz Down Conversion Receiver Configuration
- IF Roofing Filters produce Excellent Shape Factor
- VC-Tune (Variable Capacitor Tuning) Signal Peaking
- IF DSP enables Superb Interference Rejection
- 7-inch TFT Color Touch Panel with 3DSS*1 Visual Display
- Superior Operating Performance by means of ABI*2 & MPVD*3

* Microphone M-1: Optional

* Photo shows the FTDX101MP

*1 3DSS: 3-Dimensional Spectrum Stream *2 ABI: Active Band Indicator *3 MPVD: Multi-Purpose VFO Outer Dial

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**


# 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, $599.95.** 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, $569.95,** 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*!

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

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

**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.

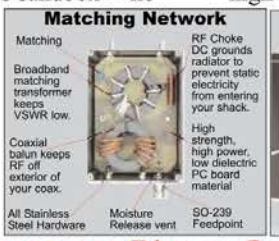
**Rugged Construction:** Thick fiberglass insulators, all-stainless steel hardware and 6063 aircraft-aluminum tubing is double or triple walled at key stress points to handle anything Mother Nature can dish out.

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

**R8, $619.95.** Like R9, less 75/80 M.

**R-8TB, $109.95.** Lets you tilt your antenna up/down easily by yourself to work.

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





## Cushcraft Dual Band Yagis

***One Yagi for Dual-Band FM Radios***


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


## Cushcraft Famous *Ringos* Compact FM Verticals


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

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

**Cushcraft**
***Amateur Radio Antennas***
308 Industrial Park Road, Starkville, MS 39759 USA
Open: 8-4:30 CST, Mon.-Fri. ***Add Shipping.***
• **Sales/Tech:** 662-323-5803 • **FAX:** 662-323-6551
***http://www.cushcraftamateur.com***



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

***Visit www.cushcraftamateur.com***

**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®

QST

# Contents

October 2021 ♦ Volume 105 ♦ Number 10



9 **Second Century**
Social Media — Friend and Foe

30 **Web Switch for Selecting Antennas and Radios**
**John Burnley, NU0V**

35 **The DC2020 Receiver**
**Harold Smith, KE6TI**

39 **Product Review**
**Mark Wilson, K1RO**
MFJ-9219 QRP Tuner, Wattmeter, and Dummy Load; HYS TC-YG08UV Dual-Band VHF/UHF Yagi Antenna; iPortable Pro2 Equipment Rack System 6UM; SIGLENT SDG1062X Waveform Signal Generator; Pacific Antenna 20/40-Meter Trap Dipole Kit


60 **The First-Ever Youth on the Air Summer Camp**
**Ruth Willet, KM4LAO, and Leah McGrane, KD9LFZ**

63 **Radio on the Island of Bonaire**
**Steve Telenius-Lowe, PJ4DX/KH0UN**

66 **Grammy-Nominated Musician Raul Midón, AE3RM, Takes Radio on the Road**
**Jim Millner, WB2REM, and Gene Hinkle, K5PA**

76 **2020 – 2021 School Club Roundup Results**
**Lew Malchick, N2RQ, and Ken Gunther, WB2KWC**

84 **The 2021 ARRL November Sweepstakes**

88 **A Look Back — December 1971**

## Columns


Amateur Radio World ..... 72
At the Foundation ..... 84
Ask Dave ..... 52
Celebrating Our Legacy ..... 93
Classic Radio ..... 94
Contest Corral ..... 75
Correspondence ..... 24
Eclectic Technology ..... 51
Happenings ..... 69
Hints & Hacks ..... 56
How's DX? ..... 78
Member Spotlight ..... 13
Microwavelengths ..... 58
Public Service ..... 73
Technical Correspondence ..... 54
The World Above 50 MHz ..... 80
Up Front ..... 20
100, 50, and 25 Years Ago ..... 96


## Departments


ARRL Section Managers ..... 16
Certificate of Code Proficiency Recipients ..... 77
Convention and Hamfest Calendar ..... 85
Feedback ..... 34
Field Organization Reports ..... 74
Guide to ARRL Member Benefits ..... 14
Ham Ads ..... 124
Index of Advertisers ..... 126, 127
New Products ..... 62
Officers, Division Directors, and Staff ..... 15
*QST* Cover Plaque Award ..... 38
Silent Keys ..... 97
Special Event Stations ..... 82
Strays ..... 83, 95
This Month in *QEX* ..... 50
Volunteer Monitor Program Report ..... 86
W1AW Qualifying Runs ..... 77
W1AW Schedule ..... 87
W1AW's QSL File ..... 28


## Digital and Mobile Editions

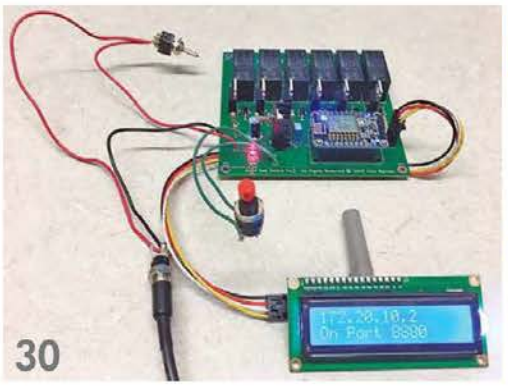
ARRL members can access the digital edition via a link at **www.arrl.org/qst**, download our iOS app from the iTunes Store, and download our Android app from the Google Play Store.

## Write for *QST*

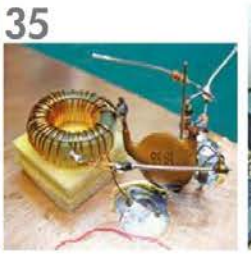
**www.arrl.org/qst-author-guide**
email: **qst@arrl.org**


### Our Cover

In July, 23 campers between the ages of 14 and 25 attended the first Youth on the Air (YOTA) summer camp in the Americas. Read all about this exciting week of youth-planned and led activities — workshops, a kit build, an ARISS contact, and more — in "The First-Ever Youth On the Air Summer Camp," by Ruth Willet, KM4LAO, and Leah McGrane, KD9LFZ. The results of the School Club Roundup also appear in this issue, and they include the efforts of Anna Matson, KN4IVD, who participated on behalf of her school from her home station, pictured here. [James Matson, KN4OQD, photo]










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

POSTMASTER: Send address changes to: *QST*, 225 Main St., Newington, CT 06111-1400, USA. Canada Post: Publications Mail Agreement #90-0901437. Canada returns to be sent to IMEX Global Solutions, 1501 Morse Ave., Elk Grove Village, IL 60007.

**US & Possessions:** Membership in 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 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 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 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**

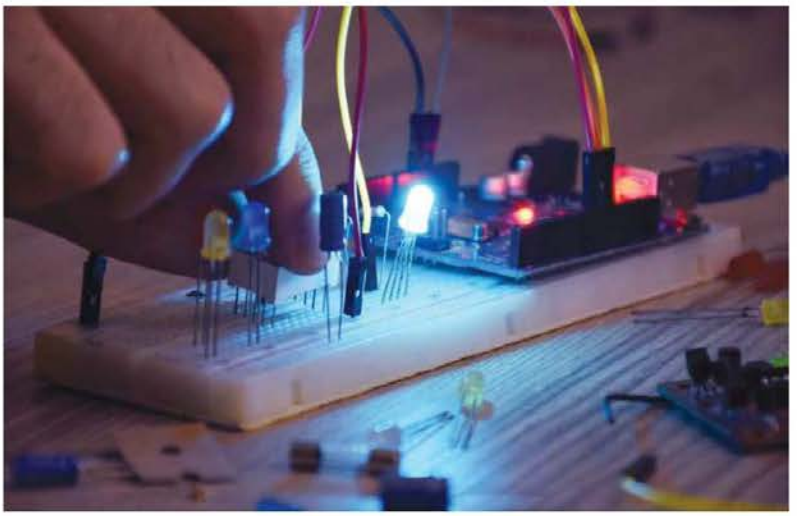
Details of our Online Privacy Policy can be found at
**www.arrl.org/online-privacy-policy**.

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

Advertorial

# Learn Arduino FAST with this beginner course, NO EXPERIENCE NECESSARY!

By: Steve Buffa (5 Minute Read)



I've been a ham for over 20 years and have been building my own custom antennas from scratch, ranging from simple dipoles to Log-Periodic antennas. Lately I've become interested in controlling my rig electronically. Anything from building an automated antenna switch, to a CW keyer, and everything in between. There was just one problem: even though I'm proficient at basic skills like soldering, wiring, etc., I wasn't quite sure how to add electronic control to my projects. So, I started asking my friends at my local club.

Some said Arduino would be perfect for these projects, while others said I should use Raspberry Pi. However, I didn't know anything about either. I tried doing an internet search to help me learn the difference, but that left me more confused than ever.

Then I found out that my ham friend Aaron had the exact same problem — or, at least, he used to. He said he found an online course (**www.GetMyBootCamp.com**) that changed everything for him, and that he'd started making his own Arduino-based projects because of it.

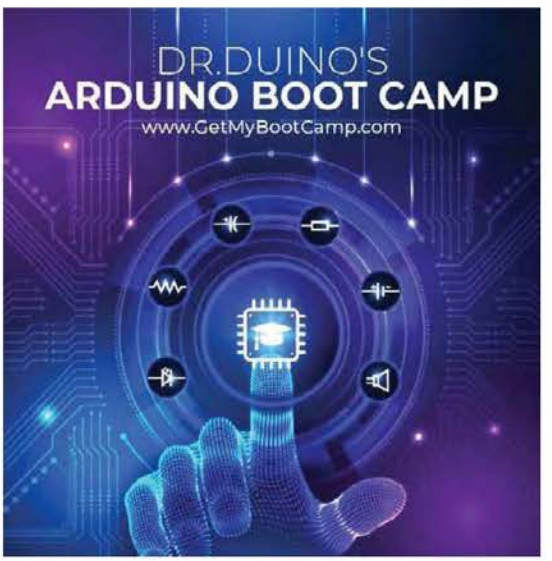
He proudly showed me some of them. They ranged from a simple RF power meter with green, yellow, and red LEDs that changed according to the signal strength, to an Arduino-controlled SDR. Aaron said the online course gave him the foundational skills he needed in order to tackle these projects, while also easily figuring out when to use Arduino over Raspberry Pi.

The secret lies in asking one simple question about your project: Does your project need to do tasks that a PC could do?

For example, does your project need a screen to display heavy graphics? If it does, then Raspberry Pi is the right path to take.

However, projects that monitor switches, or that turn motors or LEDs on and off are better suited for Arduino.

Armed with that knowledge, it was clear that the projects I wanted to do were perfectly suited for Arduino. There was just one question left in my mind: Coding. I didn't know anything about it! As it turns out, the course that Aaron found covers that, too. Much like basic training in the military, this boot camp (provided by a company called Dr.Duino) teaches you the basics for getting started with Arduino, which includes programming fundamentals.




It's eight chapters full of step-by-step, easy-to-follow examples, beginning with "what is Arduino," and ending in having you create and program your very own Morse Code Machine. That project helped solidify everything learned in the boot camp, and I completed it feeling I can finally start to tackle the electronic projects I've been wanting to build for years. So, if you're interested in getting started with Arduino, I highly recommend enrolling in the course at www.GetMyBootCamp.com.

PS- The first 200 people to enroll will receive a FREE Arduino Uno clone. HURRY, book your boot camp + receive a FREE Arduino Uno clone at **www.GetMyBootCamp.com**.

# 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!

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 |


*The Standard By Which All Others Are Judged*

RF PARTS™ COMPANY

Diamond Antenna is a division of RF Parts Company

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

## Second Century

# Social Media — Friend and Foe

*I enjoy starting every day with a coffee and a tour of the social media outlets that feature ham radio, from Facebook to Twitter to YouTube. I believe, in many ways, this set of tools makes our hobby a more enriching and enjoyable place, with the benefit of it being available on demand and as needed. It is just amazing to see the breadth of material available to us radio amateurs through social media.*

Almost a year ago now, I reached out to 32 YouTube content creators who I wanted to personally recognize for their "giving back" through their videos. Some of them are famous in our community, like Tim Duffy, K3LR, at DX Engineering. Tim works tirelessly to bring three sessions weekly to his channel, featuring everything from ham radio manufacturers to innovators. Some of them are less known, like Steve Babcock, VE6WZ, who has produced some of the best videos I have seen on constructing everything from receiving antennas to complete remote radio configurations.

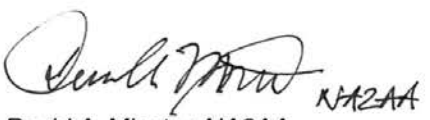
Like our radio signals that know no boundaries, social media is indeed a global endeavor. A couple of major standouts include Callum McCormick, MØMCX, who uses healthy doses of humor, technology, and experience to cover everything from antenna modeling and construction to operating. Also, Hayden Honeywood, VK7HH, whose channel seeks to educate, inspire, promote, and get people involved to learn about ham radio. This list of both regional and international ham radio content creators goes on and on.

Once you've spent some time with it, though, the dark side of social media quickly becomes apparent: Threads on websites and in groups that are beyond rational. Statements of "fact" on Facebook that just aren't true. Facebook groups of like-minded individuals where they eat their own in progressively hostile posts and comments. YouTube videos that go beyond editorial into toxic. One of the greatest problems has to do with the fact that all of this is happening in front of the very people we are trying to attract into the hobby: our youth. There are no tags on social media that warn, "Show good judgement — minors are present." As a result, it is easy to lose sight of the fact that young people, or new hams in general, are affected by the negativity and discord.

At ARRL, we are not distracted or discouraged by these outliers. There's tremendous value in using social media to fulfill some of the obligations we have, to FCC Part 97 and to each other. You will see that we have been far more prolific on our Facebook and YouTube pages. You can expect this to increase. We believe that the YouTube content will drive more interest in what we're doing as an association, as well as an extension to our educational benefits through the ARRL Learning Network and Learning Center!

You too have many opportunities for contributing to the good work being done on social media. Create posts from club events, share your experience as a contester, share pictures and videos from your holiday-style DXpedition, or even your tips on how to solder a PL-259 connector or bury a ground rod. YouTube also provides a wonderful place to archive and make accessible historical videos that may be sitting in a stack of old VHS tapes or 8 mm film on your shelf. There are endless possibilities — and we'd love to see what you've got! Tag us — #ARRL.

In closing, social media plays an important role in our future as a community, as we recognize that role and calibrate ourselves to leverage its strengths. Post your activities, experiments, successes, and stories on social media! Be radio active and connect with others to get them on the air too!




*David A. Minster, NA2AA*
***Chief Executive Officer***

# hy-gain Antennas and Rotators

## HF Verticals

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

**AV-680, $619.95. 9 Bands: (6, 10, 12, 15, 17, 20, 30, 40, 80 Meters). 26 ft., 18.5 lbs.** *Our most popular vertical now has 75/80 Meters! Lets you work exciting DX with a low 17 degree radiation angle!* Easily mount on decks, roofs, patios. *No ground or radials needed.* Extra wide 2:1 SWR bandwidths. *Each* band tunable. Auto band-switching, handle 1.5kW, 80 MPH wind survival, low 2.5 sq. ft. wind surface. Aircraft aluminum tubing, stainless steel hardware.

**AV-640, $519.95.** Like AV-680 less 80M. 25'/2', 17'/2 lbs.

**AV-620, $419.95.** Like AV-640 less 40M. 22'/2'/10'/2 lbs.

**AV-14AVQ, $249.95. (10, 15, 20, 40 Meters). 18 ft., 9 lbs.** *Classic* AV-14AVQ uses same trap design as famous Hy-Gain Thunderbird beams. 3 air dielectric Hi-Q traps with oversize coils give superb stability and 1/4 wave resonance on all bands. Automatic bandswitching.

**AV-12AVQ, $189.95. (10, 15, 20 Meters). 13 ft., 9 lbs.** Lowest priced *automatic bandswitching* tri-band vertical! Uses Thunderbird beam design air dielectric traps for extremely hi-Q performance in limited space.

**AV-18VS, $169.95. (10,12,15,17,20,30,40,80M). 18 ft., 4 lbs.** hy-gain's lowest priced vertical gives you 8 bands. Easily tuned to any band by adjusting base loading coil.

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

## HF Beams

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

**TH-11DX, $1399.95.**
**11-element, 4.0 kW PEP, 10,12,15,17,20 Meters.** *The choice of top DXers.* With 11-elements, excellent gain and 5-bands, the super rugged TH-11DX is the *"Big Daddy"* of all HF beams! Features low loss log-periodic driven array on all bands with mono- band reflectors, BN-4000 high power balun, corrosion resistant wire boom support, hot dipped galvanized and stainless steel parts.

**TH-7DX, $1199.95. 7-Element, 1.5 kW PEP, 10, 15, 20 Meters.** 7-Elements gives you *the highest average gain of any Hy-gain* tri-bander! Dual driven for broadband operation without compromising gain. SWR less than 2:1 on all bands. Combined monoband and trapped parasitic elements give you an excellent F/B ratio.

**TH-3MK4, $569.95. 3-Element, 1.5 kW PEP, 10, 15, 20 Meters.** Gives most gain for your money in full-power, full-size *hy-gain* tri-bander! Impressive gain and a *whopping* average front-to-back ratio and still fits on an average size lot. 95 MPH wind survival.

**TH-3JRS, $439.95. Compact 3-Element, 600 W PEP, 10, 15, 20 Meters.** *Hy-gain's most popular and lowest-priced tri-bander fits smallest lot*, 14.75 ft turning radius, 21 lbs. Excellent gain and front-to-back let you compete with the "big guns"! 80 MPH wind survival.

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

### HAM-IV . . . $729.95

**The most popular rotator in the world!** For medium communications arrays up to 15 sq. feet wind load area. 5-second brake delay! Test/Calibrate function. Low temperature grease permits normal operation down to -30° F. Alloy ring gear gives extra strength up to 100,000 PSI for maximum reliability. Indicator potentiometer. Ferrite beads reduce RF susceptibility. Cinch plug plus 8-pin plug at control box. Dual 98 ball bearing race for load bearing strength and electric locking steel wedge brake prevents wind induced antenna movement. North or South center of rotation scale on meter, low voltage control, max mast size of 2'/16".

**HAM-VI, $909.95.** For medium arrays up to 15 sq. ft. wind load. Like HAM-IV but has *new* ***DCU-2*** *Digital Rotator Controller.* Just dial in your beam heading or let your computer control your antenna.

**HAM-VII, $999.95.** Like HAM VI but with ***DCU-3*** digital controller with *six programmable memories.*

### Tailtwister T-2X . . . $969.95

**For** large medium antenna arrays up to 20 sq. ft. wind load. Choose ***DCU-2*** *digital* controller (T-2XD2) or *analog* control box (T-2X) with *new* 5-second brake delay and *new* Test/Calibrate function. Low temperature grease, alloy ring gear, indicator potentiometer, ferrite beads on potentiometer wires, *new* weather-proof AMP connectors plus 8-pin plug at control box, triple bearing race with 138 ball bearings for large load bearing strength, electric locking *steel* wedge brake, N or S center of rotation scale on meter, low voltage control, 2'/16" max. mast.

**T-2XD2, $1079.95.** Tailtwister with ***DCU-2*** *digital* controller.

**T-2XD3, $1139.95.** Tailtwister with ***DCU-3*** digital controller with *six programmable memories.*

**AR-40, $419.95.** For compact antenna arrays and FM/TV up to 3.0 sq. ft. wind load. Dual 12 ball-bearing race. Fully automatic.

**CD-45II, $519.95.** For antenna arrays up to 8.5 sq. ft. Bell rotator design gives total weather protection. Dual 58 ball bearing race.

### Digital Rotator Controller with 6 Programmable Beam Headings

**DCU-3**
**$519.95**

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

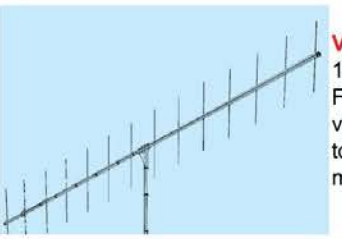
**Push** a memory button or dial in your beam heading or let *Ham Radio Deluxe* (or other program) control your DCU-3. Your antenna automatically rotates precisely and safely to your desired direction.

### Replace Your Yaesu Rotator Controller

**YRC-1**
**$399.95**

**Replace** your Yaesu rotator controller. More features and a much more robust controller that is far less prone to lighning damage. YRC-1 costs less than repairing your original controller!

### hy-gain VHF/UHF Antennas



**VB-214FM, $149.95.** 14-element 2-Meter FM beam antenna provides exceptional front-to-back ratio and maximum obtainable gains.

**VB-23FM, $69.95.** 3-element.
**VB-25FM, $79.95.** 5-element.
**VB-28FM, $129.95.** 8-element. Threaded stub for feedpoints. Accepts up to 2 inch mast.
**DB-2345, $139.95.**
Dual band 144 (3-elements) 440 (5-elements) MHz.

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

# From QRP to QRO
# Get the Magnetic Loop You Really Want!

HG3 PRO
- 100W PEP
- Air Variable Cap
- 7K Step Resolution

NEW!
HG3 QRO
- 1.5 KW PEP
- High Q Vacuum Cap
- 45K Step Resolution


## The HG3 QRO - Higher Power and Performance

**No Compromises**
Retaining all the great features of our HG3 PRO model, the new HG3 QRO high power (1.5 KW) model raises the bar again in magnetic loop antenna (MLA) performance. It covers 80*-10 meters. Adding the optional second radiator loop (two turns), allows full power operation on 80 meters.

**Unrivaled Tuning Capability**
Shown at left is the high Q vacuum capacitor with a 45,000-step resolution stepper motor. This delivers an unprecedented 511 Hz tuning resolution and allows the operator to set his/her band preferences. This is very helpful when making QSOs under non-ideal and crowded band conditions.

**New HG3 *plus* Controller**
It is completely redesigned. It controls both the HG3 PRO and HG3 QRO MLA models and the AR1 Rotator. It remotely tunes 7-30 MHz with stepper motor precision and resolution. *RapidTune*™ automatically scans each band for the lowest SWR and works with most HF radios.

preciseRf®
www.preciserf.com

13690 Wisteria Dr. NE Aurora, OR 97002 • ph: 503-915-2490 • preciserf.com • * Some items may be optional • © 2021 ADV1.2

# Array Solutions Your Source for Outstanding Radio Products

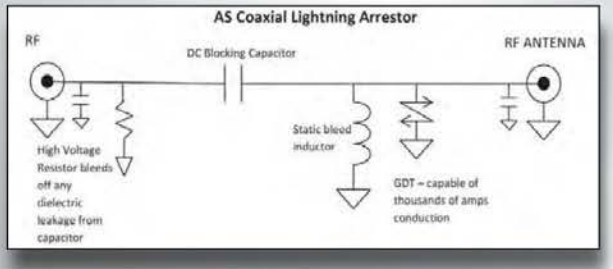
## Professional Grade Equipment from Array Solutions

### Array Solutions Lightning Arrestors
**Coaxial , Ladder Line, Single wire, Control Line protection for Rotators, Switches, and Antenna Motors**

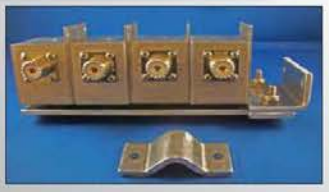
AS-300 Series arrestors are known for their reliability and performance. They feature easy mounting to plates, ground rods with our stacking bracket and also a convenient screw lug. The stacking bracket can be used on plates as well to save precious room in arrestor enclosures.

- Available in SO-239, Type-N, and 7/16 DIN
- connectors
- DC blocked, DC pass is available as a custom option
- Unique static bleed system with a UL approved Gas Discharge Tube, also ITU K 12 tested. This system usually prevents the GDT from ever firing unless a direct hit is taken. Saves your radio from static build up on large antennas.
- Models available for 3 kW, 5 kW, 10 kW and higher, details on website. Lower power available.
- FM low power broadcast model AS-303D FM
- Model AS-309H high-power single wire or ladder line arrestor, also DC block with static bleed
- Control line Arrestors for 8, 12, and 16 wires – 65V sparkover.
- Models for HF, VHF to UHF – Extremely low loss and Low VSWR

AS-303U

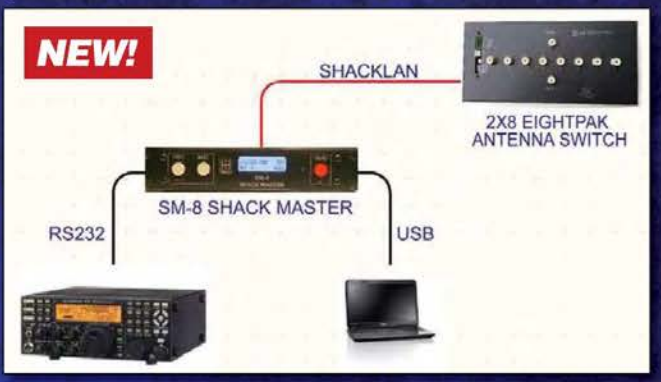




### Hamation Station Automation

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 shown.


### 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

### OM Power Amplifiers Sales and Service


### Switches for Six Antennas

5kW - DC to 6m

RATPAK – 1x6

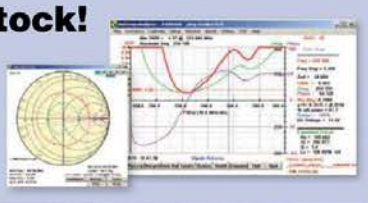
Choice of Multiple Controllers

SIXPAK – 2x6


### VNAuhf Back in Stock!

**Vector Network Analyzer**

5 kHz -1.3 GHz **$1295**



### 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

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


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


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.

Jen Glifort, KC1KNL, jglifort@arrl.org

## Member Spotlight

# Maggie Leber, K3XS, and Gwen Patton, NG3P

Spouses Maggie, K3XS, and Gwen, NG3P, were both interested in getting their amateur radio licenses before they met, but, as Maggie explained, "Having two of us egging each other on really helped." As a child, Gwen helped her dad restore a 60-pound US Navy shortwave receiver. "That infected me with the ham radio bug, but it wasn't until I moved across the country to live with Maggie that it found expression," she said.

Maggie Leber, K3XS (left), and Gwen Patton, NG3P (right).

Maggie and Gwen earned their licenses and upgrades together and are now both Amateur Extra-class licensees. They're also members of the Phil-Mont Mobile Radio Club. Maggie said, "Having somebody else in the household who understands and appreciates your accomplishments in the hobby is a big incentive. And we share instruments, parts, and tools on our workbench."

## Applied Radio Knowledge

Maggie started on her career path as a software engineer by working on IBM mainframes. She eventually moved into PCs, servers, and networking. "I currently work on management software for mobile radio-based mesh networking equipment that's used in industrial and military applications," she explained. "Having previously developed radio control software for hobby amateur equipment led quite naturally into doing similar work with commercial gear. I think having that on my resume helped me get the job I work at today."

Being a ham also gives Maggie an advantage as a pilot in a flying club, helping her understand RF propagation so she can use ground- and space-based stations for air traffic control and navigation. Her experience as an AMSAT member using packet radio to work amateur satellites helped her prepare for an FAA (Federal Aviation Administration) mandate "requiring aircraft like our flying club airplane to install and operate tracking using the ADS-B [Automatic Dependent Surveillance — Broadcast] protocol in 2018." ADS-B shares many similarities with mobile APRS.

## Ham Ingenuity

At any given time, Gwen has plenty of radio projects to tinker with. She's currently working on troubleshooting a 40-meter Soda Pop II CW transceiver (by Steve Weber, KD1JV), a QRP Labs 50 W CW amp kit, and a USB-C Power Delivery and Qualcomm Quick-Charge QRP rig power system. More about her radio projects can be found on her ham blog at **www.ng3p.com**.

"Much of my involvement in ham radio since 2006 has been filtered through the requirements of my disability," Gwen said. "A car accident left me with a broken neck in that year, which permanently disabled me with 24/7 chronic pain." Her ham radio activities often serve as a therapeutic outlet, helping to maintain hand-eye coordination and working with very small parts. She said, "Ham radio is one of the activities that keeps me connected with the outside world even when I can barely move."

In addition to radio, Gwen engages with a multitude of other hobbies. She plays various musical instruments, collects vintage slide rules, and practices sport lockpicking. "I carry a practice padlock and picks with me everywhere," she said. "I've had some really interesting conversations in waiting rooms, because it's an unusual thing to do when just sitting around."

## A More Accessible Future

Amateur radio is a hobby that Maggie and Gwen share, but it's not always easy to find accessible options. "We've had some wonderful help from our fellow club members, but it's largely been Maggie and I doing things in a way we can maintain," Gwen said.

She explained that organizations like the Handiham Program aren't equipped to deal with her particular issues, and many are primarily focused on blindness and deafness in radio operators. "This isn't a complaint, but an entreaty to give what help you can to these organizations, with hopes that more disabilities will be supported in the future," she 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 Email 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 **hq@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**

**Chief Executive Officer and Secretary**
David A. Minster, NA2AA*
225 Main St.
Newington, CT 06111
860-594-0404; **dminster@arrl.org**

**Treasurer**
Rick Niswander, K7GM

**Chief Financial Officer**
Diane Middleton, W2DLM

## Staff

**Development Manager**
Melissa Stemmer, KA7CLO

**Director of Operations**
Bob Naumann, W5OV

**Laboratory Manager**
Ed Hare, W1RFI

**Product Development Manager**
Bob Inderbitzen, NQ1R

**Membership, Marketing, & Communications Director**
Kathleen Callahan, KC1MBY

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

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

**Advertising Sales Manager**
Janet Rocco, W1JLR

**VEC Manager**
Maria Somma, AB1FM

**Lifelong Learning Manager**
Kris Bickell, K1BIC

**Radiosport & Regulatory Information Manager**
Bart Jahnke, W9JJ

**Field Services Manager**
Mike Walters, W8ZY

**Controller**
Thomas Bell, KC1MHQ

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

*Vice Director:* **Brent Walls, N9BA**
2151 E. Bomar Ln.,Greenfield, IN 46140
317-557-7224; **n9ba@arrl.org**

## Dakota Division

**www.arrldakota.org**
**Bill Lippert, ACØW**
2013 6th Ave. SE, Austin, MN 55912
507-433-5835; **ac0w@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
615-630-2753; **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:* **Scott Yonally, N8SY**
258 Valley Hi Dr., Lexington, OH 44904
419-512-4445; **n8sy@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**
**Art Zygielbaum, KØAIZ**
6601 Pinecrest Dr., Lincoln, NE 68516
402-421-0840; **k0aiz@arrl.org**

*Vice Director:* **Dave Propper, K2DP**
747 Old Bonhomme Rd., University City, MO 63132, 314-225-5167; **k2dp@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

**https://nediv.arrl.org**
**Fred Hopengarten, K1VR**
6 Willarch Rd., Lincoln, MA 01773
781-259-0088; **k1vr@arrl.org**

*Vice Director:* **Phillip E. Temples, K9HI**
125 Coolidge Ave. #803
Watertown, MA 02472-2875
617-331-0183; **k9hi@arrl.org**

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

*Vice Director:* Vacant

## 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:* **Dan Grady, N2SRK**
8706 S. Buchanan Way, Aurora, CO 80016
720-236-7397; **n2srk@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; **n6aa@arrl.org**

*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; **w5lhc@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:* Mark Stillman, KA3JUJ, 48 Upland Ct., Newark, DE 19713-2817 302-384-0916; **ka3juj@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:* Tom Sly, WB8LCD, 1480 Lake Martin Dr., Kent, OH 44240-6260 330-554-4650; **wb8lcd@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:* Bob Buus, W2OD, 8 Donner St., Holmdel, NJ 07733-2004 732-946-8615; **w2od@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:* Robert Gould, N1WJO, 572 Poland Springs Rd., Casco, ME 04015-4016 207-415-5419; **n1wjo@arrl.org**
*New Hampshire:* Peter Stohrer, K1PJS, 9 Gladstone St., Concord, NH 03301-3130 603-345-1470; **k1pjs@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:* Jo Whitney, KA7LJQ, P.O. Box 2222, Yakima, WA 98907 509-952-5765; **ka7ljq@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:* Mike Patterson, N6JGA, P.O. Box 30627, Walnut Creek, CA 94598; 925-200-8300; **n6jga@arrl.org**
*Nevada:* John Bigley, N7UR, 2420 Palora Ave., Las Vegas, NV 89121-2157 702-498-5829; **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:* Pat Malan, N7PAT, 10102 S. Redwood Rd. #95401, South Jordan, UT 84095 801-413-7438; **n7pat@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:* Jim Millsap, K9APD, 5127 Bramblewood Dr., Acworth, GA 30102-2405 770-355-0480; **k9apd@arrl.org**
*Northern Florida:* Kevin J. Bess, KK4BFN, 908 Flagler Ave., Edgewater, FL 32132-2124 386-547-2838; **kk4bfn@arrl.org**
*Puerto Rico:* Rene Fonseca, NP3O, Urb Santa Isidra 4 G8 Calle 6, Fajardo, PR 00738-4145 939-579-4134; **np3o@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:* Michael Douglas, W4MDD, 2527 Apple Blossom Ln., Wauchula, FL 33873 863-585-1648; **w4mdd@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:* Bob Turner, W6RHK, P.O. Box 973, Perris, CA 92572 951-236-8975; **w6rhk@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:* Mark Kleine, N5HZR, 2651 84th Ave. SE, Norman, OK 73026 405-410-6756; **n5hzr@arrl.org**
*South Texas:* Stuart Wolfe, KF5NIX, 5607 Sunshine Dr., Apt. 219, Austin, TX 78756 512-660-9954; **kf5nix@arrl.org**
*West Texas:* H. Dale Durham, W5WI, P.O. Box 375, Buffalo Gap, TX 79508 830-719-9000; **w5wi@arrl.org**

# LISTEN TO THE WORLD



Unbelieveable Memory


The classic look & style to match


On every wavelength

## Elite 750

- AM/FM/LW/SW bands
- Aircraft Band
- Set 9/10 KHz AM tuning; set FM tuning range
- Single-Side Band (SSB)
- 360 degree rotate AM antenna
- Auto/Manual/Direct frequency key-in and station memory tuning
- Auto Tuning Storage function (ATS) for FM/AM/Shortwave
- 1000 station memories (each band 100 memories, 500 customiable)
- Dual alarm clock function
- Line in socket (can be used as speaker for MP3)
- Line out socket (radio broadcasting can be transferred to other device)
- External antenna jacks for both AM/FM
- Power source: DC input (6V) power supply included

universal radio inc.
HAM RADIO OUTLET
Radioworld
Hammacher Schlemmer
PREFERRED Living
Abt
Lee Valley
eton

Authorized Dealers

# LISTEN TO THE WORLD



## Elite Field

- AM/FM/SW bands
- FM with RDS (Radio Data System)
- Dial-in-dial coarse/ narrow digital tuning
- Treble/bass control
- RF gain control
- Wide/narrow bandwidth selection
- 50 memory stations
- Bluetooth® ready
- External AM/FM/SW antenna connections
- Local/DX switch
- Rich orange LCD display
- Line-in/line-out and headphone jacks
- FM telescopic antenna
- Carrying strap
- Reset/lock button
- Power supply: Included 7V DC adapter or 4 D batteries (sold separately)
- Custom vegan leather Carry Case (sold separately)

## Elite Executive

- AM/FM/LW/SW bands
- FM with RDS (Radio Data System)
- Single sideband (SSB) with +/1 kHz tuning
- VHF Aircraft band
- Automatic or Manual Digital Tuning
- FM stereo/mono selection
- Electronic/volume/treble/bass control
- Sync detector with selectable sideband
- Direct key-in meter band for SW
- 700 memory stations
- PLL synthesized dual conversion receiver
- Local/DX switch
- Local/world time zones
- Clock/Alarm/Sleep Timer with time backup
- Rich orange LCD display
- Reset/Lock button
- FM telescopic antenna
- Power supply: Inclided AC adapter or 4 AA batteries (sold separately)
- Custom vegan leather case with craftsman stitching

universal radio inc.
HAM RADIO OUTLET
Radioworld
Hammacher Schlemmer
PREFERRED Living
Abt
Lee Valley
eton

Authorized Dealers

# AMERITRON *600W* 160-6M Solid State

*600 Watts is only 4 dB below 1500 Watts full legal limit -- less than an S-unit!*

Now includes 6 Meters & Auto Bandswitching!


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

| ALS-606S | ALS-606 | ALS-600S | ALS-600 |
|---|---|---|---|
| **$2199** | **$2399** | **$1999** | **$2099** |
| With Switching Power Supply Suggested Retail | With Transformer Power Supply Suggested Retail | 160-10M W/Transformer Power Supply Suggested Retail | 160-10M W/Switching Power Supply Suggested Retail |

***New!* Ameritron ALS-606S/ALS-606 Solid State 600 Watt amplifier covers 160-6 Meters and automatically bandswitches by your transceiver.**

**It's** only 4 dB below 1500 Watts -- less than an S-unit -- *nobody can hear the difference!*

**Be heard!** Work DX and ragchew with anyone. Just turn on, select band on your transceiver and operate. No tubes, no warming up, no tuning, ever.

**Desktop size** 9¾Wx7Hx14½D", just 14.2 pounds.

**SWR/thermal protected**, extremely quiet, lighted peak reading Cross-Needle SWR/Wattmeter, front panel ALC control, operate/standby switch, multimeter.

**Select** transceiver interface cable, *www.ameritron.com*

**ALS-606S, $2199** includes lightweight, highly regulated switching power supply,10 lbs., 9Wx6Hx14½D in.

**ALS-606, $2399** includes transformer power supply for 120/220 VAC, 32 lbs., 9½Wx6Hx12D inches.

**ALS-600S, $1999.** Like ALS-606S. Less auto-band switch, 6/10M. ARI-500, $119.95 auto-bandswitch box. MOD-10MB, $29.95, adds 10-Meters.

**ALS-600, $2099.** Like ALS-600S but has transformer AC power supply.

***Here's what QST said about the ALS-600 . . .***

"It protected itself from our boneheaded, sleep-deprived band changing manuevers . . . "

"I found myself not worrying about damaging this amplifier . . . Kudos to Ameritron."

"I couldn't hear any noise at all from the SPS (*switching power supply*) on the vertical or quad …"

"I came to greatly appreciate the size, weight, reliability and simplicity of this amplifier."

"ALS-600S makes it possible to pack a transceiver and a 600 Watt amplifier . . . less than 30 pounds."

# Ameritron *1200W* 160-6M Solid State Amp

ALS-1306
**$3599**
Suggested Retail

***ALS-1306 1.5-54 MHz solid state near legal limit™ FET no-tune Amplifier gives 1200 Watts PEP output on all bands, including 6/10/12 Meters. Get Instant automatic bandswitching!***

**ALS-1306** reliability is insured by using *eight rugged MRF-150 power FETs.* They are mounted on the dual heavy duty heat sink and properly arranged to spread out the heat over a large surface.

**The** RF deck operates at 50V for efficient, low distortion linear RF power service. Cooled by a whisper quiet cooling fan regulated by temperature sensors, assuring minimum noise for adequate cooling.

**Get** up to 1200 Watts of clean SSB output (100 Watts gives full rated 1200 Watts output). Only 22 lbs. 10Wx6½Hx18½Din.

**Automatic** band switching reads band data from your rig and auto changes bands as you make adjustments. Optional interface cable required.

***Hash-free*** fully regulated switching supply is 12 lbs., 10Wx6½Hx9½D". 50 VDC at 50A. 220 VAC, selectable to 110 VAC. Draws < 25 A at 110 VAC; 12A @220 VAC.

**ALS-1300, $3199.** 1200W, 1.5-22 MHz. No 6 Meters, automatic band-switching with optional ARI-500, 10/12M with mod.

***Peek Inside . . .***

*Be prepared to be amazed at the beautiful workmanship of this finely crafted piece of electronic art! It's another beautiful, yet powerful Ameritron Amplifier!*

## *Ameritron brings you the finest high power accessories!*

***RCS-12 8-pos. Auto Controller . . . $369.95***
Switch 8 antennas, covers DC to 100 Mhz and handles over 5KW at 50 ohm below 30 MHZ. 120 VAC adaptor is included.

***RCS-4 Remote Coax Switch . . . $159.95***
Use 1 coax for **4** antennas. No control cable needed. SWR less than 1.25, 1.5 - 60 MHz. Useable to 100 MHz.

***RCS-8V Remote Coax Switch . . . $219.95***
Replace **5** coax with 1! 1.2 SWR at 250 MHz. Useable to 450 MHz. Less than .1 dB loss, 1kW at 150 MHz.

***RCS-10 Remote Coax Switch… $249.95***
Replace **8** coax with 1! SWR less than 1.3 to 60 MHz. **RCS- 10L, $289.95** with lightning arrestors.

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




# Experience the Power of ClearSpeech® DSP Noise Reduction

## CLRdsp

- Speaker and headphone amplifier with ClearSpeech® adaptive DSP noise reduction for voice and CW
- Recognizes intermittent nature of CW and allows it to pass noise free
- Continuously adjustable noise reduction
- Contains a 10 watt power amplifier

## CLRspkr

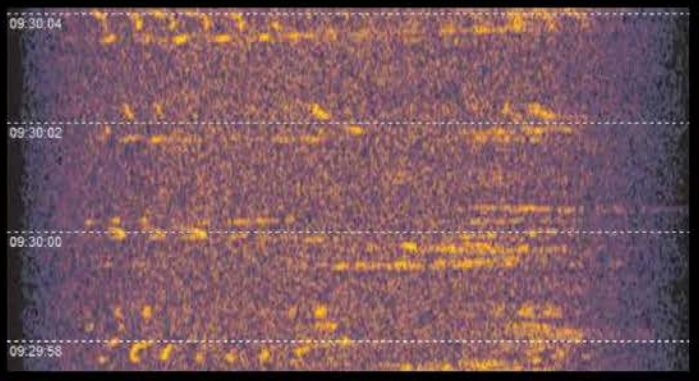
- ClearSpeech® adaptive DSP noise reduction for voice and CW
- Recognizes intermittent nature of CW and allows it to pass noise free
- Continuously variable adaptive filter noise reduction
- Contains 4-in, 7.5 watt loudspeaker

## CLRstereo

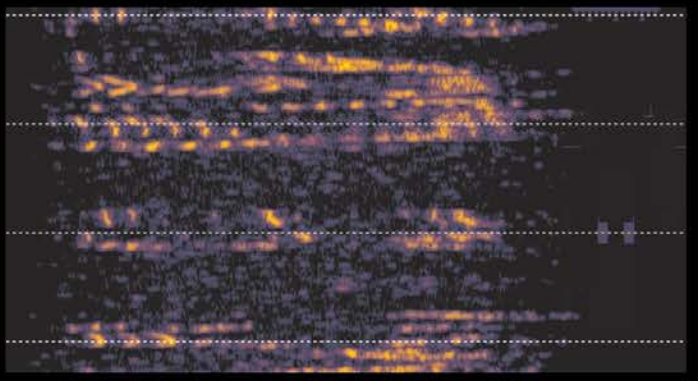
- Independent DSP noise reduction for Main and Sub RX or two separate radios
- Flexible audio switching - Listen to Main, Sub or both simultaneously
- Independent volume, tone and filtering for both channels
- Optional PTT input for fast audio recovery

## The Difference is CLR

### Before DSP Filtering




### After DSP Filtering



262-522-6503 ext 35
sales@westmountainradio.com
westmountainradio.com/QST1021

WEST MOUNTAIN RADIO

# ELECRAFT K4

## High-Performance Direct-Sampling SDR


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

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

### Modular, hybrid architecture adapts to your needs

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

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

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

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

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

### K4 KEY FEATURES

- Optimized for ease of use
- Modular, upgradeable design
- 7" color screen with touch and mouse control
- ATU with 10:1+ range, 3 antenna jacks
- Up to 5 receive antenna sources
- Full remote control via Ethernet

*The K4 interfaces seamlessly with the KPA500 and KPA1500 amplifiers*

*'The performance of their products is only eclipsed by their service and support. Truly amazing!'* **Joe - W1GO**

ELECRAFT®

**For complete features and specifications visit elecraft.com • 831-763-4211**

# Up Front

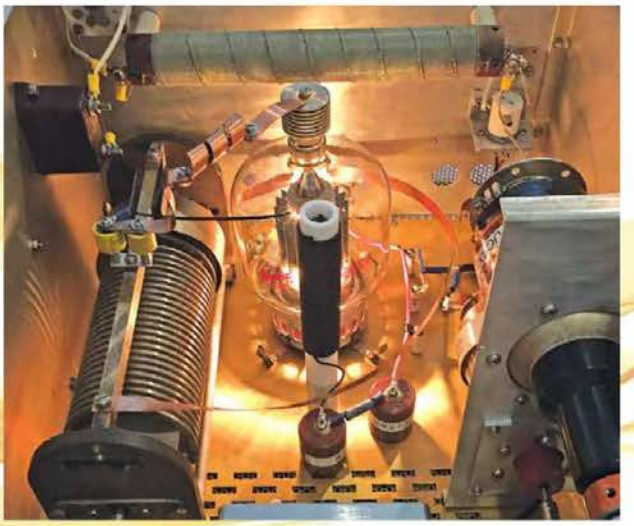
## Building a 1960s-Era Amplifier

Bob Karon, AA6RK, built a homebrew 4-1000A amplifier using many 1960s-era parts. With the help of Fred, K5TDC, and Jim, K4HJU, as well as a schematic design in the 1985 *ARRL Handbook*, Bob modified the power supply, chassis, control box, and RF deck. It took a year to build, and he's proud of the results.


*Left* — Bob's triple-decker amp, with the power supply on the bottom, then the control box, and the RF deck on top.

*Upper right* — Bob put the tube in the middle with the tunable coil on the left and the input and output capacitors staked on the right.

*Lower right* — The 4-1000A tube in the chassis glows like a lightbulb.



## A Banner Success

The Williamsburg (Virginia) Area Amateur Radio Club (WAARC) redesigned banners for their ARRL Field Day and annual special event stations. Club member Donna Ross, KO4GLO, and Nicole Denton, wife of member Steve Ramlogan, KO4ENU, designed and produced a chair-back banner that could be displayed at the club's weekly restaurant gatherings. The banner shows the club's email address and a QR code that leads to the club's website (**www.k4rc.net**). And it's already drawing some attention. Tim Clonar, KD2MAP, a previous member of the group, saw the banner and decided to rejoin the fun.

RigExpert
Antenna analyzers

# Every job needs the right tool

**Buy a RigExpert analyzer for Quality and Value:**

- SPLASH- and DUST-PROOF case
- Multilingual user friendly interface
- Consistency and accuracy without prior recalibration
- 2-year warranty coverage


AA-35 ZOOM HF


AA-55 ZOOM HF


AA-230 ZOOM VHF


Stick 230 VHF


Stick Pro UHF

AA-600 UHF

AA-650 ZOOM UHF

AA-1000 UHF

AA-1400 UHF

AA-1500 ZOOM UHF

AA-2000 ZOOM UHF

rigexpert.com

BridgeCom SYSTEMS

# FREE YOUR HAM RADIO


Are you ready for a new experience?
The AnyTone AT-D578UVIII Plus

FREE Super Codeplug
USE CODE: QSTSUPER50 At Checkout

**CALL: 816-532-8451**
TO LEARN MORE

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

BridgeCom SYSTEMS

# END YOUR EMCOMM WORRIES

**During Hurricane Maria** on the Isle of Dominica, one of our customers used our repeater system to maintain communication with their community when all else failed. With BridgeCom's repeater, they were successful in being a key source for damage reports on the storm. Of course, not everyone has stories like these, but they all rely on the same quality system. In our 17 years of working in the amateur and commercial radio industry, we've helped thousands of radio enthusiasts install turnkey systems that fit their needs, no matter the circumstance.

**Assure yourself of getting the most out of your repeater system by calling us at (816) 532-8451 or go to the link to schedule a call with our team.**


## BCR REPEATER SYSTEMS FOR 2m, 1.25m, and 70cm

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

TO LEARN MORE VISIT:
www.bridgecomsystems.com/systems

# Correspondence

# Letters from Our Members

## Mentoring a Struggling Ham

Connecticut hams may have heard Subby Cultrera, N1QBQ, on the 146.790 repeater, as well as other local Connecticut repeaters, calling for a radio check. Even after confirming a good signal, he would call for a radio check.

Although I was frustrated with the constant radio checks, I felt like this ham was struggling to get on the air. After some research, I was able to determine that Subby is located at a rehab facility near where I live. I grabbed a recent copy of *QST* and went to the rehab facility to see if I could help him get on the air, and we quickly became friends.

Subby earned his Technician-class license in 2017 and has a new Yaesu FT-60R. He's 75 years old and has been at the rehab facility for 9 years. He doesn't get around like he used to and sometimes struggles to get his thoughts or speech out clearly. Subby was grateful that I helped him, and I look forward spending more time with him.

Please be patient the next time you hear "radio check" from someone on the air. They're simply doing what we all love — playing radio and making friends. And feel free to send Subby a QSL card with some words of encouragement!

**Steve Clark, N1AD**
Bolton, Connecticut
Life Member

## Praise for LoTW

ARRL's Logbook of The World (LoTW) is a great choice for facilitating contacts. It produces confirmations quickly and it's easy to make and process award applications. You don't have to worry about sending a QSL card in a self-addressed, stamped envelope (SASE) to facilitate a return card. Nor is it necessary to obtain a QSL card for your call (although I know many hams, myself included, enjoy receiving a paper card from time to time).

I find little reason not to utilize this service, given the ease of contact confirmation, award application, and self-tracking of progress for DX entities and grid squares contacted. Using LoTW benefits both operators involved in making a contact.

**Hank Hanburger, K3YDX**
Pittsboro, North Carolina

## World War II's Voluntary Interceptors

I recently read *The Secret Wireless War: The Story of MI6 Communications — 1939 – 1945* by Geoffrey Pidgeon, about the covert radio operations during World War II. It was fascinating to read about the ingenuity that thousands of hams showed with their volunteer support of the war.

Although hams in the UK were required to disassemble their antennas and turn in their transmitters to the nearest post office during the war, some used their CW skills as Voluntary Interceptors to copy countless hours of traffic (in secret five-letter code groups), never knowing the remarkable information they provided to the Secret Intelligence Service and the Enigma codebreakers at Bletchley Park. American HRO receivers and small two- or three-tube transmitters copied from *The ARRL Handbook* were commonly used.

Reading this book reminded me of how simple it was to set up a clandestine HF radio when my health caused me to liquidate my shack. I hung a wire out of my second-floor window with an HF transceiver and was still able to contact hams over hundreds of miles away.

**Bob Bruninga, WB4APR**
Glen Burnie, Maryland
Life Member

## Increasing the Promotion of Ham Radio

Most people that I meet outside of the amateur radio community don't know much about our hobby. This made me think that we should start promoting ham radio more. I know it's expensive, but perhaps ham radio advertisements could be placed in popular magazines, such as *Popular Mechanics*, *Scientific American*, *Reader's Digest*, *National Geographic Magazine*, and so on.

I'm not sure if this has ever been discussed as a way to promote our hobby to those outside of our community, but it could inform the public about amateur radio and encourage them to visit the ARRL website for more information.

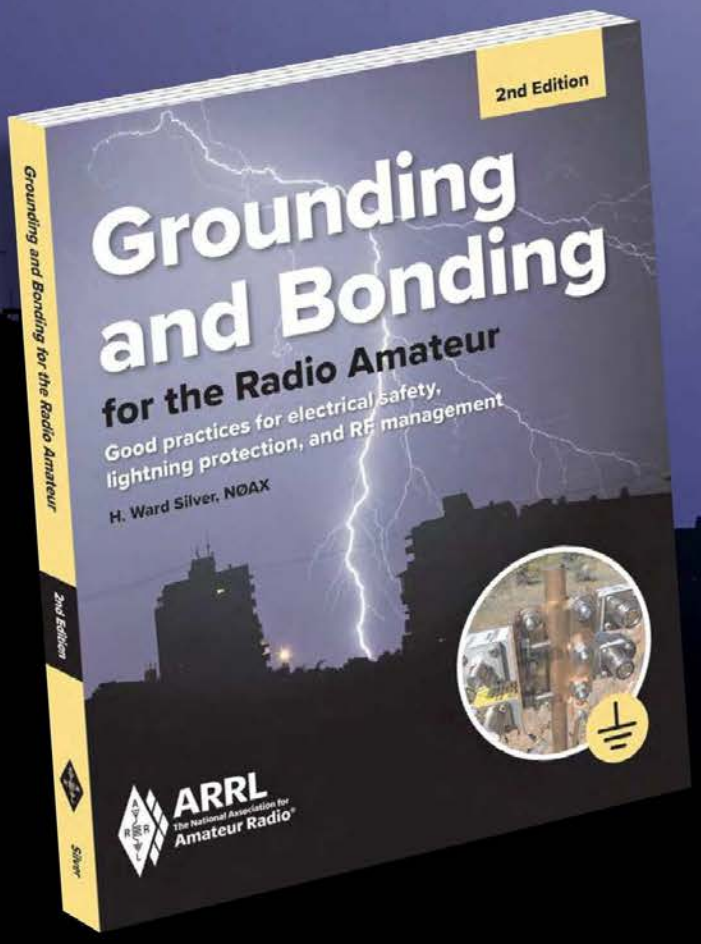
More people should be introduced to this wonderful hobby!

**George Dominick, W4UW**
Knoxville, Tennessee
Life Member

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.

# IS GROUNDING YOUR STATION HOLDING YOU BACK?

Well-known author Ward Silver, N0AX, shows you how to make sure your station follows current standards for lightning protection and communication systems. You'll learn effective grounding and bonding techniques for home stations, portable and mobile stations, towers, and outdoor antennas.




**Build your station using these techniques:**

- **AC safety:** Protect against shock hazards from ac-powered equipment by providing a safe path for current when a fault in wiring or insulation occurs.
- **Lightning protection:** Keep all equipment at the same voltage during transients from lightning, and dissipate the lightning's charge in the Earth, away from equipment.
- **RF management:** Prevent unwanted RF currents and voltages from disrupting the normal functions of equipment.

**ARRL Member Price $22.95! Retail $25.95**

**Order online at 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**

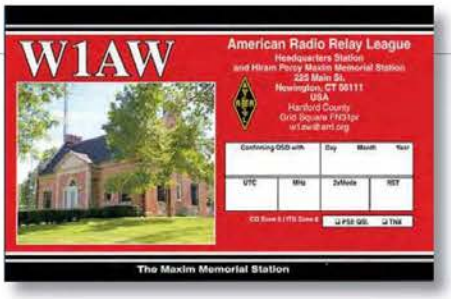
FlexRadio

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 cards.




# The EVENT HORIZON OF DX

# TS-990S

## Dual TFT Display & Dual Receiver HF/50 MHz Transceiver


The main receiver has an IP3 in the +40 dB class, and the sub-receiver is the already famous TS-590S receiver. Capable of receiving two signals at once, on different bands. 7-inch and 3.5-inch color TFT displays allow displaying of independent contents. Simplification of complex operations at a glance. Make no mistake, this is not a toy. Finally a serious tool is available for getting the very most from your hobby - of course it's a Kenwood.

- Covers the HF and 50 MHz bands.
- High-speed automatic antenna tuner.
- USB, Serial and LAN ports.
- Various PC applications (free software): ARCP-990 enabling PC control, ARHP-990 enabling remote control, and ARUA-10 USB audio driver.
- Clean 5 to 200 W transmit power through the 50 V FET final unit.
- Built-in RTTY and PSK.
- Three Analog Devices 32-bit floating-point arithmetic DSPs.
- DVI output for display by an external monitor (main screen display only).

KENWOOD

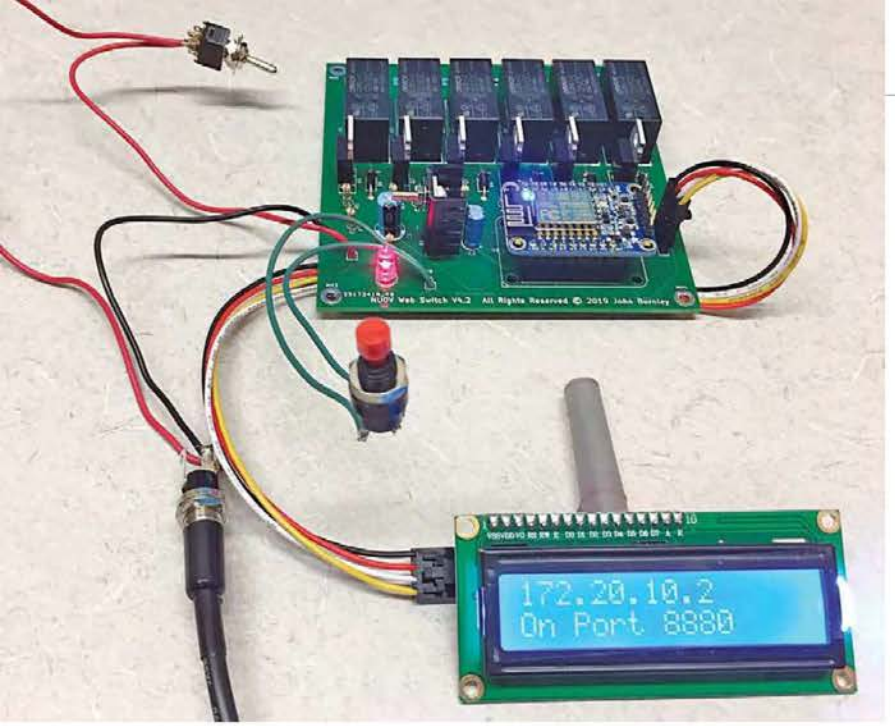
**Customer Support:** (310) 639-4200
Fax: (310) 537-8235

Scan with your phone to download TS-990S brochure.

www.kenwood.com/usa

ISO9001 Registered
JVCKENWOOD Corporation

ADS#15115




# Web Switch for Selecting Antennas and Radios

This project adds capabilities to an earlier web switch design.

**John Burnley, NUØV**

I often ignored interesting circuits in ham magazines that would require a scratch build approach, but Barry Buelow's, WØIY, *KiCad EDA* (**www.kicad-pcb.org**) presentation at the 2018 Cedar Rapids, Iowa Hamfest convinced me to try designing my own printed circuit board (PCB).

Spiros Argyros', KE2ZT, article, "Web-Controlled Receiver Antenna Switch," in the September 2016 issue of *QST*, described a web-controlled receiver antenna switch that I wanted to build. The project utilized an Internet of Things (IoT) web server with an Arduino sketch that allowed switching between a single receiver and multiple antennas. KE2ZT's circuit utilized the GPIO pins of the Adafruit HUZZAH ESP8266 microchip breakout board, which activated a relay to connect the receiver to the antenna of choice.

The HUZZAH microchip has full Wi-Fi capability and runs a simple web server that communicates with a web browser. The operator types in a specific URL containing a numeric code for the selected antenna.

## Accommodating My Modifications

I met with Barry, WØIY, about the capabilities of *KiCad* and the availability of low-cost PCB manufacturers. I modified the KE2ZT design to do the following:

**1** Accommodate multiple radios.

**2** Allow RF power transmission.

**3** Add an LCD with display.

**4** Replace KE2ZT's nested 'If' statement logic with a SELECT statement.

**5** Use variables to dynamically modify the HTML code.

**6** Use a graphical user interface (GUI) based on radio buttons for point-and-click processing.

**7** Use dynamic host control program (DHCP) processing to dynamically obtain an IP address.

**8** Display the switch IP address and port number for connection on the LCD.

**9** Provide an optional reset switch.

**10** Remove the 50 Ω resistors from relay ground path in the KE2ZT design.

I made my programming changes first. Wiring the breakout board to a prototype breadboard was easy and made checking activated or deactivated GPIO pins a simple task. Programming the HUZZAH board first enabled a means to test various functions during different construction phases.

I like the point-and-click functionality of radio buttons when using web pages. One challenge was how to display the current selections on the web page. It could take nine separate web pages with the correct buttons

*"The HUZZAH microchip has full Wi-Fi capability and runs a simple web server that communicates with a web browser."*

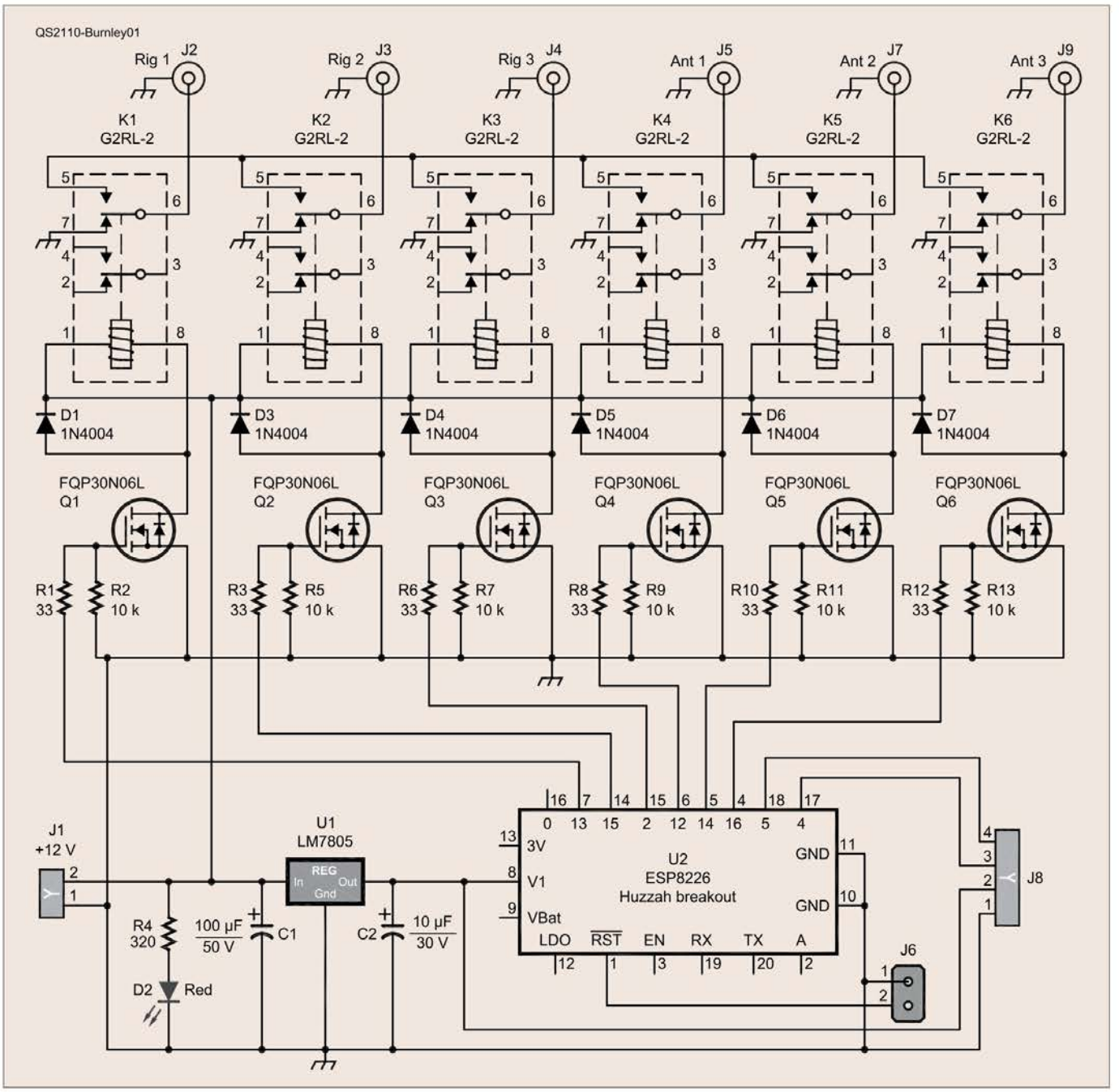



**Figure 1** — Schematic of the web switch.

C1 — 100 µF, 50 V electrolytic capacitor (**mouser.com**)
C2 — 10 µF, 30 V electrolytic capacitor (**mouser.com**)
D1, D3 – D7 — 1N4004 diode or equivalent (**mouser.com**)
D2 — 5-millimeter red LED
R1, R3, R6, R8, R10, R12 — 33 Ω resistor, ¼ W
R2, R5, R7, R9, R11, R13 — 10 kΩ resistor, ¼ W
R4 — 320 Ω resistor, ¼ W
K1 – K6 — G2RL-2-12 V dc relay (**mouser.com**)
Q1 – Q6 — FQP30N06L MOSFET (**mouser.com**)
U1 — LM7805, 5 V, 1 A regulator (**mouser.com**)
U2 — HUZZAH ESP8266, Wi-Fi-enabled microcontroller (**adafruit.com**)

activated for every possible combination. I used variables to dynamically modify the HTML code in memory for the correct radio button combination, resulting in having just one web page. Thus, whenever a web page is returned to the browser, the correct combination of checked buttons is maintained. The software uses a GET HTTP request, which places the radio and antenna selections in the Uniform Resource Identifier (browser command line).

To operate the switch, you must configure which Wi-Fi network and password to use. First, download the Arduino sketch from the **www.arrl.org/qst-in-depth** web page. Start the Arduino IDE on your computer

and open the downloaded program code. Modify the SSID variable in the sketch to your network name and specify the network password in the password variable. You may optionally add descriptions of each radio and antenna into the respective variables, but do not change the variable names. Modify only the values contained in the variables. I use an old wireless router not connected to the internet for fixed use in my shack. I can then use the same SSID on my iPhone hotspot with the same password to allow operation at another location. Compile and load the sketch to the HUZZAH breakout board, and you're ready to operate. Loading the software into the HUZZAH board is very straightforward. Adafruit provides excellent documentation on this process.[1]

## The Web Switch Circuit

I took small steps, resulting in several versions of an evolving PCB design, improving and enhancing functionality with each version. There is a free reference and starter guide at **docs.kicad-pcb.org/#_getting_started**, if you wish to design your own PCB using *KiCad*.

My circuit (see Figure 1) allows ESP8266 GPIO pins for additional radios to be used, as well as to communicate with the LCD (see the lead photo), which displays the IP address and TCP port number. GPIO pins are associated with the processor chip, and not the breakout board pins (see Figure 1).

GPIO Pins 4 and 5 (breakout board Pin 17 and 18) are used for the LCD I2C serial data communications. GPIO #4 is used for SDA (data line) and GPIO #5 for SCL (clock line), respectively. More information on mapping the ESP8266 GPIO pins to the breakout board layout may be found on the Adafruit web page.[2]

When power is applied to the switch, the LCD first displays a message indicating **ANTENNA SWITCH | INITIALIZING,** followed by the IP address obtained when connected to your network via DHCP, and the TCP port number to which the web server is listening (see the LCD in the lead photo). I chose to use DHCP to dynamically acquire an IP address, so I could use the hotspot on my iPhone, allowing portable operations. Once connected to a browser, the LCD displays the default radio and antenna connections. **D** or **G** will display if a radio is disconnected (grounded), or antenna is grounded (default upon initialization). Once selections have been made, the LCD will display the radio and antenna selected: **NUØV HAM SWITCH | RIG: 1 ANT: 1.**

*"Programming the HUZZAH board first enabled a means to test various functions during different construction phases."*

I used robust current-handling relays to accommodate transmission of RF power through the switch. W6PQL has an interesting article at **w6pql.com/using_inexpensive_relays.htm**, which discusses using inexpensive relays with RF projects.

The chosen RF circuit trace width, according to the *KiCad* run PCB calculator, could handle a little over 5 A. Assuming a 50 Ω load, it could easily accommodate 500 W, although it has only been tested up to 100 W. I chose 8 A power relays, as discussed in W6PQL's analysis, to safely handle the maximum peak voltage and current load, should higher power ever be used.

I added an optional reset switch. Pin 1 on the HUZZAH breakout board serves as a reset when low. This was very useful when debugging both software and hardware. When installing the optional switch, be sure you are using a momentary switch with the default of open circuit.

## Construction and Testing

Follow these six steps to build your switch.

### Step 1

Install all components related to power. I recommend installing female header sockets for U2, and a 1 × 4 male header in J8 for connecting to the LCD module. Install C1, U1, and C2 to provide the +5 V supply for U2. Optionally, install R4 and D2 for a visual indication of the switch in an **ON** state. Check all solder joints to ensure good connections. Apply +12 V to J1 Pad 2. D2 and the blue LED on the HUZZAH board should light up. Check U2 Pin 8 and J8 Pin 2 for + 5 V dc using a volt-ohm meter (VOM). Disconnect power from the PCB.

### Step 2

Verify that U2 and the LCD module are working properly. Temporarily insert U2 into the female header sockets. Temporarily install the LCD module at J8. Apply +12 V. Check the LCD for the initialization message. The ESP8266 should connect to your network and display the IP address and TCP port number to which the web server is listening. Connect your browser to the switch by substituting your server IP

**Table 1**
**HUZZAH Breakout Board Voltage Checks**

| Selection | HUZZAH Breakout Board Pin | Voltage |
|---|---|---|
| Radio 1 | 7 | +3.3 V |
| Radio 2 | 14 | +3.3 V |
| Radio 3 | 15 | +3.3 V |
| Antenna 1 | 6 | +3.3 V |
| Antenna 2 | 5 | +3.3 V |
| Antenna 3 | 4 | +3.3 V |

**Table 2**
**Radio-Antenna to PCB Cross Listing**

| Radio | PCB |
|---|---|
| 1 | J2 |
| 2 | J3 |
| 3 | J4 |
| **Antenna** | **PCB** |
| 1 | J5 |
| 2 | J7 |
| 3 | J9 |

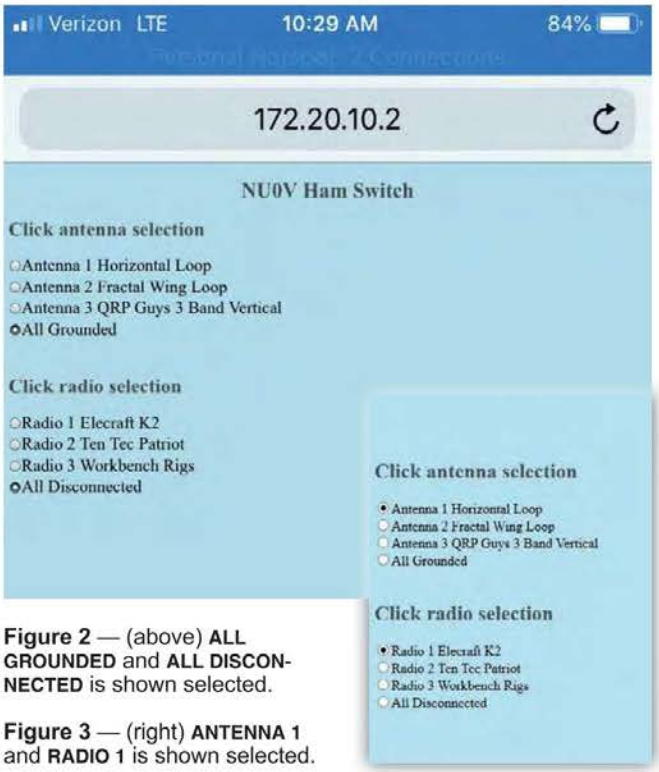



**Figure 2** — (above) **ALL GROUNDED** and **ALL DISCONNECTED** is shown selected.

**Figure 3** — (right) **ANTENNA 1** and **RADIO 1** is shown selected.

address and port number, entering **http://ip_address_of_your_server:port_number** into the browser command line. You should see the default landing page for the web server application (see Figure 2), where the **ALL GROUNDED** and **ALL DISCONNECTED** radio buttons are highlighted.

Use Table 1 as a guide to sequentially select Radio 1 – Radio 3, and check voltages at the appropriate HUZZAH board pins. Do not use the printed numbers on the HUZZAH; those are the GPIO numbers and pin functions. Refer to pin out documentation on the Adafruit website for more information.[2] After verifying Radio 1 – Radio 3, select **DISCONNECT ALL**, and repeat the process of checking voltages for the antenna selections. There should only be a positive voltage present when that resource is selected on the web page. When Radio 3 is selected, you will also see the blue LED on the HUZZAH go out.

Remove power. Remove the HUZZAH from the female header sockets and the LCD module from J8.

### Step 3

Install resistors R1, R3, R6, R8, R10, and R12. Install resistors R2, R5, R7, R9, R11, and R13. Install the 1N4004 diodes D1 and D3 – D7, observing the correct polarity. Install FETs Q1 – Q6. Install relays K1 – K6. Wire the connections to your radio and antenna connectors. Inspect all solder joints.

### Step 4

Insert U2 into the female header pin sockets. Connect the LCD module to J8. Connect a +12 V dc power source to J1 Pad 2. D2 (if installed) and the blue LED on the HUZZAH board will light up. Follow the instructions in *Step 2* to connect your web browser to the switch. Once connected, select **ANTENNA 1** and **RADIO 1** (see Figure 3). You should hear a relay engage when you click on each selection. Verify continuity with a VOM between Pad 2 (circular) of the selected radio to Pad 2 (circular) of the selected antenna. Verify there is no continuity to the remaining radios and antennas not selected. Continue by repeating the process for every radio and antenna combination. Use Table 2 as a guide for the continuity checks. Select **ALL DISCONNECTED** and **ALL GROUNDED** on the web browser. Verify with a VOM that all radio and antenna pads are grounded.

### Step 5

If installed, test the reset function by momentarily pressing the reset switch. The HUZZAH breakout board should reboot.

### Step 6

Make sure a good ground is connected to one of the mounting holes when the unit is put into operation.

## Solving Glitches

During initial testing, I discovered a critical issue. The LCD would suddenly indicate all relays in a disconnected or grounded state without any changes initiated by the browser.


**Figure 4** — The small ARRL logo icons in the top bar are example favicons.

The Arduino sketch code revealed no obvious logic error, so I reviewed the network traffic between the devices using *Wireshark* (**www.wireshark.org**) network tool to capture all traffic to the switch. Reviewing the results quickly identified the problem.

Favicons are small icons associated with a website that are displayed by the browser, such as the miniature ARRL logo icons used twice in the top bar of Figure 4. Favicons are obtained by a browser requesting the favicon file through the HTTP protocol without user interaction. If the website has a *favicon.ico* file, then that file is forwarded to the browser for processing. If not, then an HTTP return code 404 should be returned indicating file not found.

I included a figure in the **www.arrl.org/qst-in-depth** page that shows an HTTP request packet for the *favicon.ico* file from the browser, captured using *Wireshark* while trying to debug this issue. During testing, I just connected the various antenna ports and then checked for anomalies in the expected packets.

The problem was easily cured by modifying the sketch to specifically check for the favicon request and return the proper 404 return code, which indicates *File Not Found*. I suspect that anyone using or modifying the sample web server code on the Arduino IDE might eventually run into a similar problem. Another figure on the *QST* In Depth web page shows the HTTP traffic for the favicon request and response from the HUZZAH breakout board, including a fixed *favicon.ico* message.

Version 1 of the board also attempted to use GPIO #0, but I quickly discovered the breakout board designers were serious in their warning about potential looping during initialization if this pin is low during boot.

## Operating the Web Switch

The web switch is quite simple to operate. When the switch is first powered **ON**, it will attempt to connect to your Wi-Fi network. If the connect request is successful, the IP address assigned to the web switch is displayed along with the TCP port number to which the web server software is listening. Connect to the switch using the method discussed earlier. Note that the IP address may change between operating sessions because the sketch uses DHCP to dynamically obtain an IP address.

Once connected, the default web page is displayed, and the LCD will show a rig setting of **D** and an antenna setting of **G**. The web page will show your descriptions of radios and antennas with the HTML radio buttons checked for **ALL DISCONNECTED** for the radios, and **ALL GROUNDED** for the antennas. Select the radio and antenna you wish to use, and start operating.

You can easily modify my code (available on the **www.arrl.org/qst-in-depth** page) to accommodate your mix of radios and antennas without modifying the hardware.

I thank Barry Buelow, WØIY, for inspiring me to design a PCB, as well as for answering my questions about *KiCad*. I also thank Jerry Hall, WØPWE, for helping me test my design, and Spiro Argyros, KE2ZT, for his original design.

**Notes**
[1]**https://learn.adafruit.com/adafruit-huzzah-esp8266-breakout/using-arduino-ide**.
[2]**https://learn.adafruit.com/adafruit-huzzah-esp8266-breakout/pinouts**.

Photos by the author.

John Burnley, NU0V, has been licensed for 50 years. He earned a BA degree from the University of Kentucky and an MBA from the University of Iowa. John had a career in information technology that spanned over 30 years in technical, managerial, and executive leadership roles. He is a faculty member at Iowa State University and Des Moines University, teaching information technology courses at the undergraduate and graduate levels. John is a QRP enthusiast, and enjoys operating low-power equipment that he has built. You can reach John at **nu0v@arrl.net**.

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



## Feedback

In Phil Erickson's, W1PJE, article, "A Synopsis of the 2021 HamSCI Virtual Workshop," from the September 2021 issue of *QST*, TAPR should have been spelled out as "Tucson Amateur Packet Radio (TAPR)." *QST* regrets the error.

# The DC2020 Receiver

This basic direct-conversion receiver uses just a few parts and can be modified for other bands.


**Harold Smith, KE6TI**

This is an ordinary direct-conversion receiver of fairly simple design, comprising only seven transistors. I built it for quick and easy assembly and mounted it in an enclosure. I used only leaded through-hole components, (no integrated circuits — ICs), with all easily available parts. It tunes the bottom 100 kHz of the 7 MHz band for CW reception. Increasing the cutoff frequency of the audio low-pass filter could also allow reception of SSB. A 1 μV signal from a signal generator is clearly audible in my headphones.

## Circuitry

The receiver consists of four stages (see Figure 1):

**1** A variable oscillator that is voltage tuned via a pair of common rectifier diodes.

**2** A product detector with audio output.

**3** A low-pass filter that rolls off above roughly 1 kHz.

**4** An audio amplifier with more than enough gain to drive headphones.

I chose to tune the variable oscillator with a pair of rectifier diodes serving as varactors. This avoids the expense of an air variable capacitor. You might try diodes from your junk box in place of the 1N4002s that I used.

I chose a Hartley oscillator configuration, because it gave good tuning range with not too extreme tuning voltages. The Hartley uses a tapped inductor that I wound myself on a T50-7 toroid. I also used only NP0 and C0G ceramic capacitors in the oscillator to provide stability that was more than adequate for CW. I did have to tweak the coil a little to put the oscillator range where I wanted it, which allowed me to avoid using a trimmer capacitor. The tweaking consisted of compressing and stretching the turns on the toroid until it tuned the range I wanted. You can also add or subtract turns if needed.

The mixer and product detector is a differential stage, which gives good gain and light loading of the tuned circuit. The tuning range in this version is small enough that I didn't need to provide for peaking the front end to follow the oscillator tuning. You can change the bandwidth of the front end by paralleling a resistor across C1 to lower its Q, or by changing the number of turns on the primary of T1. This will lower the front-end gain.

An active low-pass filter with a cutoff of about 1 kHz follows the detector stage. It should be scalable to other frequencies by changing the values of the low-pass filter resistors. For a 3 kHz cutoff, make R11 and R12 each 510 Ω and change C17 to 100 pF. This will increase the audio bandwidth without affecting the gain.

The two-transistor audio amplifier is based on a Sziklai Pair. It produces plenty of audio to drive headphones. Mount the audio volume control, R15, close to Q5 and Q6. I used a volume control with a built-in switch to turn the power to the radio **ON** and **OFF**. The very large decoupling capacitor, C19, is used for hum suppression.

The low-frequency response is determined almost entirely by the value of C20 and the impedance of the headphones. It is common homebrew practice to use 32 Ω stereo phones with little radios like this, usually with the phone

*"Increasing the cutoff frequency of the audio low-pass filter could also allow reception of SSB."*

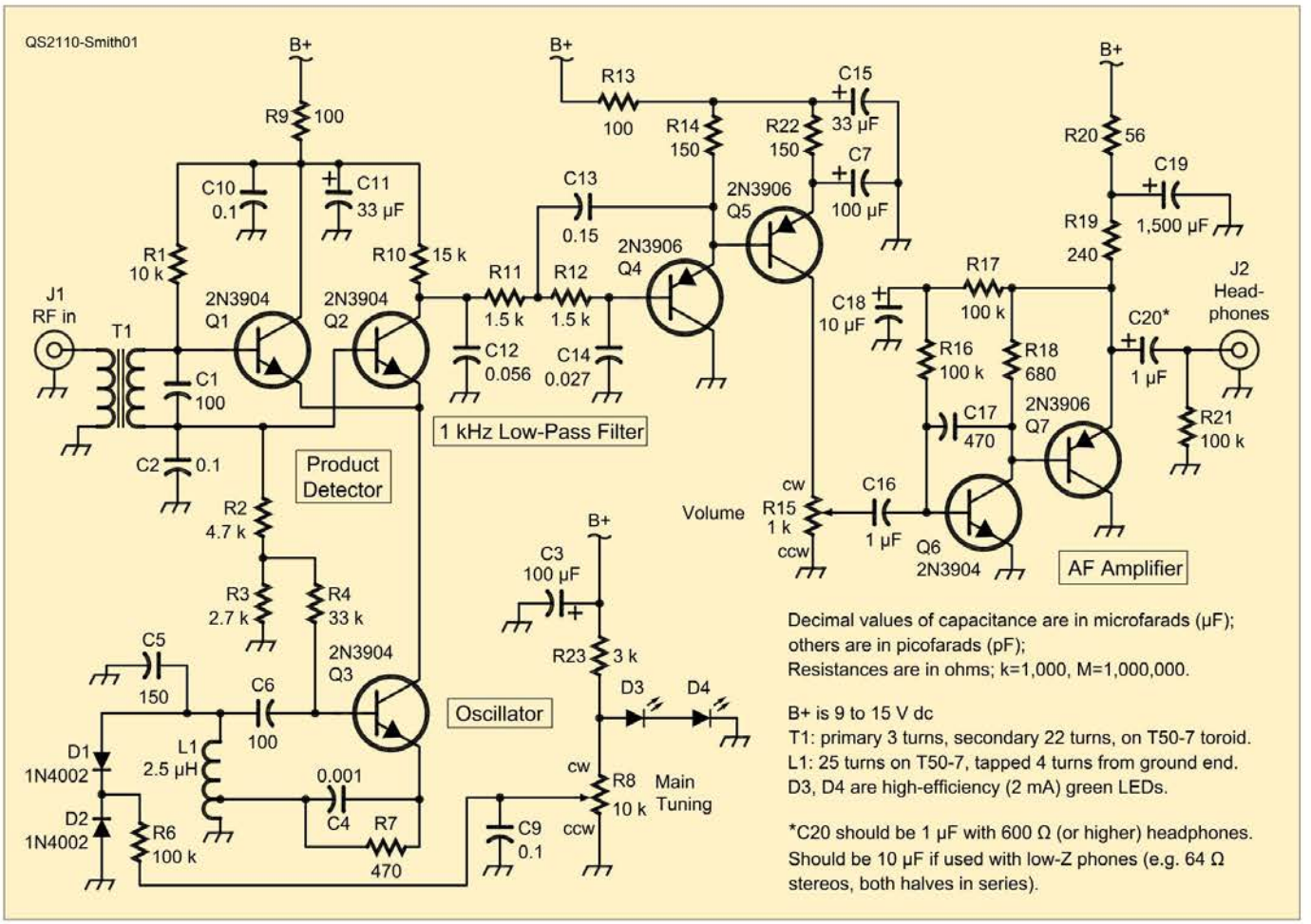



**Figure 1** — The schematic diagram of the DC2020 receiver.

jack wired to put the two earpieces in series, giving a 64 Ω headphone. With that load, C20 should be 10 µF. With high-impedance headphones — 600 Ω or more — use 1 µF for C20. This isn't a major problem as long as one uses the correct value C20.

The parts will be adequately secure if you build the receiver with this simple style. The only real issue is usually the inductors, especially the oscillator coil, L1. It must be mounted so it cannot move. I do this using double-sided foam tape. One caveat here: If you know you will be adjusting the toroid, do not stick it down until you are done. You can accomplish this and still have the toroid in its final position by leaving the cover paper on the foam tape until you are ready to permanently stick down the coil.

Most of the parts, including the bare copper-clad board for quick construction, are available from Digi-Key, Mouser, Allied Electronics & Automation, and so on. Toroids are available from Amidon Associates, Kits and Parts, and others. There are only two toroids to wind, and they both use the same T50-7-type form. I mounted my radio in a tin (see Figures 2 and 3). I recommend enclosures for construction to prevent accidental movement of parts.

Power this radio from a 9 V to 15 V dc source. It draws about 25 mA at 9 V. If the supply is external to the radio, include a series diode to protect the radio from reverse-polarity mishaps. Because the radio frequency stability depends on the supply voltage, I added a simple voltage regulator to the tuning potentiometer, R8, in the form of the two green LEDs, D3 and D4. The 3.8 V drop across them does not change much as the supply voltage changes. I added a hole in the enclosure, so one of the LEDs is visible from the panel (see Figure 2) to serve as a power **ON** indicator. The tuning potentiometer can be almost any value from about 10 kΩ or higher.


**Figure 2** — The receiver is mounted in a tin enclosure.

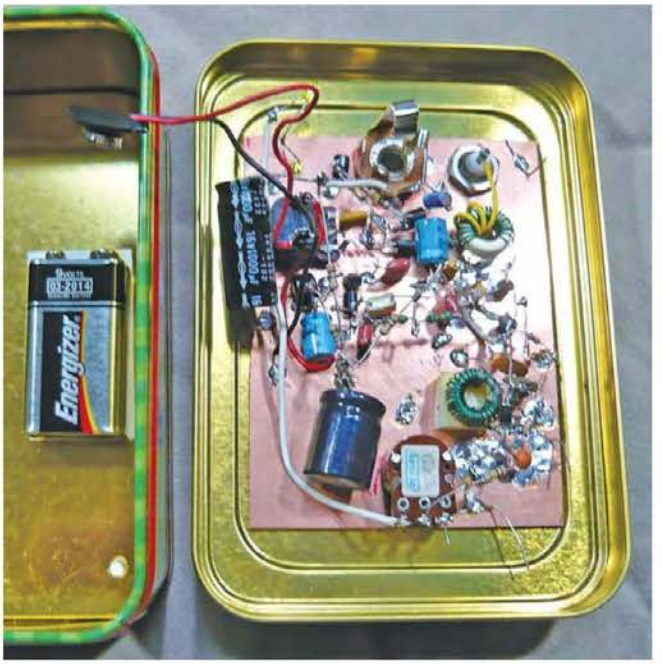



**Figure 3** — The radio PC board mounts to the lid of the enclosure, and the 9 V battery is shown in the left side of the enclosure.

**Figure 4** — A toroid can be wound with the help of a bobbin of wire.

## Construction

Obtain a piece of circuit board material and trim it to the size you want. Mine is about 3 × 4 inches, cut to fit inside the lid of the tin I used as an enclosure cabinet. Scour the copper with steel wool until it is shiny, and carefully wipe off the residue.

I located approximately where I wanted the large pieces — potentiometers and connectors — to end up, and marked keep-out areas on the board. Then I carefully drilled their mounting holes through both the board and the lid. The potentiometers and connectors hold the board to the lid, so no extra holes are needed.

It was more convenient to build most of the circuitry before mounting the big parts. That let the board sit flat on the workbench while I worked on it.

Start by soldering to ground any one of the grounded parts. I started with R3. To the non-grounded end of that part, attach those parts that connect to it, and go on from there. There is no need to try for the shortest possible lead lengths, but the parts should be mounted well enough that they do not move when the board is moved.

## Winding the Toroids

Every time the wire goes through the core counts as a turn. This radio uses T50-7 toroids, which are easier to hold and wind than smaller ones. If you want, you can use a bobbin with the wire on it (see Figure 4), and simply thread the bobbin through the core the correct number of times.

Try to lay out the radio so that your construction follows the schematic. You can see in Figure 3 that the oscillator with the toroid is down in the lower right corner of the board. Above that is the product detector, and the audio stages go off at right angles toward the center of the board. It was easy to assemble and modify as needed. Take your time and check your work often.

## Concluding Comments

The DC2020 is a basic direct-conversion receiver. It is possible to modify this radio for other bands. The only parts that would have to change are T1 and C1 in the product detector, and L1 and C5 in the oscillator. Start by scaling their values proportionally to the change of frequency.

Photos by the author.

Harold Smith, KE6TI, earned his Novice-class license in 1961 while a high-school freshman. He has been licensed continuously ever since. He began homebrewing while in high school, and still has his much-battered 1962 *Radio Amateur's Handbook*. Harold earned a degree in Radio-TV in 1969, and a BSEE in 1983. He was employed as an electronics engineer in consumer electronics until retirement in 2009. He now spends more time building than operating. You can reach Harold at **ke6ti.homebrew@gmail.com**.

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




A Sensitive Field Strength Meter for Foxhunting

A new use for a popular circuit.

**Woody White, KZ4AK**

An article from the June 2001 issue of *QST*, "Simple RF-Power Measurement," by Les Hayward, W7ZOI, and Bob Larkin, W7PUA, introduced me to the AD8307, an integrated circuit from Analog Devices. Available in an eight-pin dual inline package (DIP), the logarithmic amplifier/detector works from dc to 500 MHz. It produces a dc output proportional to the logarithm of RF power input. Connected to a calibrated meter, it makes a decent log power meter.

I built a meter with a digital readout that works from –80 dBm (.01 nW) to +12 dBm (16 mW). With over 80 dB of range, it seems to work as well as my old lab-grade power meter.

In the September 2008 issue of *QST*, Steve, N2PON, describes a similar meter with a digital readout. Both of these articles can be accessed at **www.arrl.org/arrl-periodicals-archive-search**, free for ARRL members.

### Necessities for Foxhunting

I ordered two of the AD8307 chips. With foxhunts in my future, I decided to use the spare chip in a very simple field strength meter (FSM). My digital meter would have worked, but signal trends are harder to follow on digital readouts than with an analog meter.

I have been in several foxhunts over the years, and although I was very close to the hidden transmitter, I could not find it. In spite of using good attenuators, the poorly shielded handheld transceiver/mobile receiver would saturate. There is no way to get a fix on the transmitter when this happens. Extra shielding on the receiver when near the hidden transmitter can help, but it isn't very convenient, and often, the shielding is not good enough. That's where a sensitive, wide dynamic range FSM can take over.

Be aware that the FSM front end is wide open and provides no selectivity. Any RF energy will register, up to about 500 MHz. This is great for a general-purpose FSM, but it's a bit confusing when used for foxhunting. Signals that aren't from the hidden transmitter may come and go. A narrow bandwidth antenna will provide some selectivity, and a simple band-pass filter between the antenna and the FSM helps. However, strong signals could register on the meter by bypassing the antenna and filter and leaking directly into the FSM box. To minimize this, I plan to build a circuit board shield around the AD8307 circuit.



My power meter, as built from the 2001 *QST* article, "Simple RF-Power Measurement," by Les Hayward, W7ZOI, and Bob Larkin, W7PUA. (Woody White, KZ4AK, photo)

**HAMSPEAK**

**Foxhunting**: A contest where participants try to locate a hidden transmitter. The transmitter is the *fox* and those trying to find it are the *hunters*.

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

## Product Review

# MFJ-9219 QRP Tuner, Wattmeter, and Dummy Load

*Reviewed by Phil Salas, AD5X*
**ad5x@arrl.net**

The MFJ-9219 combines an antenna tuner, an SWR/wattmeter, and a dummy load into a compact package. It is designed for portable operation at power levels up to 20 W. Many QRP (low-power) transceivers and kits do not include an antenna tuner or SWR meter, and antenna installations in the field often require compromises, so the MFJ-9219 is a useful accessory.

## Overview

The MFJ-9219's antenna tuner is a standard manual T-tuner (series-capacitance/shunt-inductance/series-capacitance). The two variable capacitors have values of 20 to 650 pF, and there are 12 selectable values of fixed inductance from 0.25 µH to 6.5 µH. The wattmeter is only functional when the internal dummy load is used. The dummy load consists of eight 2 W, surface-mount resistors. It will handle 5 W for several minutes at a time, but it is limited to no more than 10 seconds at 20 W, after which it must be permitted to cool for at least 2 minutes. The transceiver input (**RADIO**) is a BNC connector, and the output (**ANTENNA**) can either be coaxial (another BNC) or banana plugs for a random wire and ground. Figure 1 shows the interior of the unit.

The MFJ-9219 SWR circuit is based on the Wheatstone bridge, a simple circuit that can determine unknown impedances in RF circuits. (Theory of operation for the Wheatstone bridge is included in the MFJ-9219 manual, available from MFJ's website, or from **en.wikipedia.org/wiki/Wheatstone_bridge**.) Because it is a resistive bridge, some transmit power is dissipated in the bridge during the tuning process when measuring SWR. An advantage is that your transmitter is protected from high SWR conditions while tuning, because the worst SWR your transmitter can ever see is 2:1. The disadvantage is that during the tuning process, you can dissipate up to 100% of your tune-up power in two of the three bridge resistors during high SWR conditions, assuming your transmitter can deliver full power into a 2:1 SWR.


**Figure 1** — The internal view of the MFJ-9219. The tuning capacitors and switched inductor are at the upper right. Surface-mounted resistors are located on the PC board.

## Operating the MFJ-9219

Operation of the MFJ-9219 can be a little confusing at first. There are three switches that need to be used in the proper manner. The **TUNE/BYPASS** slide switch puts the T-tuner in series with your transceiver's RF output. The **METER ENABLE/OPERATE** pushbutton switch places the Wheatstone bridge in series with the transceiver's RF output. The **SWR/PWR** pushbutton switch lets you measure SWR (used for tuning) or RF power,

using the internal dummy load when the **METER ENABLE/OPERATE** switch is in the **METER ENABLE** position.

To measure power, place the **TUNE/BYPASS** switch in **BYPASS**, the **METER ENABLE/OPERATE** switch in the **METER ENABLE** position, and the **SWR/PWR** switch in the **PWR** position. Rotate the **METER SET** control to 20 W for a 20 W full-scale reading, 5 W for a 5 W full-scale reading, and 1 W for a 1 W full-scale reading. As the meter is only marked from 0 to 5, you need to multiply the meter reading by 4 for the 20 W setting, and divide by 5 for the 1 W setting.

To measure SWR, place the **TUNE/BYPASS** switch in **BYPASS**, the **METER ENABLE/OPERATE** switch in the **METER ENABLE** position, and the **SWR/PWR** switch in the **PWR** position. Apply RF power and adjust the **METER SET** control for a full-scale reading. Then set the **SWR/PWR** switch to **SWR** to read SWR. Note that the SWR scale is only marked up to a 3:1 SWR (about ⅔ of the scale).

To use the antenna tuner, set the **TUNE/BYPASS** switch to **TUNE**, the **METER ENABLE/OPERATE** switch to **METER ENABLE**, and the **SWR/PWR** switch to **SWR**. Apply enough RF power to get a meter reading. If you use more than 5 W, you will need to minimize tuning time, as shown in the transmit-time-versus-power curve in the manual. You can adjust the **METER SET** control to increase the reading if needed. Now adjust the antenna tuner controls for minimum meter reading (a recommended tuning procedure is given in the manual).

Once this is accomplished, check the actual SWR as described above, making sure to leave the **BYPASS/TUNE** switch in the **TUNE** position. If the SWR is reasonable (typically less than 2:1 SWR), set the **METER ENABLE/OPERATE** switch to **OPERATE**, and you are ready to go.

## Performance Tests

Next, I wanted to determine the meter reading accuracies, and how well the antenna tuner works. I found that the diode detector/dummy load combination was frequency insensitive (an advantage of surface-mounted components and construction), so SWR and RF power measurements were all made on 20 meters. The power meter is an analog, non-linear meter, so the readings were my best effort to interpolate the meter readings. Tables 1 and 2 detail the results of the SWR and RF power reading tests.

**Table 1**
**MFJ-9219 SWR Meter Testing**

| High-Impedance SWR | | Low-Impedance SWR | |
|---|---|---|---|
| Actual | Measured | Actual | Measured |
| 1:1 | 1:1 | 1:1 | 1:1 |
| 2:1 | 1.6:1 | 2:1 | 1.5:1 |
| 3:1 | 3:1 | 3:1 | 2.2:1 |

**Table 2**
**MFJ-9219 Power Display Accuracy***

| 1 W Setting | | 5 W Setting | | 20 W Setting | |
|---|---|---|---|---|---|
| Actual | Measured | Actual | Measured | Actual | Measured |
| 1 W | 0.9 W | 5 W | 5 W | 20 W | 20 W |
| 0.5 W | 0.5 W | 4 W | 4.2 W | 15 W | 16 W |
| 0.2 W | 0.2 W | 3 W | 3.4 W | 10 W | 10 W |
| | | 2 W | 2.5 W | 5 W | 5.5 W |

*Originally, the minimum sensitivity would only permit measuring power to 5 W maximum. I contacted MFJ, and they said that some units had been built with an incorrect potentiometer. MFJ promptly replaced the unit with one that was built correctly. Readings for the 1 W and 20 W settings were calculated from the meter scale (1 to 5).

**Table 3**
**MFJ-9219 Resistive Load and Loss Testing**

| Untuned SWR | Load (Ω) | Power Loss (%) and Tuned SWR by Band (Meters) | | | | |
|---|---|---|---|---|---|---|
| | | 160 | 80 | 40 | 20 | 10 |
| 10:1 | 5 | — | 26% | 20% | 12% | 18% |
| | | >2:1 | 1.7:1 | 1.1:1 | 1.3:1 | 1.4:1 |
| 8:1 | 6.25 | — | 22% | 23% | 2% | 8% |
| | | >2:1 | 1.25:1 | 1.3:1 | 1.2:1 | 1.2:1 |
| 4:1 | 12.5 | 17% | 13% | 18% | 6% | 5% |
| | | 1.8:1 | 1.2:1 | 1.2:1 | 1.2:1 | 1.3:1 |
| 3:1 | 16.7 | 9% | 12% | 16% | 4% | 4% |
| | | 1.5:1 | 1.2:1 | 1.3:1 | 1.2:1 | 1.3:1 |
| 2:1 | 25 | 2% | 6% | 12% | 2% | 4% |
| | | 1.2:1 | 1.1:1 | 1:1 | 1.2:1 | 1.3:1 |
| 1:1* | 50 | 0 | 0 | 0 | 0 | 0 |
| | | 1:1 | 1:1 | 1:1 | 1:1 | 1:1 |
| 2:1 | 100 | 12% | 7% | 4% | 4% | 4% |
| | | 1.9:1 | 1.1:1 | 1.2:1 | 1.1:1 | 1.4:1 |
| 3:1 | 150 | — | 6% | 6% | 4% | 6% |
| | | >2:1 | 1:1 | 1.2:1 | 1.1:1 | 1.1:1 |
| 4:1 | 200 | — | 6% | 7% | 6% | 10% |
| | | >2:1 | 1:1 | 1.1:1 | 1.3:1 | 1.3:1 |
| 8:1 | 400 | — | 7% | 8% | 9% | 12% |
| | | >2:1 | 1:1 | 1:1 | 1.3:1 | 1.5:1 |
| 10:1 | 500 | — | 10% | 8% | 8% | 14% |
| | | >2:1 | 1.4:1 | 1.1:1 | 1.1:1 | 1.4:1 |

— = no match
*Bypass

### Bottom Line

The MFJ-9219 provides a QRP antenna tuner, wattmeter, and dummy load in one convenient package.

### Tuner Matching and Loss Measurements

Next, I performed resistive matching range and loss testing. Tuning power was 5 W. All measured losses are subject to the ±3% accuracy of the National Institute of Standards and Technology (NIST) traceable test equipment used. Tuned SWR was recorded only if a tuned SWR of 2:1 or better could be achieved. The test results are given in Table 3.

The MFJ-9219 was able to tune up to 10:1 resistive SWR on 80 – 10 meters. The ability to tune mismatches on 160 meters was limited. As with all tuners, losses increase as SWR increases. Incidentally, because the tuning capacitors are isolated from ground, I experienced some RF bites (just enough to get my attention) from the capacitor knob set screws while tuning some of the high-impedance loads.

### Reactive Testing

Resistive matching tests are fine for antenna tuner comparisons, but tuners experience the highest RF current and maximum inductance with short antennas. Higher values of matching inductance can result in higher loss due to the typically lower Q (quality factor) of a physically small, higher-value inductor. To determine tuner losses in a few real-world conditions, I built antenna simulator circuits based on two different antenna lengths — a 43-foot vertical on 80 meters, and an 8-foot vertical on 40 meters. As expected, I found that higher losses do occur when matching a short antenna.

## Conclusion

The MFJ-9219 is an interesting device that can be useful for the portable QRP operator. It provides the ability to tune an antenna, and measure power and SWR in a package not much larger than your hand.

*Manufacturer:* MFJ Enterprises, 300 Industrial Park Rd., Starkville, MS 39759; **www.mfjenterprises.com**. Price: $119.95.

# HYS TC-YG08UV Dual-Band VHF/UHF Yagi Antenna

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

The HYS TC-YG08UV is a dual-band Yagi antenna designed for 2 meters and 70 centimeters. It offers five elements on 70 centimeters and three on 2 meters, so the tradeoff is reduced gain in return for lighter weight and a smaller footprint (the boom is only 36 inches in length). There are two driven elements with individual gamma-matching sections, but they combine to a single SO-239 coaxial connection (see Figure 2). With its all-aluminum construction, the TC-YG08UV weighs about 2 pounds and is rated for 100 W, although I suspect it could tolerate more power.

### Bottom Line

The HYS TC-YG08UV is a sturdy dual-band VHF/UHF Yagi antenna that will increase your effective range on 2 meters and 70 centimeters. It could be used for portable operation if you can transport it fully assembled.

## Assembly

The antenna arrives in a rather small box, but that's because the 36-inch boom and the 2-meter elements are split into several sections. The elements are inscribed with numbers that correspond to their matching holes in the boom (see Figure 3).

The 2-meter elements include extensions that must be attached to each end after you slide the elements through the boom holes. The instructions seem to imply that the extensions are numerically inscribed as well, but this is not the case. Fortunately, all extensions are the same lengths, so it doesn't matter which elements you attach them to.

The two boom pieces are joined at the driven-element section. Depending on how you position the boom pieces when attaching to the driven-element section, the TC-YG08UV will end up in a horizontally or vertically polarized orientation for attachment to a support mast via a single **U**-bolt. The supplied **U**-bolt and saddle will fit masts up to 1.57 inches in diameter.

The elements, extensions, and boom sections are all held together by stainless-steel screws. The instructions caution against repeatedly assembling and disassembling the antenna because this can ultimately weaken the screw connections. This is a point well taken. The TC-YG08UV is intended for permanent installation rather than portable use where it would be reassembled over and over. Of course, it will work well as a portable antenna if you are willing to transport it fully assembled. The longest element (the 2-meter reflector) is about 43 inches in length.

To assemble the antenna, I needed only a Phillips screwdriver. Forty minutes after unpacking the parts, the antenna was ready for use.

**Figure 2** — The TC-YG08UV driven elements use individual gamma-matching sections for each band. A single feed line runs to the transceiver.

## Testing

I attached the TC-YG08UV to a temporary wood mast and swept it on 2 meters and 70 centimeters with an antenna analyzer. The low-SWR points (less than 1.5:1) were at the bottom ends of both bands. Using a small Allen wrench, I loosened the nuts on the gamma-match shorting bars and slid each one about ½ inch. That was sufficient to bring the lowest SWR to 146 MHz on 2 meters and 440 MHz on 70 centimeters. In this configuration, the 2:1 SWR bandwidths ranged from 144 to 148 MHz and 435 to 445 MHz.


**Figure 3** — Each element is inscribed with a number that corresponds to a matching number on the boom.

Taking the TC-YG08UV to my favorite antenna test site atop a 300-foot ridge in Connecticut, I wasn't surprised to find that I could hear (and access) 2-meter and 70-centimeter repeaters as far north as New Hampshire and as far south as New Jersey. I was also lucky enough to contact a mobile station on 146.52 MHz simplex at a distance of about 20 miles. My output power during this test session was only 5 W.

Although the TC-YG08UV isn't intended for amateur satellite use, I decided to give it a try. Holding the boom at the rear, just in front of the 2-meter reflector, I managed to make a few contacts through AMSAT-OSCAR 27 as it zipped overhead. The satellite's signal was full quieting at peaks and, according to reports, so was I.

Overall, the TC-YG08UV is easy to assemble and seems durable enough to survive all but the worst conditions. If you're looking for an antenna to expand your VHF/UHF range, especially if you are using low power, this may be a model to consider.

*Manufacturer:* Quanzhou Truest Communication, Fujian, China. Available from **www.amazon.com** and **www.newegg.com**. Price: $100.

# iPortable Pro2 Equipment Rack System 6UM

*Reviewed by Rick Palm, K1CE*
**k1ce@arrl.net**

The iPortable Pro2 Equipment Rack System model 6UM is a portable, medium-duty hard shell case that includes two 12-inch-wide shelves for mounting transceivers, power supplies, digital mode interfaces, or other gear. It includes panels on each side of the shelves for speakers and external power and antenna connections. The outer dimensions of the box are 12 × 22 × 18 inches (height, width, depth), and it weighs about 19 pounds. The iPortable Pro2 case comes with covers for the back and front that are deep enough to provide some extra room for radio knobs, fans, or connectors. A zippered nylon mesh pocket attached to the inside of the back cover holds extra cables and radio manuals. The covers are secured with sturdy latches. The package is designed for use as a complete solution for an emergency go-kit or portable station. Figures 4, 5, and 6 show several views of the iPortable Pro2 rack system


**Figure 4** — The iPortable Pro2 Equipment Rack System 6UM prior to installing equipment.

### Bottom Line

The iPortable Pro2 Equipment Rack System 6UM offers a flexible way to build a portable station that's quick to set up and well-protected when in storage or in transit.

## More Details

The box has molded, integrated feet on both sides for placement on the ground, and there are pull-out handles on each side of the case. An adjustable bright-

**Figure 5** — Front and back covers offer protection for equipment in storage or in transit. The covers are deep enough to clear equipment knobs and connectors.

**Figure 6** — A look into the rack case from the rear. The speakers and power wiring are visible on the right side.

ness LED light bar along the top of the front opening illuminates the front panels of installed equipment.

The panel on the left side has two 3.5-inch front-firing speakers and two ¼-inch headphone jacks. Below the speakers are four standard ATC-type fuses (see Figure 7). I used the fuses and power cables marked Circuit 1 and Circuit 2 for supplying power to my two installed radios. Below those fuses is a 10 A fuse to protect the 12 V dc cigarette lighter power socket.

The Anderson Powerpole connector on the front panel is for providing dc input power to the iPortable rack (for example, from your dc power supply or battery), or it can be used as another output to a radio or accessories. It is protected by a 30 A fuse. The setup also includes a separate power cable that can be run out of the back of the box to your power source. Finally, there are two USB power ports — one rated for 0.5 A, and the other for 2.4 A.

On the right-side panel are three plastic plugs that can be removed with a screwdriver. These holes fit bulkhead-style SO-239 coax connectors for easy antenna feed line connections. Inside the case, short jumper cables connect the bulkhead connectors to the radio rear-panel antenna jacks. The bulkhead connectors and coaxial jumpers are not included.

Below the antenna connectors are two slide switches. One is to power an accessory or fan (not included). The other switch and dimmer are for the LED light bar.

## Installation

Upon arrival, I opened the shipping container, removed the box, removed the covers, and found loose screws. The screws are for securing the radio trays to the rack mount frame, four screws for each tray. All screws were there, but I would have liked to see them taped to the cabinet, or otherwise secured.

The only included documentation was a one-sheet wiring diagram. Upon closer examination, I decided that a manual must not be necessary; mounting and operation looked simple and straightforward. I drilled mounting holes through the two trays, and mounted my two radios — an Icom IC-7300 transceiver for 160 – 6 meters, and an Icom IC-9700 VHF/UHF multimode transceiver.

I then mounted the trays inside the box with the screws supplied, but I mounted them backward at first (with radios' front panels looking out the back of the box). I removed the radios/trays and re-rigged them to the proper configuration. Later, I discovered more documentation and photos showing equipment installation on the DX Engineering web page for this rack.

With everything mounted and wired, I thought that the combined weight and size of my IC-7300 and IC-9700 radios was just a bit too much to stuff into the iPortable


**Figure 7** — The iPortable Pro2 fuses and power connections.


**Figure 8** — The author's final configuration with an IC-7300 and an FT-2980R VHF FM radio in place.

box. I ended up removing the IC-9700 and replacing it with my Yaesu FT-2980R VHF FM transceiver (see Figure 8). The combination of the smaller VHF FM radio and HF radio was a winner, and that's how I have kept it. By moving the IC-7300's tray up a hole on the mounting bracket, I was able to fit my external automatic antenna tuner under the radio and tray by using zip ties — a perfect solution. That exercise demonstrates the flexibility of this equipment case, which can be configured many different ways to suit your equipment lineup and operating needs.

## Using the iPortable

I grabbed the box with radios mounted inside and set it up in the hatchback of my 2016 Honda Fit in an adjustable wooden frame I constructed to secure it (with flexible ties) on top of the spare tire compartment. The Powerpoles make battery connections easy, and my magnet-mount roof antenna feed lines ran easily down a groove in the roof and into the back of the car for easy connection to the bulkhead connectors.

The iPortable rack's built-in speakers (connected to each radio's external speaker jack by supplied cables) offered good audio output, and it was nice to be able to adjust the light bar to illuminate the front panels of the radios as necessary. With the rack's covers removed, it seemed to me that there was sufficient convection cooling, considering that the FT-2980R has huge heatsinks for its 80 W RF output, and the IC-7300 has an integrated cooling fan. The iPortable rack system is lightweight, easy to tote, and well-engineered and sturdy. An interlocking feature allows for stacking additional boxes (not tested for this review).

## Conclusion

With many years of experience taking delicate radios into the field, it seems to me that the iPortable Pro2 Equipment Rack System 6UM box is a good solution for any field application where grab-and-go and equipment protection is involved. The built-in speakers, power wiring, and antenna connections eliminate hunting for cables and make it a breeze to get a station up and running in the field. The gasket-sealed case covers help protect gear from the elements.

I recommend setting aside plenty of time for planning and setting up your portable station, and experimenting with placement of the various pieces before locking it all down. Once installed, you'll find that you won't want to remove and replace your radios regularly.

I operated Field Day this year from an Emergency Operations Center (EOC) and noticed emergency management staffers using the iPortable rack system boxes with radios for deployment to area Red Cross shelters. That's a good indication of their quality and usefulness. A 9-inch-high version, the 4UM, is available for single-radio applications.

*Manufacturer*: iPortable, **www.iportableus.com**. Available from DX Engineering, **www.dxengineering.com**. Price: $375.

# SIGLENT SDG1062X Waveform Signal Generator


(Photo courtesy of SIGLENT Technologies North America)

*Reviewed by Phil Salas, AD5X*
**ad5x@arrl.net**

When it comes to test equipment in my home lab, I've always skimped on a good waveform generator. However, as I've been spending more time making receiver and transmitter tests, I thought the time was right to purchase a quality signal generator and invested in a SIGLENT SDG1062X.

## Overview

The SIGLENT SDG1062X is a dual-channel function/waveform generator capable of generating signals up to 60 MHz with very low jitter (variation in the waveform) and very low total harmonic distortion (THD). It generates sine, square, pulse, ramp, noise, and arbitrary waveforms. A library of 196 waveforms is included in the SDG1062X's internal memory, or you can create and store your own arbitrary waveform. The SDG1062X will also sweep the selected waveform,

### Bottom Line

The SIGLENT SDG1062X is a high-quality, useful waveform signal generator with many uses in the amateur workshop.

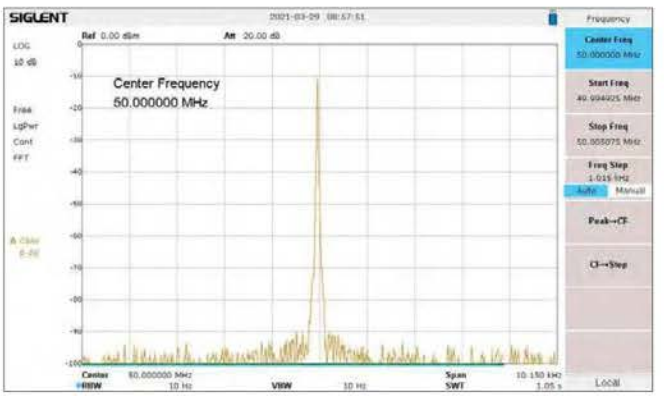



**Figure 9** — The close-in noise on the 50 MHz output from the SDG1062X observed on a SIGLENT SSA3021X spectrum analyzer.

**Table 4**
**SDG1062X Specifications**

Bandwidth: 1 µHz resolution, max. frequency 60 MHz.

Amplitude: 1 mVpp to 20 Vpp.

Sampling rate: 150 MSa/s (mega samples per second).

Vertical resolution: 14 bit.

Waveform length: 16,000 points.

Jitter: less than 300 picoseconds +0.05 ppm of the period.

Total harmonic distortion: <60 dBc up to10 MHz, <40 dBc up to 60 MHz.

Analog and digital modulation types: AM, DSB-AM, FM, PM, FSK, ASK, PSK, and PWM. Waveform combining function.

Frequency counter: 10 Hz – 200 MHz (200 mV RMS minimum, 5 Vpp max).

Internal storage: 20 MB.

Standard interface: USB; GPIB optional.

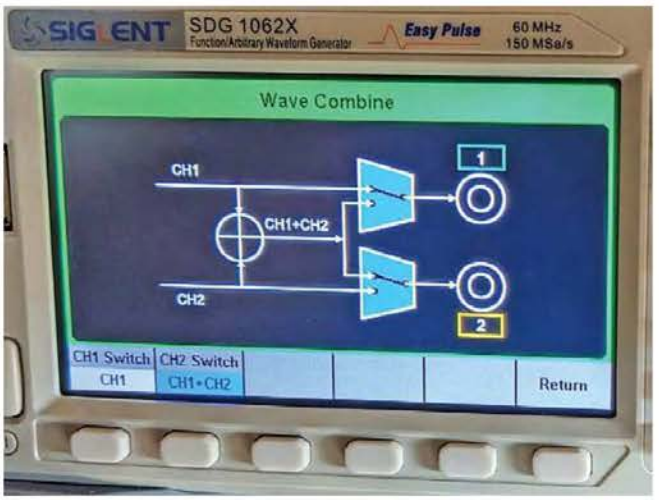



**Figure 10** — The A and B outputs can be internally combined.

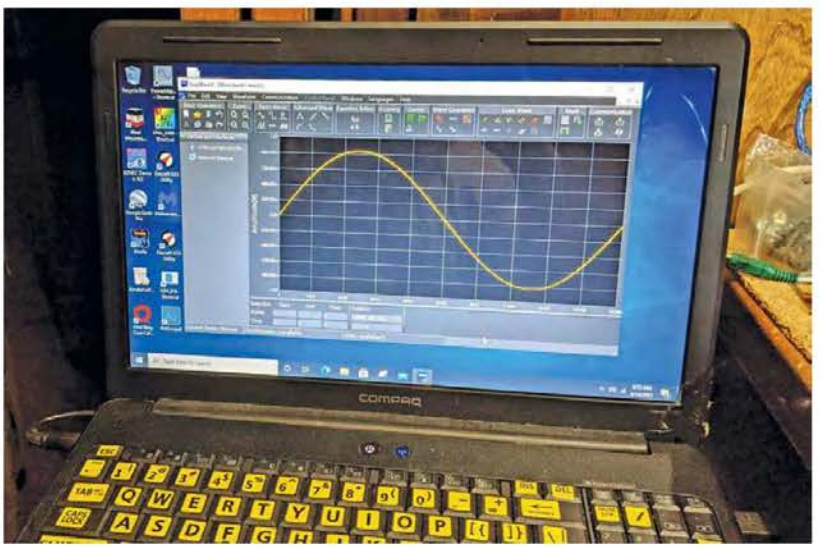


**Figure 11** — *EasyWaveX* provides PC control of the SDG1062X.

either linearly or logarithmically. Table 4 lists the basic specifications.

## Using the SDG1062X

A detailed manual is available for download from the SIGLENT website. The basic functions are pretty much self-explanatory. If you're familiar with using test equipment, you'll probably be able to do many things without having to refer to the manual.

The 4.3-inch TFT-LCD screen provides all the information you need, and the display changes based on what you want to do. The soft keys below the display also change functions based on what you want to change. The display does not show the output waveform in real time, instead showing one cycle of the waveform that is being output. A USB interface on the left side of the front panel permits using additional memory for data storage, and it is also used for updating the firmware. There is also internal nonvolatile storage for saving configuration settings and custom waveforms.

The output signal is very clean, as you can see in the 50 MHz signal in Figure 9. Therefore, the SDG1062X should provide little or no degradation to any connected equipment under test.

The two channels are completely independent. Further, the two channels can be combined internally (see Figure 10). And the combined signals can be connected to either or both outputs.

The ability to output a dual-tone signal of any separation provides a lot of flexibility for measuring the performance of receivers, preamps, transmitters, and amplifiers up to 60 MHz. One popular test is the two-tone intermodulation distortion (IMD) testing of transmitters. This test is performed by injecting two tones (typically 700 Hz and 1,900 Hz) into the transmitter's microphone jack and monitoring the resulting output with a spectrum analyzer. The combined 700 Hz and 1,900 Hz output signals from the SDG1062X are quite clean (see the sidebar, "Two-Tone Test Transmitter Interface" for more information).

Virtually all receiver tests performed in the ARRL Lab can be accomplished with this instrument. (See the ARRL Lab Test Procedures Manual, available from **www.arrl.org/how-equipment-is-tested**.) However, a step attenuator will be necessary for most receiver tests as the minimum output level of the SDG1062X is 1 millivolt peak-to-peak

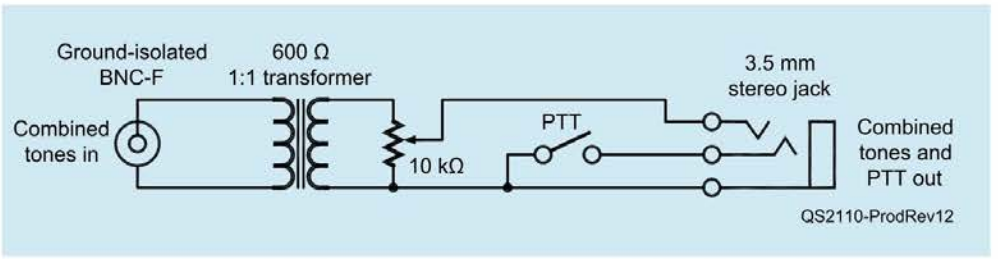



**Figure 12** — Two-tone test interface schematic. The ground-isolated BNC connector is TE Connectivity part number 5227726-1, and the audio transformer is Walfront item number 8541759415, both found on Amazon.


**Figure 13** — The assembled two-tone test interface with microphone interface cables.

## Two-Tone Test Transmitter Interface

The combined A/B channel output for two-tone testing is a nice feature of the SDG1062X. However, the audio levels can only be adjusted independently. This is inconvenient, and it would be nice if the combined output could be adjusted easily once the levels are properly set. Further, isolation of the dc power supply, radio, and signal generator ground connections is often necessary. This led me to build an interface that both isolates the ground and permits adjusting the composite output level from the SDG1062X. I also added a PTT switch, so the radio under test can be controlled by the PTT switch during two-tone testing. Figure 12 is a schematic of this interface, which required a ground-isolated BNC-F connector and a 1:1 audio isolation transformer. Figure 13 shows the assembled unit with cables that I built for testing my Icom IC-706MKIIG and Xiegu G90 transceivers.

(–56 dBm, or S-9+17 dB). Inexpensive step attenuators can be found on the popular auction sites.

Because the SDG1062X can also output broadband noise, you can pair this signal generator with a spectrum analyzer, such as the tinySA (reviewed in the March 2021 "Product Review" column in *QST*) and display a filter passband. You can also add an inexpensive directional coupler and look at return loss. Both of these methods are described in the tinySA review.

Finally, SIGLENT provides *EasyWaveX* software for Windows (see Figure 11). It is an arbitrary waveform software platform that supports waveform creation and editing. It provides 11 types of standard waveforms, equation drawings, hand drawings, points drawings, as well as horizontal, vertical, and oblique drawings. And you can add, subtract, or multiply any two waveforms under edit. You can also export or import waveforms from the SDG1062X arbitrary waveform generator, and analyze or modify an imported waveform.

## Final Thoughts

The SIGLENT SDG1062X is a powerful, full-featured, dual-channel arbitrary waveform generator that can satisfy a variety of testing applications for amateurs and professionals alike. If you don't need the 60 MHz range of the SDG1062X, the SDG1032X (30 MHz maximum frequency) is available at a lower cost.

*Manufacturer*: SIGLENT Technologies North America, 6557 Cochran Rd., Solon, OH 44139; **www.siglentna.com**. The SDG1062X is available from multiple sources, including TEquipment, Amazon, Digi-Key, and other vendors. Price: SDG1062X $459, SDG1032X $319.

# Pacific Antenna 20/40-Meter Trap Dipole Kit

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

The Pacific Antenna 20/40-meter trap dipole kit offers a lightweight, inexpensive solution to adding those bands to a portable station. The antenna is rated for up to 100 W, and the finished length is 51 feet. (In addition to isolating the center section of the antenna for 20 meters, the traps provide some loading, which shortens the overall length from the typical 66 feet for a half-wave 40-meter dipole. Traps are discussed in detail in the "Multiband HF Antennas" chapter of the *ARRL Antenna Book*.) Pacific Antenna offers another version of this antenna for 17 and 30 meters.

## Building the Kit

The kit includes everything needed to build the antenna — 75 feet of #24 AWG stranded wire, a center insulator and BNC jack, end insulators, and materials to make the traps. You just add some small-diameter rope to hang the finished antenna and a feed line. You'll need a tape measure, something to cut and strip wire, and a small soldering iron. It only took me an hour to put it all together.

Following the detailed and well-illustrated instructions, the first step is to cut the wire into six pieces (two of these will be used to wind coils for the traps). Then build the traps and do the final assembly.

### Bottom Line

The Pacific Antenna 20/40-Meter Trap Dipole Kit is easy to build and results in a lightweight, portable antenna with good coverage of the 20- and 40-meter bands.

Each trap is made with a narrow PC board and a plastic coil form. Solder two small capacitors to the PC board, then wind the coil on the plastic form. I found that the number of turns on the coil worked out perfectly if you cut the wire to the specified length and wind the turns tightly. With the capacitors soldered to the PC board, slide the board inside the coil form, and solder the coil wires and antenna wires.

Once you've tested the finished antenna and it's working as expected, the traps will be covered with supplied heat-shrink tubing. The tubing is fairly thick, so I borrowed a heat gun to shrink it. Figure 14 shows a finished trap.

The center insulator is a piece of PC board material with holes and solder pads for securing a BNC connector and the antenna wires, as well as a hole at the top for a support rope (see Figure 15). The end insulators are just short pieces of the same plastic material used for the coil forms. According to my postal scale, the assembled antenna weighs just 4.5 ounces.

## In the Field

I tried the trap dipole as an inverted V during portable operations at several local parks. I hung the center insulator from a 20-foot collapsible mast secured to the trailer hitch on my vehicle and fed the antenna with 50 feet of RG-58 coaxial cable. Rather than drive stakes into the ground, I added lightweight rope to the end insulators and tied the rope to 1-gallon beverage containers filled with water. The antenna is so light that it doesn't take much to hold it in place.

I swept the antenna system with an antenna analyzer. On 40 meters, the minimum SWR was 1.1:1 at 7.110 MHz, and it covered 7.015 to 7.210 MHz with SWR of 2:1 or less. On 20 meters, the low SWR point (1.1:1) occurred at the bottom of the band, with SWR rising to about 2.6:1 at the top of the band. Although I could have shortened the 20-meter section to move the low-SWR point higher in the band, I left it alone. The SWR curve would likely change somewhat in other portable installations, and the antenna tuner in my transceiver allowed operation throughout the bands.

In previous portable operations, I typically used short-loaded vertical antennas on my vehicle. In addition to having to change antennas to change bands, those antennas have a narrow SWR bandwidth and usually require adjustment of the whip on top when switching between the CW, digital, and phone segments of the bands. I enjoyed the wide SWR bandwidth of the trap dipole and the convenience of changing bands or band segments without adjusting the antenna. I had no trouble making plenty of contacts on both bands from several local parks.

**Figure 14** — A finished trap covered with heat-shrink tubing.


**Figure 15** — The feed line connects to a BNC connector on the center insulator. The PC boards used for the center insulator and traps have additional holes for routing the antenna wires to avoid stressing the soldered connections.

Although I didn't have much difficulty packing and unpacking the antenna when switching parks, I ended up using a couple of plastic rope winders to store the antenna when not in use.

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

---


**All ARRL members can now enjoy the online edition of *QEX* as a member benefit. Coming up in the September/October 2021 and future *QEX* issues are articles and technical notes on a range of amateur radio topics. These are at the top of the queue.**

- Tom Alldread, VA7TA, designs a small RF step attenuator that is accurate over a wide frequency range.
- Luiz Duarte Lopes, CT1EOJ, solves a matching network graphically, using drafting implements.
- In his essay series, Eric Nichols, KL7AJ, organizes the use of Kirchhoff's laws.
- Steve Stearns, K6OIK, explains a paradox where the additional transmission line loss due to SWR can be negative in decibels.
- Lynn Hansen, KU7Q, describes the CTR2 HMI for managing radios in your shack.
- Maynard Wright, W6PAP, shows that SWR can depend on amplifier output impedance.

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

Would you like to write for *QEX*? We pay $50 per published page for full articles and *QEX* Technical Notes. Get more information and an Author Guide at **www.arrl.org/qex-author-guide**. If you prefer postal mail, send a business-size self-addressed, stamped (US postage) envelope to: *QEX* Author Guide, c/o Maty Weinberg, ARRL, 225 Main St., Newington, CT 06111.

Steve Ford, WB8IMY, wb8imy@arrl.net

# Eclectic Technology

# Voice Over LoRa

*In a previous column, I speculated that LoRa (short for "long-range") technology might not be useful for voice communication due to its relatively low data rate. Not true! Dr. Daniel Fay, KG5VBY, has developed a fascinating approach to using ubiquitous (and inexpensive) LoRa UHF transceivers for exactly this purpose. The result is a digital voice network that offers wide coverage at very low cost. In this month's column, Dr. Fay describes his work.*

QMesh is a novel mesh networking protocol designed to provide rapid self-healing and streaming capabilities to mesh networks in order to enable live voice communications. In a QMesh system, every QMesh device (a handheld transceiver, mobile rig, repeater, etc.) functions as a linked repeater. QMesh leverages characteristics of Semtech's LoRa chirp spread spectrum (CSS) waveform. LoRa is a low-power communications waveform increasingly used in many Internet of Things (IoT) devices to provide long range, as well as to enable reliable real-time streaming of data.

## A "Flood" of Data

QMesh uses synchronized flooding to provide these capabilities. Synchronized flooding is a packet relay technique where every node repeats the data it receives at roughly the same time. A major drawback of synchronized flooding, however, is the self-interference that occurs from these simultaneous retransmissions. QMesh uses a few techniques to mitigate this self-interference. First, it employs forward error correction (FEC) to correct interference-induced errors. Second, QMesh randomly varies the center frequency of transmissions by ± 25% of the LoRa waveform's bandwidth (common LoRa spread spectrum bandwidths include 125 kHz, 250 kHz, and 500 kHz). Finally, QMesh randomly adds a timing offset of up to half of a LoRa symbol period. With a spread spectrum waveform like LoRa, the last two techniques reduce the overlap between concurrent transmissions, which increases the likelihood that a receiving node will receive one of the transmissions via the FM capture effect.

Employing these interference-mitigation techniques allows QMesh nodes to achieve over 99% packet reception rates with three nearby nodes retransmitting at the same time in a worst-case scenario. Without these features, the packet reception rate is reduced to around 90% for those same three retransmitting nodes.

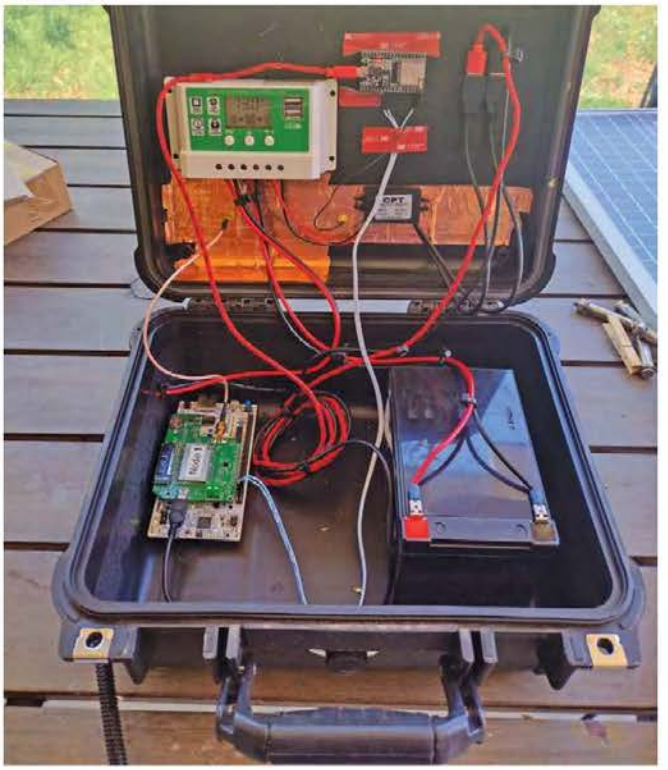


**Figure 1** — QMesh node hardware inside a waterproof enclosure with a solar charge controller, an AGM battery, and an ESP32 board that allowed me to remotely administer/monitor/update the firmware on the board. In the upper right-hand corner, you can also see the solar panel used to charge the battery.

## Keeping It Simple

In its current form, QMesh nodes provide a KISS interface over a serial port (UART). Such an interface allows existing KISS-compatible software, such as the APRS smartphone application *APRSdroid*, to communicate with QMesh nodes and the QMesh network. Each node is currently implemented using STM32 NUCLEO-144 development boards, along with a custom board that provides a 1W LoRa module (either for the 70- or 33-centimeter band), a 16 MB flash chip (used to store configuration and logging information), and a small OLED display (for monitoring the node in the field). Each node can be assembled for less than $100 in parts.

In its current development form, a QMesh node can be powered via USB and placed inside a weatherproof box outdoors along with a modest 12 V lead acid or lithium iron phosphate (LiFePO4) battery and solar charge controller. An ordinary 20 – 30 W 12 V solar panel is sufficient to supply the entire setup (see Figure 1). It is expected that further power consumption optimizations in the QMesh firmware can further reduce these solar and battery needs. Outdoor nodes also include an ESP32 board to provide remote monitoring, administration, and firmware upgrades over a Wi-Fi network. You'll find software and documentation at **github.com/faydr/QMesh**.

— *Dr. Daniel Fay, KG5VBY*, **daniel.fay@gmail.com**

Dave Casler, KEØOG, askdave@arrl.org

# Ask Dave

*QST's* new question-and-answer column is here. Submit your questions to askdave@arrl.org.

# Getting Antennas to Play Ball

## Ground-Wave Propagation

**Q** Tim Carter, W3ATB, of New Hampshire, asks: How far can ground waves travel, and what effect does the frequency have on the distance they might travel? How does vegetation on terrain come into play? What about weather? It seems obvious to me that a ground wave might go much farther across Kansas than say, West Virginia.

**A** To quote *The ARRL Antenna Book*:

> The term *ground wave* has had several meanings in antenna literature, but it has come to be applied to any wave that stays close to the Earth, reaching the receiving point without leaving the Earth's lower atmosphere…A ground wave could be traveling in actual contact with the ground, where it is called the *surface wave*. As the frequency is raised, the distance over which surface waves can travel without excessive energy loss becomes smaller and smaller…Vertically polarized antennas are preferred, which tends to limit amateur surface-wave communications to the bands and installations for which large vertical antennas can be erected. (p. 4.2)

Ground-wave and surface-wave propagation are the bread and butter of the AM broadcast band during the daytime, limiting propagation distance to 100 miles (161 kilometers) or so. However, the distance the ground or surface wave can travel on the ham bands becomes severely limited (see Figure 1).

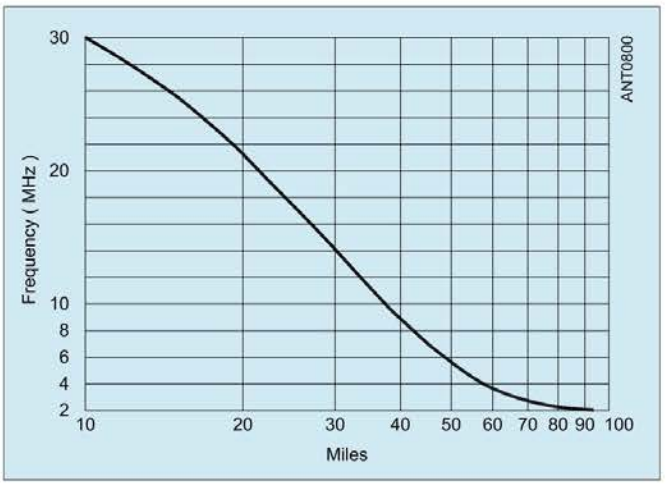



**Figure 1** — Typical HF ground-wave range as a function of frequency.

The distance available for ground-wave contact varies widely with frequency. When looking at 160, 80, 60, and 40 meters, you may find a competing ionospheric form of propagation called near-vertical incidence skywave (NVIS) propagation that can provide communications out to a few hundred miles. NVIS users vastly prefer horizonal polarization, while ground wave seems to do best with vertical polarization. Regarding terrain and vegetation, everything has some effect on propagation, but ground or surface waves seem able to penetrate the deepest canyons and thick vegetation canopies. I once helped a new ham put up an 80-meter dipole where he lived during the summer, deep in the canyon of the Gunnison River. The canyon walls went up at 45 degrees for about 2,000 feet (610 meters). He had excellent communications. Now, was this ground wave or NVIS? I think it was a combination of the two, but that signal got out of that canyon just fine.

To summarize, ground wave is not a prominent propagation form in ham radio, given that it tends to be more of a medium-wave (AM broadcast band) phenomenon. Instead, on the lower amateur bands (160, 80, 60, and 40 meters), NVIS seems to have grabbed all the attention. Further, ground wave is associated with vertical polarization, which is hard to accomplish on these amateur bands. A simple 80-meter vertical antenna is 132 feet (40 meters) tall, which is not something you'll see in many hams' backyards.

## Antenna Tuners Don't Affect Antenna Range

**Q** Dan Evander, KJ7YBK, of Arizona, asks: I realize that many transceivers today have built-in antenna tuners, and we can also use an external tuner for more severe out-of-balance situations. I also understand that the purpose is to provide a 50 Ω to 50 Ω network, avoiding any unused power feedback to the transceiver. My question is, does the tuner actually provide more transmitting power to the antenna (increasing range), or is most of the circuit just converting the unused power to heat? If both effects occur (range and heat), are some tuners more effective in boosting range than others?

**A** Looking at Figure 2, the transmitter is on the left and outputs power as a 50 Ω source. The tuner, assumed to be perfect, provides an exact match between the radio and the antenna system, consisting of the transmission

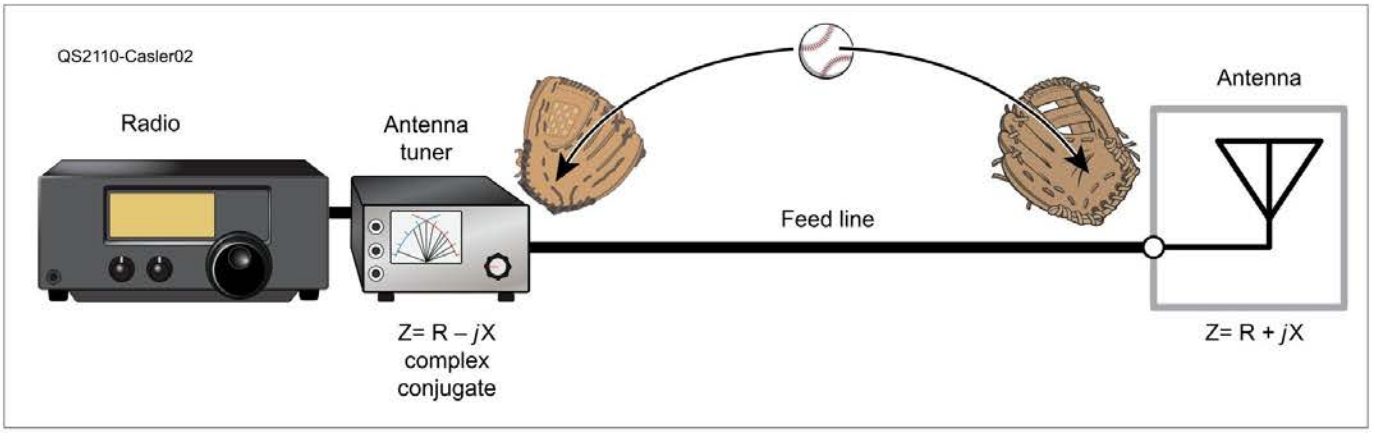



**Figure 2** — The transmitter outputs power as a 50 Ω source, and the tuner provides an exact match between the radio and the antenna system.

line and antenna. We don't know the exact impedance of the antenna, so we'll just say it's both resistive and capacitive. Let's make a simplifying assumption. The transmitter puts out a single cycle (360 degrees) of RF. This will go through the tuner, which will somewhat modify both the phase and resistance. This travels through the transmission line to the antenna. The antenna will partly transmit the signal, dissipate a bit of the signal as heat in the antenna's ohmic resistance, and reflect part of the signal back up the transmission line somewhat out of phase with the original signal. Some of this signal will be turned to heat in the ohmic resistance of the transmission line.

Next, the tuner catches what is sent back as though the tuner and antenna are playing toss-the-ball. Note that we said the antenna was capacitive. Well, the tuner sees the reflective signal with a skewed phase because of the capacitance. So, the tuner uses an opposite inductance (the complex conjugate) to skew the signal back to its proper phase and reflects it back toward the antenna. (Remember, we're looking at a single cycle playing catch here.) The signal hits the antenna, some is transmitted, some is turned into heat, and the rest is thrown back. This repeats over and over until the signal is entirely converted to heat.

Now let's put this in the real world. The transmitter sends cycle after cycle down the line. So, the line is constantly playing catch with the reflections, and the transmission line and antenna are constantly converting RF to heat. If you have a high-impedance feed line, such as window line at 450 Ω, the heat is greatly reduced, which increases the power out.

To summarize, all tuners work this way, regardless of the circuits inside. The worse the match, the more the losses, because the ball that is being tossed back and forth is bigger. A tuner cannot create energy; it just manages the interchange between the tuner and the combination of the transmission line and antenna. Generally, you're better off with antennas as close to resonance as you can get them or using a high-impedance transmission line, or both.

It's a bit like baseball. For example, the shortstop grabs a ground ball and changes the speed and direction (phase) of the ball on its way to first base. All this is done in one fluid motion. The shortstop changes two key characteristics of the ball to get the third out and wins the game.

Check out the video answer to this question in the "QST: Ask Dave" playlist on ARRL's YouTube channel, at **https://www.youtube.com/user/ARRLHQ/playlists**.

## Unused Antennas

**Q** John Flood, K4DLX, of Florida, asks: I have a 50-foot tower with four horizontal beams stacked: 20 through 10, 6, and 2 meters, as well as 70 centimeters. They all connect to a common feed line through an antenna switch on the tower. Should the unselected antennas be terminated in short or open or 50 Ω?

**A** Interesting question. The answer depends entirely on the coax switch you're using at the top of the tower. I would recommend, if the switch permits it, the antenna not in use would be shorted closed and attached to ground (in this case, the tower). Even if all the antennas are simply connected in parallel, they will not affect each other that much. Think of it as a sort of complicated fan dipole. Overall, for safety's sake, the unused antennas should be shorted to ground at the top of the tower to reduce the probability of an induced high voltage coming down the line to the radios.

Send your questions to **askdave@arrl.org**, or fill out the form at **www.ke0og.net/ask-dave**. I answer some questions here, and some via videos on my YouTube channel (**www.youtube.com/davecasler**), or during my weekly livestream on Thursdays at 6:45 to 8:15 PM Mountain Time on my channel.

## Technical Correspondence

# An Experiment with Diversity Reception and An Easy Approach to Determining Transmission Line Loss

### Diversity Reception with Two HF Antennas

Diversity reception is an effective way to improve receiving performance by combining signals from two or more independent sources (antennas) to create one signal at the receiver. One advantage of diversity reception is that it can be used to reduce fading and co-channel interference. For instance, a signal that fluctuates in strength may be stronger at one antenna and weaker at another at any given moment. In the process of combining the signals from both antennas, one can adjust their phase relationships to either enhance a desired signal or suppress an undesired signal.

My main (transmit and receive) antenna is a 130-foot inverted L fed with a 49:1 transformer. My auxiliary (receive only) antenna is a 135-foot terminated inverted U fed with a 16:1 balun. I wanted to see if I could create a diversity reception system of my own.

An MFJ-1708 SDR switch provides a receive-only path for diversity combining (see Figure 1). I've put an MFJ-1025 noise canceler/signal enhancer to work as a combiner, blending received signals from both antennas.

DX Engineering DXE-RG5000HD limiters are used to protect the combiner from strong transmit signals that might leak through the SDR switch or be picked up by the auxiliary antenna. An MFJ-1046 pre-selector provides selectivity and is between the combiner and the SDRplay RSP2 receiver.

My transceiver is used strictly for transmitting while the *SDRuno* software on my station computer is processing the output of the RSP2 receiver.

While this isn't an ideal setup for diversity reception, I noticed the benefits immediately. By adjusting the MFJ-1025, I was able to enhance or suppress selected signals to varying degrees, sometimes dramatically. For example, I was able to peak or null time stations WWV and CHU with simple adjustments of the MFJ-1025. The effects on marginal signals could be quite noticeable as well. — *73, Joe Ostrowski, KI5FJ,* **ki5fj@arrl.net**

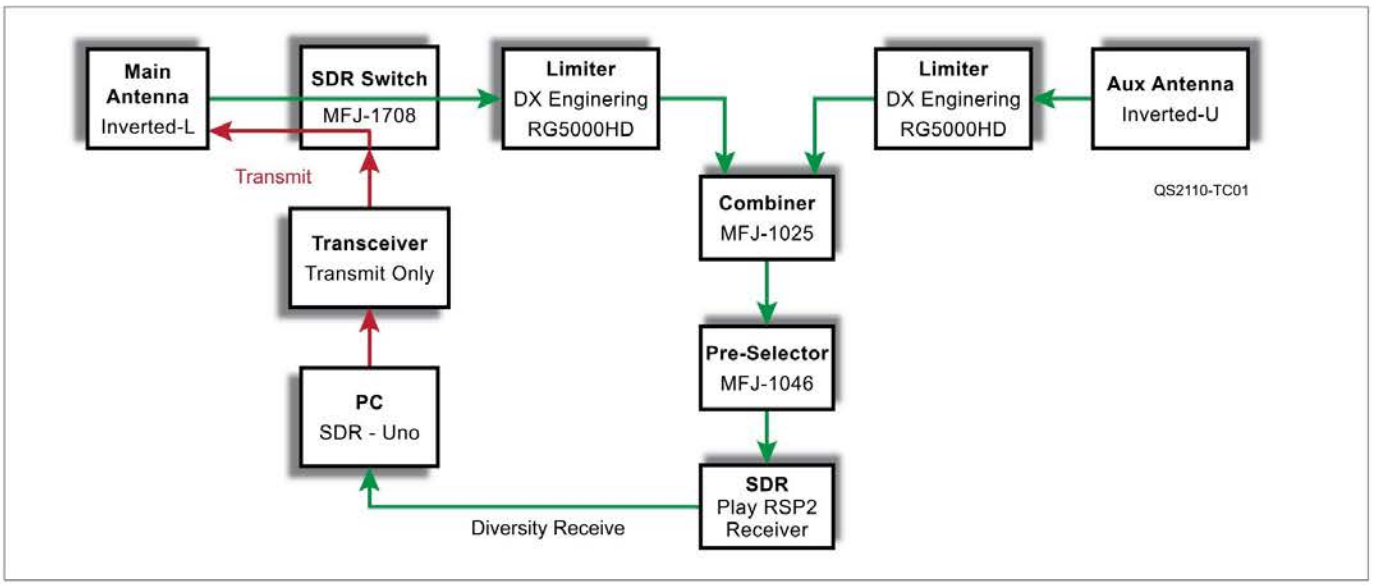



**Figure 1** — An MFJ-1025 noise canceler/signal enhancer was used as a combiner in this diversity reception experiment. The unit allowed the author to combine the signals from two antennas while adjusting their phase relationships. An SDRplay RSP2 was used as the receiver; the transceiver is used only for transmitting.

## Calculating Transmission Line Loss with SWR Readings

Here is a remarkably simple way to determine the percentage power loss in your coax with any amount of standing-wave ratio (SWR). The accuracy will depend on the accuracy of your SWR meter, but that's not overly critical. The method consists of taking two readings and then consulting the chart shown in Figure 2. All readings are taken at the transmitter end of the coax.

Read SWR values directly at the coax input, not through an antenna tuner or other device in the line. A choke or current balun at the antenna will help ensure accurate SWR values and prevent strange readings. Just use the following steps:

1 If you know the matched (SWR = 1:1) loss of your coax in decibels, you can skip this step by using the small red numbers along the bottom of the chart. Otherwise, replace the antenna with a short or open on the antenna end of the coax and measure the SWR. By consulting the bottom scales on the chart, you can relate this SWR to the matched coax loss. The SWR measurements with an open and with a short may be different, especially if the coax is less than one quarter wave at your operating frequency. If so, convert the two SWR values to matched loss values using the red scale at the bottom of the chart. Then take the average of the two matched loss values as the value to use.[1]

2 With the antenna connected, measure the SWR at the operating frequency.

3 Using the chart in Figure 2, find where the two SWR readings cross. Read the percentage of power reaching the antenna from the diagonal lines.

[1]The reason why this averaging method is used is explained in Frank Witt's, AI1H, May/June 2005 *QEX* article, "Measuring Cable Loss."

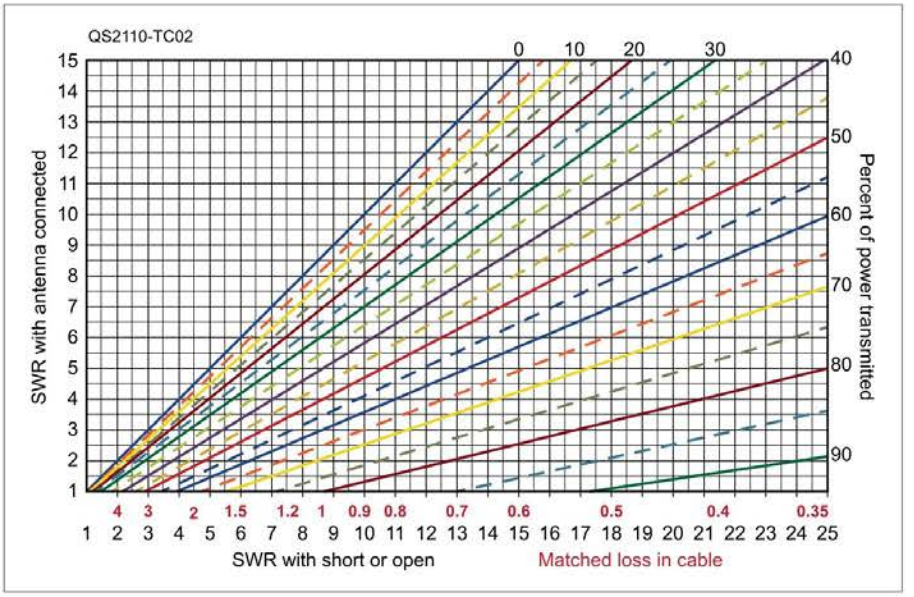



**Figure 2** — Use this chart to calculate actual coax loss by comparing two SWR readings.

For example, if the SWR with a short or open is 10:1, the matched coax loss will be about 0.9 dB. If the SWR with the antenna connected is 3:1, 65% of the transmitter power will reach the antenna. By matching at the antenna (reducing the SWR to 1:1), about 82% of the power will reach the antenna. — *73, John Stanley, K4ERO,* **k4ero@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.

# Hints & Hacks

# Money-Saving Beads; Getting Rid of Windows Ports for Good, and QSL Albums

## Budget Spacers

I needed 16 spacers to mount four small circuit boards onto a sub-chassis. At the local home improvement store, I found aluminum spacers, about 8 millimeters long, but the price of a single spacer was nearly $1.

Because part of being a ham is always looking for a cheaper alternative, I visited a hobby store. There I discovered all sorts of inexpensive plastic beads. The ones I picked out measure approximately 6 × 7 millimeters and have a hole size that permits a 6-32 machine screw to pass through it with ease (see Figure 1). The best part, a bag of 500 beads only costs $1.99, or less than 0.004 cents each. I now have enough spacers to last a lifetime. — *73, Ron Rausch, K5HZ,* **wn0mqx@gmail.com**

## Forcing Windows to "Forget" a COM Port

When you install a device that requires a COM port in Windows for the first time, Windows assigns that device to COM 1. The next device you install will be assigned to COM port 2 and additional devices will be assigned consecutive numbers. However, Windows never forgets the ports numbers it has assigned unless you initiate a special procedure and force Windows to uninstall them. Simply uninstalling a port in the "normal" Device Manager will not totally uninstall it.

Assume you have devices on COM ports 1, 2, 3, and 4, and then you decide to remove one of those devices — the one on COM port 3. You'd go to the Device Manager and uninstall COM port 3. Now when you plug in a new device, you're puzzled by the fact that Windows assigned it to COM port 5. If you return to the Device Manager, find the device on COM port 5, then attempt to change it back to COM port 3, Windows will tell you that COM 3 is still in use.

Again, Windows never forgets a COM port unless you force it to do so. While you can manually reassign COM 5 to COM 3, this may not cure the problem because Windows will still be sending data to the original COM 3.

Here's the fix for Windows 10, the most commonly used version of Windows.

**Figure 1** — An inexpensive assortment of colorful plastic beads makes a great substitute for circuit board spacers. [Ron Rausch, K5HZ, photo]


**Figure 2** — In Windows 10, the **COMMAND PROMPT** is in the **WINDOWS SYSTEM** folder. [Alan Hoffmaster, WA3EKL, photo]

Start by logging into Windows as an Administrator. Next, find the **COMMAND PROMPT**. Click the **START** icon in the lower-left corner, then scroll through the programs until you see the **WINDOWS SYSTEM** folder. Click on this folder and, among all the items displayed, you'll see **COMMAND PROMPT** (see Figure 2).

Right-click the **COMMAND PROMPT** icon on the desktop, followed by **MORE**, and a window will pop up. Left-click **RUN AS ADMINISTRATOR.** A black command window will appear.

At the blinking cursor, type the following (all in lowercase letters):

**set devmgr_show_nonpresent_devices=1**

Then push the **ENTER** key on your keyboard. If you typed the line correctly, you will see the blinking cursor once again. Type:

**start devmgmt.msc** and push the **ENTER** key again (see Figure 3).

A slightly different version of the Device Manager will appear. Left-click the **VIEW** tab below the words "Device Manager" at the top of the new window and another window will pop up.

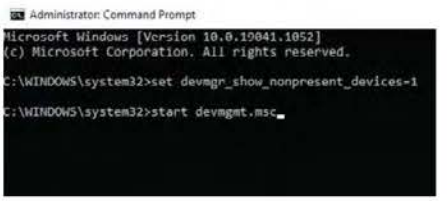



**Figure 3** — The **COMMAND PROMPT** screen in Windows 10. [Alan Hoffmaster, WA3EKL, photo]

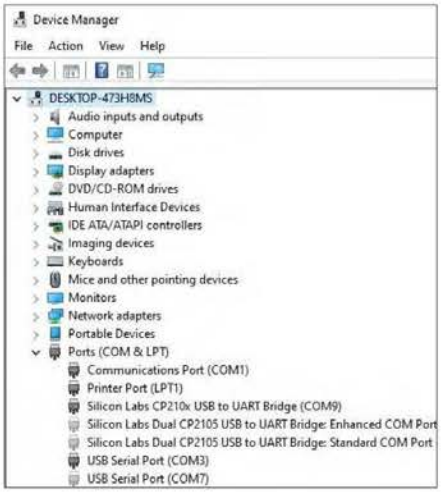



**Figure 4** — In the Device Manager, expand the **PORTS** list and notice which COM ports are grayed out. [Alan Hoffmaster, WA3EKL, photo]

Left-click **SHOW HIDDEN DEVICES**. All your devices should now show up like they do in the normal Device Manager.

Left click the > sign to the left of **PORTS (COM & LPT)** to expand the list. Now you can see all the ports that Windows has ever installed on your computer (see Figure 4).

Most likely, you will have the same number assigned to more than one port. The grayed-out ports are the original ports, or the currently non-used ports, and you can uninstall them in this window by right-clicking the port and then left-clicking **UNINSTALL**.

Be careful that you don't uninstall a port you need, or you'll have to reinstall that device again. For example, I use *LP-Bridge* to allow *N1MM+* and *WSJT-X* to talk to my Elecraft K3 transceiver at the same time. *N1MM+* is on virtual COM port 5 and *WSJT-X* is on virtual COM port 7 within *LP-Bridge*. If those programs aren't running when I do the above procedure, ports 5 and 7 appear to be grayed out. Don't make my mistake and uninstall a port just because it's grayed out.

Write down all the ports you're using before you start uninstalling them. When you're finished uninstalling, close everything, restart your computer, and you may discover that your COM port issues have disappeared.
*— 73, Alan Hoffmaster, WA3EKL,* **alanbh@cablespeed.com**

## QSL Binders

Exchanging paper or cardboard QSL cards isn't as popular as it once was, but many amateurs still maintain the tradition. The prob-lem, however, has always been finding a convenient place to store all the cards.

Of course, there are the plastic wall hangers that ham dealers still offer today, as well as the simple use of shoeboxes. I've come to rely on albums with clear plastic inserts (see Figure 5). These are popular among people who stored printed photos because they not only protect the photos, but they make it easy to browse the collection any time you want to.

Many of these albums consist of three-ring binders with an initial stock of plastic inserts. For postcard-sized inserts, each page can usually hold two cards per side. That means a single page can hold up to four cards, and quite a few of these pages can fit within a single binder. Depending on the size of the binder, it is not uncommon to have a single binder capable of storing more than 200 cards.

Just make sure the insert pages can accommodate the cards. This usually works if the album's pages are specified to hold 5 × 7 photographs. You can even find specially treated inserts intended for long-term archival storage. The chemical composition of their plastic is designed to avoid degrading photographic prints — or QSL cards.

Of course, there is still the option to use conventional card boxes such as the ones you'll find at Hobbymaster, at **www.hobbymaster.com**.
*— 73, Klaus Spies, WB9YBM,* **wb9ybm1@yahoo.com**

"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.

**Figure 5** — Photo albums with plastic insert sheets can make excellent QSL card archives.

Paul Wade, W1GHZ, w1ghz@arrl.org

## Microwavelengths

# Microwave Amateur Television

*Amateur microwave bands have a lot of bandwidth, and we only use a small fraction for weak-signal communications. This leaves room for experimentation with wider-bandwidth modes, such as amateur television (ATV). Digital TV requires much less transmitted power for quality pictures, therefore, digital ATV (DATV) has become more popular. For this month's column, I've asked Jim Andrews, KH6HTV, (**kh6htv@gmail.com**), Editor of the* Boulder Amateur Television Club Newsletter*, to explain ATV.*

When discussing ATV, most hams think of slow-scan television (SSTV). They're unaware that amateur radio bands can be used for more than voice, CW, digital text modes, or SSTV. However, the FCC allows hams to also operate live broadcast-quality TV on the 70-centimeter band and the higher microwave frequencies. In the US, TV channels are 6 MHz wide. Thus, the 70-centimeter band at 430 MHz is our first higher band with sufficient spectrum available to support TV. It's also close to the UHF TV broadcast band (470 – 698 MHz) with similar propagation characteristics.

## Digital ATV

The first ham radio TV two-way contact was made in 1940. Today, broadcast TV has transitioned from the old analog NTSC (National Television Standards Committee) to digital. Many ATV hams now transmit high-definition (1080p) digital video and CD-quality stereo audio, resulting in great pictures and sound. A few US hams are experimenting with the American digital broadcast system called ATSC (Advanced Television Systems Committee), but most are exploring digital TV using the European-based system, DVB-T (Digital Video Broadcasting — Terrestrial). DVB-T uses COFDM modulation with QPSK, 16QAM, or 64QAM and is highly tolerant of severe multipath propagation. In Europe, most ATV hams are using DVB-S (Digital Video Broadcasting — Satellite) and have the QO-100 geostationary satellite to experiment with. This satellite is a transponder for amateur digital TV, with microwave uplink in the 2.4 GHz band and downlink in the 10 GHz band.

We've found that digital TV outperforms the old analog NTSC TV. Experiments have shown that with identical transmitter powers, antennas, and so on, digital TV provides a perfect image and sound, while a P2-quality analog TV signal provides images that are barely distinguishable.

Due to bandwidth, there's a big difference in TV receiver sensitivity versus SSB or FM voice. It's set by the law of physics and the thermal noise baseline: Pn = kTB. Boltzmann's constant is k, the Kelvin temperature is T, and bandwidth in Hertz is B. Using this equation for a 6 MHz DATV signal, the noise floor for a receiver will be –106 dBm. For an FM voice radio with 15 kHz bandwidth, it's –132 dBm. For an SSB voice radio with 2.4 kHz bandwidth it's –140 dBm, so a received signal level greater than –130 dBm is needed for a 10 dB signal-to-noise ratio. With DVB-T, using a good low-noise preamplifier on the receiver and 6 MHz bandwidth, QPSK, 1080p resolution, and normal forward error correction (FEC) of 5/6, the minimum detectable signal requires an 8 dB signal-to-noise ratio, or about –98 dBm (2.8 µV). If we use really aggressive FEC of ½, we get another 3 dB in sensitivity. Therefore, a signal of about 30 dB more is needed for DATV compared to SSB.

There's also a difference in how we rate digital transmitter power versus analog. Analog TV is rated the same as an SSB transmitter — by peak envelope power (PEP). The peak is the sync pulse on an analog TV signal. For digital, the waveform has no distinguishing features, but looks like random noise with power peaks 8 – 10 dB above the average root


Jim Andrews', KH6HTV, homebrew 5.8 GHz DVB-T transverter. [Jim Andrews, KH6HTV, photo]

Debbie Goldman, WB2DVT, operating 10 GHz digital ATV during the 2020 ARRL 10 GHz and Up Contest. [Pete Goldman, WB2DVS, photo]


Don Nelson's, NØYE, DATV picture received from 9.4 miles away, recorded by Jim Andrews, KH6HTV. [Jim Andrews, KH6HTV, photo]

mean square (RMS) power. Therefore, a digital transmitter is rated by its RMS power, which is typically 8 – 10 dB below its maximum power rating. For example, a 10 W RMS DVB-T transmitter amplifier is capable of putting out 50 W PEP in SSB service, and 70 W in FM/CW service.

## DATV Operation

As with 2-meter and 70-centimeter FM voice, ATV hams also use repeaters to enhance their coverage areas. In the US, I know of at least 40 active ATV repeaters (analog, digital, and mixed mode). Most are on the 70- and 23-centimeter bands, but some also include inputs and/or outputs on the higher microwave bands up to 10 GHz. For example, our Boulder, Colorado, WØBTV repeater has inputs on 70 and 23 centimeters, and outputs on the 70- and 5-centimeter bands. Many ATV repeaters also stream their video and audio over the internet. The best place to find many of them is on the British Amateur Television Club's (BATC) website (**https://batc.org.uk/live**). There you'll find almost 60 ATV repeater streams from around the world. The most complex ATV repeater system is that of the Amateur Television Network (ATN), a system of linked ATV repeaters covering southern California, southern Nevada, and Arizona (Phoenix and Tucson). ATN uses microwave links on the 9- and 5-centimeter bands to tie the various sites together.

Like other microwavers, ATVers like to get out in the field on microwave DXpeditions to see how far they can exchange signals. Boulder ATV hams have worked all bands (70, 33, 23, 13, 9, 5, and 3 centimeters) with digital ATV up to 10 GHz, and have used ATV to send pictures of our club's 2021 Field Day operation around the world. This required an intermediate point-to-point relay hop to get from our mountaintop site to our WØBTV TV repeater, and from there to the internet. We've also participated in the ARRL 10 GHz and Up Contest, but with fewer ATV participants we haven't scored very high. Locally, our current best distances on microwaves are 51 kilometers (5.7 GHz) and 36 kilometers (10 GHz). With our WØBTV DVB-T repeater, we've successfully made two-way contacts with the 70- and 23-centimeter inputs and 70-centimeter output, to 123 kilometers on the Colorado/Wyoming border. The repeater also has an analog FM-TV transmitter on 5.905 GHz, and we've been able to receive that microwave signal out to 112 kilometers.

## Equipment

A mixture of commercial and homebrew equipment can be used for digital ATV. HiDes Technologies modulators are popular and cost about $370. For receivers, we use inexpensive set-top box receivers from Amazon, which only cost $50. Cheap USB TV tuner dongles for a PC can also be used as receivers. The BATC sells transmitter and receiver kits to its members (they require a computer such as a PC or Raspberry Pi).

Commercial DVB-T modulators and receivers are available for bands up to 13 centimeters (2.4 GHz). Above that, we need to use transverters for digital TV signals. Microwave transverters from Down East Microwave (US) and Kuhne Electronic (Germany) can be easily modified from SSB service to work with digital ATV by using a 70-centimeter DVB-T modulator and receiver for the IF, rather than an SSB transceiver. If you homebrew your digital ATV transverter, the key element is a good local oscillator (LO). For digital TV, absolute frequency accuracy isn't as important as it is for SSB, but low phase noise is crucial in the LO.

## More Information

If you want to learn more about analog and digital ATV, download *Introduction to Amateur Digital Television*, by Jim Andrews, KH6HTV, at **www.arrl.org/atv-fast-scan-amateur-television**.

Created by and for young radio amateurs, this summer camp connects youth across the Americas and promotes ham radio.

# *The First-Ever* Youth on the Air Summer Camp

**Ruth Willet, KM4LAO, and Leah McGrane, KD9LFZ**

On July 11, 2021, the first Youth on the Air (YOTA) Summer Camp in the Americas began, consisting of 1 week of learning and friendship at the National Voice of America (VOA) Museum of Broadcasting in West Chester Township, Ohio. YOTA is a movement in the Americas focused on promoting youth activity in amateur radio. This group strives to apply the successful techniques learned from Youngsters On The Air in Europe, Africa, the Middle East, and Western Asia to connect young people around the world.

Led by Camp Director Neil Rapp, WB9VPG, and a team of staff, YOTA Camp focuses on activities that are planned and led by young radio amateurs. The goal is to build a community of young hams mentoring others and increasing the number of young people on the air. Because of our incredible sponsors, 23 campers between the ages of 14 and 25 at all license levels were able to attend. The National VOA Museum of Broadcasting hosted the camp, with radio operations from the West Chester Amateur Radio Association's WC8VOA station, using gear provided by Icom. A temporary station was also set up at the hotel where campers stayed. We (Ruth, KM4LAO, and Leah, KD9LFZ) both attended as campers, and Ruth led the Satellite Operations and ARISS Contact workshops.

## A Week of Activities

The YOTA Summer Camp schedule was packed with hands-on workshops covering many subjects. After an engaging camp orientation on Sunday, including a keynote address from DX Engineering CEO Tim Duffy, K3LR, we were all excited for activities to commence.

Monday morning started early, as campers were shuttled to the museum each day before the workshops began at 9 AM (except for Wednesday, when campers could sleep in). Sam Rose, KC2LRC, led a build for an 80-meter receiver kit. One of the campers, Taylor Laub, KE8KWZ, especially loved kits, sharing, "I had been wanting to learn to solder since becoming a ham. I soldered for the first time at YOTA Camp and feel like a whole new world has been opened up to me."

Next on the schedule was contesting skills with Bryant Rascoll, KG5HVO, who gave an excellent introduction to HF contesting that segued into practicing running pileups on the radios. Several attendees made their first HF contacts with our special event call sign, W8Y, using IC-7300 transceivers provided by Icom. Bryant also organized an in-person

**Above** — Campers released a high-altitude balloon that rose over 100,000 feet before popping and returning the payload to Earth.


2021 YOTA Summer Camp participants and staff at the National VOA Museum of Broadcasting in West Chester Township, Ohio.

sprint to practice contesting skills in a fun environment. Everyone enjoyed trying to exchange information without radios as quickly and accurately as possible, especially when the adults started creating copious interference.

On Tuesday, we went over high-altitude balloons (HABs) and Digital Smart Technology for Amateur Radio (D-STAR). In an engaging workshop, Will Jourdain, AA4WJ, taught us all about D-STAR, as we followed in real time using Icom IC-705 transceivers. Jack McElroy, KM4ZIA, and his father, Tom McElroy, W4SDR, then led the balloon workshop. We learned about HABs and the Automatic Packet Reporting System (APRS), before helping them package the payload for a HAB launch. It was fascinating to see the payload come together, fill the giant balloon with helium, and then carry it into an open field for release. The total flight took about 5 hours, and the balloon rose over 100,000 feet in altitude before popping and returning the payload to Earth. YOTA Camper Dylan Romero, KN6IVW, had "always wanted to be a part of a balloon launch."

Satellites and foxoring (a combination of classic orienteering and direction finding on 80 meters) were the focus on Thursday. Ruth rotated campers between a presentation on all aspects of satellite communications and conducting FM passes. Campers were able to watch her demonstration, be coached through making contacts using her equipment, and then attempt their own pass with Arrow antennas and Icom handheld transceivers. They were able to see how complex and fun satellite contacts can be, and were thrilled to make a few contacts.

Adam Johnson, KD9KIS, and Dylan Romero, KN6IVW, worked together on the air using W8Y, the YOTA Summer Camp special event call sign.

That afternoon, Bob Frey, WA6EZV, led a foxoring workshop and competition. First, we used orienteering maps to find specific circle checkpoints to determine where beacons would be located in a course around the museum. Once we found those locations, we used direction finding to locate the beacons somewhere in or near the circle on 80 meters. YOTA Camper Kees Van Oosbree, W0AAE, completed the entire course in 11 minutes!

The camp concluded on Friday with an antenna build, and campers really got creative. Contacts were made on everything from SSB HF wire antennas to a 2-meter heart antenna built by Kaleigh Squires, KI7TXN, and Leah.

## Making an ARISS Contact

The most unique part of camp was hosting an Amateur Radio on the International Space Station (ARISS) contact on Wednesday. Neil and Ruth had been working with the ARISS team since 2019. Thanks to their willingness to work with our camp schedule, we were approved for an ARISS Multipoint Telebridge Contact. The ground station was operated by John Sygo, ZS6JON, in South Africa. He tracked the ISS and relayed the audio to us, allowing us to talk with Japan Aerospace Exploration Agency (JAXA) Astronaut and Expedition 65 ISS Commander Akihiko Hoshide, KE5DNI. Ruth served as the YOTA host, organizing everything at camp and handling the logistics of rotating through campers' questions.

A few weeks before camp, Ruth selected 15 questions from seven campers, giving them the opportunity to talk to Akihiko with her. We rehearsed questions and ensured everyone could hear prior to the contact. It was incredibly special to contact NA1SS. We couldn't stop smiling, as dreams of talking with an astronaut finally came true.

## Fun Off the Air

One of the biggest lessons learned from Youngsters On The Air was the importance of downtime for the campers. YOTA Summer Camp staff ensured that the schedule allowed time for us to relax and play radio, talk about shared interests, or simply build rapport with each other. We ate at Dave & Buster's, visited Kings Island Amusement Park and Soak City Water Park, and had a pool party with s'mores at the hotel. We also created our own downtime with the Late-Night Lobby Club. Over real Wisconsin cheese curds (courtesy of camper Adam Johnson, KD9KIS), this club discussed amateur radio, aviation, and future careers after camp hours in the hotel lobby.

## Future Plans

YOTA Summer Camp was an absolute success and an invaluable opportunity for us to bond with other young hams, learn more about our hobby, and become better operators. Peter Fujisawa, KE8MPK, said, "This week was the most fun I have had in my life. It really changed me and the way I view ham radio. [It's] not all about search-and-rescue stuff, but it's about forming tight communities with other young folks and encouraging each other."

We're committed to the continued involvement in YOTA and furthering youth activities on the air. The 2021 YOTA Summer Camp was the first of many camps to come, and we can't wait to see how it impacts even more youth in ham radio.

All photos by the authors.

Leah McGrane, KD9LFZ, is a young ham who enjoys participating in Parks on the Air® (POTA), as well as building and testing new antennas and radios. She posts amateur radio videos to her YouTube channel, *Astro Leah*, and hopes to inspire future hams to be more active in the hobby. Leah is a student pilot, who aims to make a career out of flying planes and her passion for everything space-related. She can be reached at **serious1413@gmail.com**.

Ruth Willet, KM4LAO, is a 22-year-old ham from Virginia. She recently graduated from Kettering University in Flint, Michigan, with a double major in engineering physics and mechanical engineering and a minor in acoustics. She enjoys operating on HF and satellites, as well as mentoring other hams. In 2018, Ruth was named the ARRL Hiram Percy Maxim Memorial Award recipient. She can be reached at **km4lao@arrl.net**.

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


## New Products

### SSB-Electronics Germany LNA 30 Wide-Band Preamplifier

SSB-Electronics in Germany has announced their new LNA 30 wide-band preamplifier for applications from 5 kHz to 30 MHz. The preamplifier is supplied with 12 – 24 V via the UHF socket, or it can be powered by a 24 V battery. Linear power supplies are recommended. The preamplifier is equipped with a UV-resistant, weatherproof housing. For more details or to purchase, contact **sales@ssb-electronic.com** or visit **www.ssb-electronic.com**.

# Radio on the *Island of Bonaire*

## This sought-after contest location holds one of the largest stations in the Caribbean.

**Steve Telenius-Lowe, PJ4DX/KHØUN**

The island of Bonaire (PJ4) became a DXCC entity on October 10, 2010, upon the dissolution of the former country of the Netherlands Antilles. As we celebrate its 11th anniversary as a DXCC entity, I wanted to look at amateur radio activity on this small Dutch island in the southern Caribbean.

Among radio aficionados, the island is best known for being the location of the most powerful AM band station in the Americas: TWR (Trans World Radio). TWR Bonaire operates on 800 kHz with a power of 450 kW and a four-tower directional antenna system. Unfortunately, the former Radio Netherlands Worldwide shortwave relay station operated by the Dutch government closed in 2012, and its towers and curtain antenna arrays were dismantled.

The new PJ4K station (formerly known as PJ1B), before monoband antennas were installed. It has three 140-foot towers, and, when construction is complete, it'll be one of the largest stations in the Caribbean.



Eva Telenius-Lowe, PJ4EVA, operating SSB on 20 meters.

Ward Silver, NØAX; Scott Robbins, W4PA, and Brad Brooks, WF7T, installing an antenna for one of the many contests they've participated in at Scott's Bonaire location.

Noah Gottfried, K2NG, owns the PJ4G contest station, located on one of the highest points of the island.

## Radio Licensing

Amateur radio licensing is carried out by Agentschap Telecom, which maintains a small office in Kralendijk, the island's capital. This office also handles licensing for Sint Eustatius (PJ5) and Saba (PJ6). These islands, along with Bonaire, make up the BES Islands, also known as the Caribbean Netherlands.

Bonaire has signed up for the European Conference of Postal & Telecommunications Administration (CEPT) amateur radio license, per Recommendation T/R 61-01. This allows amateurs visiting the island from the US, Canada, or any CEPT country to operate as PJ4/the operator's call sign, for a period of up to 3 months. They can do so for free and without having to make any application.

For residents, there are two license classes available: Novice and Full. Novice allows access to 7.05 – 7.15, 14.0 – 14.25, and 28.0 – 29.7 MHz, plus the 2-meter, 1.25-meter, and 70-centimeter bands, with a power output of 25 W. Full allows access to all of the International Telecommunications Union (ITU) Region 2 privileges. In 2017, Full licensees received permission to use 5.3515 – 5.3665 MHz on a secondary basis, with a maximum power level of 25 W Effective Isotropic Radiated Power (EIRP).

Novice and Full licensees are issued call signs in the series PJ4, followed by two or three letters. The licensing fee is $56 for 10 years. Single-letter PJ4 calls, such as PJ4A, are available for contests and special events. The licensing fee is the same but the maximum duration is 3 months, after which the call sign may be reissued.

Right now, there are more radio amateurs living on Bonaire than ever before. Nine hams reside on the island, in addition to two American-owned contest stations that are activated a few times per year.

Shortly after my wife and I moved to Bonaire in 2013, I received my PJ4DX license. As of August 2021, I've made over 110,000 contacts and have over 300 DXCC confirmed contacts. I qualify for nine-band DXCC, although I have yet to apply.

## Contesting on Bonaire

Bonaire is in the fabled CQ Zone 9, and, at only 50 miles from the coast of Venezuela, is part of South America. This makes it a particularly attractive location for HF contesting and there are two dedicated contest stations on the island.

PJ4G is a top-performing station in most DX contests. It's located on one of the highest points of Bonaire with a clear takeoff over the ocean. The station is owned by Noah Gottfried, K2NG, who now also holds the permanent Bonaire call sign PJ4NG. The house is available for rent when Noah isn't using it (visit **www.pj4g.com** for more information). John Laney, K4BAI, and Jeff Clarke, KU8E, often operate contests from this station.

The other station was formerly known as PJ1B, which won many of the big international contests in the 1980s and '90s. The station was inactive for nearly 2 decades, but is being rebuilt by Walt Rakitsky, WA3LRO; Rich Smith, N6KT, and their teams of volunteers. The station is still under construction, but there are three 140-foot towers with monoband antennas for 10 through 40

The Agentschap Telecom licensing office in downtown Kralendijk.

meters, wire beams for 80 meters, a 160-meter vertical antenna, and an impressive array of dedicated low-band receive antennas. This station now uses the special contest call PJ4K and will be one of the biggest amateur stations in the Caribbean once it's completed.

Scott Robbins, W4PA, owner of Vibroplex® (**www.vibroplex.com**), as well as the Bencher® and INRAD brand names, has been visiting Bonaire for many years to operate the CQ World Wide DX CW and Phone contests using the call sign PJ4Q. For years, Scott operated from the duplex unit adjacent to my location in Bonaire, where he has been joined by many well-known contesters, including Ward Silver, NØAX; Brad Brooks, WF7T; Randy Thompson, K5ZD, and Robert Kasca, S53R/T6AA. Bonaire locals such as Peter de Graaf, PJ4NX; Bert van Oort, PJ4KY, and I have often joined Scott's teams for their contest operations.

Bonaire locals Bert van Oort, PJ4KY, and Peter de Graaf, PJ4NX, have often joined Scott Robbins', W4PA, contest team operations over the years.

## Visiting Bonaire

Local Bonaire radio amateurs get together once a week as part of an informal group known as BAR — Bonaire Amateur Radio. However, there's talk of creating a more formal amateur radio society.

COVID-19 travel restrictions keep changing, making it easier to travel to Bonaire from North America and Europe and allowing visiting amateurs to once again join the weekly gatherings. Contact me or one of the other resident amateurs mentioned in this article via the email addresses published on **www.qrz.com** to let us know when you're coming. All hams are welcome!

All photos by the author.

Steve Telenius-Lowe, PJ4DX, was first licensed as G8FEO when he was a high school student in England in 1971, later upgrading to become G4JVG. Before taking early retirement, he was Managing Editor of the Radio Society of Great Britain's (RSGB) membership magazine, *RadCom*. After retirement in 2005, he and his wife, Eva, PJ4EVA, moved to the island of Borneo in East Malaysia, where he was active as 9M6DXX and 9M8Z. While living in the Far East, he took the FCC exams at the South East Asia Net (SEANET) Convention and now also holds the call sign KHØUN. He and his wife settled in Bonaire in 2013. Steve can be reached at **teleniuslowe@gmail.com**.

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

# Grammy-Nominated Musician *Raul Midón, AE3RM,* Takes Radio on the Road

This blind ham, jazz singer, songwriter, and guitarist blends radio with his music career, while operating from his accessible stations at home and on tour.

**Jim Millner, WB2REM, and Gene Hinkle, K5PA**

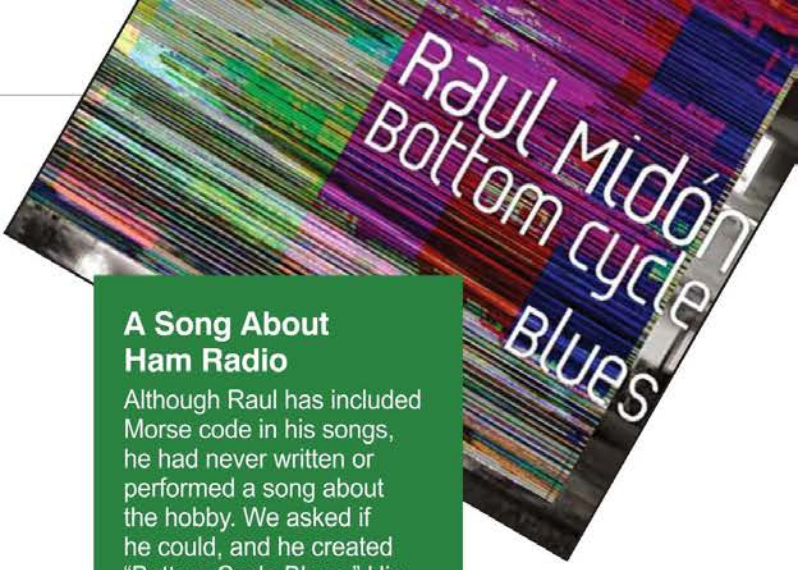
Amateur Extra-class licensee Raul Midón, AE3RM, and his twin brother have been blind since birth. When he was young, Raul enjoyed listening to his Zenith Trans-Oceanic radio and was fascinated by the communications and music he heard from around the world. He first learned to play a flamenco guitar at the age of five, and was introduced to amateur radio at 12 years old by his science teacher at the New Mexico School for the Blind and Visually Impaired.

## Mixing Radio and Music

Raul participated in the Studio Music and Jazz Performance Program at the University of Miami, with an emphasis on guitar. In his early performing years, he provided backup singing and instrumentals for performers such as Julio Iglesias and José Feliciano. He worked in the prestigious Miami session scene, ultimately accepting a gig in Shakira's band as a singer and background vocalist from 1999 to 2001. As a solo artist, Raul made his debut on *The Late Show with David Letterman* and has appeared on *Jimmy Kimmel Live!*, *The Tonight Show with Jay Leno*, and television shows around the world. In 2017 and 2018, Raul's albums, *Bad Ass and Blind* (2017) and *If You Really Want* (2018), were nominated for Grammy awards.

Raul has combined his passions for music and ham radio by including Morse code in many of his songs. His major-label debut album, *State of Mind* (2005), includes the song "Sittin' in the Middle," which features Morse code. His old call sign, KB5ZOT, can also be heard as the rhythmic pattern of the song. His next album, *A World Within a World* (2007), features Morse code in the song "Peace on Earth." On *Don't Hesitate* (2014), Raul used Morse code at the beginning of "I Can See For Miles," which was originally performed by The Who.

Raul enjoys making DX contacts from his home station, as well as remotely when he's on tour. Although he says he likes the sense of anonymity from being on the air, he doesn't mind talking about performing, traveling, and the music business if he's asked. He's always happy to meet local hams when traveling around the world, as it makes him feel at home and provides a personal touch for hams that attend his performances. You can find out when he'll be in your area at **www.raulmidon.com/tour.html**.




### A Song About Ham Radio

Although Raul has included Morse code in his songs, he had never written or performed a song about the hobby. We asked if he could, and he created "Bottom Cycle Blues." His song can be heard on YouTube, at **https://youtu.be/cq9hzqD3_Ow**. Be sure to listen for the Morse code message during the guitar passage toward the end.

## An Accessible Home Station

Raul enjoys operating from his home in Maryland, where he has assembled a top-notch station of Kenwood transceivers, an Ameritron ALS-1306 linear amplifier, a 55-foot crank-up/tilt tower, and an assortment of HF and V/UHF beams. "My favorite radios are the Kenwood TS-2000 and TS-480, due to their operating ease for blind hams and all-mode, all-band coverage," Raul said. He explained that these radios have an excellent verbal readout of control settings and the right mix of knobs for tactile rig control. He has found that many of the newer radios, especially software-defined radios (SDRs), use menu systems and graphical interfaces that make it harder to find and set controls.

In addition to the verbal readout for Raul's Kenwood TS-2000, he uses LDG Electronics TW-1 and TW-2 Talking Wattmeters to hear the RF power and antenna matched condition. These meters also emit a tone that changes frequency as the standing wave ratio (SWR) is lowered during tuning. This enables Raul to tune his antenna for minimum SWR when using an external tuner.


The song "Peace on Earth" on Raul Midón's, AE3RM, 2007 album, *A World Within a World*, features Morse code.

Station computers are commonplace, which presents some difficulty to a blind operator. Raul uses several software programs to assist him with reading his computer's monitor, including the world's most popular program screen reader, *JAWS®* (*Job Access With Speech*) and a powerful computer accessibility program for displays, called *HotSpotClicker*. Both programs are essential to help Raul navigate computer readouts and controls.

Raul enjoys on-air activities, such as making long contacts, working DX, some contesting, and monitoring the ham bands. His favorite modes are SSB and CW.

## Radio on the Road

Although he has traveled with radios, Raul finds it more convenient to take a remote setup with fewer components with him while on the road. "When I'm connected to my home station, my remote setup doesn't require a heavy power supply, HF transceiver, antenna system, or other components," he said.

Raul's remote station includes a Microbit RemoteRig RRC-1258MkII to interface his radio to the internet while he travels. His Kenwood TS-480 has a detached front panel that allows the main body of the radio to stay at home. This piece is light, making travel easy. At his home station, the TS-480 radio body is attached to the linear amplifier that remains connected to his antenna system. In addition, he can remotely operate his rotator controller and amplifier.

Reliable access to the internet is required to operate this remote radio system, and that can be a challenge while staying in hotels. Raul finds that a personal computer allows him to initially set up internet access. As an alternative, he also uses *RCForb Client,* which can be downloaded from **www.remotehams.com**, allowing him access to other remote radio servers from around the world and providing a lot of flexibility for staying in touch with friends.

## Staying in Touch

Raul uses ham radio to touch base with ham friends while he's on the road, performing in the US and around the world. He hasn't let his visual impairment become an obstacle to his career, nor his enjoyment of amateur radio. His use of auditory aids put him on an even playing field with sighted amateurs, and his musical genius is recognized around the world.

We're grateful to Raul for answering our questions, as well as producing and performing "Bottom Cycle Blues," per our request (see the sidebar, "A Song About Ham Radio"). We hope you enjoy that song, along with his others, as much as we did.

All photos by the authors.

Jim Millner, WB2REM, has been a ham for over 50 years. He's an avid DXer, world traveler, and licensed psychologist. He first began experimenting with remote control linking in the 1980s, and published the article, "The Missing Link," in the September 1986 issue of *73 Magazine*. Additionally, his remote link was featured in a portion of the 1988 ARRL video, *The New World of Amateur Radio*. In the January 1995 issue of *QST*, his article, "The WB2 'REMote' Link," presented a hardware solution to remote linking. He has written other related articles for *QST*, as well as articles about his profession and the current state of amateur radio for *CQ Magazine*. Most recently, a photo from his article, "HD8M DXpedition to the Galapagos Islands," was featured on the cover of the April 2020 issue of *QST*. Jim can be reached at **wb2rem@verizon.net**.

Gene Hinkle, K5PA, began experimenting with ham radio at a young age, which led him to a career in RF engineering. He earned a Master's degree in electrical engineering from The University of Texas at Austin, is an IEEE Senior Life Member, and a retired professional engineer in Texas. Gene is an ARRL Life Member and Volunteer Examiner (VE). He recently retired from a radio technology company specializing in radio geolocation. His favorite ham radio pursuits are CW, low-band digital signals, and making DX contacts. His interests, photographs, and many publications can be found on his website, at **www.k5pa.com**. Gene can be reached at **k5pa@arrl.net**.

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

Rick Lindquist, WW1ME, ww1me@arrl.org

## Happenings

# ARRL Board Creates Emergency Communications and Field Services Committee

At its July meeting, the ARRL Board of Directors approved by-law changes creating a third Standing Committee that joins the existing Administration and Finance Committee and Programs and Services Committee. The charter of the new Emergency Communications and Field Services Committee (EC-FSC) is to develop and recommend new or modified Board policy and programs for emergency communications through the Amateur Radio Emergency Service® (ARES®) and National Traffic System (NTS™) entities. The committee will also offer enhanced support for its Field Organization leadership volunteers, including Section Managers, and an increased focus on ARRL Affiliated Clubs.

Further, the EC-FSC will provide guidance to the CEO in translating Board policy into prioritized tasking, funding, and staffing of programs, services, and training in support of amateur radio emergency communications, field organization volunteers, and recruitment and retention of new and existing members through assistance to Affiliated and Special Service Clubs.

The EC-FSC will have additional responsibility to monitor and assess trends in emergency communications technology and participant skills worldwide, and to identify "best practices" for voluntary emergency communications provided by ARES and NTS, coordinating and cooperating with other amateur radio national societies as appropriate.

## ARRL Headquarters Holds Rededication Ceremony

On July 15, ARRL Headquarters hosted a rededication ceremony, recognizing ARRL's commitment to all radio amateurs who enhance the communications capability and security of the nation. The event coincided with the attendance of the ARRL Board of Directors. In his remarks, ARRL President Rick Roderick, K5UR, recognized members of ARRL's Amateur Radio Emergency Service® (ARES®) for serving their communities with essential communications When All Else Fails®. ARRL CEO David Minster, NA2AA, reflected on the commitment made to maintain the organization's operations for the benefit of its members during the pandemic. US Congressman John B. Larson presented Minster with a Congressional Recognition for "the dedicated and phenomenal service that the ARRL and its members" provide.


US Congressman John B. Larson (left) presenting ARRL CEO David Minster, NA2AA (right), with a Congressional Recognition for ARRL.

## FCC Application Fees Unlikely to Go into Effect Until 2022

The schedule of FCC amateur radio application fees likely will not go into effect before 2022. FCC staff confirmed during a July virtual meeting with Volunteer Examiner Coordinators (VECs) that the agency is still working on the necessary changes to the Universal Licensing System (ULS) software and other processes and procedures that must be in place before it starts collecting fees from amateur applicants.

Once it's effective, the $35 application fee will apply to new, modification (upgrade and sequential call sign change), renewal, and vanity call sign applications. All fees will be per application. Administrative update applications, such as those to change a licensee's name, mailing, or email address, will be exempt from fees. ARRL VEC Manager Maria Somma, AB1FM, said Volunteer Examiner (VE) teams will not face the burden of collecting the $35 fee.

"Once the FCC application fee takes effect, new and upgrade applicants will pay the exam session fee to the VE team as usual, but they'll pay the $35 application fee directly to the FCC using the FCC Pay Fees system," she explained. When the FCC receives the examination information from the VEC, it will email a link with payment instructions to each successful candidate, who then will have 10 days from the date of the email to pay.

After the fee is paid and the FCC has processed an application, examinees will receive a second email from the FCC with a link to their official license. The FCC no longer provides printed licenses.

### ARRL Provides Free RF Exposure Calculator

Under new FCC guidelines and procedures for evaluating environmental effects of RF emissions, some amateurs must perform routine station evaluations to ensure that their stations comply with the RF exposure rules. This can be as simple as running an online calculator to determine the minimum safe distance between any part of your antenna and areas where people might be exposed to RF energy from your station. Amateurs can take their own measurements, but evaluations can also be done by calculation.

To simplify the task, ARRL now provides an RF exposure calculator on its RF Exposure page, at **http://arrl.org/rf-exposure-calculator**. To use the calculator, enter your transmit peak-envelope power (PEP) and operating mode, and answer the questions about the maximum amount of time you might be transmitting. The calculator will give users the minimum distance people must be from your antenna and human exposure.

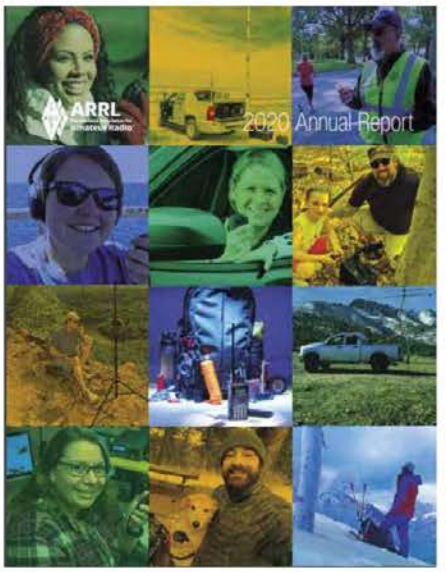
Results may be printed for filing; these do not need to be sent to the FCC.

## ARRL's *2020 Annual Report* Now Available to Download

The ARRL *2020 ARRL Annual Report* has been posted and is available to download at **www.arrl.org/annual-reports**. The report summarizes ARRL program and fiscal activity for the year. In his introductory remarks, ARRL President Rick Roderick, K5UR, called 2020 a difficult and challenging year.

"The coronavirus pandemic changed everything, from the way we socialized, to the way we worked, to the way students learned," Roderick wrote. Nonetheless, Roderick said ARRL remained determined to overcome any obstacles in order to serve its members.

"Due to the pandemic and state-imposed work restrictions, ARRL Headquarters closed and employees suddenly had to adjust to working remotely," he recounted. "ARRL staff banded together and kept things running for our members. I'm proud of our staff for how quickly they adapted and worked together as a team. They made the shift to working from home as seamless as possible, and they continued to develop new products and services."




ARRL's *2020 Annual Report* is available for download.

He went on to explain that these new services "included things like the ARRL Learning Network webinars, allowing members to expand their radio knowledge from home through video seminars from industry experts, and the At Home virtual events held by the Marketing department, providing ARRL staff with an opportunity to engage with members and give video tours of W1AW through a new online platform. They did a remarkable job!"

ARRL CEO David Minster, NA2AA, who came aboard a year ago, said

ARRL's new ideation process is proving successful. "Stemming from an authentic interest and need to become more inclusive as a community, especially to newly licensed hams, our members have great ideas about how ARRL could be doing things better," Minster said. "To expand upon that culture of collaboration, we now have a web page, **www.arrl.org/ideas**, and email address, **ideas@arrl.org**, where members can send their thoughts and well-formatted ideas about changes to ARRL programs and services to the management team for consideration. This process has enjoyed early success, and we look forward to much greater interaction with members in the future."

Two major initiatives came to fruition — in January with the introduction of *On the Air* magazine, and in February with the inauguration of the ARRL Volunteer Monitor Program. 2020 marked the first time when both *QEX* and *NCJ* were available digitally.

The 56-page *Annual Report* recounts and summarizes the activities of all ARRL departments and includes a complete 2020 fiscal report. ARRL ended 2020 with 158,494 members, which was ahead of its goal for the year.

## ARRL Announces Leadership Changes in the Central Division

Following the retirement of ARRL Central Division Director Kermit Carlson, W9XA, in July, ARRL President Rick Roderick, K5UR, appointed Brent Walls, N9BA, as the Central Division Vice Director. Walls succeeded the Vice Director, who assumed the Director's chair.

Brent Walls, N9BA, during a visit to W1AW.

An ARRL Life Member, Walls served as Indiana Section Manager from 2016 until 2018. Active in ARES, he is a former ARRL Indiana Section Emergency Coordinator and also served as Marion County, Indiana, Emergency Coordinator. He is an ARRL VEC Volunteer Examiner.

Carlson served as Vice Director and then Director of the Central Division for a total of 12 years. He said his resignation stemmed from "an intractable conflict" between Board and family obligations that would impinge upon his travel on behalf of ARRL.

"It would be impossible to maintain the level of in-person engagement with the members that I believe is essential," Carlson said.

Carlson will continue as chair of the Electromagnetic Compatibility Committee (EMC).

## Section Manager Nomination Notice

To all ARRL members in the Eastern New York, Eastern Pennsylvania, Louisiana, North Carolina, Pacific, San Diego, South Dakota, and Virginia Sections. 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 (ie, autobiographical information should appear exactly the same on all copies). All forms/copies must be submitted together.

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

We suggest the following format:

(Place and Date)

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

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

(Signature _____ Call Sign _____ City _____ ZIP _____)

Any candidate for the office of Section Manager must be a resident of the Section, an amateur radio licensee of Technician class or higher, and a full member of 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 10, 2021. If more than one member is nominated in a single Section, ballots will be mailed from Headquarters no later than January 3, 2022 to full members of record as of December 10, 2021, which is the closing date for nominations. Returns will be counted on February 22, 2022. Section Managers elected as a result of the above procedure will take office April 1, 2022.

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, 2022. 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. — *Mike Walters, W8ZY, Field Services Manager*

Rick Lindquist, WW1ME, ww1me@arrl.org

## Amateur Radio World

# Amateur Radio Responds to Flooding in Western Europe

International Amateur Radio Union (IARU) Region 1 Emergency Communications Coordinator Greg Mossop, GØDUB, reported in mid-July that amateur radio volunteers had responded in the wake of widespread flooding in Germany, Belgium, and the Netherlands. The flooding, resulting from unprecedented heavy rainfall, claimed over 100 lives.

The Dutch Amateur Radio Emergency Service (DARES) went on standby on July 14, as the first reports of flooding came in. An initial attempt to establish a point-to-point link from the provincial capital of Maastricht to the north of Limburg province was halted due to heavy traffic, as residents evacuated low-lying areas. DARES volunteers were in contact with members of the Belgian Emergency Amateur Radio Service (B-EARS) to coordinate their efforts.

The European Civil Protection Mechanism was activated, and emergency groups across the region reported that their governments were sending extra assistance and supplies to the areas where damage was worst. The floodwater surge continued to make its way north, leading to further evacuations, and amateur radio emergency groups focused on requests for assistance. B-EARS was asked to provide a backup VHF link between the emergency call center in Brussels and the province of Hainaut, while DARES had four stations active in the Limburg area ready to respond if needed.

Marc Lerchs, ON3IBZ, Information Director of the Walloon Brabant Crisis Centre, told *Crisis Response Journal* that the police building in Wavre, including its TETRA antenna and computers, was left completely underwater. Some 30 ham radio volunteers deployed in the region to support communication for fire and ambulance stations, hospitals and emergency medical vehicles, the main command post in Wavre, and 112 ("911") dispatch in Mons.

Flooding in Tilff, Belgium. [Régine Fabri, photo]

The greatest loss of life and damage has occurred in Germany, where more than 1,000 residents remained unaccounted for in July. The loss of mobile telecommunication networks slowed the effort to locate people, while many others were without power or homes. The emergency communications unit of the Deutscher Amateur Radio Club (DARC) handled inquiries for amateur radio support in the worst-hit areas, but members in the area have been flood victims as well, losing equipment or their homes.

"Amateur radio clubs have been in contact with relevant authorities, but there is currently no need for operational support from radio amateurs," the DARC reported at the time. A mutual aid arrangement exists among amateur radio organizations in Germany, Belgium, and the Netherlands.

"This emergency will last for some time as infrastructure is repaired and the threat from damaged dams and more rainfall is reduced," Mossop said.

### Swiss Radio Amateurs are Facing a Fee to Use the QO-100 Satellite

In what might be a first, Switzerland's telecommunications regulator, Ofcom, is charging the equivalent of $76.25 to issue special permits for radio amateurs to use the QO-100 (Es'hail-2) amateur satellite transponders.

According to a post on the website for the USKA — Switzerland's IARU member-society — the regulator wishes to protect license-exempt users in the 2.4 GHz industrial, scientific, and medical (ISM) band, and Ofcom reserves the right to withdraw the special permit if problems arise.

The special permit entitles the holder to use a transmitter with a maximum output of 100 W PEP for a satellite uplink in the 2400 – 2410 MHz band. As part of their application, radio amateurs must provide coordinates, antenna gain in dBi, antenna height above ground, antenna direction, and a telephone number where the radio amateur can be reached while operating, in addition to the usual name and call sign information.

Rick Palm, K1CE, k1ce@arrl.org

## Public Service

# ARRL Field Day at an Emergency Operations Center

This year, I participated in the North Florida Amateur Radio Club (NFARC) and Alachua County Emergency Operations Center (EOC) Radio Club ARRL Field Day operation, NF4AC. It took place on the large county EOC campus on the outskirts of Gainesville, Florida, a major university town prone to hurricanes and other severe-weather emergencies. Our focus for the 2021 ARRL Field Day was preparation and practice for providing emergency communications services to the community, especially for the EOC, where Amateur Radio Emergency Service® (ARES®) has worked hard for its excellent relationship with county emergency management administrators and staff. There's a room dedicated to an amateur radio station just off the EOC's center of activity room, where emergency support function professionals sit during an incident.

Last year, the group successfully carried out their first Field Day at the EOC, during the COVID-19 pandemic. This year, efforts began in April to obtain permission and plan for the June 26 – 27 event following Incident Command System (ICS) procedures. A new sheriff's administration posed an opportunity for forming new relationships, and Field Day would help establish them.

Leaders reviewed 61 Improvement Plan (IP) recommendations from the 2020 event and created an improved Incident Action Plan for 2021, recruiting Section Chiefs and Unit Leaders to work within an ICS structure.

Former FEMA Administrator Craig Fugate, KK4INZ, operated FT8 and GridTracker during the NFARC and Alachua County EOC Radio Club Field Day operation, NF4AC. [Gordon Gibby, KX4Z, photo]

### Valuable Improvements

Significant advances resulting from this year's Field Day operation included testing an improved backup EOC HF antenna with successful PSKReporter checks, confirming near-equivalent performance of the primary and secondary antennas. For many of the operators, Field Day brought their first 6-meter experience. The participants gained a better understanding of EOC/sheriff volunteer vetting processes. Most significantly, the team improved its operating efficiency, doubling the number of contacts made over the previous year's operation.

Contributing to efficiency and performance was an improved computer-based automatic logging system for the FT8 station, which required almost no user intervention by the control operator other than verifying that it was logging. Other contributing factors included an operation management system that coordinated the stations through a microwave local area mesh network.

Here are some of the major strengths identified during this year's Field Day:

- Setup was completed in only 3 hours, including raising two HF antennas in a grassy field and an innovative 6-meter vertical antenna built on the base of a basketball hoop.
- Tear-down was completed in just 75 minutes.
- A 6-meter station greatly contributed to the contact total using the "free" VHF transmitter rule, allowing for a lot of youth participation.
- Two large RVs provided additional protection from the elements and offered a more comfortable operating experience for the VHF and FT8 station.
- Many new amateur radio operators gained valuable experience and training.
- The microwave network was a success for moving data in and out of the heavily reinforced EOC building.
- The decision to employ external RF power amplifiers was validated by higher contact rates.
- Interference issues between the higher-power stations 200 yards apart were found to be minimal, even without band-pass filters.
- A media campaign garnered wide coverage, resulting in visits from reporters and the public, which was far more than last year.

- Registering with the ARRL Field Day Station Locator (**www.arrl.org/field-day-locator**) gave wider visibility among other stations.
- There was better coordination with nearby groups, including Columbia County ARES.
- New leadership gained significant experience in preparation for the rest of hurricane season, as well as next year's Field Day, incidents, and exercises.

## Areas for Improvement

Although the goal was to manage the operation under the ICS model, there was no Incident Commander at a command post to monitor the operation from activation to deactivation. This deficiency led to several near misses, which were fortunately caught. An IP item for next year is to add an Incident Commander at a command post.

## Personal Observations

I was impressed with the strict observance of the Field Day golden rule: safety first. A few examples of this include installation of semi-permanent ground rods throughout the site; safe generator locations with yellow warning tape/flags and fire extinguishers, and identification, observance, and avoidance of power lines during antenna setup. However, I was most impressed with the "pull-the-plug" protocol. When the first clap of thunder was heard, all operations were immediately halted, antenna cables and AC extension cords were disconnected, and participants took shelter in safe locations against the rain, lightning, and storm that lasted about 45 minutes.

The leadership team went out of their way to mentor new licensees (many of whom were participating in their first Field Day) on operating practices. There was an emphasis on promoting ARES, and I'm sure many will join the local ARES program as a result.

While operating the FT8 station, I enjoyed monitoring the automatic logging function connected to the microwave mesh data network, which is used for logging by all operators and coordination of band usage and rules compliance. I improved my technique in the setting of the crowded FT8 spectrum by looking for relatively clear transmitting frequencies on the spectrum scope/waterfall display. Using a bit more power (about 140 W) seemed to help, too.

My personal Field Day goals every year include learning something new and having fun, as well as helping to provide a new licensee or operator with the same experience. I was mentored on an impressive new program called GridTracker (**https://gridtracker.org**), by team member/fellow operator and former Federal Emergency Management Agency (FEMA) Administrator Craig Fugate, KK4INZ. I also learned how to use a pneumatic antenna line launcher that worked very well. Additionally, I gained much more understanding of the ICS. Reading about it in an online course is one thing, but seeing it in action is greatly beneficial.

Operating Field Day on a major EOC campus was not only exciting, it was a privilege. I want to thank NFARC and the Alachua County EOC Radio Club for the opportunity.

# Field Organization Reports

### July 2021

## 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**.

590
WA7PTM

491
KE8BYC

480
KE8BOC

475
WA3EZN

445
N9VC

340
AD8CM

319
W7PAT

315
W7EES

305
ND8W

260
KB3YRU
KD2NMG

256
W3GWM

250
KK6GXG

248
W9RY

245
W8IM

236
WA2CCN

235
N5MKY

234
W0PZD

230
KT2D

210
W4CMH

206
N3KRX

200
KW9EMG

195
KM8V

186
KD2LPM

180
WO2H

177
W4CPD

175
KD8UUB

170
W2PH

168
K0FBS
AI9F

160
KC9FXE
W8DJG
WM5N

156
N2DW

155
K9LGU
N4CNX

154
W4INX

153
K3FAZ

152
N8SY

151
WM2C

150
WB9WKO
WD8USA

140
WC4FSU
AD3J
WB9QPM
K4IWW
KK3F

136
KB5PGY

135
W3YVQ
KF5OMH

133
K1XFC

130
N1LL
N2LC
WK4WC
N2JBA
KI7TIG
KW1U
KD8ZCM
KB8RCR

126
K9ILJ

125
AG9G
AC8NP

124
KE4DRF

123
AC0KQ

120
WA4VGZ
K3JL
KA9QWC
KD0HHN
N2WGF
KA9MZJ
KY2D
NA7G
N7IE
KE5YTA
KG5NNA
KB8PGW

117
K8AMH

116
KD8KBX

115
N1TF

114
KC8T

113
AB3WG

112
WV5Q

110
K6HTN
WA3QLW
AB8MW
N8CJS
KC8WH
N3SW
W4DNA
KB2QO
KO4OL
W1RVY
N1IQI
KA5AZK
WB8TQZ

109
KB1TCE
KY2MMM
KO4OL

106
K8MDA

105
W2PAX
AD4DO
AA3SB

101
KC8YVF

100
WB4RJW
KZ8Q
W1KX
KN9P
NX9K
W9EEU
AC8RV
KA2GQQ
W2AH
AK2Z
K2EAG
KB2YAA
W2ZXN
W7GRG
W7PHX
K7OED
KB1NMO
N1LAH
K8ED

99
WA1URS

96
W4TTO

95
K0WAV
WB8SIQ

92
NI2W

90
KM4WHO
KB9GO
AB9ZA
K8KRA
N8MRS
KB8HJJ
KL7RF
KA9IKK
K3MIY
WX2DX
AA3N
W4KX
N2TSO
KA2HZP
WB4ZDU
AA7BM
K1HEJ
KD2JKV
KC1KVY
KC1MSN
KC1HHO

89
N6IET
WB8YYS

88
KU1U
K6JT

87
W3CJD
W3NTS

86
KT4WX

85
N3RB

84
KV8Z
W3ZR

82
N3XMB
KD2PQP

80
KR4ST
W9BGJ
W8FAE
W8GSR
W4EDN
KF7GC
KJ7BHO
WB8R

77
KF5IVJ

76
K4FHR
K2MZ
W5XX

75
KA1G
K2MTG

73
AJ7B
W2ARP
N4ZM

72
KA2JFU

71
KD2GXL
K3YAK
WB2VUF
KB3MKX

70
K6RAU
WB6NCT
KN4AAG
WA1LPM

The following stations qualified for PSHR in previous months, but were not reported in this column yet. May: KB3YRU 235, W0PZD 230, KT2D 220, KD2NMG 200, WO2H 175, WM2C 157, W8IM 153, W9GRG 150, WA2BSS 149, AD8CM 139, N1LL, N2JBA 130, KA9QWC, W4NWT 120, N2DW 113, W9EEU 104, WB8SIQ 100, AB9ZA, WX2DX 90, KT4WX, K7ASA 83, AA7BM 81, N4ZM 82, W8GSR, W9BGJ, KF7GC 80, N2TSO 79. June: WF2Y 110, WD0BFO 90, KA0DBK 83.

### Section Traffic Manager Reports

The following Section Traffic Managers reported: AK, AR, AZ, CO, CT, DE, ENY, EPA, IL, IN, KY, LAX, MDC, ME, MI, MO, MS, MT, NC, ND, NFL, NLI, NM, NNJ, NTX, NV, OH, OR, SD, SFL, SJV, STX, TN, UT, WCF, WI, WNY, WPA, WV, WY.

### Section Emergency Coordinator Reports

The following Section Emergency Coordinators reported: CT, EWA, MI, MN, MO, MS, ND, OR, NLI, NM, NNJ, NV, OK, PAC, SCV, SFL, SJV, SNJ, STX, TN, VA, VI, WCF, WPA, 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 1,499, NX9K 1,498, WB9WKO 927, N9CK 880, K6HTN 806.

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

# Contest Corral

# October 2021

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 |
|---|---|---|---|---|---|---|---|---|
| 2 | 0600 | 3 | 0600 | 1.8-28 | Oceania DX Contest, Phone | Ph | RS, serial | www.oceaniadxcontest.com |
| 2 | 0600 | 3 | 1800 | 3.5-28 | TRC DX Contest | CW Ph | RST, serial, "TRC" if member | trcdx.org/rules-trc-dx |
| 2 | 0700 | 2 | 1000 | 3.5, 7 | German Telegraphy Contest | CW | RST, LDK (if member) | agcw.de/index.php/en |
| 2 | 1200 | 3 | 1159 | 1.8-28 | Russian WW Digital Contest | Dig | RST(Q), oblast code or serial | www.rdrclub.ru |
| 2 | 1300 | 2 | 1330 | 144 | Two-Meter Classic Sprint | CW Ph | Serial, 4-char grid square | fwrc.info/2021/05/21 |
| 2 | 1600 | 3 | 1100 | 3.5, 7 | International Hell-Contest | Dig | RST, serial | darc.de/der-club/referate/conteste |
| 2 | 1600 | 3 | 2200 | 1.8-28 | California QSO Party | CW Ph | Serial CA county or SPC | www.cqp.org/Rules.html |
| 2 | 1800 | 3 | 1800 | All | SKCC QSO Party | CW | RST, SPC, name, 4-char grid | www.skccgroup.com |
| 3 | 0500 | 3 | 2300 | 3.5-28 | RSGB DX Contest | CW Ph | RS(T), serial | www.rsgbcc.org/hf |
| 3 | 0600 | 3 | 0900 | 3.5 | UBA ON Contest, SSB | Ph | RS, serial, ON Section (if ON) | uba.be/en/hf/contest-rules |
| 3 | 2200 | 3 | 2359 | 3.5-14 | Peanut Power QRP Sprint | CW Ph | RS(T), SPC, peanut nr or power | nogaqrp.org/PeanutPower |
| 4 | 1900 | 4 | 2030 | 3.5 | RSGB 80-Meter Autumn Series, CW | CW | RST, serial | www.rsgbcc.org/hf |
| 5 | 0100 | 5 | 0300 | 3.5-28 | ARS Spartan Sprint | CW | RST, SPC, power | arsqrp.blogspot.com |
| 6 | 1700 | 6 | 2000 | 144 | VHF-UHF FT8 Activity Contest | Dig | 4-char grid square | ft8activity.eu/index.php/en |
| 6 | 1900 | 6 | 2300 | 432 | 432 MHz Fall Sprint | CW Ph Dig | 4-char grid square | svhfs.org |
| 6 | 2000 | 6 | 2100 | 3.5 | UKEICC 80-Meter Contest | Ph | 6-char grid square | ukeicc.com/80m-rules.php |
| 7 | 1700 | 7 | 2000 | 3.5 | SARL 80-Meter QSO Party | Ph | RS, serial, grid locator | www.sarl.org.za |
| 7 | 1700 | 7 | 2100 | 28 | NRAU 10-Meter Activity Contest | CW Ph Dig | RS(T), 6-char grid | nrrlcontest.no |
| 7 | 1900 | 7 | 2100 | 1.8-50 | SKCC Sprint Europe | CW | RST, SPC, name, mbr or "none" | www.skccgroup.com |
| 8 | 1400 | 9 | 0200 | All | YLRL DX/NA YL Anniversary Contest | CW Ph Dig | Serial, RS(T), SPC | ylrl.org/wp/dx-na-yl-contest |
| 9 | 0000 | 9 | 2359 | 1.8-28 | QRP ARCI Fall QSO Party | CW | RST, SPC, mbr or power | qrparci.org |
| 9 | 0000 | 10 | 1559 | 3.5-28 | Makrothen RTTY Contest | Dig | 4-char grid square | www.pl259.org/makrothen |
| 9 | 0300 | 10 | 2100 | 1.8-UHF | Nevada QSO Party | CW Ph Dig | RS(T), NV county or ARRL section | nvqso.com/contest-rules |
| 9 | 0600 | 10 | 0600 | 1.8-28 | Oceania DX Contest, CW | CW | RST, serial | www.oceaniadxcontest.com |
| 9 | 0800 | 9 | 1400 | 902 and up | Microwave Fall Sprint | CW Ph Dig | 6-char grid square | svhfs.org |
| 9 | 1200 | 10 | 1200 | 3.5-28 | Scandinavian Activity Contest, SSB | Ph | RST, serial | www.sactest.net |
| 9 | 1200 | 10 | 2359 | 1.8-50 | SKCC Weekend Sprintathon | CW | RST, SPC, name, mbr or "none" | www.skccgroup.com |
| 9 | 1500 | 10 | 0500 | 1.8-144 | Arizona QSO Party | CW Ph Dig | RS(T), AZ county or SPC | www.azqp.org |
| 9 | 1600 | 10 | 0400 | 144-432 | Cosack's Honor VHF/UHF Contest | CW Ph Dig | RS(T), serial, 6-char grid | cshonor-vhf.ho.ua/eng1.html |
| 9 | 1600 | 10 | 2200 | 1.8-UHF | Pennsylvania QSO Party | CW Ph | Serial, PA county or ARRL section | paqso.org |
| 9 | 1800 | 10 | 1800 | 1.8-144 | South Dakota QSO Party | CW Ph Dig | RS(T), SD county or SPC | www.sdqsoparty.com |
| 9 | 2000 | 10 | 2000 | 1.8 | 160-Meter Great Pumpkin Sprint | Dig | RST, SPC | www.podxs070.com |
| 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 | 0600 | 10 | 0900 | 3.5 | UBA ON Contest, CW | CW | RST, serial, ON Section (if ON) | uba.be/en/hf/contest-rules |
| 11 | 0000 | 11 | 0200 | 1.8-28 | 4 States QRP Second Sunday Sprint | CW Ph | RS(T), SPC, mbr or power | www.4sqrp.com |
| 13 | 0030 | 13 | 0230 | 3.5-14 | NAQCC CW Sprint | CW | RST, SPC, mbr or power | naqcc.info |
| 13 | 1700 | 13 | 2000 | 432 | VHF-UHF FT8 Activity Contest | Dig | 4-char grid square | ft8activity.eu/index.php/en |
| 13 | 1900 | 13 | 2030 | 3.5 | RSGB 80-Meter Autumn Series, Data | Dig | RST, serial | www.rsgbcc.org/hf |
| 16 | 0000 | 17 | 2359 | 3.5-28 | JARTS WW RTTY Contest | Dig | RST, age of operator | jarts.jp/rules2021.html |
| 16 | 0001 | 17 | 2359 | 28 | 10-10 International Fall Contest, CW | CW | Name, mbr or "0," SPC | www.ten-ten.org |
| 16 | 1400 | 17 | 0200 | All | New York QSO Party | CW Ph Dig | RS(T), NY county or SPC | www.nyqp.org |
| 16 | 1500 | 17 | 1459 | 3.5-28 | Worked All Germany Contest | CW Ph | RS(T), DOK or "NM" or serial | darc.de/der-club/referate/conteste |
| 16 | 2000 | 16 | 2359 | 1.8-7, 21-50 | Feld Hell Sprint | Dig | RST, mbr, SPC, grid | sites.google.com/site/feldhellclub |
| 16 | 2130 | 16 | 2230 | 7 | Argentina National 7 MHz Contest | Ph | RS, 2-digit year first licensed | www.lu4aa.org |
| 17 | 0000 | 17 | 0200 | 14, 21 | Asia-Pacific Fall Sprint, CW | CW | RST, serial | jsfc.org/apsprint |
| 17 | 0700 | 17 | 1000 | 144 | UBA ON Contest, 2 Meters | CW Ph | RS(T), serial, ON Section (if ON) | uba.be/en/hf/contest-rules |
| 17 | 1700 | 18 | 0100 | 1.8-144 | Illinois QSO Party | Ph | RS(T), IL county or SPC | www.w9awe.org/ilqp |
| 17 | 1900 | 17 | 2030 | 3.5 | RSGB RoLo CW | CW | RST, previous 6-char grid received | www.rsgbcc.org/hf |
| 17 | 2300 | 18 | 0100 | 1.8-28 | Run for the Bacon QRP Contest | CW | RST, SPC, mbr or power | qrpcontest.com/pigrun |
| 18 | 1300 | 22 | 2359 | All | ARRL School Club Roundup | CW Ph | RS(T), Class (I/C/S), SPC | arrl.org/school-club-roundup |
| 18 | 1900 | 18 | 2030 | 3.5-14 | RSGB FT4 Contest Series | Dig | 4-char grid square | www.rsgbcc.org/hf |
| 20 | 1900 | 20 | 2030 | 3.5 | AGCW Semi-Automatic Key Evening | CW | RST, serial, year first used a bug | alt.agcw.de/index.php/en |
| 23 | 0000 | 24 | 2359 | 2.3 GHz and up | ARRL EME Contest | CW Ph Dig | Signal report | arrl.org/eme-contest |
| 23 | 1200 | 24 | 1200 | 3.5-28 | UK/EI DX Contest, SSB | Ph | RS, serial, District Code (if UK/EI) | ukeicc.com/dx-contest-rules.php |
| 23 | 1500 | 24 | 1500 | 1.8 | Stew Perry Topband Challenge | CW | 4-char grid square | www.kkn.net/stew |
| 24 | 0000 | 24 | 0400 | 3.5-14 | North American SSB Sprint Contest | Ph | Other's call, your call, serial, name, SPC | ssbsprint.com/rules |
| 24 | 1400 | 27 | 0800 | 1.8-144 | Classic Exchange, CW | CW | Name, RST, SPC, radio model | www.classicexchange.org |
| 24 | 1800 | 26 | 0300 | 1.8-UHF | Telephone Pioneers QSO Party | CW Ph Dig | Chapter nr or RS(T), name | www.tpqso.com |
| 27 | 0000 | 27 | 0200 | 1.8-50 | SKCC Sprint | CW | RST, SPC, name, mbr or "none" | www.skccgroup.com |
| 27 | 2000 | 27 | 2100 | 3.5 | UKEICC 80-Meter Contest | CW | 6-char grid square | ukeicc.com/80m-rules.php |
| 28 | 1900 | 28 | 2030 | 3.5 | RSGB 80-Meter Autumn Series, SSB | Ph | RS, serial | www.rsgbcc.org/hf |
| 29 | 1600 | 29 | 2359 | 3.5-14 | Zombie Shuffle | CW | RST, SPC, Zombie nr or area code, name | www.zianet.com/qrp |
| 30 | 0000 | 31 | 2359 | 1.8-28 | CQ Worldwide DX Contest, SSB | Ph | RS, CQ Zone | www.cqww.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 and Ken Gunther, WB2KWC, wb2kwc@kengunther.com

# 2020 – 2021 School Club Roundup Results

The next School Club Roundup will take place October 18 – 22, 2021.

Anna Matson, KN4IVD, operated from home as part of the Schofield Middle School Radio Club during the October 2020 School Club Roundup. [James Matson, KN4OQD, photo]

The main purpose of School Club Roundup (SCR) is to acquaint school-age students with the fun of amateur radio. The most recent sessions were impacted by the COVID-19 pandemic, but students still found a way to enjoy the SCR and get on the air.

## Participation

With only 80 entries this year, the number of entries decreased from last year's 139. Most notably, there were no entries from elementary schools during either session. In other years, entries usually represented more than 500 operators/participants with an average of more than 10 per school entry. Neither session topped 150 operators/participants from schools and clubs. W. Travis Loften High School Amateur Radio Club, K4WTL, in Gainesville, Florida, was outstanding, with 40 reported operators/participants in each session. The full results are available at **https://contests.arrl.org/scrresults.php**.

## Adjusting to COVID-19

All of the school clubs should be commended for their persistence and ingenuity during the pandemic.

A Connecticut school was resourceful. Anthony Girasoli, W1TTL, developed a remote-operation tool based on a Raspberry Pi and a relay board, allowing several Norwich Free Academy Amateur Radio and Engineering Club, W1HLO, members to operate their club station remotely. They were able to share receive-and-transmit audio and control push-to-talk (PTT). For more details, visit **https://github.com/discsoftron/W1TTL-Rig-Control**.

Schofield Middle School Radio Club, N4SMS, in Aiken, South Carolina, reported their operating conditions on the ARRL Contest Soapbox page (at **https://contests.arrl.org/scroct/soaps**), saying, "No high-power HF amplifier, no beam antennas at 60 feet. As far as equipment, just a 100 W Icom IC-7300 and an out-of-production 80-meter CAROLINA WINDOM® wire antenna strung between pine trees."

The club station of LaFayette Middle School in LaFayette, Georgia, shared, "For spring 2021 SCR, W4LMS operated from our football field's concession stand. It was a heated location on campus that allowed our community volunteers access to assist us. And just like the fall SCR, we operated on '100 W and a wire' with battery power. And once again, we operated with an all-female crew on the radio."

The SCR is a great way to introduce students to amateur radio. A fourth-year student at Case Western Reserve University wrote that their radio club, W8EDU, was "still able to get some new hams to the station, including two first-year students."

## Looking Ahead

We look forward to the next two SCR sessions, with the hope that school activities will be closer to normal. All modes that support the full contact exchange are permitted. (Note that as of this writing, *WSJT-X* doesn't support the SCR.) JS8 might be a mode to try. Please share your stories and pictures and discuss any less-common digital modes you've used on our Soapbox page, along with your submission.

For more information and discussions about SCR, join our email group at **scr@groups.io** or visit **www.arrl.org/school-club-roundup**. You can also contact us at **scr@limarc.org**.

# Certificate of Code Proficiency

## Recipients

Sponsored by
VIBROPLEX
www.vibroplex.com

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

**April 2021**

| | |
|---|---|
| William T. Cronenwett, W5TPJ | 10 |
| Dane E. Groszek, KD2SSS | 10 |
| Christopher J. Porter, AA7KL | 10 |
| Donald L. Steinbach, AE6PM | 10 |
| Bill H. Stephens, NUØY | 10 |
| Joel F. Wagner, III, ND5V | 10 |
| Richard J. Berezanich, WB3HUS | 15 |
| Victor Denisov, N6DVS | 15 |
| Edward H. Linch, III, N4LS | 15 |
| Richard B. Peglowski, KE4SAV | 15 |
| Warren T. Seeley, W4FLL | 15 |
| John H. Summers, Jr., WØDY | 15 |
| Richard B. Dervan, N1RBD | 20 |
| Robert T. Marston, AA6XE | 20 |
| Arvid W. Weflen, KL7YC | 25 |
| James Carson, WT8P | 30 |
| Christopher G. Pearson, G5VZ | 30 |
| Edward J. Picha, N9EP | 35 |

**May 2021**

| | |
|---|---|
| Angelica T. Brewer, KN4SGS | 10 |
| James W. Carter, K7IOL | 10 |
| Federico Grau, KC3MWD | 10 |
| Roger L. Burkhart, N3GE | 15 |
| Daniel Lasorso, KD8OFT | 15 |
| Bill H. Stephens, NUØY | 15 |
| Joel F. Wagner, III, ND5V | 15 |
| Roger L. Burkhart, N3GE | 20 |
| Bill H. Stephens, NUØY | 20 |
| William N. Massie, AA8KY | 20 |
| Dennis J. Niles, WV7S | 20 |
| Paul D. Manoli, KB1NCD | 35 |

**June 2021**

| | |
|---|---|
| David O. Ausley, WB4NCT | 10 |
| Russell Calabrese, KR2NZ | 10 |
| Harold D. Craft, Jr., AA2J | 10 |
| Jere F. McAlister, N5DFW | 10 |
| Glenn E. Schnell, KC3LBI | 10 |
| Lawrence Schall, KB2MN | 15 |
| Thomas J. Warren, K3TW | 35 |

**July 2021**

| | |
|---|---|
| Bill Durham, KG5ZCI | 10 |
| Bruce E. Friedline, N9XAU | 10 |
| Roy L. Schmiesing, KT6B | 10 |
| Richard J. Guerrera, KB1FGC | 25 |
| Richard J. Hubbard, Jr., WF4W | 30 |
| James B. Elkins, KG4IKQ | 35 |
| Christopher G. Pearson, G5VZ | 40 |

Congratulations to all the recipients.

## October 2021 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 are scheduled to be transmitted by KH6TU on Wednesday, October 27 at 6 PM HST (0400 UTC) on 7047.5 and 14047.5 kHz. Unless indicated otherwise, sending speeds are from 10 to 40 WPM.

Amateur radio operators who participate in Qualifying Runs may submit proof of 1 minute of the highest speed they have copied in the hope of qualifying for the Certificate of Code Proficiency, or an endorsement to their existing certificate.

Legibly copy at least 1 minute of text by hand, and mail the sheet to: W1AW Qualifying Runs, 225 Main St., Newington, CT USA 06111.

Include $10 (check or money order) if this is a submission for your initial Code Proficiency certificate; $7.50 if you are applying for an endorsement (available for speeds up to 40 WPM). Your test will be checked against the actual transmissions to determine if you have qualified.

Members of the North Fulton (Georgia) Amateur Radio League (**https://nfarl.org**) are offering to subsidize the total cost of a Code Proficiency certificate or endorsement submission for any individual age 21 years and younger, and who reside in either the US or Canada. Participants who wish to make use of this offer should indicate on their qualifying run submissions they are age 21 or younger, and certify as such via their signature. Eligible participants are not required to send any fee with their Code Proficiency submissions.

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

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

**W1AW Code Proficiency Schedule — October 2021**
**(All times are in Eastern Daylight Time)**

| Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|
| **10/4**<br>4 PM – 2000Z<br>10 – 35 WPM | **10/5**<br>7 PM – 2300Z<br>35 – 10 WPM | | **10/7**<br>10 PM – 0200Z<br>**(10/8 – UTC)**<br>10 – 40 WPM | **10/8**<br>9 AM – 1300Z<br>10 – 35 WPM |
| **Columbus Day** | **10/12**<br>4 PM – 2000Z<br>10 – 35 WPM | **10/13**<br>7 PM – 2300Z<br>10 – 40 WPM | **10/14**<br>9 AM – 1300Z<br>35 – 10 WPM | **10/15**<br>10 PM – 0200Z<br>**(10/16 – UTC)**<br>10 – 35 WPM |
| | **10/19**<br>9 AM – 1300Z<br>10 – 35 WPM | **10/20**<br>10 PM – 0200Z<br>**(10/21 – UTC)**<br>35 – 10 WPM | **10/21**<br>7 PM – 2300Z<br>10 – 35 WPM | **10/22**<br>4 PM – 2000Z<br>10 – 40 WPM |
| **10/25**<br>10 PM – 0200Z<br>**(10/26 – UTC)**<br>10 – 40 WPM | | **10/27**<br>9 AM – 1300Z<br>35 – 10 WPM | **10/28**<br>4 PM – 2000Z<br>35 – 10 WPM | **10/29**<br>7 PM – 2300Z<br>10 – 35 WPM |

Bernie McClenny, W3UR, w3ur@arrl.org

## How's DX?

# Three Dual-Hemisphere DXpeditions

As the Northern Hemisphere eases into fall and DXers below the equator begin spring, we enter one of the best times of the year for propagation on all bands. The high and low bands on HF should give us all very good conditions.

It looks like this October you'll want to make sure your antennas can point toward Africa, because at least three major DXpeditions are scheduled to take place. Africa is the second largest continent and is in both the Northern and Southern hemispheres.

### J5 — Guinea-Bissau

The Republic of Guinea-Bissau, formerly known as Portuguese Guinea, is located in West Africa. Guinea-Bissau is positioned south of Senegal, east of Guinea, and east of the Atlantic Ocean. The country ranks as one of the lowest in the world for gross domestic product, and over ⅔ of the population lives below the poverty line.

During the 13th century, Guinea-Bissau was part of the Mali Empire, eventually becoming a Portuguese colony in the late 1800s. Independence began in the 1960s, and was eventually gained in 1973 and recognized 1 year later. In 1980, Guinea-Bissau was overthrown in a military coup. A new constitution was adopted in 1984, and they held multi-party elections 10 years later.

Guinea-Bissau was on the first ARRL post-World War II country list as Portuguese Guinea — CR5. Some of the first CR5 stations came on the air in 1950, including CR5AC, CR5AD, and CR5AF. By 1965, the prefix for Portuguese Guinea switched to CR3. After gaining independence in the '80s, Guinea-Bissau began issuing J5 call signs. Currently, J5 ranks number 111 worldwide on Club Log's DXCC Most Wanted List. In recent years, Father Gianfranco Gottardi, J52OFM (J54OFM, J59OFM), participated in many missions throughout the country and helped multiple DXpeditions put J5 on the air. The last activity from J5 was that of Livio Pesavento, J52EC, in 2018 and 2019 for a few weeks, who made several thousand contacts. The last major DXpedition was J5T in 2017 by the Italian DX Team (IDXT), who made almost 64,000 contacts.


Members of the IDXT have announced their plans to go back to Guinea-Bissau. They'll be active as J5T on CW, SSB, and RTTY, while using the call sign J5HKT exclusively on FT8. Plans are to be on Bubaque Island — Islands On The Air (IOTA) reference number AF-020 — from October 7 to 18. The team includes Alfeo Caputo, I1HJT; Antonio Petroncari, I2PJA; Silvano Borsa, I2YSB; Vinicio Ravizza, IK2CIO; Angelo Selva, IK2CKR; Stefano Casari, IK2HKT, and Franco Prete, I1FQH. DXpedition pilot questions (questions between the DX community and the DXpedition team) should be sent to **idtpilot@gmail.com**.

The J5T and J5HKT team will almost always be operating split, so everyone will need to listen to find out on which frequency they should be calling the DXpedition. Activity will be on 1.8 through 50 MHz, with up to four stations active simultaneously.

CW frequencies for J5T will be: 1826, 3527, 7025, 10115, 14030, 18068, 21030, 24890, and 28030 kHz.

J5T SSB frequencies will be: 3775, 7090, 14240, 18130, 21310, 24950, and 28470 kHz.

J5T RTTY frequency will be: 14084 kHz.

J5T 6-meter frequencies will be: 50090 kHz CW, 50160 kHz SSB (J5HKT), and 50303 FT8.

J5HKT FT8 frequencies will be: 1845, 3567, 7056, 10131, 14084, 18095, 21091, 24911, and 28091 kHz.

The J5HKT/J5T team will be posting their log (possibly in real time) at **http://win.i2ysb.com/logonline**. QSL cards for both J5T and J5HKT go directly to I2YSB, or you can use Online QSL Requests (OQRS). All contacts will be uploaded to Logbook of The World (LoTW) within 6 months of completion of the DXpedition. More information can be found on the IDXT website, at **www.i2ysb.com/idt**.

### S9 — São Tomé and Príncipe

The Democratic Republic of São Tomé and Príncipe consists of a two-island nation located in the Gulf of Guinea. These two islands were uninhabited until around 1470, when the


Portuguese arrived. The English names of these two islands are Saint Thomas and Prince, the latter referring to the Prince of Portugal. The islands were settled in 1493 and 1500, respectively. By 1515, the islands became a slave depot, eventually gaining independence in 1975.

São Tomé and Príncipe were on the original DXCC list with the prefix CR5, due to its Portuguese colonization. That prefix was used until independence was gained in 1975, when S9 was implemented by the International Telecommunication Union (ITU). For the IOTA Award, São Tomé counts as AF-023 and Príncipe counts for AF-044.

In 1981, Dr. Vince Thompson, K5VT (SK), was active for just a few days as S9VCT. In the 1990s, S9 started issuing numbers after the prefix, but since then not all S9 licenses have been issued this way. Since 2000, S9 has been active about every 2 – 3 years. Between 2002 and 2007, Charles Lewis, KY4P, and his wife, Leslie Lewis, S9YL, were very active, especially on the low bands. S9 currently ranks number 160 on Club Log's DXCC Most Wanted List, and the last major operations were in 2019 by the Lazy DXers (S9A and S92HP) and Helio Pereira, CT1ENW, who made over 39,000 contacts combined.

In mid-June, members of the Czech DXpedition group announced their plans to put on their next DXpedition from São Tomé as S9OK. They anticipate arriving on October 2, and hope to be fully operational between October 3 – 5. The team includes Petr Bohacek, OK1BOA; Petr Spacil, OK1FCJ; Palo Halek, OK1CRM; Pavel Novak, OK1GK; Rudolf Sedlak, OK2ZA; Ludek Odehnal, OK2ZC; Karel Odehnal, OK2ZI, and David Beran, OK6DJ. They'll be active on SSB, CW, RTTY, and FT8 on 1.8 through 50 MHz, until October 16. Once up and running, the team hopes to be able to "use Club Log Live Stream wherever it will be possible," (**https://clublog.org/livestream/s9ok**) provided they have a good internet connection. For transceivers, they'll have three Elecraft K3s, three Kenwood TS-480HXs, and a SunSDR2 DX, along with five JUMA PA1000 amplifiers. A wide selection of antennas will be installed, including multiple Beverage antennas and a receive vertical antenna, to help with their emphasis on the low bands. OK6DJ will be the QSL manager. For more details on this DXpedition, visit **www.cdxp.cz**.

## 3DA — Kingdom of Eswatini

In 2018, Swaziland was officially renamed the Kingdom of Eswatini. The landlocked nation is surrounded on the north, west, and south by South Africa, with Mozambique to the east. The current boundaries for Eswatini were drawn during the Scramble for Africa in 1881. After the Second Boer War in 1903, the Kingdom of Swaziland became a British protectorate. Swaziland became independent on September 6, 1968 and is ruled by an absolute monarchy.

Swaziland was on the original DXCC list and started off with the ZS7 prefix, changing to ZD5 in 1965. In 1969, the prefix was changed to 3D6 and eventually changed to its current prefix, 3DAØ, in 1988. Eswatini is a member of the International Amateur Radio Union (IARU) Radio Society of Eswatini (RSE) and has a QSL bureau. Currently, 3DAØ ranks number 120 on Club Log's Most Wanted List.

The Russian DXpedition Team (RU DX Team) has announced their plans for 3DAØRU to be a DXpedition to the Kingdom of Eswatini, taking place between October 22 and November 8, including the CQ World Wide DX SSB Contest. The Russian team of Nikolay Tolkunov, R5EC; Vasily Pinchuk, R7AL; Vasily Sukhanov, RA1ZZ; Vladimir Angeli, RK8A, and Leonid Berezhnoy, RW9JZ, will be joined by Slav Rodin, OK8AU; Wlodek Herej, SP6EQZ, and Albert Sagitov, UB9WLJ. The RU DX Team pulled off the 7Q7RU, A25RU, and C92RU DXpeditions during the COVID-19 pandemic.

As 3DAØRU, they'll be operating on CW, SSB, and FT8 fox and hound on 1.8 through 50 MHz. Plans are to have six stations, with all but one running amplifiers. RW5C will be the DXpedition pilot, communicating between the DXpedition team and the DX community during the DXpedition. R7AL will be handling the QSL duties, and they prefer that everyone requests QSLs using OQRS on Club Log. Visit the 3DAØRU team's website at **https://dxpedition.wixsite.com/3da0ru**.


### Wrap-Up

That's all for this month. Please send any DX and IOTA news, photos, and club newsletters to **bernie@dailydx.com**. Until next month, see you in the pileups!
— *Bernie, W3UR*

Jon Jones, NØJK, n0jk@arrl.org



# High Solar Cycle 25 Activity and Noctilucent Clouds

Record-breaking 50 and 144 MHz sporadic E occurred in July 2021, marking it as one of the best months ever for sporadic-E propagation. There were days of long-lasting 6-meter openings from Europe and east and southeast Asia extending deep into the central US, and there were several openings from Australia to Europe and Japan to Brazil. There were two days of record-setting 2-meter sporadic E, including double-hop contacts from the Midwest to the Caribbean, and W1 to Idaho.

## Record-Setting 2-Meter Sporadic E

On July 13, an intense sporadic-E opening occurred over North America and the Caribbean. According to the DX Cluster, "6 meters sound[ed] like 20 meters." Rich, K1HTV (FM18), was driving home when his son, Andy, K1RA, "came on the local 2-meter repeater to notify me that the Pack Rat guys in the Philly area were working into Puerto Rico on 144.174 FT8." He said when he got home, he "swung the beam to the Caribbean and started working 2-meter sporadic E." Mike, W3IP (FM19), worked the same stations as Rich.

I (NØJK) received a "–18 dB" signal report from WP4G on FT8, but the contact was incomplete. Jay, KA9CFD (EN41); Bob, K2DRH (EN40); Jeff, N8CC (EN72), and David, WA9DU (EM69), were able to make Caribbean contacts on 2 meters. Bob's contact with WP4KJJ at 3,472 kilometers is in the top five for an all-time record of North American 2-meter $E_s$ contacts. K1HTV noted during the July 13 opening that there were two highly ionized patches of sporadic E that were in the right spot — one over EM64 and the other over FL06 (see Figure 1).

Two meters was also open even further south. K2IL (EL97) worked stations in Bonaire and Curacao, while operating "off the back of his 2-meter Yagi" and working $E_s$ to the north. Chris, NV4B (EM64), worked J79WTA on 2-meter FT8 at 1559Z. There was also 2-meter $E_s$ from New England to Idaho. Jay, NY2NY (FN30), was heard by W7OUU, on double-hop 2-meter $E_s$.

During the evening of July 13, there was even more 2-meter $E_s$. Sam, K5SW (EM25), and W5EME (EM32) worked into Virginia on SSB. K1HTV worked $E_s$ to Minnesota, the Gulf Coast, and Texas. NØHJZ (EN34) made SSB $E_s$ contacts to Virginia. WZ1V (FN31) worked into the Gulf Coast and KN4NN to the northeast states.

On July 14, more sporadic E openings took place from the Midwest states for several hours to W1, W2, VE2, and VE3. Jay, W9RM (DM58), worked Robert, AA9MY (EN50), and Mike, K7ULS (DN41), worked KØAWU (EN37).

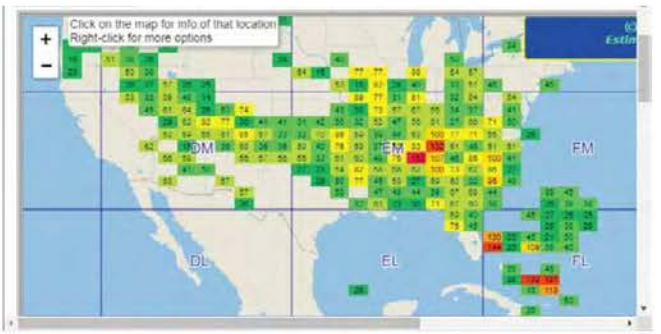



**Figure 1** — Rich, K1HTV, concluded from the MUF map that during the July 13 opening, there were two highly ionized patches of sporadic E. [**www.dxmaps.com**]

## Cause of Abundant Sporadic E

Solar Cycle 25 may be a factor, because solar activity picked up dramatically the last week of June with an X-class solar flare on July 3. **Spaceweather.com** reported it as the "first X-flare in 4 years."

However, low geomagnetic activity and Noctilucent clouds may be the real cause. Noctilucent clouds were bright and abundant in July. According to the **Spaceweather.com** report, the University of Colorado's Lab for Atmospheric and Space Research professor Cora Randall noted:

> We're seeing more clouds at 80°N than in any other year since [NASA's Aeronomy of Ice in the Mesosphere (AIM) experiment] was launched. Cloud frequencies at 80°N are around 85%, whereas it's more typical to see frequencies of about 75%. (Frequencies are a measure of patchiness. 100% is complete coverage; 0% is no clouds at all.) NLCs are Earth's highest clouds. They form when summertime water vapor rises up to the edge of space — about 83 kilometers high — and crystalize around disintegrated meteoroids. When you see one, you're literally seeing a cloud of frosted meteor smoke.

According to a 1993 *WGN* Journal report titled, "The occurrence of sporadic-E and Noctilucent clouds, and correlations with meteor and auroral activities," some scientists believe there is a connection between Noctilucent clouds (NCL) and sporadic E. The article stated:

> $E_s$ and NLC trends from year to year are broadly similar...Since the total mean strengths and relative proportions of both $E_s$ and NLC were so similar, a link between their formation mechanisms can be at least implied. Additional features support this view, e.g. sheet nuclei particles and their origins...NLC nuclei may be carried back to the $E_s$ layer.

Thus, increased nuclei particles from meteors may in turn cause more intense sporadic E. The low A and K indices through July also helped high-latitude sporadic-E formation.

## On the Bands

**50 MHz**. In July, Bob, K2DRH, picked up 10 new countries on FT8, one of which he'd been chasing since 2001. He noted small pinpoint footprints on some of the openings, and on one he worked Israel, but there was no copy on OD5. On July 1, KFØM (EM17) and NØLL (EM09) worked OX3LX. On July 2, K1HTV (FM18) worked OHØ100AX and OJØMR.

On July 4, JA7WSZ (QM07) received PY5EW (GG46) at 1950Z. This is 18,043 kilometers and crosses the geomagnetic equator. PY5EW uses 400 W and a six-element Yagi, and he was working WQ5L (EM50). On July 5, Bob, G3NSM (IO91), worked KL7HBK at 1447 UTC on 50.323 MHz FT8. On July 7, VK3OT (QF12) worked across the geomagnetic equator, logging UT7QF (KN77) at 0608Z.

From northeast Kansas, July 2 had the best European openings for NØJK east to S58T (JN76), 9K2MU (LL49), and rare GU8FBO (IN89). On July 7, KMØT (EN13), worked into Germany, Italy, and Latvia, and W5AFY (EM04) worked 7Z1SJ (LL25).

July 8 was mostly open to the Netherlands and the United Kingdom. KFØM made several European contacts with 100 W from his camper and a Moxon Yagi. JP1LRT (PM95) worked VP2V/K3TRM (FK78) at 2217Z. K9RX (EM84) worked BG2AUE. On July 11, KFØM made contacts with stations in Taiwan, Korea, and China. On July 12, Dave, N4QS (EM56), put 4Z1UF and OD5KU in the log. The next day, he worked rare CP6UA (see Figures 2 and 3).

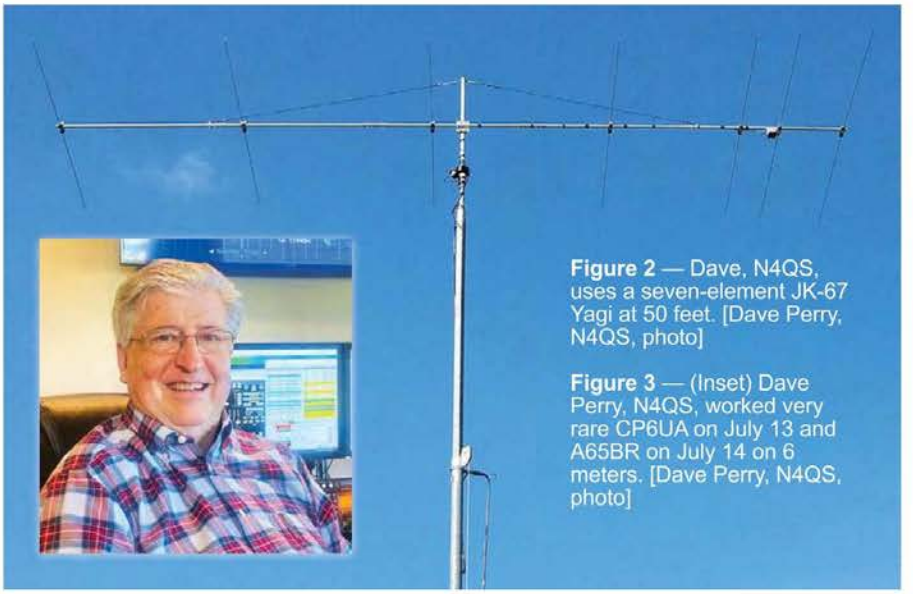


**Figure 2** — Dave, N4QS, uses a seven-element JK-67 Yagi at 50 feet. [Dave Perry, N4QS, photo]

**Figure 3** — (Inset) Dave Perry, N4QS, worked very rare CP6UA on July 13 and A65BR on July 14 on 6 meters. [Dave Perry, N4QS, photo]

On July 14, K4PI, NQ4I, K4JPD, KX4R, and N3XX, in Atlanta, Georgia, worked 4L/DL7ZM on CW and later FT8. N4QS added EA9IB, C31CT, 5B4AGN, and A65BR to the log. On July 15, Andy, YS1AG, operated from rare El Salvador.

On July 17, Larry, W5LDA (EM15), worked R6KA (LN04). An amazing 6-meter contact occurred on July 19, when Tac, JA7QVI (QM08), worked PJ4BZL (FK52) at 2139Z at a distance of 13,663 kilometers. NØLL (EM09) logged HL3GOB, DB3DNT, and DS4EOI.

A significant opening for the Midwest to Alaska and Japan was on July 23 and 24. WL7N (CO45) was worked by KFØM, AAØMZ, NØLL, and others. WQØP (EM19) worked BA4SI, BH4SCF, and many Japanese stations. On July 27, KØGU (DN70) spotted ZL1RS (RF64).

Due to the high volume of reports, I gratefully acknowledge these not mentioned earlier: NP2J, N2SLO, AJ6T, KØIS, W5AJ, WBØTML, WA2GFN, WB2CUT, KB3LR, WA2VJL, AC4TO, KD4ESV, KE6GFI, WB7AEA, WW3ZZ, N2AMC, KD2CYU, K3FR, W4CRN, WD9BGA, WB2AMU, NN4X, W9VHF, W3ATV K5GZR, and N1AV.

**144 MHz**. There were several other days in July with 2-meter $E_s$. Sam, K5SW (EM25), worked AC4TO (EM70) on SSB on July 11.

On July 24, a big $E_s$ opening took place, with several $E_s$ centers. Jan, KCØV (DN70), worked K2DRH (EN41) and W8 and W9 stations. AA5CC (EM04) worked VE3KRP (EN58) and others. NØLL (EM09) worked several stations in Florida. AB8SF (EN72) worked into Dallas, Texas. I decoded W4ENN (EM64), working WQØP. WQØP worked W4ENN, VE3ELL (FN04), and others on FT8.

Mike, K7ULS, worked TA1D on EME on July 7. A major tropo opening took place the last week of July. K9MRI (EN71) and WZ8D (EM89) made contacts into Kansas, and W3NH (EM64) worked several stations through the K8HO FM repeater in Ohio.

**5760 MHz**. W5AFY (EM04) worked K5LLL (EM10) on SSB tropo on July 25.

### Here and There

Fred, K6IJ/KH7Y, posted the KH6HME logs online on the KH6HME **qrz.com** page. QSLs may be requested via Club Log.

# Special Event Stations

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

**Through Dec. 31, 0000Z – 2359Z, all calls**, all areas. VE2GT and VE2NCG. **Quebec Parks on the Air (QCPOTA)**. Certificate. *This is an operating event. See website for details.* **qcpota.ca**

**Mar. 15 – Nov. 30, 0000Z – 2300Z, II3VE**, Venezia, Italy. ARI Venezia. **1,600 Years of the Foundation of Venice**. All bands. Certificate & QSL. Sezione ARI Venezia, S. Croce 1776/B, Venezia 30135, Italy. *Detailed rules on ARI Venezia website and* **QRZ.com** *for II3VE. Both II3VE and club call IQ3VE are valid. QSL via eQSL or bureau.* **www.arivenezia.it**

**Sep. 18, 1300Z – 1900Z, W1M**, Russell, MA. Western Mass Council BSA. **Moses Scout Reservation 75th Anniversary**. 14.250 7.250. QSL. eQSL or Tom Barker, WA1HRH, 329 Faraway Rd., Whitefield, NH 03598.

**Sep. 18, 1400Z – 2100Z, WØEBB**, Leavenworth, KS. Pilot Knob Amateur Radio Club. **Harvey House on the Air**. 28.380 21.380 14.280 7.260. Certificate & QSL. Charles Jackson, 717 Mt. Calvary Rd., Lansing, KS 66043. **n0cs@arrl.net**

**Sep. 25 – Sep. 26, 1521Z – 1519Z, NØN**, Lincoln, NE. Southeast Nebraska Amateur Radio Club. **85th Anniversary**. 7.180 14.230. Certificate & QSL. Charles Bennett, P.O. Box 67181, Lincoln, NE 68506. **senebrradioclub@gmail.com** *or* **www.facebook.com/SENRC**

**Oct. 1 – Oct. 31, 0001Z – 2359Z, W2RDX/73**, East Rochester, NY. Rochester DX Association. **73rd Anniversary**. 14.250; CW, SSB, and digital on all bands. QSL. Chris Shalvoy, K2CS (W2RDX), 512 Beechwood Dr., East Rochester, NY 14445. *New York QSO Party (NYQP) on Oct. 16; find rules at* **nyqp.org**. **www.rdxa.com**

**Oct. 2, 1400Z – 2000Z, K8HO**, Hillsboro, OH. Highland Amateur Radio Association. **World's Largest Horseshoe Crab Roadside Attraction**. 14.220 7.220. Certificate. Highland Amateur Radio Association, 21 Highland Dr., Hillsboro, OH 45133. **highlandara@gmail.com**

**Oct. 2 – Oct. 3, 1500Z – 2359Z, WØD**, Macon, MO. Macon County Amateur Radio Club. **Lester Dent — Doc Savage Special Event**. 14.250 7.200. Certificate. Dale Bagley, 1402 Eastern Dr., Macon, MO 63552. **dbagley@cvalley.net**

**Oct. 2 – Oct. 5, 1800Z – 2300Z, W4BLT**, Alton, AL. Blount County Amateur Radio Club. **35 Year Celebration**. 21.370 14.270 7.275 3.870. QSL. Daryl Isbell, W4DAI, P.O. Box 51, Alton, AL 35015. **www.w4blt.org**

**Oct. 3, 1300Z – 2000Z, N1EPJ**, East Greenwich, RI. Massie Wireless Club. **2021 Yankee Steam-Up**. CW: 14.058 7.058 3.558; SSB: 14.258 7.250 3.825. QSL. Massie Wireless Club N1EPJ, P.O. Box 883, East Greenwich, RI 02818. **www.newsm.org** *or* **www.qrz.com/db/n1epj**

**Oct. 3 – Oct. 9, 0000Z – 2359Z, NØF through N9F, KF2IRE, and VA3FIRE**, East Hanover, NJ. Siemens Fire Safety USA Amateur Radio Club. **Fire Prevention Week Special Event**. 21.250 14.225 7.175 3.800; all bands, all modes. Certificate & QSL. Siemens Fire Safety USA Amateur Radio Club, 8 Fernwood Rd., East Hanover, NJ 07936. *Certificate for working any 10 of the 12 stations. Watch for spots.* **hamfire.com**

**Oct. 3 – Oct. 9, 1800Z – 2200Z, KD9FDH**, Madison, IN. Royal Rangers Amateur Radio Club. **National Royal Rangers Week**. 28.435. Certificate & QSL. Jerry Barnes, 601 Spring St., Madison, IN 47250. **wjbarnes@cinergymetro.net** *or* **www.qrz.com/db/kd9fdh**

**Oct. 4 – Oct. 9, 1500Z – 2100Z, K7UGA**, Chandler, AZ. Central Arizona DX Association. **Senator Barry M. Goldwater Memorial and AZ QSO Party**. All bands, all modes. QSL. Bob Davies, K7BHM, 1623 N. Los Altos Ct., Chandler, AZ 85224. *Five-day Special Event leading up to AZQP.* **www.cadxa.org**

**Oct. 9, 1300Z – 1800Z, WØIN**, Joplin, MO. Joplin Amateur Radio Club. **Joplin Hamfest/Tailgater**. 147.210. QSL. Joplin ARC, P.O. Box 2983, Joplin, MO 64803-2983. **jimjohannes@sbcglobal.net**

**Oct. 9, 1500Z – 2000Z, KSØKS**, Olathe, KS. Sant Fe Trail Amateur Radio Club. **200th Anniversary of the Santa Fe Trail**. 18.080 14.280 10.118 7.280. QSL. SFTARC, P.O. Box 3144, Olathe, KS 66063. **www.sftarc.org**

**Oct. 9, 1600Z – 2300Z, NI6IW**, San Diego, CA. USS *Midway* (CV-41) Museum Ship**. US Navy Birthday**. 14.320 7.250 PSK and CW on various HF bands, D-STAR on various reflectors. QSL. USS *Midway* Museum Ship COMEDTRA, 910 N. Harbor Dr., San Diego, CA 92101. *Check spotting networks to find us on HF,* **www.dstarusers.org** *to find NI6IW, and Reporting Note to see what reflector we're using.* **www.qrz.com/db/ni6iw**

**Oct. 9 – Oct. 11, 1400Z – 0200Z, W5D**, Tuskahoma, OK. Vm Okla Nan Ola Amateur Radio Club. **World War I Code Talker Commemoration**. PSK31: 21.070 14.070 7.070; LSB: 7.218; USB: 21.318 14.318. Certificate. WI5ND Attn: Holly Sharrock, KG5SSJ, 12715 N. 410 Rd., Hulbert, OK 74441. **www.facebook.com/Vm-Okla-Nan-Ola-104220878292184/** or **www.qrz.com/db/wi5nd**

**Oct. 9 – Oct. 17, 0000Z – 2359Z, many 1×1s**, worldwide. US Affiliate (KFF), Worldwide Flora & Fauna. **Get Your Park ON! Celebrating Earth Science Week**. All bands, all modes. Certificate & QSL. *Check WWFF website for a list of participating calls, including NØM, N2G, and N4G.* **QRZ.com** *or* **www.wwff.us**

**Oct. 16, 1300Z – 1900Z, W1M**, Russell, MA. Western Mass Council, BSA. **JOTA/JOTI**. 7.060 7.250 14.060 14.250. QSL. Tom Barker, 329 Faraway Rd., Whitefield, NH 03598. *W1M will also be on BrandMeister TG 907.*

**Oct. 16, 1400Z – 2000Z, K4RC**, Williamsburg, VA. Williamsburg Area Amateur Radio Club. **Yorktown Surrender Day Event**. 14.265 7.265. Certificate & QSL. QSL Manager, P.O. Box 1470, Williamsburg, VA 23187. **www.k4rc.net**

**Oct. 16 – Oct. 17, 2200Z – 1700Z, W9DUE**, Metropolis, IL. Massac County Amateur Radio Club. **Fort Massac Encampment Honoring Fort Massac Heritage**. All bands, all modes. QSL. Massac County ARC, P.O. Box 5, Metropolis, IL 62960. **www.facebook.com/groups/151861769202256**

**Oct. 17 – Oct. 23, 0600Z – 0600Z, W4DO**, Charlottesville, VA. Albemarle Amateur Radio Club. **Shenandoah National Park Special Event**. 7.240 14.310. Certificate & QSL. AARC/SNP Special Event, P.O. Box 6833, Charlottesville, VA 22906. *Contact all stations for a clean sweep and certificate.* **www.albemarleradio.org**

**Oct. 22 – Oct. 24, 0000Z – 2300Z, W5M**, Spavinaw, OK. Mayes County Amateur Radio Club. **Mickey Mantle Day**. 14.285 7.240 3.850. QSL. Mayes County ARC, P.O. Box 1195, Pryor, OK 74361. **www.qrz.com/db/wx5mc** *or* **www.mcarc.me**

**Oct. 30 – Oct. 31, 1500Z – 2355Z, WØJH**, Split Rock, MN. Stillwater Amateur Radio Association. **Remembering the *Edmund Fitzgerald* (Split Rock Lighthouse)**. 21.360 14.260 7.260 3.860. Certificate. By email only **SplitRock2021@radioham.org**. *WØJH stations operating from Amateur Radio Lighthouse Society USA 783 and Parks On The Air K-2524. Grid Square: EN47.* **www.radioham.org**

**Oct. 31 – Nov. 1, 0001Z – 0400Z, KC5BOO**, Cleburne, TX. Club KC5NX. **Boo to You!** 14.310. QSL. Judy Cox, 3701 Park Rd. 21, Cleburne, TX 76033. **kc5boo@yahoo.com**

**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. *Note: Some clubs may ask for a nominal fee to cover the cost of the certificate or QSL. Request will be made on air during the event or on the club's website.

**Special Events Announcements**: For items to be listed in this column, use the ARRL Special Events Listing Form at **www.arrl.org/special-events-application**. A plain-text version of the form is available at that site. You may also request a copy by mail or email. Off-line completed forms can be mailed, faxed (Attn: Special Events), or emailed.

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. Note: All received events are acknowledged. If you do not receive an acknowledgment within a few days, please contact us. ARRL reserves the right to exclude events of a commercial or political nature.

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

## Strays

***QST* Congratulates…**

■ Paul Walcott, WD8H, on the release of his first novel, *The Latter End.* The novel centers on the service and struggles of a Vietnam War Army nurse. It is available on Amazon in Kindle format.

■ Dave Burgess, WA2TVS, for winning the Jason Hall Award in May of 2021. Dave, a Navy veteran, has volunteered on the Battleship *New Jersey* Amateur Radio Station, NJ2BB, with his wife, Margaret, since 2001. The annual award is presented to an outstanding volunteer who went above and beyond to help the ship.

■ Don Keith, N4KC, on the release of his two new books, *Warshot* and *Only the Brave*. *Warshot* is the sixth book in Keith's *Hunter Killer* series of submarine/Navy SEAL thrillers, co-written with former submarine captain George Wallace. *Only the Brave*, a non-fiction book, tells the story of the World War II battle for Guam in the Mariana Islands. Both are available wherever books are sold.

■ Stanley Johnson's, WØSJ, May 2021 *QST* article, "Scavenger Time-Domain Reflectometer Coaxial Cable Tester" inspired John Price, WA2FZW, to work with Stanley and a few others to create a printed circuit board (PCB) for the time-domain reflectometer. The board can be built using either through-hole or surface-mount device (SMD) parts.

The Gerber files, documentation for the PCB, and two Android apps developed by Roderick Wall, VK3YC, to do the calculations are all available on GitHub at **https://github.com/WA2FZW/A-PCB-for-the-W0SJ-TDR-by-WA2FZW**.

# The 2021 ARRL November Sweepstakes

*CW:* 2100 UTC Saturday, November 6 – 0259 UTC Monday, November 8
*Phone:* 2100 UTC Saturday, November 20 – 0259 UTC Monday, November 22



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.

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 0259 UTC Monday, November 15, and phone logs must be submitted or postmarked by 0259 UTC Monday, November 29.

If you want to convert your paper log into a Cabrillo-formatted log for electronic submission, go to **www.b4h.net/cabforms** and select the event. You can input your log data, which will be converted into 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, paper entry and logging forms, and complete rules, visit www.arrl.org/sweepstakes or email contests@arrl.org**

The 2020 ARRL November Sweepstakes (Phone) was Dr. Scott Newland's, AC3D, first contest. He finished in the top five for Tennessee in the Single Operator, Low Power category. [Dr. Scott Newland, AC3D, photo]

Melissa Stemmer, KA7CLO, mstemmer@arrl.org

## At the Foundation

# ARRL Foundation Grant Program Moves to Cyclical Model

The ARRL Foundation Board of Directors voted at its July 2021 meeting to move its grant program to a cyclical model. Grant proposals will now be accepted from February 1 – February 28; June 1 – June 30, and October 1 – October 31. All proposals will be reviewed by the Grant Committee at the close of each cycle. Once the committee agrees on the proposals to award, they will be sent to the full Foundation Board for a formal vote. Awardees will be notified approximately 1 month after the closing of each cycle.

The ARRL Foundation Grant Program awards funding to organizations for eligible amateur radio-related projects and initiatives, particularly those with a focus on educating, licensing, and supporting amateur radio activities. Youth-based projects and initiatives are especially encouraged. Proposals for projects with a high likelihood of sustainability or expansion and with demonstrated support of the local amateur radio community or clubs are encouraged and preferred.

ARRL Foundation grants are awarded only to organizations, not individuals, and generally do not exceed $3,000. Only programs or initiatives conducted within the US are eligible for consideration. Grant requests for emergency communications equipment, facilities, or ongoing operations or expenses will not be considered.

Recent grants awarded by the ARRL Foundation include a grant to Civil Air Patrol Squadron 131 in Eloy, Arizona, for their Ham Radio in the Classroom project; a grant to Briarcrest Christian School in Eads, Tennessee, to support the launch of their high school amateur radio club, and an award to the Minsi Trails Council in Lehigh Valley, Pennsylvania, to support the Implementation of Ham Radio Program at Scout Camp Minsi.

To learn more about the ARRL Foundation Grant Program, please visit **www.arrl.org/amateur-radio-grants** or contact Development Manager Melissa Stemmer, KA7CLO, at **mstemmer@arrl.org**.

# Convention and Hamfest Calendar

A = AUCTION
D = DEALERS / VENDORS
F = FLEA MARKET
H = HANDICAP ACCESS
Q = FIELD CHECKING OF QSL CARDS
R = REFRESHMENTS
S = SEMINARS / PRESENTATIONS
T = TAILGATING
V = VE SESSIONS

**Abbreviations**

*Spr* = Sponsor
*TI* = Talk-in frequency
*Adm* = Admission

**Alabama (Chickasaw) — Oct. 23 D F H Q R S V**
8 AM – 2 PM. *Spr*: Deep South ARC. J.C. Davis Auditorium, 400 Thompson Blvd. *TI*: 146.745 (123 Hz). *Adm*: $5. **www.k4dsr.com**

**Arizona (Congress) — Nov. 6 D Q T**
8 AM. *Spr*: Hassayampa Amateur Radio Klub. Escapees North Ranch, 30625 Hwy 89. *TI*: 146.580 (no tone). *Adm*: Free. **www.harkaz.org**

## ARRL PACIFIC DIVISION CONVENTION

**October 15 – 17 San Ramon, California**
**D F H R S V**
8 AM – 10 PM. *Spr*: Mt. Diablo ARC. San Ramon Marriott Hotel, 2600 Bishop Dr. *TI*: 147.06 (100 Hz). *Adm*: $25 advance, $30 door. **www.pacificon.org**

**Connecticut (Gales Ferry) — Oct. 30 H R T**
10 AM – 3 PM. *Spr*: Radio Amateur Society of Norwich. Our Lady of Lourdes R.C. Church Hall, 1650 Route 12. *TI*: 146.730 (156.7 Hz). *Adm*: $5. **www.rason.org**

**Florida (Bradenton) — Oct. 23 F T**
8 AM – 1 PM. *Spr*: Manatee ARC. Bible Baptist Church of Bradenton, 2113 57th St. East. *TI*: 146.820 (100 Hz). *Adm*: $5. **www.manatee-arc.org**

**Florida (New Port Richey) — Oct. 16 T V**
8 AM – noon. *Spr*: Gulf Coast ARC. Millennium Academy, 10005 Ridge Rd. *TI*: 146.67 (146.2 Hz). *Adm*: $5. Email: **keavbv@msn.com**

## ARRL GEORGIA STATE CONVENTION

**November 6 – 7 Lawrenceville, Georgia**
**D F H Q R S T V**
Sat. 8 AM – 4 PM, Sun. 8 AM – 2 PM. Spr: Alford Memorial Radio Club. Gwinnett County Fairgrounds, 2405 Sugarloaf Parkway. TI: 147.075 (82.5 Hz). Adm: $8 advance online, $10 door. **www.stonemountainhamfest.com**

**Indiana (Lynnville) — Oct. 23 D F H R T**
7 AM – 2 PM. *Spr:* Tri State ARS. Lynnville Community Center, St. Rt. 68. *TI:* 146.790 (88.5 Hz) analog, 145.250 Yaesu C4FM. *Adm:* Free. **www.hamtoberfest.com**

**Indiana (Shelbyville) — Oct. 16 D F H R T**
8 AM – noon. *Spr:* Blue River Valley ARS. Shelby County Fairground, 500 Frank St. *TI:* 145.48 (88.5 Hz). *Adm:* Free. **www.brvars.com**

**Iowa (Boone) — Oct. 30 D F H Q S T V**
8 AM – 1 PM. *Spr:* 3900 Club. Boone County Iowa Fairgrounds, 1601 Industrial Park Rd. *TI:* 146.850 (no tone). *Adm:* $7; 14 years old and under free with adult. **www.3900club.com**

## ARRL LOUISIANA STATE CONVENTION

**October 8 – 9 Slidell, Louisiana**
**D F H R S T V**
Fri. 2 PM – 5 PM, Sat. 8 AM – 3 PM. *Spr*: Ozone ARC. Slidell City Auditorium, 2056 2nd St. *TI*: 147.270 (114.8 Hz). *Adm*: $5. **www.w5sla.net/hamfest-2021.htm**

**Michigan (Kalamazoo) – Oct. 17 D F Q S V**
8 AM – noon. *Spr:* Kalamazoo ARC and Southwest Michigan Amateur Radio Team. Kalamazoo County Expo Center and Fairgrounds, 2900 Lake St. *TI:* 147.040 (94.8 Hz). *Adm:* $7. **www.kalamazoohamfest.com**

**Michigan (Muskegon) — Oct. 16 D F H R S V**
8 AM – noon. *Spr:* Muskegon County Emergency Communication Services, Inc. Fellowship Reformed Church, 4200 E. Apple Ave. (M-46). *TI:* 146.820 (94.8 Hz). *Adm:* $5. **www.mcecs.net/Hamfest.htm**

**Missouri (Kirkwood) — Oct. 30 D F H R V**
7:30 AM – 1 PM. *Spr:* St. Louis ARC. Kirkwood Community Center, 111 S. Geyer Rd. *TI:* 147.150 (141.3 Hz). *Adm:* $4 each or 3 for $10 advanced, $7 door. Email: **bcsluder@msn.com**

**Missouri (Sedalia) — Oct. 16 D F H R T**
8 AM – 1 PM. *Spr:* Sedalia Pettis ARK. Our Savior Lutheran Church Gymnasium, 3700 W. Broadway Blvd. *TI:* 147.030 (179.9 Hz) *Adm:* $5. **www.wa0sdo.org**

**New Jersey (Wayne) — Oct. 16 H R**
8 AM – 1 PM. *Spr:* WRAET ARC. United Methodist Church, 99 Parish Dr. *TI:* 145.21 (79.7 Hz). Adm: $5. **www.wraet.com**

**New Mexico (Socorro) — Oct. 16 F H Q R S T V**
8 AM – 12:30 PM. *Spr*: Socorro ARA, Tech ARA. New Mexico Firefighters Training Academy, 600 Aspen Rd. *TI*: 146.68 (100 Hz). *Adm*: Free. **www.socorroara.org/socorro-hamfest**

**New York (Palmyra) — Oct. 2 D F H R T**
8 AM – 1 PM. *Spr:* Drumlins ARC. Palmyra VFW Post 6778, 4306 Rt. 31. *TI:* 146.745 (71.9 Hz). *Adm:* $5. **www.drumlinsarc.us**

**North Carolina (Winston-Salem) — Oct. 16 D F H T**
7:30 AM – 11:30 AM. *Spr:* Forsyth ARC. Robinhood Road Baptist Church, 5422 Robinhood Rd. *TI:* 145.47 (100 Hz). *Adm:* $7. **www.w4nc.com**

**Ohio (Georgetown) — Nov. 6 D F H R**
8 AM – 2 PM. *Spr:* Grant ARC. ABCAP Building, 406 West Plum St. *TI:* 146.73 (162.2 Hz). *Adm:* Free. Email: **w8ujm@yahoo.com**

**Ohio (Green) — Oct. 31 D F H R V**
8 AM – 4 PM. *Spr:* Massillon ARC. Military Air Preservation Society Hangar, 5383 Massillon Rd. *TI:* 147.18 (110.9 Hz). *Adm:* $5. **www.w8np.org**

**Ohio (Westminster) — Oct. 9 F R T**
8 AM – 1 PM. *Spr:* Northwest Ohio ARC. Westminster UMC (Warm Building), 6650 Faulkner Rd. *TI:* 146.670 (no tone). *Adm:* $5, 12 years old and under free with adult. **www.nwoarc.com**

**Oklahoma (Ardmore) — Oct. 22 – 23 D F H Q R S T V**
Fri. 3 PM – 8 PM, Sat. 8 AM – 1:30 PM. *Spr:* CORA and Texoma Hamarama. Ardmore Convention Center, 2401 Rockford Rd. *TI:* 146.97 (131.8 Hz). *Adm:* $8 advance, $10 door. **www.hamholiday.com**

**Oklahoma (Enid) — Nov. 5 – 6 D F H R S T V**
8 AM – 5 PM. *Spr:* Enid ARC. Garfield County Fairgrounds – Hoover Building, 305 East Oxford Ave. *Tl:* 145.290 (no tone), 147.150 (no tone), 444.825 (no tone), EchoLink. *Adm:* $5. **www.enidarc.org/enidhamfest**

**Pennsylvania (Washington) — Nov. 7 D F Q R V**
8 AM – 5 PM. *Spr:* WACOM. Washington County Fairgrounds, 2151 North Main St. *Tl:* 146.790 (no tone). *Adm:* $5. **wa3com.com/hamfest.html**

**South Carolina (Gaffney) — Oct. 23 D H R T V**
7 AM – 3 PM. *Spr:* Carolina ARES. Southside Baptist Church, 204 W. O'Neal St. *Tl:* 145.430 (162.2). *Adm:* $5. Email: **dianemccoy@charter.net**

**South Carolina (Rock Hill) — Oct. 2 D F H R S T V**
8 AM – 2 PM. *Spr:* York County ARS. Newport Baptist Church, 175 Museum Rd. *Tl:* 147.030 (88.5 Hz). *Adm:* $5. **www.ycars.org**

**Tennessee (East Ridge) — Oct. 16 D F H**
8 AM – 2 PM. *Spr:* Chattanooga ARC. Camp Jordan Amphitheater, Camp Jordan Pkwy. *Tl:* 146.790 (107.2 Hz). *Adm:* $5. **www.w4am.net**

**West Virginia (Mineral Wells) — Oct. 9 F H R T V**
8 AM – 2 PM. *Spr:* Wood County Emergency Communications. Wood County 4-H Campground, Butcher Bend Rd. *Tl:* 147.255 (131.5 Hz). *Adm: $*5. **www.wc8ec.org**

**Wisconsin (Kaukauna) — Nov. 7 D F H R V**
8 AM. *Spr:* Fox Cities ARC. Starlite Club, W2091 County Rd. JJ. *Tl:* 146.760 (100 Hz). *Adm:* $5 advance, $6 door. **www.fcarc.club/hamfest.php**

**Wisconsin (Milwaukee) — Nov. 6 D H R**
6:30 AM – 3:30 PM. *Spr:* Milwaukee Repeater Club. Elks Lodge, 5555 W. Goodhope Rd. *Tl:* 146.910 (127.3 Hz). *Adm:* $5. **www.mrc91.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.

Events that are sanctioned by ARRL receive special benefits, including an announcement in these listings and online. Sanctioned conventions are also listed in *The ARRL Letter.* In addition, events receive donated ARRL prize certificates and handouts. Once the form has been submitted, your ARRL Director will decide whether to approve the date and provide ARRL sanction.

The deadline for receipt of items for this column is the **1st of the second month preceding publication date**. For example, your information must arrive at HQ by **November 1** to be listed in the **January** issue. Information in this column is accurate as of our deadline; contact the sponsor or check the sponsor's website for possible late changes, driving directions, and other event details. Please note that postal regulations prohibit mention in *QST* of games of chance, such as raffles or bingo.

Promoting your event is guaranteed to increase attendance. As an approved event sponsor, you are entitled to special discounted rates on *QST* display advertising and ARRL web banner advertising. Call ARRL's toll-free number at 1-800-243-7768, or email **ads@arrl.org**.

# Volunteer Monitor Program Report

The Volunteer Monitor (VM) Program is a joint initiative between ARRL and the FCC to enhance compliance in the Amateur Radio Service. This is the July 2021 activity report of the VM Program.

♦Technician-class licensees in Spring Valley, Smith River, and Nipomo, California; Oneonta, New York; Idaho Falls, Idaho, and Center, Texas, received advisories concerning FT8 operation on frequencies not authorized to Technician licensees.

♦General-class licensees in Marco Island and Arcadia, Florida, and in Maryland received advisories for operation in the Amateur Extra-Class portion of the 20-meter band.

♦A licensee in Parks, Arizona, received an advisory concerning failure to abide by a request to stay off a repeater. The matter will be referred to the FCC for enforcement action.

♦A General-class licensee in Acworth, Georgia, received an advisory concerning failure to identify properly and for repeated communications with unlicensed stations on 3.895 MHz.

♦An Amateur Extra-class licensee in Keansburg, New Jersey, received an advisory concerning on-the-air threats directed at another operator on 3.844 MHz.

♦The final totals for VM monitoring in July were 1,736 hours on HF frequencies and 2,185 hours on VHF and UHF frequencies.

The IT staff at ARRL Headquarters has begun work on the automated system for Volunteer Monitors to report monthly monitoring hours and incident reports. — *Thanks to Volunteer Monitor Program Administrator Riley Hollingsworth, K4ZDH*

# 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.

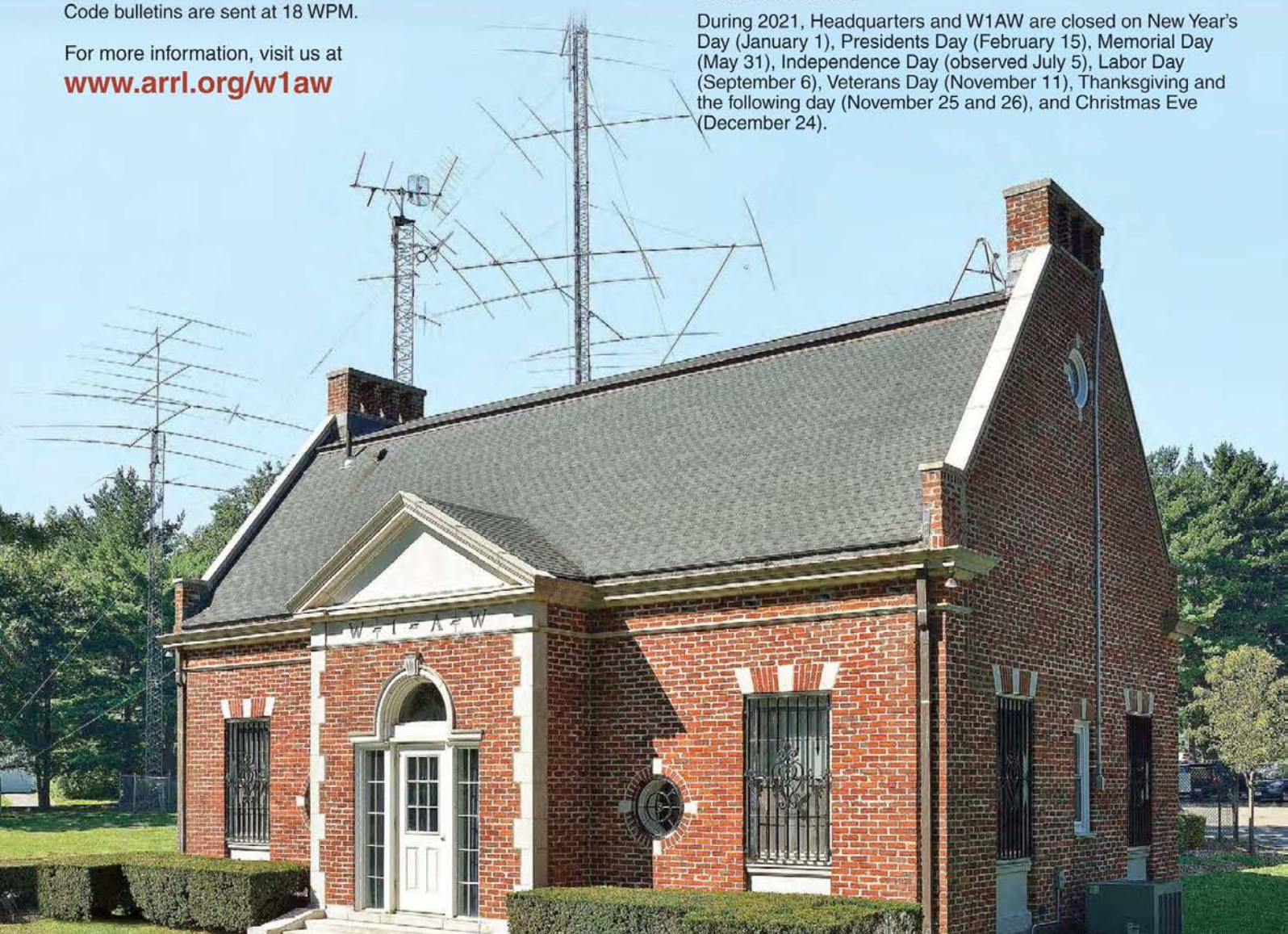
Keplerian elements for many amateur satellites will be sent on the regular digital frequencies on Tuesdays and Fridays at 6:30 PM Eastern time using Baudot and PSK31.

♦ 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.

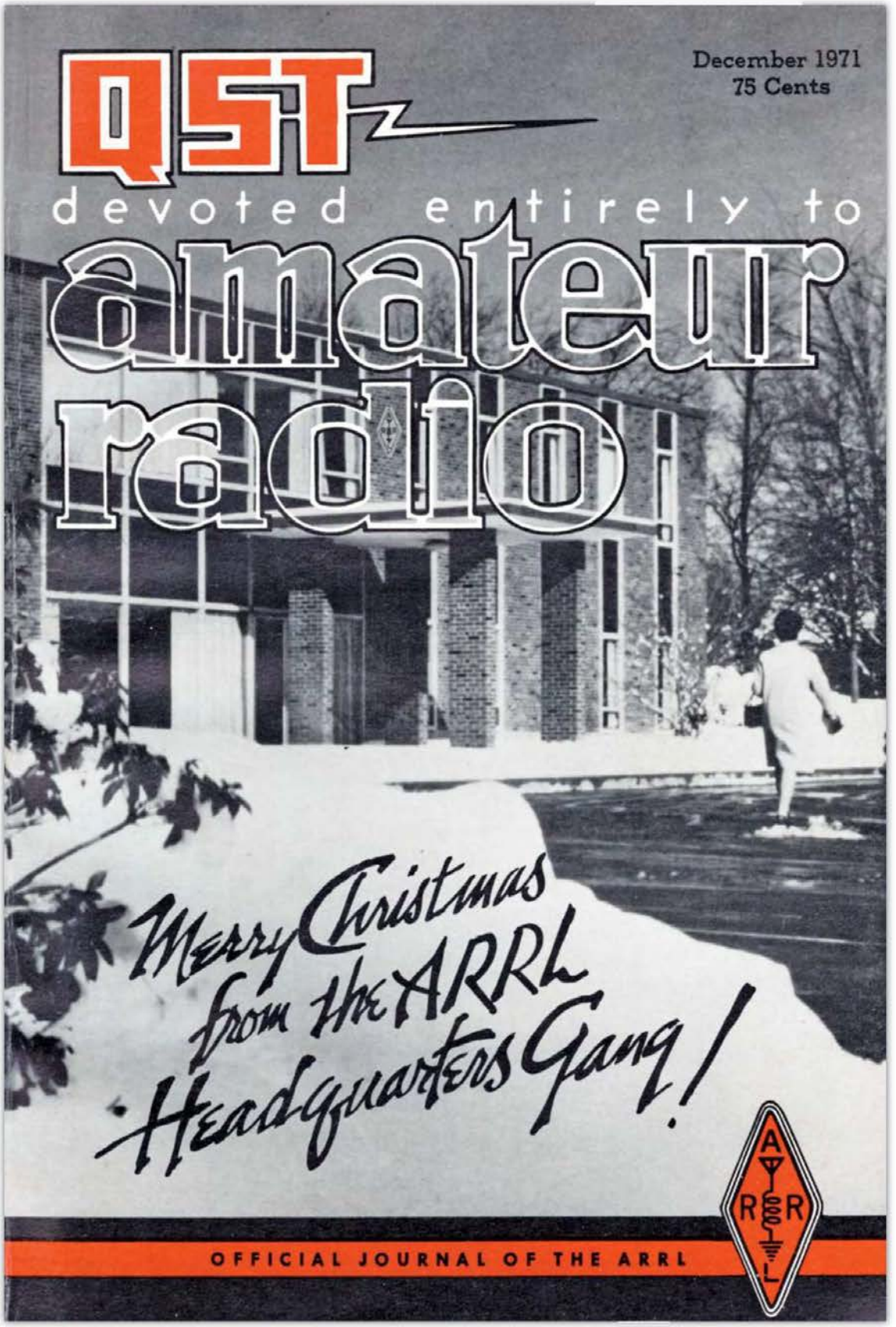
♦ Notes: On Fridays, UTC, a DX bulletin replaces the regular bulletins. W1AW is open to visitors 10 AM to noon and 1 PM to 3:45 PM Monday through Friday. FCC-licensed amateurs may operate the station during that time. Be sure to bring a reference copy of your current FCC amateur license. In a communication emergency, monitor W1AW for special bulletins as follows: voice on the hour, teleprinter at 15 minutes past the hour, and CW on the half hour.

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

During 2021, Headquarters and W1AW are closed on New Year's Day (January 1), Presidents Day (February 15), Memorial Day (May 31), Independence Day (observed July 5), Labor Day (September 6), Veterans Day (November 11), Thanksgiving and the following day (November 25 and 26), and Christmas Eve (December 24).



# A Look Back


QST
December 1971
75 Cents
devoted entirely to
amateur radio
Merry Christmas from the ARRL Headquarters Gang!
OFFICIAL JOURNAL OF THE ARRL

# Threshold Detectors in a CW Audio Filter

*This audio filter incorporates a new twist to improve selectivity. The innovation is a threshold detector — series-connected diode switches in the signal path.*

BY CHARLES B. ANDES,* WB2VXR

THE AUTHOR'S IDEA to improve the performance of an audio filter for cw is to establish a voltage threshold, a level where switching occurs. Above that level, the audio signal is passed; but, below the threshold, no output will occur. When the threshold detector is combined with a selective filter, the filter skirts are made extremely sharp. A second smoothing filter is needed to eliminate the harmonics and discontinuities caused by the threshold switching. Fig. 1 shows a block diagram of such a filter.

## Circuit

The input and output stages function as active filters providing good selectivity; any conventional design may be employed. The particular filter design used is essentially a high-gain operational amplifier with a notch filter located in a feedback loop.[1] The closed-loop gain is very high (close to open-loop gain) at the notch frequency but nearly unity at all other frequencies. An attenuator is used at the input of each amplifier section to reduce the overall gain. In addition, the inverting terminal of the op amp is loaded to ground to prevent oscillation at the notch frequency.

Following the first filter section, the audio signal passes to series-connected silicon diodes which conduct only the signals which produce peak voltages higher than the conduction level of the diodes (approximately 0.6 volt). By setting the input audio level so that the first active-filter section has an output of 2 volts pk-pk at resonance, the diodes will conduct. However, the voltage output of the active filter will fall quickly only a few cycles off resonance, and the threshold diodes will cut off. Then, the audio output from the diodes will drop to nearly zero. In a practical cw filter, the output is still noticeable even though it is nearly 60 dB down. Fig. 2 shows the schematic diagram of the complete filter, which has a voltage gain of approximately 5. Total gain depends on the open-loop gain of the op amps used. To adjust the overall gain up or down, vary the value of either or both of the resistors in the input attenuators, R1 or R2.

A 3-pole double-throw switch is used to apply power and to switch the headset connection from the input to the output. Power is obtained from a pair of 9-volt transistor-radio batteries. However, any voltage up to 15 can be used. The current drain is 5 mA; batteries will last about 100 hours.

The selectivity characteristic of the filter is illustrated in Fig. 5. The 6-dB bandwidth is only 62 Hz with a selectivity ratio (60 dB:6 dB) of 6.56. The operating frequency is 1.1 kHz, but can be easily changed using values calculated from the equations given in Fig. 4.

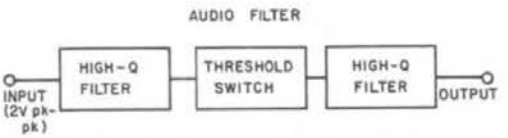
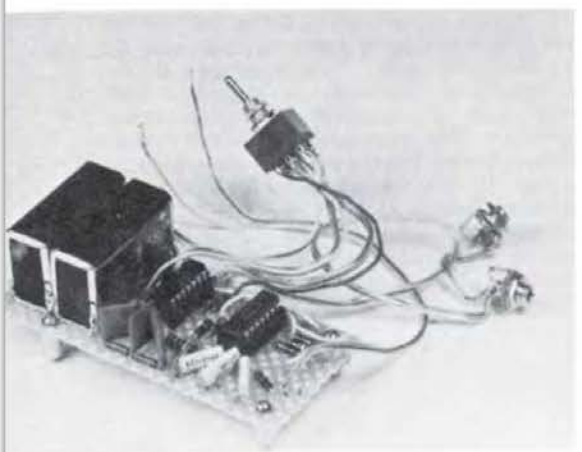



Fig. 1 — Block diagram of the filter.

## Results

This writer uses an inexpensive stereo headset for cw operation (it performs very well for phone signals, too). If a telegrapher's headset is employed, the filter should be designed to have the same resonant frequency as the phones, usually about 800 Hz.

The two active filters provide an extremely sharp response; therefore, the components used in



The audio filter is constructed on a small piece of electronic pegboard. The completed unit is mounted inside a communications receiver.

* 8760 Howard Dr., Williamsville, NY 14221.

1 The notch network should not be confused with the twin T, although both are similar in appearance.

*QST* for

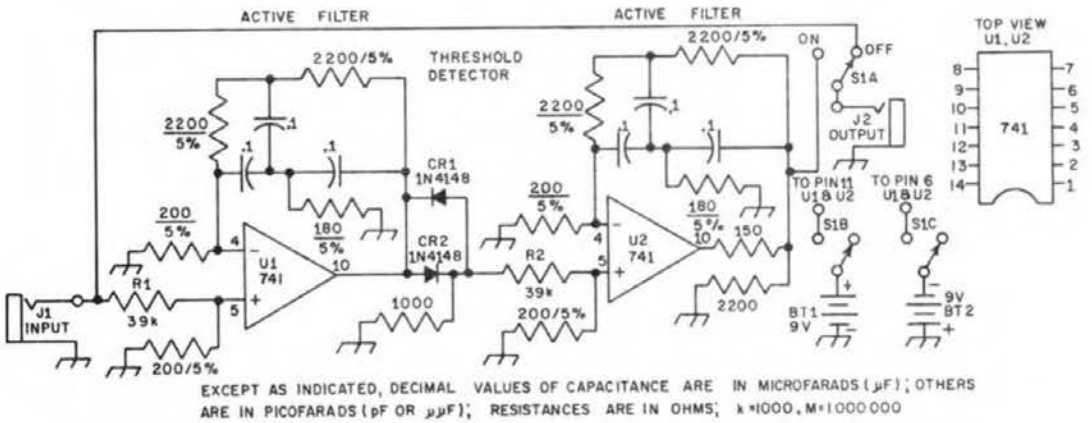



Fig. 2 — Schematic diagram. Resistors are 1/2-watt composition, 5-percent tolerance. Capacitors may be ceramic or mylar, using matched values in each filter section (see text). Pin numbers given are for the 741 op amp in a 14-lead flat pack.
BT1, BT2 — Transistor-radio battery, 9 V.
J1, J2 — Miniature phone jack, panel mount.
R1, R2 — Designated for text reference.
S1 — 3pdt toggle.
U1, U2 — 741 compensated op amp (Motorola MC1741, Fairchild μA741, Signetics N5741, or equiv.).

both filter sections must be identical. Use 1-percent tolerance resistors and select the capacitors so they are very close to being identical in value. Even with these precautions, the author's filter has two separate peaks in the response, which appears as a single flattened peak in Fig. 5. This effect is caused by the slight difference in capacitor values. The two peaks are actually 39 Hz apart at 1.1 kHz, or about 3.5 percent from each other. However, the effect of the flattened peak is desirable in this application.

R2 (Fig. 4) has a profound effect on the notch depth of the feedback network. When setting up one of the active filters for the first time, adjust the notch network by itself first for a good null. Then, connect it into the amplifier circuit and measure the peak characteristic. A little "tweaking" of the network values helps to improve performance of any high-selectivity filter.

If one already owns a multisection audio filter, he can add the threshold diodes to it. Simply locate a point at the end of a filter section where the audio level is approximately 2 volts pk-pk and insert the series diodes. An output load of less than 1000 ohms should be used to assure a sharp threshold switching characteristic. QST

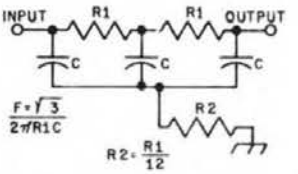



Fig. 4 — Circuit and design equations for the notch network.

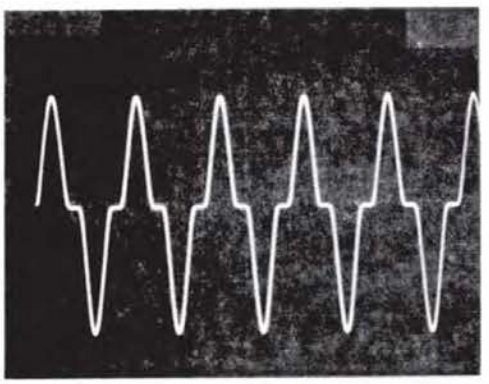


Fig. 3 — An oscilloscope photograph shows the switching action of the threshold detector.

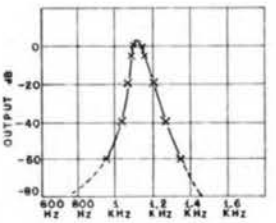



Fig. 5 — Selectivity characteristic of the audio filter.

## Gimmicks and Gadgets

# A Tone Generator for Netting of SSB Stations

BY STAN OEHMEN,* W2HG

NET OPERATION requires that all of the participating ssb stations be on frequency, preferably within 20 Hz. The operator usually tunes his receiver for a normal-sounding voice quality. Carrier insertion is used occasionally for netting, but at best, this is crude. The passbands of the ssb filter and the audio system restrict the response below 300 Hz. This makes it very difficult to hear the low-frequency note when zero beating. Some years ago it was suggested that a small amount of carrier be transmitted (30 dB below the output signal) for the receiver to lock on. The system required an extensive amount of equipment at the receiving station and proved to be impractical.

* 1387 Potters Blvd., Bay Shore, NY 11706.

### *A Better System*

It is easy to set two suppressed carriers to the same frequency when they are both modulated by

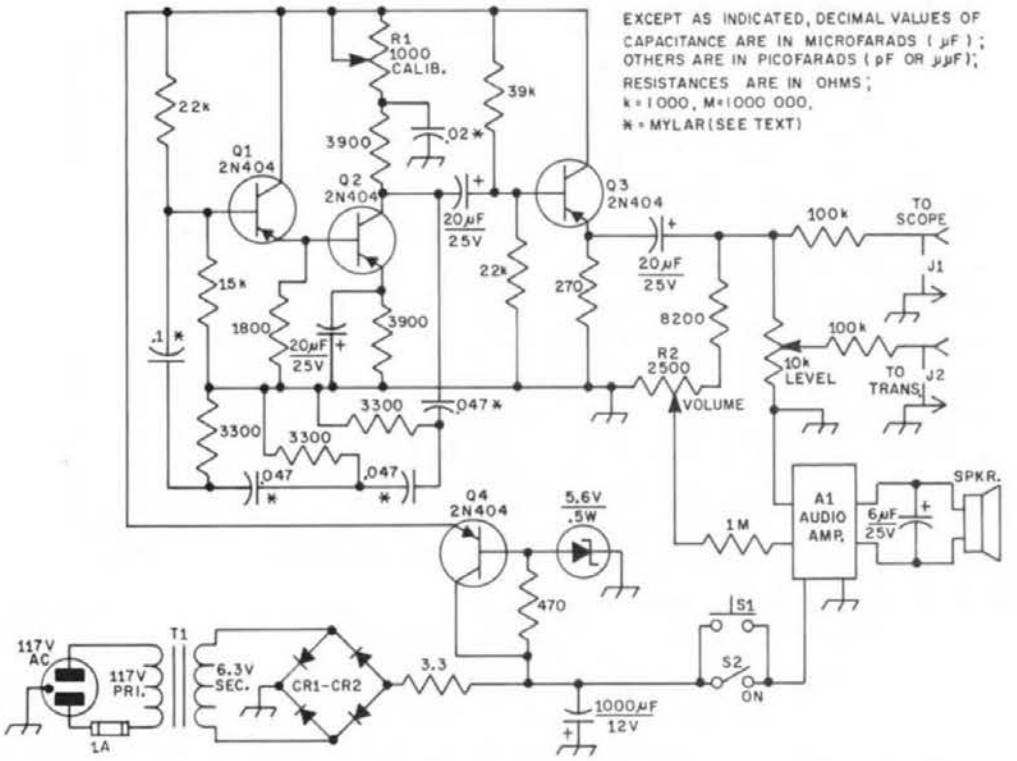



Fig. 1 — Circuit diagram of the tone generator. Capacitors are disk ceramic or Mylar (except those marked with polarity, electrolytic). Resistors are 1/2-watt, 10-percent-tolerance, composition. Component designations not listed below are for text reference.

A1 — Audio amplifier module (RCA KD2115 or equiv.).
CR1-CR4, incl. — 100-PRV, 1-A, silicon diode.
J1, J2 — Phono jack, panel mount.
R1 — 1000-ohm, linear-taper, 1/2-watt control.
R2 — 2500-ohm, linear-taper, 1/2-watt control.
S1 — Spst push button.
S2 — Spst toggle.
T1 — Filament type, 6.3 V (Stancor P-8389 or equiv.).

identical audio oscillators. An audio tone, when transmitted, will appear as a single carrier. While listening to the tone being transmitted, the transceiver VFO is adjusted so that the received note is the same as a "standard." The frequency of the transceiver-transmitted signal then will be the same as the one being received.

### *The Tone Generator*

There are several reasons for selecting a musical note for a standard. First, a 440-Hz tone can be calibrated against WWV transmissions. Additionally, the generator can be checked by comparing it with a musical instrument.

A two-stage phase-shift oscillator is used to produce a sine wave at the proper frequency. See Fig. 1. The tone can be varied by altering the amount of phase shift in the last stage. R1 serves as the calibration control. Mylar capacitors should be used in the phase-shift circuit. The power supply consists of a silicon-rectifier bridge circuit connected to the secondary of T1 – a 6-volt filament transformer. The series regulator and Zener diode provide 5.4 volts for the oscillator and emitter-follower stage. A 6-$\mu$F capacitor is connected across the speaker voice coil to reduce its high-frequency response. S1 allows the operator to listen to the tone momentarily, and S2 is used for longer calibration periods. The power requirement is so low that the unit can be left on continuously.

The oscillator output is coupled to an emitter-follower stage which drives the internal audio amplifier (A1) for speaker operation. A phono jack permits connection to a monitor scope (such as the Heath SB-610) and the station transmitter. Fig. 2 shows how this equipment is interconnected with the existing station components. While the monitor scope allows visual display, aural zero beating is just as accurate.

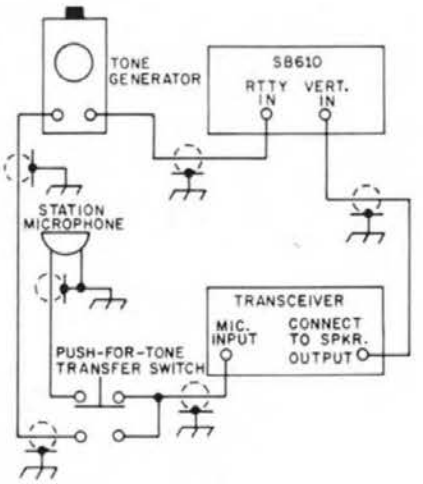



Fig. 2 – Connections between station equipment and the tone generator should be made with shielded wire. A push-button switch can be included to select either the station microphone or the tone generator.

### *Operation*

Some operators may mistakenly zero against 220 Hz or 880 Hz. This can occur if there is an unusually high amount of distortion in the receiver or generator output. As soon as speech is applied to the transmitter however, the mistake will be immediately apparent. The accuracy of this zero-beating technique is dependent on the VFO remaining stable between the transmit and receive modes. Since the calibrator does not rely on the ac line for determining its frequency, it can be adapted to mobile use by powering it from a battery supply. QST

# Celebrating Our Legacy

## Finding Public Service Through Radio

At 8 years old, I received a transistor AM/FM radio for Christmas. It was fascinating to hear music and listen to people talking from hundreds of miles away. My interest in technology grew throughout high school. I started college majoring in electronics technology, and although my major changed to photography, I still held a deep interest in electronics and radio communication.

I was interested in monitoring public safety radio. At my college apartment, I used a RadioShack crystal scanner, and eventually a Realistic Pro-34, to monitor the city and university police departments. I was even allowed to put a discone antenna on the roof. Morse code was a challenge for me, but I studied hard and was able to pass the 5 WPM code test, earning my Technician-Plus license. In 2015, I earned my General-class license and then my Amateur Extra-class license a few months later.

Since 2010, my interest in radio and public safety have led me to take a Community Emergency Response Team (CERT) class, as well as get training to become a structural and wildland volunteer firefighter and EMT, where I now help take care of the department's radios and pagers.

**Craig Moyer, NN2B**
Woodland Hills, Utah

## Station Evolution Over the Years

I first became interested in radio in 1951. I was a shortwave listener using a World War II vintage Philco all-band receiver. The radio had no bandspread, but I sharpened its selectivity by introducing feedback into its single IF stage. In just a couple years, I logged over 100 DXCC countries on 20-meter AM phone.

At age 15, I earned my General-class license. I got on the air in 1953, with a Hallicrafters S-40B receiver, my homebrew crystal-controlled 6L6 oscillator running 25 W input, and a 135-foot wire across two friendly neighbors' yards. I worked most of the US and plenty of DX on 40- and 80-meter CW. I later upgraded to a better receiver and an 807 beam tetrode vacuum tube running about 60 W.

I studied chemistry at Worchester Polytechnical Institute in Massachusetts, as well as Stanford University in California. After earning my PhD in 1964, I got a job at Procter & Gamble (P&G) in Cincinnati, Ohio, and earned my current call sign. Since then, I've maintained my interests in DX, contests, and collecting certificates.

**George Rizzi, W8GOC**
Cincinnati, Ohio

## A Lifetime of Radio

Growing up, I was a member of the Lanier High School Radio Club in Macon, Georgia. At the time, I was a shortwave listener. The leader of our radio club was our physics teacher, Lloyd Newberry, W4SPD (SK). Five of us traveled to the FCC office in Atlanta to take our Novice-class license test, and we all passed with 5 WPM code. After a few weeks, we received sequential call signs: WN4YWV, WN4YWW, WN4YWX, WN4YWY, and WN4YWZ.

One of my mentors was George Rankin, W4BK (SK), who was the CEO of WMAZ-TV. After graduating from Georgia Institute of Technology and the Graduate School of Banking at Louisiana State University, I started a 52-year career in banking.

My wife, Betty, KA4PAE, and I are now retired. We live in a high-rise building in downtown Orlando, Florida, that has room for a 20-meter dipole. Ham radio has been a great hobby for 68 years!

**Bert McCowen, W4YWW**
Orlando, Florida

## Sharing Radio with a Ham Friend

One Christmas morning, my wife's friend, Pauline, WA9CNV (SK), invited us over. She explained that she had been a ham for many years and was an avid county hunter. At 60 years old, she had worked 2,300 counties.

She had to move after her husband passed away earlier that year, and could no longer get on the air due to antenna restrictions at her new home. I explained that I could set up a mobile station for her and she could still work the counties. In return for my help, she gave me a set of Drake Twins: R-4C and T-4X. I had my General-class license and a homebrew one-tube crystal-controlled CW transmitter with a Heathkit HR-1680 receiver.

Bert McCowen, W4YWW, at his home station.

After a few hours visiting with Pauline, we packed the Drake Twins into the car and headed home. Pauline was an amazing woman and she had done some very interesting things with radio. It was a memorable Christmas and an example of radio bringing people together.

**Michael P. Heiderscheidt, WD9GNX**
Waterman, Illinois

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.

George J. Misic, KE8RN, ke8rn@comcast.net

## Classic Radio

# Hallicrafters FPM-300: The Last SSB-CW Transceiver

In 1971, Hallicrafters introduced the FPM-300 single-sideband (SSB)-CW transceiver for 80/75 to 10 meters (see Figure 1). They did a minor update to it in 1972 and continued to sell it until they closed in 1974.

This radio was unlike earlier Hallicrafters products because it came complete with a power supply (ac and dc), a speaker, built-in voice-operated transmit (VOX), and a crystal calibrator (see Figure 2).


**Figure 2** — The front panel of the FPM-300.

For a long time, Hallicrafters was the leader of the option sellers, but not with the FPM-300. The only options were the crystals for complete 10-meter coverage, an optional cooling fan for the two vacuum tubes, the power cord, and the mounting bracket for a mobile installation (see Figure 3).

## Design

The FPM-300 was solid state, except for two vacuum tubes, the driver stage, and the final amplifier — a 12BY7 and a 6KD6. It was designed so the radio tuned in the same direction on all bands, unlike the Drake TR-3 and TR-4, the Galaxy III and V, the NCX-5, and many other rigs of the era. The sideband created and received changes, depending on the band, but the transceiver accommodated with switches on the bandswitch, so the selected sideband remained unchanged in the operator's view when the band in use changed. The radio was factory equipped with the 28.50 to 29.00 MHz segment of 10 meters. When the radio was originally sold, all the phone operation took place in this segment of 10 meters. Now, the phone part of the band begins at 28.30 MHz, but many other radios have 10-meter coverage beginning at 28.50 MHz. Heathkit radios came with the full 10-meter coverage, as did the vacuum-tube Swan radios.


**Figure 1** — The Hallicrafters FPM-300 Transceiver.

The FPM-300 had an opening top that is pivoted at the rear and latched shut on each side. The controls for operation of the VOX were internal; the opening lid needed to be opened to reach them. The radio used a sine wave tone fed into the SSB input to create a CW signal. The VOX put the radio in the transmit mode for CW transmission. The settings for pleasant VOX operation were different for CW and SSB, and the adjustments could only be optimized for SSB or CW. The controls had no means to be optimized differently for each. The tone used on CW was about 1750 Hz, which was higher than most operators prefer or were used to. This made it difficult to keep the FPM-300 on the exact frequency

as the CW station being worked. I assume the high tone frequency was chosen for best performance with the method used to generate the CW signal.

The ac/dc power supply was a conventional design using a single power transformer with two primary windings for 120 V ac each. They were wired inside the FPM-300 in parallel for 120 V ac input or in series for 240 V ac input. The power cord wiring was the same for either voltage. The only change was internally in the FPM-300. When using 13.8 V dc power, a small feedback transformer was used to provide feedback to sustain oscillation of the two inverter transistors. The dc power supply only operated with a negative ground dc power source. The only US-made 12 V automobile with positive ground was the 1955 Packard. For 1956, Packard changed the car to the universal 12 V negative ground configuration.

## Using New Components

The FPM-300 employed a number of new devices in the design and construction of the transceiver. The device used as the product detector was the Motorola MC1496G double-balanced mixer. This is now a rare vintage part that worked very well, but it was new when the FPM-300 was designed. A packaged double-balanced four-diode mixer was used to mix the VFO with the crystal oscillator to generate the injection needed to define the bands covered.

Analog integrated circuits (ICs) were used in the IF amplifier stages. A divide-by-four IC (actually, two divide-by-two IC segments) was used to turn the 100 kHz calibrator into a 25 kHz calibrator. Both junction field-effect transistors (FETs) and dual-gate metal-oxide silicon FETs (MOSFETs) were used as oscillators, amplifiers, and mixers in the design of the FPM-300.

The FPM-300 had a meter that served as a signal strength meter on receive and as a cathode current meter for the final amplifier on transmit. The marks on the frequency dial were 10 kHz apart. The knob had divisions that did not actually help calibrate the frequency readout much better. The tuning was smooth. Some FPM-300s were quite stable, and some were not. The one I own drifts very little.

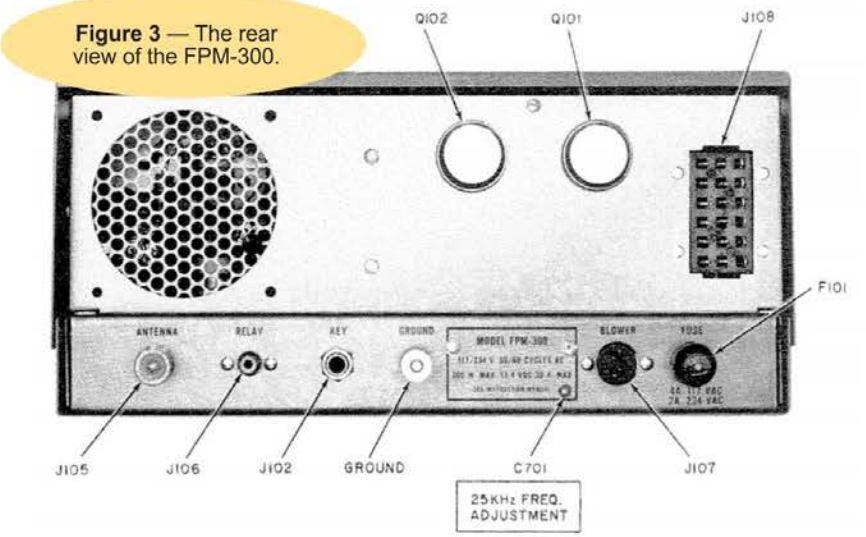



**Figure 3** — The rear view of the FPM-300.

## Errors in the Manual

In some versions of the operation manual from Hallicrafters, such as the one that came with my radio, there were several places where an "8" was typed when a "6" was intended. The receiver product detector was identified as a Motorola MC1498G, when the proper part number was MC1496G. The vacuum tube used in the final amplifier stage was identified as a type 8KD8, when in fact it is a 6KD6 tube. The "8 for 6" issue appeared again in the section that discussed the optional cooling fan kit, identifying it as the HA-80 when in reality it is part number HA-60. Not all versions of the manual have this issue. For instance, the online version does not have this issue.

## Overall Impression

If you get a Hallicrafters FPM-300 with good frequency stability, the only issues you may have are the 10 kHz divisions on the frequency readout dial and the cumbersome setting of the VOX controls for both SSB and CW. The 1750 Hz tone used to generate the CW signal may be a negative for some CW operators, as the tone frequency is about double what most CW operators are used to. I find the FPM-300 to be a nice rig to use, with its built-in crystal calibrator, VOX, and easy-to-open top cover.

Photos from the Hallicrafters *Operating and Service Instructions for Communications Transceiver Model FPM-300.*

# Strays

### *QST* Congratulates...

■George J. Whalen, NY9A, on the publication of his book, *The Story of Radio: To 5G Wireless*, which recounts the history of radio technology and how it evolved to the present day.

■Peg Nichols, KD0VQO, on the publication of her new book, *Sidewalk Sale Across America*. It's a snapshot of the history of the COVID-19 pandemic that also gives readers a glimpse into the world of amateur radio. *Sidewalk Sale Across America* is available on **Amazon.com** as an eBook or in paperback. For more information, email **kd0vqo@arrl.net**.

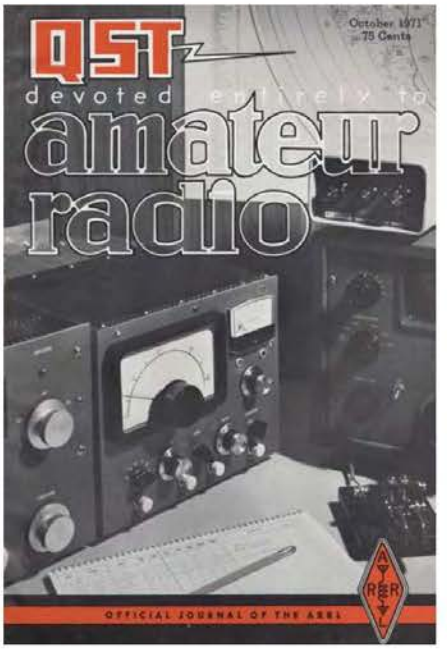
# 100, 50, and 25 Years Ago

## October 1921

- The cover photo celebrates the success of the first A.R.R.L. National Convention.
- The editorials praise the first A.R.R.L. National Convention for bringing so many hams together.
- The 13-page article, "Our First National Convention," reports on the event's many speakers and the subjects they addressed, as well as the ongoing in-person extended conversations that were enjoyed by all.
- A 7-page article reports on "Some New Apparatus at the Convention."
- "Godley to England to Copy Transatlantics" reports that the Board of Directors voted to send Paul F. Godley to England for the forthcoming winter Transatlantic Tests, using American equipment to supplement the many British participating stations.


## October 1971

- The cover photo shows Robert Myers', W1FBY, "T9er" CW exciter/transmitter package described in this issue.
- The editorial discusses the (sometimes limited) successes of amateur radio's efforts at the IARU World Space Conference to secure additional satellite privileges.
- Douglas A. Blakeslee, W1KLK, and Gus Wilson, W1NPG, present "A Transverter for 1.8, 21, or 28 MHz" for use with a 75-meter transceiver.
- E. R. V. Anderson, K6AWG, discusses the "Fabrication of Printed-Circuit Boards."
- "Voltage Multipliers," by Jack Althouse, K6NY, describes circuits that can deliver dc output of up to eight times the peak input voltage.
- In "The Apartment Dweller's Dilemma," Lewis G. McCoy, W1ICP, presents his Transmatch for use in matching random-length antennas.
- Doug DeMaw, W1CER, discusses "Two New ICs for the Receiver Builder."
- Marvin R. Clinch, K2BYM, and Calvin R. Graf, W5LFM, explain "High-Frequency Atmospheric Noise."
- John D. Allyn, W7YGN, talks about "The W7YGN Contest Keyer," which he calls a secret weapon for CW.




## October 1996

- The cover photo shows a cottage rental located on the Swedish/Norwegian border. Its rental fee includes a ham station that covers 160 meters to 70 centimeters with two call signs — LG5LG and SJ9WL. Rental proceeds go to funds in Norway and Sweden to benefit disabled hams.
- The editorial discusses the FCC's rewritten rules regarding "RF Safety."
- R. Dean Straw, N6BV, explains how to use "Heavy-Duty HF Propagation-Prediction/Analysis Software."
- William F. Baker, KA1WEG, reports on "An Antarctic DXpedition" aboard the expedition ship MS *Hanseatic*, with some 20-meter hamming taking place.
- Fred "Fritz" Hauff, W3NZ, talks about "The Gadget — An SWR Analyzer Add-On."
- In Part 1 of "Get on 440-MHz ATV!," William Sheets, K2MQJ, and Rudolf F. Graf, KA2CWL, present a tunable downconverter.
- L. B. Cebik, W4RNL, aims to help hams who build their own equipment, with "A Homebrew, Light-Duty Metal Brake."
- In "Brass and Steel," Rob Henderson, KB7PWJ, shares tales of World War II maritime radiomen who were hams.
- Joel L. Dryer, JD, NØGHT, shares how to deal with the problems caused by Covenants, Conditions, and Restrictions, in "The ABCs of CC&Rs."
- "Antenna Here Is a Full-Size Rhombic at 170 Feet," by Brian Davis, W9HLQ, tells the tale of a group of hams using antennas at a Voice of America relay station.

# Silent Keys

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

WA1DMM **Gerrard**, James A., Queensbury, NY
♦•WA1DRA **Dixon**, Charles, Nashua, NH
•N1FYY **Reed**, Arthur W. "Joe," Fairfield, ME
W1LAB **Lawson**, Ralph, III, "Pete," Fort Pierce, FL
K1PM **Mayer**, Paul D., Enfield, ME
KU1Q **Horvay**, Walter M., Goshen, CT
•KA1UDB **Falcon**, Herman C., Jr., Swansea, MA
N2CPR **Arnold**, Arthur R., Cherry Hill, NJ
KC2EVO **Stott**, Robert R., Williamstown, NJ
♦KC2FR **Jagerman**, David, Lawrenceville, GA
N2GMT **Noone**, Albert M., Winston Salem, NC
WB2HFB **Blair**, Ronald L., Frewsburg, NY
WA2KDB **Macari**, Gerard A. "Jerry," Spring Hill, FL
KF2KF **Kenny**, Carmel P., Lake Grove, NY
N2NVX **Abrams**, Evelyn, New Hyde Park, NY
N2QAE **Martin**, Arthur J., Long Valley, NJ
WB2QAV **Guarneri**, Joseph F., Palm Coast, FL
KA2VTN **Kirchhof**, Janet L., Howell, NJ
N2XCD **Wirth**, Joseph C., Robbinsville, NJ
K3ABH **Belella**, Carlo A., Hagerstown, MD
WA3AIA **Blouch**, Richard H., Franklintown, PA
W3BQG **Bour**, Richard F., Monongahela, PA
W3COX **Cox**, James E., Greenwood, SC
K3NV **Reed**, Henry W. "Walt," Las Vegas, NV
KC3OQC **Turner**, Mark W., Northumberland, PA
K3SGB **Hite**, John, Silver Spring, MD
WE3Y **Frankenstein**, Karl E., Bethel Park, PA
N4AEB **Becker**, Anthony E., Davie, FL
♦N4AGG **Reynolds**, James A., Raleigh, NC
♦WA4AZL **Little**, Neil L., Fuquay Varina, NC
KF4BMW **Ward**, Toni L., Bristol, TN
K4BRE **Bridges**, Dixon M., Sr., Casar, NC
•KA4BSQ **Ables**, Ralph E., Geraldine, AL
WA4BTG **Williams**, James H., Elizabethton, TN
•W4BWD **Dobbins**, Billy W., Huntsville, AL
•KA4CGW **Rice**, Harry W., Columbus, GA
N4CLN **Brooks**, Clayton L., Clemmons, NC
W4DOW **Pierce**, Dow L., Meadowview, VA
WB4DXJ **Faulkner**, David H., Versailles, KY
KC4EFH **Powell**, Kevin R., Angier, NC
W4EW **Wise**, Edward M., Jr., Commerce, GA
•N4FMW **Waters**, Frances M., Washington, NC
K4GEU **Rowland**, George F. "Woody," Lexington, NC
KF4ISF **Sparks**, Wilson W., Jr., Advance, NC
W4JAW **Ward**, John A., Belmont, MI
KK4JFP **Piper**, Paul E., Vero Beach, FL
KJ4KZR **Christian**, Terry R., II, Chelsea, AL
N4LV **Everest**, Glenn E., Oriental, NC
WA4OBO **Winston**, Kenneth W., Jr., Bermuda Run, NC
K4OFO **Biggs**, Donny N., Hermitage, TN
KC4OLH **Yother**, Dennis B., Gadsden, AL
KM4QPS **Ellis**, David F., Winston-Salem, NC
♦K4SCL **Huddleston**, Woodrow, Largo, FL
AD4US **Williams**, Randy E., Jacksonville, FL
K4VY **Florence**, Richard B., Ruckersville, VA
KD4WSZ **Abrams**, Julie S., New Hyde Park, NY
KF4WWB **Bryant**, Charles D., Brundidge, AL
KD4Y **Connellan**, Herbert D., Jr., Greenville, AL
♦N4ZKR **Wieck**, Dennis J., Paris, TN
K5ACQ **Poquette**, Alfred H., Jr., Iuka, MS
KA5AHK **Dahlberg**, Franklyn L., Keithville, LA
K5ALU **Cranford**, Roger W., Springfield, MO
W5AU **Ballard**, Troy W., Doyline, LA
KE5BPL **Grayson**, Stephen T., Olustee, OK

N5HIC **Davis**, Paul K., Ponca City, OK
KB5HTB **Cruz**, Raul M., Austin, TX
KI5IAH **Otteson**, David L., Haltom City, TX
KD5IHZ **Crawford**, Lee Ann, Lovington, NM
KG5KMP **Remmel**, James B., Fayetteville, AR
♦K5LTD **Winkler**, John P., Jr., Watauga, TX
WA5OOE **Moore**, James R., Jonesboro, AR
WB5RZR **Ridling**, James R., Atkins, AR
KC5UPE **Moody**, Alfred A., Fort Smith, AR
W5VE **Roberts**, Ralph W., Alexander, NC
♦W5VX **Parry**, William H., McAllen, TX
KD5WCY **Dahlberg**, Franklyn L., Jr., Huntsville, AL
K5ZIP **Ledet**, Donald L., Thibodaux, LA
•KG6GHS **Peckham**, Mark R., Alameda, CA
•KF6JCF **Lipscomb**, Travis B. "Chaddy," Lufkin, TX
♦KW6L **Sanders**, James A. "Jim," San Francisco, CA
KI6PR **Siegel**, Michael C., Merced, CA
W6QNT **Tim**, John C., Pinole, CA
•KC6TLB **Greggs**, Jane S., Irvine, CA
NH6WH **Riechel**, Robert G., Ocean View, HI
KG6ZQV **Mistretta**, Arthur P., Murrieta, CA
•K7CAI **Oswald**, Milton D. "Ozzie," Haugan, MT
W7DEP **Park**, Donald E., Herriman, UT
♦W7EB **Bloch**, Elliott A., Las Vegas, NV
KE7G **Kleinlein**, Stephen H., Sandy, UT
N7GOP **Cassorla**, Earl, Battle Mountain, NV
KE7HHL **Mertz**, Gene E., Spokane Valley, WA
♦K7IOO **Moore**, William C., Grand Coulee, WA
K7IRA **Blegen**, Howard L. "Hal," Spangle, WA
KB7ITR **Wieglenda**, Margaret M., Gladstone, ND
W7JHS **Thompson**, Cormac C., Jr., Prosser, WA
KF7JZH **Edmo**, Ronald S. "Snake," Pocatello, ID
•K7RKG **Hanusosky**, Julius, Mesa, AZ
•K7TBQ **Powell**, Jeffrey L. "Jeff," Portland, OR
♦W7USB **Brown**, Neal B., Lebanon, NH
KC7USN **Rowe**, Charles F., John Day, OR
♦•W7VME **Jones**, Millard C., Snoqualmie, WA
W7VSM **James**, John E. "Ted," Salt Lake City, UT
♦NV7X **Hance**, William J. "Bill," Elko, NV
W7XW **Thissell**, Michael A., Milwaukie, OR
N8BBR **Cuthbert**, Robert L., Bay City, MI
♦W8DHG **Poling**, Duane "Corky," Convoy, OH
W8DJS **Szymanski**, David P., Petersburg, MI
N8EQT **Suing**, Raymond B., Chesterland, OH
K8GLC **Carver**, Gilbert L. "Gib," Sciotoville, OH
K8GRD **Rubin**, Philip S., Flower Mound, TX
♦K8II **Bay**, Fred R., Morrow, OH
K8KIU **Ford**, Judith M., Gladwin, MI
W8KQ **Bishop**, Gerald S., Alpena, MI
WA8NEJ **Wegman**, Preston L., Sebring, OH
♦♦W8OU **John**, Andrew C., Edmond, OK
WD8PNL **Wiesen**, Ronald R., Cocoa, FL
AB8RB **Carr**, David T., Jr., Cincinnati, OH
K8RD **Warren**, Edward F., Camarillo, CA
KD8ULA **Morin**, William J., Midland, MI
•K8VWO **Poling**, James C., Jr., Athens, AL
K8YEU **Pigman**, Leonard M., Gainesville, FL
WA9ACW **Launer**, Eldon L., Springfield, IL
KG9BS **Darsch**, Arnold P., Lake Mills, WI
N9CY **Dobrowolskyj**, Wasyl K., Pell Lake, WI
W9DAG **Lovell**, David, Greenfield, IN
WD9DSP **Brown**, Sharon L., Pleasant Lake, IN
N9DT **Taylor**, Darell W., Fowler, IL
W9DUT **Domanski**, Jude V., Chicago, IL

♦K9DZG **Johnson**, Kenneth C., Mazomanie, WI
N9EZQ **Shawgo**, James E., Nappanee, IN
♦W9FA **Avellone**, Francis P., Lake Forest, IL
KC9FBG **Hoff**, Terry E., Noblesville, IN
WA9FXA **York**, Raymond, New Castle, IN
K9LCR **Clark**, Robert N., Ingleside, IL
WR9N **Bishop**, Douglas R., Mason, IL
•KC9NP **East**, Robert E., Michigan City, IN
W9PB **Spears**, Jerry D., Venice, FL
K9RSK **Foxworthy**, Ronald, Green Bay, WI
•K9RWE **Engel**, Richard W., West Bend, WI
♦WB9SLM **Hickerson**, Kristine A., Greenville, IL
KC9STE **Bainter**, William L., Jr., Goshen, IN
K9TS **Covert**, Philip E., Quincy, IL
♦W9ZJ **Vehe**, William D., La Grange, IL
KØALF **Hayes**, Larry E., Council Bluffs, IA
KØBBD **Ellis**, Jonathan E. "Iggy," Colorado Springs, CO
KØCKE **Kiekenapp**, Robert A. "Captain Bob," Cottonwood, AZ
♦KØCVD **Swenson**, Curtis R. "Curt," Sarasota, FL
NØFKC **Sigtermans**, Pieter H. "Pete," Hastings, MN
KCØHMN **Goesch**, Jason E., Spencer, NE
NØIME **Lundy**, Alan S., Vermillion, SD
♦KØKRB **Bartz**, Leonard E., Appleton City, MO
NØKXV **Calkins**, Dean A. "Butch," Marshalltown, IA
NØPDD **Stark**, Robert J., Sr., Winona, MN
KBØPDL **Bien**, Michael K., Las Vegas, NV
WBØQDE **Farmer**, Raymond K. "Keith," Fort Scott, KS
KCØREN **Woolsey**, Neil F., Grand Forks, ND
NØTHE **Blessing**, Richard A., Toddville, IA
WBØTTB **Johnstone**, Elmer L., Omaha, NE
WBØTTS **Barker**, Joseph H., Arcadia, MO
WØVYY **Hedberg**, Paul C., Southlake, TX
•KCØWDW **Perry**, Rodney D., Kansas City, MO
NØWTN **Schneweis**, Anthony F., Manhattan, KS
VE1AUZ **Thomas**, Martin P., Midville Branch, NS, Canada
VE7DNK **Prendergast**, Donald M., Sechelt, BC, Canada
VE7GCG **Boldt**, Peter A., Victoria, BC, Canada
VE7GNU **Collinge**, Douglas J., Victoria, BC, Canada
OE1WHC **Harranth**, Wolf, Vienna, Austria

♦ Life Member, ARRL
♦ Maxim Society
♦ Current Diamond Club
• 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.

# HAM RADIO OUTLET®

WWW.HAMRADIO.COM

## HRO FLORIDA COMING SOON!

### IC-9700 | *All Mode Tri-Band Transceiver*

• VHF/UHF/1.2GHz • Direct Sampling Now Enters the VHF/UHF Arena • 4.3" Touch Screen Color TFT LCD • Real-Time, High-Speed Spectrum Scope & Waterfall Display • Smooth Satellite Operation

### IC-7851 | *HF/50MHz Transceiver*

• 1.2kHz "Optimum" roofing filter • New local oscillator design • Improved phase noise • Improved spectrum scope • Dual scope function • Enhanced mouse operation for spectrum scope

### IC-7300 | *HF/50MHz Transceiver*

• RF Direct Sampling System • New "IP+" Function • Class Leading RMDR and Phase Noise Characteristics • 15 Discrete Band-Pass Filters • Built-In Automatic Antenna Tuner

### IC-7610 | HF/50 MHz *All Mode Transceiver*

• Large 7-inch color display with high resolution real-time spectrum scope and waterfall • Independent direct sampling receivers capable of receiving two bands/two modes simultaneously

### IC-718 | *HF Transceiver*

• 160-10M** • 100W • 12V operation • Simple to use • CW Keyer Built-in • One touch band switching • Direct frequency input • VOX Built-in • Band stacking register • IF shift • 101 memories

### IC-705 | HF/50/144/430 MHz *All Mode Transceiver*

• RF Direct Sampling • Real-Time Spectrum Scope and Waterfall Display • Large Color Touch Screen • Supports QRP/QRPp • Bluetooth® and Wireless LAN Built-in

### IC-7100 | *All Mode Transceiver*

• HF/50/144/430/440 MHz Multi-band, Multi-mode, IF DSP • D-STAR DV Mode (Digital Voice + Data) • Intuitive Touch Screen Interface • Built-in RTTY Functions

### IC-2730A | *VHF/UHF Dual Band Transceiver*

• VHF/VHF, UHF/UHF simultaneous receive • 50 watts of output on VHF and UHF • Optional VS-3 Bluetooth® headset • Easy-to-See large white backlight LCD • Controller attachment to the main Unit

### ID-4100A | *VHF/UHF Dual Band Digital Xcvr*

• Compact, Detachable Controller for Flexible Installation • DV/FM Near Repeater Search Function • Apps for iOS™ and Android™ devices • Wireless Operation with VS-3 & UT-137 Bluetooth® Headset & Module • MicroSD Card Slot

### IC-2300H | *VHF FM Transceiver*

• 65W RF Output Power • 4.5W Audio Output • MIL-STD 810 G Specifications • 207 alphanumeric Memory Channels • Built-in CTCSS/DTCS Encode/Decode • DMS

### IC-V86 | *VHF 7W HT*

• 7W OutputPower Plus New Antenna Provides 1.5 Times More Coverage • More Audio, 1500 mW Audio Output • IP54 & MIL-STD 810G–Rugged Design Against Dust & Water • 19 Hours of Long Lasting Battery Life • 200 Memory Channels, 1 Call Channel & 6 Scan Edges

### ID-5100A Deluxe

*VHF/UHF Dual Band Digital Transceiver*

• Analog FM/D-Star DV Mode • SD Card Slot for Voice & Data Storage • 50W Output on VHF/UHF Bands • Integrated GPS Receiver • AM Airband Dualwatch

## WE'RE GOING BIG... AGAIN, FOR OUR 50TH ANNIVERSARY WITH THE "50 Years Of Excellence" Giveaway #2!

# Grand Prize

2021 Chevy Trailblazer and Icom Gear

| 2ND Place | 3RD Place | 4TH Place |
|---|---|---|
| IC-7610 | IC-2730A | $50 GC |


Vehicle shown may not be actual vehicle.

Entering is Easy...

**hamradio.com/50**

Rules apply. No purchase necessary. Void where prohibited.
For Official Rules please visit hamradio.com/50.

**Except 60M Band. ***Frequency coverage may vary. Refer to owner's manual for exact specs. The Icom logo is a registered trademark of Icom Inc. 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

HAM RADIO OUTLET 1971 50 YEARS 2021 ANNIVERSARY

## FAMILY OWNED AND OPERATED SINCE 1971

### FTDX101MP | *200W HF/50MHz Transceiver*

• Hybrid SDR Configuration • Unparalleled 70 dB Max. Attenuation VC-Tune • New Generation Scope Display 3DSS • ABI (Active Band Indicator) & MPVD (Multi-Purpose VFO Outer Dial) • PC Remote Control Software to Expand the Operating Range • Includes External Power With Matching Front Speaker

### FTDX10 | *HF/50MHz 100 W SDR Transceiver*

• Narrow Band and Direct Sampling SDR • Down Conversion, 9MHz IF Roofing Filters Produce Excellent Shape Factor • 5" Full-Color Touch Panel w/3D Spectrum Stream • High Speed Auto Antenna Tuner • Microphone Amplifier w/3-Stage Parametric Equalizer • Remote Operation w/optional LAN Unit (SCU-LAN10)

### FT-991A | *HF/VHF/UHF All 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

### FT-818ND | *HF/6M/2M/440 All Mode Portable Xcvr*

• Ultra-Compact/Portable • Multi-Color Easy to See LCD • 208 Memory Channels/10 Memory Groups • Built-in Electronic Keyer • Internal Battery Operation Capability • Two Antenna Connectors • Built-in High Stability Oscillator ±0.5 ppm

### 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

5 Ways to Shop!

- 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 | SACRAMENTO, CA (877) 892-1745 | PORTLAND, OR (800) 765-4267 | PHOENIX, AZ (800) 559-7388 | MILWAUKEE, WI (800) 558-0411 | WOODBRIDGE, VA (800) 444-4799 | WINTER SPRINGS, FL (800) 327-1917 |
| 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 | WWW.HAMRADIO.COM |

# Heard It. Worked It. Logged It.

## IC-7851

**The Ultimate HF / 6M Transceiver**

The Pinnacle of HF Perfection

Keep that competitive edge and magically pull out the weak signals

## IC-7610

**HF / 6M SDR Transceiver**

The SDR you have asked for. Faint signals are no longer a challenge for DXers and contesters around the world.

## IC-9700

**2M / 70cm / 23cm SDR Transceiver**

Direct sampling to the VHF/UHF world. Built with the VHF/UHF weak signal operator in mind.

## IC-7300

**HF / 6M SDR Transceiver**

New technology changing our ways. Industry's first, HF - Direct sampling system in an entry level rig.

## For the love of **ham radio.**

www.icomamerica.com/amateur
sales@icomamerica.com

ICOM®

# TIMEWAVE TECHNOLOGY INC.

**New!!**
**ANC-4+**

**Timewave Products available at:**
- HRO
- R&L Electronics

## *NEW! ANC-4+


### ANC-4+ Antenna Noise Canceller

**The familiar, rugged ANC-4 now with:**
- *External TX/RX control*
- *Adjustable TX hang time*
- *Noise amp front end protection*
- *TX LED indicator*
- *SMT construction*

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

*Estmated availability June 2021. Check Timewave & our Dealers Websites. Get on the list for this popular item!*


## 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!


**Customize your PK-232 installation with our complete line of upgrades, accessories and cables.**

*100,000 sold - All-time top selling data controller!*

## 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!*

- 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!


### ■ 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**

# hy-gain Rotators

## . . . the first choice of hams around the world!

### HAM-IV

***The most popular rotator in the world!***

HAM-IV **$729.95**

For medium communications arrays up to 15 sq. ft. wind load area. 5-second brake delay, Test/Calibrate function. Low temperature grease permits normal operation down to -30 degrees F. Alloy ring gear for extra strength up to 100,000 PSI for maximum reliability. *Precision* indicator potentiometer. Ferrite beads reduce RF susceptibility. Cinch plug 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 **$909.95** with DCU-2

HAM-VII **$999.95** *with DCU-3*

### TAILTWISTER SERIES II

T-2X **$969.95**

T-2XD2 **$1079.95** with DCU-2

T-2XD3 **$1139.95** with DCU-3

**For** large medium antenna arrays up to 20 sq. ft. wind load. 5-second brake delay, Test/Calibrate functions. Low temp grease, tough alloy ring gear, indicator potentiometer, ferrite beads on potentiometer wires, weatherproof AMP connectors plus 8-pin plug at control, triple bearing race (138 ball bearings) for large load bearing, electric locking steel wedge brake, North/South center of rotation scale meter, low voltage control, $2^{1}/_{16}$" mast.

**MSHD, $149.95.** Above tower heavy duty mast support. Accepts $1^{7}/_{8}$-$2^{5}/_{8}$" OD.

### CD-45II

CD-45II **$519.95**

**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.

| *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 Rotator Specifications* | |
|---|---|
| Wind load capacity (inside tower) | 20 square feet |
| **Wind Load (w/ mast adapter)** | **10 square feet** |
| Turning Power | 1000 in.-lbs. |
| **Brake Power** | **9000** in.-lbs. |
| Brake Construction | Electric Wedge |
| **Bearing Assembly** | **Triple race/138 ball brngs** |
| Mounting Hardware | Clamp plate/steel U-bolts |
| **Control Cable Conductors** | **8** |
| Shipping Weight | 31 lbs. |
| **Effective Moment (in tower)** | **3400 ft.-lbs.** |

| *CD-45II Rotator Specifications* | |
|---|---|
| Wind load capacity (inside tower) | 8.5 square feet |
| **Wind Load (w/ mast adapter)** | **5.0 square feet** |
| Turning Power | 600 in.-lbs. |
| **Brake Power** | **800 in.-lbs.** |
| Brake Construction | Disc Brake |
| **Bearing Assembly** | **Dual race/48 ball brings** |
| Mounting Hardware | Clamp plate/steel U-bolts |
| **Control Cable Conductors** | **8** |
| Shipping Weight | 22 lbs. |
| **Effective Moment (in tower)** | **1200 ft.-lbs.** |

### hy-gain Programmable DCU-3 Digital Rotator Controller

New!

DCU-3 **$519.95**

***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

**$479.95.** Like DCU-3, but less programmable memories. 110 VAC. Order **DCU-2X**, for 220 VAC.

### AR-40

AR-40 **$419.95**

**For** compact antenna arrays and large FM/TV up to 3.0 square feet wind load area. Dual 12 ball bearing race. Automatic position sensor never needs resetting. Fully automatic control -- just dial and touch for any desired location. Solid state, low voltage control, safe and silent operation. $2^{1}/_{16}$ inch maximum mast size. MSLD light duty lower mast support included.

| *AR-40 Rotator Specifications* | |
|---|---|
| Wind load capacity (inside tower) | 3.0 square feet |
| **Wind Load (w/ mast adapter)** | **1.5 square feet** |
| Turning Power | 350 in.-lbs. |
| **Brake Power** | **450 in.-lbs.** |
| Brake Construction | Disc Brake |
| **Bearing Assembly** | **Dual race/12 ball bearings** |
| Mounting Hardware | Clamp plate/steel bolts |
| **Control Cable Conductors** | **5** |
| Shipping Weight | 14 lbs. |
| **Effective Moment (in tower)** | **300 ft.-lbs.** |

### Replace your *YAESU* Rotator Controller

New!

YRC-1 **$399.95**

***Hy-gain YRC-1 gives you more features and a much more robust controller that is far less prone to lightning damage. Costs less than repairing your original Yaesu controller!***

**Easy-to-use** -- dial in your beam heading and tap *GOTO* button. *Exclusive* 180 degree *AutoReversal*™ for fast longpath operation.

**Has** all features of DCU-2. Bright blue LCD shows current, dialed-in and computer controlled beam headings and your call. USB port for computer control. Extra heavy-duty AC power supply.

**Variable** DC motor speed for minimizing damaging antenna overshoot and fast operation. Intuitive menu for calibrating, offsetting, or changing parameters. Field upgradeable firmware. Use with Yaesu G-800/1000/2800/G450/650. For AC or DC motors.

***www.hy-gain.com***

***Nearest Dealer, Free catalog, To Order . . .***

**Voice:** 662-323-9538 **Fax:** 662-323-6551

**hy-gain**

***Antennas, Rotators & Towers***

***308 Industrial Park Road,Starkville, MS 39759, USA***

# 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, $79.95.** 80-10M. 102 feet long.
**MFJ-1778M, $69.95.** 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, $119.95.** 800 Watts.
**MFJ-1982MP, $89.95.** 300 Watts.
**MFJ-1982LP, $69.95.** 30 Watts.
***40-10 Meters, 66 feet:***
**MFJ-1984HP, $99.95.** 800 Watts.
**MFJ-1984MP, $79.95.** 300 Watts.
**MFJ-1984LP, $59.95.** 30 Watts.

### Off Center Fed Dipoles

**Lightweight**, virtually invisible. Gives you directivity and gain (*see MFJ website*).
**MFJ-2012, $99.95, 40/20/10/6 Meters, 1500 Watts. 67 ft.**
**MFJ-2010, $79.95. 40/20/10/6 Meters, 300 Watts. 67 ft.**
**MFJ-2014, $129.95. 75/40 Meters, 1500 Watts. 122 ft.**
**MFJ-2016, $159.95. 160/75/40 Meters, 1500 Watts. 240 ft.**
**MFJ-2013, $99.95. 60/30 Meters, 300 Watts. 86 ft.**

### *Dual Band* 80/40 or 40/20 Dipoles, 1.5 kW


**MFJ-17758, $119.95.** 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, $79.95.** 40/20M, 42 ft.

### MFJ All Band Doublet

**MFJ-1777, $89.95.**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, $49.95. 20-6M, 35 feet.**
**MFJ-1779B, $69.95. 80-40M,135 feet.**
**MFJ-1779A, $89.95. 160M, 265 feet.**

### 20M Extended Double Zepp

**MFJ-1742, $104.95.** 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, $104.95.** 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, $309.95.** Six-bands: 20/17/15/12/10/6 Meters, 1.5 kW. *Perfect for restricted space*. Nearly invisible. 9x9x½ 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, $279.95.** Like MFJ-1836H, but 300 Watts.

### MFJ *4-Band* Dipole Octopus Antenna


***Octopus** antenna hub turns ham-sticks 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, $299.95.** Includes 8 hamsticks for 75/40/20/15 M.
**MFJ-2100, $129.95.** 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, $349.95.** 6 bands: 40/20/15/10/6/2M, 12 feet.
**MFJ-1797, $379.95.** 7 bands:40/30/20/17/15/12/10M. 23 ft.
**MFJ-1797LP, $359.95.** Like MFJ-1797, but only 9 feet tall. Narrower bandwidth on 40 Meters.
**MFJ-1799, $469.95.**10 bands: 80/40/30/20/17/15/12/10/6/2M. 20 ft.
**MFJ-1799X, $419.95.** Like MFJ-1799, but less 80M.

### MFJ 43-foot Vertical, 160-6 Meter

**MFJ-2990,$419.95.** 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, $129.95.** 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, $219.95.** 7-55 MHz. *Full-size* 20-6 Meter dipole, 40M air loading coil. Two 17 ft. telescopic whips, 28" collapsed.

### MFJ-915, $49.95 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, $49.95 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, $49.95, 300W MFJ-919, $74.95, 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, $29.95.** 400W.
**MFJ-272, $44.95.** 1500W.
Gas discharge tube shunts 5000 amps peak.< 0.1 dB loss. 1 GHz. SO-239s.

### 2-Position Antenna Switch

**MFJ-1702C, $54.95.**
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 If Pigs Could Fly . . .


**If pigs could fly . . . I think we wouldn't go outside very much. I also think our antennas would not survive those Pig Flying Roosters. Thank goodness pigs are not flying and we do not have to worry about such a thing. In a world of Covid and Killer Hornets, we certainly do not need any flying pigs. Now, flying cobwebs, flying Octopus, flying G5RVs, OCFDs, dipoles, beams, yagis, loops and masts?**

**Yes one of each please.**

**MFJ-2100, $129.95.**
Want a super versatile antenna system? This Octopus hub lets you place four bands, two hamsticks each. Picture 75/40/20/10 Meters or any other combination you wish.
One feedline, tough aircraft aluminum construction.
**MFJ-2104, $299.95.** 75/40/20/15M hamsticks, hub combination.
**MFJ-2104X, $309.95.** Octopus hub and your choice of four pair of MFJ hamsticks.

**MFJ-1838, $469.95.**
The Cobweb Antenna for restricted spaces covers 8-bands: 40/30/20/17/15/12/10/6 Meters. Super strong large diameter fiberglass, heavy duty 14 gauge stranded hard copper wire. 1500 Watts. 12 feet 23 lbs.

**MFJ-1836H, $309.95.**
20-6 Meters, 1500W.

**MFJ-1797, $379.95.**
SkyMaster 40-10 Meter vertical covers all of your favorite bands: 40/30/20/17/15/12/10 Meters. Handles 1000 Watts PEP. Just 7.5 lbs, 23.5 feet tall.
**MFJ-1797LP, $359.95.**
Like MFJ-1797 less the 14.5' whip, less efficient, narrow bandwidth on 40M. Weighs 6 lbs., only 9 feet tall for super low profile.
**MFJ-2982, $179.95.** The FeatherLite is a self-supporting vertical antenna that sets up in minutes, collapses to 3.8 feet for easy storage. Perfect for RVs, vacations, field day. 80-6M, includes mount, balun, wire and telescopic mast.
**MFJ-2980, $129.95.** 40-6 Meters.

**MFJ-2389, $349.95.**
Compact Vertical Antenna covers 80/40/20/15/10/6/2 Meters and UHF. Weighs less than 6 lbs. and just 8.5 feet tall. Built-in ground radial system, no fooling with counterpoise wires. SWR is 1.5:1 or less, handles 200 Watts. 1/4 wave on HF, 80-6 Meters, 1/2 wave on 2-Meters and a 5/8 wave on 440 MHz. *All in one antenna!*

**MFJ-1886, $299.95.**
Low-Noise Receive Loop lets you work DX and ragchew even through horrendous noise. Pull weak signals out of static crashes, atmospheric, man-made and power line noise. Clearly hear signals 50 KHz to 30 MHz.
**MFJ-1888, $459.95.** Like MFJ-1886 but includes MFJ-1888MC remote multi-coupler. Connect 4 receivers.

**MFJ-1778, $79.95.**
The famous G5RV antenna is 102 feet wide with 32.5 feet of ladder line terminating in an SO-239 connector. Operate all bands 160-10 Meters.
Use **MFJ-915, $49.95,** RFI isolator for eliminating RF from traveling on long coax lines.
**MFJ-1778M, $69.95.**
Half-size G5RV Junior is 52 feet, covers 40-10M with tuner. 1500 Watts.

**MFJ-1779 ABC, $89.95, $69.95, $49.95.**

Single Band Dipole antennas have a custom injection molded UV-resistant center insulator with heavy duty 14-gauge hard copper wire. Models for 20-6M, 80-40M and 160M. Use horizontal, sloping or inverted vee.
MFJ-1779A, 265 ft.160M.
MFJ-1779B, 135 ft. 80/40.
MFJ1779C, 35 ft, 20-6M.

**MFJ-2010, $79.95.**

Off Center Fed Dipole delivers ham radios most interesting DX bands, 40/20/10/6M. Long leg is 44.6 ft., short is 22.3 ft. Perfect for low profile, portable, QRP, < 2 lbs.
**MFJ-2012, $99.95.** Like MFJ-2010 but legal limit.
**MFJ-2013, $99.95.** For 60/30 Meters, 300 Watts.
**MFJ-2014, $129.95.** For 75/40 Meters, legal limit.

**Build your own!**

**MFJ-2774K, $74.95.**
Deluxe dipole kit includes three multi-purpose center insulators, 100 feet of nylon rope, copper wire, two PL-259 connectors, two RG68 reducers, stainless steel screws and nuts and six ceramic insulators. Make G5RV, doublet or dipole antennas!

**You want antennas? We've got antennas! You want parts to build antennas with? We've got parts! You want a pig that flies? We don't have that! Come fly with MFJ, send an antenna up and start receiving signals from all over the universe!!!**

**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 Deluxe Code Oscillator

## IN STOCK!

**Wow!** **MFJ-557, $69.95**

MFJ-557 lets you practice sending Morse Code at home, work, in your car, outside on the picnic table, anywhere. Volume adjusts from barely audible to full classroom sound. Black Morse straight key on a non-skid heavy steel base -- stays put and doesn't move around while sending. Built-in speaker, adjustable contacts. Use 9V battery, not included. Compact 8.5Wx3.75Hx2.25D inches.

**MFJ-550**
**$24.95** Key only.

*IN STOCK!*
**MFJ-4230MV**
**$144.95**

30 Amp Switching Power Supply has an amp/volt meter and adjustable voltage. It weighs only 3 lbs, but delivers 25A continuously or 30A surge at 13.8 VDC. Selectable voltage 4-16V. Selectable input voltage of 120/240 VAC at 47-63 Hz. Excellent 75% efficiency and low ripple and noise. Fan cools by convection and forced air. Over voltage and over current protection systems.

*IN STOCK!*
**MFJ-225**
**$399.95**

MFJ HF/VHFTwo Port Graphic Antenna Analyzer has all of the basic analyzer functions you've come to depend on plus a host of advanced features. Built-in LCD graphics, PC interface using IG-miniVNA freewae, precise DDS frequency control, self-calibrating. Measure SWR (1:1 to 9.9:1), Complex Impedance, Impedance Magnitude, Return Loss, Phase, Capacitance, Inductance, Cable Length, Cable Loss. 1.5-179.9 MHz


*IN STOCK!*
**MFJ-108B**
**$29.95**

Separate 24 hour and 12 hour displays. Read both UTC and local time simultaneously. HUGE high-contrast 5/8" LCD numerals are eady to see from across the room. Mounted in an attractive solid brushed aluminum frame with a sloped face for easy viewing. Synchronizable to UTC. Quartz controlled for excellent accuracy. Long life button batteries included. 4.5Wx2Hx1D inches.
**MFJ-107B, $17.95.** 24 Hr. module.

*IN STOCK!*
**MFJ-1640T**
**$24.95**

Hamsticks make HF mobiling fun and easy! Lightweight, efficient, and super easy-to-use.Ruggedly constructed. Stainless steel whip adjusts for lowest SWR. 250 Watts PEP. 7' extended, 4' collapsed for storage.

*IN STOCK!*
**MFJ-822**
**$79.95**

Compact Cross-Needle SWR/Wattmeter has HUGE 3" meter. Read forward/reflected power and SWR simultaneously. Perfect for mobile or portable operation. Two selectable 30/300 power ranges. 1.8-200 MHz.

*IN STOCK!*
**MFJ-1866**
**$64.95**

Scanner-Discone Antenna receives 25-1300 MHz, transmits 144 to 1290 MHz. Handles 200 Watts. Super easy to put together. Lightweight for portable use. Ideal for 2/6M, 220/440 MHz emergency services.

*IN STOCK!*
**MFJ-1724B**
**$39.95**

World's best selling dual band 2-Meter/440 MHz magnet mount natenna is perfect for your dual band mobile or HT. Powerful 3.5 inch magnet holds firmly at highway speeds. 19-inch black stainless steel whip. 300W PEP. 12 foot coax.

*IN STOCK!*
**MFJ-4125**
**$124.95**

Tiny 5.75Wx3Hx5.75D inches fits anywhere. The perfect Go-Box power supply. Delivers 25A surge, 22A continuously. 5-way binding posts and speaker terminals for low power accessories. Over Voltage and Over Current protection modes.

*IN STOCK!*
**MFJ-1702C**
**$64.95**

2-Position antenna switch has center ground position, built-in lightning surge protection, works to over 650 MHz, handles legal limit. Unused positions grounded. Handy mounting holes, high qualtiy diecast metal.
**MFJ-1704, $129.95.** 4-position antenna switch.

*IN STOCK!*
**MFJ-270**
**$29.95**

Safeguard your expensive gear from static electricity and lightning surges. Ultra-fast gas discharge tube safely shunts up to 5000A of peak impulse current harmlessly to ground. SWR <1.1:1. < 0.1 dB loss. Use up to 1000 MHz. 400W PEP.

*IN STOCK!*
**MFJ-281**
**$19.95**

MFJ *ClearTone*™ Communication Speaker brings out speech fidelity you never knew existed. Designed to improve the intelligibility of speech in the range of 600-400 Hz while reducing noise, static and hum. 3-inch speaker handles 8 Watts. 3.5 mm mono plug, 6' cord.

**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.**

# 2021 ONLINE AUCTION
## October 8–14


## PRE-REGISTRATION BEGINS OCTOBER 5
## ARRL.ORG/AUCTION

**The 2021 ARRL Online Auction features unique vintage items, new gear, Product Review items, and more! New items are being added every day, pre-register to see them all!**

Sponsored by GigaParts® Technology Superstore

**MFJ . . .the World Leader in Ham Radio Accessories!**

# MFJ *Low-Noise Receiving* Loops

## *Work DX and ragchew even through horrendous noise!*


***Pull weak signals out of static crashes, atmospheric, man-made and power line noise!***

**Clearly** hear signals 50 KHz to 30 MHz you never knew existed. Power line noise and static just disappears.

**MFJ-1886** drastically reduces noise and interference by receiving the magnetic field and rejecting the electric field. Rotate MFJ-1886 receiving loop to totally eliminate interfering signals or greatly peak desired signal.

**Excellent** antenna and preamplifier balance gives deep null.

**State-of-the-art** push-pull Gali MMICs preamp gives you high dynamic range, low IMD and 25 dB of low noise gain. Gives excellent strong and weak signal performance without overload.

**Fully protected** preamplifier -- magnetically coupled voltages up to 40V and capacitively coupled voltages up to 20V will not damage preamplifier. Output is protected from transmission line surges induced by distant lightning.

**Use** anywhere, inside or outside. RF signal and power goes through your 50 Ohm coax.

**Ruggedly** built to withstand extreme weather. 1-inch OD diameter 6061 aluminum tubing. 36-inch diameter. 2½lbs. SO-239. Use masts up to 1¾ inches.

**MFJ-1886, $299.95.** Includes receive loop and MFJ-4116 bias-tee to power MFJ-1886 through coax.

**MFJ-1886TR, $349.95.** Includes MFJ-1886 and MFJ-4113TR Bias-Tee/Transmit/Receive switch. MFJ-4113TR powers MFJ-1886 through coax and switches between transmitting antenna and receiving loop. For radios with only one antenna connector.

**MFJ-4116, $44.95.** Bias-Tee provides RF signal and power through coax transmission line. Send up to 1A DC up to 50 Volts.

**MFJ-4113TR, $119.95.** Bias-Tee with built-in Transmit/Receive switch.

Switches between transmitting and receiving antenna. For radios with only one antenna connector. Provides RF signal and power through coax.

**Multi-coupler/Bias-Tee**

***New!*** **MFJ-1888MC, $239.95.** Connect four receivers to one antenna. Receivers are fully isolated. Each receiver port has 1-12 dB adjustable gain. IP3 is +15 dB. 2dB noise figure. Built-in Bias-Tee powers receiving loop through coax. SO-239s. Use 12 VDC or 110 VAC with MFJ-1312D, $24.95. RF tight, 7¼Wx1¾Hx5D inches.

### Super High Dynamic Range High Gain Receiving Loop


***New!*** **MFJ-1888, $459.95.** 32 dB gain from 50 KHz to 30 MHz. 20 dB gain at 80 MHz. IP3 is + 30 dB, 1 dB compression point is 23 dB, noise figure is 1.7 dB. Built-in BCB input filters to reduce overloading. Includes MFJ-1888MC remote multi-coupler. Can be used with MFJ-4113TR Bias-Tee/T/R switch and/or MFJ-4116 bias tee. 36-inch diameter. 2½ lbs. SO-239. Use masts up to 1¾ inches.

## Antenna Rotator

***Perfect for MFJ-1886/1786/1788 loop, VHF/UHF, small HF beams, TV, FM antennas.***

AR-500 $189.95

**Weather-proof** one piece cast aluminum housing with precision all metal gears, steel thrust bearings and automatic braking. Includes rotator, controller, remote control, clamps, hardware. Memories for 12 directions! Digitally displays position. 110/220 VAC.

## *Wipe out RFI*


***Wipe out RFI, noise, interference from any direction at any frequency with a 60 dB notch before it gets into your receiver!***

MFJ-1026 $249.95

**Eliminate** power line noise, fluorescent lamps, light dimmers, computers, TVs, lightning, motors, industrial processes.

**Null** out QRM on rare DX and work him! Null out local ham or AM station to prevent receiver overload. Works on SSB, AM, CW, FM, digital BCB to lower VHF. Plugs between antenna and transceiver. 12VDC, 110VAC with MFJ-1312D, $19.95.

## MFJ *Super High-Q™ Transmitting Loop* Antennas


***MFJ 36-inch diameter transmitting loop antenna lets you operate 10-30 MHz continuously including WARC bands!***

**Ideal** for limited space, HOA.

**Work** DX with low angle radiation and local close-in contacts with high angle radiation when mounted vertically. 150 watts.

**Super** easy-to-use! MFJ remote control auto tunes to your desired band. Fast/slow tune buttons, Cross-Needle SWR/Watt-meter lets you quickly tune to your exact frequency. No control cable needed.

***World's** most efficient small loop antenna has all welded construction, welded butterfly capacitor with no rotating contacts, large 1.050 inch diameter aluminum radiator for highest efficiency.*

**Every** capacitor plate is welded for extremely low loss and polished to prevent high voltage arcing. Nylon bearing, anti-backlash mechanism, limit switches, continuous no-step DC motor gives smooth precision tuning. Heavy-duty ABS plastic housing has ultraviolet inhibitor.

**Cover 40-15 Meters. MFJ-1788, $579.95.** Like MFJ-1786 but covers 40-15 Meters continuous. Includes remote control.

### Portable Loop


**MFJ-1780, $379.95.** *Box fan loop with carrying handle, 24x24x 5¾".* 20-10 Meters continuous, 150 Watts. Fast/slow tune remote control. Highly efficient all-welded construction.

**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.

# Got Noise?!

# MFJ has answers

## Noise-Cancellers Wipe Out Interference

***Null out all types of noise!!!*** Severe power line noise from arcing transformers and insulators, fluorescent lamps, dimmers, touch controlled lamps, computers, TV birdies, lightning, garage door openers, electric drills, motors, industrial processes. It's much more effective than a noise blanker because interference much stronger than a desired signal can be completely removed without affecting the desired signal. All modes -- SSB, AM, CW, FM, frequences from BCB to lower VHF.

**Null** out strong QRM on top of weak rare DX ! Null out a strong local ham or AM broadcast station to prevent your expensive receiver from overloading.

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

MFJ-1026 **$249.95**


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

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

**RF-sense** T/R switch auto bypasses your rig when you transmit. Adjustable T/R delay time. Use 12 VDC or 110 VAC with **MFJ-1312D, $24.95**. 6½X1½X6¼ inches.

**MFJ-1025, $219.95.** Like MFJ-1026, less the built-in active antenna. Use external antenna connection.

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

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

MFJ-5008 **$219.95**

## MFJ Power Line Noise Finder

MFJ-852 **$149.95**

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

**MFJ-1767, $109.95.** Adds 3-element beam to MFJ-852.

**MFJ-856, $189.95.** Combination of MFJ-852 noise finder and MFJ-1767 three-element beam antenna.

## MFJ Low-Noise Receiving Mag Loop

**Clearly** hear signals 50 KHz to 30 MHz you never knew existed. Power line noise and static disappears. Rotating the MFJ-1886 eliminates interfering signals or greatly peaks desired signals. Excellent antenna and preamplifier balance gives deep null. Gives excellent strong and weak signal performance without overload. Fully protected state-of-the-art push-pull Gali MMICs preamplifier gives high dynamic range, low IMD and 25 dB of low noise gain. Use inside or outside.


## Reduce Harmonics, Avoid TVI with MFJ Low Pass Filters

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

**MFJ-702B, $49.95.** 200W. SWR below 1.5 to 30 MHz.

**MFJ-704, $114.95.** 1500W. SWR below 1.3 to 30 MHz.

**MFJ-705, $169.95.** 2500W. SWR below 1.3 to 30 MHz.

MFJ-854 **$149.95**

## MFJ Clamp-on RF Ammeters

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

**MFJ-853, $89.95.** Like MFJ-854, Ranges: 0.3, 1, 3 A. Mini size.

**MFJ-853H, $89.95.** 3/10/30 A ranges.

**MFJ-805, $129.95.** Check RFI on cables up to 1/4" dia. VLF to VHF.

MFJ-1164B **$104.95**

## MFJ AC Line Filter/Protector

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

### Ferrite RFI Suppression Chokes

MFJ-700A4, $16.95. .275" diameter 4-Pack
MFJ-700B4, $16.95. .402" diameter. 4-Pack
MFJ-700C4, $29.95. .528" diameter 4-Pack
MFJ-700D4, $34.95. .750" diameter 4-Pack

**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.

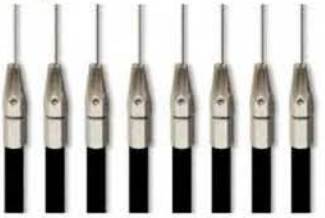
# Quicksilver Radio

## HAMMO-CAN™ Go Box

A complete VHF-UHF station in a can. Get them with or without radios. Check out our large assortment of parts if you want to build your own!

## Ultimate Crimp Kit™

## Quickstick™



"Hamstick" style mobile antenna. Available from **6M to 75M**. Made in the USA

## DC Power Cables

## Test Equipment

## Powerpoles & DC Connectors

## FREE SHIPPING

on all orders over $73.00 to any United States address.

**HybridDX™ HF antenna. Get on 6M to 160M in less than 80 ft.**

## Connectors & Adapters

## Play-Series™ System

Modular system with meters, usb, powerpoles, switches and more.

**In these tough times, we're here to help you with Quality, Service & Value!**

**www.qsradio.com**

# "Best thing since sliced bread!"

*More hams use MFJ analyzers than all others in the world!*

## MFJ-259D . . . World's Most Popular Antenna Analyzer!

*New!*


MFJ-259D **$329.95** *New and improved, now covers 280 KHz-230 MHz!*

***World** famous* MFJ-259D gives you a complete picture of your antenna's SWR and Complex Impedance.

**MFJ-259D** is a complete ham radio test station including frequency counter, RF signal generator, *SWR Analyzer*™, RF Resistance/Reactance Analyzer, Coax Analyzer, Capacitance/Inductance Meter and more!

**Read** Complex Impedance as series resistance and reactance (R+jX) or as magnitude (Z) and phase (degrees).

**Determine** velocity factor, coax cable loss in dB, length of coax and distance to short/open.

**Read** SWR, return loss and reflection coefficient at any frequency simultaneously.

**Read** inductance (uH) and capacitance (pF) at RF frequencies.

**Large** easy-to-read two line LCD screen and side-by-side meters clearly display your information.

**Built-in** frequency counter, Ni-MH/Ni-CD charger circuit, battery saver, low battery warning, smooth reduction drive tuning.

**Super** easy-to-use! Just set the bandswitch and tune the dial -- just like your transceiver. SWR, Complex impedance displayed instantly!

**Fully** portable, take it anywhere -- remote sites, up towers, on DX-peditions. Use 10 AA or Ni-Cad or Ni-MH batteries (not included) or 110 VAC with MFJ-1312D, $19.95. Rugged metal cabinet, 4x2x6¾". **MFJ-249D, $309.95.**

MFJ-249D does everything MFJ-259D does with digital display only.

## MFJ-269D . . . 280 KHz - 230 MHz plus 415-470 MHz, 12-bit A/D

***New and improved. Now covers 280 KHz to 230 MHz and 415 to 470 MHz and 2200 Meter band!***

**Instantly** gives you a complete picture of your antenna.

**Read** SWR, return loss, reflect-ion coefficient, match efficiency at any frequency simultaneously.

**Read** Complex Impedance (100 KHz to 230 MHz) as series equivalent resistance and reactance (Rs+jXs) or as magnitude (Z) and phase (degrees). Also reads parallel equivalent resistance and reactance (Rp+jXp).

**Determine** velocity factor, coax loss in dB, length of coax and *distance to short or open in feet (it's like a built-in TDR).*

***Coax Calculator***™ calculates coax line length in feet given degrees and vice versa for any frequency, velocity factor.

**Measure** SWR and loss of coax with *any* characteristic impedance (280 KHz to 230 MHz) from 10 to over 600 Ohms.

*New!* MFJ-269D **$429.95**


**Measures** inductance in uH and capacitance in pF at RF frequencies, 100 KHz to 230 MHz.

**High** contrast LCD gives precision readings and two side-by-side analog meters make antenna adjustments smooth and easy.

**12-bit** A/D converter gives much better accuracy and resolution than common 8-bits -- *MFJ-269D exclusive!*

**Built-in** frequency counter, battery saver, low battery warning, Ni-Mh/NiCd charge circuit. 4Wx2Dx6¾", 2 lbs. Use ten aA batteries or 110 VAC with MFJ-1312D, $19.95.

***MFJ-269DPRO***™ ***SWR Analyzer***

**MFJ-269DPro, $469.95.** Like MFJ-269D, but UHF range covers ***430 to 520 MHz***. For commercial work.

## MFJ-223 1-60 MHz Color Graphic VNA Analyzer

**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, it's packed with VNA features and performance you need!

MFJ-223 **$349.95**

- **Single-frequency** and *swept-frequency* operation
- **Truly accurate** SWR, R, X, and Z measurements
- **Seamless DDS** coverage, 100-Hz resolution from 1-60 MHz
- **Smooth "skip-free"** encoder tunes fast or slow without missing a step
- **Powerful +5-dBm** stimulus generator
- **Field-strength meter**
- **DDS generator** precision signal source
- **Vivid 1600-pixel/inch** color graphics on a 2x2 inch non-glare TFT screen

## MFJ-225 1.5-180 MHz *continuous* Two-Port Graphic Analyzer


**Out** in the field, the MFJ-225 is a compact completely *self-contained handheld graphing analyzer*. On the bench it becomes a full-fledged two-port (S21) desktop machine when teamed up with your PC. Using powerful IG-miniVNA freeware, you'll run de-tailed data analysis and print out stunning color-graphic plots to document your work! Built-in back-lighted *3-inch LCD graphic* display. Make fine adjustments using full-screen easy-to-view SWR bargraph, capture vivid swept displays for SWR, impedance, re-turn loss, phase angle, more. DDS generator.

MFJ-225 **$349.95**

## SWR Analyzer Accessories

**A. MFJ-29D/MFJ-39D, $44.95.** Carrying Pouch for MFJ-259D/269D.

**B. MFJ-92AA10, $44.95.** 10-Pk 2500 mAh Ni-MH Supercells.

**C. MFJ-66, $44.95.** Dip coils, set of two covers 1.8-230 MHz.

**D. MFJ-731, $124.95.** Tunable Analyzer Filter, 1.8-30 MHz, for strong RF fields.

**E. MFJ-917, $44.95.** 1:1 Current balun for SWR Analyzers to test balanced line antennas, other loads.

**F. MFJ-7737, $7.95.** PL-259 to BNC Female.

**G. MFJ-7727, $7.95.** PL-259 to SMA Female.

**H. MFJ-5510C, $19.95.**12VDC cigarette lighter adapter.

E

F

G

H

**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.**

# Born in the U.S.A.!

**Buy American! MFJ automatic tuners are built on American soil by American workers right here in Starkville, Mississippi USA.**

# MFJ *IntelliTuner*™ Automatic Tuners

MFJ-993B
**$309.95**
*Full Digital Power!*

**The** MFJ-993B *IntelliTuner*™ lets you tune any antenna *automatically -- ultra fast.*

**It's** a comprehensive automatic *antenna tuning center* complete with SWR/Wattmeter, antenna switch for two antennas, wire connection and 4:1 current balun for balanced lines.

**MFJ's** exclusive *IntelliTuner*™, *Adaptive Search*™ and *Instant Recall*™ algorithms give you *ultra fast* automatic tuning with over 20,000 *VirtualAntenna*™ Memories.

**You** get a highly efficient L-network, 6-1600 ohm matching at 300 Watts SSB/CW and digital or *extra-wide* 6-3200 Ohm matching at 150 Watts SSB/CW and digital, 1.8-30 MHz coverage, Cross-Needle *and* digital meters, audio SWR meter, *backlit* LCD, remote control port, radio interface, heavy-duty 16 amp/1000V relays. MFJ-993B automatically tunes for minimum SWR and remembers your frequency and tuner settings. The next time you operate on that frequency and antenna, these tuner settings are instantly restored and *you're ready to operate in milliseconds!* 10Wx2¾Hx9D inches. Use 12-15 VDC/1 amp or 110 VAC with **MFJ-1316, $29.95**. Radio interface cables, remote control available. See ***www.mfjenterprises.com***

made in USA

**600 Watt MFJ Automatic Antenna Tuner**

**MFJ-994B, $389.95.** Like MFJ-993B but handles 600 Watts SSB/CW/Digital, matches 12-800 Ohms. 10,000 memories. Doesn't have LCD, antenna switch, balun, audio SWR meter. 10Wx2¾Hx9D inches.

## More hams use MFJ tuners than all other tuners in the world!

***World's most advanced Automatic Antenna Tuners feature world renowned MFJ AdaptiveSearch™ and AutomaticRecall™ algorithms -- world's fastest ultra-wide range tuning. Nine World Class models! Choose your features: Digital/Analog/Audio SWR-Wattmeter, Antenna Switch, Balun, Radio Interface, Digital frequency readout, Remoteable, Coax/Balanced Lines/Wire Tuning, Field Upgradeable . . .***

## 1500 Watt *Legal Limit*

***for Ameritron AL-1500/1200/82 amps***

MFJ-998
**$749.95**
*Full Digital Power!*

**Roam** the entire HF spectrum 1.8- 30 MHz *hands-free* with full *1500 Watt* legal limit on SSB/CW/Digital and near-perfect SWR! Lighted LCD/Cross-Needle Meter.

## 300 Watt ...*Extra* Wide Range

***SWR/Wattmeter, 10000 VA Memories***

MFJ-991B
**$269.95**
*Full Digital Power!*

***Extra*** *wide matching range at less cost.* MFJ's *exclusive* dual power level: 300 Watts for 6-1600 Ohms; 150Watts for 6-3200 Ohms. Cross-Needle SWR/Wattmeter.

## 200 Watt ...Compact

***Digital Meter, Ant Switch, Wide Range***

MFJ-929
**$279.95**
*Full Digital Power!*

**World's** fastest compact auto tuner uses MFJ *Adaptive Search*™ and *InstantRecall*™ algorithms. 132,072 tuning solutions instantly match virtually any antenna with near perfect SWR. Bright LCD Display.

## 200 Watt *MightyMite*™

***Matches IC-706, FT-857D, TS-50S***

*Full Digital Power!*

MFJ-939KIY
**$179.95**

**200W SSB/CW and Digital.** Low-profile automatic tuner is great for those tiny new rigs. Just tune and talk! Includes interface cable, 2-year warranty. 6½Wx2⅞Hx8⅜D".

## MFJ *Remote* AutoTuners

**Get** greatly reduced losses and high efficiencies with long coax runs and high SWR antennas. *Full Digital Power!*

**MFJ-926B, $339.95. 200W.**
MFJ-993BRT, $349.95. 300W.
**MFJ-994BRT, $469.95. 600W.**
MFJ-998BRT, $879.95. 1.5 kW.

## *G5RV Antennas*

MFJ-1778
**$79.95**

**Cover** 160-10 Meters with antenna tuner. 102 ft. long. Use as inverted vee or sloper, 160 Meters as Marconi. 1500 Watts. Super-strong fiberglass center/feedpoint insulators. *Glazed ceramic* end insulators.

**MFJ-1778M, $69.95.** 52'. 40-10M.

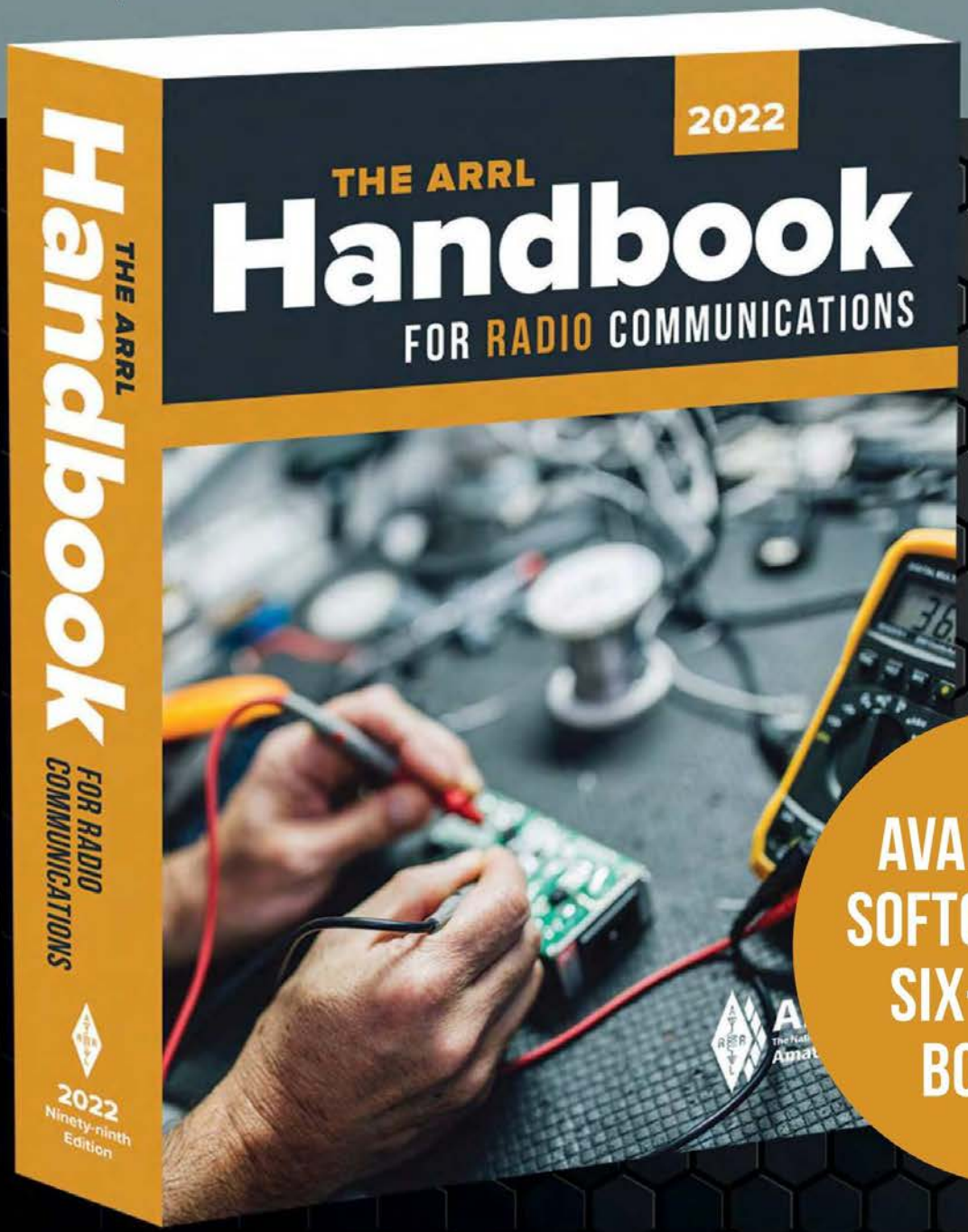
## *No Matter What*™ Warranty

**Protected** by MFJ's famous one year *No Matter What*™ limited warranty. We will repair or replace (at our option) for a full year.


**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.**

*Coming in October!*

# ARRL Handbook 2022




**AVAILABLE IN SOFTCOVER AND SIX-VOLUME BOOK SET**

# MFJ Tuners

## Ham Radio's Most Popular 300 Watt Antenna Tuner


**MFJ-949E $229.95**

**More hams use MFJ-949s than any other antenna tuner in the world!**

**Why?** Because the world's leading tuner has earned a worldwide reputation for being able to match just about anything.

### Full 1.8-30 MHz Operation

**Tune your antenna for minimum SWR!** Works 1.8-30 MHz on dipoles, verticals, inverted vees, random wires, beams, mobile whips, shortwave receiving antennas...Use coax, random wire, balanced lines. Has heavy-duty 4:1 balun for balanced lines.

### Custom inductor switch

**Custom** designed inductor switch, 1000 volt tuning capacitors, Teflon® insulating washers and proper L/C ratio gives you arc-free no worries operation up to 300 Watts PEP transceiver input power.

**The** MFJ-949E inductor switch was custom designed to withstand the extremely high RF voltages and currents that are developed in your tuner.

### 8-Position Antenna switch

**Antenna** switch lets you select two coax fed antennas, random wire/balanced line or dummy load through your MFJ-949E or direct to your transceiver.

### Lighted Cross-Needle Meter

**Full** size 3-inch lighted Cross-Needle Meter. Lets you easily read SWR, peak or average forward and reflected power simultaneously. Has 300 Watt or 30 Watt ranges.

### QRM-Free PreTune™

**MFJ's** QRM-Free PreTune™ lets you pre-tune your MFJ-949E off-the-air into its built-in dummy load! Makes tuning your actual antenna faster and easier.

### Plus Much More!

**Full** size built-in non-inductive 50 Ohm dummy load, scratch-proof Lexan multi-colored front panel, $10^5/_8$ x $3^1/_2$ x 7 inches. Superior cabinet construction and more!

**MFJ-948, $199.95.** Econo version MFJ-949E. Has all features except for dummy load.

### No Matter What™ Warranty

**Every** MFJ tuner is protected by MFJ's famous one year **No Matter What™** limited warranty. We will repair or replace your MFJ tuner (at our option) for a full year.

## More hams use MFJ tuners than all other tuners in the world!

### MFJ-989D Legal Limit Tuner

**MFJ-989D $479.95**

**New**, improved MFJ- 989D legal limit antenna tuner gives you better efficiency, lower losses and a new true peak reading meter. Easily handles full 1500 Watts SSB/CW, 1.8-30 MHz, including MARS/WARC bands. Six position antenna switch, dummy load. New 500 pF air variable capacitors. New improved AirCore™ Roller Inductor. New high voltage current balun. New crank knob. $12^7/_8$W x 6H x $11^5/_8$D inches.

### MFJ-986 Two knob Differential-T™

**MFJ-986 $429.95**

**Two** knob tuning (differential capacitor and AirCore™ roller inductor) makes tuning foolproof and easier than ever. Gives minimum SWR at only one setting. Handles 3 KW PEP SSB amplifier input power (1.5 KW output). Gear-driven turns counter, lighted peak/average Cross- Needle SWR/Wattmeter, antenna switch, balun. 1.8 to 30 MHz. $10^3/_4$W x $4^1/_2$H x 15 in.

### MFJ-962D Compact kW Tuner

**MFJ-962D $369.95**

**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. $10^3/_4$ x $4^1/_2$ x $10^7/_8$ in.

### MFJ-969 300W Roller Inductor Tuner

**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-969 $269.95**

### MFJ-941E Super Value Tuner

**Most** for your money! 300 Watts PEP, 1.8-30 MHZ, lighted Cross-Needle SWR/Wattmeter, 8 position antenna switch, 4:1 balun, 1000 volt capacitors, Lexan front panel. $10^1/_2$W x $2^1/_2$H x 7D in. **MFJ-941EK, $159.95.** Tuner Kit -- Build your own!

**MFJ-941E $179.95**

### MFJ-945E HF/6M Mobile Tuner

**Extends** your mobile antenna bandwidth so you don't have to stop, go outside and adjust your antenna. Tiny 8 x 2 x 6 in. Lighted Cross-Needle SWR/Wattmeter. Lamp and bypass switches. Covers 1.8-30 MHz and 6 Meters. 300 Watts PEP. **MFJ-20, $11.95**, mobile mount.

**MFJ-945E $169.95**

### MFJ-971 Portable/QRP Tuner

**Tunes** coax, balanced lines, random wire 1.8-30 MHz. Cross-Needle Meter. SWR, 30/300 or 6 Watt QRP ranges. Matches popular MFJ transceivers. Tiny 6 x $6^1/_2$ x $2^1/_2$ in.

**MFJ-971 $159.95**

### MFJ-901B Smallest Versa Tuner

**MFJ's** smallest (5 x 2 x 6 in.) and most affordable wide range 200 Watt PEP Versa tuner. Covers 1.8 to 30 MHz. Great for matching solid state rigs to linear amps.

**MFJ-901B $129.95**

### MFJ-902B Tiny Travel Tuner

**Tiny** $4^1/_2$ x $2^1/_4$ x 3 inches, full 150 Watts, 80-6 Meters, has tuner bypass switch, for coax/random wire. **MFJ-904H, $179.95.** Same but adds Cross-needle SWR/Wattmeter and 4:1 balun for balanced lines. $7^1/_4$ x $2^1/_4$ x $2^3/_4$ inches.

**MFJ-902B $139.95**

### MFJ-16010 Random Wire Tuner

**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 2 x 3 x 4 in.

**MFJ-16010 $89.95**

### MFJ-9201 QRPocket™ Tuner

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, $59.95**

**MFJ-9201 $64.95**

### MFJ-921/924 VHF/UHF Tuners

**MFJ-921** covers 2 Meters/220 MHz. **MFJ-924** covers 440 MHz. SWR/Wattmeter. 8 x $2^1/_2$ x 3 in.

**MFJ-921/924 $114.95**

### MFJ-931 Artificial RF Ground

**Eliminates** RF hot spots, RF feedback, TVI/RFI, weak signals caused by poor RF grounding. Creates artificial RF ground or electrically places far away RF ground directly at rig. **MFJ-934, $259.95**, Artificial ground/300 Watt Tuner/Cross-Needle SWR/Wattmeter.

**MFJ-931 $139.95**

**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.

New!

# MFJ SDR T/R Protection Switch

***Turn your SDR into a panadapter to see entire bands on frequency/waterfall displays . . .***


***An inexpensive wide-band SDR dongle receiver lets you see entire bands on frequency/waterfall computer displays!***

MFJ-1708B-SDR **$129.95**

**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 fail-safe RF sense switches MFJ-1708B-SDR. For HF/VHF/UHF. Monitor multiple bands with multiple SDRs and a multi-coupler.

**MFJ-1708B-SDR-S, $139.95.** SMA connector for your SDR.

***New B series improvements . . .***

The original MFJ-1708 series used one relay and wires to connect the SO-239s. The *new B-series* uses *four* relays and connectors on a *single* pc board. This gives you > 50 dB isolation at 300 MHz and > 68 dB at 50 MHz. SWR < 1.16:1 at 50 MHz and < 1.75:1 at 450 MHz at the transmit port. Mute output is a selectable short or open to ground. Use "boat anchors" or modern receivers or key a linear amplifier. Receiver input protection prevents overload from nearby high power signals and from receive to transmit. A hybrid splitter on SDR models reduces loading effect and gives > 15 dB isolation between the SDR REC and XCVR ports to reduce interference. The original MFJ-1708 series is still available.

## MFJ Low Noise VLF/HF Receiving Loop

***Pull weak signals out of static crashes, atmospheric, man-made and power line noise!***


**Hear** signals 50 KHz to 30 MHz cleaner, quieter than ever before! Power line noise disappears. Rotate its figure 8 pattern and its extremely deep null to completely eliminate an interfering signal or greatly peak a desired one. Fully protected state-of-the-art Gali MMICs in push-pull gives you a preamp with extremely high dynamic range, low IMD and 25 dB of low noise gain. Excellent performance on strong and weak signals without overload. 36-inch dia. loop. 1-in. OD 6061 aluminum.

## MFJ *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, $64.95.** Like MFJ-1868 but transmits 144-1290 MHz. Coax and mounting hardware not included.

## Tuned Indoor SDR Active Antenna


**Make** your SDR receiver come alive with HF signals, .3-40 MHz, while rejecting interference with MFJ-1020C *tuneable* indoor active antenna! Gain control, telescoping whip.

## Untuned Indoor SDR Active Antenna

**MFJ-1022, $89.95.** Hear weak, noisy VLF to UHF signals. Noise-less feedback gives excellent low noise reception. Handles strong signals.

## Active OutdoorAntenna


***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/preamp gives maximum signal and minimum noise. Covers .05-30 MHz.

**Indoor** unit: 20 dB attenuator, gain control, 2 receiver and 2 antenna switches.

## HF SDR Preselector


**Tuneable** MFJ-1040C lets you copy **weak**, noisy SDR signals from 1.8 to 54 MHz. Greatly tunes out and reject out-of-band interference. Up to 20 dB gain. Has gain control. Cascode FET/bipolar transistor gives low noise, high gain without overloading. Switches for 2 antennas and 2 receivers. SO-239s. Has 20 dB attenuator. Automatically bypasses when transmitting or use PTT. 6½Wx2½Hx4D inches.

## MFJ LW/MW/SW SDR Preselector/Tuner


**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** 2x3x4 inches. SO-239 connectors.

MFJ-1708B $129.95.

## MFJ RF Sense Transmit/Receive Switch

**Switches** your antenna from receiver to transmitter using a relay. Shorts your receiver to ground during transmit. Use RF sensing with adjustable delay or PTT line. Has selectable open/short mute.

MFJ-1707B $129.95.

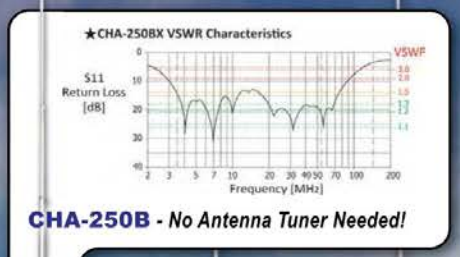
## Auto switch XCVR between 2 antennas

**Automatically** switches separate transmit and receive antennas on transceivers with only one antenna port. *Example:* Efficient 75M dipole for XMIT and low noise MFJ loop for receive -- *no static crashes!*


**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.

# COMET® Life is a JOURNEY. Enjoy the ride!




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




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


# 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 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

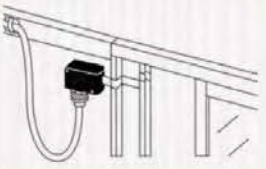
**❸ COMET GP-6 DUAL-BAND 146/446MHZ BASE REPEATER ANTENNA**
Wavelength: 146MHz 5/8 wave x 2 • 446MHz 5/8 wave x 5 • Max Pwr: 200W • Length: 10'2"• Weight: 3lbs. 8ozs. • Conn: Gold-plated SO-239 • Construction: Fiberglass, 2 Sections

**❹ 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

**❺ 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

**❻ 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

**❼ COMET CTC-50M WINDOW GAP JUMPER**
Avoid drilling holes or leaving windows open/unlocked. Flat coax easily forms to window frame. Low loss SO-239 on each end, 15 inch length.
• Max Pwr: **HF** 100W PEP / **VHF** 60W FM / **UHF** 40W FM / **900-1300 MHz** 10W FM



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

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

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

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

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

Shoulder strap included.

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

COMET®

# MFJ-4416C *Super* Battery *Booster*

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

MFJ-4416C **$209.95** **Keeps** your transceiver at full power output, provides full performance, high efficiency, prevents output signal distortion and transceiver shutdown. Compensates for run-down battery, wiring voltage drop or when car is off. Provides up to 25 Amps peak with 90% efficiency. Selectable 9/10/11 Volts minimum input voltage prevents battery damage from over-discharging. RF sense turns MFJ-4416C off during receive to save power, increases efficiency and reduces noise. Adjustable 12 to 13.8 VDC output pass-through improves efficiency and lets transceiver run cooler. Has output over-voltage crowbar protection. *Anderson PowerPoles*(R) and high-current 5-way binding posts for DC input, regulated output. 7¾Wx4Hx2⅛D inches. **MFJ-4416BRC, $99.95.** Booster Remote Control.

### *Super Heavy Duty Battery Booster*

MFJ-4418 **$259.95**

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

### RFI Filter for DC power

MFJ-1142 **$79.95**

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

### Digital Volt/Amp Meter

MFJ-4422 **$59.95**

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

### RFI Ferrite Chokes

MFJ-700A4 **$16.95**

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

### *PowerPole*™ DC Outlet Box

MFJ-1104 **$54.95**

**One** fused 30 Amp input and 25, 10, 5 Amp fused outputs *with Anderson PowerPoles*™. Has open fuse indicator. Sturdy metal construction, 2¾Wx3¼Hx1½D inches.

### MFJ Low Pass Filter

MFJ-704 **$114.95**

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

### Lightning Surge Protector

MFJ-270 **$29.95**

**Protect** your expensive equipment from lightning induced surges on 50 Ohm coax. Use for transceivers up to 400 Watts, 1000 MHz. **MFJ-272, $44.95.** 1.5 kW.

### MFJ 30-Amp Power Supply

MFJ-4230MV **$124.95**

**World's** most compact 30 Amp switching power supply. Switchable Volt/Amp meter. Adjustable 4 to 16 VDC output. Select 120/240 VAC input. 5Wx2½Hx6D in., 3 lbs.

### High-efficiency Loop Tuner

*New!* MFJ-935C **$299.95**

**Instantly** turn wire or coax into a small, high-efficiency multi-banded loop antenna. 150W, 5.3-30 MHz. Tripod/mast mount included. **MFJ-936C, $349.95.** Relative RF antenna current and Cross-needle SWR/Wattmeter. **MFJ-933C, $249.95.** Like MFJ-935C, no meter.

### MFJ Field Strength Meter

MFJ-801 **$44.95**

**Relative** field-strength readings .1-500 MHz. Sensitivity control, 1¾ inch meter. 20-inch telescoping whip. Finger contact increases sensitivity.

### Tuned Indoor Active Antenna

MFJ-1020C **$129.95**

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

### 25-1300 MHz Discone Ant

MFJ-1868 **$84.95**

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

### 17-foot Telescopic Whip

MFJ-1979 **$74.95**

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

### Telescopic Fiberglass Mast

MFJ-1906HD **$259.95**

**Super-strong** heavy-duty mast with *QuickClamps*™. 38 ft. ext., 6 ft. collapsed. 2½" OD bottom, 1" OD top. .125" thick wall. Supports "*real*" weight.

### Giant 2½ inch LED Clock

MFJ-117 **$27.96** New Low Price!

**Giant** 2½ inch super bright LEDs -- see from across the street day or night. 12/24 switch, 110VAC, 9V battery backup.

## MFJ 2-Position *Remote* Antenna Switch

MFJ-4712 **$99.95**

**MFJ** 2-position *remote* antenna switch uses a *single* coaxial feedline to feed two antennas, DC power and control signals. Remotely switch HF and/or VHF antennas. Covers 1.8 MHz to 150 MHz and handles 1500 Watts. Impedance is 50-75 Ohms. Compact 4Wx2⅝Hx1½D". *Outside Switch Box* is fully enclosed and weather protected. Three quality *Teflon*(R) SO-239 connectors for transmitter, antenna one and antenna two. Stainless steel 1½" tall bracket with a U-bolt for masts up to 1½ in. O.D. *Inside biastee* control is 2¼Wx2½Hx1¼ in. Use 12 VDC or 110 VAC with MFJ-1312D, $24.95.

### MFJ Artificial RF Ground

MFJ-931 **$139.95**

**By** tuning out ground wire reactance RF hot spots disappear and your rig is at actual earth ground. Improve signals by resonating a wire into a tuned counterpoise.

**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.

# 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

*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 meets Tue on 7.185 & Thur on 14.316 @ 12:30 ET. Daily Meeting on QSO NET on 21.350 @ 11:30 Eastern Time. More info please visit HAAM Group website www.qsl.net/haam.

## Property/Vacation/Rentals

**A CARIBBEAN SAINT KITTS "V4" DX RENTAL.** See V47JA on QRZ.com and email: W5JON@sbcglobal.net for Ham Discount information. John W5JON/V47JA

**A DX Apartment** available in VP9 with rigs and antennas. Email: ed@vp9ge.com for details.

Beautiful outdoor Idaho! Spacious low populated areas. Abundant recreation opportunities. Moderate four-season climate. Thinking of buying or selling? Contact Ron Bishop, W7IM, Keller Williams Realty Boise. 208-870-6075. Ron@BoiseBargains.com

CAPE COD real estate for hams, buy or sell, John Strome, KC1MLR, ColdwellBanker associate, john.strome@nemoves.com, 508-527-0499

COLORADO CHALET with ham gear for weekly rental, www.lostcreekcabin.com. WØLSD, Buena Vista, CO.

Ham Home in Colorado (Elbert County) 5 acres, five towers. w6oal@aol.com for details

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

**MAINE** year round Ham Station. www.CottagebytheDam.com

NE Kansas 160 acres w/80 mature timber. 7 towers including 200 ft self-support. Towers: 200, 150, 4-90, 40 triband on 90. GMRS Repeater. Prime trophy deer location with over 3100 sq ft 3-bedroom house plus attached double garage. Outbuildings. House designed to utilize solar. Own water. 2 KW solar. In ground 36 x 16 pool. Hi-speed internet. 5 ea PTZ Hi res network cameras one at 140 ft. See Google Earth. Pictures upon request. 7922 E 197th St, Quenemo KS 66528, 785-665-7795 W0TI

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

www.peidxlodge.com

## Antique/Vintage/Classic

6 Meter legacy by K6EDX K6MIO. www.bobcooper.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

**Awesome Technology & Stem Museum - www.cyberengineer.info**

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 Radio Active Patches** Deputypatch.com

**CALLSIGN PLAQUES** www.HamPlaques.com

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.

## 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

#1 Amateur website for useful links and downloadable information: www.kb9at.com

Amateur and High-End Audio Equipment Repair/Test/Calibration. Charles, AJ4UY - email: seecumulus@gmail.com (SMT PCB Repair Available)

**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

**Custom LED Call Signs. www.ledboothsign.com 408-315-4573 Phone**

"Flaunt your call! www.**HAMFLAGS**.com"

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:** The highest-class Telecommunications Certification! Fast, inexpensive, Guaranteed Home-Study. Command Productions. **www.LicenseTraining.com** Free info: (800) 932-4268

**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.COM**. 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**

**LEARN MORSE CODE:** Developed by an expert in memory and cognition. No Gimmicks. **skilman.com**

**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. NW9Alliancellc@gmx.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**

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 450D, DX-10, 817ND, 857D, 897D, 891, 991A, ICOM 7300, 7200, 7000, 706/703 and 9700. W0MSN www.portablezero.com

Universal Aluminum push up towers. Same day shipping. www.antennapartsoutlet.com

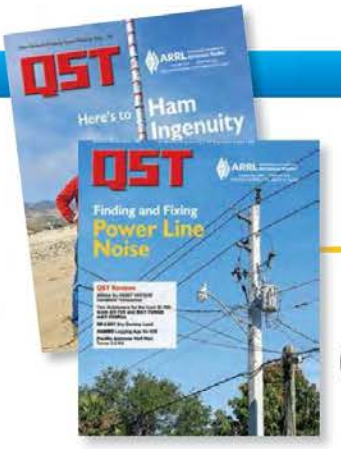
WANTED: Kenwood DK-520 Digital Adapter Kit. b52ewo54@gmail.com or 484.474.2167

**WANTED**: - Auto CR/LF Kit or parts for teletype mode 32 ASR. mkelly917@yahoo.com or 904-288-7024.

**What does the general public know about Amateur Radio?** Not much. **Sidewalk Sale Across America** looks into the world of Harold Harkins, a ham who hopes to keep his day job and help his wife's small business survive Covid-19. Available on Amazon. Peg Nichols, kd0vqo@arrl.net

Xcellent **Amateur** and **Monitor Logging** from **DXtreme!** Click **www.dxtreme.com**

Yaesu FL-7000 HF solid state automatic tuning QSK linear amplifier, with built in power supply. Excellent condition. Includes manual. Contact: suny@roadrunner.com




**Advertising Department Staff:**

Janet Rocco, W1JLR, Advertising Sales Manager
Lisa Tardette, KB1MOI, Account Executive

# QST Index of

**Advanced Specialties** – www.advancedspecialties.net ..... 120
**Alpha Delta Radio Communications, LLC** – www.alphadeltaradio.com .... 125
**Alfa Radio Ltd.** – www.alfaradio.ca ..... 106
**Ameritron** – www.ameritron.com ..... 17
**Arcom Communications** – www.arcomcontrollers.com ..... 100
**Array Solutions** – www.arraysolutions.com ..... 12
**ARRIS** – www.ariss-usa.org/donate ..... 106
**ARRL** – www.arrl.org ..... 25, 100, 104, 108, 110, 118, 120
**bhi Ltd** – www.bhi-ltd.com ..... 108
**Bioenno Power** – www.bioennopower.com ..... 104
**BridgeCom Systems** – www.BridgeComSystems.com ..... Cover III, 22, 23
**California Pheripherals & Components, Inc** – www.CaliforniaPC.com .... 104
**Clear Signal Products, Inc.** – www.coaxman.com ..... 126
**Communication Concepts, Inc.** – www.communication-concepts.com ..... 108
**Cushcraft** – www.cushcraftamateur.com ..... 2
**Diamond Antenna** – www.diamondantenna.net ..... 8
**DMMCheckPlus** – www.DMMCheckPlus.com ..... 104
**Dr.Duino** – www.Dr.Duino.com ..... 6
**Elecraft** – www.elecraft.com ..... 19
**Elk Antennas** – www.ElkAntennas.com ..... 104
**Eton Corporation** – www.etoncorp.com ..... 16A, 16B
**Eventide, Inc** – www.eventidecommunications.com ..... 125
**Expert Linears America, LLC** – www.ExpertLinears.com ..... 106
**FlexRadio Systems** – www.flex-radio.com ..... 26, 27
**Global TSCM Group, Inc.** – www.kn2c.us ..... 104
**HamEstate**– www.hamrestate.com ..... 100
**Ham Ads** – www.arrl.org/ham-ad-listing ..... 124
**Ham Radio Outlet** – www.hamradio.com ..... 98, 99, 112
**Hammond Mfg. Co.** – www.hammondmfg.com ..... 100
**Hy-Gain** – www.hy-gain.com ..... 10, 103
**ICOM America** – www.icomamerica.com ..... 101
**Intuitive Circuits, LLC** – www.icircuits.com ..... 120
**K6IOK** – www.k6iok.com ..... 126
**Kenwood Communications** – www.kenwood.com/usa/ ..... Cover IV, 29
**LDG Electronics** – www.ldgelectronics.com ..... 112

**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

**MFJ Enterprises** – www.mfjenterprises.com ..... 105, 107, 109, 111, 113, 115, 117, 119, 121, 123
**Mosley Electronics –** www.mosley-electronics.com ..... 112
**Motosports of Ukiah** – www.hondashop.com ..... 108
**NCG Company** – www.natcommgroup.com ..... 3, 122
**OCI-Old Communications Inc. -** www.oci.com ..... 127
**Pacific Antenna** – www.qrpkits.com ..... 112
**Palomar Engineers** – www.Palomar-Engineers.com ..... 100
**PreciseRF –** http://preciserf.com ..... 11
**PreppComm** – wwwpreppcomm.com ..... 126
**Quicksilver Radio Products** – www.qsradio.com ..... 114
**Radio Club of JHS 22 NYC** – www.wb2jkj.org ..... 116
**Rig Expert Ukraine, Ltd.** – wwwrigexpert.com ..... 21
**RFC2** – wwwrfc2.com ..... 100
**RF Parts Company** – www.rfparts.com ..... 127
**RT Systems** – www.rtsystems.com ..... 116
**RW Antenna Store –** www.rwantennastore.com ..... 120
**SteppIR Communications Systems –** www.steppir.com ..... 7
**Tac-Comm** – www.tac-comm.com ..... 112
**Ten-Ten International Net, Inc.** – www.ten-ten.org ..... 104
**Tigertronics –** www.tigertronics.com ..... 104
**Timewave Technology, Inc. –** www.timewave.com ..... 102
**Unified Microsystem.** – www.unifiedmicrosystems.com ..... 126
**W5SWL Electronics** – www.w5swl.com ..... 120
**Warren Gregoire & Associates –** www.superbheadsets.com ..... 120
**West Mountain Radio –** www.westmountainradio.com ..... 18
**Yaesu USA** – www.yaesu.com ..... Cover II, 1

# The **ARRL** Diamond Club

*Loyal donors are the foundation of ARRL's evolution, providing the means for the organization to carry out our mission of advancing the art, science, and enjoyment of amateur radio.*

Join the Diamond Club today and receive all the benefits of annual ARRL membership, including your choice of print magazine QST or On the Air, along with the satisfaction of knowing your donation provides financial resources where it's needed most to advance ARRL.

Join or Renew with a $375 or more contribution and receive a limited-edition First-Day Cover display with an original Amateur Radio stamp and new Diamond Club Challenge Coin.

This replica display of a First Day Cover commemorates and honors the emergency communication efforts of amateur radio operators during the devastating 1964 Alaska earthquake.

New and renewing Diamond Club members contributing $100 or more will receive the new Challenge Coin.



To learn more about Diamond Club and the 2021 Diamond Club Premium, visit **arrl.org/the-arrl-diamond-club**

# The Legend Continues




## The TS-590SG


Back in 1973, Kenwood introduced the first affordable HF radio to the world, the legendary TS-520... 27 years later, the TS-570D and the TS-570S with 6 meters were by far the most popular HF and HF+6 transceivers on the market.

Be witness to the evolution of KENWOOD's pride and joy - the TS-590S HF transceiver - pushing performance and technology to its utmost limit, with the receiver configured to capitalize on roofing filter performance and IF AGC controlled through advanced DSP technology. Enter the TS-590SG. A new generation of high performance transceiver, with the type of high level response to meet DX'ers needs.

Don't be fooled by big boxes, high price tags, complex operation and broken promises. As Kenwood continues to build outstanding products with unparalleled performance and great value, it's no surprise Kenwood is rated as one of the leading choices for HF radios.

*It's not too late to own an HF legend because we still build them today.*

KENWOOD

**Customer Support:** (310) 639-4200
Fax: (310) 537-8235

www.kenwood.com/usa

ISO9001 Registered

ADS#36419