

Special Insert! Resources, Ideas, and Tips for Contest Season 2021 – 2022

QST



DIGITAL EDITION



ARRL The National Association for
Amateur Radio®

November 2021 www.arrl.org

DEVOTED ENTIRELY TO AMATEUR RADIO

Achieve Your Goals!

QST Reviews

QRP Labs QCX-mini
CW Transceiver Kit

SOTABEAMS External
DSP Audio Filter

RigExpert Stick Pro
0.1 – 600 MHz Antenna
and Cable Analyzer

Digirig Mobile Digital
Mode Interface



NEW DEFINITION OF DIGITAL HANDHELD

Meet the Advanced Technologies



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

FT5DR

C4FM
DIGITAL CLEAR VOICE
Clear and Crisp Voice Technology

AMS
Automatic Mode Select

66 db DPS

WIRES-X

Touch & Go
OPERATION

microSD
Card

Bluetooth

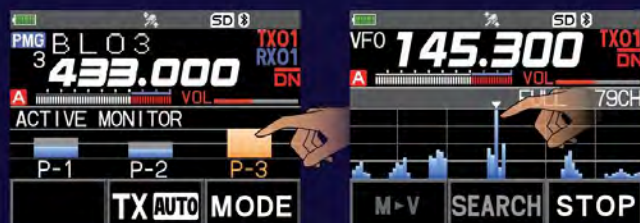
- ◆ Advanced C4FM Digital / 1W Audio Output
- ◆ Robust Tough Body with Rubber Protection
- ◆ Worldwide WIRES-X Internet Communications
- ◆ Fully Compatible with APRS
- ◆ Memory Auto Grouping (MAG) / VFO Band Skip Function

《 Actual Size 》

Primary Memory Group 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>

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

C4FM/FM 144/430MHz Dual Band Mobile

High Visibility and Resolution QVGA Display with Exceptional Operability
Real Dual Band Operation V+V/U+U/V+U/U+V & Simultaneous C4FM Monitoring

FM Friendly Digital : AMS (Automatic Mode Select)

System Fusion II Compatible

WIRES-X Portable Digital Node Function

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

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

FTM-300DR



Bluetooth

AMS
Automatic Mode Select

microSD
Card



C4FM
Dual Conversion
Clear and Crisp Voice Technology

WIRES-X

YAESU
The radio

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

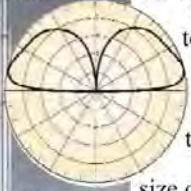
For the latest Yaesu news, visit us on the Internet: <http://www.yaesu.com>

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

New! Cushcraft R9 . . . 80-6 Meters MA-5B 5-Band Beam

R-9
\$719⁹⁵
80-6 Meters

R-8
\$619⁹⁵
40-6 Meters



Omnidirectional
low angle radiation
gives incredible
worldwide DX.

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

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

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

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

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

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

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

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

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

R8, \$619.95. Like R9 antenna but less 75/80 Meters.

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

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



MA-5B
\$599⁹⁵

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

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

Matching Network

Matching
Broadband matching transformer keeps VSWR low.

Coaxial balun keeps RF off exterior of your coax.

All Stainless Steel Hardware

Moisture Release vent

RF Choke
DC grounds radiator to prevent static electricity from entering your shack.

High strength, high power, low dielectric PC board material

SO-239 Feedpoint

Super Rugged Design

Stainless steel machine screws guarantee base integrity.

Dual plate mount makes it easy to install counterpoises.

Heavy duty stainless steel/aluminum interface plate mount keeps your antenna up for years to come.

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!

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.

A270-10S
\$219⁹⁵

A270-6S
\$179⁹⁵



A-4S
\$779⁹⁵



A-3S
\$669⁹⁵

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 Famous Ringos Compact FM Verticals

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

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

AR-2 \$99⁹⁵ **AR-6** \$149⁹⁵ **AR-10** \$159⁹⁵

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>

Prices/specifications subject to change without notice/obligation. © Cushcraft®, 2021.

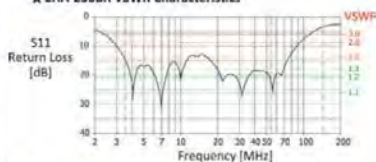
Cushcraft . . . Keeping you in touch around the globe!

Visit www.cushcraftamateur.com

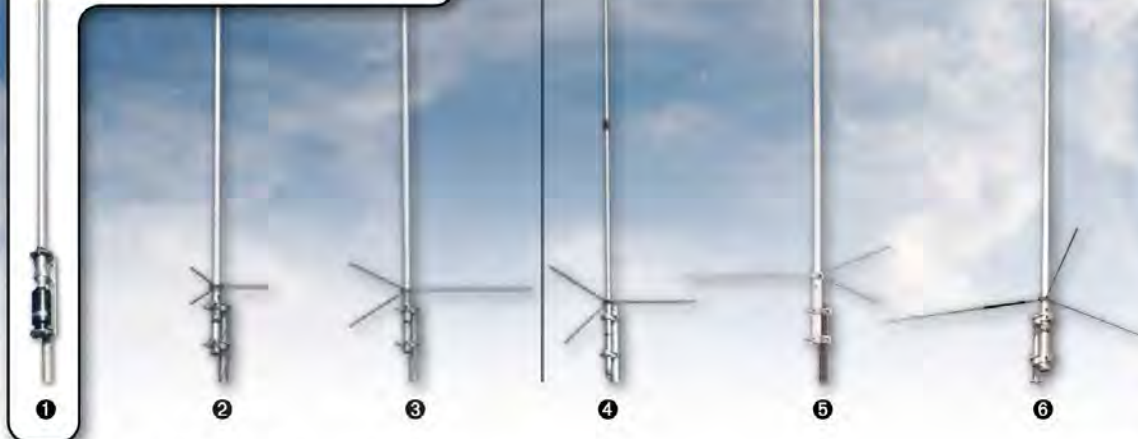


**Life is a JOURNEY.
Enjoy the ride!**

★CHA-250BX VSWR Characteristics



CHA-250B - No Antenna Tuner Needed!



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



Base Antennas

1 C★MET, 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

2 C★MET, 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

3 C★MET, GP-6 DUAL-BAND 146/446MHZ BASE REPEATER ANTENNA

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

4 C★MET, GP-9 / GP-9N DUAL-BAND 146/446MHZ BASE REPEATER ANTENNA

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

5 C★MET, CX-333 TRI-BAND 146/220/446MHZ BASE REPEATER ANTENNA

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

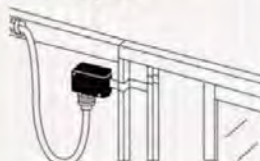
6 C★MET, GP-15 TRI-BAND 52/146/446MHZ BASE REPEATER ANTENNA

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

7 C★MET, 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



David A. Minster, NA2AA
Publisher

Becky R. Schoenfeld, W1BXY
Editorial Director

Jen Glifort, KC1KNL
Senior Editor

Caroline Kenney
Leanna Figlewski
Assistant Editors

Bart Jahnke, W9JJ
Radiosport & Regulatory
Information Manager

Rick Lindquist, WW1ME
Happenings

Paul Cianciolo, W1VLF
Product Review Lab Testing

Steve Ford, WB8IMY
Mark J. Wilson, K1RO
Al Brogdon, W1AB
Bernie McClenny, W3UR
H. Ward Silver, N0AX
Dave Casler, KE0OG
Paul Wade, W1GHZ
Jon Jones, N0JK
Rick Palm, K1CE
Joel R. Hallas, W1ZR
Barry Shackelford, W6YE
Kai Siwiak, KE4PT
Bruce Draper, AA5B
Phil Salas, AD5X
John Stanley, K4ERO
Contributing Editors

Michelle Bloom, WB1ENT
Production Supervisor

Jodi Morin, KA1JPA
Assistant Production Supervisor

Maty Weinberg, KB1EIB
Production Coordinator

David Pingree, N1NAS
Senior Technical Illustrator

Janet Rocco, W1JLR
Advertising Sales Manager

Bob Inderbitzen, NQ1R
Product Development Manager

Yvette Vinci, KC1AIM
Marketing and Sales Manager

Steve Ewald, WV1X
Field Organization Supervisor

9 Second Century

Fall Into Contesting!

30 The CW Game

Robert Anding, AA50Y

33 An Optimized Inverted L for 160 & 80 Meters

George Cooley, NG7A

36 Product Review

Mark Wilson, K1RO

QRP Labs QCX-mini CW Transceiver
Kit; SOTABEAMS External DSP
Audio Filter; RigExpert Stick Pro
0.1 – 600 MHz Antenna and Cable
Analyzer; Digirig Mobile Digital
Mode Interface



53 The First Activation of Antsell Rock

David Wise, KM3A

55 The Beverage Antenna, 100 Years Later

Ward Silver, N0AX, and Frank Donovan, W3LPL

58 ARRL Board Returns to In-Person Meeting for Second 2021 Session

★64A Special Insert! Contest Season 2021 – 2022

80 Frequency Measuring Test — November 2021

Ward Silver, N0AX

81 The 2021 ARRL 160-Meter Contest

81 The 2021 ARRL 10-Meter Contest

82 The December 2021 ARRL Rookie Roundup — CW

89 A Look Back: January 1972

★
64A



Columns

Ask Dave	48
At the Foundation	82
Celebrating Our Legacy	93
Classic Radio	94
Contest Corral	79
Correspondence	24
Eclectic Technology	52
Happenings	61
Hints & Hacks	50
How's DX?	84
Member Spotlight	13
Public Service	77
Up Front	20
The World Above 50 MHz	86
100, 50, and 25 Years Ago	96

Departments

ARRL Section Managers	16
Certificate of Code	
Proficiency Recipients	64
Convention and Hamfest Calendar	88
Feedback	78
Field Organization Reports	78
Guide to ARRL Member Benefits	14
Ham Ads	124
Index of Advertisers	126, 127
Officers, Division Directors, and Staff	15
QST Cover Plaque Award	47
Silent Keys	97
Special Event Stations	83
Strays	35
Volunteer Monitor Program Report	88
W1AW Qualifying Runs	64
W1AW Schedule	28



Our Cover

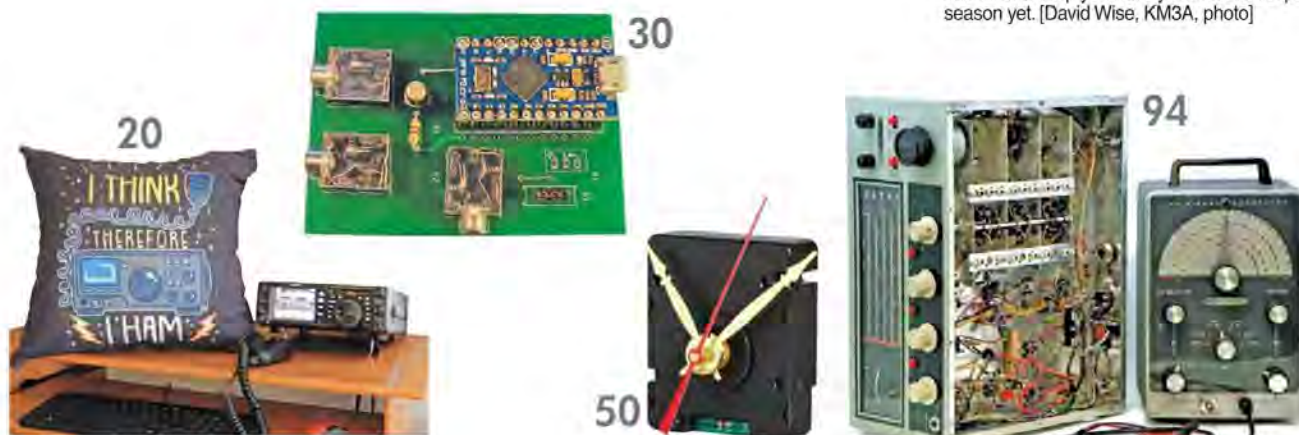
Ham radio's many sub-hobbies offer endless ways to challenge yourself. In this month's cover story, "The First Activation of Antsell Rock," David Wise, KM3A, details his progression from a beginner Summits on the Air (SOTA) aficionado to becoming the first ham (along with Scott Lindquist, N00I, who's pictured on the cover) to activate Antsell Rock, in the San Jacinto Wilderness. Find further tools and inspiration for goal-setting in Robert Anding's, AA5OY, article "The CW Game," which offers a way to hone your Morse code skills, and don't miss this issue's special insert, "Contest Season 2021 – 2022," which is full of resources and hints to help you have your best radiosport season yet. [David Wise, KM3A, photo]

Digital and Mobile Editions

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

Write for QST

www.arri.org/qst-author-guide
email: qst@arri.org



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.

Copyright © 2021 by the American Radio Relay League Inc. Title registered at the US Patent Office. International copyright secured. All rights reserved. Quedan reservados todos los derechos. Printed in the USA.

QST®, DXCC®, VUCC®, DX Century Club®, ARES®, Amateur Radio Emergency Service®, Logbook of The World®, LoTW®, and ARRL, The National Association for Amateur Radio® are registered trademarks of the American Radio Relay League, Inc.

ARRL and QST in no way warrant the products described or reviewed herein.

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@arri.org or 860-594-0200 immediately. Thank you for your assistance.

Reprints and permissions: permission@arri.org

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

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

DIY Electronic Kits Changed My Life -- Now Arduino Kits Can Change Yours Too!

By: Steve Buffa (5 Minute Read)



When I was young, my family would gather for Sunday dinners at my grandmother's house. My uncle, who lived with my grandmother, had what he called his "Shack" in the backyard. Every evening after dinner he would leave the room saying, "Time to hit the shack". One night I asked, "What's in the shack?" What he did next changed my life forever!

"Instead of telling you, why don't I show you?" he said. As he opened the door to the shack, I remember the smell of solder in the air and being in awe of all of the electronic equipment everywhere. There were microphones, receivers, transmitters, tubes, resistors, capacitors, and inductors -- it was like a candy store for electronics lovers.

I was immediately drawn to one piece of equipment which looked half assembled. My uncle told me that this was a radio receiver that he'd purchased as a kit and was in the middle of putting it together.

As he flicked on his soldering iron, he said that he had purchased prebuilt units before but, when something failed, he had no idea how to repair it. He said that by purchasing kits, he'd learned how they worked from the inside out. That was a turning point in my life! I spent the next few years assembling kits with my uncle, which eventually led me to a successful career as an electronics technician.

After I retired, I wanted to start learning how to add electronic control systems to my own shack -- things like a CW keyer or an automatic antenna switch -- but I had no idea how to do it. My friend Tom from my local ham meetup told me that I could do all of this and more with something called Arduino. This is a really simple micro-controller development platform that you can customize and program to make it do whatever you want. I looked around to find a good place to start, but I was inundated with all of the different vendor and kits. Where do I begin?

Luckily, I keep all my past issues of QST magazine and happened to see a review of a product called the Dr.Duino Explorer which is an Arduino compatible kit.



After reading this review, I knew that this was exactly what I was looking for. It comes as a DIY style kit accompanied by a superb set of step-by-step online instructions that teach you about the Arduino as you build it. PLUS, for a limited time, when you order your own Explorer Edition from www.DoctorDuino.com, you'll even get access to an Arduino Boot Camp for FREE! This is a mini course that starts by teaching you what you can and can't do with Arduino, and ends with you creating your very own Morse code machine! I'd hurry though, because it looks like this is only available to the first 200 takers!

SteppIR Heavy Hitters

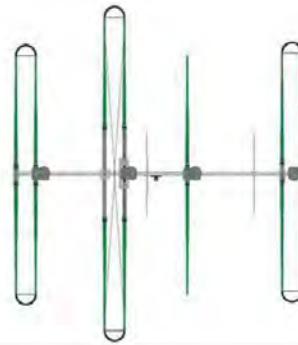
DB18E YAGI

2 elements 40m
3 elements 30m-10m
4 elements 6m



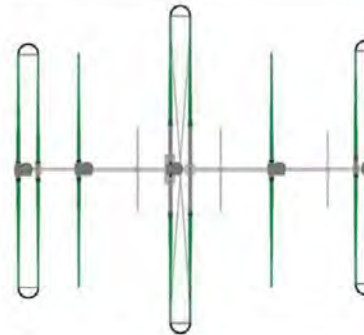
DB36 YAGI

Dipole 80m, 3 elements 40m/30m
4 elements 20m-10m, 6 elements 6m



DB42 YAGI

Dipole 80m, 3 elements 40m/30m
5 elements 20m-10m, 8 elements 6m



UrbanBeam

SPACE SAVING DESIGN
Dipole 40m/30m, 2 elements 20m-6m



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!

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

X700HNA Special Features:

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

The Standard By Which All Others Are Judged

NR770H Series

SG7900A

X30A / X50A

X700HNA



**RF PARTS™
COMPANY**

Diamond Antenna is a division of RF Parts Company



Second Century

Fall Into Contesting!

Autumn is my favorite season. It has always felt like renewal, new beginnings. And nothing makes that truer for me than the arrival of contest season. I've been contesting since I was a teenager. It was quite accidental that I met contesting. I was a new ham, with no experience whatsoever, trying to achieve Worked All States. I got on one weekend, and WOW! The bands were on fire. Stations everywhere, from everywhere. My states count looked like it would skyrocket, but what in the world were these ops sending to each other? 123 B WB2AAA 65 WNY? Well, of course, it was ARRL Sweepstakes. A call to a friend provided what I needed to know — before he slammed the phone down to get back to the contest.

And so began my love affair with contesting. Much of what I have learned about ham radio has come through the reading and operating associated with DX contests. I have been a longtime subscriber to ARRL's *National Contest Journal*, where many secrets of the "Big Guns" are shared, such as this simple one: "If you can't hear it, you can't work it." Makes perfect sense, so you'll see over the years many contesters make an effort to get just a few more dB of SNR to hear stations that are just below the noise, principally through advances in receiving antennas.

My call sign comes from a friendship and mentorship I enjoyed from contesting. Gene Walsh, N2AA, had a huge impact on me in my late teens and early 20s. He was a remarkably skilled and competitive operator. Most importantly, he had space in his life to give me pointers and advice. I met Gene as part of the Tuxedo Park contest station owned and operated by Hazard "Buzz" Reeves, K2GL. When my friend Doug, KR2Q, took me to the station as a teenager, he said, "After today, you will never look at ham radio the same way again." He was so right! It was there I fell in love with the style of contesting I still focus on today: multioperator.

I have had the opportunity to participate in multioperator events during myriad contests on HF and VHF from N2AA (@K2GL), N2RM, WA2SNA, NW2D, K2BAR, V26B, and most recently — and my favorite of all — PJ4G. I have met many people, and learned everything that I know today by partnering with these teams. I've worked stations using long path, skewed path, aurora, and even EME! Through incremental improvement to the stations and the operators, we were able to be constantly improving our capabilities.

This month in *QST*, we celebrate the beginning of contest season with our Contesting Supplement. We have partnered with the best contesters from some of the best contest clubs to bring you their advice: their learning and secrets to success. As you read through this section, the advice may seem too advanced, or may not even make sense. That's fine! Don't let that discourage you.

Make an upcoming contest experience your own. Set a simple goal, perhaps 50 or 100 contacts. Don't let the craziness of the beginning of a contest dissuade you. Come back later as things start to calm down. During DX contests, the last 8 hours are an easier time for getting on and operating. If you're working on WAS or DXCC, make a list of what you really want to work — and work it! Use dxwatch.com or a similar website for showing who is on, and from where. And don't be afraid to work QRP in a contest. I have done it, and even earned a plaque for one of my efforts! I only made 200 or so contacts over the entire weekend, but for QRP, it turned out to be a winning effort. Who knew?

So, fall into contesting. Give it a try if you haven't. And if you have, come back and enjoy operating. Yes, I know there are people who get upset when a contest interrupts their weekend plans for a net or a desire to DX, and the bands are a mess, or dead because "everyone" is using a different mode. This is where some patience and forbearance go a long way. Every contact counts. Every contact helps. Jump on and make even a few contacts to help the ops, the teams, who work all year for those precious few hours to compete with their fine-tuned stations. They're looking for you!

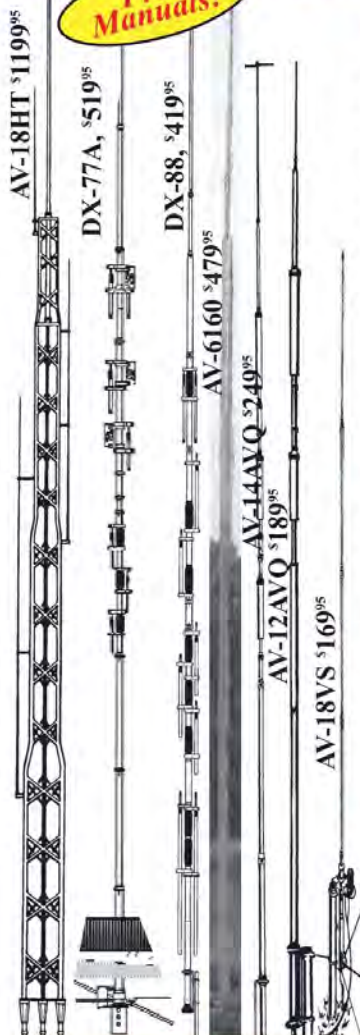
I have made lifelong friends through contesting. You'd be surprised how inclusive the community can be. So be *contest* active! Be a connector and get your friends or club to set some simple goals and get radio active — maybe even set up a little challenge between friends. With these being the early years of Cycle 25, the bands are only getting better.

David A. Minster, NA2AA
Chief Executive Officer

hy-gain[®] HF VERTICALS

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

Free Manuals!



hy-gain^(R) Classics

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

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

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

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

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

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

Two year limited warranty.

AV-18HT, \$1199.95. (10,12,15,20,40,80 M, 160, 17 Meters optional). 53 ft., 114 lbs.

Standing 53 feet tall, the famous Hy-Gain HyTower is the world's best performing vertical! The AV-18HT features automatic band selection achieved through a unique stub-decoupling system which effectively isolates various sections of the antenna so that an electrical 1/4 wavelength (or odd multiple of a 1/4 wavelength) exists on all bands. Approximately 250 kHz bandwidth at 2:1 VSWR on 80 Meters. The addition of a base loading coil (LC-160Q, \$169.95), provides exceptional 160 Meter performance. **MK-17, \$139.95.** Add-on 17M kit. 24 foot tower is all rugged, hot-dip galvanized steel and all hardware is iridized for corrosion resistance. Special tilt-over hinged base for easy raising & lowering.

AV-18VS, \$169.95 (10,12,15,17,20,30,40,80 Meters). 18 ft., 4 lbs. High quality construction and low cost make the AV-18VS an exceptional value. Easily tuned to any band by adjusting feed point at the base loading coil. Roof mount with Hy-Gain AV-14RMQ kit, \$139.95.

AV-14AVQ, \$249.95. (10,15,20,40 Meters). 18 ft., 9 lbs. The Hy-Gain AV-14AVQ uses the same trap design as the famous Hy-Gain Thunderbird beams. Three separate air dielectric Hy-Q traps with oversize coils give superb stability and 1/4 wave resonance on all bands. Roof mount with AV-14RMQ kit, \$139.95.

AV-12AVQ, \$189.95. (10, 15, 20 Meters). 13 ft., 9 lbs. AV-12AVQ also uses Thunderbird beam design air dielectric traps for extremely Hy-Q performance. Inexpensive tri-band performance in limited space. Roof mount with AV-14RMQ kit, \$139.95.

AV-6160, \$479.95. (6, 10, 12, 15, 17, 20, 30, 40, 80, 160 Meters). 43 ft., 20 lbs. Self-supporting 43 foot vertical assemblies in less than an hour and its low profile blends in with the sky and trees -- you'll barely see it . . .

Entire length radiates to provide exceptional low angle radiation 160-20 Meters and very good performance on 17-6 Meters. A wide range automatic or manual antenna tuner at your rig easily matches this antenna for all bands. No physical adjustments. Includes ATB-65 base mount. Optimized balun design allows direct coax feed with negligible coax loss. AV-6110, \$369.95. Option: 1.5 kW 80/160 Meters high efficiency matching network.

DX-88, \$419.95. (10, 12, 15, 17, 20, 30, 40 Meters, 160 Meters optional). 25 ft., 18 lbs.

All bands are easily tuned with the DX-88's exclusive adjustable capacitors. 80 and 40 Meters can even be tuned from the ground without having to lower the antenna. Super heavy-duty construction. DX-88 OPTIONS: 160 Meter add-on kit, KIT-160-88, \$199.95. Ground Radial System, GRK-88, \$99.95. Roof Radial System, RRR-88, \$99.95.

DX-77A, \$519.95. (10, 12, 15, 17, 20, 30, 40 Meters). 29 ft., 25 lbs.

No ground radials required! Off-center-fed Windom has 55% greater bandwidth than competitive verticals. Heavy-duty tiltable base. Each band independently tunable.

80-6 Meters

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

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

Highly Efficient

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

Each band individually tunable

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

Sleek and low-profile

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

Built-to-last

High wind survival of 65 mph. Broadband matching unit made from all Teflon[®] insulated wire. Aircraft quality aluminum tubing, stainless steel hardware.

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

hy-gain[®] warranty

Two year limited warranty. All replacement parts in stock.

AV-640, \$519.95. 8 bands: 40, 30, 20, 17, 15, 12, 10, 6 Meters. 25.5 ft., 17.5 lbs.

AV-620, \$419.95. 6 bands: 20, 17, 15, 12, 10, 6 Meters. 22.5 ft., 10.5 lbs.



Free Hy-Gain Catalog

and Nearest Dealer . . . 800-973-6572

Call your dealer for your best price!

hy-gain[®]

Antennas, Rotators & Towers

308 Industrial Park Road, Starkville, MS 39759 USA

Toll-free Customer Sales Hotline: 800-973-6572

• TECH: 662-323-9538 • FAX: 662-323-6551

<http://www.hy-gain.com>

Prices and specifications subject to change without notice or obligation. © Hy-Gain[®], 2021.

From QRP to QRO

Get the Magnetic Loop You Really Want!



HG3 PRO

- 100W PEP
- Air Variable Cap
- 7K Step Resolution
- Auto assist tuning
- 40m-10m standard
- 80/60m resonator



HG3 QRO

- 1.5 KW PEP
- High Q Vacuum Cap
- 45K Step Resolution
- Auto assist tuning
- 40m-10m standard
- 80m-30m add-on loop

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.

Unrivalled 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 3.5-30 MHz with stepper motor precision and resolution. *RapidTune* automatically scans each band for the lowest SWR and works with most HF radios.



For the latest features, prices and new 80m-30m capability, check preciserf.com

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

Array Solutions

Your Source for Outstanding Radio Products



Professional Grade Equipment from Array Solutions

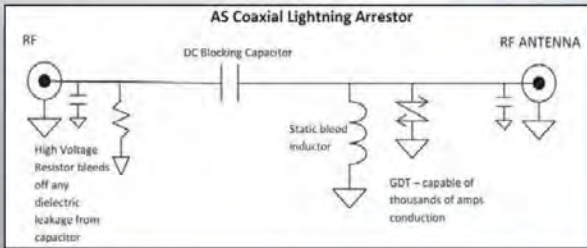
Array Solutions Lightning Arrestors Coaxial, Ladder Line, Single wire, Control Line protection for Rotators, Switches, and Antenna Motors

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



OM Power Amplifiers Sales and Service



OM Power Amplifiers.
The New RF Power
Benchmark!

Switches for Six Antennas



5kW - DC to 6m

RATPAK - 1x6

Choice of Multiple Controllers

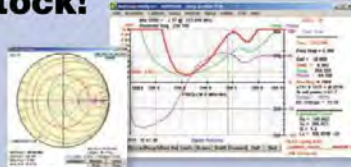
SIXPAK - 2x6



VNAuhf Back in Stock!

Vector Network Analyzer

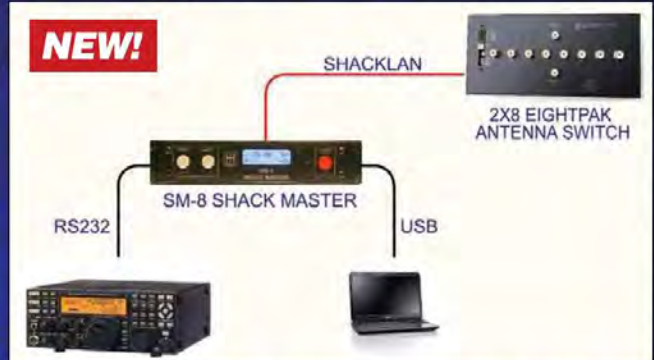
5 kHz - 1.3 GHz \$1295



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



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.arrayolutions.com

Check our Website for more new products!



2611 North Beltline Rd., Suite 109
Sunnyvale, Texas 75182 USA
sales@arrayolutions.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.

Member Spotlight

Matt Makaveli, KY4GPD

General-class licensee Matt Makaveli, KY4GPD, of Georgetown, Kentucky, has some unique ham radio bragging rights: he designed Kentucky's ham radio license plate. The process began a few years ago on a whim, when Matt decided to send then-Kentucky Lieutenant Governor Jenean Hampton, K5EIB (who served from 2015 – 2019), a ham radio license plate design.

"I figured who better to understand...a license plate designed by a ham radio operator for ham radio operators?" Matt said. He modified an existing Kentucky ham radio plate to include an antenna, and sent it to Hampton, who expressed interest, as did Kentucky Section Manager Steve Morgan, W4NHO. The idea for the plate circulated briefly, then fell by the wayside until a few years later, when the state moved from a stamped plate to a printed plate — and was looking to refresh the design of the ham radio plate.

May the Best Design Win

Kentucky State Trooper Jack Hedges, KY4TPR, started a contest of sorts. He invited local hams to submit designs, which would be made public so hams could vote on them. Jack would then present the winning design at a Kentucky Transportation Cabinet (KYTC) meeting to see if it might meet with state approval.

Five designs were submitted to Jack's contest, and several hundred people voted. When all was



said and done, Matt's design received 41% of the votes — much to his own surprise. "I thought I was gonna get clobbered," he said. "Some of the other designs were really nice."

True to his word, Jack, who is also the ARRL Kentucky Section State Government Liaison, brought Matt's



A mock-up of Matt's, KY4GPD, license plate design.

design before the KYTC, who turned out to be interested. They asked for a few changes to the design, which Jack helped Matt implement over the course of a couple of months of discussion with the KYTC. "He made my design idea better," Matt said.

Ultimately, the design was finalized and went into production. The plate started being spotted on the streets in the spring of 2021. Matt is eager to get one for his own vehicle, which he says he'll do when his current plate expires.

A Community Focus

In the meantime, Matt keeps busy as a certified SKYWARN storm spotter, an Assistant Emergency Coordinator for Scott County, and net control for an ARES 2-meter net every Tuesday night. He's dabbled in FT8 at a friend's station, and his personal ham radio goal these days is to get set up to run it at home.

He's also the secretary of the Scott County Amateur Radio Emergency Services Club. "We're growing," Matt says of the club, who welcomed a brand-new ham to their ARRL Field Day operation earlier this year. "We have about 25 members, and we're growing, slowly but surely."

The club also engages in outreach activities, such as programming storm radios for the local community — a community where Matt's license plate is increasingly being seen.

Guide to Member Benefits



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/arri-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.

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.

Join or Renew

www.arrl.org/join

Donate

www.arrl.org/donate

Benefits

www.arrl.org/benefits

Shop

www.arrl.org/shop

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](https://www.facebook.com/ARRL.org)

Twitter: [@arrl](https://twitter.com/arrl), [@w1aw](https://twitter.com/w1aw), [@arrl_ares](https://twitter.com/arrl_ares)

Instagram and Instagram TV: [@arrlhq](https://www.instagram.com/arrlhq)

YouTube: **ARRLHQ**

LinkedIn: <https://www.linkedin.com/company/american-radio-relay-league/>

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 Vallo, 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

Member Services Manager
Yvette Vinci, KC1AIM

Publications & Editorial Manager
Becky R. Schoenfeld, W1BXY

Advertising Sales Manager
Janet Rocco, W1JLR

VEC Manager
Maria Somma, AB1FM

Education and Learning Manager
Steve Goodgame, K5ATA

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, AC0W
2013 6th Ave. SE, Austin, MN 55912
507-433-5835; ac0w@arrl.org

Vice Director: Lynn Nelson, W0ND
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 Jiram, 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, K0AIZ
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

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, K0RM
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

westgulfddivision.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

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.

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, KA3JUU, 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 618-534-0282; 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, AE0EE, 2120 Aldrich Ave. S., Apt. 208, Minneapolis, MN 55405 510-529-5658; ae0ee@arrl.org
North Dakota: Richard Budd, W0TF, 4951 64th St. NE, York, ND 58386-9304 701-466-2028; w0tf@arrl.org
South Dakota: Chris Stallkamp, KI0D, 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, W2KFF, 38 Appletree Ln., Carle Place, NY 11514-1336 516-315-8608; w2kff@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, WA0UIG, 145 Front St., Robins, IA 52328-9718 319-213-3539; wa0uig@arrl.org
Kansas: Ronald D. Cowan, KB0DTI, P.O. Box 36, LaCygne, KS 66040 913-757-3758; kb0dti@arrl.org
Missouri: Cecil Higgins, AC0HA, 27995 County Rd. 220, Hermitage, MO 65668-8493 417-399-5027; ac0ha@arrl.org
Nebraska: Matthew N. Anderson, KA0BOJ, 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, AH0A, 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; kh6gjb@arrl.org
San Joaquin Valley: John Litz, N26Q, 1434 Douglas Rd., Stockton, CA 95207-3536 209-331-3078; n26q@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, N0ESQ, 300 Plaza Dr., Suite 200, Highlands Ranch, CO 80129 720-592-0394; n0esq@arrl.org
New Mexico: Bill Mader, K8TE, 4701 Somberele 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, 240 W. Railroad Ave., Green River, WY 82935 307-707-4010; n1tek@arrl.org

Southeastern Division AL, GA, NFL, PR, SFL, VI, WCF

Alabama: J'Vann 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, A6DF, P.O. Box 4678, Palos Verdes Peninsula, CA 90274-9618 310-544-2917; a6ddf@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; n5hzz@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

Pull Out the Muscle!



Hear the roar and feel the **POWER!** Get that **POWER** you need to really bust through the pileups, win a few contests, work the world!!! Ameritron amplifiers will go a long way towards making those dreams a reality. We got an amplifier for every budget!

AMERITRON . . . 800 Watts . . . \$1299!

More hams use Ameritron AL-811/H amplifiers than any other amplifier in the world!



AL-811H
\$1299
Suggested Retail
4-Tubes, 800 Watts

AL-811
\$1199
Suggested Retail
3-Tubes, 600 Watts

Only the Ameritron AL-811H gives you four fully neutralized 811A transmitting tubes. You get absolute stability and superb performance on higher bands

that can't be matched by un-neutralized tubes.

You get a quiet desktop linear that's so compact it'll slide right into your operating position -- you'll hardly know it's there . . . until QRM sets in. And you can conveniently plug it into your nearest 120 VAC outlet -- no special wiring needed.

You get all HF band coverage (with license) -- including WARC and most MARS bands at 100% rated output. Ameritron's Adapt-A-Volt™ hi-silicon core

power transformer has a special buck-boost winding that lets you compensate for high/low power line voltages.

You also get efficient full size heavy duty tank coils, slug tuned input coils, operate/standby switch, transmit LED, ALC, dual illuminated meters, QSK with optional QSK-5, pressurized cooling that you can hardly hear, full height computer grade filter capacitors and more. 13 3/4 Wx8 Hx16 D inches.

AL-811, \$1199.

Like AL-811H, but has three 811A tubes, 600 Watts output.

AMERITRON no tune Solid State Amplifiers

ALS-500M 500 Watt Mobile Amp



ALS-500M 500 W
\$1099
Suggested Retail PEP/ 400 W CW out-

put, 1.5-22 MHz, instant bandswitching, no tuning, no warm-up. SWR, load fault, thermal overload protected. On/Off/Bypass switch. Remote on/off control. DC current meter. Extremely quiet fan. 13.8 VDC. 9Wx3 1/2 Hx15 D in., 7 lbs. **ALS-500RC, \$49**, Remote Head.

Desktop Kilowatt Amplifier



AL-80B
\$1999
Suggested Retail
Whisper quiet desktop amp plugs into 120 VAC to give full kilowatt SSB PEP output. Ameritron's exclusive DynamicALC™ doubles average SSB power out and Instantaneous RF Bias™ gives cooler operation. All HF bands. 850 Watts CW out, 500 Watts RTTY out, extra heavy duty power supply, 3-500G tube, 70% efficiency, tuned input, Pi/Pi-L output, inrush current protection, dual Cross-Needle meters, QSK compatible, 48 lbs. 14Wx8 1/2 Hx15 1/2 D", 2-year Ameritron warranty.

Near Legal Limit™ Amplifier



AL-572
\$2199
Suggested Retail
Near Legal Limit™ amp gives you 1300W PEP SSB power output for 60% of the price of a full legal limit amp! Four rugged 572B tubes. Instant 3-second warm-up, 120 VAC. Desktop 14 1/2 Wx8 1/2 Hx15 1/2 D". 160-15M. 1000 Watt CW output. Tuned input, instantaneous RF Bias, dynamic ALC, parasitic killer, inrush protection, cross-needle meters, multi-voltage transformer.

ALS-606S 600 Watt 160-6M Amp

600 Watts PEP/ 500W CW output, 160-6M with automatic instant band-switching. Desktop. 9 1/2 Wx7 Hx14 1/2 D". 14.2 lbs. Only 4 dB below 1500W -- less than an S-unit!

ALS-606S
\$2199
Suggested Retail



ALS-606, \$2399, like ALS-606S above, but has transformer power supply.

ALS-1306 1200W 1.5-54 MHz Amp



ALS-1306
\$3599
Suggested Retail
Ameritron's highest power solid state FET amplifier gives you automatic bandswitching! Get 1200W PEP output on all bands, including 6-Meters. No tuning, no warm-up, no tubes to baby and no fuss! Eight rugged MRF-150 power FET's give outstanding reliability. Just 100 Watts drive gives full rated power MHz. Compact 10Wx6 1/2 Hx18 D in., just 22 lbs. **ALS-1300, \$3199**. Like ALS-1306 but less automatic bandswitching and 6-M coverage.

HF Amps with 3CX800A7 tube



AL-800
\$3199
Suggested Retail
Desktop 3CX-800A7 tubes cover 160-15M, WARC bands. Adjustable slug tuned input, grid protection, ALC control, vernier reduction drives, hefty 32 lb. transformer, high capacitance computer grade filter capacitors. Multi-voltage, dual cross-needle meters. 14 1/2 Wx8 1/2 Hx16 1/2 D".

AL-800H
\$4399
Suggested Retail
2 tubes, 1.5 kW Plus Eimac® tubes

AMERITRON full legal limit amplifiers

AMERITRON legal limit amps use a super heavy duty power transformers capable of 2.5 kW!

Most powerful -- 3CX1500/8877



AL-1500F
\$4199
3CX1500/8877 Tube

Ameritron's most powerful amplifier uses the herculean 3CX1500/8877 ceramic tube. 65 watts gives full legal output -- loafing with a 2500W power supply.

Toughest -- 3CX1200Z7



AL-1200
\$4999
Suggested Retail
Ham radio's toughest tube -- the Eimac®

3CX1200Z7. 50-Watt control grid dissipation. Super heavy duty power supply loafs at legal power -- delivers more than 2500 Watts PEP two tone output for a 1/2 hour.

Classic -- Dual 3-500Gs



AL-82
\$3599
Suggested Retail
Gives full legal output using a pair of genuine

3-500Gs. Competing linears using 3-500Gs can't give you 1500 Watts because their lightweight power supplies can't use these tubes to their full potential.

AMERITRON®

. . . the world's high power leader!

116 Willow Road, Starkville, MS 39759
TECH (662) 323-8211 • FAX (662) 323-6551
8 a.m. - 4:30 p.m. CST Monday - Friday
For power amplifier components call (662) 323-8211

<http://www.ameritron.com>

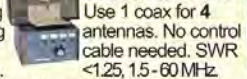
Prices and specifications subject to change without notice. ©2021 Ameritron.

ARB-704 amp-to-rig interface . . . \$84⁹⁵



Protects rig from keying line transients. Easy rig hookup.

RCS-4 Remote Coax Switch...\$219⁹⁵



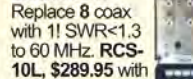
Use 1 coax for 4 antennas. No control cable needed. SWR <1.25, 1.5-60MHz. Useable to 100 MHz.

RCS-8V Remote Coax Switch...\$249⁹⁵



Replace 5 coax with 1! 1.2 SWR, 250 MHz. Useable to 450 MHz. <.1 dB loss, 1kW@150MHz.

RCS-10 Remote Coax Switch...\$249⁹⁵



Replace 8 coax with 1! SWR<1.3 to 60 MHz. RCS-10L, \$289.95 with lightning arrestors.

RIGblaster **DXpro**

Dual Sound Card Technology



Features

- Operate digital mode programs simultaneously while logging
- Software configuration of most options with included DXpro application
- Fully compatible with RemoteHams/HRD for remote control
- Switchable 12V DC output for remotely controlling a small station accessory
- Onboard header for optional CLRmod DSP gives you fully adjustable Clearspeech® audio
- Integrated sequencer ports for high power VHF/UHF safety

What is a RIGblaster

A RIGblaster is the easiest way to properly connect your radio to a computer so that you may operate using over 100 existing and future ham radio sound card software programs. You will be able to operate any sound-card based digital mode that your radio could not otherwise operate.

For more information on this RIGblaster and others visit westmountainradio.com

262-522-6503 ext 35
sales@westmountainradio.com
westmountainradio.com/QST1121



KX Line: KX3/KX2

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

ELECRAFT
KX3

SSB/CW/Data/AM/FM • 160-6 m • 15 W



KX Line Packages
Visit Elecraft.com

ELECRAFT
KX2

SSB/CW/Data/AM/FM • 80-10 m • 12 W



AX1 20/17 Whip
Antenna for the
KX2!

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

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

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

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

*Option

Make Waves in Style with the New K-Line.

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



K4 Features

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



KPA1500 Features

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



ELECRAFT®

elecraft.com • 831-763-4211

Up Front

Operating from the Illinois Nature Preserve

Vince Koepke, NT9N, set up from an old-fashioned train caboose on the Santa Fe Nature Preserve in Hodgkins, Illinois. The grounds of the Santa Fe Prairie allow for various antenna configurations. Koepke operated with a mobile 3/8-24 mount fastened to the roof of the caboose, and the coax was run to the inside through the floor. He used a pulley system attached to nearby trees for hoisting a 25-foot, 20-meter dipole.



The Santa Fe Prairie and the train caboose, which operates as the visitor's center, is a good resource for testing antennas and operating special event stations. It has a mobile 3/8-24 mount fastened to the roof.

In December 2020, the Santa Fe Prairie was listed as an official Parks on the Air site (K-7839). The Prairie Caboose is open to the public from 10 AM to 2 PM on the weekends. The caboose is heated by the original stove, which is very important for Chicago winters. With advance notice, the Prairie allows for 24-hour ARRL Field Day operation.



Santa Fe Prairie Volunteer Don Kinnally rewired the caboose to make it a usable visitor center for radio amateurs, adding a solar panel array and wind generator on the roof.



A Fitting Gift

Charlie Maulick, WB2YZX, received this comfortable pillow as a thoughtful gift to put in his station.

With the appropriate message,

"I think, therefore I ham,"

Charlie's naps may be filled with visions of rigs, amps, and antennas.

DX Vultures

Dennis Dismachek, N6ITY, has an antenna in a stowed position. He uses it to monitor DX stations, and then he "pounces on them to get a new contact," much like the three vultures that were using his antenna as an observation post.



**WHEN YOU TAP INTO OUR GENIUS SOLUTIONS,
SUDDENLY EVERYTHING AROUND YOU FEELS SMARTER.**

Genius products are engineered to work so well in tandem, expanding your station's ability to deliver exceptional experiences and exponential performance increases. Add a Power Genius XL and get the only legal-limit SO2R/Multi-Singlecapable HF/6M amplifier on the market. Add a Tuner Genius XL and gain not only super-fast, legal-limit impedance matching on antennas with up to 10:1 SWR but then pick up 70dB of port isolation for seamless SO2R operation. Add an Antenna Genius and enjoy frequency-driven contest-class SO2R antenna switching and super-station automation capabilities. With integration this easy, our Genius Solutions help you realize the potential of your station, making you genius-level smart along the way. Learn more at FlexRadio.com



Find Everywhere

IT'S TOTALLY NORMAL TO SUDDENLY FEEL LIKE THE SMARTEST PERSON ON THE PLANET.



GENIUS SOLUTIONS INCLUDE

► POWER GENIUS XL

► TUNER GENIUS XL

► ANTENNA GENIUS

FREE YOUR HAM RADIO



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

FREE Super Codeplug

USE CODE: QSTSUPER50 At Checkout



BridgeCom[®]
SYSTEMS
816-532-8451
sales@bridgecomsystems.com

CALL: 816-532-8451
TO LEARN MORE

END YOUR EMCOMM WORRIES

BridgeCom[®]
SYSTEMS

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.



BridgeCom[®]
SYSTEMS
816-532-8451
sales@bridgecomsystems.com

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

Correspondence

Letters from Our Members

My 32-Foot Soda Can Antenna

The coffee can antenna on the cover of the August 2021 issue brought back memories of when I was a Novice operator. Newer hams may not be aware of the historical “beer can” antenna.

When I was 15 years old, my best friend, Chuck Goelz, WA3CEJ (SK), and I were too young to partake in the traditional source of cans for these antennas, so we used steel Mountain Dew cans instead. In my basement ham shack, I would solder together stacks of 10 – 15 cans. It took 73 cans to make the 32 feet needed for a 40-meter vertical antenna. Once we had enough, I soldered the stacks together in my backyard and set the antenna upright. A Mountain Dew plastic bottle was used for the base insulator and we used heavy string for guying. The antenna worked well, but was only up for about a week before some neighborhood kids knocked it down (we didn’t expect the antenna to last long anyway).

A few years later, Chuck was in the US Army, stationed in Korea. Mountain Dew wasn’t available near his Army base, so his mom wrote a letter to PepsiCo asking if they had a distributor near Chuck’s address to ship him some. She also enclosed some photos of our soda can vertical antenna with her letter. A few weeks later she received a letter back, stating that a case of Mountain Dew was on its way to Chuck, courtesy of PepsiCo!

Don Stewart, WA3HGW
Pittsburgh, Pennsylvania

Radio on the Big Screen

I’ve been home more due to the COVID-19 pandemic and have been watching movies to pass the time. I recently watched the 1944 World War II movie short *Patrolling the Ether*,

about amateur radio transmissions being ordered to cease on December 8, 1941 — the day after the attacks on Hawaii, the Philippines, Guam, Malaya, Taiwan, and Wake Island. The film was also reviewed in the May 1944 issue of *QST*.

The story follows a young ham who’s visited by an FCC Radio Intelligence Division (RID) official, who informs him that ham radio communications are banned due to the impending war, but asks him to keep listening to the air waves for any suspicious activity. The young ham eventually joins the agency and helps track down Nazi agents transmitting from a cemetery and a moving taxi.

It’s always fun watching films about our hobby!

Marvin Taylor, AE0EG
Omaha, Nebraska
Life Member

QST’s New Advice Column

When it was announced that Dave Casler, KE0OG, would be writing the “Ask Dave” column in replacement of Joel Hallas’, W1ZR, “The Doctor is In,” I was skeptical. Because I’ve watched a few of Dave’s videos on his YouTube channel, *Ham Radio Answers*, I knew he was knowledgeable, but I wasn’t sure if he could fill the Doctor’s shoes. However, after only a few columns, I’ve been proven wrong — Dave is doing a great job.

Although I’ll miss Joel, I’m glad to flip to Dave’s column each month when *QST* arrives in my mailbox.

Steve Hersey, K7OFG
Payson, Arizona

A Solution to Poor Field Day Propagation

As many 2021 ARRL Field Day participants recall, Saturday, June 26, had poor HF propagation (thankfully, Sunday was better). Our club, Kent Amateur Radio Society in Chestertown, Maryland, only made 16

contacts on the first day. Operating with the call K3ARS, our club had a plan in case the HF bands were dead: VHF on SSB. We had 6-meter and 2-meter stations set up with beams, hoping to make some extra contacts. We did make some, but not as many as I’d hoped.

This year was a perfect example of why I think clubs should consider having VHF (SSB and CW) stations for Field Day 2022. Beams for 2 and 6 meters aren’t very large, are easy to set up and take down, and could provide another option to unreliable HF propagation. Although these bands can be unpredictable, they seem to regularly have sporadic openings. Having two VHF station setups can provide an opportunity for more participation (and maybe more points).

Field Day seems to mostly focus on HF, but thinking outside the box might pay off in points and fun. During the first VHF SSB contest I participated in, I was surprised to make contacts up to 350 miles away on 2 meters with a 15-element beam and 30 W of power.

If more clubs and stations add VHF to their operations, there will be more activity on those bands during the contest. That means more contacts and more fun for everyone. I hope to hear you on the VHF bands during Field Day 2022!

Chris Cote, KE5NJ
Smyrna, Delaware
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@arrrl.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.

Upgrade Your Station's Performance with DX Engineering!

DX ENGINEERING

Active Magnetic Loop MF/HF Receiving Antenna Kit

Add DX Engineering's RF-PRO-1B® to your radios and start hearing more signals with less noise. Designed for low-noise reception of signals within 100 kHz to 30 MHz, the 38" diameter loop includes an integral, extra-high dynamic range, low-noise preamplifier for minimum intermodulation distortion in the presence of high-level signals. Mounted to a pole, mast or any flat surface, the RF-PRO-1B delivers up to 30 dB of rejection of locally radiated noise and requires no manual tuning. Enter "RF-PRO-1B" at DXEngineering.com.



RF-PRO-1B.....\$549.99



HPY-MBD-8F



HPY-AS-62

Hamplus

Hamplus makes innovative RF and control switching components tailored to the Amateur Radio community. The Hamplus line includes rotator switches, smart control consoles, and antenna switches that can read data from the radio and memorize antenna selections. DX and contest stations worldwide depend on Hamplus for proven results. In an exclusive arrangement, North American operators can enjoy the same advantage by ordering Hamplus products through DX Engineering. Enter "Hamplus" at DXEngineering.com.

Noise Cancellation and Audio Enhancement Products

By harnessing cutting-edge digital signal processing technology, bhi noise cancellation and audio enhancement products make it easier for you to discern weak audio signals and increase your radio listening enjoyment. Choose from DSP and extension speakers, DSP devices, and the ParaPro EQ20 Parametric Equalizer, which allows you to adjust any part of the frequency range to customize receive audio to suit your own hearing. Enter "bhi" at DXEngineering.com.

bhi
Noise Cancellation Products



BHD-EQ20



IC-7610



IC-7300

ICOM

Icom Base Transceivers

Make DX Engineering your go-to source to upgrade your station with high-performance HF/50MHz rigs from Icom, including the top-of-the-line 200W IC-7851, featuring Icom's 1.2 kHz optimized roofing filter; the 100W IC-7610, known for its dual RF direct sampling receivers that achieve 110 dB RMDR; and the modestly priced IC-7300, with its real-time touch-screen spectrum scope and loads more. Enter "Icom Transceiver" at DXEngineering.com.



IC-7851

Low Band Systems

Band Pass Filters and Multiplexers from Low Band Systems are high-quality, multi-stage filters that limit the RF band pass to a single band, effectively eliminating the harmonic and adjacent band issues multi-radio contesters experience when using dedicated monoband stations. Filters are available for all popular HF bands. The new 200W CONTESTER system contains switchable filters for 160, 80, 40, 20, 15 and 10 meters in a single enclosure. Search "LBS Band Pass" at DXEngineering.com.



LBS-SIX2TWO-WHF

LBS
LOW BAND SYSTEMS

DX ENGINEERING



DX Engineering Receiving Equipment

Choose from unique receiving gear from the hams at DX Engineering, including the NCC-2 Receive Antenna Phasing System; RTR-2 Modular Receive-Transmit Interface for safely adding a receive antenna to a transceiver; DMC-2 Dual Module Chassis for plugging in filters and receiver protection devices; 2-Port Splitter/Combiners that split one RF signal to feed two receivers; and the Receiver Guard Electronic RF Limiter. Enter "DXE Receiving" at DXEngineering.com.

YAESU

ICOM

KENWOOD

ALINCO

ACOM

InnovAntennas

OPTIBeam



Request Your Catalog Today at DXEngineering.com!

DX
ENGINEERING

Ordering (via phone) Country Code: +1

9 am to midnight ET, Monday-Friday

9 am to 5 pm ET, Weekends

Phone or e-mail Tech Support: 330-572-3200

9 am to 7 pm ET, Monday-Friday

9 am to 5 pm ET, Saturday

Ohio Curbside Pickup:

9 am to 8 pm ET, Monday-Saturday

9 am to 7 pm ET, Sunday

Nevada Curbside Pickup:

9 am to 7 pm PT, Monday-Sunday

800-777-0703 | DXEngineering.com

**ON ALL
BANDS**



**We're All Elmers Here! Ask us at: Elmer@DXEngineering.com
Email Support 24/7/365 at DXEngineering@DXEngineering.com**

ARRL Handbook

2022

2022 EDITION NOW SHIPPING!



The ARRL Handbook is your complete guide to radio experimentation, discovery, and innovation.

New Content:

3D Printing for Ham Radio Construction

—
Battery Selection for Portable Operation

—
Solid-State Linear Amplifierlinearity

—
Safe Practices for Antenna and Tower Work

Available in:

SIX-VOLUME BOOK SET
\$59.95

SOFTCOVER BOOK
\$49.95

Order online at arrl.org/shop



ARRL
The National Association for
Amateur Radio®

Quicksilver Radio

WHY CRIMP?



- ✓ Solid mechanical & electrical connection
- ✓ No melted dielectric
- ✓ Connect all the braid, not just a few strands
- ✓ High reliability
- ✓ More info on our website

Crimp-Ons

Excellent quality, no bargain basement stuff here. Adapters & connectors for most types of connections.



USA Made Coax



Premium Bury Flex, USA-400 & USA-240 coax jumpers with your choice of UHF, Type N, BNC, SMA, TNC & Mini-UHF Connectors.

In these tough times, we're here to help you with Quality, Service & Value!

Antenna Gear



Soldering Tools



Ultimate Crimp Kit™



Connectors & Adapters



FREE SHIPPING
on all orders over
\$73.00 to any United
States address.

HAMMO-CAN™ Go Box

Ready to go, a complete VHF-UHF station in a box. Get them with or without radios installed. Fits most FM mobiles & several HF radios, too.



New Item!!
HybridDX™ HF antenna.
Get on 80M in less than
80 ft.

www.qsradio.com

W1AW Schedule

PAC	MTN	CENT	EAST	UTC	MON	TUE	WED	THU	FRI
6 AM	7 AM	8 AM	9 AM	1400		FAST CODE	SLOW CODE	FAST CODE	SLOW CODE
7 AM- 1 PM	8 AM- 2 PM	9 AM- 3 PM	10 AM- 4 PM	1500-1700 1800-2045	VISITING OPERATOR TIME (12 PM-1 PM CLOSED FOR LUNCH)				
1 PM	2 PM	3 PM	4 PM	2100	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE
2 PM	3 PM	4 PM	5 PM	2200	CODE BULLETIN				
3 PM	4 PM	5 PM	6 PM	2300	DIGITAL BULLETIN				
4 PM	5 PM	6 PM	7 PM	0000	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE
5 PM	6 PM	7 PM	8 PM	0100	CODE BULLETIN				
6 PM	7 PM	8 PM	9 PM	0200	DIGITAL BULLETIN				
6 ⁴⁵ PM	7 ⁴⁵ PM	8 ⁴⁵ PM	9 ⁴⁵ PM	0245	VOICE BULLETIN				
7 PM	8 PM	9 PM	10 PM	0300	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE
8 PM	9 PM	10 PM	11 PM	0400	CODE BULLETIN				

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

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

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

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

Code bulletins are sent at 18 WPM.

For more information, visit us at

www.arrl.org/w1aw

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

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

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

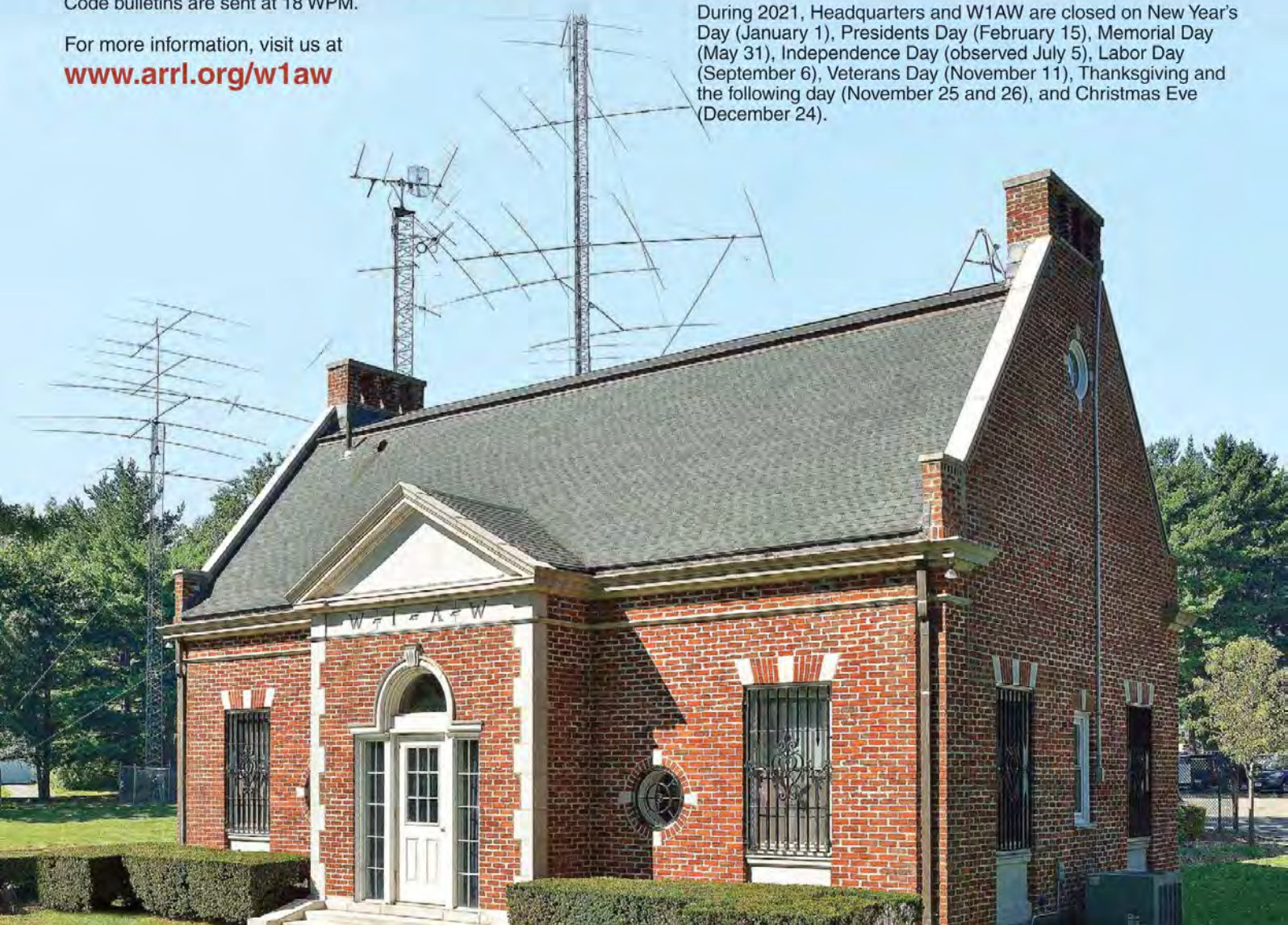
Keplerian elements for many amateur satellites will be sent on the regular digital frequencies on Tuesdays and Fridays at 6:30 PM Eastern time using Baudot and PSK31.

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

♦ Notes: On Fridays, UTC, a DX bulletin replaces the regular bulletins. W1AW is open to visitors 10 AM to 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).



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



ADS#36419

The CW Game

Learning and practicing Morse code can be a fun activity.

Robert Anding, AA5OY

The CW Game is a code practice system based on a Morse code typewriter that uses an iambic Morse key as the input, along with a CW typing game program. After I completed an earlier Morse code CW typewriter project, I practiced Morse code using the CW typewriter, with my computer's notepad program as a display.

How It Works

To liven things up, I wrote a tiny proof-of-concept command-line CW practice program that ran on both my PC and Linux computers. This program placed a randomly chosen letter, number, or word on the screen and waited for me to send it using the CW typewriter. I could use the backspace key to remove my mistakes and then enter the correct character. The practice characters — which could be a letter, number, word, or sentence — were stored in a text file, one entry per line. The ability to create my own files allowed for a focused practice of problem letters or numbers, or difficult words. I went on to create files containing letters, numbers, state abbreviations, common words, QSO terms, call signs, and more. I saved each file in the same directory as the program, and I used these as part of my daily CW practice.

What made things more exciting were some online typing program games, which took the drudgery out of sending practice CW. They challenged me to send faster as the game's speed slowly increased. However, there was a limiting factor. The groups of letters, numbers, and common words were hard-coded into program and couldn't be changed. In trying to solve this dilemma, I created *The CW Game*.

The CW typewriter uses an iambic key that acts as the computer keyboard. I based my project on the Arduino Leonardo because it can mimic the keyboard and mouse. I added a small circuit consisting of an iambic key input jack, speaker output jack, rig keyer output, WPM potentiometer, space switch, and the Leonardo USB port for communications with the PC (see Figure 1).

Improvements

To keep the focus on the CW typewriter, I added a few prosign characters: $\overline{AA}$ (start new line) sends a return character; $\overline{BT}$ (start new section) prints a line feed and adds an =, and the $\overline{BK}$ (break) prints an *. With these added prosigns, my practice ran more smoothly. At this point, the proof-of-concept program needed some improvements.

First, I eliminated the parts of my earlier Arduino CW typewriter program not needed for gaming. Using the keyboard emulation made it compatible with different operating systems. Second, I wrote a simple CW game program that used text files as the input, like my little CW practice program did. The ability to make up text files was a nice feature that I wanted to keep.

I wanted to make the code open source, hoping others might add to it and allow it to grow. I wrote the code in *Python*, because it has a big gaming community, and I thought some hams may want to create more adventurous games for CW practice. Additionally, I wanted the program to work on the three commonly used operating system platforms: PC, Mac, and Linux.

“Online typing games took the drudgery out of sending practice CW.”

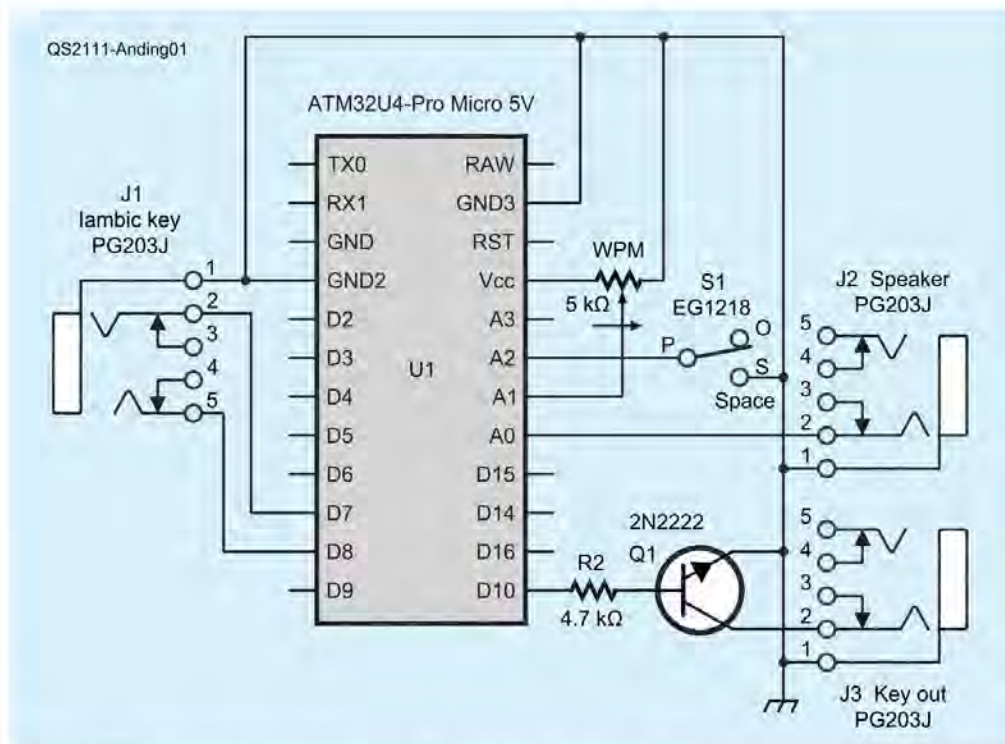


Figure 1 — The partial schematic diagram shows how the added components connect to the Arduino microchip.

Hardware: Arduino Leonardo and the CW Typewriter Sketch

Choosing the Arduino Leonardo made communicating with the computer USB port easy. I chose the ATmega32u4 microchip, 16 MHz, 5 V Micro Pro version, which can act as a keyboard or mouse. The Arduino Leonardo sketch is available at www.arrrl.org/qst-in-depth.

The small circuit attached to the Leonardo uses a simple design. Inputs are the dit (Pin 7), dah (Pin 8), and space (Pin A2); the space switch adds a word space when working with sentences, pangrams, and so on. The WPM (Pin A1); and the speed potentiometer adjusts the WPM speed of the keyer. Outputs are KeyPin (Pin 10) for the transceiver's key and a speaker pin for sidetone. The sidetone frequency code line *int sideTone = 600* in *Sketch_CW_Kybd_8-10-21.ino* is currently set for 600 Hz (suggested range is 500 to 900 Hz). The speaker output uses the Arduino Pin A0. I recommend using an amplified speaker.

You can use your transceiver as a speaker by hooking up the Arduino key out pin to the rig. Do this with caution — the KeyPin output is logic level, so check your transceiver's specifications. I also recommend that you use a 4.7 kΩ resistor along with an open collect transistor. The transistor on KeyPin output will transmit a logic ground when active.

The Arduino program contains a letter array used to convert Morse code to ASCII code. As each CW character is sent with the iambic key, each dit equals a 0 and each dah equals a 1. The 1s and 0s are collected until an end of character is detected. The character's code is compared to the letter array, and if a match is detected, it is converted to the ASCII character and sent via the USB port to the keyboard input of the computer. The letter array consists of letters, numbers, punctuation marks, and a few prosign characters. Additional Morse code characters can be defined to make additional keyboard characters. Because prosigns are used in Morse code, they make sense for this application.

Regarding keyboard emulation, whatever is sent using the iambic key is transmitted to the active computer window. Be careful, because you can inadvertently add characters to a program on your computer. Remember to click the window to give it focus, so it receives the CW typewriter output.

“The Arduino program contains a letter array used to convert Morse code to ASCII code.”

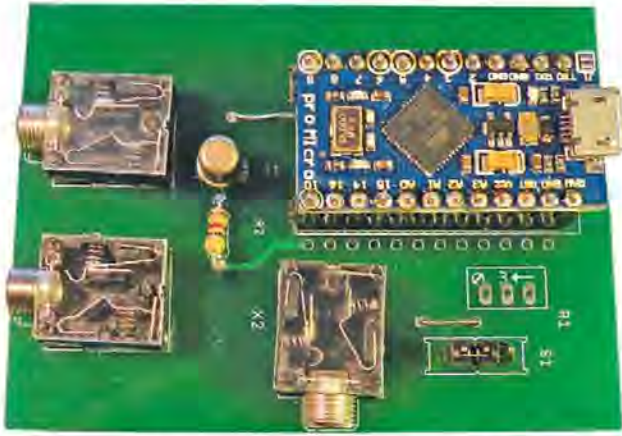


Figure 2 — The CW Typewriter board uses very few components.

The circuit (see Figure 1) consists of accessible parts and can easily be built using a prototyping board. I have designed a shield PCB for the Leonardo and a PCB for the Pro Micro version of the Leonardo (see Figure 2). If you are interested in getting a PCB for this project, contact me about price and availability.

Software

The software files are in a folder on the *QST* in Depth web page. I wrote the CW Game program in *Python 3* using the additional features from the Pygame module. *Python 2.7* comes loaded on many Mac and Linux operating systems, so make sure that you upgrade to *Python 3*. For Windows, download it from the Python website at www.python.org/downloads.

After *Python 3* is loaded on the computer, install the Pygame module. Pygame makes it possible to build and run Pygame programs. Instructions are at www.pygame.org/wiki/gettingstarted. The OS will detect files with the .py extension. Simply clicking on the *Python* file *CW_typerFINAL.py* will load the game. The CW Game program starts with a splash screen with an entry box outlined in red. Click on the entry box, type the name of the file with its extension (**LETTERS.TXT**), hit return, and the game begins. Keeping the text files in the same directory is a good practice and eliminates the need for adding a path to the file name.

There are several functions within the program. The splash screen asks for a file name. After hitting return, it is sent to the **NEW_WORD** function, which checks for

the file. If the file is found, it opens the file and copies its contents to a list. The **PLAY_GAME** function opens the game's screen, displays a random line, and moves it down the screen. The game starts slowly, and over time, it increases its pace down the screen. If the line contains more than one character, the game highlights the player's correctly entered characters in red. Otherwise, if the player misses a character, the player's answer is erased, and the player starts the line over. If it reaches the bottom of the screen, the game displays a Game Over screen with the score, and the game has ended.

The splash screen also lists the **ESC** and the **F1** keys. Hitting the **ESC** key will quit the game, while the **F1** key starts the game over by resetting the speed to slow and the score to zero. If you're getting too close to the bottom, hit the **F1** key and start over.

If a line consists of only one entry (letter, number, or a single word), the CW typewriter's space switch can be left in the **OFF** position. When working with a phrase containing spaces, turn the space switch **ON**. With the space switch **ON**, the CW typewriter detects an inter-word pause and automatically adds a space. There is meaning in the timing of spaces, so working on spacing is important to the flow of information. This is a simple game, but it can be made as complex as you want.

If you are not inclined to load *Python 3* and Pygame on your system, try the online typing lessons and games at www.typing.com/student/lessons and www.typing.com/student/games.

Over the years, CW has proved to be a valuable mode that needs continuous practice to maintain and improve CW skills. I hope you'll find it as helpful and fun as I have.

Robert Anding, AA5OY, has been a licensed amateur radio operator for 33 years. He retired from broadcast engineering after 38 years. He has a Commercial General Radio Operator License (previously, First-Class Radiotelephone License). Bob earned a Bachelor's degree in computer science from Loyola University New Orleans. He enjoys operating QRP, programming, and ham radio projects. Some are posted on his web page www.aa5oy.com. You can reach Bob at aa5oy@arri.net.

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



An Optimized Inverted L for

160 & 80 Meters

George Cooley, NG7A

An inverted-L antenna, popular on 160 and 80 meters, is optimized by the horizontal part of the antenna, providing a mostly vertically polarized signal. The inverted L described here is a variation of Don Toman's, K2KQ, Double L bent vertical (described in his article "Revisiting the Double L," from the June 2011 issue of the Yankee Clipper Contest Club's newsletter). This inverted L increases the radiating current while canceling the horizontal polarization components.

Design

The Double L's upper arm is replaced with a 160-meter loading coil and a 10-foot section of wire. The radiating vertical element is 0.166λ (85 feet) long. On 80 meters, the coil acts as an RF choke, and the vertical wire below the coil provides a 0.333λ radiator. The vertical wire is held up by a 22-foot pole and then slants toward an 80-foot tower 45 feet away. Two 0.166λ lower wires, one for 160 meters (85 feet) and the other for 80 meters (45 feet), run 6–8 feet above the ground under the slanted wire. These cancel some of the horizontally polarized components and create an off-center feed. A 2:1 balun matches the antenna's 100 Ω feed-point impedance to 50 Ω . A ground screen provides shielding of the E field to the ground, but it is not physically connected to the antenna. To save wire, the ground screen can also be made of fencing or zig-zag wires. As long as the aperture (the greatest opening) is less than 3 feet, the shielding effectiveness will be the same as with radials (see Figures 1 and 2).

Theory

Most of a dipole's current that produces the radiated field is contained in the middle third of the dipole — between 0.166 and 0.333λ from the ends (seen by making a half-wave dipole from a string of incandescent lights). Therefore, the ends can be bent horizontally or replaced by coils without much consequence. The Double L works the same way in that the maximum current is in the middle of the vertical wire, which is well above ground. The relatively smaller currents in the horizontal upper and lower wires cancel, thus leaving the antenna predominantly vertically polarized.

Dual-band use for your
160-meter antenna.

Calculations

It is easiest to feed a dipole or half-wave vertical in the middle with 50 Ω coax. However, a dipole's feed-point impedance varies as a sinusoidal function from the distance to its ends, with the lowest impedance in the center, and near infinite impedance at the ends.

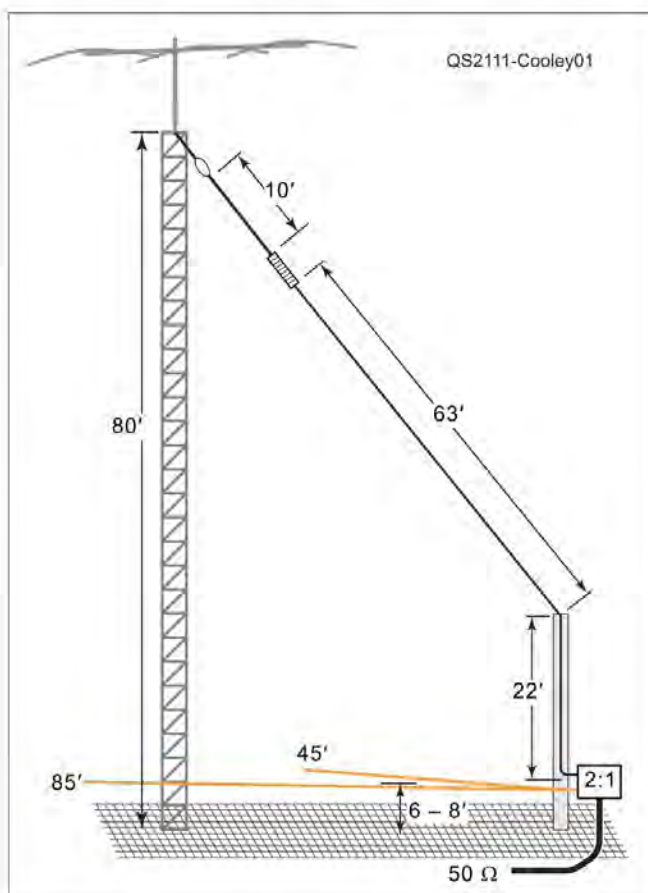


Figure 1 — The optimized inverted-L antenna dimensions.

According to John D. Kraus's, W8JK, 1988 *Antennas* book, the feed-point impedance is a function of location, and it can be calculated as follows:

$Z = Z_0 / (\sin(360 \times X)^2)$, where:

Z_0 is the feed-point impedance at the center ($\sim 72 \Omega$), and

X = position in wavelengths from the left side of the antenna (0 to 0.5λ).



Figure 2 — The optimized inverted-L antenna.

160-Meter Wire Lengths

A full-wave wire at 1.830 MHz is 511 feet. One third of a dipole (0.166λ) is 85 feet. At this length, the feed point impedance is about 96Ω with a lower horizontal wire cut for about 85 feet. A coil is inserted at the end of 85 feet of wire, and 10 feet from the end of the line. I calculated that the coil inductance needed to be about $390 \mu\text{H}$ at 1.83 MHz to resonate the antenna on 160 meters.

80-Meter Wire Lengths

A full-wave wire at 3.539 MHz is 264.7 feet. The ideal length of the upper wire is 88 feet (0.333λ), and 44 feet (0.166λ) is the desired length of the lower horizontal wire. Because the actual upper wire is 85 feet, the lower horizontal wire can be lengthened to 47 feet and cut to resonance.

NEC Simulations

The structure was simulated using the Numerical Electromagnetics Code (NEC). Wire from the base to the coil was 85 feet. Wire from the coil to the upper end was 10 feet. The lower wire was 1 foot off the ground and 82 feet long. NEC simulated a dry, sandy soil that is characteristic of the desert southwest.

The simulation showed that my initial hand-calculated coil impedance of $4,492 \Omega$ ($390 \mu\text{H}$) was too high, resulting in a higher feed-point impedance. It also forced the current too high into the upper part of the wire with almost no current in the lower part of the wire. The resulting radiation pattern was also

Filename	Inv L vertical - W8		Frequency	1.83	Mhz
			Wavelength	163.8	mtr
Voltage	97.8 + j 0 V		Current	1.02 - j 0.1 A	
Impedance	94.9 + j 8.95		Series comp.	9714	pF
Parallel form	95.7 // j 1014		Parallel comp.	85.78	pF
S.W.R.100	1.11		Input power	100	W
Efficiency	82.15	%	Structure loss	17.85	W
Radiat-eff.	12.59	%	Network loss	0	uW
RDF [dB]	5.99		Radiat-power	82.15	W
Environment	☐ Loads ☐ Polar				
GROUND PLANE SPECIFIED.					
FINITE GROUND. SOMMERFELD SOLUTION					
RELATIVE DIELECTRIC CONST. = 10.000					
CONDUCTIVITY = 1.000E-03 MHOS/METER					
Comment					
Seg's/patches	29	start	stop	count	step
Pattern lines	2701	Theta	-90	90	37
Freq/Eval steps	1	Phi	0	360	73
Calculation time	0.125	s			

Figure 3 — The NEC-tabulated data.

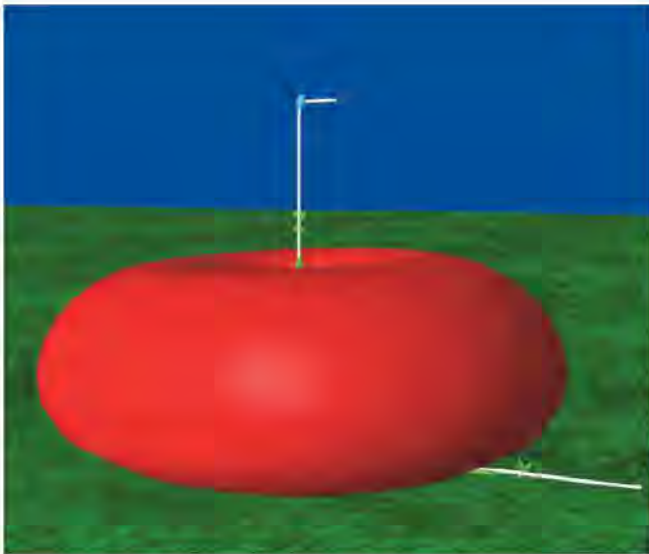


Figure 4 — The NEC-simulated radiation pattern.

degraded. Reducing the coil impedance to $3,894.5\ \Omega$ ($339\ \mu\text{H}$) maximized the current in the middle (vertical) part of the wire. The small remaining currents were taken up by the upper coil/wire, as well as the lower, tuned wire.

As NEC showed a feed-point impedance of $99\ \Omega$, a 2:1 balun was used to transform this to $50\ \Omega$. The resulting radiation pattern is also nearly uniform. Bending the upper part of the wire will result in a little skewing of the pattern, as well as changing the feed-point impedance. The model showed that the feed-point impedance can be adjusted by varying the length of the lower wire. Figure 3 shows the tabulated NEC data, and Figure 4 shows the radiation pattern.

Building the Coil

For $339\ \mu\text{H}$, Wheeler's formula predicted 150 turns of 20 AWG close-wound along 8.4 inches on a 2.4-inch outside diameter $\times$ 11-inch long PVC pipe (2-inch PVC has an outside diameter of 2.4 inches). In reality, it took 158.5 turns to get $339\ \mu\text{H}$ on the analyzer. When tuning the actual antenna, 13 turns were taken off by soldering a jumper on the coil to bring the antenna into resonance on 1.830 MHz. The lower wire was then tuned for the lowest SWR. Next, the 80-meter lower wire was added and trimmed for the lowest SWR on



Figure 5 — The finished $339\ \mu\text{H}$ inductor.

3.530 MHz. The final coil, shown in Figure 5, was brushed with PVC cement to stabilize the turns.

Results

The antenna has less than a 1.5:1 SWR on the CW portions of 80 and 160 meters, and it takes 1.5 kW on both bands. The impedance is more stable compared to the $\frac{1}{4}$ -wave inverted-L antenna and does not vary between wet and dry conditions.

Finally, I want to give a special thanks to Tom, W8TK, and Larry, KE2VB, for the many hours of cutting, measuring, and remeasuring that went into optimizing this antenna.

All photos by the author.

ARRL Life Member George Cooley, NG7A, has been a ham since an early age. A licensed Airline Transport Pilot and Electrical Engineer, he has developed many aircraft communications radios, navigation systems, transponders, and datalinks. A Senior RF Engineering Manager for Collins, George enjoys flying, hiking (SOTA), bicycling, and improving reception of weak signals through simple homebrewed antenna systems. He maintains www.ng7a.com and can be reached at george@ng7a.com.

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



Strays

I would like to get in touch with anyone that has vintage Motorola two-way radios, working or nonworking. I'm looking for a Mitrek base station, preferably with manuals. — ARRL Life Member Rich Ballieu, WB0TML, 6001 Horseshoe Bend, Mandan, ND 58554.

Product Review

QRP Labs QCX-mini CW Transceiver Kit

Reviewed by Paul Danzer, N1II
n1ii@arrl.net

You can fit this single-band CW transceiver in your shirt pocket, but it can do much of what a full-size home-station radio can do. The QCX-mini is the latest in a series of QRP transceivers from QRP Labs. The radio delivers about 5 W RF output with a 13.8 V power supply, and it will operate from 7 to 14 V. On receive, it draws a battery-friendly 85 mA, helpful for portable operation. An optional case, shown in the title photograph, is available.

The QCX-mini includes two VFOs with adjustable tuning rate, receiver incremental tuning (RIT), and 16 frequency memories. There's a CW memory keyer with practice and straight key modes, along with a CW decoder. CW offset and sidetone are adjustable. The display can show an S-meter, battery voltage, and the current time. The QCX-mini can also be set up to transmit WSPR (Weak Signal Propagation Reporter) beacons. To see the extent of this small radio's capabilities, check out the detailed documentation on the QRP Labs website.

We reviewed the original QCX transceiver in the August 2019 issue of *QST*. The most notable change from the original transceiver is the QCX-mini's smaller size. The QCX-mini in its optional case measures approximately $3.7 \times 2.5 \times 1$ inches excluding protrusions, and it weighs 7 ounces.

Overview

The QCX-mini is available as a kit or assembled and tested. It can be built for 80, 60, 40, 30, 20, or 17 meters, and the features are the same for all versions. The front panel has a 16×2 (16 character by 2 line) LCD, two knobs, and two pushbuttons. Look for the *Cheat Sheet* page in the assembly or operation manual for details on using these controls.

The left knob (**VOL**) is the receiver volume control. The markings on the front panel help with using the two pushbuttons. Above the left-hand pushbutton is a single dot with the word **KEYER**. Push the button once



and you can select the keyer speed by rotating the **TUNE** control. Other keyer choices are available in a menu. Below this **KEYER** label is the **RIT** label with two dots. Push the button twice, and you can select receiver incremental tuning (RIT) settings. Finally, the bottom **MENU** label has a dash next to it. Give the button a long press to open up the nine-section menu described in the *Cheat Sheet*.

One press of the other pushbutton selects the VFO mode (VFO A, VFO B, or split-frequency operation). Two presses, and you can save or recall a VFO memory. A long push transfers information from one VFO to the other.

The right-hand **TUNE** knob is a rotary encoder with a pushbutton switch. It is used primarily for frequency tuning, settings, and menu selections. A single press of the **TUNE** button changes the tuning rate (1 kHz, 500 Hz, 100 Hz, or 10 Hz). A double or long press is used to select and send a stored CW message from memory. With these three controls, many common operating choices may be made without going into the detailed menus.

Bottom Line

The QCX-mini from QRP Labs is a popular, tiny 5 W CW transceiver kit that can be built for 80, 60, 40, 30, 20, or 17 meters. Construction requires mounting through-hole components, and the instruction manual is excellent.

Circuit Highlights

The construction manual has a full schematic and an extensive explanation of the circuit operation. The QCX-mini design is similar to the original QCX. It's based on a preprogrammed ATmega328 microcontroller, along with an Si5351A phase locked loop. The Si5351A is controlled by a 27 MHz crystal, and its outputs are used in various ways.

On transmit, the microcontroller generates a signal, which is then shaped for the CW waveform and sent through a driver to a set of three transistors operating in class E. Finally this output is routed through a seven-element low-pass filter. The final three amplifier transistors and the driver are mounted close to each other on the circuit board. A flat washer presses all four transistors against the PC board ground plane, which serves as the heatsink.

On receive, the input signals are routed through the low-pass filter to a quadrature sampling detector, also called a Tayloe detector. Following the detector, two operational amplifiers subtract the phased outputs (I and Q), and then they are combined to form a single output. Next in the chain is a 200 Hz CW filter, followed by the audio amplifier. Enough audio power is available to drive a set of headphones, but not quite enough for a speaker.

Building and Alignment

The QCX-mini assembly manual runs about 120 pages and is available as a PDF on the QRP Labs website. In addition to step-by-step construction details, the manual includes sections on alignment, initial setup, circuit design, and troubleshooting. The manual is exceptionally complete and includes many high-quality illustrations throughout.



Figure 1 — The main circuit board carries most of the components for the receiver and transmitter sections. The microcontroller (white label) is at the upper left. T1 is the larger toroid near the center, and the socket that connects to the display board is in the upper left. The driver and final amplifier transistors are at the upper right, under the washer.

The QCX-mini is a sandwich of two printed circuit boards. The main board, shown in Figure 1, comes with many SMD (surface-mounted device) components already installed. The builder only has to add standard through-hole parts. The parts you must insert yourself have almost one page devoted to each component. Occasionally, the instructions for inserting a component run over to a second page, so it's a good idea to check the next page for additional information. The board is tightly packed, so take your time building it.

Large, clear, color photos and drawings make the construction task easier. The text notes that additional heat from your soldering iron may be needed occasionally because connections are made to the hidden ground plane. When it appeared more heat was needed, I left the soldering iron on the joint a bit longer.

Five toroids have to be wound. T1, the input transformer, is critical and a bit challenging (the manual calls it "the only really tricky piece of assembly"). The input signal is routed to five turns on T1, wound on a T50-2 toroid about the size of a dime. A multi-turn winding on the same core is resonant with a variable capacitor for the band selected. Two other five-turn windings have to be phased correctly and as identical as possible. During alignment, three variable resistors compensate for slight differences between these windings. The manual includes detailed instructions and several illustrations to help you build T1.

The manual recommends burning the insulation off the enameled wire used to wind the toroids. I followed this procedure, but during testing, the ARRL Lab discovered that in some cases, enough insulation was left to make poor soldered connections. It's probably best to scrape off the insulation first.

When the assembly of each board is completed, the two boards plug together as a sandwich with the display board on top (see Figure 2). I had a minor issue



Figure 2 — The display/control PC board completes the sandwich, with the main board on the bottom.

assembling the unit in its optional enclosure, but after re-reading the instructions, I realized that the case would go on only one way. The complete alignment procedure is brief and can be accomplished quickly. If for some reason you are not happy with the result, you can run through the alignment procedure again.

The QCX-mini has built-in troubleshooting capability, and the manual includes approximately 40 pages of circuit and troubleshooting information. As with most QRP transceivers and kits, there's an active online group with other builders willing to help (see groups.io/g/QRPLabs).

A nice added benefit of the QCX series transceivers is built-in test equipment. Although the test equipment is designed primarily to allow alignment and troubleshooting of the QCX-mini, the manual shows PC board connections for making external measurements. The test equipment set consists of a digital voltmeter (0 – 20 V dc), an RF power meter (0 – 5 W), a frequency counter (0 – 8 MHz), and a signal generator (3.5 kHz – 200 MHz).

Using the QCX-mini

The left side of the radio has a 2.1-millimeter coaxial dc power jack (cable and connector not supplied). There's a 3.5-millimeter phone jack for a keyer paddle, and another for stereo headphones. The right side panel has a BNC connector for the antenna feed line, 3.5-millimeter phone jacks for PTT output (for controlling an external amplifier or other device), and a computer-aided transceiver (CAT). I didn't use the CAT feature, but the manual gives instructions for making a cable to interface the transceiver with a PC serial port or USB-to-serial converter. The QCX-mini is compatible with the Kenwood TS-480S command set found in most logging software.

Table 1
QRP Labs QCX-mini, firmware version 1.07

Manufacturer's Specifications			Measured in the ARRL Lab	
Frequency coverage: 40-meter amateur band.			Receive and transmit: As specified.*	
Power requirements: 7 V dc minimum to 14 V dc maximum.			At 13.8 V dc: Receive, 85 mA (backlight on); 66 mA (backlight off). Transmit, 682 mA.	
Modes of operation: CW. In beacon mode, CW, FSK CW, and WSPR.			As specified.	
Receiver			Receiver Dynamic Testing	
Sensitivity: Not specified.			Noise floor (MDS): -130 dBm at 7 MHz.	
Noise figure: Not specified.			7 MHz, 21 dB.	
Blocking gain compression dynamic range: Not specified.			Blocking gain compression dynamic range: 20 kHz offset, 126 dB; 5/2 kHz offset, 116/110 dB.	
Reciprocal mixing dynamic range: Not specified.			Not measured. Low-noise 7 MHz oscillator not available.	
ARRL Lab Two-Tone IMD Testing				
<i>Band</i>	<i>Spacing</i>	<i>Measured IMD Level</i>	<i>Measured Input Level</i>	<i>IMD DR</i>
7 MHz	20 kHz	-130 dBm -97 dBm -50 dBm	-31 dBm -18 dBm 0 dBm	99 dB
7 MHz	5 kHz	-130 dBm -97 dBm	-46 dBm -29 dBm	84 dB
7 MHz	2 kHz	-130 dBm -97 dBm	-52 dBm -38 dBm	78 dB
Second-order intercept point: Not specified.			14 MHz, +53 dBm.	
IF/audio response: Not specified.			Range at -6 dB points: 605 - 854 Hz (249 Hz).	
Receive processing delay time: Not specified.			4 ms.	
Transmitter			Transmitter Dynamic Testing	
Power output: Up to 5 W, depending on supply voltage.			0.4 W at 7 V dc; 2.3 W at 10 V dc; 3.5 W at 12 V dc; 4.9 W at 14 V dc.	
Spurious-signal and harmonic suppression: >50 dB.			49 dB. (See Figure A.) Complies with FCC emission standards.	
CW keyer speed range: Not specified.			1 to 99 WPM, iambic A and B.	
CW keying characteristics: Not specified.			See Figures B and C.	
Transmit-receive turnaround time: Not specified.			S-9 signal, 23 ms (full-break-in); 570 ms (semi-break-in).	
Transmit phase noise: Not specified.			See Figure D.	
Size (height, width, depth): 2.5 × 3.7 × 1 inches, excluding protrusions. Weight, 7 ounces.				
Second-order intercept point was determined using S-5 reference.				

*The QCX-mini can be built for 80, 60, 40, 30, 20, or 17 meters. The 40-meter version was tested. Transmitter is capable of transmitting outside of the 40-meter band.

When I first turned on the radio, it was ready to get on the air with CW. All I had to do was select CW speed and reduce the sidetone volume, because I was testing with an external audio amplifier and speaker connected to the headphone output.

In addition to the assembly manual, the QRP Labs website offers a 52-page downloadable QCX operating manual. The radio has a lot of features, and it's well worth the time to read through this document. I found the *Cheat Sheet* near the end to be a helpful summary of the

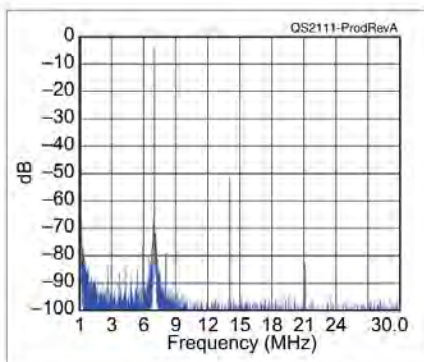


Figure A — Spectral display of the QCX-mini transmitter output. Power output is 5 W on the 7 MHz band. This plot shows the output spectrum from 0 to 30 MHz. The second harmonic is down 49 dB from the carrier, and the third harmonic is down 80 dB. The vertical scale is 10 dB per division.

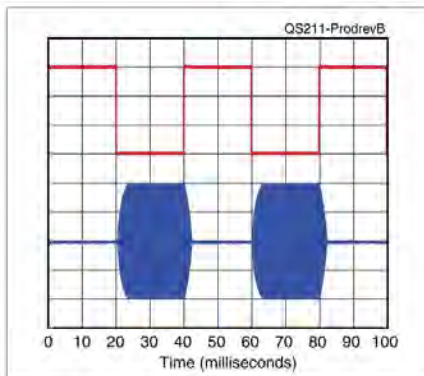


Figure B — CW keying waveform for the QCX-mini showing the first two dits in full-break-in (QSK) mode using external keying. Equivalent keying speed is 60 WPM. The upper trace is the actual key closure; the lower trace is the RF envelope. Horizontal divisions are 10 ms. The transmitter was being operated at 5 W output on the 7 MHz band. Rise time is 2.1 ms and fall time is 1.8 ms. First dit: on delay, 1.1 ms; off delay, 1.7 ms. Second dit: on delay, 0.8 ms; off delay, 1.6 ms.

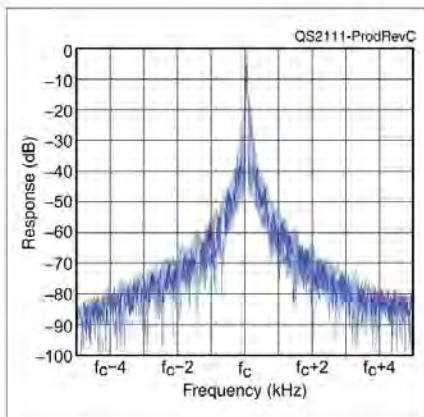


Figure C — Spectral display of the QCX-mini transmitter during keying sideband testing. Equivalent keying speed is 60 WPM using external keying. Spectrum analyzer resolution bandwidth is 10 Hz, and the sweep time is 30 seconds. The transmitter was being operated at 5 W PEP output on the 7 MHz band, and this plot shows the transmitter output ± 5 kHz from the carrier. The reference level is 0 dBc, and the vertical scale is in dB.

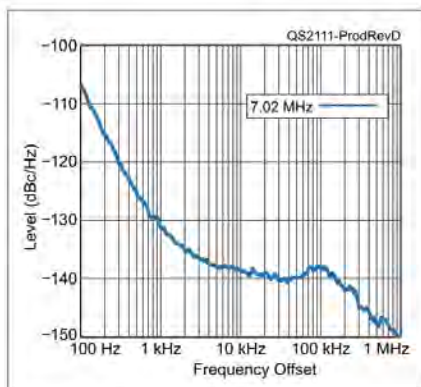
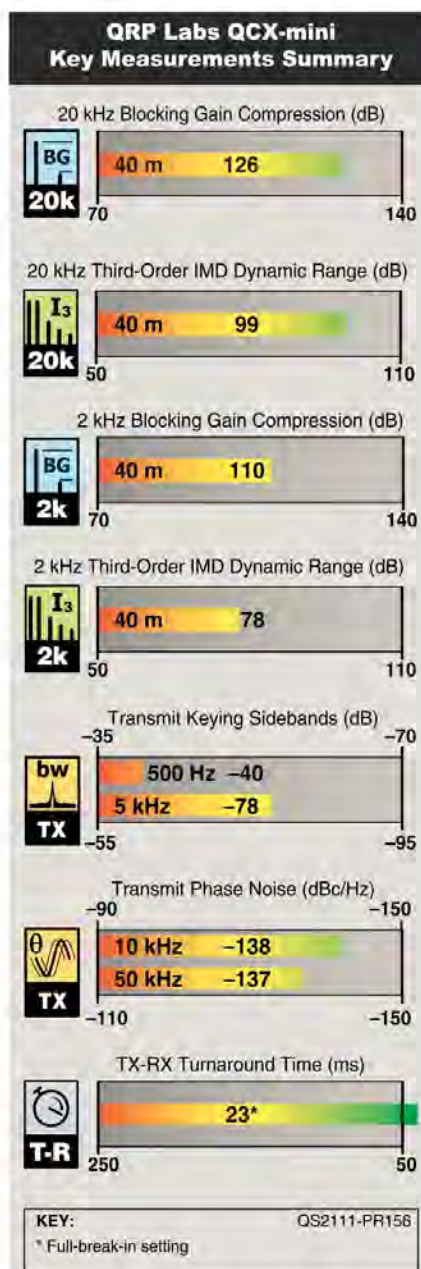


Figure D — Spectral display of the QCX-mini transmitter output during phase-noise testing. Power output is 5 W on the 7 MHz band. The carrier, off the left edge of the plot, is not shown. This plot shows phase noise 100 Hz to 1 MHz from the carrier. The reference level is -100 dBc/Hz, and the vertical scale is 10 dB per division.



menu items and controls. Once you have selected your default settings, you can save most of them from the configuration menu.

On the Air

As with any 5 W transceiver, your on-air results will depend somewhat on your antenna and band conditions. I was able to make contacts on 40-meter CW, mostly in the evening, without telling anyone that I was using just 5 W. My antenna is a fairly low 80-meter dipole fed with 10 feet of coax and then through a balun to ladder line to the dipole. A small tuner provides the needed match.

The 200 Hz CW filter seemed to work well, and with the speaker volume turned up, I did not hear noticeable ringing. The QCX-mini can operate in QSK (full break-in) or semi-break-in via a menu choice. The solid-state transmit-receive switching is silent.

Setting up the WSPR beacon was somewhat tedious, but it worked fine once I finished the configuration. If you plan to do a lot of WSPR operation, check out the optional QRP Labs QLG2 GPS module for time and frequency discipline and automatic setting of the Maidenhead grid locator.

In Summary

The QCX-mini QRP CW transceiver works well and offers many useful features. It makes extensive use of menus, so keep a copy of the *Cheat Sheet* from the manual handy. Kit construction is not too hard, although building the T1 input transformer can be challenging.

Manufacturer: QRP Labs, Mugla, Turkey; www.qrp-labs.com. **Price:** QCX-mini kit (specify band), \$55. Built and tested, \$100. Aluminum enclosure, \$20. QLG2-SE GPS module, \$20. TCXO module, \$8.25. Shipping to the US is around \$12 via FedEx and typically takes about a week.

SOTABEAMS External DSP Audio Filter

Reviewed by Steve Ford, WB8IMY
wb8imy@arrl.net

In the age of software-defined transceivers, you may think no one needs an external audio filter. If you've had the pleasure of operating a recent desktop transceiver with digital signal processing (DSP) features or a software-defined radio (SDR) transceiver, you know their signal-filtering abilities are excellent.

But there are still a lot of older analog transceivers in use, not to mention all those low-power (QRP) kit transceivers. Of course, for older transceivers that will accommodate them, there are crystal and mechanical intermediate-frequency (IF) filters you can install. Good IF filters can provide a major performance boost, but they often come with significant price tags.

An alternative is to perform filtering at the audio stage.

SOTABEAMS External DSP Audio Filter

Based in the United Kingdom, SOTABEAMS is known for offering useful products for amateurs who enjoy portable operating (as in *SOTA* — Summits on the Air) where size, weight, and power consumption are critical factors. Many portable operators use low-power transceivers, and the majority of these are analog radios.

With this group in mind, SOTABEAMS has developed a series of DSP audio filter modules that can be installed within many transceivers. For those who would rather not take that approach, they also offer an external audio filter that incorporates one of their DSP modules and adds a few controls. That's what I'll be evaluating in this review.

The SOTABEAMS external DSP filter is tiny — just $3\frac{1}{8} \times 2\frac{1}{2} \times 1$ inches. At the front of the enclosure, there is a volume control on the left side (labeled **VOL**), a red **LVL** LED that warns when you are feeding too much audio to the filter, and a green **SIG** LED that lights when you've properly tuned the target signal. More about that in a moment. There is also a small toggle switch (**W/N**) to select wide or narrow filter bandwidths.

At the rear of the filter, shown in Figure 3, you find two 3.5-millimeter jacks for the audio inputs and outputs, as well as a coaxial dc power socket. You can power the filter from any dc source that can supply 5 to 15 V at about 70 mA.



When ordering, you must specify the desired filters:

SSB + CW (Wide: 2,700 Hz and Narrow: 300 Hz)

CW wide + CW narrow (Wide: 1,000 Hz and Narrow: 300 Hz)

SSB wide + SSB narrow (Wide: 2,700 Hz and Narrow: 2,400 Hz)

For this review, I chose the SSB + CW configuration. Note that filter bandwidths are fixed at the values shown above, and they are not adjustable. Measurements in the ARRL Lab confirmed that both filters are very close to their specified bandwidths. Swept frequency response plots are available from www.arrl.org/qst-in-depth.

Putting the Filter to the Test

Using an analog HF transceiver, I attached a cable between the radio's headphone jack and the input of the SOTABEAMS filter. At the filter output, I plugged in a set of headphones. (Later I also tried a small speaker and was surprised at how loud the filter output could get.)

Bottom Line

The SOTABEAMS external DSP audio filter can improve selectivity to help separate signals on crowded bands. It's especially useful with simple QRP transceivers and older analog transceivers without DSP features or narrow IF filters.



Figure 3 — The SOTABEAMS DSP filter rear panel has jacks for dc power, audio in, and audio out.

I turned up the transceiver volume until I achieved a comfortable listening range with the filter's **VOL** control while not causing its red **LVL** LED to flash. With the 2,700 Hz filter mode selected, I browsed a few SSB signals and was impressed with how well the SOTABEAMS filter enhanced the overall audio quality. I really didn't expect to hear a significant effect, but the SOTABEAMS filter made an obvious improvement.

The best was to come when I switched to CW. A CW contest taking place during the weekend after I received the filter provided an ideal environment for testing. Tuning into the CW portion of 20 meters, several signals popped through the 2,700 Hz filter simultaneously. When I switched the SOTABEAMS filter to narrow, however, the effect was pronounced. What was previously a chaotic mess became far easier to navigate.

Keep in mind that the filter is working at audio frequencies rather than RF, so its performance can be affected by such things as AGC pumping from strong nearby signals (where the desired signal level rises and falls as the receiver reacts to those nearby signals). Even so, the ability of the SOTABEAMS filter to impose a significant degree of order on the cacophony was remarkable. You can download an MP3 audio file and listen to the SOTABEAMS filter in action at www.arrl.org/qst-in-depth.

Switching back to the wide filter, I tuned again while watching the signal-tuning LED. This LED is driven by an independent DSP filter centered in the CW pass-band at 750 Hz. So, whenever I saw the green **SIG** LED pulsing to the beat of a CW signal, I knew I could immediately switch to the narrow filter and find that it was perfectly tuned. This became one of my favorite features.

A Worthwhile Addition

An external audio filter — even a DSP model such as this one — can't work miracles. It won't match the performance of a quality IF filter, and it will fall far short of what can be achieved in a software-defined radio. Still, the SOTABEAMS DSP filter made a vast improvement to my analog QRP radio, especially for CW operating, and it did so at an attractive cost.

Manufacturer: SOTABEAMS, Macclesfield, United Kingdom; www.sotabeams.co.uk. Price: \$73.44.

RigExpert Stick Pro 0.1 – 600 MHz Antenna and Cable Analyzer

Reviewed by Phil Salas, AD5X
ad5x@arrl.net

I reviewed the RigExpert Stick 230 antenna and cable analyzer in the June 2020 issue of *QST*, so I was interested in taking a look at the new Stick Pro. Like the Stick 230, the Stick Pro is quite compact, making it convenient for field measurements. It can be carried around your neck with the included lanyard, or it easily fits in a pocket or go bag. The Stick Pro adds some nice features compared to the Stick 230, such as a TFT color display, extended frequency range, and both audible and tactile feedback whenever you press a key. However, the operation and features of both analyzers are quite similar. More information is available in the manual available on the RigExpert website.



Stick Pro Overview

The Stick Pro is a single-port vector network analyzer (VNA) that provides signed, complex impedance measurements of RF loads from 100 kHz to 600 MHz, with a frequency resolution of 1 kHz. While the measurement port is a type N female, a UHF-to-N adapter is included. A USB A/C cable is provided for computer interfacing and charging of the internal lithium-ion battery. A battery indicator on each of the three main menus shows the battery status. A two-page *Cheat Sheet* is included with the Stick Pro, and a full user manual is available from rigexpert.com. There is also a Bluetooth LE interface to permit display and control from an iOS or Android device.

All information is displayed on a 1 × 1 inch TFT color screen, which I found easy to see even in strong sunlight. You can select single-frequency or swept-frequency displays of many of the measured parameters. Table 2 summarizes key specifications.

Using the Stick Pro

Prior to using the Stick Pro for the first time, go to the RigExpert website and download *AntScope2* software (Windows, macOS, and Linux versions are available), along with the *Flash Tool* for Windows or macOS. Install *AntScope2*, and then connect your Stick Pro USB cable to your computer, which automatically

Table 2
Stick Pro Manufacturer's Specifications

Frequency range: 0.1 to 600 MHz with 1 kHz resolution for 25, 50, 75, 100, 150, 200, 300, 450, and 600 Ω systems.
SWR measurement range: 1 to 100 in numerical modes, 1 to 10 in chart modes.
Impedance ranges: R = 0 to 2,000 Ω , X = -2,000 to 2,000
SWR chart: 100 points.
SWR chart at fixed ham bands by IARU regions: 100 points.
RF output: Square wave, 0.1 to 600 MHz, at -10 dBm into 50 Ω .
Operating temperature: 32 – 104 °F.
Dimensions: 7.3 × 1.6 × 1.3 inches. Weight: 6.5 ounces with battery.

Bottom Line

The Stick Pro antenna and cable analyzer is accurate, lightweight, and rugged. It will provide all the antenna, transmission line, and component evaluation needs of hams and professionals alike.

Open/Short/Load Calibration Loads

Sometimes it is convenient to calibrate out the interconnecting coax cable to be able to make a remote antenna measurement. To do this, you need to run through the open/short/load (OSL) calibration routine, where the open, short, and load are placed at the end of the cable. Of course, if you calibrate with the cable, you'll need to calibrate again right at the Stick Pro output to return everything to normal, as the Stick Pro only saves the last calibration file. The procedure takes about 2 minutes. See www.arri.org/qst-in-depth for details of the components and procedure used.

powers on the Stick Pro. Now open the downloaded *Flash Tool* file and the *Flash Tool* will automatically determine if there is a newer version of firmware available. If so, it will automatically update your firmware. It's all very easy to do. While you're in the downloading mode, grab your smartphone or tablet and download *AntScope* for iOS or Android.

The Stick Pro operation takes a little getting used to because there are only six keys on the unit, but it is not difficult to learn. If you use the Stick Pro infrequently, keep the manual or *Cheat Sheet* on hand for quick reference.

A quick press of the $\blacksquare$ key at the lower right, or a long press of any of the top four keys, will power on the unit. At turn-on, the display will momentarily show Antenna Analyzer 600 MHz, the serial number, and the firmware version. Then the Stick Pro will display the first of three main menus (see Figure 4), which is for antenna measurements. (The label **SHEET** with the top two measurement modes refers to display of the measurement results as numbers, while **CHART** at the bottom refers to display of results as charts as well as numbers.) A second tap of the $\blacksquare$ key brings up the **TOOLS** menu, and another tap of the $\blacksquare$ key will bring up the **CABLE** menu. Press and hold the $\blacksquare$ key to turn off the unit.

In the first menu, a tap of the > key at the lower left provides screens with descriptions of the measurement options, and it also provides access to user-adjustable settings. This includes open/short/load (OSL) calibration if desired. While the Stick Pro is shipped fully calibrated, you may wish to do an OSL calibration at the end of a coax feed line, so you can take remote measurements. OSL calibration only takes about 2 minutes. For more information, see the sidebar, "Open/Short/Load Calibration Loads."



Figure 4 — The Stick Pro controls and first displayed menu.

Antenna Measurements

The first menu offers several measurement options. In the **SINGLE** mode, you can sequentially display fixed frequency values of SWR and return loss (screen 1), Z , R and X (screen 2), L_s and C_s (screen 3), R_p and X_p (screen 4), and L_p and C_p (screen 5). I used the **SINGLE** mode to take the data shown in the measurement tables presented in this review.

The **MULTE** mode scans the entire 100 kHz to 600 MHz frequency range and displays all frequencies where the SWR is less than 3:1. You step through the found frequencies with the left and right arrow keys in the center row of buttons.

The **HAM** mode displays SWR graphically on each of the ham bands (plus 11 meters). You step through the bands with the left and right arrow keys. Once a band is selected, you can adjust the swept bandwidth with the $-$ and $+$ keys on the top row of buttons. You can change the center frequency with the left and right arrow keys. Figure 5 is an SWR scan of a 15-meter antenna using the **HAM** mode.

The **FREE** mode lets you set up a user-defined swept-frequency range. This is useful for sweeping a non-ham frequency range or looking at multiple resonances that you might find in a multiband antenna.

Table 3
Stick Pro Measured Open Circuit Impedance

Stick Pro serial number 00178, Firmware v. 1.3

Frequency (MHz)	Output (Z) (Ω)	Frequency (MHz)	Output (Z) (Ω)
1.8	>5,400	50	>1,500
3.5	>5,300	146	>500
7	>5,000	222	>370
14	>4,000	440	>180
28	>2,600		

In all cases, you can change frequency in two ways. First, tapping the left or right arrow key will decrement or increment the frequency in small steps. Pressing and holding one of these keys will change frequency in an accelerating manner. The second way to change frequency is to press the $>$ key for 2 seconds. This brings up a screen that permits changing the individual frequency digits using the left and right arrows and the $-$ and $+$ keys. After you've changed the digits, tap the $>$ key to set the frequency.

Other Measurements

The **TOOLS** menu displays the Bound, TDR, R and X , and Rloss tools. The Bound mode permits looking at a single-frequency SWR or return loss. The TDR (time-domain reflectometer) tool is a great way to find any problem areas in your transmission line. It shows blips on the plot where discontinuities or impedance bumps occur, as well as permitting a readout of the physical distance to these anomalies. You can also determine the physical length of your transmission line by disconnecting the far end, as this will show a major discontinuity at that point. The R and X (resistance and impedance) mode permits measuring the complex input impedance of an antenna system or filter, and the plot output makes it easy to find the resonant frequency of your antenna system even if the SWR is

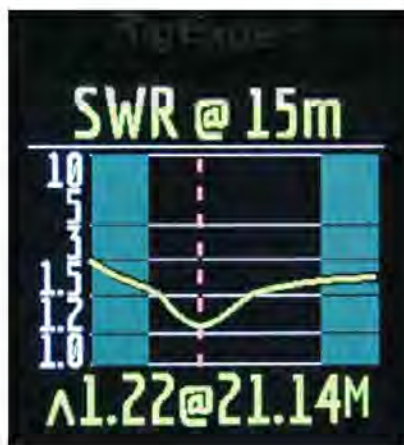


Figure 5 — An SWR plot of a 15-meter antenna viewed on the Stick Pro in the **HAM** mode.

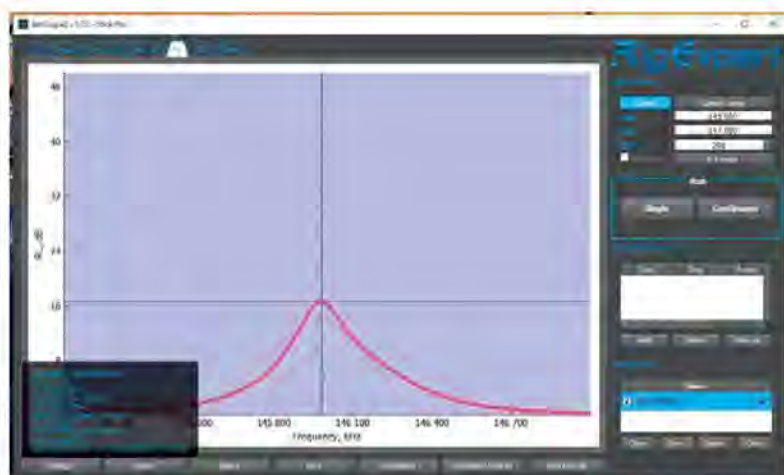


Figure 6 — The AntScope2 return loss sweep of a 2-meter band-pass filter.

Table 4
SWR Load Measurements

Measurements with the Stick Pro compared to Array Solutions VNAuhf

Freq. (MHz)	1.0:1 SWR Pro/VNA	1.9:1 SWR Pro/VNA	3:1 SWR Pro/VNA	4.4:1 SWR Pro/VNA	8.7 SWR Pro/VNA
1.8	1.0/1.0	2.00/2.02	3.2/3.2	4.7/4.6	11/11
3.5	1.0/1.0	2.00/2.01	3.2/3.2	4.7/4.6	11/11
7	1.0/1.0	2.00/2.01	3.2/3.2	4.7/4.6	11/11
14	1.0/1.0	2.00/2.01	3.2/3.2	4.7/4.6	11/11
28	1.0/1.0	2.00/2.00	3.2/3.2	4.7/4.6	11/11
50	1.0/1.0	2.00/2.00	3.2/3.2	4.7/4.6	11/11
146	1.0/1.0	1.99/1.98	3.2/3.2	4.8/4.8	10/10
222	1.0/1.0	1.98/1.95	3.3/3.2	5.1/4.9	11/10
450	1.0/1.0	1.97/1.98	3.7/3.2	5.6/5.3	13/9

Table 5
Stick Pro Complex Load Measurements

Stick Pro compared to Array Solutions VNAuhf measurements of SWR and series resistance/capacitance

Frequency (MHz)	Stick Pro SWR	Stick Pro Rs + Cs	VNAuhf SWR	VNAuhf Rs + Cs
50	1.98	48 Ω + 94 pF	1.97	48 Ω + 95 pF
146	1.83	45 Ω + 38 pF	1.83	46 Ω + 37 pF
222	1.78	42 Ω + 28 pF	1.77	43 Ω + 28 pF

high. This is good for adjusting the tap on a matching network to improve the SWR at a given resonant frequency. Finally, the RLoss (return loss) mode is a more sensitive means of measuring an antenna system or filter match as compared to SWR. It plots the results as well as displays the result numerically.

From the **TOOLS** menu, another short tap of the **□** key brings up the **CABLE** menu. From this menu, you can determine ¼- and ½-wavelength stub lengths (StubT), the length and velocity factor of a connected cable (cLen), the characteristic impedance of a connected cable versus frequency (clmp), and the loss of a connected cable versus frequency (cLoss).

Stick Pro Testing

I began my tests by checking the Stick Pro output against WWV at 10 MHz. I could not discern any difference in frequency between the two tones. Next, I found the signal frequency output level to be -8.6 dBm over the

full frequency range. Of course, the Stick Pro outputs more of a square wave, so there is high harmonic content in this measurement. As I only have a broadband power meter that responds to the power in the harmonics as well as the fundamental, I'd estimate that the fundamental frequency level is close to the -10 dBm specification.

Next, I recorded the Stick Pro's open-circuit impedance measuring capability. This gives an indication of the impedance magnitude that can be accurately

measured as a function of frequency. The results are tabulated in Table 3.

To test SWR accuracy, I checked the Stick Pro against a precision 50 Ω load, and then shorted microwave attenuators of 5 dB (1.92:1 SWR), 3 dB (3.01:1 SWR), 2 dB (4.42:1 SWR) and 1 dB (8.7:1 SWR). Because the attenuators are not perfect, I also measured them on my Array Solutions VNAuhf for comparison, as shown in Table 4. Both devices were calibrated with the same OSL components. The Stick Pro SWR readings compare quite favorably to the VNAuhf readings.

For my final tests, I used series resistive/capacitive (RC) complex loads with an SWR of approximately 2:1 at 50 MHz, 146 MHz, and 222 MHz. Table 5 displays the Stick Pro measurements compared to the VNAuhf. As you can see, the Stick Pro provides measurements almost identical to those seen on the VNAuhf.

AntScope for iOS and Android

An *AntScope* app provides the capability to control the Stick Pro and display measured data on iOS or Android devices via a Bluetooth LE (BLE) connection. I loaded *AntScope* for Android on my older smartphone (Android 6, which is the earliest supported version) and *AntScope* for iOS on my iPad (iOS 14.7.1).

In the iOS app, available menu choices are SWR Chart, Smith Chart, All Parameters, and TDR Chart. The **SETTINGS** screen is for specifying the measurement frequency range in kHz (either start/end frequencies or center frequency/span) and the number of measurement points. Although the latest version of *AntScope* for iOS in the App Store (v 1.4.5) recognized the device as a Stick Pro, the highest available End Frequency in **SETTINGS** was 230000 kHz (230 MHz, the top end of the Stick 230). It appears that the app is yet to be fully updated for the new model. Also, I was unable to find a way to save or export measurements made while the Stick Pro was controlled from the app. Figure 7 shows an SWR chart viewed in the iPad.

The latest version of *AntScope* for Android on Google Play was version 2.28. Unlike the iOS version, this allowed a Stop frequency up to 600 MHz with the Stick Pro connected. Measurement choices across the top of the screen are SWR, Phase, impedance ($Z = R + jX$ or $Z = R|+|jX$) and return loss (RL), and the measurements are displayed as plots. In the One FQ mode, you can display multiple measured parameters at a single frequency. Measurements and plots can be saved, recalled, and exported. At times, I found it difficult to establish and maintain the BLE connection between the Stick Pro and my Android phone. Some reviews on Google Play reported similar connectivity problems. I didn't experience that with the iPad. — Mark Wilson, K1RO

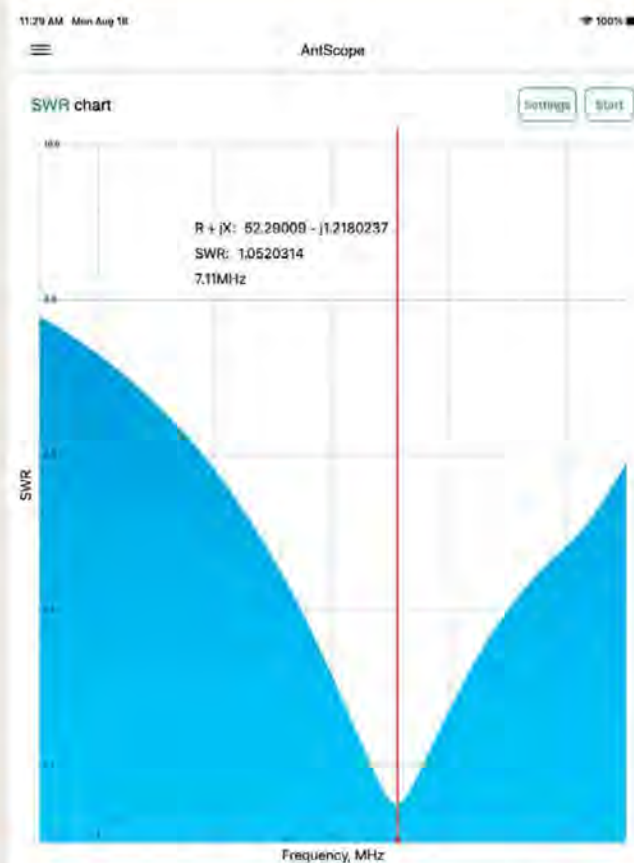


Figure 7 — SWR chart for a 40-meter dipole measured with the Stick Pro and the *AntScope* iOS app. The app automatically indicates the low SWR point (red line) and displays the frequency, SWR, and impedance measurements.

Computer Interface

As discussed earlier, the supplied USB cable provides for charging the internal battery and firmware updates when plugged into your computer, as well as interfacing with the *AntScope2* software program. *AntScope2* permits display of SWR, phase, impedance, return loss, Smith Chart, and TDR plots. *AntScope2* also permits importing and saving data from the Stick Pro memory, as well as providing real-time control of the Stick Pro.

Figure 6 shows the *Antscope2* return loss display of a 2-meter band-pass filter. Note that the return loss is displayed inverted from what is normally seen in other VNA software. I was unable to run the OSL calibration from *AntScope2*, as it would lock up on me part way through. This was unfortunate, as it appears that you can save multiple sets of calibration data when using

AntScope2. This would be convenient for storing calibration for different cable lengths and quickly being able to reload the normal calibration file. (For more on using the Stick Pro with mobile devices, see the sidebar, “*AntScope* for iOS and Android”).

Conclusion

The standalone Stick Pro works quite well. It is very accurate and is more compact and less expensive than the RigExpert AA-600 analyzer that covers a similar frequency range. Although it's not perfect, the companion *AntScope* software for PC and mobile devices is useful for viewing and manipulating measured data on a larger screen. See www.arrl.org/qst-in-depth for additional illustrations and information about the Stick Pro.

Manufacturer: Rig Expert Ukraine Ltd., Kyiv, Ukraine; www.rigexpert.com. Available from several US dealers. Price: \$390.

Digirig Mobile Digital Mode Interface

Reviewed by Steve Ford, WB8IMY
wb8imy@arri.net

Don't let the name of this product mislead you. Digirig Mobile is a digital transceiver interface for any application, mobile, or otherwise. This tiny device will allow almost any transceiver to interface with any computer that sports a USB port. With Digirig Mobile, your digital-mode software can switch the radio between transmit and receive. If your transceiver offers computer-aided transceiver (CAT) functionality, Digirig Mobile provides a serial data interface to allow your software to control various transceiver functions. Digirig Mobile also contains its own audio codec to process audio to and from the radio.

The Digirig Mobile has a black aluminum enclosure that measures $1.5 \times 1 \times 1$ inches, or about the size of a 9 V battery, and it weighs just 1 ounce. At one end of the case is a USB-C port for the cable to your computer. At the opposite end are two 3.5-millimeter jacks — one for serial data and the other for transmit and receive audio. There are no switches or indicators. The computer supplies dc power via the USB cable.

Setting Up Digirig Mobile

Digirig Mobile uses the common CP2102 serial interface, so chances are good that your computer already has the CP210x driver. This was the case for my Windows 10 laptop. When I plugged in the USB cable, the laptop quickly located and installed the driver, creating a virtual COM port. Bringing up the Windows Device Manager, I saw the new port and made a note of its number. At the same time, Windows recognized the Digirig Mobile audio codec as an "audio device" and added it to the list of audio inputs and outputs.

For this review, I used Digirig Mobile with a Yaesu FT-818 transceiver. High-quality cables specifically wired for your radio are options available at an additional cost, so I purchased the coiled cable set for the '818. Digirig Mobile offers cables for the Yaesu FT-100, FT-817/FT-818, FT-857, FT-857D, FT-891, FT-897, and FT-897D transceivers, as well as the Xiegu G90 and X5105 transceivers. Of course, you can make up your own cables and the Digirig website (www.digirig.net) offers detailed wiring diagrams.

Digirig Mobile does not come with a USB-C to USB-A cable, but these are inexpensive and commonly available. The Digirig website sells a well-made, coiled USB cable for \$8.97.



It is important to point out that Digirig Mobile can be used with transceivers that don't support CAT functionality, including handheld radios. There is a set of pads on the interface circuit board that can be easily bridged with bits of solder. By doing so, the TxD and RxD serial lines become non-inverting open-collector drivers controlled by the RTS and DTR lines of the virtual COM port. These drivers can be used to control the transceiver's PTT and CW key lines. Instructions on the website explain this.

Digirig Mobile developer Denis Grisak, KØTX, is also exploring the possibility of a simple modification that would add CI-V compatibility for Icom radios.

Digirig Mobile on the Road

As simple as Digirig Mobile is to set up and use, I thought a good test would be to take it on an impromptu Parks on the Air (POTA) expedition to a nearby park. I packed up the laptop computer, my FT-818, the Digirig Mobile interface, a sealed lead-acid battery, a portable HF vertical antenna, and headed out. Within minutes, I had my station up and running with *WSJT-X* software and making contacts using FT8 (see Figure 8). *WSJT-X*'s CAT function had no difficulty "talking" to the FT-818 transceiver through the Digirig Mobile interface once I selected the proper COM port. *WSJT-X* also recognized the audio codec inputs and

Bottom Line

The Digirig Mobile offers a seamless way to add a digital mode interface to transceivers without that capability built in. For plug-and-play setup, check out the optional cables if you have a compatible radio.



Figure 8 — The Digirig Mobile interface resting atop my Yaesu FT-818 transceiver. During this Parks on the Air activation, it worked perfectly for FT8 and PSK31 operating.

outputs. The receive level was somewhat high, so I accessed the audio codec device properties in the Windows Control Panel and adjusted it accordingly.

Switching to *fldigi* software, I chased down a few PSK31 contacts. I had to reconfigure *fldigi* to use the Digirig Mobile COM port and the audio inputs and out-

puts, but once communication with the interface was established, everything went smoothly.

Digirig Mobile is about as close to a plug-and-play digital-mode interface as you're likely to find. The interface does not come with a user manual; it is a matter of simply plugging in the cables, and you're on your way.

Manufacturer: Digirig, P.O. Box 2451, Grand Junction, CO 81502; **www.digirig.net**. Digirig Mobile interface, \$39.97; pre-wired cables for Yaesu FT-8xx series transceivers, \$29.97; pre-wired cables for Xiegu G90 and X5105 transceivers, \$19.97.



Congratulations

August 2021
QST Cover Plaque Award Winner

Hiroki Kato
AH6CY

In his article, "The Tin-Can Tower Vertical," Hiroki shows what can be done with scrap parts that might normally wind up in a landfill.

QST Cover Plaque Awards are given to the author or authors of the most popular article in each issue.

You choose the winners by casting your vote online at

www.arrl.org/cover-plaque-poll

Log in now and choose your favorite article in this issue!

The Tin-Can Tower Vertical

An effective 15-meter portable antenna made from coffee cans.

Hiroki Kato, AH6CY

I drink a lot of Italian Illy coffee, and wanted to use the abundant amount of coffee cans on a radio-connected project. Remembering an old article about a vertical antenna made from beer cans soldered together, I wanted to reproduce that with the coffee cans, which are 3.5-inch-diameter steel cans and could be easily soldered together with a 100 W soldering iron. Further, the larger the diameter of an antenna, the broader the frequency coverage, and the more efficient it is due to the increased radiating surface.



Ask Dave

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

Poor Transmit Audio Setup Leads to Splatter

Antenna Tuners Shouldn't be in Series

Q Frederick Baumgartner, KØFMB, of Colorado, asks: I've seen linear amplifiers with autotuners that include a warning to bypass the internal tuner if an external antenna tuner is in use. I can understand the folly of two automatic tuners in line chasing each other into the depths of destruction. However, I use a double-balanced tuner with wire antennas that often doesn't quite get to a 1:1 match. What would be wrong with having the amplifier's (or radio's) internal autotuner correct for the last little mismatch to a manual tuner?

A You're right that the general guidance is not to string multiple antenna tuners in series. Although tuners are conceptually simple devices, usually consisting of a couple variable (or switchable) capacitors and a variable (or switchable) inductor. When two are strung together, the underlying reactive circuit becomes far more complex, and the two tuners can react with each other in unpredictable ways. Voltages can become very high and tuner elements can be damaged.

An SWR that is not quite 1:1 may be perfectly acceptable. Some instruction books say the antenna system should have an SWR of 1.6:1 or less; others say 2:1. I do not use an external tuner at all. I have a 500 W amplifier, and do not have a tuner big enough to handle that. So, I try to prune my antennas so they all present a reasonable SWR — less than 1.6:1 — to the radio or amp. When I'm just using the radio, I will let the internal tuner touch things up. Rather than giving all your attention to the SWR, look at other factors, such as how high you can get the antenna, nearby large metal objects that might obstruct propagation, the strength of the guys, how well it will stay up in the event of a windstorm or ice storm, and signal strength of received signals. Use your *WSJT-X* setup on WSPR, so you can see where your antenna is being heard.

I recommend using your favorite tuner that gets the SWR down to about 1.6:1 and just going with it. You'll hear and be heard across your favorite bands.

Pennant Antennas

Q Rob Steenweg, VE1CHW, of Nova Scotia, Canada, asks: Why can't I find a pennant antenna design optimized for 40 meters? I have found designs for 160 and 80 meters, but not for 40 meters.

A The pennant antenna belongs to a group of non-resonant antennas, like the Beverage and flag antennas, and as such, they have high directivity, low gain, and very low noise. In form, they're part of the set of wave antennas, such as the open V and the rhombic. They were developed back when 1 MHz was considered a high frequency. With a preamplifier, they are great as receiving antennas. They work because the noise picked up is so much less than the signal. They are not transmitting antennas. Will they transmit? Yes, but much less than a dipole or properly loaded vertical.

You must consider the wavelength involved. These antennas work at low frequencies. For ham radio, that would mean 160 meters and 80 meters. You might get some good results on 60 meters. However, 40 meters is getting well out of the range where the signal travels close enough to the ground that it can be picked up without picking up noise. Note that because these antennas are non-resonant, one built for 160 meters may work well on higher frequencies, but by the time you get to 40 meters, you're probably getting very little useful work from them.

In an odd way, this is an exception to the rule that you can scale antennas for a higher or lower frequency. These specialized antennas don't scale much, having an upper frequency limit.

Using 40-Meter Antennas for 15 Meters

Q James Burrough, N5DTT, of Texas, asks: Some hams commonly use their 40-meter dipoles as 15-meter antennas. Is there any advantage on 15 meters as to gain or radiation pattern, or is this just a convenient way to be on both bands?

A I've done this many times. A 40-meter half-wave antenna is a three-half-wave antenna on 15. There are sticky things in the details, though.

I used *EZNEC 6+* to model a simple 40-meter dipole at 35 feet, which would be a common height for many amateurs. An optimum height would be 66 feet, but most hams (me included) can't get an antenna that high. Figure 1A shows the very common elevation pattern for the 40-meter dipole at this height. Unsurprisingly, most of the radiation goes up. Figure 1B shows the azimuth pattern, which, for an antenna over ordinary ground, is pretty omnidirectional. Now watch what happens to the elevation pattern in Figure 1C when a 40-meter dipole is used on 15 meters. About half the radiation goes up, and the other half to the horizon. It becomes very clear when you look at the azimuth pattern in Figure 1D. There are six lobes and some deep nulls too. So, whether you can work someone on 15 meters depends very much on how your antenna happens to be oriented with respect to the other ham.

There is one other problem pointed out by the modeling. If your antenna is cut for 7.15 MHz (the midpoint of the 40-meter band), the SWR on 15 meters can be quite high, varying from about 3:1 at the top of the band up to about 8:1 at the bottom of the band. Whether your rig's built-in antenna tuner can handle this depends on many variables. If it can't, you can try an external wide-range tuner.

Or, just put up a dipole cut for 15 meters. The pattern will be much more omnidirectional. Furthermore, the half-wave height for this antenna is just 22 feet (6.7 meters).

Splatter

Q Eric Johnson, KD9RNA, of Wisconsin, asks: During the Great American QSO Party, I noticed there were many calls that showed up at several points on the band — I believe this is called *splatter*. Can you explain what is going on, and what I should do to make sure I'm not guilty of the same thing?

A The sounds you are hearing are indeed called *splatter* — RF energy emitted by a transmitter outside the intended transmit bandwidth. It's caused because something in the audio or RF chain is being over-driven (microphone gain set too high) to the point that the circuit in question becomes nonlinear. This nonlinearity causes internal mixing and can create RF energy outside the normal RF bandwidth. This can occur if there's too much signal compression, which distorts audio so it can't be understood, and can create audio components that are out of band. It can also occur if the transceiver's final RF amplifier is overdriven (which is hard to do with modern transmitters), or the station's high-power amplifier is being overdriven.

Splatter is frowned upon because the out-of-band signals cause interference. Furthermore, it's pointless because the energy sent where it shouldn't go means that the actual signal has less power, and it's usually badly distorted and hard to understand. This is the great paradox of splatter: the operator tries so hard to be heard that the audio is hard to understand.

It's harder to create splatter with modern radios, because they have internal feedback circuits, but it is still possible. To avoid creating splatter, get out your rig's manual. Follow the instructions exactly for setting your microphone gain and again for setting your audio compression. If someone else listens for you as you do this, they'll tell you that your signal is clear and understandable. Adding compression beyond this level becomes counterproductive, because while it may sound louder, it starts to get distorted. Stick with the instructions in the manual.

Check out the "QST: Ask Dave" YouTube playlist at <https://bit.ly/3z2MBMI> for the video answer to this question.

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.

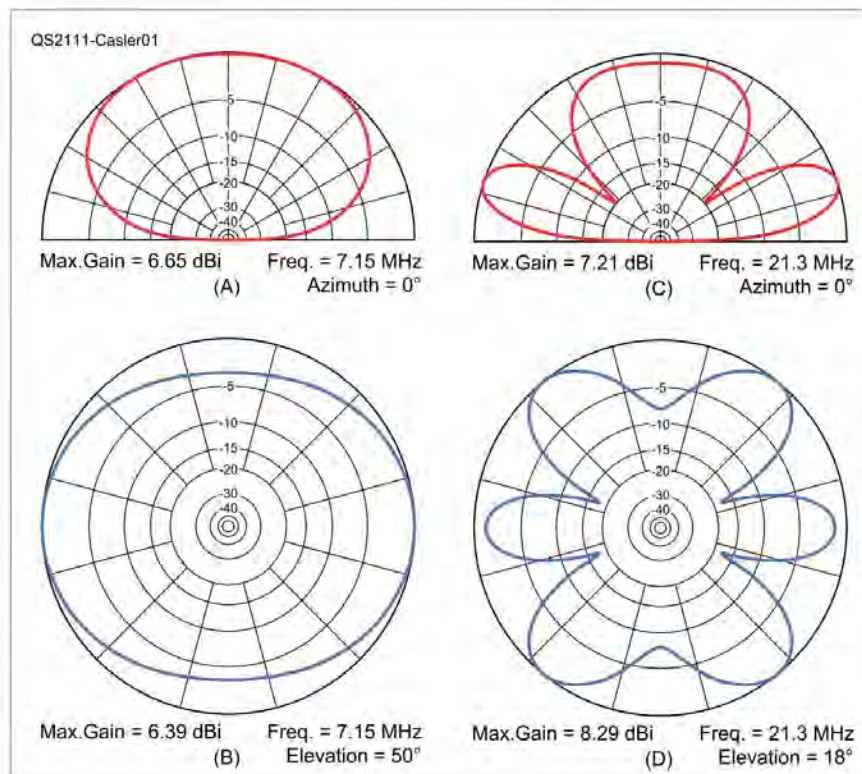


Figure 1 — *EZNEC* modeling showing results of using a 40-meter dipole at 35 feet above ground. (A) shows the elevation pattern of the dipole used on 40 meters. (B) shows the azimuth pattern, which is not quite omnidirectional, but it is close. (C) shows the elevation pattern when the 40-meter dipole is used on 15 meters. (D) shows the azimuth pattern with its six beam patterns and some deep nulls.

Hints & Hacks

A Customized Station Clock

I've designed a unique station clock that simultaneously reads in both UTC and local time. The magic of this clock lies in its uncommon arrangement of numerals.

In Figure 1, you can see that there is an 8 where a 12 would normally be. This is because the "out-of-phase" numerals are UTC, not local time; you don't need numerals to determine local time. Therefore, the numbers on this clock display UTC only.

Try reading the clock yourself. Are you able to read the local time in Figure 1? Clearly, it is 8 minutes after 9. How about UTC? Again, it is easy to see that it is 8 minutes after 5.

Of course, the UTC numbers must be different for each local time zone. For my home in California, the UTC offset is local time plus 8 hours. That's why there's an 8 where a 12 would normally be. You will find number tem-

plates to download for the six main US time zones on the *QST* in Depth page at www.arrl.org/qst-in-depth.

The little numbers on the outer rim are also UTC, but only for when your time zone is observing Daylight Saving Time.

More Personalization

I like the idea of custom hands with a bit of ham radio flair. I own a 3D printer, so it was easy for me to make hands with a theme. (If you don't own a 3D printer, there may be a ham in your area who does.) I chose a multi-element Yagi antenna for the hour hand and a length of coax with a PL-239 connector for the minute hand. You may, if you wish, use stock hands. The 3D printer STL files for my custom hands are available at www.arrl.org/qst-in-depth.

As a final touch, and one which is very handy for operating, I added my

Maidenhead grid square number and my latitude and longitude to the clock face.

This project uses an inexpensive clock you can find on Amazon for about \$11. Just go to www.amazon.com and search for "Bernhard Products Black Wall Clock." Look for the 10-inch model.

However, this project does not use the quartz movement that comes with the clock. I wanted the additional accuracy of a WWV-synchronized clock for my station. An inexpensive 60 kHz WWV synchronized "atomic" replacement movement is available from www.klockit.com. It is a 1:1 snap-in fit for most quartz clocks (see Figure 2).

The atomic movement is also better than the stock unit in that it accepts much thicker modified or 3D-printed plastic hands. I used glue-on card stock cutouts to customize the hands



◀ **Figure 1** — A customized station clock. It is based on an inexpensive Bernhard Products clock that has been fitted with a few personalized features.

▲ **Figure 2** — The WWV-synchronized 60 kHz "atomic" replacement movement from Klockit.



Figure 3 — The Klockit movement mounted in its inverted position in the support fixture.

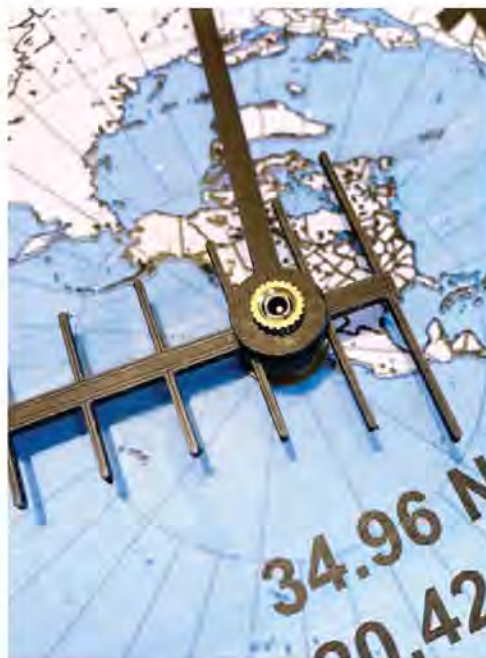


Figure 4 — Custom 3D-printed hands secured on the motor shaft.

on my initial prototype. You may do the same with this movement using any of the stock hands.

If you have experience with *Photoshop* or similar graphics software, you may wish to add a background image. I used an azimuthal map of the world, centered on my location. Tom Epperly, NS6T, provides maps at his website at ns6t.net/azimuth/azimuth.html. On that site, you can customize and download an azimuthal map centered on your location, at a radius of your choice.

Align the numerals template for your time zone, the background image, and the text of your Maidenhead grid square and latitude and longitude. This can easily be done using the “Layers” functions of your graphics program. Print the result as the new face on heavy-weight card stock. If your 8½ × 11 inch printer cuts off the image at the edge, resize the face to compensate, or join together two sheets of card stock for a face that is wider than your printer allows.

Construction

Disassemble the case. Pull off the hands and remove the existing face. Unscrew the motor nut and remove the movement from the mounting fixture on the back.

Glue the new face in place and cut out the center hole with a hobby knife. Push the new atomic movement into the fixture from the back and secure it in the case with the nut and washer supplied (see Figure 3). It is larger than the stock movement and must be mounted upside down. During initial setting of the atomic movement, as detailed in the supplied instructions, you will need to pull off and then reattach the hands in inverted positions because of the upside-down movement.

Using my 3D-printed hands, the Yagi-beam hour hand slides onto the largest shaft diameter of the Klockit motor using light pressure (see Figure 4). I recommend first manually running a 15/64-inch drill bit carefully

through the mounting hole in the hand. Go easy; the hand is strong but breakable. Do not use a drill motor or drill press. The minute hand also pushes on and is secured with the small, knurled nut supplied with the motor. Pay attention to the alignment flats in the mounting hole in the hand. Synchronizing instructions for the atomic movement come with the motor. — 73, John Portune, W6NBC, jportune@aol.com

All photos by the author.

“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@arri.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.

Eclectic Technology

Notes from the CW Software Front

For many years, I've had a certain fascination with CW decoding software. You'd think that a relatively straightforward coding scheme — International Morse — applied to simple on/off transmitter keying would lend itself well to decoding with software. While progress has been made in this area, after more than 2 decades of development the results still fall short of what flesh-and-blood operators can achieve.

A large portion of the problem is variability, which is a fancy way of saying that different people have different CW sending styles. If everyone sent machine-perfect CW, decoding with software wouldn't be such a challenge. The software would "know" exactly what to expect in terms of the lengths of the *dits* and *dahs*, and the spaces between them. But combine operator variability with the vagaries of noise, fading, and interference and you have a challenging situation to say the least. Once again, human brains handle this very well. For most software decoders, however, it is a bridge too far.

CWTY Decoder

Grant Connell, WD6CNF, has been authoring Windows-based amateur radio software for years. He gives away his creations free of charge at his website, www.hotamateurprograms.com. In preparation for an Eclectic Tech podcast interview with Grant last July (Episode 37), I visited his website and discovered a new program: *CWTY Decoder*.

Among his many interests, Grant has been chasing the goal of improving CW decoding software and *CWTY Decoder* is the latest result. In this application, he attempts to expand on the idea of software that "learns" as it decodes, trying to compensate for CW sending that deviates from perfect, and dealing with noise and everything else at the same time.

I gave *CWTY Decoder* a try and the results were impressive. The software locks onto signals quickly and begins tracking variations in the operator's sending style, learning and adapting as it goes. It can display the signal as an audio spectrum, or you can switch to a waterfall display. Figure 1 shows an optional window that compares the audio signal pluses with what the software is decoding, and the timing differences between the two.

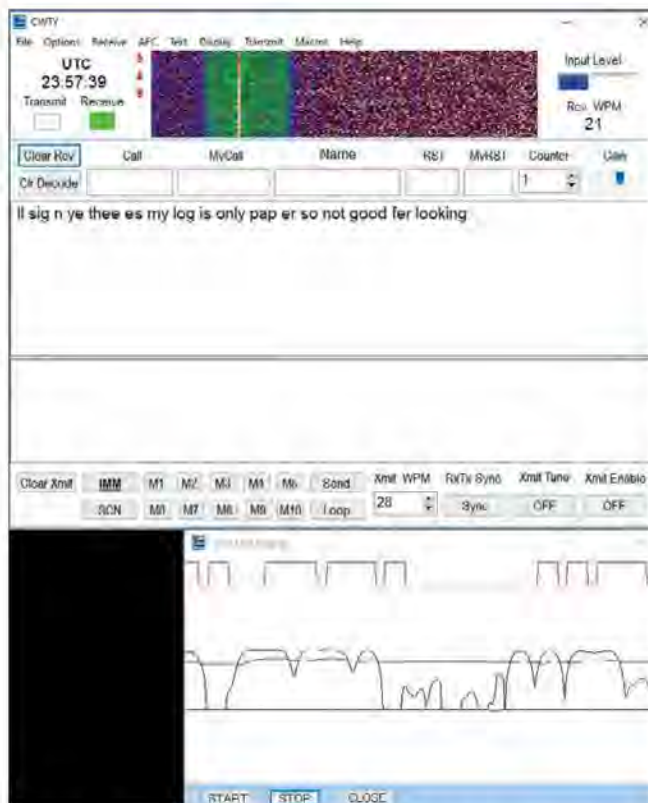


Figure 1 — *CWTY Decoder* with the waterfall display enabled. For this view, the Time Line Display has also been activated to compare the received signal with the application response.

Soon after loading the software, I ran into a person on 20 meters sending rather badly with a bug. Did *CWTY Decoder* perform magic and render a perfect result from the mangled Morse? No, but it at least printed lines of text that were mostly comprehensible, enough that one could get the gist of what was being sent. Better fists produced much better results, of course.

CWTY Decoder can also send as well as receive. You can type into the transmit window or use any of the programmable macro buttons. Interestingly, Grant took the additional step of including the ability to send a number of rarely encountered characters such as @, #, and parentheses. Assuming the person on the receiving end recognized the characters, this could be a helpful feature.

CWTY Decoder is still no match for a seasoned CW operator, but Grant has clearly advanced the CW-decoding art. If you're curious, it costs nothing to try.

The First Activation of Antsell Rock

David Wise, KM3A

One of the many things I enjoy about ham radio is that there are many different aspects of the hobby, so just about everyone can enjoy it. I discovered my interest in radio in 2019, when I activated my first summit with Summits on the Air (SOTA). This program encourages portable operation in mountainous areas around the world.

My first SOTA activation involved driving to the top of a 930-foot hill and walking several hundred feet to set up a Yaesu FT-817 and a magnetic loop antenna. I made five contacts on 20-meter SSB, with operators in Washington, Kansas, Oklahoma, and Louisiana. This might not seem like much to a seasoned ham, but it was incredibly exciting for a beginner like me. It was my first test of HF, QRP, and SOTA, and I was impressed that I could communicate that far outside of California with only 5 W and no other infrastructure.

Seeking Adventure

As I continued my quest for exciting SOTA activations, my skills progressed and I improved my portable station. Through repeat contacts and social media, I met Scott Lindquist, NØOI, who shared a love of SOTA. He had 33 years of experience in the hobby and ultimately became my mentor. We both live in southern California, approximately 1½ hours driving distance from each other.

After activating several summits together, we started looking at various maps in an attempt to locate summits that had never been activated before. One mountain stood out to both of us — Antsell Rock in the San Jacinto Wilderness. Apache Peak (to the east) and Tahquitz Peak (to the west) had been activated numer-

In search of adventure, a novice ham and his mentor were the first to activate this challenging summit for Summits on the Air.



David Wise, KM3A, holding the SOTA flag at the top of Antsell Rock.

ous times, but Antsell Rock had never been activated. In my research, I found that prior mountaineers claimed the peak was the “most difficult peak in the Desert Divide” (a major ridge system in the southern part of the San Jacinto Mountains) and that it was “a high jagged ridge” that involved a difficult Yosemite



◀ Scott Lindquist, NØOI, ascends the YDS Class 4 face of Antsell Rock in the final stretch toward SOTA Summit W6/CT-248.

Decimal System (YDS) Class 4 climb over several exposed areas. Because Scott and I had climbing backgrounds and were familiar with mountaineering and the use of ropes, we decided to attempt an activation of Antsell Rock.

Activating a New Summit

With the aid of a topographical map, Scott and I were able to navigate to the Pacific Crest Trail (PCT) via a saddle between Antsell Rock and Apache Peak. We followed the PCT for a short distance before needing to climb a steep gully that was approximately 700 – 800 vertical feet. After that, we were faced with some large boulders and an exposed climbing wall, which didn't require any ropes, but we needed to use both hands and feet to maneuver through it.

We were thrilled when we reached the summit, and our excitement was elevated by the stunning views of the surrounding San Jacinto Wilderness. While there had been other expeditions that successfully summited Antsell Rock, none of them had activated the peak for SOTA. Scott and I set up our antenna systems and began calling CQ.

Our expedition totaled 26 contacts on CW, SSB, and FM. Rather than returning the way we came, we decided to rappel down several canyons. Although this made for a quick initial descent, we were forced to bushwhack for a bit, which resulted in minor abrasions and cuts. Upon returning to our car, we both agreed this expedition was probably the best activation either of us had ever done.

Conclusion

Even though this particular trip didn't require a stamp in a passport, a rare grid, or a DX contact, for us it was truly extraordinary. With Antsell Rock now behind us, the quest continues. More exciting adventures, stories, contacts, and SOTA summits await, and I'm eager for the experiences they'll bring.

All photos by the author.

David Wise, KM3A, currently works as a Financial Crimes Investigator for Orange County in California and is a US Marine Corps veteran. He enjoys the outdoors and primarily operates CW and QRP portable. David can be reached at km3a@arri.net.

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

VOTE

If you enjoyed this article, cast your vote at www.arri.org/cover-plaque-poll

The Beverage Antenna, 100 Years Later

Still relevant for its noise-rejection abilities, the Beverage will become more important during Solar Cycle 25 as increasing sunspot activity leads to weaker signals on 160 and 80 meters.



Ward Silver, NØAX, and Frank Donovan, W3LPL

On June 7, 1921, Harold Beverage, W2BML, (previously 2BML) obtained his first patent for his radio receiving system. Back then, as they do now, operators struggled to hear signals through the atmospheric static that grew stronger as the frequency dropped. The VLF-through-MF spectrum had very high noise levels that overloaded receivers and made consistent reception very difficult, particularly in the summer months.

Beverage's main discovery was that a long horizontal wire (known to have a bidirectional pattern) could be made unidirectional by keeping it close to the ground and terminating one end of the wire with a resistor. When the wire was aimed at the transmitting station, this had the effect of rejecting noise and interference from other directions, which increased the signal-to-noise ratio (SNR).

A Basic System

The basic Beverage antenna system is shown in Figure 1. The antenna needs to be close to the ground (as opposed to being high in the air) and works best over a ground area with medium-to-poor conductivity.

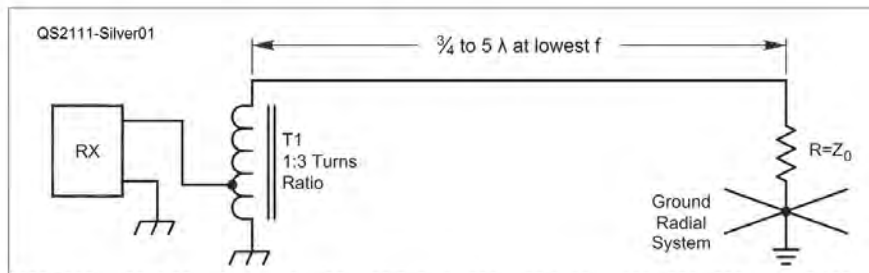


Figure 1 — A simple one-wire Beverage antenna with a resistive termination and a 9:1 impedance transformer provides a good match to 50 Ω coaxial cable.

The trade-off is length — Beverages need to be at least $\frac{3}{4} \lambda$ long to provide effective noise rejection.

Wave Front Tilt

A radio wave is an electromagnetic field (EMF) with an electric (E) and magnetic field strength (H) component at right angles. An EMF induces voltage and current in every conductor it encounters. How much voltage and current depends on the orientation of the EMF, with respect to the antenna. As a radio wave arrives from the ionosphere, its vertically polarized electric field component (E field) is tilted forward, as shown in Figure 2. Wave front tilt results from being reflected by the ionosphere. Higher arrival angles increase the tilt.

Figure 2 shows why tilt is important. For the wave to induce a voltage in the antenna, the E field must at least partially align with the antenna. There won't be any voltage if the wave front arrives with a perfectly vertical E field. When the E field is tilted, however slightly, it becomes partially parallel to the antenna. The vertical portion of the tilted E field doesn't create voltage in the antenna, but the horizontal portion does. The result is induced voltage along the entire length of the antenna.

Vertical vs. Horizontal Polarization

Figure 2 shows a vertically polarized E field. A horizontally polarized E field that's parallel and close to Earth is severely attenuated by ground losses. Furthermore, if arriving along the antenna, the E field is at a right angle to the antenna and can't induce voltage in it. That means the Beverage antenna is most sensitive to vertically polarized signals arriving in line with the antenna. (Regardless of a signal's

original transmitted polarization, ionospheric propagation always causes polarization rotation, known as Faraday rotation, so the sky-wave signal arrives with a mix of vertical and horizontal polarization.)

The Side and Top

Even if tilted, the vertically polarized E field of signals arriving broadside to the antenna is at a right angle to the antenna and can't induce voltage. Horizontally polarized signals arriving broadside to the antenna have an E field parallel to the antenna, but don't result in strong received signals.

While the vertically polarized E field of a sky-wave signal is perpendicular or tilted with respect to Earth, the horizontally polarized E field is always parallel to Earth. When a horizontal E field is very close to Earth (much less than $\frac{1}{4} \lambda$), it's significantly attenuated by ground conductivity and can't induce much voltage into the antenna.

When sky-wave signals arrive from nearly overhead, both horizontally and vertically polarized E fields are parallel to Earth. They are severely attenuated when close to Earth, before inducing a voltage into the antenna.

Front and Back

The Beverage antenna develops a main forward beam because wave fronts arriving at angles offset from the antenna induce progressively less voltage into it as the angle increases.

Figure 3 shows the Beverage antenna accepting signals from the "front" and rejecting them from the "back." If the right-hand end of the antenna in the figure is left open-circuited, a signal from the back reflects off the end of the wire, just like in an open-ended transmission line. The signal then returns to the feed point, diminished by a small amount of attenuation from the lossy

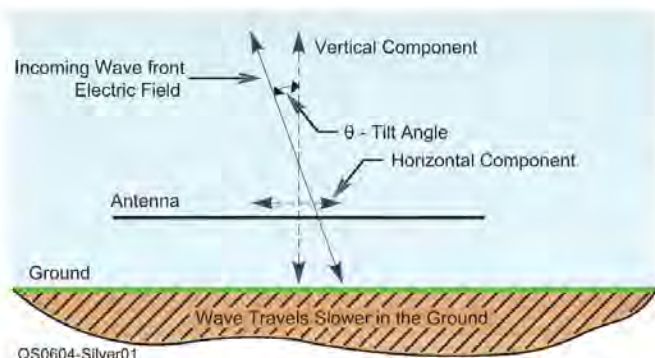


Figure 2 — Incoming signal wave fronts tilt at ground level, due to reflection in the ionosphere and the effects of ground.

ground below the wire. This unterminated, bidirectional Beverage receives signals from the "front" and slightly less from the "back."

If the antenna is terminated with a resistance approximately matching its characteristic impedance, the undesired signal is absorbed at the end of the antenna and not reflected to the feed point. We now have an antenna that attenuates signals in all directions, except from the direction of its terminating resistance. Figure 4 shows the resulting pattern for 160-meter Beverages that are 1λ (545 feet) and 2λ (990 feet) long.

Traveling-Wave Antennas

The Beverage antenna is a traveling-wave antenna because it never has standing waves from reflections from the ends of the wire. As a result, it's also non-resonant, and the antenna dimensions aren't required to be a specific fraction or multiple of the signal wavelength. Beverages work well over a fairly wide frequency range where they're between about $\frac{3}{4}$ and 5λ long, with good performance around 1 to 2λ .

Transmission Line

The Beverage antenna has a characteristic impedance and not a feed-point impedance. Like a dipole antenna, current in the Beverage's horizontal wire creates an electrical reflection or image on the ground below it. The current in the wire and its image create an unbalanced transmission line with a characteristic impedance. If this Beverage transmission line is terminated with that same impedance, any signals flowing toward the termination are absorbed, as with any other transmission line. Most Beverages have a characteristic impedance of about

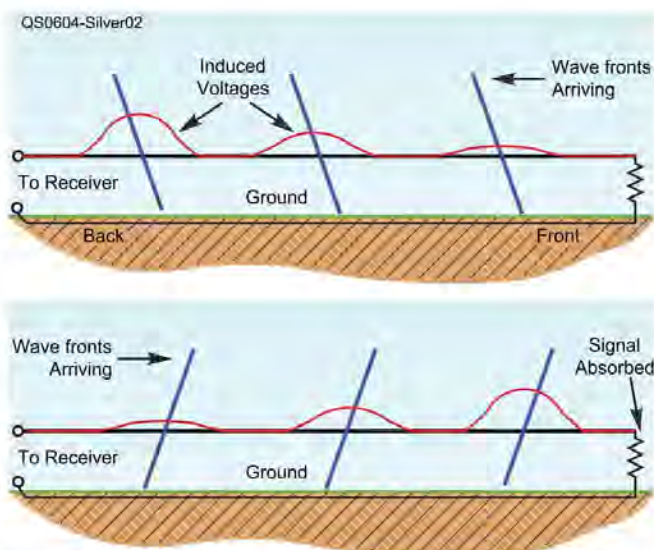


Figure 3 — Voltage waves build up along the antenna and are either transferred to a feed line or absorbed by a terminating resistance.

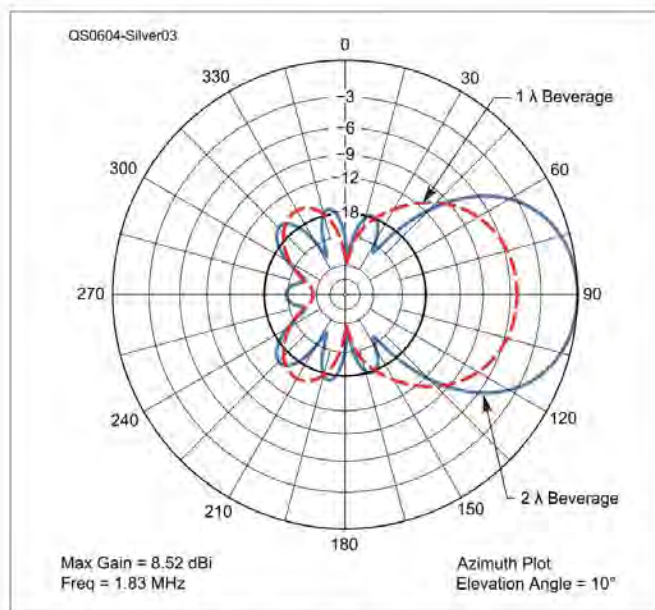


Figure 4 — Radiation patterns for a 1 and 2 λ Beverage antenna. Both antennas have a broad forward lobe and good rejection of signals from the sides and back.

500 Ω . The exact value is relatively unimportant to the performance of the antenna.

Ground Conductivity

Ground conductivity has a big effect on Beverage performance. Lossy ground enhances its performance, but high ground conductivity (especially salt water) severely degrades it. The horizontally polarized E field and tilted vertically polarized E field that induce voltage into the antenna when it's installed over lossy ground are shorted out. Unlike transmitting antennas, the Beverage requires medium or poor ground conductivity to work well.

Building a Basic Beverage

Figure 1 shows a basic Beverage antenna. Any sturdy wire will do (insulated or bare), as long as it's strong enough under the necessary tension. Transformers can be purchased from various sources, or you can wind your own. Tom Rauch, W8JI, has published an informative website on constructing Beverage antennas at <https://new.w8ji.com/beverage-antenna-construction>.

The full benefits of a Beverage antenna begin to appear when the length reaches about 1 λ , but any length above about $\frac{1}{2} \lambda$ will have some useful directivity (see Table 1). Consider that a Beverage antenna that's 1 λ long at 160 meters will be 2 λ on 80 meters and 4 λ on 40 meters. The antenna can be used on all of these fre-

quencies. Longer Beverages develop a progressively narrower pattern and better interference suppression outside the narrower beam. With a length above 5 λ , sensitivity begins to decline

because voltages and currents induced by the tilted wave front start interfering with voltages and currents traveling along the antenna to the feed point.

Speaking from experience, the Beverage wire should be high enough that animals don't run into it. Typical heights range about 6 – 10 feet. The wire should have insulated support at about every 50 feet, but this isn't critical. Electrical fence insulators work well and can be nailed to wooden posts or trees.

The antenna isn't particularly sensitive to small variations in height above ground. Like small "wrinkles" in a two-wire feed line, unless the variations exceed about 0.1 λ , which is about 50 feet at 160 meters, they'll have little effect. Small detours around or over non-conductive obstructions also have little effect.

By using separate feed lines at each end or by using relays to switch between a terminating resistor and a transformer and feed line, signals can be received from either direction. You can also build a two-wire Beverage that can receive from either direction through a single feed line, as described in *The ARRL Antenna Book for Radio Communications* (www.arrl.org/arrl-antenna-book) or *ON4UN's Low-Band DXing* by John Devoldere, ON4UN (SK).

Table 1 — Recommended Beverage Lengths

Band	Length
160 meters	500 – 1,200 feet
80 meters	300 – 600 feet
40 meters	200 – 500 feet

Ward Silver, N0AX, has been licensed since 1972. He is Lead Editor of *The ARRL Handbook* and *The ARRL Antenna Book*, and is the author of all three editions of the *ARRL Ham Radio License Manual* and study guides. He released the well-received *Grounding and Bonding for the Radio Amateur* in 2017 and recently authored the third edition of *Ham Radio for Dummies*. Ward can be reached at n0ax@arrl.org.

Frank Donovan, W3LPL, began his ham radio journey at 12 years old, during the W1OP/1 Providence Radio Association 1959 Field Day. His multioperator, multitransmitter DX contest teams have made more than one million DX contacts in CQWW and ARRL DX contests. He retired 10 years ago as a Chief Engineer at General Dynamics, after a 45-year career in electronics and systems engineering. Frank can be reached at donovanf@erols.com.

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



ARRL Board Returns to In-Person Meeting for Second 2021 Session

During the July meeting, the ARRL Board of Directors adopted a licensing grant program for young amateurs, created a new committee, and conferred awards to deserving applicants.



With the COVID-19 travel and gathering restrictions decreasing, the ARRL Board of Directors met in person on July 16 – 17 in Windsor, Connecticut, for the first time since January 2020 (the Board and Executive Committee had been meeting in virtual sessions since then). During this meeting, ARRL formally endorsed a proposed “Youth Licensing Grant Program,” which asks ARRL to cover the \$35 application fee for ham radio license candidates younger than 18 years of age. The FCC isn’t expected to implement the new application fee schedule until 2022.

The concept behind the program was first raised by ARRL Southeastern Division Director Mickey Baker, N4MB, at the Board’s annual meeting in January. An ad hoc committee review subsequently expanded the scope of the original motion.

The program goals include expanding the reservoir of trained operators, technicians, and electronics experts within the amateur radio community, and removing a financial obstacle to young people who wish to acquire

an amateur radio license. This program aims to help encourage careers in science, technology, engineering, and mathematics.

Under the program, ARRL would cover a one-time \$35 application fee for each qualified candidate who passes one or more amateur radio exams taken on the same day at a single examination session. Tests would have to be administered by a Volunteer Examiner (VE) team working under the auspices of the ARRL Volunteer Examiner Coordinator (VEC). Qualified candidates would pay ARRL VEC® a reduced exam session fee of \$5.

The new program would also “enhance ARRL’s position as the leader in volunteer testing,” the Board motion said. “The Board believes that the recruitment and training of young amateur radio operators is a necessary and proper mission of ARRL, and that subsidization of the \$35 fee will reduce the number of new amateurs that otherwise would be lost from these groups.”

Staff at ARRL Headquarters would determine the method of qualifying applicants, giving VE teams flexibility to determine whether a candidate is eligible for reimbursement in the absence of documented proof. The new program would initially serve up to 1,000 new license applicants who are under the age of 18.

The motion gave ARRL staff “complete latitude” to determine how payment is delivered to the FCC or how to reimburse eligible applicants. The program length is



The ARRL Board of Directors met on July 16 – 17 in Windsor, Connecticut, for its second meeting of 2021. [Michelle Patnode, W3MVP, photo]



ARRL President Rick Roderick, K5UR, and CEO David Minster, NA2AA. [Michelle Patnode, W3MVP, photo]

indefinite — it may be renewed or terminated by the ARRL Administration and Finance Committee or the Board of Directors.

New Emergency Communications and Field Services Committee

At the July meeting, the ARRL Board approved changes to the By-Laws, creating a third standing committee that joins the existing Administration and Finance Committee, as well as the Programs and Services Com-

mittee. The charter of the new Emergency Communications and Field Services Committee (EC-FSC) is to develop and recommend new or modified Board policies and programs for emergency communications through the Amateur Radio Emergency Service® (ARES®) and National Traffic System (NTS™).

The committee will also offer enhanced support for its Field Organization leadership volunteers, including Section Managers, and an increased focus on ARRL Affiliated Clubs. Furthermore, the EC-FSC will provide guidance to the CEO regarding translating Board policies 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. Additionally, the EC-FSC will be responsible for monitoring and assessing trends in emergency communications technology and participant skills worldwide, and for identifying best practices for voluntary emergency communications provided by ARES and NTS, while coordinating and cooperating with other amateur radio national societies, as appropriate.

Awards Conferred

Doug DeMaw, W1FB, Technical Excellence Award

Steve Franke, K9AN; Bill Somerville, G4WJS, and Joe Taylor, K1JT, received the ARRL Doug DeMaw, W1FB, Technical Excellence Award for their July/August 2020 QEX article, "The FT4 and FT8 Communication Protocols." The DeMaw Award honors the author of an article or article series in ARRL periodicals for the past year, which possesses the highest degree of technical merit.

Philip J. McGan Memorial Silver Antenna Award

John Levo, W8KIW, of Hillsboro, Ohio, was designated as the recipient of the 2021 ARRL Philip J. McGan Memorial Silver Antenna Award. This award honors a Public Information Officer who successfully promotes all aspects of amateur radio that enhance the understanding of amateur radio's contributions to education, public safety, and recreation. The Board said that over time, Levo's efforts have captured "the many avenues of opportunities of amateur radio as a hobby, an education tool, and a service for public safety."

Technical Service Award

The 2021 ARRL Technical Service Award recipient is James Baxter, KØUA, of Branson, Missouri. The Board said that Baxter "exemplifies the spirit of this award due to his diligent work assisting hundreds of hams get on the air [sic], particularly with FT8, and by spending countless hours on web sessions with them to work out their con-

figuration issues, show them best practices, and to help track down RFI issues."

Technical Innovation Award

The Board bestowed the 2021 ARRL Technical Innovation Award on Steve Haynal, KF7O; Wojciech Kaczmarek, SP5WWP, and Roger Clark, VK3KYY. Haynal was cited as the driving force behind the Hermes-Lite 5 W HF software-defined radio (SDR) transceiver, which is a fully open-source hardware and software project. Kaczmarek was recognized for developing the open-source digital radio communication protocol M17, which led to the development of DROID-Star (an Android application) by Doug McLain, AD8DP. Clark was cited for spearheading a successful effort to augment a low-cost handheld radio for use by visually impaired operators, significantly lowering the cost of entry for such amateurs.

Herb S. Brier Instructor of the Year Award

The Board awarded the 2021 ARRL Herb S. Brier Instructor of the Year Award to David Ritter, ND4MR, of North Wilkesboro, North Carolina. ARRL sponsors this award in conjunction with the Lake County Indiana Amateur Radio Club in Brier's memory, to recognize superior amateur radio instruction and recruitment. An ARRL member for nearly 40 years, Ritter is an ARRL registered license instructor and a full-time faculty member at Wilkes Community College in Wilkesboro, North Carolina, where he's been the lead (and sole) Technician licensing course instructor since 2010.

Other Business

In other business at the Board's July meeting, ARRL Treasurer Rick Niswander, K7GM, reported that ARRL's investment portfolio recorded a total return of \$1.377 million for the second quarter.

Chief Financial Officer Diane Middleton, W2DLM, reported that ARRL continues to have a financially strong balance sheet with current total assets of \$42 million, generating larger-than-expected gain from operations through June 30. Total revenues were greater than forecast, while expenses were lower than forecast.

Chief Executive Officer David Minster, NA2AA, told the Board about an exponential return to "normalcy" at ARRL Headquarters. Minster also touched upon the pending implementation of the cloud-based association management solution, Personify360.

The Board authorized ARRL President Rick Roderick, K5UR, to create a committee to search for a new ARRL Treasurer to present to the Board of Directors for their approval.

The Hiram Percy Maxim Award

Increasing the interest and participation in amateur radio of those younger than the age of 21 remains a primary effort of ARRL. Under-scoring that focus is ARRL's annual bestowing of its premier award, the Hiram Percy Maxim Memorial Award, on a young member whose contributions to both amateur radio and their local community embody the ideals of the Amateur Radio Service.

The recipient of the 2021 Hiram Percy Maxim Memorial Award is Katherine M. Forson, KT5KMF, of Plano, Texas. A Technician in 2013 at the age of 9, a General in 2017, and an Amateur Extra in 2018, Forson's enthusiasm resulted in her appointment as the ARRL North Texas (NTX) Section Youth Coordinator in 2019.

She's an active member of the Plano Amateur Radio Klub and Collin County Radio Amateur Civil Emergency Service (RACES), and is a trained National Weather Service (NWS) SKYWARN® Storm Spotter. She has been profiled in the QST "Member Spotlight" column, participates as an amateur radio operator in public service events such as the Plano Balloon Festival, and is currently working with several other young female hams in the ARRL NTX Section to help build a female-friendly area of the Section's website.

When not on the radio, Forson is active in her school and community. A senior at Plano West Senior High School, she's a member of the National Honor Society, the Spanish National Honor Society (Sociedad Honoraria Hispánica), and the high school band. She won second place in the Dallas Regional Science and Engineering Fair and placed second in the physics and astronomy category at the Texas State Science & Engineering Fair. She serves as a children's lector at her church, and is a Visiting Nurse Association (VNA) Meals on Wheels volunteer for Dallas County residents.

The Hiram Percy Maxim Memorial Award consists of a \$1,500 cash award and an engraved plaque. West Gulf Division Director John Robert Stratton, N5AUS, and NTX Section Manager Steven Smith, KG5VK, will present Forson with her award at an upcoming meeting of the Plano Amateur Radio Klub.

ARRL Seeks Treasurer

After 10 years of distinguished service to ARRL as its volunteer Treasurer, Frederick "Rick" Niswander, K7GM, has decided to step down when his current term expires in January 2022. ARRL is seeking qualified candidates from among its membership. The Board of Directors elects the Treasurer and other officers at its Annual Meeting in even-numbered years.

The Treasurer is a non-voting member of the Board of Directors and must be a licensed radio amateur and a full member of ARRL for 4 continuous years prior to nomination. The ARRL By-Laws state that in consultation with and subject to the general supervision of the Administration and Finance Committee, the role of the Treasurer is to:

- ♦ Provide for the investment and reinvestment of the surplus funds of the League in any bonds, stocks, or other securities as would be selected by a trustee with the care of a prudent investor.
- ♦ Provide reports to and attend all regular meetings of the Board of Directors.
- ♦ Serve as a member of the Administration and Finance Committee and, if assigned, subcommittees of the Board or Administration and Finance Committee.

The position is unpaid; however, necessary expenses, including travel to meetings, are reimbursable. For further information, please see the full position description at arrrl.org/treasurerposition.

A search committee has been established to recommend one or more candidates for Treasurer to the Board. Qualified members are invited to submit a statement of interest and qualifications via email to treasurersearch@arrrl.org. The deadline is November 12, 2021.



ARRL
The National Association for
Amateur Radio®

Happenings

Three-Way Races for Director Under Way in New England and Roanoke Divisions



ARRL members in the New England and Roanoke Divisions are choosing among three candidates for Director, including incumbents, in each Division. These are the only contested races in this year's election cycle for Director and Vice Director.

In the New England Division, the candidates for Director are the incumbent, Fred Hopengarten, K1VR, of Lincoln, Massachusetts; Tom Frenaye, K1KI, of West Suffield, Connecticut, and Fred Kemmerer, AB1OC, of Hollis, New Hampshire.

New England Division Vice Director Phil Temples, K9HI, of Watertown, Massachusetts, was uncontested and has been declared elected.

In the Roanoke Division, the candidates for Director are the incumbent, George "Bud" Hippisley, W2RU, of Penhook, Virginia, and challengers James Boehner, N2ZZ, of Aiken, South Carolina, and Marvin Hoffman, WA4NC, of Boone, North Carolina.

No one challenged Roanoke Division Vice Director Bill Morine, N2COP, of Wilmington, North Carolina, and

he has been declared elected for a new term.

Incumbent Directors and Vice Directors in the ARRL Central, Hudson, and Northwestern Divisions also had no challengers and have been declared elected.

Ballots will be mailed no later than October 1 to ARRL members who are in good standing as of September 10, 2021. Completed ballots must be received at the designated PO Box in the envelope provided by noon Eastern Time Friday, November 19, 2021.

Utah Amateur Radio Club Receives Nearly \$18,000 Grant to Introduce and Engage Youth

The Bridgerland Amateur Radio Club (BARC) in northern Utah has received a nearly \$18,000 grant from the non-profit Amateur Radio Digital Communications (ARDC) to fund the club's initiatives to engage and educate youth in amateur radio through hands-on space science activities.

"This grant and our Bridgerland Amateur Radio Club demonstrate the important role amateur radio can play in furthering STEM education, which is critical to continuing Utah's high-tech economy," said Utah Section Manager Pat Malan, N7PAT, who came into office on July 1. Malan said prime movers behind the grant initiative included Jason Peterson, K7EM; BARC President Ted McArthur, AC7II, and BARC Treasurer Kevin Reeve, N7RXE — the Utah Section Youth Coordinator.

In July 2019, ARDC announced that it would use the proceeds from its sale of



some 4 million unused consecutive Amateur Packet Radio Network (AMPRNet) internet addresses to fund its operations and to establish a program of grants and scholarships to support communications and networking research, with a strong emphasis on amateur radio.

BARC has laid out an 18-month timeline of proposed activities, which would include an Amateur Radio on the International Space Station (ARISS) contact between students in a local school and a member of the ISS crew, hands-on workshops to build and launch a high-altitude balloon and amateur radio payload, and youth-oriented hands-on operating events.

"Where local schools do not have the equipment to make this a possibility, the Bridgerland Amateur Radio Club is prepared to set up and maintain a portable ground station and provide the expertise to help [schools] make ISS contacts," the announcement said.

A component of this initiative would include training local radio amateurs to use the ground station equipment to prepare them to mentor students and apply the necessary skills to help run the activities.

ARDC has said that it intends to award "a total of several million dollars in grants of varied amounts" to qualified beneficiaries, to be used in accordance with ARDC's mission. Numerous amateur radio organizations and projects have already benefited from ARDC's largesse. In 2020, the ARRL Foundation received a \$200,000 scholarship-matching grant.

FCC Grants 60-Day Waiver of Part 97 Data Rate Rules for Hurricane Relief Traffic



In an August 30 Order (available at <https://docs.fcc.gov/public/attachments/DA-21-1075A1.pdf>), the FCC granted a temporary waiver sought by ARRL to facilitate relief communications related to Hurricane Ida. The waiver also applies to relief communications directly related to any future hurricane over the next 60 days. The waiver permits radio amateurs handling hurricane relief communications on HF to use any protocol that would comply with the FCC's rules but for the symbol rate limits.

In its request, ARRL said that Section 97.307(f) of the FCC's Amateur Service rules prevents the use on HF of certain protocols capable of higher data rate emissions that many amateur stations are capable of using while active in emergency communications preparedness. ARRL asserted that higher data rates can be critical to timely transmission of relief communications, such as lists of needed and distributed supplies.

The Commission noted that a waiver was necessary because Section 97.307(f) limits the symbol rate at which the carrier waveform amplitude, frequency, and/or phase is varied to transmit information for HF RTTY/data transmissions to 300 baud for frequencies below 28 MHz (except on 60 meters), and to 1,200 baud on 10 meters.

"The digital code used to encode the signal being transmitted must be one of the codes specified in section 97.309(a) of the FCC's rules, but an amateur station transmitting a RTTY or data emission using one of the specified digital codes may use any technique whose technical characteristics have been publicly documented, such as CLOVER, G-TOR, or PACTOR," the FCC said.

The waiver is limited to amateur radio operators in the US and its territories using publicly documented data protocols that are compatible with FCC rules, with the exception of the data rate limit waived here, for those directly involved with HF hurricane relief communications."

Youth on the Air Campers Enjoy Successful ISS Contact, Other Activities

Young radio amateurs at the first Youth on the Air (YOTA) camp in the Americas enjoyed a variety of activities in mid-July. Campers had fun while operating special event station W8Y and launching a balloon carrying a ham radio payload (reaching approximately 100,000 feet), among other activities.

Several of the approximately two dozen campers got to ask questions of ISS Crew Member Akihiko Hoshide, KE5DNI, during an Amateur Radio on the International Space Station (ARISS) contact. Responding to a query posed by Graham Rousseau, KO4FJK, Hoshide said the most interesting things he's seen from space included flying through an aurora and looking down at "shooting stars" from the ISS. He also said the ISS crew was able to view a partial lunar eclipse from space.

Hoshide answered another camper's question, saying that individual crew members may get on the ISS ham radio every couple of weeks or so, or as the opportunity arises.

Camp Director Neil Rapp, WB9VPG, said he hopes to replicate the pilot camp experience over multiple locations in the years to come.

The camp's opening observance featured keynote speaker Tim Duffy, K3LR, who told the campers, "Amateur radio is the best hobby in the world."



YOTA camper Leah McGrane, KD9LFZ, was one of the campers chosen to ask Astronaut Akihiko Hoshide, KE5DNI, a question during an ARISS contact.

GENESIS Satellites Among Payloads Lost in Launch Failure

The GENESIS-L and GENESIS-N ham radio satellites were among several carrying amateur radio payloads lost following the failure of the Firefly Alpha rocket during its first launch on September 2 from the Vandenberg Space Force Base in California. This was sad news for AMSAT-EA (Spain), as GENESIS-L and GENESIS-N were the first satellites they had built themselves.

According to the AMSAT-EA website, the GENESIS satellites were destroyed after the Firefly Alpha vehicle presented an anomaly as it hit a velocity of Mach 1 and reached Max Q, a point of maximum aerodynamic pressure on the vehicle.

GENESIS-L and GENESIS-N were to conduct a series of telecommunications-related experiments, while a ground-station analysis of the received signals would try to attain Doppler variations in order to perform orbit determination and satellite identification from radio amateur stations around the world. Several other satellites carrying amateur radio payloads were also lost.



The launch of the Firefly Alpha rocket.

Nathaniel Frissell, W2NAF, Awarded \$481,260 NASA Research Grant

Ham Radio Science Citizen Investigation (HamSCI) founder Nathaniel Frissell, W2NAF — an assistant professor in The University of Scranton's Physics and Engineering Department — has been awarded a \$481,260 grant through the NASA Space Weather Applications Operations Phase II Research Program. Frissell will serve as principal investigator for a research project entitled, "Enabling Space Weather Research with Global Scale Amateur Radio Datasets." He'll collaborate with Philip Erickson, W1PJE, of the Massachusetts Institute of Technology (MIT) Haystack Observatory and Bill Engelke, AB4EJ, at The University of Alabama.

"This grant includes significant funding for participation of Scranton undergraduate students in this research, as well as support for new computation resources," Frissell said. He explained that the grant will fund "the development of an empirical model for the prediction of traveling ionospheric disturbances (TIDs) in high-frequency radio communications while investigating the geophysical drivers of these disturbances." The grant will cover 2 years of work.

Frissell said that the predictive, empirical TID models will be developed using data collected by the Reverse Beacon Network, WSPR, and PSKReporter.

This new NASA award complements a 5-year National Science Foundation (NSF) grant of more than \$616,000 that Frissell received in 2020. That investigation aims to understand the source of TIDs observed in amateur radio and other scientific datasets.

In 2019, Frissell received a \$1.3 million NSF grant to fund a 3-year initiative to measure modulations produced in the Earth's upper atmosphere.



Nathaniel Frissell, W2NAF

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 (i.e., autobiographical information should appear exactly the same on all copies). All forms/copies must be submitted together.

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

We suggest the following format:

(Place and Date)

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

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

(Signature _____ Call Sign _____ City _____ ZIP _____)

Any candidate for the office of Section Manager must be a resident of the Section, an amateur radio licensee of Technician class or higher, and a full member of 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*

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.

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, NU0Y	15
Joel F. Wagner, III, ND5V	15
Roger L. Burkhart, N3GE	20
Bill H. Stephens, NU0Y	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

Stephen J. Banko, KI5IIL	10
Bert H. Berrong, WZ5L	10
Bill Durham, KG5ZCI	10
Bruce E. Friedline, N9XAU	10
Roy L. Schmiesing, KT6B	10
Richard J. Guerrero, KB1FGC	25
Richard J. Hubbard, Jr., WF4W	30

Dwight Edward Morrow, VE7BV	30
James B. Elkins, KG4IKQ	35
Johnny L. Welch, Sr., KE6K	35
Christopher G. Pearson, G5VZ	40

August 2021

Christopher E. Johnson, WB9FXW	10
Charles E. Ruotolo, KA8VYG	10
George A. Stickney, W7BXW	10
Kenneth G. Koenig, KK6XI	15
Donald W. Brown, W0AF	20
Victor Denisov, N6DVS	20
Ronald L. Edwards, KE8NCJ	20
David W. Hibbard, NK0K	20

Congratulations to all the recipients.

November 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.

November 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 K9JM on Wednesday, November 17 at 9 PM PST (0500 UTC on November 18) on 3590 and 7047.5 kHz. Unless indicated otherwise, sending speeds are from 10 to 35 WPM.

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

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

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

Members of the North Fulton (Georgia) Amateur Radio League (<https://nfarl.org>)

are offering to subsidize the total cost of a Code Proficiency certificate or endorsement submission for any individual age 21 years and younger, and who reside in either the US or Canada. Participants who wish to make use of this offer should indicate on their qualifying run submissions they are age 21 or younger, and certify as such via their signature. Eligible participants are not required to send any fee with their Code Proficiency submissions.

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

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



W1AW Qualifying Runs — November 2021

(All times are in Eastern Standard Time; Blue indicates Eastern Daylight Time.)

Monday	Tuesday	Wednesday	Thursday	Friday
11/1 4 PM – 2000Z 10 – 35 WPM	11/2 7 PM – 2300Z 35 – 10 WPM		11/4 10 PM – 0200Z (11/5 – UTC) 10 – 40 WPM	11/5 9 AM – 1300Z 10 – 35 WPM
	11/9 4 PM – 2100Z 10 – 35 WPM	11/10 9 AM – 1400Z 35 – 10 WPM	Veteran's Day	11/12 10 PM – 0300Z (11/13 – UTC) 10 – 35 WPM
	11/16 9 AM – 1400Z 10 – 35 WPM	11/17 10 PM – 0300Z (11/18 – UTC) 35 – 10 WPM	11/18 7 PM – 0000Z (11/19 – UTC) 10 – 35 WPM	11/19 4 PM – 2100Z 10 – 40 WPM
11/22 10 PM – 0300Z (11/23 – UTC) 10 – 40 WPM		11/24 9 AM – 1400Z 35 – 10 WPM	Thanksgiving	Thanksgiving

QST

Contest Season 2021 – 2022

QST Supplement, November 2021
Sponsored by Ham Radio Outlet
hamradio.com



ARRL
The National Association for
Amateur Radio®

**CONTESTERS KNOW THAT EVERY BIT OF PERFORMANCE COUNTS.
COUNT ON US FOR YOUR PERFORMANCE NEEDS!**

YAESU

The radio



FTdx10



FTdx101D



FTdx101MP

**HAM
RADIO
OUTLET**
WORLDWIDE DISTRIBUTION



Providing Contesters and Operators
with excellence in sales, service,
and support since 1971.

ANAHEIM, CA: 800-854-6046 | ATLANTA, GA: 800-444-7927 | DENVER, CO: 800-444-9476
MILWAUKEE, WI: 800-558-0411 | NEW CASTLE, DE: 800-644-4476 | PHOENIX, AZ: 800-559-7388
PLANO, TX: 877-455-8750 | PORTLAND, OR: 800-765-4267 | SACRAMENTO, CA: 877-892-1745
SALEM, NH: 800-444-0047 | SAN DIEGO, CA: 877-520-9623
WINTER SPRINGS, FL: 800-327-1917 | WOODBRIDGE, VA: 800-444-4799

HAMRADIO.COM



Contest Calendar

November 2021 – December 2022

This calendar covers the major contests, but there are plenty of others throughout the year. Visit www.arrl.org/contest-calendar and contestcalendar.com for more contest dates and details.

Nov 2021

- 6-8 ARRL NOVEMBER SWEEPSTAKES – CW
- 20-22 ARRL NOVEMBER SWEEPSTAKES – PHONE

Dec 2021

- 3-5 ARRL 160 METER CONTEST
- 11-12 ARRL 10 METER CONTEST
- 12 ARRL & RSGB 160-METER TRANSATLANTIC CENTENARY QSO PARTY
- 19 ARRL ROOKIE ROUNDUP – CW

Jan 2022

- 8-9 ARRL RTTY ROUNDUP
- 15-16 NORTH AMERICAN QSO PARTY – CW
- 22-23 NORTH AMERICAN QSO PARTY – SSB

Feb 2022

- 5-6 NORTH AMERICAN SPRINT – CW
- 12-13 CQ WORLD WIDE WPX – RTTY
- 14-18 SCHOOL CLUB ROUNDUP
- 19-20 ARRL INTERNATIONAL DX – CW
- 26-27 NORTH AMERICAN QSO PARTY – RTTY

Mar 2022

- 5-6 ARRL INTERNATIONAL DX – SSB
- 12-13 NORTH AMERICAN SPRINT – RTTY
- 26-27 CQ WORLD WIDE WPX – SSB

Apr 2022

- 10 ARRL ROOKIE ROUNDUP – PHONE

May 2022

- 28-29 CQ WORLD WIDE WPX – CW

Jun 2022

- 25-26 ARRL FIELD DAY

Jul 2022

- 9-10 IARU HF WORLD CHAMPIONSHIP
- 16-17 NORTH AMERICAN QSO PARTY – RTTY

Aug 2022

- 6-7 NORTH AMERICAN QSO PARTY – CW
- 20-21 NORTH AMERICAN QSO PARTY – SSB
- 21 ROOKIE ROUNDUP – RTTY

Sep 2022

- 24-25 CQ WORLD WIDE DX CONTEST – RTTY

Oct 2022

- 17-21 SCHOOL CLUB ROUNDUP
- 29-30 CQ WORLD WIDE DX CONTEST – SSB

Nov 2022

- 5-7 ARRL NOVEMBER SWEEPSTAKES – CW
- 19-21 ARRL NOVEMBER SWEEPSTAKES – PHONE
- 26-27 CQ WORLD WIDE DX CONTEST – CW

Dec 2022

- 2-4 ARRL 160 METER CONTEST
- 10-11 ARRL 10 METER CONTEST
- 18 ARRL ROOKIE ROUNDUP – CW
- TBD ARRL & RSGB TRANSATLANTIC CENTENARY MARATHON

Performance Enhancement Tips

Bud Trench, AA3B, Frankford Radio Club



Here are just a few of the things you can do before, during, and after a contest effort to improve your efficiency and your score.

For all Categories

Be active! Short burst contests like the CWops Tests (CWT), state QSO parties, or DX contests sponsored by national organizations are excellent opportunities to practice and experiment, as well as verify station functionality. Your presence in these events improves your recognition of active contesters call signs, and promotes recognition of your call in the contest community.

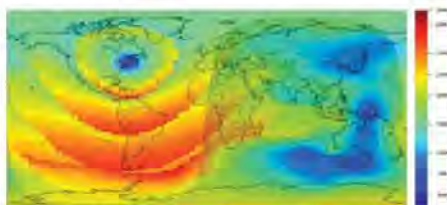
Study your peers or competitors.

You can study their public logs to identify their band selections and off times. There are often useful intelligence nuggets in the postings on <https://www.swpc.noaa.gov/>. For CW and RTTY contests, Reverse Beacon Network (RBN) data offers a wealth of information — see http://www.reversebeacon.net/raw_data/.

Create goals for the contest.

The goals should include challenging QSO and multiplier targets for each band. When setting goals, consider the past performance of yourself and peers, and the impacts of propagation. See “Setting Goals for Your Contest Operation” on the next page for more guidance.

Review propagation predictions and forecasts. Voice of America Coverage Analysis Program (VOACAP) Online Prediction Services available at <https://www.voacap.com/> and the K7RA Solar Update (available in the weekly *ARRL Letter*, <http://www.arrl.org>).



VOACAP offers customizable propagation tools.

[org/rrlletter](http://www.rrlletter.org)) are worthy of study prior to a contest. These predictions can be augmented by mining raw RBN data. During the contest, consult the hourly forecasts from the National Oceanic and Atmospheric Administration (NOAA) Space Weather Prediction Center (SWPC, <https://www.swpc.noaa.gov/>).

Craft an operating plan that identifies the most productive band (predicted) by hour and flags multiplier-rich openings. Include off-times, sunrise, and sunset.

Maximize your QSO rate by keeping all stored messages (macros and WAV files) to the minimum length needed to convey the required information.

Leverage technology that provides signals visualization. Integrating visualization with rig control and logging software provides powerful capabilities for assessing band activity at a glance, finding run frequencies, or doing rapid search and pounce.

Log on to online scoreboards for motivation and tracking competitor progress. Many participants provide band breakdowns, which gives valuable insight on their progress, and can inform your band selections.

Maximize points per hour (rather than rate) in contests like CQ World Wide WPX or IARU HF World Championship that have different point values per QSO. Avoid prolonged runs of contacts with low QSO point values.

On CW, transmit a bit above or below the frequency of the station you're calling if that station has multiple callers transmitting on the same frequency.

Track your performance during the contest against goals and/or previous scores. Consulting hourly breakdowns from previous contests can impact your operating decisions for the balance of the contest period.

Critically analyze your results.

Document what went well and note opportunities for improvement. Did you make the right band and off-time selections? How did your competitors do? Was there any unexpected propagation? What were your best and worst hours? Are there any faults or intermittent conditions that need to be resolved before the next event?

For Unlimited (Assisted) Category Operations

Set up multiple DX cluster nodes to hedge against a node failure. Configure your contest logging software to allow rapid transitions between nodes.

Consider setting up a second DX cluster application dedicated to displaying only spots of your competitors. This will give you real-time awareness of their presence and band choices.

IT'S HERE!



GET YOUR GEAR - [ARRL.ORG/SHOP](https://www.arrl.org/shop)

Setting Goals for Your Contest Operation

Bud Trench, AA3B, Frankford Radio Club



This is the technique I used to synthesize overall goals for IARU HF World Championship 2021 and allocate these goals to each band. This technique can readily be applied to other contests.

Start by building a table of results for a peer group, as illustrated in **Table 1**. This information is typically available from contest results articles, score databases provided by the contest's sponsor, or from **3830scores.com** listings.

Table 1. Peer Performance from IARU HF World Championship 2020

SOHP CW IARU Performance Parameters from 2020							
Call	Score	Q	M	Qpts	Qpts/Q	Rate	M/Q
AA3B	3060344	3110	296	10339	3.32	130	0.10
W1KM	2631980	2691	260	10123	3.76	112	0.10
VE3JM	2428790	2913	221	10990	3.77	121	0.08
K8AZ	2306739	2227	303	7613	3.42	93	0.14
K1KI	2214576	2421	252	8788	3.63	101	0.10
Average	2528486	2672	266	9571	3.58	111	0.10

Key

SOHP = Single Op High Power

Q = QSOs

M = Multiplier

Qpts = QSO points

Rate = QSOs/hour

Next, analyze the performance by band, as shown in **Table 2**. The key calculation is provided in the Average Allocation row, which is the percentage of total QSOs or multipliers worked on each band.

Table 2. Peer Band Breakdowns from IARU HF World Championship 2020

	160m		80m		40m		20m		15m		10m	
Call	Q	M	Q	M	Q	M	Q	M	Q	M	Q	M
AA3B	41	15	424	54	910	66	1125	80	514	51	96	30
W1KM	68	22	268	42	652	55	1139	69	442	45	122	27
VE3JM	71	11	411	40	593	41	1223	60	536	41	79	28
K8AZ	26	10	244	49	720	73	839	88	322	53	76	30
K1KI	34	20	160	34	792	59	983	66	207	42	245	31
Average	48	16	301	44	733	59	1062	73	404	46	124	29
Average Allocation	2%	6%	11%	17%	27%	22%	40%	27%	15%	17%	5%	11%

The third step is to establish QSO, multiplier, and score targets for the current year.

QSO Target: The QSO Target should consider propagation, station and/or operating enhancements, and stretch goals. I typically use these factors to adjust my average rate from the prior year. In this case, I decided to increase my 2020 rate from 130 to 133 QSOs/hour, resulting in a 2021 QSO Target of 3,193.

Multiplier Target: A starting point for the Multiplier Target is to multiply the QSO Target by a Multiplier / QSO (M/Q) value selected after consideration of Table 1 data. I picked a M/Q ratio of 0.095, which was slightly less than the peer group average resulting in an initial Multiplier Target of 303.

Score Target: The initial Score Target is determined by multiplying the QSO Target by the Multiplier Target by a QSO points / QSO (Qpts/Q) ratio based on the data in **Table 1**. The Qpts/Q ratio I used was 3.35, which was less than the peer group ratio but greater than my 2020 performance. The resulting Score Target calculation for IARU 2021 was 3.2 million points.

Raw goals for each band are next determined by applying the ratios from the Average Allocation row in **Table 2** to the QSO and Multiplier Targets.

Finally, do a qualitative assessment, based on experience and judgement, of all calculated values to finalize the goals. My raw and finalized targets for IARU 2021 are shown in **Table 3**.

Table 3. AA3B QSO and Multiplier Goals by Band for IARU HF World Championship 2021

	160m		80m		40m		20m		15m		10m		Total	
	Q	M	Q	M	Q	M	Q	M	Q	M	Q	M	Q	M
Raw Band Targets	57	18	360	50	876	67	1269	83	483	52	148	33	3193	303
Final Band Targets	50	15	350	55	900	65	1200	80	550	55	150	35	3200	305

In closing, goal setting improves readiness and creates a competitive advantage. The goals can motivate the operator to make the extra push needed to meet or beat a target. After the contest, a review of performance versus goals is often a useful aid in developing lessons learned for the next year.

Amateur Radio Contesting for Beginners

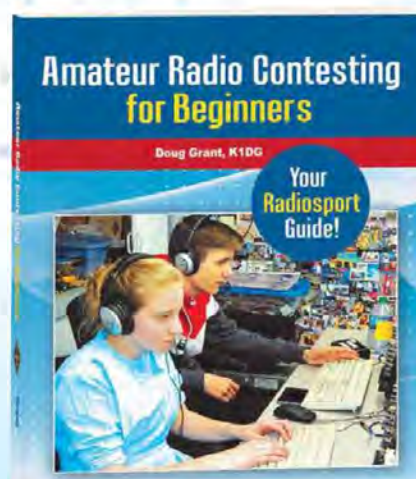
by Doug Grant, K1DG

offers ideas to get you started in contesting or to build your skills if you're already active.

Three tips from the book to get you started:

- Get on the air as frequently as possible before the contest.
- Talk (or send code) at the same rate of speed as the station you're contacting.
- Use contest logging software to log your contacts.

Order Online at arrrl.org/shop



Propagation Tools and Resources for Contesting



Ken Caruso, WO1N, with Andrew Rodland, KC2G, and members of the Yankee Clipper Contest Club (YCCC)

HF propagation predictions provide data that, when analyzed, can help you maximize your rate and multipliers during DX contests. Real-time propagation tools may help you more rapidly adjust to changing conditions during the event.

It is hard to find a substitute for operating experience when it comes to understanding propagation from your home station, especially if you've been operating from your station for multiple solar cycles. Keeping an eye on the basics

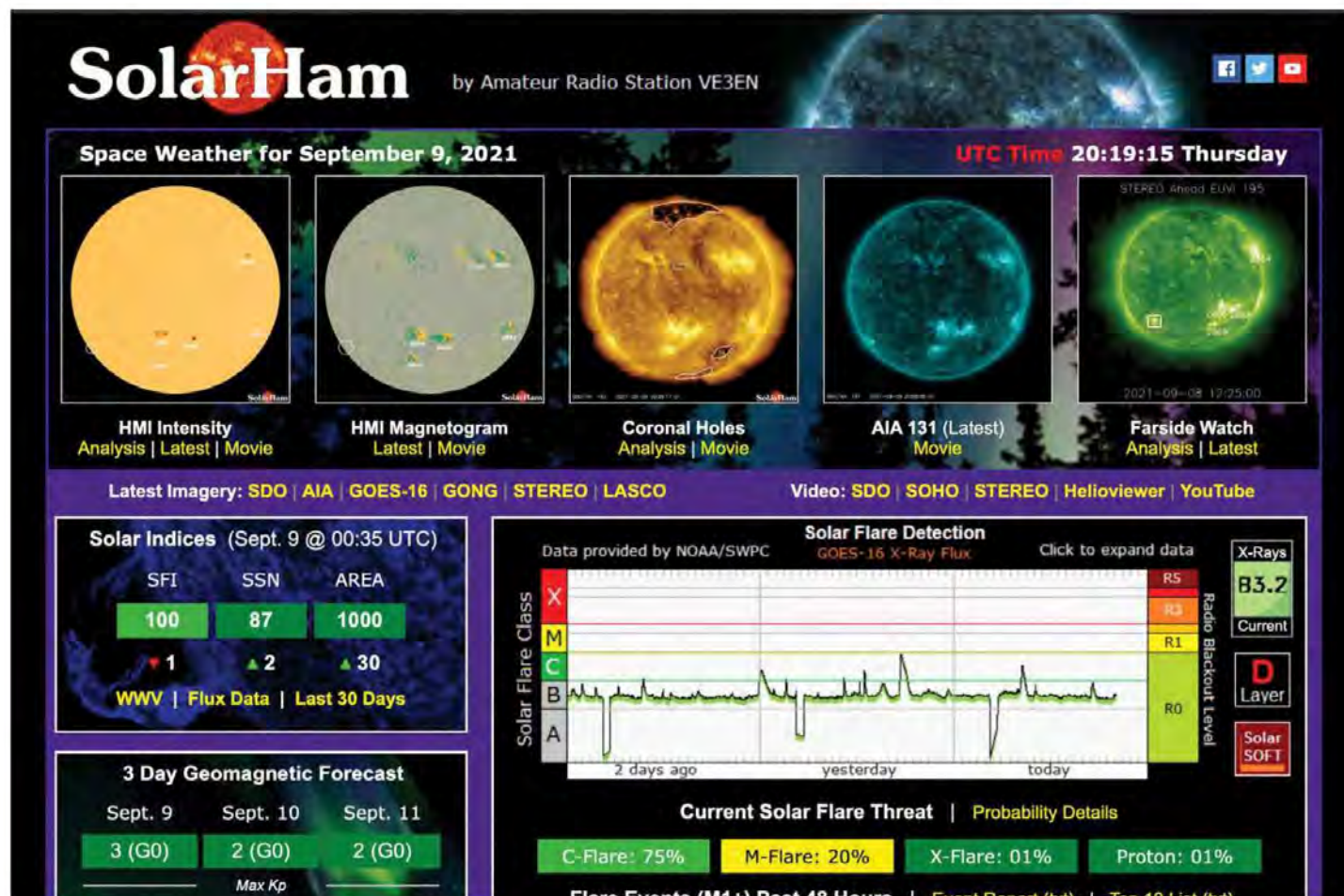
(sunspot numbers, geomagnetic activity, grayline) and reviewing past logs from prior solar cycles with similar conditions can remind you of any unusual openings.

When operating from a new station location (perhaps remotely or on a DXpedition), you might not be familiar with the propagation characteristics from that location. Employing the tools described here before and during the event can help you to develop a sense of what to expect.

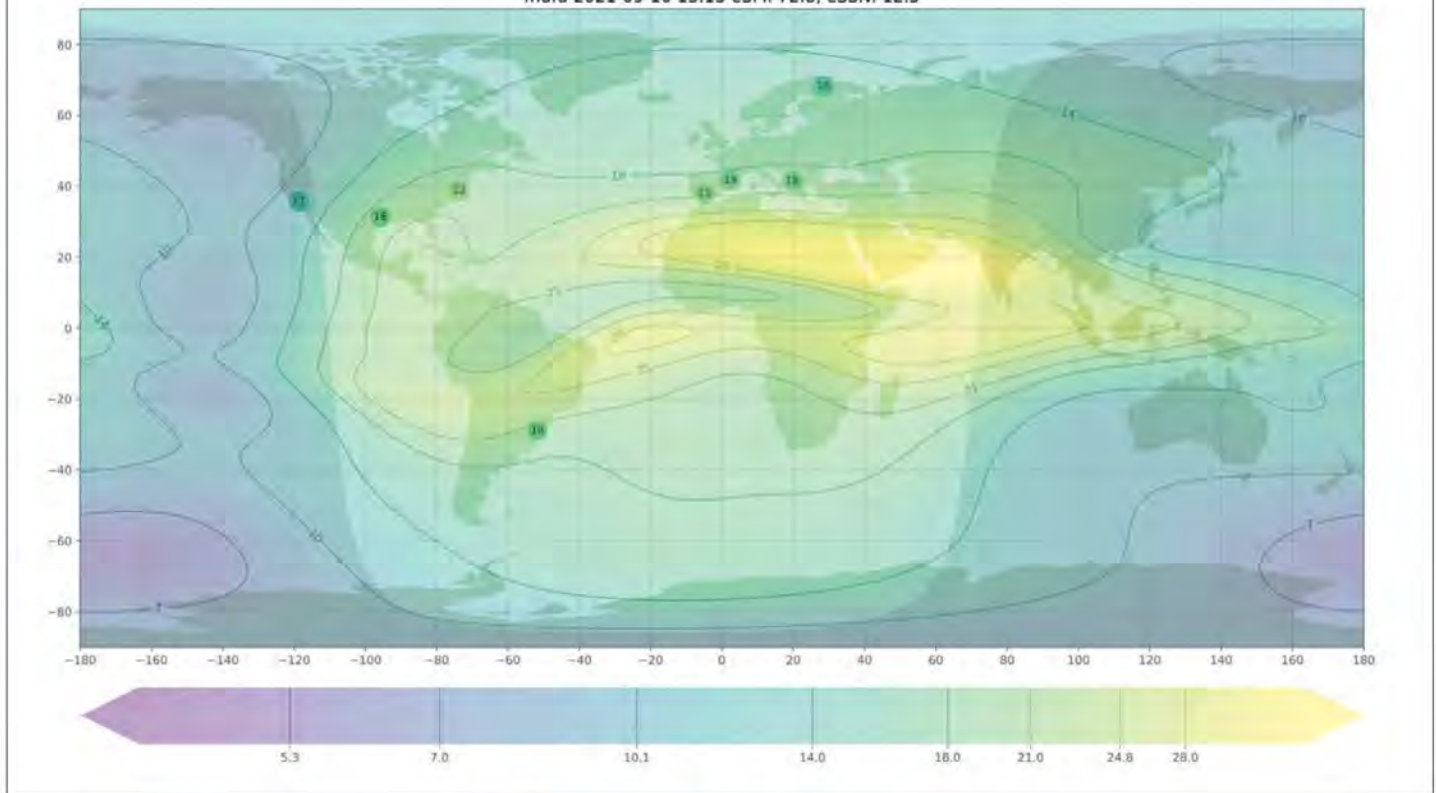
Many of these tools are interactive online resources that you can use for

planning your contest effort. You can gather data and develop an operating strategy. While identifying major band openings to maximize your rate is important, analysis might reveal secondary paths to help you eke out a rare multiplier or two. In the end, more contacts and more multipliers result in a higher score for you and your contest club.

Other websites that offer real-time data can help you understand the current conditions during a contest, but be aware that using real-time data could land you in the contest's assisted class.



The SolarHam site (solarham.net) aggregates data from several sources to create a snapshot of current space weather conditions.



The real-time maps at prop.kc2g.com are based on real-time ionospheric data.

Planning Tools

SolarHam — solarham.net — by VE3EN brings together useful data from NOAA, NASA, Environment Canada and other agencies, with links to the original sources. This site is the total snapshot of the current space weather conditions, an important factor in developing propagation predictions.

VOACAP Online for Ham Radio — voacap.com/hf/ — was put together by Jari Perkiomaki, OH6BG; James Watson, MØDNS, and Juho Juopperi, OH8GLV. It translates the tabular VOACAP predictions from days past into very informative graphical presentations. The site has been recognized for excellence by the YASME Foundation.

Proppy — soundbytes.asia/prop.py/ — is an HF propagation prediction website developed by James Watson, MØDNS. Proppy utilizes the ITU's ITURHFPROP application for predictions. Excellent graphical displays of area and point-to-point predictions can be produced. Short Wave Listeners

are considered, with a tab focused on International Broadcasters.

Real-Time Monitoring Tools

Real-Time HF Propagation Prediction — hamwaves.com/propagation/en/index.html — maintained by Serge Stroobandt, ON4AA, is a useful presentation of the current HF propagation influencers. Especially useful is the real-time MUF (maximum usable frequency) and OWF (optimum working frequency) information.

PSK Reporter (pskreporter.info/pskmap.html) and **WSPRnet** (wsprrnet.org/drupal) are useful for keeping an eye on what QSOs are really happening right at the moment.

DXMaps.com is likewise useful for viewing QSOs that are happening in real time.

aprs.mennolink.org (worldwide) and **www.propquest.co.uk** (Europe) display VHF path enhancements such as E_s or tropospheric ducting.

prop.kc2g.com/ provides near real-time maps and data describing ionospheric conditions and is recognized as a game-changer for the amateur community by moving from prediction-based analysis, to analysis based on real-time ionospheric data. Data from the network of ionospheric sounders (GIRO) is merged with NOAA Ap estimates to produce global values for foF₂, hmF₂, MUF, and foE. MUF isolines are estimated and plotted across the globe.

These tools synthesize an astounding array of complex inputs that describe the anticipated or current propagation conditions. You can employ these tools to develop your operating plan, and to identify when to look for rare multipliers or band openings. Armed with real-time data, you can quickly react to the ever-changing conditions experienced during a contest. The net result should be an increase in your contest score from wherever you operate.

Contesting Do's and Don'ts

by members of the Florida Contest Group



To someone just starting out, contesting can seem to be the ultimate insider's sport. Contesters who are at the top of the standings over and over always seem to be in the right place at the right time, and seem to find band openings that mere mortals can only dream of. More importantly, they seldom make the big mistakes that sometimes sink their competitors.

A number of years ago, some of the experienced and accomplished members of the Florida Contest Group distilled their decades of experience into a list of do's and don'ts that would help all contesters position themselves for success before, during, and after a contest. Even if you apply just one tip out of dozens to your next contest operation, we think it will help your score. Good luck!

— W4WF, K5KG, K1TO, K8NZ, K4XS

Planning Ahead

- Do any necessary antenna work as far in advance as possible.
- Think about your contest strategy in advance.
- Decide on your category.
- Select your power level. Remember to check whether if the contest rules include a power multiplier for QRP or LP, and whether your power level is compatible with your category.
- Select and update logging software, and test the interface with your transceiver.
- Record and test CW, RTTY, and/or SSB messages in advance.
- Ensure your signal is clean — no key clicks or SSB splatter. Ask a friend to evaluate your signal on the air if needed.

- If you're multi-op, set up and test your logging network.
- Set your goals — personal best? Top 10? 500+ QSOs?
- Prepare snacks, meals, and drinks in advance.
- Consider your sleep schedule in advance and set an alarm clock (before the contest starts!).
- Know the log submission deadline.
- If possible, be active on the air for a few days before the contest; try to get a feel for propagation and activity.
- Check **NG3K.com** and *The Daily DX* for activity from rare multipliers (in a DX contest). Keep the list handy during the contest.

During the Contest

- Start on time — don't give up operating time at the beginning!
- Send your full call when calling another station — no partials or last-two.
- Avoid time-wasting fillers, but remain approachable and friendly-sounding.
- If the rates drop, turn your keyer speed down. On phone, use your "friendly voice."
- Don't be a packet rat. Verify calls from the cluster and RBN.
- Use your software's Note function to record notes about any questionable QSOs.
- Work dupes — arguing about dupes wastes time.
- If you're operating from a DX location and you start to get a string of 6–10 dupes, you've been spotted incorrectly. Your best choice is often to find a new frequency (thanks W2OX/V47KP).

- Tune in the direction of the sideband — tune up the band on USB, tune down the band for LSB.

After the Contest

- Save your log to your logging computer, and back it up to a flash drive or elsewhere.
- Turn off your rig and disconnect your antennas.
- Check your Notes file and resolve any issues noted during the contest.
- Report your score to **3830scores.com**.
- Submit your Cabrillo file to the contest sponsor before the deadline.
- Let your family know that you're alive and well!

Tips Applicable to All Contests

- Read the rules *before the contest!* Not only will it help you determine your entry category, you may find special band segments and other unusual rules that are not immediately obvious. You may even find that the rules have changed from the last time!
- If your goal is to win your category or Section/state, look over the previous year's results.
- Establish a goal for your effort, whether it's beating your buddy, beating your score from last year, working a few new ones, or just operating for as long as it's fun.
- Be honest with yourself about your station's strengths and weaknesses, and spend more time on bands and modes that play to those strengths.
- Know your radio's functions and how to use them. There are few things more satisfying than getting the first QSO after a rare multiplier goes split



Position yourself for contesting success with the help of the tips in this article.

HENRYK KOTOWSKI, SM0JHF

because you know how to set your second VFO without fumbling.

- If your radio has a second receiver, try using the second RX to search and pounce more efficiently. Start at the bottom of the band with one RX and the top of the band with the other. It may seem awkward at first, but you'll soon be doubling your S&P rate.
- Try to think outside the box. To avoid the Sunday doldrums in Sweepstakes, K8MR operates from 3–4 different stations with different call signs. He's always "fresh meat," and often his combined scores exceed the winning single-operator score.

- Invite someone to operate your station if you can't get on, or organize a multi-op entry. Hosting and multi-ops are great opportunities to teach or learn contesting skills while enjoying the fellowship of like-minded testers.

When Planning a Part-Time Entry

- Consider the bands, modes, and operating times that will allow for the most fun.
- Consider using packet/RBN unless you're philosophically opposed, but as the saying goes, "trust, but verify" those packet spots!

Tips for Low-Power Entries

- Choose your CQ frequency carefully. First, send "QRL?" to make sure the frequency isn't occupied. Don't open up with 100 W next to someone running high power and large antennas; you'll have a tough time getting traction.
- A few minutes calling CQ costs little and there is much to be gained. In most contests, the number of operators who are tuning the band at any given time far exceeds the number who are calling CQ. If you find a spot, jump in!

Club Contesting

Eric Silverthorn, NM5M, DFW Contest Group



Contesting as part of your club is yet one more way to have fun. Radio clubs around the country collect scores from their members and compete against other groups in the Club Competition category.

Each contest organizer has different policies on Club Competition, so be sure to familiarize yourself with the rules. For example, ARRL requires that members of a club effort reside and operate within 175 miles from the club center.

To operate as part of a club effort, you can still get on the air from your home station, as you normally would. After the contest, upload your log to <https://contest-log-submission.arrl.org/>. Be sure to include your radio club's information when you submit the log, so that your score is added to your club's overall score.

Club operating activities can be a lot of fun, especially if you compare your group's score with groups from a similar geographic area or ARRL Division. ARRL breaks out club efforts according to the size of the group, as a way of keeping operations competitive. Small clubs enter the Local category, and larger groups may qualify for the Medium or Unlimited categories.

Aside from creating a greater amount of on-air activity, club competition is a wonderful way to motivate amateurs in your area to participate in the contest and maximize their effort for the benefit of the club. Small stations as well as large stations are encouraged to participate.

The DFW Contest Group (in the North Texas Section) often organizes club efforts to maximize our score in various contests. A few weeks before a contest, emails are sent to

motivate members to get on the air. We also encourage multi-operator stations to invite members who don't have a home station to join their larger effort.

One of our members, George Perkins, N5UI, has created a club score listing on our website, www.dfwcontest.com. Listing individual scores has created an incentive for our members to get on the air, and it gives the club leadership insight into who is getting on the air. ARRL offers awards to high-scoring clubs, so there is motivation to win!

ARRL Sweepstakes CW 2020

Call	Name	Category	QSO's	Mult's	Total
NKSM (KSGA)	Bill	SO High	1,331	84	223,608
K3RT	Paul	SO Unlimited High	1,191	83	197,796
WAZZBT	Dennis	SO Unlimited Low	475	82	77,736
K3QR	Andy	SO Unlimited Low	416	83	69,056
K3ME	Bob	SO Low	364	80	58,240
K5CI	Leonid	SO Unlimited High	315	83	52,290
W5GN	Barry	SO Unlimited High	303	81	49,086
W5SD	Vin	SO Low	234	76	35,568
N5CHA	Todd	SO Low	220	69	30,360
W5OV	Dave	SO Low	204	67	27,536
W5LX3	Dennis	SO High	148	58	17,168
NM5M	Eric	SO Unlimited High	140	60	16,800
K5MBA	Robert	SO Low	100	38	7,600
K5HW	Henry	SO Low	168	43	7,224
Total					369,868

DFW Contest Group lists members' scores on the group's website, to encourage members to participate in contests.

Contest Clubs

Though any club can mount a group effort in a contest, some clubs specialize in radiosport. Here are just a few.

CONTEST CLUB

Alabama Contest Group
 Arizona Outlaws Contest Club
 Arizona VHF Society
 Carolina DX Association
 Central Texas DX and Contest Club
 Contest Club Ontario
 DFW Contest Group
 Florida Contest Group
 Frankford Radio Club
 Hudson Valley Contesters and DXers
 Kentucky Contest Group
 Mad River Radio Club
 Minnesota Wireless Assn
 Mt Airy VHF Radio Club
 Niagara Frontier Radiosport
 North Coast Contesters
 North East Weak Signal Group
 Northeast Maryland
 Amateur Radio Contest Society
 Northern California Contest Club
 Potomac Valley Radio Club
 Rochester VHF Group
 Society of Midwest Contesters
 South East Contest Club
 Southern California Contest Club
 Tennessee Contest Group
 Texas DX Society
 Western Washington DX Club
 Willamette Valley DX Club
 Yankee Clipper Contest Club

WEBSITE

alabamacontestgroup.org
www.arizonaoutlaws.net
www.azvhf.org
www.cdxa.org
www.ctdxc.org
www.va3cco.com
www.dfwcontest.com
floridacontestgroup.org
www.gofrc.org
www.qsl.net
www.n4gn.com/kgc
www.madriverradioclub.org
www.w0aa.org
www.packratvhf.com
www.qrz.com/db/NF2RS
www.northcoastcontesters.com
www.newsvhf.com

www.nemarc.org
www.nccc.cc
www.pvrc.org
www.rvhfg.org
www.w9smc.com
southeastcontestclub.com
www.socalcontestclub.org
k4tcg.org
www.tdxs.net
www.wdxc.org
wvdx.org
www.yccc.org

Contesting from the Caribbean

The Caribbean has long been a popular destination for away-from-home ham operations, and it has its pros and cons. For example, if you're there for the ARRL DX Contest, you don't need to turn your antennas — but you do end up competing with Europe and Asia at times when the stations you need to work have their antennas pointed elsewhere.

To avoid frustration and the dreaded Sunday afternoon slowdown, combine the operation with a great vacation that includes non-ham family and friends, and alter the scope — and the attitude — of the trip to maximize the fun!

Bringing a multi-operator team and their families means the more the merrier, on the air and off. There are so many things to do and see, no one will be bored. You can adjust your operating schedule to give team members as much time on the air as they want, while still being able to spend time with their families. Doug Priest, W3CF, recalled an operation in Antigua where, “two of us would be operating for a few hours, and the other two would have

off. This worked out great. Each of us got a full 24 hours in the chair, but we also got to spend time with our spouses.”

Some operators return to the same lodgings for years, and establish relationships with hotel and property management, which can lead to hotels or rental properties making allowances for ham operators. If you're staying in a hotel, you may be required to run tests to ensure that your radios will not interfere with the property's satellite TV services. One hotel even allowed a returning group of testers to permanently install antennas on the property, on the condition that the antennas be made available to local amateurs should there be a communications emergency.

There are many ways to make this kind of operation easier on yourself. Many modern radios are quite small and can easily fit in your regular suitcase. Bringing radio equipment and antennas in cardboard boxes or special-



Antennas and palm trees — a winning combination!

ized cases can draw attention to them, which you do not want. Customs agents who are not familiar with amateur radio may see your equipment as a way to collect import duty. Most airports on the islands have porters who assist vacationers with their bags and streamline their passage through customs. Use these fellows' services, and tip them well. You'll be out of the airport and on the way to your hotel in no time.

This kind of holiday-style operation can be a win-win. Everyone gets a nice vacation with beautiful views, island breezes, and great food — and the hams get to run pileups amid the camaraderie of a multi-operator effort!

NATIONAL CONTEST JOURNAL



NCJ

Published bimonthly, NCJ features articles by top testers, operator profiles, editorial comments, and correspondence from readers, as well as scores for the North American QSO Party and North American Sprint.

A valuable source of information on the active world of competitive radio!

Subscribe today!

arrl.org/ncj

WHO SAYS YOU CAN'T CONTEST OUTDOORS?

YAESU
The radio



FT-891



FT-991A

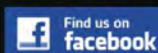
**HAM
RADIO
OUTLET**
WORLDWIDE DISTRIBUTION



Providing Contesters and Operators
with excellence in sales, service,
and support since 1971.

ANAHEIM, CA: 800-854-6046 | ATLANTA, GA: 800-444-7927 | DENVER, CO: 800-444-9476
MILWAUKEE, WI: 800-558-0411 | NEW CASTLE, DE: 800-644-4476 | PHOENIX, AZ: 800-559-7388
PLANO, TX: 877-455-8750 | PORTLAND, OR: 800-765-4267 | SACRAMENTO, CA: 877-892-1745
SALEM, NH: 800-444-0047 | SAN DIEGO, CA: 877-520-9623
WINTER SPRINGS, FL: 800-327-1917 | WOODBRIDGE, VA: 800-444-4799

HAMRADIO.COM



Public Service

Around the Horn: An Emergency Message Routing Test

Doug Stevens, WA2BBS, is an active member of the ARRL Eastern Pennsylvania (EPA) Section Amateur Radio Emergency Service® (ARES®) in Luzerne County, Pennsylvania. The late EPA Section Emergency Coordinator (SEC) Walter T. (W.T.) Jones, WN3LIF (SK), mentored Doug and a group of hams during an emergency message routing test, which Doug discusses in this month's column.



Our primary goals as ARES members are to train, practice, and prepare to be communicators during a disaster. There are many modes available for passing communications traffic, but you must always consider the worst-case scenario.

Message Routing During a Disaster

Imagine that you're at a distant incident and are given a message that must get to the county Emergency Operations Center (EOC), but all the repeaters are down and you can only hear one station. With no other outlet available, you must use that station to send the message.

The second station can only hear you and one other station, so they send the message on to the third station, and so on, until the message reaches its destination. The message can't be

sent back to a station that already handled it, because that wouldn't send it where it needs to go. The route the message takes depends on who can hear who.

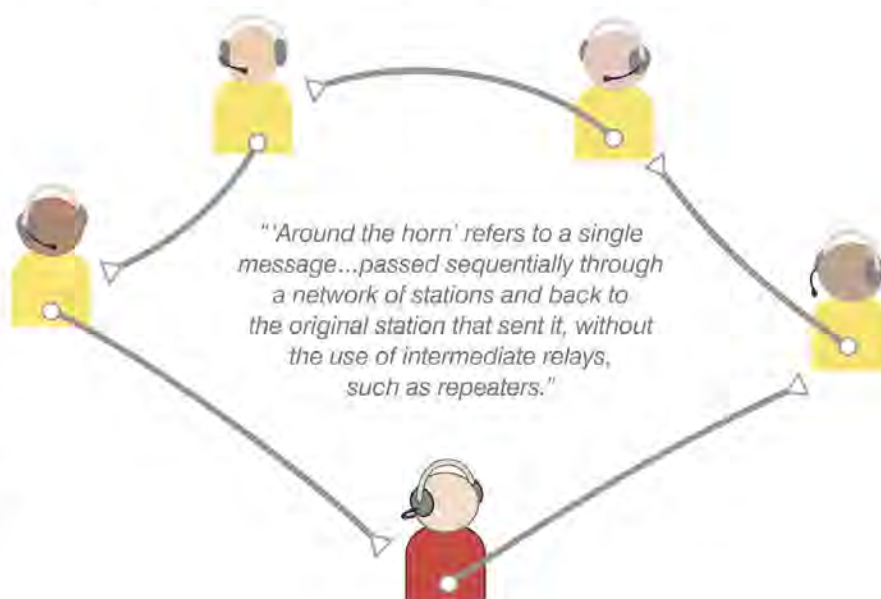
The ARRL EPA Luzerne County Digital Net has been working on this problem and found that antenna issues, radio settings, terrain, and the use of digital modes can present several challenges. We're pretty good at handling messages digitally on the repeaters, but wondered what would happen if we operated using only simplex. We've done several simplex voice tests to find out if the results are the same as with a digital mode, such as *fldigi* or Winlink.

Performing the Test

Our SEC, WN3LIF (SK), came up with a test that he called "around the horn." For this test, there's no limit to

the number of players, but once you're registered for the test you must participate. In baseball, "around the horn" means that if there are no runners on base and fewer than two outs after a strikeout, the ball is tossed from the catcher to third base, second base, the shortstop, first base, and then the pitcher — each player only handles the ball once.

For the purposes of ham radio, our use of "around the horn" refers to a single message getting passed sequentially through a network of stations and then back to the original station that sent it, without the use of intermediate relays, such as repeaters. The digital modes and frequencies used are up to the participants. We chose to use VHF/UHF digital simplex and the *fldigi* suite of programs for our test, but any modes can be used.



Field Organization Reports

August 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.

564 KB3YRU	211 KD2LPM	131 KB5PGY	104 KV8Z	89 K1SLIC
499 W7PAT	205 N7CTM	130 W4CMH N2JBA	103 W3NTS	87 AA3N KD2PQP
495 WA3EZN	200 K9LGU	WK4WC K8ED	102 K9ILJ W9EEU	86 KE4DRF KD8UUB KA1G K2EAG
468 AD8CM	198 KM8V W0PZD	129 KB1TCE WB8YY5	100 WB4RJW K28Q	85 K7OED
466 WA7PTM	175 W02H KK6GXG	125 AG8G N2DW KE5YTA	99 KN9P NX9K W1KX AC8RV KB1NMO K3YAK W2AH W3CJD AA3SB AK2Z W2ZXN	84 KA2GQQ
420 N9VC	170 W2PH	123 N12W	97 K7LRF	83 N6IET
350 ND8W	169 N3KRX	120 WC4FSU KA9QWC K3JL N2WGF KA9MZJ W8IM KB8PGW KY2D WA4VGZ KG5NNA KF5OMH	96 W7PHX KF5IVJ	82 KT4WX
339 KE8BYC	161 KC8T	115 N2LC K1XFC	85 KT5SR	81 K0WAV K6JT
315 W9GRG W7EES	160 N1LL AI9F	113 K8AMH	92 W4TTO K8RDN	80 AJ7B KF4ST KM4WHO W8GSR W9BGJ KF7GC
305 AL0Y	155 N4CNX	110 K6HTN KD0HHN WA1URS KC8WH W4EDN N3SW WA3QLW WB8TQZ KB2QQ KA5AZK	91 W2ARP	79 KB2YAA
268 W9RY	152 N8SY	106 KD8KBX	90 KB9GO K3MIY KA9IKK W1LBV WB8SIQ K8KRA N8MRS KB8HJJ AB9ZA N2TSO W4KX N4ZM AA7BM KJ7BHO KA2HZP KB3MXK	78 N0UMP K1STM WB8R K2IE
265 W3GWM	150 W8DJG KD8ZCM KK3F	105 WPAX AD4DO K8MDA KD2GRS KY2MMM	80 K89GO K3MIY KA9IKK W1LBV WB8SIQ K8KRA N8MRS KB8HJJ AB9ZA N2TSO W4KX N4ZM AA7BM KJ7BHO KA2HZP KB3MXK	77 K1HEJ
260 KD2NMG	147 WM2C N3XMB KC8YVF	145 WD8USA	76 KF0BPN W3ZR WB2VUF	75 K4FHR
255 KD0DPX	140 WB9WKO AD3J K4IWW WB9QPM	135 AC8NP W4DNA W3YVQ	72 N3ARB	71 KU1U KA2JFU
235 KC9FXE KT2D	145 WD8USA			
220 WM5N AB8MW	140 WB9WKO AD3J K4IWW WB9QPM			
230 N5MKY	140 WB9WKO AD3J K4IWW WB9QPM			
215 WA2CCN	135 AC8NP W4DNA W3YVQ			
213 KD2GXL	135 AC8NP W4DNA W3YVQ			

Section Traffic Manager Reports

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

Section Emergency Coordinator Reports

The following Section Emergency Coordinators reported: CT, EPA, MDC, MO, ND, NLI, NM, NNY, NV, SCV, SNJ, TN, VI, WCF, WPA, WWA.

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.

NX9K 1,384, KY2D 1,114, KK3F 1,014, N9CK 780, WB9WKO 737, K6HTN 563.

KY2D qualified for BPL with the following points during these previous months, but was not recognized in this column.

(Jul.) 1,250, (Jun.) 2,016, (May) 1,030, (Apr.) 1,916, (Dec. 2020) 2,118.

At the beginning of your test, the message originator (who is also the final station to receive the message) will prepare a message and announce on voice that the test is starting. Next, they'll send the message to the first station designated on the list provided by the team. The message may only be sent using the chosen software (we used *flmsg*).

Each station will receive the message and send it to the next station, then save it (there's no need to "save as"). The contents of the message must not be altered, and each station can only handle it once during the test. A successful receive ("bad files" are not permitted) means that the station copied the message without checksum errors. The file name and contents must appear exactly the same as in the original message.

Once the message has been received by the next station, the sending station's participation in the test is complete; they can't receive the message again and send it to another station.

The message routing is up to the discretion of the participants. The net members must work as a team to determine how the route will work (it may help to try out your voice mode of choice prior to the test). Planning can be done any time before the "around the horn" test, and net members may communicate on voice during the test for coordination purposes. The message cannot be passed on your voice mode.

At the end of the test, all participating stations email their saved copy of the message to the originating station. For the test to be deemed a success, all stations in the net must successfully receive the message and send it to the next station, with the originating station being the last to receive it.

Participating stations must register with the originating station before the test. Stations are allowed to move to a better location, as long as they aren't more than 5 minutes away from their station's license address location.

Results

When the ARRL EPA Luzerne County Digital Net tried this test, we had one failure, but otherwise it was a success. Several issues arose prior to the test that included radio setup, antenna placement, mode used, etc. We were able to work through most of the issues.

We encourage all ARES groups and county Emergency Coordinators to try "around the horn" and share their results with each other.

I would like to thank WN3LIF (SK), for giving us this challenge and acting as mentor and referee. Other group participants were Thomas Davis, N3XMB; John DiLiberto, AB3ZI; Robert Nygren, N3RN; Robert Folmar, KB3VS; Christopher Keller, WA2EXI; Richard Tyira, KC3FKW; Timothy Chase, KC3MES, and John Denisco, K3DBG.

Feedback

In "Field Organization Reports" in the September 2021 issue, the Public Service Honor Roll contained an incorrect call sign. With a total of 580 points, ARRL recognizes Jon Wanzer, KK6GXG, for his public service performance. *QST* regrets this error.

Contest Corral

November 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 Date-Time	Finish Date-Time	Bands	Contest Name	Mode	Exchange	Sponsor's Website
1 0000	1 0100	1.8-28	K1USN Slow Speed Test	CW	20 WPM maximum; name, SPC	www.k1usn.com
1 0600	1 0859	3.5, 7	Silent Key Memorial Contest	CW	RST, SK call sign you want to recognize	skmc.hu/en/rules.html
1 2000	1 2130	3.5	RSGB 80-Meter Autumn Series, Data	Dig	RST, serial	www.rsgbcc.org/hf
2 0100	2 0159	1.8-50	Worldwide Sideband Activity Contest	Ph	RS, age group (OM, YL, or youth)	www.sac.com/rules.html
2 0100	2 0300	3.5-28	ARS Spartan Sprint	CW	RST, SPC, power	arsqrq.blogspot.com
2 1700	2 1900	3.5-14	RTTYops Weekspint	Dig	Other's call, your call, serial, name	rttyops.com
3 0230	3 0300	1.8-21	Phone Weekly Test – Fray	Ph	Name, SPC	perluma.com/Phone_Fray_ConTEST_Rules.pdf
3 1300	3 1400	1.8-28	CWops Mini-CWT Test	CW	Name, mbr or SPC	cwops.org/cwops-tests
3 1700	3 2000	144	VHF-UHF FT8 Activity Contest	Dig	4-char grid square	ft8activity.eu/index.php/en
3 1900	3 2000	1.8-28	CWops Mini-CWT Test	CW	Name, mbr or SPC	cwops.org/cwops-tests
3 2000	3 2100	3.5	UKEICC 80-Meter Contest	Ph	6-char grid square	ukeicc.com/80m-rules.php
4 0000	5 0300	7	Walk for the Bacon QRP Contest	CW	13 wpm max; RST, SPC, name, mbr/power	qrptest.com/pigwalk40
4 0300	4 0400	1.8-28	CWops Mini-CWT Test	CW	Name, mbr or SPC	cwops.org/cwops-tests
4 0700	4 0800	1.8-28	CWops Mini-CWT Test	CW	Name, mbr or SPC	cwops.org/cwops-tests
4 1700	4 1900	3.5-14	RTTYops Weekspint	Dig	Other's call, your call, serial, name	rttyops.com
4 1800	4 2200	28	NRAU 10-Meter Activity Contest	CW Ph Dig	RS(T), 6-char grid square	nrllcontest.no
4 1900	4 2000	3.5, 7	EACW Meeting	CW	RST, mbr (if any), nickname, EA province or DXCC	eacwspain.es/eacwmeeting
4 2000	4 2200	1.8-50	SKCC Sprint Europe	CW	RST, SPC, name, mbr or "none"	www.skccgroup.com
5 0145	5 0215	1.8-21	NCCC RTTY Sprint	Dig	Serial, name, QTH	www.ncccsprint.com
5 0230	5 0300	1.8-21	NCCC Sprint	CW	Serial, name, QTH	www.ncccsprint.com
5 2000	5 2100	1.8-28	K1USN Slow Speed Test	CW	20 WPM maximum; name, SPC	www.k1usn.com
6 0500	6 1200	3.5-28	IPARC Contest, CW	CW	RST, serial, IPA, US state (if USA)	www.iparc.de
6 1200	7 1200	1.8-28	Ukrainian DX Contest	CW Ph	RS(T), 2-letter Ukraine oblast or serial	urdx.org/rules.php?english
6 1300	6 1330	144	Two-Meter Classic Sprint	CW Ph	serial + 4-char grid square	fwc.info
6 2100	8 0259	1.8-28	ARRL Sweepstakes Contest, CW	CW	Serial, precedence, your call, check, ARRL/RAC Section	www.arrl.org/sweepstakes
7 0500	7 1200	3.5-28	IPARC Contest, SSB	Ph	RST, serial, IPA, US state (if USA)	www.iparc.de
7 0800	7 1200	Any	EANET Sprint	CW Ph Dig	RS(T)	fediea.org/news/?news=20201108
7 1400	7 1700	3.5-28	High Speed Club CW Contest	CW	RST, mbr or "NM"	www.highspeedclub.org
10 1700	10 2000	432	VHF-UHF FT8 Activity Contest	Dig	4-char grid square	ft8activity.eu/index.php/en
10 2000	10 2130	3.5	RSGB 80-Meter Autumn Series, SSB	Ph	RS, serial	www.rsgbcc.org/hf
13 0000	14 2359	3.5-28	WAE DX Contest, RTTY	Dig	RS, serial	darc.de/der-club/referate/conteste
13 0000	14 2359	3.5-144	Day of the YLs Contest	CW Ph	RS(T), YL/OM	ka1uln.blogspot.com
13 0000	15 2359	1.8-7	PODXS 070 Club Triple Play Low Band	Dig	RST, SPC	www.podxs070.com
13 0001	14 2359	28	10-10 International Fall Contest, Digital	Dig	Name, mbr or "0," SPC	www.ten-ten.org/
13 0500	14 1100	50-1296	SARL VHF/UHF Analogue Contest	CW Ph	RS(T), 6-char grid locator	www.sarl.org.za
13 0700	14 1300	1.8-28	JIDX Phone Contest	Ph	RST, JA prefecture number or CQ zone	jidx.org/jidxrule-e.html
13 1200	14 1200	1.8-28	OK/OM DX Contest, CW	CW	RST, 3-letter OK/OM district code or serial	okomdx.crk.cz/index.php?page=english
13 1200	14 2359	1.8-50	SKCC Weekend Sprintathon	CW	RST, SPC, name, mbr or "none"	www.skccgroup.com
13 1600	13 1800	3.5-28	FISTS Saturday Sprint	CW	RST, SPC, name, mbr or "0"	fistsna.org/operating.html#sprints
13 1900	15 0500	1.8-432	CQ-WE Contest	CW Ph Dig	Name, location code, years of service	cqwe.cboh.org/rules.html
13 2300	22 0300	1.8-14	AWA Bruce Kelley 1929 QSO Party	CW	RST, name, QTH, equipment year/type/power	antiquewireless.org/homepage
14 0700	14 1700	3.5-28	FIRAC HF Contest	Ph	RS(T), serial	www.firac.de
14 1400	17 0800	1.8-144	Classic Exchange, Phone	Ph	Name, RS, SPC, rig manuf/model	www.classicexchange.org
15 0100	15 0300	1.8-28	4 States QRP Second Sunday Sprint	CW Ph	RS(T), SPC, mbr or power	www.4sqrp.com
18 0000	19 0300	14	Walk for the Bacon QRP Contest	CW	13 wpm max; RST, SPC, name, mbr/power	qrptest.com/pigwalk20
18 0130	18 0330	3.5-14	NAQCC CW Sprint	CW	RST, SPC, mbr or power	naqcc.info
19 1600	19 2200	3.5	YO International PSK31 Contest	Dig	RST, serial, country or YO county	www.yo5crq.ro/Rules.htm
20 0000	21 2359	50-1296	ARRL EME Contest	CW Ph Dig	Signal report	www.arrl.org/eme-contest
20 1200	21 1200	3.5-28	LZ DX Contest	CW Ph	RS(T), 2-letter LZ district or ITU zone	lzdxbfira.org/rulesen.html
20 1600	20 2359	1.8	All Austrian 160-Meter Contest	CW	RST, serial, district code (if OE)	www.oevs.at
20 1700	21 0100	1.8	REF 160-Meter Contest	CW	RST, serial, department code	concours.r-e-f.org/reglements/index.php
20 1900	20 2059	1.8-50	Feld Hell Sprint	Dig	RST, mbr, SPC, grid	sites.google.com/site/feldhellclub
20 1900	20 2300	1.8	RSGB 1.8-MHz Contest	CW	RST, serial, district code (if UK)	www.rsgbcc.org/hf
20 2100	22 0259	1.8-28	ARRL Sweepstakes Contest, SSB	Ph	Serial, precedence, your call, check, ARRL/RAC Section	www.arrl.org/sweepstakes
21 1300	21 1700	3.5, 7	Homebrew and Oldtime Equipment Party	CW	RST, serial, class	qrpc.de/contestrules/hotr.html
21 2100	21 2300	3.5-28	FISTS Sunday Sprint	CW	RST, serial, SPC, name, mbr or "0"	fistsna.org
21 2300	22 0100	1.8-28	Run for the Bacon QRP Contest	CW	RST, SPC, mbr or power	qrptest.com/pigrun
24 0000	24 0200	1.8-50	SKCC Sprint	CW	RST, SPC, name, mbr or "none"	www.skccgroup.com
24 2000	24 2100	3.5	UKEICC 80-Meter Contest	CW	6-char grid square	ukeicc.com/80m-rules.php
25 2000	25 2130	3.5	RSGB 80-Meter Autumn Series, CW	CW	RST, serial	www.rsgbcc.org/hf
27 0000	28 2359	1.8-28	CQ Worldwide DX Contest, CW	CW	RST, CQ zone	www.cqww.com/rules.htm
29 2000	29 2130	3.5-14	RSGB FT4 Contest Series	Dig	4-char grid square	www.rsgbcc.org/hf

There are a number of weekly contests not included in the table above. For more info, visit: www.qrpfhoxhunt.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 WATBNM 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, WATBNM, in providing this service.

Frequency Measuring Test — November 2021



Due to a high solar flux, two stations will cover North America.

Ward Silver, N0AX
n0ax@arrl.org

Solar Cycle 25 is causing an increased number of sunspots, but a higher solar flux makes propagation a little more difficult on the lower bands. Because of this, the Frequency Measuring Test (FMT) will use a dual-station format this November. This should give stations throughout North America an opportunity to receive and measure a strong signal.

If you've never entered an FMT before, information on how to measure the frequency of a carrier is available at www.k5cm.com.

Measurement Software

The free software tools available are quite advanced. If you're already using the *WSJT-X* suite on FT8 or WSPR, you can use its frequency calibration mode as a sophisticated frequency measuring tool. George Allison, K1IG, discusses how to use *Spectrum Lab*, *fldigi*, and WSPR

for FMT measurements at www.ve2azx.net/technical/FreqCal.pdf.

Additionally, Joe Taylor, K1JT, explains how to use *WSJT-X* for frequency measurement in *Accurate Frequency Measurements with your WSPR Setup* (physics.princeton.edu/pulsar/k1jt/FMT_User.pdf).

FMT Schedule and Format

The FMT "runs" will start with a call up at 0230 UTC on November 12 (Thursday evening in North America). FMT Manager Connie Marshall, K5CM, notes that the call up may start earlier than the listed times to establish a clear frequency, if necessary, but every effort will be made to start the key down transmissions at the published time in Table 1. A single, unmodulated carrier will be transmitted near those FMT frequencies.

K5CM will transmit from Oklahoma, and Michael Suhar, W8RKO, will transmit from Ohio. Be prepared to

tune to find the call up transmissions, if necessary.

Similar to last year, there will be a slight shift in the frequency to be measured. You'll hear the frequency shift shortly after the call up. The test transmission will be near (but not exactly on) the call up frequency. One measurement for 40 meters and one reading for 80 meters should be submitted.

Submit your measurements using the data entry website at fmt.arrl.org/fmtentry.php. Results will be published immediately following the data entry deadline, 0200 UTC on November 15 (Sunday evening, November 14, in North America).

Table 1
Frequency Measuring Test Schedule

Start: November 12 at 02:30 UTC (Thursday evening in North America)

Results: Submit measurements online until November 15 at 02:30 UTC (Sunday evening in North America)

40 Meters: K5CM near 7064 kHz

02:30 Call up

02:33 Key down

02:34 End 40-meter run

40 Meters: W8RKO near 7064 kHz

02:45 Call up

02:48 Key down

02:49 End 40-meter run

80 Meters: K5CM near 3598 kHz

03:00 Call up

03:03 Key down

03:04 End 80-meter run

80 Meters: W8RKO near 3598 kHz

03:15 Call up

03:18 Key down

03:19 End 80-meter run

If there's interference on the published frequency, tune around to find the FMT transmissions.

The online data entry form is available at fmt.arrl.org/fmtentry.php. Please include notes and observations about making your measurement, including the equipment used and any special techniques. Results are published immediately following the submission deadline.

The 2021 ARRL 160-Meter Contest

2200 UTC Friday, December 3 – 1559 UTC Sunday, December 5

ARRL's 160-Meter Contest gives participants an opportunity to log another state for the Worked All States Award (WAS) or a new country for DXCC. Even if you don't have a dedicated 160-meter antenna, you can load up any length of wire to make contacts. Give it a try and you might be surprised by the results!

♦ Operate using CW only (1.830 – 1.835 MHz should be used for intercontinental contacts only).

♦ Categories include Single Operator or Single Operator, Unlimited (spotting

assistance allowed), at the high, low, or QRP power levels. There's also the option of operating Multioperator, Single Transmitter (use of spotting networks is permitted) at high or low power.

♦ DX stations work stations in ARRL/RAC Sections. W/VE stations work stations in ARRL/RAC Sections and DXCC entities.

♦ KL7, KH0 – KH9 (including KH6), and

KP1 – 5 stations count as US sections and may be contacted by DX, US, and VE stations.

7-Day Log Deadline: ARRL 160-Meter Contest logs must be uploaded via our web app (<http://contest-log-submission.arrl.org>) or postmarked by 1559 UTC December 12, 2021. Paper logs can be sent to ARRL 160-Meter Contest, 225 Main St., Newington, CT 06111.



During the 2020 ARRL 160-Meter Contest, Bryan "Tom" Bydal, W5MX, was excited about his top-ten finish in the Single Operator, High Power category. [Bryan "Tom" Bydal, W5MX, photo]

Special Event: 160-Meter Transatlantic Centenary QSO Party

0200 – 0800 UTC Sunday, December 12, 2021

ARRL and the Radio Society of Great Britain (RSGB) will each activate special event stations for 6 hours on 160 meters to commemorate the 100th anniversary of the Transatlantic Tests. In 1921, ARRL sent Paul F. Godley, 2ZE, to Ardrossan, Scotland for the first successful listening test. Godley received the signals of more than 2 dozen American stations, heralding the dawn of Amateur Radio Transatlantic communications. To celebrate the historic achievement, ARRL will activate W1AW, and RSGB will activate GB2ZE from Scotland. The stations will operate on CW only. If propagation across the Atlantic holds up, the stations may continue to operate beyond 0800 UTC. GMDX Group of Scotland will award a *quaich* (a traditional Scottish drinking cup representing friendship) to the first stations in North America and the UK to complete contacts with both W1AW and GB2ZE during the QSO party. The results will be published jointly by ARRL and RSGB, and there will be a commemorative certificate for stations that work one or both of the activations. For more information, visit arrl.org/transatlantic and rsgb.org/transatlantic-tests.

Complete rules, multiplier lists, and forms can be found at www.arrl.org/160-meter

The 2021 ARRL 10-Meter Contest

0000 UTC Saturday, December 11 – 2359 UTC Sunday, December 12

Regardless of your experience level, the 2021 ARRL 10-Meter Contest offers something for everyone — beginners and more experienced operators can all join the fun!

This contest relies in part on winter E-skip, so propagation may favor higher activity during daylight hours. Be on the lookout for some unexpected band openings and favorable propagation. Solar Cycle 25 may offer up surprises on 10 meters.

There are categories for Single Operator and Multioperator entrants. Stations can be contacted on CW, phone, or both.

Multipliers include US and Mexican states, Canadian provinces, and DXCC countries (excluding the US, Mexico, and Canada). Complete rules, multiplier lists, and forms can be found at www.arrl.org/10-meter.

7-Day Log Deadline: ARRL 10-Meter Contest logs must be uploaded via our web app (<http://contest-log-submission.arrl.org>) or postmarked by 2359 UTC December 19, 2021. Paper logs can be sent to ARRL 10-Meter Contest, 225 Main St., Newington, CT 06111.

The December 2021 ARRL Rookie Roundup

— CW 1800 UTC – 2359 UTC,
Sunday, December 19

The Rookie Roundup is an event to encourage newly licensed operators to get on the HF bands and experience competitive amateur radio operating. This is a great way for clubs to get newer members on the air and the perfect opportunity to be a mentor to new licensees.

Rookies will attempt to make as many contacts as possible during this 6-hour event. Rookies work everyone, and non-Rookies work only Rookies. Stations exchange each other's call signs, first names, a two-digit year, and state (US or Mexican), Canadian province, or "DX."

You can enter as a Rookie if:

- ♦ You made or will make your first-ever contact this year or during the previous 3 calendar years (send the last two digits of the year of your first contact in your exchange),
- ♦ Or you've never made any contest contacts using CW (send the last two digits of the current year in your exchange).

If you're a non-Rookie, send the last two digits of the year of your first license.



Rookie Roundup participants can download a certificate (available at contests.arrl.org/certificates.php) suitable for framing to display their achievement. Stan Swanson, W4SSF, earned first place in the Single Operator category in the W4 call area during the December 2020 ARRL Rookie Roundup CW event.

Rookies can enter as a Single Operator or invite Rookie friends over and operate as Multioperator. Up to five Single Operator Rookies can also enter from their individual stations and submit their total score as a team!

Non-Rookies can join in the fun by calling "CQ Rookies," encouraging the Rookie operators to call you.

All scores must be reported within 72 hours after the event. No late entries will be accepted.

Complete rules, log sheets, and links for submitting your score can be found at www.arrl.org/rookie-roundup

Melissa Stemmer, KA7CLO, mstemmer@arrl.org

At the Foundation

The ARRL Foundation Board of Directors is pleased to announce four new scholarships established to assist amateur radio operators with college or university costs.

The CWops Scholarship

The CW Operators' Club (CWops) has endowed a \$1,000 scholarship for students who demonstrate CW operating ability within the last 24 months by providing a copy of a certificate, a listing in a magazine showing results, or a letter from a person responsible for membership. There are no requirements as to field of study, location, or nationality.

The Ronald Hesselbrock, WA8LOW, Memorial Scholarship

The estate of Ronald Hesselbrock, WA8LOW, has endowed a \$10,000 scholarship for students who have held their amateur radio license and who have been a member of ARRL for a minimum of 1 year prior to the application date. Applicants must demonstrate

they are active in amateur radio by submitting a letter from an amateur radio club officer or from an official in ARRL Field Services verifying their activity.

The Robert A. Rodriguez, K5AUW, Scholarships

Funded by the San Antonio Radio Club, two \$1,000 scholarships will be awarded to students pursuing studies in electrical engineering, electronics engineering, computer engineering, electrical technology, electronics technology, or computer technology. Preference will be given to applicants who reside in the ARRL South Texas Section (first preference), the State of Texas (second preference), or the ARRL West Gulf Division (third preference).

The John C. York, KE5V, Scholarship

Funded through a donation by Bernie Krasowski, KD5QHV, in honor of John C. York, KE5V, this \$1,000 scholarship is for students pursuing a field of study leading to a career in the healing arts, including but not limited to a career in



medicine, nursing, dentistry, pharmacy, EMT, or radiology. Applicants should describe how they have engaged in volunteer and/or public service activities making use of amateur radio.

How to Apply

Full scholarship eligibility requirements for all scholarships can be found at www.arrl.org/scholarship-descriptions. The 2022 Scholarship Program will be accepting applications online from November 1, 2021 until December 31, 2021. For the first time, transcripts and any additional required documents must be submitted with the application. If you are a high school senior or attending college next year and you are an FCC-licensed, active amateur radio operator, you are encouraged to apply. Awards will be announced in May 2022. Awards are sent directly to recipients' colleges.

To learn more about the ARRL Foundation Scholarship Program, please visit www.arrl.org/scholarship-program.

Special Event Stations

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

Through – Nov. 30, 0000Z – 2300Z, I13VE, 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 on QRZ.com for I13VE. Both I13VE and club call IQ3VE are valid. QSL via eQSL or bureau.* www.arivenezia.it

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

Oct. 22 – Oct. 24, 1400Z – 2359Z, N4H, Tarpon Springs, FL. Upper Pinellas Amateur Radio Club. **100th Anniversary of the 1921 Hurricane**. 14.265 14.074 7.265 7.074. Certificate & QSL. UPARC QSL, P.O. Box 1684, Tarpon Springs, FL 34688. www.w8rd.net/hurricane

Oct. 22 – Oct. 25, 2000Z – 2000Z, K5D, Gautier, MS. The Jackson County Amateur Radio Association, Inc. **Deer Island MS 0115 Expedition, US Islands Awards Program**. 21.350 14.250 7.250. QSL. The Jackson County Amateur Radio Association, P.O. Box 234, Gautier, MS 39553.

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

Oct. 31 – Nov. 1, 0300Z – 0400Z, WA4TRS, Bat Cave, NC. The Road Show Amateur Radio Club, Inc. **A Night on Bald Mountain**. 14.331 7.331. Certificate & QSL. The Road Show Amateur Radio Club, Inc., 57 Echo Lake Dr., Fairview, NC 28730. www.roadshowarc.org

Nov. 1 – Nov. 15, 0000Z – 0000Z, N5VET, Cleburne, TX. Club KC5NX. **Veterans Day 2021**. 14.255 14.045 7.240 7.235. QSL. Club KC5NX, 9200 Summit Ct. W., Cleburne, TX 76033. www.qrz.com/db/kc5nx, jay.n.violet@gmail.com or www.qrz.com/db/n5vet

Nov. 5 – Nov. 6, 2300Z – 2200Z, W9TAL, Ottawa, IL. The American Legion Post 33 Amateur Radio Club. **13th Annual Veteran Honor Guard Vigil at the Ottawa Illinois War Memorial**. 7.200 3.900. QSL. Joe Tokarz, TALARC Post 33, 901 La Salle St., Ottawa, IL 61350-4223. www.ottawaalpost33.com

Nov. 6, 1400Z – 2200Z, K5U, McKinney, TX. McKinney Amateur Radio Club. **Veterans Day Salute to the USO**. 14.322. QSL. Dave Marking, 6710 Virginia Pkwy., Ste. 215, PMB 52, McKinney, TX 75071. www.qrz.com/db/k5u

Nov. 7, 1400Z – 2000Z, W4CA, Roanoke, VA. Roanoke Valley Amateur Radio Club. **Mill Mountain Star**. 14.265 7.265. QSL. Roanoke Valley ARC, P.O. Box 2002, Roanoke, VA 24009. www.w4ca.com/special-events

Nov. 9 – Nov. 10, 1700Z – 0100, N9H, Rochester, NY. W2JLD. **Hedy Lamarr Day 2021**. ROC-HAM/EchoLink 531091; AllStar 2585,47620,47918; other EchoLink conferences will be connected for this. QSL. John Derycke, W2JLD, 85 Amherst St., Apt. 2, Rochester, NY 14607. www.roc-ham.net

Nov. 12 – Nov. 13, 1400Z – 2100Z, NB9QV, Manitowoc, WI. USS *Cobia* Amateur Radio Club. **Celebrating Veterans Day**.

14.240 7.240. QSL. Fred Neuenfeldt, W6BSF, 4932 S. 10th St., Manitowoc, WI 54220. www.qrz.com/db/nb9qv

Nov. 13, 1500Z – 2100Z, WX4SC, Gaffney, SC. Carolina Amateur Radio Emergency Services. **Cherokee County Veteran's Appreciation Day**. 7.225 145.150 (no tone). Certificate. CARES, P.O. Box 8006, Gaffney, SC 29340. ki4mjk@gmail.com or www.facebook.com/Carolina-Amateur-Radio-Emergency-Services-230499684304071

Nov. 13, 1700Z – 2359Z, N16IW, San Diego, CA. USS *Midway* (CV-41) Museum Ship. **Celebrating Veterans Day and US Marine Corps Birthday**. 14.320 7.250 PSK and CW on various HF bands; D-STAR on various reflectors. QSL. USS *Midway* Museum Ship COMEDTRA, 901 N. Harbor Dr., San Diego, CA 92101. *Check spotting networks to find us on HF, www.dstarusers.org to find N16IW, and Reporting Note to see what reflector we're using.* www.qrz.com/db/n16iw

Nov. 13 – Nov. 14, 1700Z – 0000Z, W6TOI, Downey, CA. Downey Amateur Radio Club, Inc. **70th Anniversary**. 28.425 21.325 14.270 7.225. Certificate. Downey Amateur Radio Club, P.O. Box 207, Downey, CA 90241. <https://darcarc.wordpress.com>

Nov. 17, 1500Z – 2400Z, K7GST, Prescott, AZ. Yavapai Amateur Radio Club. **NRA's 150th Birthday Party**. 21.3325 14.250 14.040 7.250. Certificate. eCertificate (preferred) or direct to: YARC, P.O. Box 11994, Prescott, AZ 86304. www.w7yrc.org/nrabirthday

Nov. 17 – Nov. 19, 0800Z – 2000Z, W4H, Mars Hill, NC. High Appalachian Mountain Amateur Radio Society. **2021 Hammarlund Radio Hullabaloo**. 14.250 14.071 14.045 7.250. QSL. Jerry Robinson, P.O. Box 366, Mars Hill, NC 28754. www.hamars.club

Nov. 20, 1400Z – 2000Z, W1M, Russell, MA. Western Mass Council BSA. **WHOA Weekend**. 7.060 7.250 14.060 14.250. QSL. Tom Barker, 329 Faraway Rd., Whitefield, NH 03598. *Paper logging, eQSL, and USPS for QSL card.*

Certificates and QSL cards: To obtain a certificate from any of the special event stations offering them, send your QSO information along with a 9 × 12 inch self-addressed, stamped envelope (three units of postage) to the address listed in the announcement. To receive a special event QSL card (when offered), be sure to include a self-addressed, stamped business envelope along with your QSL card and QSO information.

Special Events Announcements: For items to be listed in this column, use the ARRL Special Events Listing Form at www.arrl.org/special-events-application.

Submissions must be received by ARRL HQ no later than the 1st of the second month preceding the publication date; a special event listing for **February** QST would have to be received by **December 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.

How's DX?

The Unique History of Bouvet Island

Bouvet Island (Bouvetøya to Norwegians) is a subantarctic volcanic island located in the South Atlantic Ocean, some 2,563 kilometers (1,593 miles) from Cape Town, South Africa, and can be found at 54° 25' South and 3° 22' East. The island is almost entirely covered by glaciers, and because it's not located below the 60th parallel south, it's not part of the 1961 Antarctic Treaty System. This treaty relates to all land and ice shelves below 60 degrees south of the Earth's equatorial plane. There can't be any new DXCC countries in this region because those who've signed the treaty agreed not to dispute or establish territorial claims, or assert new ones.

The island was discovered on January 1, 1739, by Jean-Baptiste Charles Bouvet de Lozier, a French naval officer. Captain Harald Hornthvedt landed on the island on December 1, 1927, and claimed it for Norway. It was then annexed on January 23, 1928, and became a dependent territory of Norway on February 27, 1930.

DXCC History

Bouvet Island (3Y/B) wasn't on the original post-World War II DXCC list, which was published in 1947. The March 1963 issue of *QST* announced the addition of the island to the ARRL DXCC list (at this time, there weren't set criteria for adding and deleting countries). Under today's criteria, it would meet the rules for a geographically separate entity, as it's well over 350 kilometers from Norway.

At the time of the *QST* announcement, contacts with the world's most remote island could be credited starting May 1, 1963 for contacts made on or after November 15, 1945, which was the start date of the current



The second-most-wanted DXCC entity, Bouvet Island, is located 2,563 kilometers south of Cape Town, South Africa.

DXCC program. For the Worked All Continents Award (WAC), it counts for Africa and is located in CQ Zone 38. Bouvet Island counts as AN-002 for Islands On The Air (IOTA).

There have only been nine activations from this rare location, all of which count for DXCC. The first operation that counted for Bouvet Island was LH4C by Gus Browning in November 1962. Fifteen years later was the first Norwegian operation, which lasted only 2 hours. It occurred on February 24, 1977 at Cape Fie, and was done by Audun Hjelle, LA3CC, operating as 3Y3CC (who made 28 contacts), and John Snuggerud, LA1VC, as 3Y1VC (who made 27 contacts). From December 1978 to January 1979, Thore Winsnes, LA5DQ (SK), was there working and operating as 3Y5DQ in his spare time, with 550 contacts in the log. Also during that time, LA1VC went back to Bouvet to operate as 3Y1VC. During the first

3 months of 1979, he made 1,930 contacts.

The first multioperator DXpedition to Bouvet was 3Y5X, from December 28, 1989 to January 13, 1990. The team included Einar Enderud, LA1EE; Kåre Pedersen, LA2GV; Jin Fujiwara, JF1IST; Jacky Clavo, F2CW (now ZL3CW), and Willy Rüscher, HB9AHL. They made 47,010 contacts. The team arrived via a small boat, while their equipment was flown by helicopter from the ship to the island. You can watch a 30-minute video of this operation at www.youtube.com/watch?v=fPz_c5BcTUU&t=1745s.

On February 22, 1997, Kåre Pedersen, LA2GV, who was part of the 1996/97 Norwegian Antarctic Research Expedition, was able to go ashore and operate as 3Y2GV, making about 200 contacts in 2 – 3 hours. Astronaut and doctor Chuck Brady, N4BQW (SK), was there



Chuck Brady, N4BQW (SK), was an astronaut, doctor, and amateur radio operator. In late 2000 and early 2001, Brady was part of the Norwegian Antarctic Research Expedition and operated in his spare time, making around 8,000 contacts as 3Y0C.

accompanying the Norwegian Antarctic Research Expedition for several months in late 2000 and early 2001. He made around 8,000 contacts as 3Y0C. The last operation from 3Y/B was between December 2007 and February 2008. Petrus Kritzing, ZS6GCM (also ZS8T), was working on the island and active in his spare time as 3Y0E.

Afterward, the licenses 3Y0G and 3Y0H were issued to Mark Demeuleneere, ON4WW, and Dmitry Zhikharev, RA9USU, respectively, but both of them decided not to go.

Since then, there have been two attempts, both of which failed. The first was the 3Y0Z team in 2018. They got within sight of the island and had to abort due to serious engine troubles aboard the MV *Betanzos*. The second was in March 2019 by the Rebel DX Group, led by Dom Grzyb, 3Z9DX, but they were overtaken by a serious storm within several hundred miles of the island.

A Change of Plans

In April 2021, the Intrepid-DX Group, led by Paul Ewing, N6PSE, teamed up with Ken Opskar, LA7GIA, announcing their 2023 Bouvet Island DXpedition (see the June 2021 "How's DX?" column for more information).

Originally, they were going to travel via the MV *Braveheart*, but the ship was sold. The team refunded all of the donations and began looking at other transportation options. However, they decided to part ways.

In the beginning of August, the Intrepid-DX Group decided not to go to Bouvet Island and are now planning on activating "a different rare and much-needed entity in January/February 2023."

Looking Ahead

Currently, there are two groups heading to 3Y/B, which happens to be the second-most-wanted DXCC entity on Club Log's Most Wanted DXCC List.

Dom Grzyb, 3Z9DX, and his team are expected to depart for 3Y/B around mid-December 2021. Updates can be found on their website at <https://bouvetoya.org>, or at your favorite DX outlet.

The second group will be led by Ken Opskar, LA7GIA; Rune Øye, LA7THA, and Erwann Merrien, LB1QI. Joining them will be Gjermund Bringsvor, LB5GI; Adrian Ciuperca, KO8SCA; Laci Radócz, HA0NAR; Dmitry Zhikharev, RA9USU; Bill Straw, KO7SS; Sandro Nitoi, VE7NY; Axel

Schernikau, DL6KVA; Dr. Mike Crownover, AB5EB, and one more team member who hasn't been announced. They're aiming to have 3Y0J on the air in November of next year. More details and photos can be found on their website at www.3y0j.no.

This team is planning to operate from Cape Fie on the southeastern side of the island. Reportedly, this is the only place to safely stay overnight. They won't be permitted to set up on the beach, so they'll have to set up camp on the rocks above the beach, which is some 80 meters (250 feet) above the landing site. The team will set up a winch system to lift their equipment from the beach to the overlook. They're anticipating spending 2 days to get the camp set up.

They plan to be operational on 160 through 10 meters, including 60 meters and the WARC bands, on SSB, CW, FT4, FT8, and RTTY.

Sponsorship

The 3Y0J team said, "With an overall budget of \$650,000, this will be the most expensive DXpedition ever." Support is being sought from corporations, clubs, foundations, and individuals. On August 30, the Northern California DX Foundation (NCDXF) announced they're "granting \$100,000 to the 3Y0J 2022 Bouvet Island DXpedition planned for November 2022." This is the biggest grant NCDXF has ever given for a DXpedition. By the end of October, the team needs to have 30% down on the vessel in order to ensure a November 2022 DXpedition. The goal for the 3Y0J DXpedition to Bouvet Island is to make 120,000 contacts. Visit their planning site at www.3y0j.no.

Wrap-Up

That's it for this month. Don't forget to send your DX news, whether it's a serious or "holiday" operation, to bernie@dailydx.com. Until next month, see you in the pileups!
— Bernie, W3UR

The World Above 50 MHz

Solar Cycle 25 Brings November F2



F2 propagation on 50 MHz may appear for the northern hemisphere in November 2021 as the pace of Solar Cycle 25 picks up. Solar Cycle 25 is running ahead of schedule, with the peak possibly occurring in fall 2024, which is a year earlier than previously predicted. The effect of the winter anomaly begins in November, which creates higher F-layer MUF (maximum usable frequency).

The most likely scenario for a 6-meter F2 opening in fall 2021 is during, or just after, a geomagnetic storm. The high geomagnetic activity can boost the MUF on north-south paths, such as North America to the Caribbean and South America or North America to Oceania. It takes a much higher sustained solar flux for the transatlantic path to open. Watch websites such as Solarham.com and Spaceweather.com for updates.

2021 Perseid Meteor Shower

KB7Q (DN54) 222 MHz, Wyoming

Gene Shea, KB7Q, operated from the Beartooth Plateau (DN54fw) on 222 MHz in August (see Figures 1 and 2). He worked eight stations on MSK144 meteor scatter, including W5ZN at 1,150 miles for his state #45. On moonbounce, he logged four stations, including WA4NJP for his state #48. Dave, N9HF (EL99) also worked KB7Q/p on EME using JT65B for his state #42 on 222 MHz.

N7GP/R (DN76, DN77, DN85, and DN86), South Dakota

Also in August, Tom, N7GP/R (ex-WA8WZG), was active on 6 meters. He made 237 contacts, most on

MSK144 and a few on FT8. I (NØJK, EM28) logged Tom in DN77 and DN85 on MSK144. AAØMZ (EM29) worked him in DN85 for one of his last Fred Fish Memorial Award (FFMA) grids.

NØLL/P (EM07), Kansas

Larry, NØLL, operated again from EM07, focusing on 6 meters. He made 94 good MSK144 contacts, 111 FT8 contacts, and 30 incomplete contacts. He was on the air by 5 AM each day until around 1:30 PM in the afternoon. He tried to work Hal, N7NW (CN87), who only needs a couple of grids to complete the FFMA, with EM07 being one of them, but there was only one decode from Hal. Overall, Larry said

the Perseid meteors “were excellent.” (see Figure 3). He noted that he “had some intermittent E_s for FT8 during the late morning.” He made one MSK144 2-meter contact with KC4AAW (EM85). He used a five-element Yagi up 15 feet and 70 W.

On the Bands

50 MHz. Sporadic E continued through the first 2 weeks of August. Steve, NN4X (EL98), worked 20 European stations on August 1. On August 2, he picked up TZ4AM and 5T5PA. On Tuesday, August 3, he worked G1RZN.

Rich, K1HTV (FM18), worked 5T5PA, TZ4AM, 8P6ET, 9Y4D, J35X, and others on August 3. On August 4, WA2GFN (FN20) worked W5KDX (DM65) on SSB. KE6GFI (DM34) worked from EL96 north to NJØF (EN34) and west to W7YOZ (CN87) on SSB. On August 10, K9RX (EM84) copied OD5ET and worked G4IFX and another European station on August 12. That appears to be the last of the 2021 transatlantic E_s season.



▲ **Figure 1** — Gene Shea, KB7Q, set up a portable operation for 222 MHz from grid DN54 in Wyoming. [Gene Shea, KB7Q, photo]



▲ **Figure 2** — Gene's, KB7Q, portable 222 MHz MSK144 and EME station. [Gene Shea, KB7Q, photo]



Figure 3 — Composite of 17 separate Perseid meteor shower streaks, ranging in time from 3:07 to 4:24 AM CDT on August 14, 2021. Looking northeast from near Bowman Woods Park in Cedar Rapids, Iowa, skies were clear. The constellation Perseus is at the upper left. The Pleiades star cluster is at the right center, and the constellation Taurus at the lower right. [Gregg Alliss, KE0RBK, photo]

K9RX worked VK4QG on EME on August 14. On August 16, Ron, K3FR (FM18), worked VO1SIX (GN27) on FT8. The last 6-meter E_s in North America reported for August was on the 25 – 26. K3FR reported contacts from Florida to Colorado. I worked KD5M (EM60), W4LID (EM77), and WB4QOC (EM95) on FT8.

144 MHz Tropospheric Opening.

A major tropo opening took place the last week of July. Several days of intense tropo associated with a stagnant high-pressure system took place from July 27 – 29. On July 27, WQ0P (EM19) worked stations as far as K4RCA (FM06) on 2 meters, with many contacts on 222 and 432 MHz. N0LL (EM09) worked as far as KE8FD (EN80).

I (EM28) worked K9MRI (EN71) and WZ8D (EM89) on FT8 with 50 W and a M2 Yagi. The best day for stations in eastern Kansas was on July 28.

WQ0P, K2DRH (EN41), and KA9CFD (EN40) worked many stations. There was strong tropo from Kansas to W4, with K4NKT (EM64), W3CP (EM74) and KC4AAW (EM85) going in my log on FT8, along with many W8 and W9 stations. I worked WA9DU (EM69), filling in EM28 for him. I had a PSK flag from W3IP (FM19) at 1,483 kilometers.

Sam, K5SW (EM25), worked N8DJB (EM77) on SSB. The tropo moved east on July 29. Stations in Alabama worked to W8 and W4. NV4B/R was on from rare grid EM54 and worked stations from Kansas (WQ0P) to Wisconsin (KO9A).

On August 4, a rare late-season 2-meter E_s opening occurred. WZ1V (FN31) worked KA9CFD (EN40) at +21 dB, as well as K0TPP (EM48) and W5LDA (EM15) around 2300Z. Gary, N2AMC (FN30), logged W5LDA at 0032Z at 2,051 kilometers. On August

13, Rich, N0HJZ (EN34), worked W1XX (FN41) in Rhode Island on 2-meter SSB on meteor scatter “on a 15-second burn.” He noted that there was few people on 144.200 MHz SSB or CW.

On August 18, FG4ST (FK96) decoded CT1ETL/1 (IM58), calling CQ on 144.174 MHz FT8 at 2232Z at –20 dB. FG4ST was working EA8 on tropospheric propagation across the Atlantic. A two-way contact would have achieved the Brendan Shields award which, according to Irish Radio Transmitters Society, “will be awarded to each of the operators of the two amateur radio stations which first establish two-way communication between the continents of Europe and America (North or South) within the 2 Metre Amateur Band [using an all-terrestrial, non-artificial means of propagation].” For more information about the Brendan Awards, consult Ev Tupis’, W2EV, article, “The Brendan Awards: Insights for the New Millennium,” from the August 2002 issue of *QST*.

The tropo continued through August 20. Ramsey, NP3XF, worked EA8BPX, EA8CTK, and EA8CXN on 144.250 MHz SSB. On August 28 – 29, K7ULS worked 20 stations on EME in the Russian EME contest, including TA1D at 0904Z at –27 dB.

222 MHz. K7ULS (DN41) worked W0VTT (EN33) on MSK144 on August 6 at 1134Z. The contact took an hour to complete.

432 MHz. WQ0P (EM19) worked K4RCA (FM06) on July 28 using FT8 tropo at –8 dB.

Here and There

With inspiration from Francis, KV5W, Jim, K5ND, has written an article to help those just learning about the FFMA with a list of resources to assist in achieving this distinguished award. You can find it at www.k5nd.net/2021/08/fred-fish-memorial-award-ffma.

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 (Montgomery) — Nov. 20 D F H Q R S T V
8:30 AM – 2 PM. *Spr*: Montgomery ARC. Alcazar Shrine Temple, 555 Eastern Blvd. *Ti*: Call W4AP 146.84 (123 Hz). *Adm*: \$8, includes one admission and ticket. w4ap.org/marc/hamfest

Arizona (Marana) — Nov. 13 D F H Q R S T V
7 AM – 1 PM. *Spr*: Oro Valley ARC. Marana Middle School, 11279 West Grier Rd. *Ti*: See website. *Adm*: \$5. Tucsonhamradio.org

Arizona (Mesa) — Dec. 4 D F H Q R S T V
7 AM – 3 PM. *Spr*: Superstition ARC. Superstition Springs Center, 6555 E. Southern Ave. *Ti*: 147.120+ (162.2). *Adm*: \$5, kids under 12 free. superstitionsuperfest.org

Florida (Ocala) — Dec. 4 D F H Q R T V
7:30 AM – 3 PM. *Spr*: Silver Springs Radio Club. First Christian Church, 1908 East Ft. King St. *Ti*: 146.610 (123 Hz). *Adm*: \$10. k4gso.us

Florida (Pinellas Park) — Nov. 13 D F H R T V
8 AM – noon. *Spr*: St. Petersburg ARC. Freedom Lake Park, 9990 46th St. N. *Ti*: 147.06 (no PL). *Adm*: Free. Email: kc1yl@yahoo.com

ARRL WEST CENTRAL FLORIDA SECTION CONVENTION

December 10 – 11 Plant City, Florida

D F H Q R S T V
Fri. 1 PM – 6 PM, Sat. 8 AM – 4 PM. *Spr*: Florida Gulf Coast Amateur Radio Council. Strawberry Festival Expo Building, 301 Berryfest (was N. Lemon). *Ti*: 145.410 (131.8 Hz). *Adm*: \$9 Advance, \$10 door. www.fgcrc.org

ARRL CENTRAL DIVISION CONVENTION

November 13 – 14 Fort Wayne, Indiana

D F H Q R S V
Sat. 9 AM – 4 PM, Sun. 9 AM – 2 PM. *Spr*: Allen County Amateur Radio Technical Society. Allen County War Memorial Coliseum, 4000 Parnell Ave. *Ti*: 146.880 (no tone). *Adm*: \$6 both days, \$3 Sun. www.fortwaynehamfest.com

Louisiana (Harahan) — Nov. 13 D F H R S T V
8 AM – 1 PM. *Spr*: Crescent City Amateur Radio Group. VFW Hall, 1133 Hickory Ave. *Ti*: 146.82 (114.8 Hz). *Adm*: \$5. ccarg.org

Michigan (Troy) — Dec. 5 D F H R V
8 AM – noon. *Spr*: L'Anse Creuse ARC. Balkan American Community Center, 1451 East Big Beaver Rd. *Ti*: 147.08 (100 Hz). *Adm*: \$10. www.n8lc.org

Mississippi (Ocean Springs) — Nov. 12 – 13 D F H Q R S V
Fri. 4:30 PM – 8 PM, Sat. 8 AM – 3 PM. *Spr*: Jackson County ARA. St. Martin Community Center, 15008 Lemoyne Blvd. *Ti*: 145.110 (123 Hz). *Adm*: \$5. www.jcmsara.com

Missouri (Brookline) — Nov. 13 D F H R S V
8 AM – 1 PM. *Spr*: Nixa ARC. The Barn House Event Center, 5484 W. Sunshine St. *Ti*: 147.015 (162.2 Hz). *Adm*: \$10. smirs.files.wordpress.com/2021/07/2021-nixa-arc-hamfest-flyer_reva.pdf

Nebraska (Norfolk) — Nov. 20 D F H R S V
8:30 AM – 2 PM. *Spr*: Elkhorn Valley ARC, Inc. CHC Hall, 105 Elm Ave. *Ti*: 146.73 (131.8 Hz). *Adm*: \$5. qsl.net/evarc

New Jersey (Fair Lawn) — Nov. 26 D H R
5 PM. *Spr*: Fair Lawn ARC. Fair Lawn Senior Center, 11-05 Gardiner Rd. *Ti*: 145.470 (167.9 Hz). *Adm*: \$2. auction.fairlawnarc.org

New York (Hicksville) — Nov. 14 D F H Q R S V
9 AM – 1 PM. *Spr*: Long Island Mobile ARC. Levittown Hall, 201 Levittown Parkway. *Ti*: 146.850 (136.5 Hz). *Adm*: \$6. Email: k2knb@arrrl.net

North Carolina (Benson) — Nov. 21 D F R T V
8 AM – 1:30 PM. *Spr*: Johnston ARS. American Legion Building, 605 N. Wall St. *Ti*: 147.270 *Adm*: \$9 Advance, \$10 door. www.jars.net/jarsfest-2021

Ohio (Delta) — Dec. 4 D F H R V
8 AM – 11 AM. *Spr*: Fulton County ARC. Villadelta Memorial Hall, 401 Main St. *Ti*: 147.195. *Adm*: \$5. k8bxq.org/hamfest

VIRTUAL ARRL WISCONSIN STATE CONVENTION

November 13, Online

9:30 AM – 4:30 PM. Wisconsin ARES/RACES Conference. *Adm*: Free. www.wi-aresraces.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 August 2021 activity report of the VM Program.

◆ Licensees in Pawcatuck, Connecticut; Wamego, Kansas; Valley Cottage, New York; Long Valley, New Jersey; Columbia, South Carolina, and Maryville, Tennessee, were sent advisories concerning operation on frequencies that were set aside for Haiti earthquake emergency communications by the International Amateur Radio Union (IARU) Region 2 Emergency Coordinator.

◆ Licensees in Prineville, Winston, Silver Lake, and Roseburg, Oregon; Sioux Falls, South Dakota, and Houston, Texas, were sent advisories concerning failure to identify, as required by Section 97.119(a) of the FCC Amateur Radio Service, pursuant to a nationwide rule compliance review of operations on 3.819 MHz and 3.953 MHz.

◆ A former licensee in Seabrook, Texas, was sent an advisory concerning operation with an expired license.

◆ An FT8 operator in Orion, Michigan, was sent an advisory reminding him of the 200 W power limit on 30 meters.

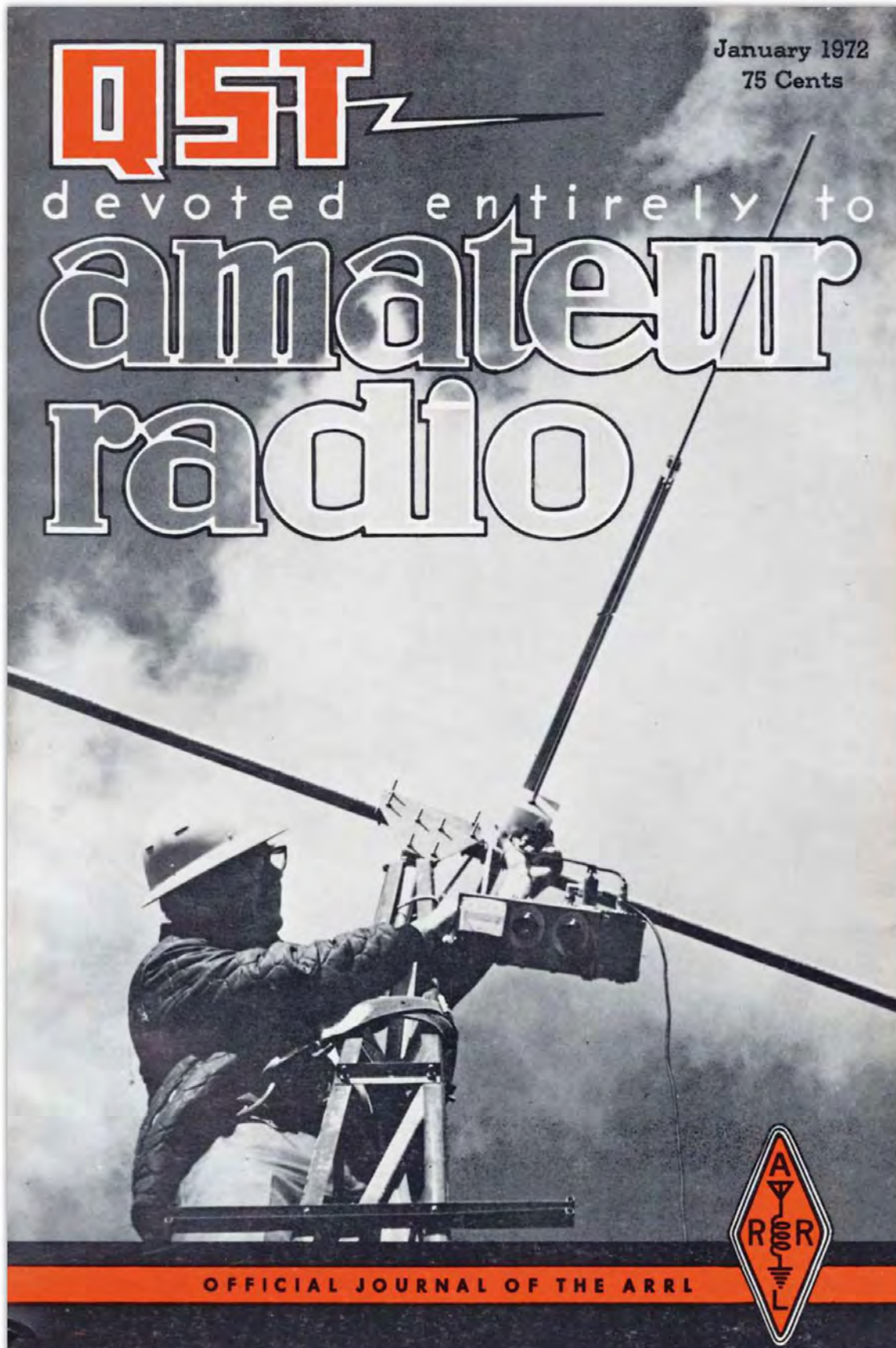
◆ A licensee in New Caney, Texas, was sent a final notice that his case was being referred to the FCC for license revocation or deletion of voice privileges from his license.

◆ A Good Operator commendation was sent to an operator in Roseville, California, for Exemplary Amateur Procedure on May 21, 2021, during the 40-meter California Rescue Communications Net.

◆ The revised total for VM monitoring in July was 5,746 hours — the highest number of hours monitored since the inception of the VM Program.

The IT staff at ARRL Headquarters completed work on an automated system for Volunteer Monitors to report monthly monitoring hours and incident reports. — *Thanks to Volunteer Monitor Program Administrator Riley Hollingsworth, K4ZDH*

A Look Back



Gimmicks and Gadgets

A Crystal Filter for the Drake R-4B

BY DAVID SUMNER,* K1ZND



HERE IS an easy (though expensive) modification which may be performed on the Drake R-4 series of receivers to add a crystal filter. No holes need be drilled and the receiver can be restored to its original condition in less than an hour. The modified receiver has an i-f system with a 6-dB bandpass of approximately 2.2 kHz and a 6:60-dB shape factor of 1.5:1.

The R-4 is a dual-conversion receiver with a four-pole, 6-kHz-wide crystal filter in the first i-f stage (5645 kHz). The purpose of this filter is to provide immunity to out-of-band signals and to assure adequate image rejection which might otherwise be a problem in a receiver with a 50-kHz second i-f. The companion T-4XB exciter/transmitter uses two 8-pole crystal filters at 5645 kHz — one for each sideband. If provision is made for impedance matching, it is possible to use the 8-pole transmitter filters in the receiver first i-f stage. The combination of the sharper crystal filter in the first i-f and the LC filter in the second i-f provides excellent selectivity for ssb operation.

Components

The 8-pole filters are available from the R. L. Drake Company at a cost of approximately \$80. Included in the package are two filters, a switch, and a mounting bracket. Additionally, a set of

* P.O. Box 17401, West Hartford, CT 06117.

matching transformers is required (T2 and T3 in the T-4XB). These cost approximately \$8 for the pair. The only other items needed are three feet of shielded cable (RG-174 or equiv.), a metal box, and three 1/4-inch-dia rubber grommets. Any aluminum box larger than 2 1/2 x 3 x 3 inches will be satisfactory.

Step-by-Step Procedure

- 1) Mount the switch, bracket, and filters in the enclosure as shown in the photograph. Include two grommets on the rear of the box.
- 2) Route a pair of 18-in. coaxial cables through the grommets on the rear of the enclosure and connect the center conductor of each cable to the center lug of each switch pole. Connect the shields of both cables to the nearest ground lug, respectively.
- 3) Remove the receiver top and bottom covers.
- 4) Locate T5 and T6 (the filter matching transformer and the existing crystal filter). Make a sketch of the connections to these transformers (for later reference).

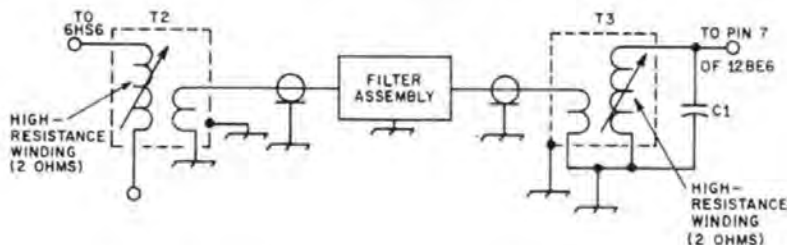


Fig. 1 — Circuit diagram of the modified i-f transformer section of the R-4B receiver. C1 is a 27-pF disk ceramic capacitor in the R-4A. The R-4B uses a 21-pF capacitor. The filter assembly consists of two filters, a ceramic switch, and a mounting bracket. T2 and T3 are the T-4XB transformer designations which replace the receiver T5 and T6 respectively.

Inside view of the filter assembly built by K1JHX. The box is homemade. Two of the screws for securing the receiver top cover are used to hold the assembly in place. Press-on decals and a Drake knob add a final touch.



5) Disconnect all of the leads to T5 and T6, then remove the transformers. It is not necessary to break or drill anything; the transformers are held in place with a pair of spring clips.

6) Install the new T2 and T3 (T-4XB nomenclature) transformers where T5 and T6 were mounted. T2 replaces T5 and T3 replaces T6. Note that in both cases the high-resistance windings (about 2 ohms) of both transformers are nearest the tube socket to which they are connected. See Fig. 1. The low-resistance windings of each transformer face each other.

7) Reconnect all of the wires and components to the lugs on both transformers. *Exception:* Omit the connections between the two transformer low-resistance windings.

8) Position a rubber grommet in the spare jack hole on the rear chassis apron. Route the shielded wires from the filter box through the grommet and along the chassis to the new i-f transformers. Connect these cables to the i-f transformers as shown in Fig. 2. The center lugs on the transformers are not used. The lugs to which the shields are connected are then grounded with a short piece of hookup wire.

Alignment

Set the receiver tuning dial to position one of the crystal calibrator markers in the middle of the passband. Select either USB or LSB with *both* the passband tuner and the crystal-filter switch. Adjust the PRESELECTOR, T2, and T3 for maximum S-meter reading. This condition occurs with the transformer slugs nearly all the way out. There should be no noticeable decrease in sensitivity or overall gain after the modification is completed.

Operation

The crystal-filter switch must be placed in the proper position for the mode of operation. The 4.8-kHz selectivity position of the passband switch is limited by the crystal filter, but the receiver is still usable for a-m reception.

The additional selectivity provided by the filter is noticed mostly while operating ssb during crowded band conditions. However, the cw performance is also improved since there is a substantial reduction of the audio image on the other side of zero beat. The entire modification requires roughly 2 1/2 hours.

QST

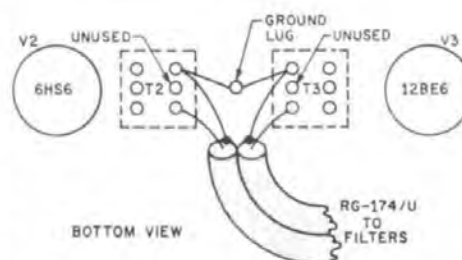
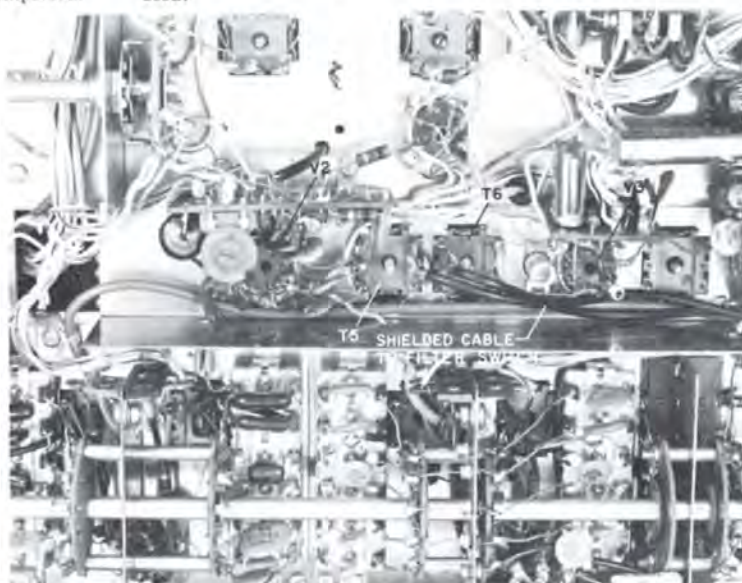


Fig. 2 — The two cables from the filters are routed through the grommet mounted on the rear chassis apron. The center lugs on the transformers are not used.

Bottom view of the modified R-4B. The leads from the filter assembly are routed through a grommet in the rear chassis apron.



January 1972

Strays



During the 1971 Miss America Pageant in Atlantic City, New Jersey, the Southern Counties Amateur Radio Association operated special events station WX2MAP. Taking a breather from Pageant activities, Sheila Bernhagen, Miss Minnesota, paused to say hello to some lucky amateur as W2BZL and WB2QXX look on.



Among recent visitors to Hq. was the Friedman family which includes OM Jordan, WN2QXQ; Edward, WN2QY; Jay, WN2PTL; and 8-year-old Beverly, WN2QW. The family shares a Globe Scout 680A and a Hammarlund HQ-200 with which they keep Levittown, N.Y. well represented on the Novice bands.

Here's a group of contest/DX types really "with it" snapped during a recent impromptu gathering hosted by W1CW. (l. to r.) bottom, WA8TBQ, W8FAW, WA1KQM, W1CW; top, K1ZND, W1BGD, WA8VRB, W1FBY.

January 1972



Mayor Graham of Las Cruces, New Mexico, took time out during a city council meeting recently to present a certificate of appreciation from the regional Office of Civil Defense to George and Rose Stewart, K5YRY and WA5ALX, for providing communications during emergencies.



As part of the Union County, Indiana, Sesquicentennial Celebration, local amateurs manned special events station WS9UCI September 19-26 on 160 through 10 meters. Shown here are W9LVH and XYL WN9HGN. A commemorative QSL is available via W9LVH.



Celebrating Our Legacy

An Airman Influenced by Radio

Fifty years ago, I was on the last leg of my 4-year enlistment in the US Air Force (USAF), stationed at the Offutt Air Force Base in Omaha, Nebraska. I enjoyed operating QRP CW from my barracks room with a TEN-TEC Power-Mite 2 and a 20-meter dipole strung to a tree.

Back then, ham radio exams involved quite a bit of studying to learn electronics theory and draw schematics. I was fascinated with radio, and soon after graduating high school, I enlisted in the USAF as an Electronics Technician. After finishing Air Force Technical Training at the Keesler Air Force Base in Biloxi, Mississippi, I worked in the Precision Measurement Equipment Laboratory (PMEL) at a number of duty stations, repairing and aligning test equipment like meters, oscilloscopes, and signal generators. I worked for various companies in that capacity for many years after.

I never thought I wanted to operate CW, so instead of becoming a Novice operator, I earned my Technician-class license and operated 2-meter AM. A few years later, I earned my Amateur Extra-class license and got bit by the CW bug.

I still enjoy tinkering with homebrew electronic circuits and kits when I'm not making contacts and chasing DX.

Joe Falletta, W6UDO
Terrebonne, Oregon

My Early Years in Radio

In the early 1960s, I would sit next to my father, W7PVD (SK), and listen as he made CW contacts. He eventually gave me a machine that sent Morse code using paper tapes. It had to be wound up because it had no electric motor, and was connected to a one-tube code practice oscillator, which allowed contacts to be made through the holes as the tape rolled.

After studying, I was ready for my Novice-class license test. My dad's good friend, W7PKM (SK), gave me the test, and I passed. While waiting for my license to arrive, my dad searched for used gear. He found a Hallicrafters SX-110 receiver and HT-40 transmitter for \$100. After many hours of mowing lawns, I earned enough money to afford the station.

After my Novice-class license finally arrived, I worked the world on 15 meters with one crystal and 75 W. I built a 15-meter beam out of thin wall conduit and mounted it on top of 20 feet of 2-inch pipe. I anchored it just outside my bedroom window (where my station was), so I could listen through the window from outside and rotate the antenna by hand to peak the signal.

When I was ready for my General-class license, it took two tries to pass the test. While I was waiting for my new license to arrive, I worked at a Boy Scout camp in New Mexico. I took my Hallicrafters station with me to make nightly contacts with home. My dad finally called to tell me my license arrived.

When I was 15 years old, I joined the US Army Military Auxiliary Radio System (MARS) and passed a lot of traffic. I always seemed to do well on the procedure tests, which checked your knowledge on how to communicate according to the book.

Fifty-five years after earning my Novice-class license and I still have my first Hallicrafters station!

Joe Bronson, WA7HOP
Globe, Arizona
Life Member

Inspired by Build Articles

I built my first amplifier in 1971, closely following the instructions found in "The 'Junker' Amplifier" by Lewis McCoy, W1ICP, in the October 1970 issue of *QST*. Of the three tube

choices the article mentioned, I used an 813 and its 10 V filament transformer, probably because I already had one or could easily get one. I distinctly remember the winding of the tank coil, using a piece of plexiglass as a mount after drilling the required holes, and adding a small coil made of 1/4-inch copper tubing for the 15- and 10-meter positions. For the most part, it all worked as described. My shielding wasn't great, and I recall being mostly limited to 80 and 40 meters until cable TV arrived. I used this amplifier with my SB-303 and -401 Heathkit twins for many years. I still own the Heathkits!

The December 1970 issue featured the construction article, "A High-Output VFO for a Beginner's Transmitter," by Peter Zilliox, WA3EQK. I never built this one, but often thought about doing so.

Pete was later awarded the call sign K5PZ and moved to southern California. He became well known, especially in the boatanchor community, not only as a collector and meticulous restorer, but as a reliable mentor. He was instrumental in forming and fostering the Vintage SSB Roundtable about 10 years ago, which survives as a cohesive, friendly group that meets weekly.

Sadly, Pete passed away in August 2020. All of us vintage radio enthusiasts in southern California were enriched by knowing him and miss him deeply.

Ron Pollack, K2RP
Encinitas, California

Send reminiscences of your early days in radio to "Celebrating Our Legacy," ARRL, 225 Main St., Newington, CT 06111 or celebrate@arri.org. Submissions selected for publication will be edited for space and clarity. Material published in "Celebrating Our Legacy" may also appear in other ARRL media. The publishers of *QST* assume no responsibility for statements made in this column.

Classic Radio

Troubleshooting a Classic Receiver

If you have a classic vacuum-tube receiver, but it needs some troubleshooting and repairs, be assured that working on a classic receiver is more straightforward than you might think. It just requires an understanding of what goes on inside the radio and a method of finding what needs to be fixed.

Here's a brief review of some basics, an example from the repair bench (see Figure 1), and notes on getting started.

The Signal Chain

To troubleshoot a superheterodyne receiver, you must know the *signal chain* — the stages through which a radio signal is converted and processed — from the antenna to the speaker.

As seen in Figure 2, a 7.0 MHz signal is tuned and amplified in the RF stage and sent to the mixer. A 7.455 MHz signal is generated by the oscillator and also sent to the mixer. The oscillator's output is ganged with the RF stage, and its frequency always tracks 455 kHz above that being tuned in the RF. So, tuning the radio up the band to 7.1 MHz would result in the oscillator tracking at 7.555 MHz, and so on.

At the mixer, the RF's 7 MHz and the oscillator's 7.455 MHz signals are combined, or *heterodyned*. This produces an output from the mixer that is the difference between the RF and oscillator frequencies — 455 kHz. This is the *intermediate frequency* (IF). Whichever frequency the receiver is tuned to, the IF signal created in the mixer is fixed at 455 kHz, and retains any information, such as AM, CW, SSB, or data contained in the RF's signal.

The mixer's intermediate frequency signal is passed through the IF stage,

which is tuned to 455 kHz, increasing selectivity and further amplifying the signal. Filtering to adjust passband width takes place here, and a BFO can be switched in to create the carrier needed to detect CW and SSB.

The signal from the IF stage goes to the detector where AM, CW, SSB, or data are recovered as audio output. The audio signal is sent on to the AF stage for amplification, ending at the speaker or headphone.

The design of the receiver is focused around conversion. The RF tunes over a wide band, being converted to a fixed IF for processing. This simplifies circuitry and greatly improves stability, selectivity, and gain. A signal can be converted more than once to enhance performance. Figure 2 shows a single 455 kHz conversion.

Note that most single-conversion communications receivers, including the Heathkit HR-10B in Figure 1, use two

Figure 1 — The Heathkit HR-10B receiver and IG-102 signal generator from the vacuum-tube era.



IF and AF stages. Figure 2 shows one of each for simplification.

Signal-Substitution

Vacuum-tube circuits carry potentially lethal high voltages. Caution must be exercised when working with power on. Familiarize yourself with safe operating procedures, and follow them when troubleshooting.

Most problems in a receiver — especially if it is dead, intermittent, or has weak output — can be located by starting with a signal generator, working the signal chain in reverse. The AF is tested first, moving back to the detector and IF, the oscillator/mixer, and RF. Output of the stage under test passes to a stage already checked, ending with a confirming tone at the speaker.

The signal generator output is either set to an audio frequency (commonly 400 Hz) for the AF stage, or to the fre-

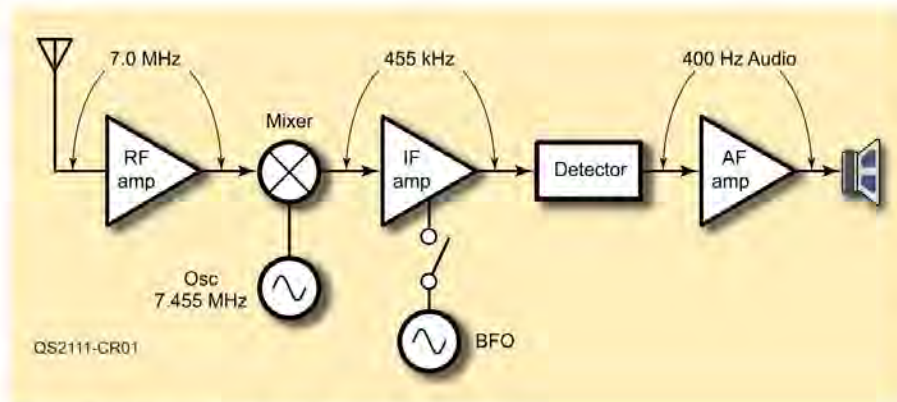


Figure 2 — A signal-chain block diagram.

quency of the RF or IF, and modulated with an audio carrier. Arrows in the block diagram show test points on the signal chain and the frequencies to which the signal generator is set for a radio tuning 7.0 MHz with a 455 kHz IF.

With the signal generator's test lead placed at the input of the stage being checked, the tone will be heard if the stage is functioning properly. If it doesn't pass, or there's distortion from the speaker, correct the problem before moving to the next stage.

At the same time the signal check is being made, the signal generator can be used with a voltmeter to determine if a stage is producing sufficient gain.

When troubleshooting moves into a faulty stage, much of the work involves voltage and resistance measurements reflected in the schematic. Each stage is prone to specific troubles. Having a checklist that prioritizes them speeds the elimination process.

HR-10B Checkout and Repair

My Heathkit HR-10B (see Figure 1) had never been subject to serious neglect or damage. A few minor problems kept it from operating. Solving them only required a method of finding and diagnosing them.

Before troubleshooting, conduct a visual inspection for signs of component failure and faulty wiring. I tested

the tubes and cleaned the band switch, controls, and vacuum-tube pins.

As a precaution, I replaced three electrolytic capacitors in the power supply and installed a grounded line cord for safety. There are risks of damage if full ac current is run through a power supply with a shorted electrolytic capacitor, and they can deteriorate over time. Also, an electrolytic that is open or loses capacity can cause under-voltage and audio hum.

When I turned on the HR-10B, the tubes lit, and there were no obvious signs of damage, but once it warmed up, audio was intermittent with a hard tap on the chassis.

Using the signal generator's 400 Hz audio output, the audio transformer and second AF stage passed their separate checks. The intermittent output surfaced in the first AF stage test. I cleaned up some poorly dressed connections with the soldering iron, and checked again. After it passed, I concluded the likely culprit was a solder-starved joint at the coupling capacitor between the audio stages.

I tested the detector and second IF at the input of the second IF. The signal generator was set at the HR-10B's 1681 kHz IF frequency, with a 400 Hz audio carrier. There was weak gain in the speaker. The IF's cathode-bypass

capacitor was open and had deteriorated with age. Several solder joints at the vacuum-tube terminals of both stages also looked suspicious. I fixed those issues, and replaced the IF's cathode-bias resistor.

The first IF stage didn't raise any red flags, nor did the mixer/oscillator when I used 3.5 MHz modulated with 400 Hz at the mixer input.

I fed the radio through the antenna jack and switched the signal generator through all five bands, and the RF stage checked okay. I cleaned the band switch again to fix intermittent issues.

Getting Started

To get started in troubleshooting, references from the 1950s or early '60s are essential. Among the best is the 1955 edition of *Elements of Radio Servicing*, by Marcus and Levy. Proceeding from the power supply through each individual stage, circuits are explained down to the component. Troubleshooting is equally detailed.

If looking for a project, consider starting with a basic, single-conversion receiver with a transformer power supply. One like the HR-10/10B is a good choice, with its straightforward circuitry and uncluttered chassis. I would not recommend a first project using radios without transformer power supplies, such as the Hallicrafters S-38 and National SW-54. Their hot-ground chassis pose a serious shock hazard to the inexperienced.

At the bench, all equipment must be at the same ground potential. With a vacuum-tube signal generator, be sure its line cord is correctly polarized. Present-day signal generators can fault out or be damaged by high voltages, so caution is advised. Regardless of vintage, always prevent dc from coming back into the signal generator by having a capacitor in series with the test lead — see the owner's manual.

100, 50, and 25 Years Ago

November 1921

- The cover art shows a woman wearing a “radio hat,” as she listens with earphones.
- The editorial explains that there can never be a competing amateur radio association, when A.R.R.L is “the strongest, the most forward looking, and in the highest regard of our Government.”
- “The Protection of Near-by Wiring Against Troubles Caused by Spark Transmitters” offers good advice to the ham who might experience such problems.
- In “Brew Your Own,” Robert Hertzberg, 2ABK, tells the story of a small group of hams who had too many “brews” one evening.
- McMurdo Silver instructs readers on “Increasing the Tuning Range of Regenerators.”
- W. C. White discusses “Some Operating Notes on the Larger Sizes of Transmitting Tubes.”
- “New Apparatus” provides an overview of some of the radio equipment that’s now being offered by various manufacturers.
- “Short Wave H. F. Amplification” reports the details of the hookup that Ellery W. Stone (of the Atlantic-Pacific Radio Supplies Co.) demonstrated at the recent Chicago Convention.

November 1971

- The cover photo shows the new repeater antenna of the Northwest Florida FM Association being ferried into place atop a 150-foot-high water tower by a helicopter.
- The editorial, “More Ham Bands?,” discusses international radio conferences and the possibility of getting some new bands in the future.
- Douglas A. Blakeslee, W1KLK, presents information on “AC-Operated Regulated DC Power Supplies for Transistorized Rigs.”
- George Grammer, W1DF, talks about “Interpreting SSB Linear Amplifier Peak and Average Power.”
- Jack Gelfand, K2BMI, explains how to modify the HW-100’s selectivity to result in “The HW-100 and 1/2.”
- Lewis G. McCoy, W1ICP, shares how to build “A Low-Cost Tilt-Over Tower.”
- Doug DeMaw, W1CER, explains “How to Tame a Solid-State Transmitter” whose unwanted radiation might be causing the neighbors to have an interference in their TV reception.
- Eugene Pearson, W3QY, presents “A WWVL Receiver” that will receive signals in the 20 kHz range.
- In “Two Possible Explanations for LDEs,” C. R. Clark, WB4OBZ, looks again at the phenomenon of long-delayed echoes of radio signals.

November 1996

- The cover photo shows the picturesque location of the Portland (Maine) Amateur Wireless Association’s Field Day operation as W1KVI.
- The editorial discusses the importance of ham radio as a “Community.”
- “The Truth About Contesters,” by Patty Winter, N6BIS, takes a look at the 1996 World Radiosport Team Championship.
- Ronald Lumachi, WB2CQM, provides tips on “Recycling TV Antennas for 2-Meter Use.”
- In Part 2 of “Get on 440-MHz ATV!,” William Sheets, K2MQJ, and Rudolph F. Graf, KA2CWL, explain how to build a “2-W, 3-Channel ATV Transmitter.”
- Tom Atkins, VE3CDM, reports on “Ham Radio ‘96 at Friedrichshafen,” a huge ham gathering.
- Tom Spann, WD0HBR, shares a brief history and appreciation of “The FCC Grand Island Monitoring Station,” on the occasion of its closing.



Silent Keys

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

•WB1AST
K1BIX
K1CVP
N1EID
W1EW
♦N1IA
AA1N
KB1OWW
W1TOA
KB1YYG
K1ZVP
K2ABX
N2BJW
N2BR
KB2FE
AA2GT
W2JHH
WA2KAY
KB2KNR
N2LHV
WA2NJW
W2NVZ
♦WB2UKX
♦WA2URK
WB2WPQ
♦W2YMG
♦K3CS
KC3DPE
N3EFD
♦W3EZG
♦W3KT
W3TTT
KB3WKT
W4BDA
KF4BHP
WB4BML
♦WB4CIJ
WB4DNK
KX4FAE
♦W4FRX
N4JBK
KC4KCY
W4KUM
♦WA4MJK
W4MTT
WB4PHC
K4RHB
K4ROZ
KD4RYS
K4SR
WA4TB
AD4TO
♦KC4UEC
KR4UK
♦KE4VJM
♦N4VUS
WB4VWZ
K4WHL
K4WTV
♦KG4WTW
KN4WZQ
KE4YHY
♦AC4ZO

Smith, Richard P., Marlborough, MA
Plush, Rusty E., Cornwall, PA
Evans, Richard W., Port Charlotte, FL
Bacci, Joy C., Avon, CT
Johnston, John J. "Jack," Jr., Stoneham, MA
Dutcher, Barry C., Holly Springs, NC
Palmquist, Phillip E., Jr., Coventry, RI
Despres, Joseph R., Fort Kent, ME
Lambert, Wayne M., Weymouth, MA
McFadden, Colin J., Bristol, CT
Colinan, David, Barrington, RI
Fisher, Paul A., Apalachin, NY
Fusare, Scott T., Burlington, VT
Raymer, Bobby A., Cookeville, TN
Linsky, Edward W., Old Bridge, NJ
Yulke, David M., The Villages, FL
Hamilton, Jerry H., Clarksville, GA
Luciani, Thomas A., Bethpage, NY
Cunha, Jose F., Newark, NJ
Van Horn, Martin, Leesburg, FL
Landau, Gary S., Marietta, GA
Erskine, Robert J., Rochester, NY
Biedricki, Edward, II, Ocala, FL
Swiatlowski, Edward J., Camillus, NY
Bianchi, Richard, Lodi, NJ
Felice, Nicholas R., Mahwah, NJ
Freeman, Peter, Los Angeles, CA
Boyer, Doreen A., Kutztown, PA
Goida, Nicholas, Freeland, PA
Borkenhagen, Gil, Port Charlotte, FL
DeNuzzo, Frank, Gainesville, FL
Cotton, Joseph B., Baltimore, MD
Horton, Amanda M., Dover, DE
Pritchett, John S., Crossville, TN
Shirah, Aaron L., Geneva, AL
Player, Charles E., Jr., Macon, GA
Boardman, Allen H., Maryville, TN
Bratton, James R., Winston-Salem, NC
Brady, George W., Winston-Salem, NC
Bishop, Robert J., Easton, MD
Barnes, Joe, Jacksonville, FL
Erskine, George, Vienna, VA
Baine, Samuel N., Lake Wales, FL
Kinzer, Robert L., Winston-Salem, NC
Helm, Howard C., Rich Creek, VA
Carlidge, David R., Chattanooga, TN
Burns, Robert H., Madison, AL
Schwartz, Dale M., Atlanta, GA
Turpin, Kenneth E., Gordonsville, VA
Carr, Herman J., Chadbourn, NC
Brown, Tommy, Dalton, GA
Belue, Bobby F., Tusculum, AL
Bibby, Richard E., Brandon, FL
Harrelson, Rodney R., Whiteville, NC
Hayes, Anna, Rockwood, TN
Ferguson, Russell N., Kingsport, TN
Sloan, Thomas H., Washington, NC
Lucado, William H., Davie, FL
McCann, John F., Jr., Myrtle Beach, SC
Byrge, Harry, Huntsville, TN
Scrimager, Jerry L., Nancy, KY
Elrod, Donald M., Arab, AL
Wittich, Jeff A., Cary, NC

W05A
♦KA5AGK
♦W5AHD
AJ5B
K15CAD
KE5CTZ
N5DW
N5HCX
W5IDN
K5JLS
K5KPK
KC5KXY
AC5LH
KG5MWM
KM5NL
W5NQZ
KC5ODW
N5OJ
W5ONL
W5PNM
KD5SZ
W5VAY
♦W5VZF
K5WDS

♦K6AGC

WA6AGL
N6AJV
♦WB6APH
KD6GMM
♦W6KIT
N6MNL
WA6N
WW6O
AL6U
K16WNW
K6YBV
♦KB6ZE
♦WA7ACA
AA7AD
W7BWY
N7DLW
KL7IKX
WC7N
KE7NEG
KG7ODH
K7PRQ
KC7QKS
AF7RX
K7SBK
♦K7SEC
KE7TQW
WB7VBE
W7YDW
K7ZH
N8AD
♦KC8EJX
KD8KWD
♦♦W8LLY
KC8QOF
KE8QR
W8RZN

Chaloner, Roy L., Murfreesboro, AR
Lewis, Norma D., Clovis, NM
Huff, Carroll E. "Rusty," Lawton, OK
Oravec, Kalman I., Socorro, NM
Barrios, Albert, Jr., Plano, TX
Ewing, James J., Azle, TX
White, David W., Norman, OK
Littleton, C. Max, Albuquerque, NM
Newman, Garland G., Murphy, TX
Mann, J. T., Hulbert, OK
Kauffman, Kwang, Rio Rancho, NM
Kent, La Rae J., Christoval, TX
Yenni, Salvador J., Jr., Ponchatoula, LA
Ohse, Richard A., Newalla, OK
Noakes, R. K., Fayetteville, AR
Radway, Stephen R., Paris, TX
Jump, Paul W., Tulsa, OK
Jeffcoat, Owell, Lamesa, TX
Sisson, John S. "Dick," Jr., Garland, TX
Baade, Duane R., Lewisville, TX
Rogers, William M., Anadarko, OK
Seamans, Fred H., Ponca City, OK
Akers, Jimmy D., Starkville, MS
Sutherland, William D. "Satch," Theodore, AL
Ankerbrand, Barbara W., Fredericksburg, VA
Neiswonger, Richard A., Buena Park, CA
Krock, Frederick H., Danville, CA
Howell, Dorothy "Dotti," Canoga Park, CA
Brown, John B., III, Montgomery, TX
Mullin, Kit E., Honolulu, HI
Robinson, Robert L., El Sobrante, CA
Benoit, Louis A., Jr., Mi Wuk Village, CA
Gilbertson, Rolf "Orin," Carson City, NV
Ettell, Mark, Las Vegas, NV
Melroy, Stephen H., Desert Hot Springs, CA
Ringwald, Robert S., Placerville, CA
Griffitts, Robert W., Covina, CA
Brandenburg, George C., Silver City, NM
Anhorn, Rick C., Mead, WA
Atwood, Bob M., Guthrie, OK
Riley, Morgan S., Phoenix, AZ
Dickinson, Douglas P., Anchorage, AK
Ingram, Rodney R., Gold Beach, OR
Armentrout, David L., Mesa, AZ
Hunt, Dennis W., Yakima, WA
Mriss, Michael A., Phoenix, AZ
Williams, Carol H., Jr., Laveen, AZ
Buffington, John R., Vancouver, WA
Gerbens, Albert R., Jr., Mesa, AZ
Douglas, Phyllis S., Marana, AZ
Noid, Benjamin M., Sr., Kimball, SD
Ayers, Arnold L., Jr., Idaho Falls, ID
Woods, Richard L., Tucson, AZ
Vaughan, William L., III, Glendale, AZ
Stefanelli, Leonard A., Fairview, PA
Patterson, Patrick A., Wilmot, OH
Robinson, John W., III, Tallmansville, WV
Stone, Fred, Bellbrook, OH
Hartmeyer, Joseph J., Maryville, TN
Peoples, Clifton M. "Pete," Jr., Clayton, OH
Higgins, Francis "Frank," Jr., Toledo, OH

W8TXX
K8YPA
WB9BZC
♦K9CAK
K9CDH
N9EVM
KC9FMS
N9FO
WA9JLV
WA9JOB
N9KAP
K9MDS
KB9MGG
♦K9NF
KG9NLP
KA9OTR
♦WB9RVL
♦KB9SQW
W19X
KF9XL
♦AA0AV
WD0BQG
K0CQ
WB0DHS
WE0G
N0GAB
W0GAW
♦N0GE
KG0ND
♦K0OHB
W0POT
KA0PXG
N0XRS
♦WB0YEA
N0YGG
VE3CNA

VE3MFP

VE7FYU
VK2MBA

VK3JKY
DJ3IW
XE1V

Isham, James R., East Lansing, MI
Lemaster, Roger S., Lyndhurst, OH
Capello, Pearl, Milwaukee, WI
Norman, Ken J., Jr., Racine, WI
Hayes, Clifton D., Jr., Blanchard, OK
Richards, Norman L., Seymour, IN
Tovo, Michael A., Dundas, IL
Creek, James "LeRoy," Frankfort, IL
Tafflove, Allen, Skokie, IL
Harvey, Nels W., Mequon, WI
Yoder, Nellie O., Elkhart, IN
Denton, Mayford, Lebanon, IN
Melton, Richard D., North Vernon, IN
Ault, John H., Kenosha, WI
Zuehlke, Donald J., Sun Prairie, WI
Holvay, Robert L., Sikeston, MO
Tapp, Larry W., Charlestown, IN
Poynter, Randall L., Shelbyville, IN
Stoeber, James R., Belleville, IL
Kraak, John G., Waukesha, WI
Irvin, Ben F., Jr., Tulsa, OK
Rice, M. W., Scottsbluff, NE
Johnson, Gerald N. "Jerry," Ellsworth, IA
Marthaler, Martin A., Marshall, MN
Haye, Harold Keith, Centerville, MO
Novak, Edward "Butch," Kansas City, KS
Jones, Doris B., Overland Park, KS
Rogers, Gregory E., Angier, NC
Cluever, Norman W., Des Moines, IA
Ashwell, Wayne C., Saint Louis, MO
Layton, Donald H., Valley City, ND
Williams, Lawrence "Gale," Springfield, MO
Yost, Virgil W., Colorado Springs, CO
Zeiler, Gale Douglas, Los Angeles, CA
Higginbotham, Thomas E., Magnolia, TX
Hogarth, Gordon H., Scarborough, ON, Canada
Laliberty, Denis G., St. Catharines, ON, Canada
Tait, Henry, West Vancouver, BC, Canada
Orbell, Bernard George, Sydney, NSW, Australia
Wilson, Dave, Stratford, VIC, Australia
Linss, Goetz, Burglengfeld, Germany
Libin, Lorne S., Cuernavaca, Morelos, Mexico

- ♦ 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-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



ID-4100A | VHF/UHF Dual Band Digital Xcvt

- 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-7851 | HF/50MHz Transceiver

- 1.2kHz "Optimum" roofing filter • New local oscillator design • Improved phase noise • Improved spectrum scope • Dual scope function • Enhanced mouse operation for spectrum scope



IC-705 | HF/50/144/430 MHz All Mode Transceiver

- RF Direct Sampling • Real-Time Spectrum Scope and Waterfall Display • Large Color Touch Screen • Supports QRP/ QRPp • Bluetooth® and Wireless LAN Built-in



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-7300 | HF/50MHz Transceiver

- RF Direct Sampling System • New "IP+" Function • Class Leading RMDR and Phase Noise Characteristics • 15 Discrete Band-Pass Filters • Built-In Automatic Antenna Tuner



IC-7100 | All Mode Transceiver

- HF/50/144/430/440 MHz Multi-band, Multi-mode, IF DSP • D-STAR DV Mode (Digital Voice + Data) • Intuitive Touch Screen Interface • Built-in RTTY Functions



IC-V86 | VHF 7W HT

- 7W Output Power Plus New Antenna Provides 1.5 Times More Coverage • More Audio, 1500 mW Audio Output • IP54 & MIL-STD 810G—Rugged Design Against Dust & Water • 19 Hours of Long Lasting Battery Life • 200 Memory Channels, 1 Call Channel & 6 Scan Edges



IC-7610 | HF/50 MHz All Mode Transceiver

- Large 7-inch color display with high resolution real-time spectrum scope and waterfall • Independent direct sampling receivers capable of receiving two bands/two modes simultaneously



IC-2730A | VHF/UHF Dual Band Transceiver

- VHF/VHF, UHF/UHF simultaneous receive • 50 watts of output on VHF and UHF • Optional VS-3 Bluetooth® headset • Easy-to-See large white backlight LCD • Controller attachment to the main Unit



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
IC-7610

3RD Place
IC-2730A

4TH Place
\$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

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 Mode Transceiver

- Real-time Spectrum Scope with Automatic Scope Control • Multi-color waterfall display • State of the art 32-bit Digital Signal Processing System • 3kHz Roofing Filter for enhanced performance • 3.5 inch Full Color TFT USB Capable • Internal Automatic Antenna Tuner • High Accuracy TCXO



FTDX101D | HF + 6M Transceiver

- Narrow Band SDR & Direct Sampling SDR • Crystal Roofing Filters Phenomenal Multi-Signal Receiving Characteristics • Unparalleled - 70dB Maximum Attenuation VC-Tune • 15 Separate (HAM 10 + GEN 5) Powerful Band Pass Filters • New Generation Scope Displays 3-Dimensional Spectrum Stream



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 Mode/Fixed Mode 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-5DR C4FM/FM 144/430 MHz Dual Band

- High-Res Full-Color Touch Screen TFT LCD Display • Easy Hands-Free Operation w/Built-In Bluetooth® Unit • Built-In High Precision GPS Antenna • 1200/9600bps APRS Data Communications • Supports Simultaneous C4FM Digital • Micro SD Card Slot



FT-65R | 144/430 MHz Transceiver

- Compact Commercial Grade Rugged Design • Large Front Speaker Delivers 1W of Powerful Clear Audio • 5 Watts of Reliable RF Power Within a compact Body • 3.5-Hour Rapid Charger Included • Large White LED Flashlight, Alarm and Quick Home Channel Access



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

• **ONLINE** – WWW.HAMRADIO.COM

• **FAX** – All store locations

• **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

WOODBIDGE, 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



Great Service Incredible DX

BeLoud.US
Work DX or be DX!

Low Cost Amateur Radio Remote



www.BeLoud.US
803-566-7388
BeloudUS@gmail.com

Our **W1AW t-shirts** celebrates the history of this simple and graceful building with a line-drawn design of the iconic structure. Show your love for this landmark of amateur radio and order yours today!

For every t-shirt purchase, \$5 is donated to the W1AW Endowment Fund to ensure the station's preservation.



Order now at **arrrl.org/shop**

ARRL The National Association for
Amateur Radio®

Contest From Home or Remotely

Stay Connected With Icom's SDR Technology.



IC-9700: VHF / UHF SDR Transceiver

- RF Direct Sampling on 2m / 70cm
- 100W on 2M / 75W on 70CM / 10W on 23cm
- Dual Independent Receivers Capable of Full Duplex and Dual Receive
- Dedicated Amateur Satellite Operation
- Ethernet port with RS-BA1 Internal Server

IC-7300: HF / 6M SDR Transceiver

- 100 Watt Output Power*
- Entry level HF SDR/High-End Features

*40W on AM

IC-7610: The Perfect Trifecta

Round-Out Your Contesting Station Today



- 100 Watt Output Power*
- Dual Independent Receiver
- Ethernet port with RS-BA1 internal server

*40W on AM

For the love of **ham radio.**



©2021 Icom America Inc. The Icom logo is a registered trademark of Icom Inc. All other trademark remain the property of their respective owners. All specifications are subject to change without notice or obligation. 31455


ICOM[®]

***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 suppressing power line noise, plasma TV noise & many other local electrical noises.

Estimated 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!



PK-232SC+

Multimode Data Controller*

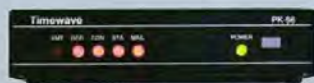
- RTTY
- Packet
- Pactor
- CW
- PSK31 & all the Sound Card modes!

**Upgrade any PK-232 to the PK-232SC with New Lower Combo Pricing for SC & DSP Upgrade!*

Customize your PK-232 installation with our complete line of upgrades, accessories and cables.

100,000 sold - All-time top selling data controller!

- Single USB connection to computer
- USB Sound Card built-in
- 3-Way Rig Control built-in - logic level, RS-232 & USB!
- Computer isolated from radio
- Real FSK & AFSK
- keyboard CW - send and receive
- Dual Port - two radios at same time!



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

hy-gain Rotators

... the first choice of hams around the world!

HAM-IV ^{HAM-IV} The most popular **\$729⁹⁵** rotator in the world!

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 **\$909⁹⁵**
with DCU-2
HAM-VII **\$999⁹⁵**
with DCU-3

TAILTWISTER SERIES II

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.



T-2X **\$969⁹⁵**
T-2XD2 **\$1079⁹⁵**
with DCU-2
T-2XD3 **\$1139⁹⁵**
with DCU-3

CD-45II

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 bearings
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	8
Shipping Weight	31 lbs.
Effective Moment (in tower)	3400 ft.-lbs.

CD-45II Rotator Specifications	
Wind load capacity (inside tower)	8.5 square feet
Wind Load (w/ mast adapter)	5.0 square feet
Turning Power	600 in.-lbs.
Brake Power	800 in.-lbs.
Brake Construction	Disc Brake
Bearing Assembly	Dual race/48 ball bearings
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	8
Shipping Weight	22 lbs.
Effective Moment (in tower)	1200 ft.-lbs.

Hy-Gain Programmable DCU-3 Digital Rotator Controller 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 Taittwister 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
\$479.95. Like DCU-3, but less programmable memories. 110 VAC.
Order DCU-2X, for 220 VAC.

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 desired location. Solid state, low voltage control, safe, silent operation. 2 1/16" max mast. MSLD low mast 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

YRC-1 - \$399.95

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

Easy-to-use -- dial in your beam heading and tap GOTO button, Exclusive 180 degree AutoReverse!™ for fast longpath operation. All DCU-2 features. Bright blue LCD shows current, dialed-in, computer controlled beam headings, call. USB port for computer control. Extra heavy-duty AC power supply. Fast variable DC motor minimises overshoot. Intuitive menu. Field upgradeable. For Yaesu G-800/1000/2800/G450/650, AC or DC motors.

YRC-3, \$499.95. Like YRC-1 and adds 6 memories.



AR-500 Rotator/Controller -- \$199.95

UHF/VHF/6-Meter, MFJ-1886 Rotator/Controller and

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

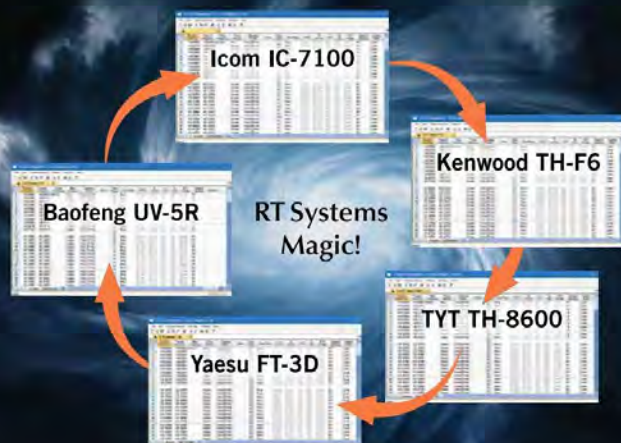


hy-gain

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

Add Shipping. Prices and specifications subject to change. © 2021 Hy-Gain

Share ...Your knowledge of radio with a new ham
 ...Your time to help spark interest
 ...Your radio files, even those for a different radio



Want your radio programmed like your friend's but don't want to enter that list one frequency at a time?

Send that file* to RT Systems using "File | Send file to Tech support" in the programmer. We'll work our magic to convert it then send your friend the file for their radio.

* The original file must be from an RT Systems V4 or V5 programmer.

** You must have the RT Systems Programming system for your radio.

Note: No data manipulation with this service. You may want to do a little "touch up" with the resulting file, but the majority of the work will be done. We'll even include a *.pdf file of the original programming file so you have more information to work with. All at no charge to you or your friend.

485

477 unique radio Programmers...
 Check for your radio model at:
www.rtsystems.com

*"Do not let what you cannot do interfere
 with what you can do."* — John Wooden

800-921-4834 | www.rtsystems.com | Personal Assistance Mon.-Fri., 9:00-6:00 EST

rt SYSTEMS

Fun and affordable kits from
Pacific Antenna

Tracer Injector
 Tenna Dipper II
 Micro Attenuator
 Mini SWR Indicator

See our selection of quality
 Kits starting at \$5
www.qrpkits.com

PROMOTING THE USE OF TEN METERS SINCE 1962
Ten-Ten International Net, Inc.
 Awards - QSO Parties - Special Events - Paperchasing
 NETS DAILY (except Sunday) on 28.380 and 28.800 at 1800z

 CHECK US OUT ON THE WEB
www.ten-ten.org / www.10-10.org
 1349 Vernon Ter San Mateo CA 94402-3331

SSB
 Passion in high frequency

SEQUENCER
 6 m, 2 m & 70 cm

DCW 2004 B
 SEQUENCE CONTROLLER

**LOW NOISE
 PREAMPLIFIERS**
 for 70 cm and 2 m

NEW!

- Improved large signal performance
- With weatherproof mast housing
- Transferable power using antenna switch AS-3000 A: 1000 W at 2 m / 800 W at 70 cm

Accessories from SSB-Electronic:
 Crimping tools · Grounding kits · Lightning protection · Cable cutters · Mounting clamps

SSB-Electronic Germany · sales@ssb-electronic.com · www.ssb-electronic.com

ARES
Field Resources
Manual

ARES
 Field Resources Manual
 A Quick Trainer and Resource Guide
 for the Emergency Communicator
 Presented by
 ARRL amateur radio

**A Quick Trainer and
 Resource Guide for the
 Emergency Communicator**

Item No. 5439 Retail \$12.95

ARRL The National Association for
 Amateur Radio®
www.arrl.org/shop

MFJ 600 Watt Intelli-Tuner

IN STOCK!



MFJ-994B, \$389.95

600 Watt Intelli-Tuner automatic antenna tuner has 10,000 VirtualAntenna™ memories and matches impedance ranges 12-800 Ohms. Handles a full 600 Watts on SSB, CW and Digital!

Analog Cross-Needle SWR/Wattmeter, three antenna connections. Tune any antenna -- dipoles, verticals, beams, phased arrays, quads, invertedvees, random wires, mobile antennas and limited space antennas. This makes a perfect match for your Ameritron AL-811, ALS-600 or ALS-606 amplifiers. Prewired interface cables for Icom, Yaesu available. 10Wx2.75Hx9D inches. **Made in the USA.**



IN STOCK!

MFJ-1836H \$309.95

6-Band Cobweb Antenna covers 20/17/15/12/10/6 Meters, just 8 lbs., 9x9x1/2 feet, handles 1.5 kW. Horizontally polarized for low noise.

IN STOCK!



**MFJ-884
\$139.95**

MFJ 3-inch Cross-Needle

SWR/Wattmeter covers HF/VHF/UHF, 1.8 to 525 MHz. Handles 0-200 Watts in three power ranges: 2/20/200W. Separate HF and VHF/UHF power sensors with SO-239 connectors. LED backlight gives excellent night vision. Three color scaled meter. Backlight requires 13.8 VDC or 110 VAC operation. Super compact 5.5Wx3.18Hx5D inches.

IN STOCK!

**MFJ-1040C
\$149.95**



Copy weak, barely readable signals with this MFJ All-Band Transceiver/Preselector. Rejects out-of-band signals, images 1.8-54 MHz. Get up to 20 dB gain. Uses a cascode FET/bipolar transistor for low noise, high gain with a 20 dB attenuator. Connect two antennas to two receivers with SO-239 connectors. Automatically bypass when transmitting to 125 Watts. 6.5Wx2.5Hx4D inches.

**IN STOCK!
MFJ-1699S/T
\$89.95**

10-band Mobile Antenna covers 80/40/30/20/17/15/12/10/6 and 2 Meters! Low SWR, 200 Watts. Changing bands is easy, just change the tap on the wander-lead. Max height is 49.5". MFJ-1699S has SO-239, MFJ-1699T is 3/8x24.



**IN STOCK!
MFJ-115
\$39.95**

24 Hour Quartz World Time clock

lets you determine the time in any time zone of the world at any time of the day. Premier world cities encircle its colorful world map face to indicate time zones. 12-inch round, seconds hand.

**IN STOCK!
MFJ-956
\$89.95**



LW/MW/SW Preselector/ Tuner boosts your favorite listening stations while rejecting images, intermod and phantom signals. Greatly improves reception from 0.15 to 30 MHz. Has tuner bypass and ground receiver positions. 2Wx3Hx4D inches.

**IN STOCK!
MFJ-260C
\$54.95**



Air-cooled non-inductive resistor is housed in a perforated metal housing. MFJ's dry dummy load handles full load 300W for 30 seconds. Use from 1.8 to 650 MHz. SWR 1.1:1 to 30 MHz, 1.5:1 to 650 MHz. 2.25Wx2.25Hx7".



**IN STOCK!
MFJ-4275
\$309.95**

Heavy duty 75A switching power supply is excellent for powering all of your HF/VHF rigs and accessories. Can also power ALS-500M amplifier. 70A continuous, selectable 110/220 voltage, battery charging circuit. 10.5 lbs.



**IN STOCK!
MFJ-2703
\$89.95**

3-Position antenna

switch has gold plated flanges, connector contacts, low VSWR, low insertion loss. Rock-solid, sturdy die-cast design gives up to 70 dB isolation. 2 kW, operate from DC to 3 GHz with less than a 1.2:1 SWR.

**IN STOCK!
MFJ-1124
\$89.95**



6-outlet DC

power strip has 1A, 5A, two 10A, two 25A, and 40A fuses. Outlets 1-4 are PowerPoles™, 5-6 are 35A high current posts. Has 30A PowerPole™ mating connectors. 8Wx1.25Hx2.75D inches.



**IN STOCK!
MFJ-1104
\$59.95**

Four connector

Anderson PowerPole™ Splitter gives one input and three outputs. Handles 30 Amps total. Input (30A) and each output is fused (25, 10, 5A). Has open fuse indicator. 2.75Wx3.25Hx1.5D inches.



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.

Add shipping. Prices and specifications subject to change. (c) 2021 MFJ Enterprises, Inc.

• 1 Year No Matter What™ warranty • 30 day money back guarantee (less s/h) on orders direct from MFJ





EXPERT LINEARS
America LLC



ExpertLinears@Att.net
ExpertLinears.com
Distributor for the Americas

Fully Automated Solid State Linear Power Amplifiers

Most Technologically Advanced in the World!



Expert 2K-FA



Expert 1.5K-FA



Expert 1.3K-FA

Expert 1.5K FA Product Review Nov 2019 QST

Superior Operating Capabilities

Built In Power Supply & Automatic Antenna Tuner
Follows Transceiver & Fully Remoteable!

Automatically Changes Bands, Antennas & Stores in Memory
The CPUs intelligently protect and control the linears plus produce warning & alarm messages. Compatible W/Modern Transceivers.

Sales & Expert Amps Service

- ★ SPE Factory Trained over 8 years
- ★ Warranty/Non Warranty Service/All SPE Amps

See **EVENTS**
on our
Website

Remote Antenna Matrix System
AM-01/06 Available

ORDER CABLES
kc5pcb2@Att.Net

EXPERT LINEARS AMERICA, LLC
PO Box 1224, Magnolia, TX 77353
Contact: Bob Hardie W5UQ 281-259-7877

Authorized Distributor for **EPE** Linear Amplifiers

Tigertronics *Signalink*™ USB

When it comes to sound card interfaces, nothing beats the *Signalink USB*'s combination of performance, value, and ease of use! Whether you're new to Digital operation, or an experienced user, the *Signalink USB*'s built-in sound card, front panel controls, and simplified installation will get the job done right the first time—and without breaking the bank! The *Signalink USB* supports virtually all sound card digital and voice modes, and works with virtually all radios. It is fully assembled (**made in the USA!**) and comes complete with printed manual, software, and all cables. Visit our website today and see what all the buzz is about!



(800) 822-9722
(541) 474-6700

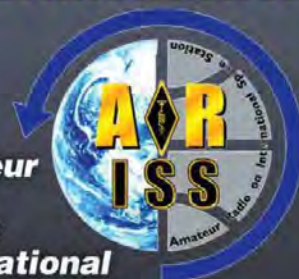
Operate the WSJT-X FT8 mode plus most other sound card modes including PSK31, Olivia, SSTV, RTTY, VARA and CW to name a few!



Order your *Signalink* today at
www.tigertronics.com

Tigertronics 154 Hillview Drive Grants Pass, Oregon 97527

**Inspiration...
Exploration...
Experimentation**



**Amateur Radio
on the
International
Space Station—**

ARRISS

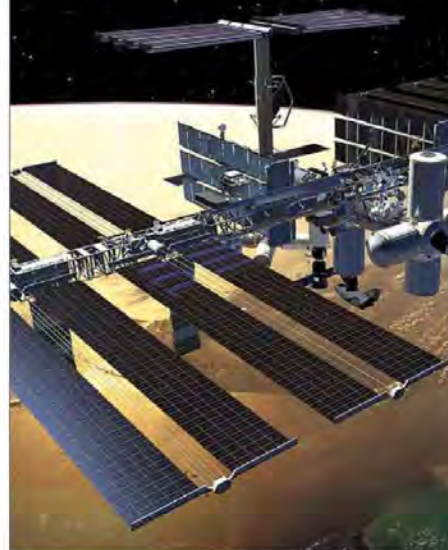
- Licensed hams (like you!) contact the ISS via Amateur Radio voice, packet/APRS, SSTV, and digital TV
- Students interview astronauts in space and learn about life in space, space research, and radio science
- Hams on the ground experiment with space communications
- Amateur Radio supports NASA by providing ISS backup communications

Your donations will help support continuing operations and Amateur Radio equipment upgrades on the ISS.

Receive an **ARRISS**
Challenge Coin
for a donation of
\$100 or more



Go to **www.ariss.org** and click on "Donate" to help keep Amateur Radio in space!



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 freeware, 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 easy 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 antenna 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 quality 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

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.

Add shipping. Prices and specifications subject to change. (c) 2021 MFJ Enterprises, Inc.

• 1 Year No Matter What™ warranty • 30 day money back guarantee (less s/h) on orders direct from MFJ



CABLE X-PERTS, INC.
Connecting You to the World...

A Name You Can Trust
1-800-828-3340

FOR PREMIUM
ELECTRICAL
PERFORMANCE
FROM
YOUR EQUIPMENT

Private labeling at no charge.

Our quality products are also carried at:

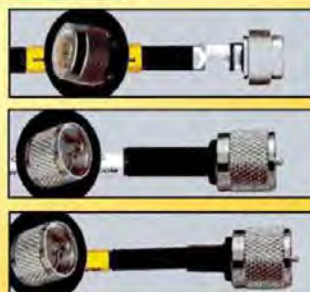
HAM RADIO OUTLET

We take great pride in our work!

**Custom or Ready-Made
Coaxial Assemblies**

Visit us on-line for cable
selection and great prices.

Made in the USA
Serving You Since 1989



Direct burial cables with glued heat shrink tubing.
Contact us for details.

www.CableXperts.com

**Innovation
Realized**



**DMX-40
Transceiver**

Dual Mode: Autonomous QRP 3-5 watt 40M SDR transceiver, and a decoder/encoder transceiver assistant, both with **best-in-class decoding** for reliable operation in any band condition! Color touch screen GUI, keyboard and manual key entry plus practice key timing analyzer. 10 frequency memories, 28 function & help screens, 3 built-in RPL programs for 4-way call & answer cybernetic automation. 12 user RPL programs to add features and recast operating style to match the user SOP.

PreppComm
www.PreppComm.com
eric@AF7YQ.com

**Buckmaster
OCF Dipoles**



Built to last from quality materials!

4-Band 68': 40, 20, 10, & 6 meters

7-Band 135': 80, 40, 20, 17, 12, 10, & 6m

8-Band 270': 160, 80, 40, 20, 17, 12, 10, 6m

BUCKMASTER 800-282-5628 HamCall.net
INTERNATIONAL 540-894-0907

**Still Struggling With
Your 20-Year-Old
Repeater Controller?**



**More Power, More Features
Less Money**

**State-of-the-Art Repeater
Controllers and Accessories**

Arcom

Aurora, OR 97002 (503) 678-6182
www.arcomcontrollers.com

ALFA ROTATORS
Alfa Radio Ltd. 780-466-5779



Azimuth
Elevation



Ring

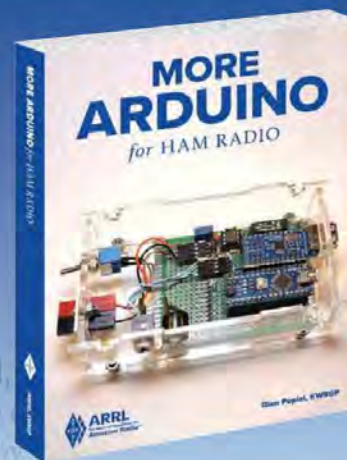


Azimuth

High Torque • Self braking worm drive USB
720 degrees programmable limits simple wiring
13.8 to 18 Volt small footprint for controller

WWW.ALFA RADIO.CA

sales@alfaradio.ca



Written by popular author and experimenter Glen Popiel, KW5GP, *More Arduino for Ham Radio* introduces many of the new Arduino boards and add-on modules, followed by an overview of the software, tools, and techniques needed to bring projects to life. Practical projects showcase a wide variety of applications and include how the software "sketches" work.

Projects:

- Yaesu FH-2 Keypad
- Peltier Cooler Controller
- Rotator Turn Indicator
- Rotator Position Indicator
- Build Your Own AR-40 Rotator Controller
- Modified AR-40 Rotator Controller
- USB CW Keyboard
- Yaesu CAT Display
- CDE/HyGain Keypad Rotator Controller
- RTTY Reader

Member Price \$34.95
(retail \$39.95)

Order online at arrrl.org/shop



ARRL The National Association for
Amateur Radio

MFJ . . .the World Leader in Ham Radio Accessories!

MFJ

G5RV Antennas

Operate all bands 10 thru 160 Meters with a single wire antenna!



MFJ-1778 The famous G5RV antenna is the most popular ham radio antenna in the world!
It's an efficient, all band 102 foot long antenna --

shorter than an 80 Meter dipole. Has 32.5 foot ladder line matching section ending in

SO-239 connector for your coax feedline.

Use horizontally or as Inverted Vee or Sloper with just one support. 1500 Watts.

Operate all bands 80-10 Meters with an antenna tuner and even 160M with ground.

Fully assembled with ceramic end and fiberglass center insulators. *Hang and Play™* -- add coax, rope to hang and you're on air!

MFJ-1778M, \$69.95. Half-size, 52 foot G5RV JUNIOR for limited space. 40-10 Meters with tuner. Full 1500 Watts.

MFJ All Band Classic Doublet

MFJ 102 foot all band doublet covers 160-6 Meters with balanced line tuner. Super strong custom fiberglass center insulator relieves stress on 100 foot ladder line.

Glazed ceramic end insulators. 1500 Watts.



MFJ-1777 \$89.95

RF Isolator

MFJ-915 RF Isolator prevents unwanted RF from traveling on the outside of your coax shield into your transceiver. This unwanted RF can cause painful RF "bites" when you touch your microphone or volume control, cause your display or settings to go crazy, lock up your transceiver or turn off your power supply. In mobile installations, stray RF could cause your car to do funny things even blow your car computer. Clear up these problems, plug an MFJ-915 between your antenna and transceiver. 1.8-30 MHz, 1500 Watts. 5x2 inches.

MFJ-919, \$74.95. 4:1 current balun, 1.5 kW.

MFJ-913, \$49.95. 4:1 balun, 300 Watts.



MFJ-915 \$49.95

True 1:1 Current Balun & Center Insulator

MFJ-918 True 1:1 Current Balun/Center Insulator forces equal radiator currents in dipoles for true dipole radiation pattern. Reduces coax radiation and field pattern distortion -- your signal goes where you want it. Reduces TVI, RFI and RF hot spots. *Don't build a dipole without one!* 50 hi-permeability ferrite beads on high quality RG-303 Teflon® coax and Teflon® SO-239. 1.5kW 1.8-30 MHz. Stainless steel hardware. 14 gauge stranded copper wire is directly connected to your antenna. 5x2 inches. Heavy duty weather housing.



MFJ-918 \$44.95

2-Position Antenna Switch

MFJ-1702C, \$54.95. 2-position antenna switch, lightning surge protection, center ground. SO-239s.

Lightning surge protectors. MFJ-270, \$29.95. 400W. **MFJ-272, \$44.95.** 1500 W. Gas discharge tube shunts 5000 amps peak. < 0.1 dB loss. 1 GHz. SO-239s.

MFJ-16C06, \$8.95. 6-pack glazed ceramic end/center ant. insulators.

MFJ-16B01, \$29.95. Molded high-strength center insulator. SO-239.

MFJ-16D01, \$11.95. 450 Ohm fiberglass end/center insulator with ladder line stress relief and SO-239 mount.

MFJ-18H100, \$49.95. 100 feet, 450 Ohm ladder line, 18 gauge copper clad.



80-10 Meter End-Fed Half Wave antenna

Cover all HF bands with one single wire and no tuner!



MFJ-1982HP, \$119.95

No tuner needed!

All band 80-10M EFHW antenna

Get-on-the air on all bands 80-10 Meters with just one wire and one support (pole or tree) and no tuner or long counterpoise.

Installs anywhere in minutes! Rugged insulated-wire radiator prevents detuning when contacting limbs/branches. "No-sag" end insulator slides over branches, leaves.

Toss over a high limb for inverted-V or sloper or go vertical with an inverted-L.

Dark jacketed wire is virtually invisible -- don't let antenna restrictions keep you off the air! Great for emergencies.

EFHWs naturally resonate on the 1/2-wave fundamental frequency and odd/even harmonics. Covers 80/40/30/20/17/15/12/10 Meters without traps, stubs or resonators.

Broad-band matching transformer at feed point gives SWR so low you may never need a tuner. Compensating inductor optimizes SWR. 800 Watts SSB/CW. 132 feet jacketed antenna wire.

MFJ-1984HP, \$99.95. Like MFJ-1982HP but 40-10M. 66 feet jacketed wire.

See www.mfjenterprises.com for 30 Watt QRP and 300 Watt models.

Dual Band Dipoles



MFJ-17758 \$119.95

MFJ-17758, \$119.95. Operate 80/40 Meters with a short 85 foot dipole. Full-size on 40 Meters

with ultra-efficient end-loading on 80 Meters. 1500 Watts. Super-strong custom molded center insulator with SO-239 connector and hang hole. Ceramic end insulators. 7-strand, 14 gauge hard copper wire. *No tuner needed!*

MFJ-17754, \$79.95. Like MFJ-17758 but is only 42 feet. Operate 40/20 Meters. Full-size on 20 Meters, ultra-efficient end-loading on 40 Meters. 1500 Watts.

Single Band Dipoles



MFJ-1779A \$89.95

160M, 265 ft.

MFJ-1779B \$69.95

80-40M, 135 ft.

MFJ-1779C \$49.95

20-6M, 35 ft.

Ultra high quality center fed dipoles give years of trouble-free service.

Custom injection-molded UV-resistant center insulator has built-in SO-239 and hanging hole. Glazed ceramic end insulators. 7-strand, 14-gauge hard copper antenna wire. 1500 Watts. Use horizontally or as sloper or inverted vee. Simply cut to length with provided cutting chart.

OCFD Dipoles



MFJ-2012 \$99.95

1500 Watts

MFJ-2010 \$79.95

300Watts

No tuner needed! MFJ

Off-Center Fed Dipoles use MFJ's exclusive *ExactRatio™* RF broadband transformer to give low SWR and maximum

bandwidth on 40/20/10/6 Meters. A Guanella current balun kills feedline radiation, pattern distortion, SWR shifts, RFI and noise pickup. Install anywhere and get the same

predictable performance regardless of feedline length. You get ground reinforced gain over verticals. Use horizontally, inverted vee, sloper. 98% efficient, 14 gauge, 7-strand copper wire, ceramic end insulators.

MFJ

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.

Add shipping. Prices and specifications subject to change. (c) 2021 MFJ Enterprises, Inc.

• 1 Year No Matter What™ warranty • 30 day money back guarantee (less s/h) on orders direct from MFJ





GREEN HERON ENGINEERING LLC

RT-21 DIGITAL ROTATOR CONTROLLERS

Unmatched Performance for any Rotator



RT-21 Rotator Packages

- RT-21 with Yaesu & M2 Orion Rotators

RT-21 internal Wi-Fi Option

- Control your rotator from ANYWHERE using a web browser

WIRELESS NETWORK CONTROLS

- Internet access for switches and rotators
- Eliminate cables and tethered control boxes
- Create customized on-screen controls
- Great circle maps



GH Everywhere Base and Remote



- USB and wireless relay controls
- Options: outdoor enclosures and external antennas

Select-8 Wireless Remote Coax Switch

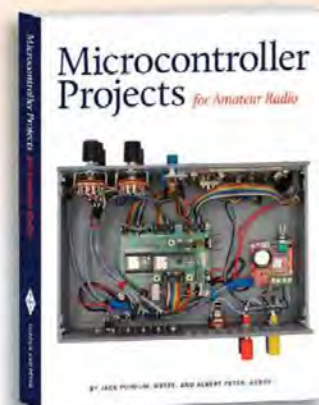
- Built-in GHE Wireless
- Powered through the coax
- Tower leg Mount
- Amphenol RF connectors



www.greenheronengineering.com ♦ (585) 217-9093

Microcontroller Projects for Amateur Radio

By Jack Purdum, W8TEE,
and Albert Peter, AC8GY



Member Price **\$34.95**

Retail \$39.95



ARRL The National Association for
Amateur Radio®

www.arrl.org/shop

The Radio Club of Junior High School 22

Bringing Communication to Education Since 1980



DONATE YOUR RADIO

Radios You Can Write Off - Kids You Can't

- Turn your excess Ham Radios and related items into a tax break for you and a learning tool for kids.
- Donate radios or related gear to an IRS approved 501(c)(3) charity. Get the tax credit and help a worthy cause.
- Equipment picked up anywhere or shipping arranged.

RC OF JHS 22 NYC
PO Box 1052
New York NY 10002

Call Now 516-674-4072

email: crew@wb2jkj.org www.wb2jkj.org



MFJ...the World Leader in Ham Radio Accessories!

MFJ Weather-Proof Window Feedthrough Panels

Weather-proof window feedthrough panels bring coax, balanced lines, HF/VHF/UHF antennas, random wire antennas, ground, rotator/antenna switch cables and DC/AC power into your hamshack without drilling through walls!



MFJ Weather-Proof Window Feedthrough Panels mount in your window sill. Lets you bring all your antenna connections into your hamshack without drilling holes through walls.

Simply place in window sill and close window. One cut customizes it for any window up to 48 inches. Use horizontally or vertically. Connectors are mounted on inside/outside stainless steel plates and attached to a 4 foot long, 3 1/2 inch high, 3/4 inch thick pressure-treated wood panel.

Real Western Red Cedar wood is naturally resistant to rot, decay and insects – lasts longer, maintenance-free. Pitch and resin free for a wide range of beautiful finishes or leave it in its naturally beautiful raw finish. Edges sealed by weather-stripping. Seals and insulates against all weather conditions. Includes window locking rod.

Inside/outside stainless steel plates ground all coax shields. Stainless steel ground post brings ground in.



MFJ-4603 Universal Window Feedthrough Panel

Four 50 Ohm Teflon® SO-239 coax connectors lets you feed HF/VHF/UHF antennas at full legal power limit.

A 50 Ohm Teflon® coax N-connector lets you use any antenna up to 11 GHz, including 450 MHz, UHF, satellite, moon bounce and 2.4/5.8 GHz Wi-Fi antennas.

A 75 Ohm, 1 GHz F-connector makes it easy to bring in television, Satellite, HD, cable TV and FM radio signals.

A pair of high-voltage ceramic feedthru insulators lets you bring in 450/300 Ohm balanced lines directly to your antenna tuner.

Has random/longwire antenna ceramic feedthru insulator.

5-way binding posts lets you supply 50 Volts/15 Amps DC/AC power to your outside antenna tuners/relays/switches.

Stainless ground post brings in ground connection, bonds inside/outside stainless steel panels together and drains away static charges.

MFJ's exclusive Adaptive Cable Feedthru™ lets you bring in rotator/antenna switch cable, etc. without removing connectors (up to 1 1/4 X 1 5/8 in). Adapts to virtually any cable size. Seals out rain, snow, adverse weather.

MFJ-4603
\$119.95

3 Coax, Balanced Line, Random Wire

Best Seller! 3 Teflon® coax connectors for HF/VHF/UHF antennas. Separate high voltage ceramic feed-thru insulators for balanced lines and longwire/random wire, Stainless steel ground post.

MFJ-4602
\$89.95

6 Coax

6 high quality Teflon® coax connectors for HF/VHF/UHF antennas. Stainless steel ground post. Full 1500 Watt legal limit.

MFJ-4601
\$79.95

4 Balanced Line, 2 Coax

4 pairs of high-voltage ceramic feed-thru insulators for balanced lines and 2 coax connectors.

5 Cables, any-size

5 Adaptive Cable Feedthrus™. Pass any cable with connector: 2 cables with large connectors up to 1 1/4 x 1 5/8 inches and 3 cables with UHF/N size coax connectors. Seals out weather.

MFJ-4600
\$99.95

MFJ-4604
\$124.95

All-Purpose FeedThru/CableThru™

Stacks MFJ-4603 and MFJ-4604!

Gives you every possible cable connection you'll ever need through your window without drilling holes in wall – including UHF, N and F coax connectors, balanced lines, random wire, ground, DC/AC power and cables of any size for rotators, antenna switches, etc.

MFJ-4605
\$189.95

Bring cables through the eave of your house



MFJ-4616
shown with standard full size vent (not included) it replaces. For 6 Cables

\$39.95



MFJ-4613
shown with standard half size vent (not included) it replaces. For 3 Cables

\$24.95



Replace your standard air vents on the eave/soffit of your house with these MFJ AdaptiveCable™ Air Vent Plates and...

Bring in coax, rotator, antenna switch, power cables, etc. with connectors up to 1 1/4 x 1 5/8 inches!

Sliding plates and rubber grommets adjust for virtually any cable size to seal out adverse weather, insects and varmints. Use existing vent hole, mounting screws and screw holes.



AdaptiveCable™ Wall Plates

MFJ-4614
For 4 Cables

\$49.95

Bring nearly any cable – rotator, antenna switch, coax, DC/AC power, etc. -- through walls without removing connectors (up to 1 1/4 x 1 5/8 inches). Sliding plates and rubber grommets adjust hole size to weather-seal virtually any size cable.

Includes stainless steel plates for each side of wall, sliding plates, rubber grommets, weather stripping and screws.



MFJ-4612
For 2 Cables

\$39.95



MFJ-4611
For 1 Cable

\$24.95

Free Dealer/Catalog/Manuals/Instructions – Visit:
www.mfjenterprises.com
or call toll-free 800-647-1800



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.

Add shipping. Prices and specifications subject to change. ©2021 MFJ Enterprises, Inc.
• 1 Year No Matter What™ warranty • 30 day money back guarantee (less s/h) on orders direct from MFJ



bhi Enjoy great receive audio with.. ..a bhi DSP noise canceling product!

New In-Line Module



- **New** amplified DSP noise canceling In-Line module
- 8 filter levels 8 to 40dB, tone reduction up to 65dB
- 5 W audio with latest bhi noise canceling
- Use with a passive mono extension speaker
- Audio bypass feature - 3.5mm mono input/output
- Headphone socket - DC power 10 to 16V DC
- Replacement for NEIM1031MKII & ANEM MKII

New DESKTOP MKII



New DESKTOP MKII - 10W

- DSP noise canceling base station speaker
- Now with latest bhi DSP noise canceling technology for even better receive audio
- Easy to use rotary controls - 8 DSP filter levels - "Real time" audio adjustment
- Suitable for all radios incl' SDR

Dual In-Line

Fully featured amplified DSP noise canceling in-line module - Separate mono or stereo input and outputs - Headphone socket - Latest bhi DSP noise canceling technology - Suitable for all radios, receivers and SDR - Use with headphones and a speaker at the same time

NES10-2MK4



- 5W audio power - Latest bhi DSP noise canceling
- Up to 65dB tone reduction
- 8 filter levels 9 to 40dB
- Single function switch for "Off", "On" and "DSP" filter
- Audio overload LED
- Audio bypass feature
- Headphone socket



Compact In-Line



- Simple controls
- Use with speakers or headphones
- Line/speaker level inputs - Use mobile with AA batteries

High-performance audio processing on all radio bands - Enjoy clear receive audio!

DX ENGINEERING

DXEngineering.com -1-800-777-0703

www.bhi-ltd.com

GigaParts

-1-256-428-4644 E & O.E.

Radio Direction Finder

KN2C DF2020T Kit

Useful for 100~1000MHz

Map Plotting Program
On Google Earth™
with GPS Data

On Sale \$398
www.kn2c.us



ADVANCED SPECIALTIES INC.

YAESU
The radio

www.advancedspecialties.net

BIG ONLINE CATALOG



AMATEUR RADIO EQUIPMENT & ACCESSORIES - SCANNERS
ANLI · COMET · UNIDEN · YAESU

(201)-VHF-2067

114 Essex Street, Lodi, NJ 07644

Closed Sunday & Monday

LARGE Tactical Radio Carrier



Fits: K3s
KPA500
IC-7200
IC-7300
FT-991A
FT-450
FT-857
FT-897
+Others

Tac-Comm.com

THE WIREMAN, INC.™

"CERTIFIED QUALITY"

800-727-WIRE (9473)

Still, going strong after 35 years! The "Keywords" for "Certified Quality" Wire, Cable, Connectors, Accessories, and customer service. See it all at www.thewireman.com

Tech Help: 864-895-4195 or info@thewireman.com

SOUTHWEST US? Call 405-376-9473

TOP WIREMAN dealer **CLEAR SIGNAL PRODUCTS**
www.coaxman.com • orders@coaxman.com

STOP RFI NOW

RFI Kits—Home/Mobile/Portable

Audio/home theater, AM/FM Broadcast, Marine/RV, Ham Radio, Consumer Electronics, Computer, Solar, Garage Door, Grow Lights, HVAC, LED, Ethernet/Cable TV/DSL, Appliances

Ferrites—Toroid Rings,
Snap-on, Slip-on—all sizes



Noise Filters—for AC/DC power, coax noise filters, wall wart, generator, inverter, battery charger

Antennas, Chokes, Transformers

BULLET™ End Fed, OCF, Loop antennas from QRP to Kilowatts, Termination Resistors for BBTD, T2FD
1:1 to 81:1 Baluns/Ununs to 5 KW, 100 KHz-180 MHz

On-line Tutorials show how to stop RFI from 100 KHz to 2 GHz - OEM, Dealer, Group Quantity Pricing, Monthly Specials, Download Free RFI Tip Sheet

Palomar-Engineers®.com
760-747-3343

ARRL Logbooks



Our classic and mini spiral logbooks are compact and convenient when operating portable or from your home station.

arrl.org/shop



ARRL
The National Association for
Amateur Radio®

MFJ Power Supplies

World's Best and Largest Selection of Clean, NO RF Hash, no RFI power supplies are designed for ultra-reliable ham radio! High duty cycles on switchers for long Digital mode transmissions!

75-Amps, \$349⁹⁵



MFJ-4275MV
high-current
switching
power supply

gives 75A max/70A continuous. Great for ALS-500M amplifier. Adjustable output 4-16 VDC/ 110/220 VAC. Binding posts, quick connects, *PowerPoles*^(R), cigarette lighter socket on front. Battery charger gives charging current of 20A max, 5A continuous. 9³/₄Wx5¹/₂Hx9¹/₂D". Only 10.5 lbs.

45-Amps, \$229⁹⁵

MFJ-4245MV

Switching power supply gives 45A surge/40A continuous. 9-15 VDC out. 85-260 VAC in. Low ripple, highly regulated. 5-way posts, cigarette lighter, quick connects. 5 lbs., 7¹/₂Wx4³/₄Hx9D".

25-Amps, \$164⁹⁵

MFJ-4225MV

Switching power supply gives 25A surge, 22A continuous. Adjustable 9-15 VDC output, 85-260 AC input. Large 3" dual Amp/Volt meters, binding posts, cigarette lighter socket. 3.7 lbs., 5¹/₄Wx4¹/₂Hx6D".



MFJ PowerPole^(R) Splitters



MFJ-1104, \$59⁹⁵

PowerPole^(R) Splitter, 30 Amp fused input, outputs fused at 25, 10, 5A. Open fuse indicator.

2³/₄Wx3¹/₄Hx1¹/₂D".

MFJ-1107, \$69⁹⁵

40A fused binding posts input, 4 fused *PowerPole*^(R) outputs, two 2.1 mm center positive power jacks.

MFJ-1106, \$59⁹⁵

One in, six out *PowerPoles*^(R). 30A total. 7 sets of mating connectors included.



\$144⁹⁵



Add a pair of *PowerPoles*^(R)

MFJ-4230MVP, \$144⁹⁵

PowerPoles^(R) on back.



MFJ-4230MPF, \$134⁹⁵

PowerPoles^(R) on front of unit.

MFJ-4230DMP, \$184⁹⁵

Like MFJ-4230MVP but has bright orange digital Volt/Amp display.



35-Amps, \$184⁹⁵

MFJ-4235MV

switching power supply. 35A surge, 30A continuous. 4-16 VDC, 1% voltage regulation. <9 mV peak-to-peak ripple. AC in: 90-125 or 200-240V. 7Wx4¹/₄Hx8³/₄D", 4 lbs.



25-Amps, \$124⁹⁵

MFJ-4125 gives 25A

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



35-Amps, \$179⁹⁵

MFJ-4035MV

19.2 lb. transformer, 35A max, 30A continuous. 1-14 VDC out, 110 VAC in. Highly regulated, 1% load, 1 mV ripple. 5-way posts, cig lighter. 9¹/₂Wx6Hx9³/₄D".



25-Amps, \$134⁹⁵

MFJ-4125P 25A

surge, 22A continuous. 13.8 VDC switcher has 2-pair *PowerPoles*^(R), 5-way posts, quick connects. 3.5 lbs.



15-Amps, \$84⁹⁵

MFJ-4115 17A

surge, 15A cont. 13.8 VDC. 110/220 VAC. 3³/₄Wx2¹/₄Hx7³/₄D", 1.5 lb. 5-way posts.



MFJ-4215MV, \$84.95. Like MFJ-4115 but has backlit volt/amp meters.

28-Amps, \$104⁹⁵

MFJ-4128 28A

surge, 25A cont. 13.8 VDC. AC: 85-135/170-260 VAC. 5-ways, cig sock. **MFJ-4218MV, \$129.95.** 0-24 VDC, 18A@13.8/9A@24VDC.



MFJ High Current DC Multi-Outlet Strips

Power multiple transceivers/accessories from a single DC power supply



MFJ-1118, \$109⁹⁵

Power two HF and/or VHF rigs

and six accessories from rig's 12 VDC supply. 35A high-current and 15A accessory binding posts, Voltmeter, on/off switch. Master fuse, RF bypass. 12¹/₂Wx2³/₄Hx2¹/₂D".



MFJ-1116, \$74⁹⁵

Like MFJ-1118 but 15A total, 8

pairs 5-ways. "On" LED, 0-25 VDC voltmeter.



MFJ-1112, \$59⁹⁵

Like MFJ-1116 but 6 pairs 5-way

posts, no meter/switch. 12¹/₂Wx2³/₄Hx2¹/₂D".



MFJ-1117, \$84⁹⁵

High-current. Powers four HF/VHF radios simultaneously -- 2 at 35A each, 2 at 35A combined. 8Wx2Hx3D".



MFJ-1129, \$144⁹⁵

10 outlets. Installed fuses: two 1A, three 5A, three 10A, two 25A, one 40A. Outlets 1, 2, 4-8 are *PowerPoles*^(R). Outlet 3 is a 35A high current post, outlet 9, 10 are 15A posts. Switch, voltmeter. 12¹/₂Wx1¹/₄Hx2¹/₂D".



MFJ-1128, \$134⁹⁵

12 fused *PowerPoles*^(R), three 1A, four 5A, four 10A, one 25A, one 40A. Switch, Meter.



MFJ-1126, \$104⁹⁵

8 fused *PowerPoles*^(R): a 1A, three 5A, two 10A, one 25A, one 40A. Switch, Voltmeter. 9Wx1¹/₄Hx2³/₄D".



MFJ-1124, \$89⁹⁵

4 pairs 35A *PowerPoles*^(R), 2 pairs 35A high current posts.



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.

Add shipping. Prices and specifications subject to change. (c) 2021 MFJ Enterprises, Inc.

• 1 Year No Matter What™ warranty • 30 day money back guarantee (less s/h) on orders direct from MFJ



RF Connectors and Adapters

**DIN – BNC
C – FME
Low Pim
MC – MCX
MUHF
N – QMA
SMA – SMB
TNC
UHF & More**

**Attenuators
Loads &
Terminations
Component
Parts
Hardware
Mic & Headset
Jacks
Mounts
Feet – Knobs
Speakers &
Surge
Protectors
Test Gear Parts
Gadgets – Tools**

www.W5SWL.com



MANUFACTURING FOR RADIO SINCE THE BEGINNING



- Racks & Cabinets, Shelves, Panels, Outlet Strips
- Small Cases & Project Boxes
- Transformers



RACKS & CABINETS



TRANSFORMERS



SMALL CASES

Technical Data, Drawings, List of Stocking Distributors:

www.hammondmfg.com



**Dual Band
2M/440
and other
models**

EmComm,
Satellite work,
long distance
simplex and
repeater use.

Elk Antennas
Log-Periodic Antennas
for the Radio Amateur
Jim@ElkAntennas.com
www.ElkAntennas.com



DTMF decoder board with eight relays



Remote control eight
devices via radio audio.
Password protection
against unauthorized
entry. Unique board ID.
Comes assembled
with relays. 4.5" x 2.5".

Intuitive Circuits, LLC
Voice: (248) 588-4400
http://www.icircuits.com

DTMF-8 \$119.00
Visa • MC • Prepayment

www.SwapMyRigs.com
Modular Rig VGA-Cable Mobile Separation Kit



Swap rigs without ever changing cables.
One cable replaces three regardless of make or model.
\$89.99 complete with 15' VGA cable.
AE4S, LLC



HONDA
GENERATORS

MOTOSPORTS
OF UTAH

"By hams, for hams" • K2HZ0 • KM6LLL

EU2200i 10% more powerful...
just as light and as quiet as previous model.

Microcomputer-controlled sinewave inverter:
clean sine wave – making it ideal for use with
frequency-sensitive electrical equipment such as
computers and radio equipment

Eco-Throttle: only runs at necessary speed to
power what you are running – reduces noise and
fuel consumption!

Clean, Quiet, Portable power!

New Model!
Lowest Prices!!

(800)-832-7365

www.hondashop.com

Free Shipping!! (In the continental 48 states)

CA residents add 7.375 tax
Please read your Owner's Manual and all labels before operation.



"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 **New and improved, now covers 280 KHz-230 MHz!**
\$329⁹⁵

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, 4x2x6^{3/4}".

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, reflection coefficient, match efficiency at any frequency simultaneously.

Read Complex Impedance (100 KHz to 230 MHz) as series equivalent resistance and reactance ($R+jX$) or as magnitude (Z) and phase (degrees). Also reads parallel equivalent resistance and reactance ($Rp+jXp$).

Determine velocity factor,

New! MFJ-269D **\$429⁹⁵**

coax loss in dB, length of coax and distance to short or open in feet (it's like a built-in TDR).

Coax Calculator™ calculates coax line length in feet given degrees and vice versa for any frequency, velocity factor.

Measure



SWR and loss of coax with any characteristic impedance (280 KHz to 230 MHz) from 10 to over 600 Ohms.

Measures inductance in 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. 4Wx2Dx6^{3/4}", 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!

- **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-223 **\$349⁹⁵**

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 bar-graph, capture vivid swept displays for SWR, impedance, re-tune loss, phase angle, more. DDS generator.



MFJ-225 **\$349⁹⁵**

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.



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.

Add shipping. Prices and specifications subject to change. (c) 2021 MFJ Enterprises, Inc.

• 1 Year No Matter What™ warranty • 30 day money back guarantee (less s/h) on orders direct from MFJ





HamEstate

Serving Hams and Their Families

Turnkey Ham Radio Liquidators and Subscription Service. Give your loved ones peace of mind. Become a subscriber and we will take care of your station when you cannot. Don't leave your loved ones to the mercy of bargain hunters. We do it turnkey INCLUDING tower and antenna removals! We purchase used towers and equipment and arrange pickup or shipping.

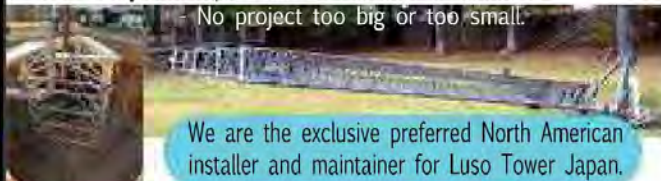
www.hamestate.com 1-833-891-0073 info@hamestate.com

RFC2 www.rfc2.com towers@rfc2.com
Telecom LLC

Get it done right!

Planning a new tower project or relocating? We can help and work nationwide! Email or call us 501-330-1080

- Crankup tower and antenna installations.
- Relocation, repairs and servicing nationwide.
- Turnkey station design, installation and automation.
- We service and install all tower brands.
- Over 25 years experience in Telecommunications
- No project too big or too small.



We are the exclusive preferred North American installer and maintainer for Luso Tower Japan.

LDG Electronics

**REMOTE TUNERS
DESKTOP TUNERS
ZERO POWER TUNERS**



Z-100Plus/IC-705 Zero Power Antenna Tuner

125 Watt power handling, 2000 memories
Full tunes take an average of only 8 seconds.
Now includes 8 AA heavy duty batteries, stereo interface cable, and BNC to PL-259 coax cable.

Z-100A

Plug & Play Operation

Features 10:1 SWR tuning range that matches dipoles, verticals, end-fed wires, G5RVs or even an off-center fed. Goes anywhere with your HF radio... desktops, parks, islands, or tall summits.



For These LDG Products And More Visit:

HAM RADIO OUTLET

WWW.HAMRADIO.COM



MOSLEY ANTENNAS
...built to last!

AIRCRAFT GRADE ALUMINUM
ELEMENTS & BOOMS and
STAINLESS STEEL HARDWARE

STRONG!

AVERAGE IN USE
LIFE OF 27+ YEARS
WITHOUT MAINTENANCE

Mosley "Shorty 40"

The SF-402-A is a heavy duty,
smaller 2 element for 40 meters!

SMALLER In Size - **BIG** in Performance!

SF-402-A

- * NO MEASURING
- * PRE-DRILLED
- * COLOR CODED
- * 2 YEAR WARRANTY
- * 14 FOOT BOOM
- * LESS THAN 48 LBS. ASSEMBLED

Call 800-325-4016

to REQUEST A CATALOG or E-mail from our Website

FIND MORE Mosley designs at **www.mosley-electronics.com**



W5CCG

The Greater New Orleans Ham Fest

Sponsored by Crescent City Amateur Radio Group, Inc.



November 13, 2021 - 8 AM to 1 PM

VFW Hall

1133 Hickory Ave., Harahan, LA 70123

FREE Tables • FREE Tailgating • FREE Parking

We will raffle off over **20** radios and other items.

Includes 2 HF radios, VHF/UHF radios,
handhelds and much more

VE Exam Session Starts at 8:30 AM

ARRL, ARES and DMR Forums

Talk in - 146.82 Repeater - PL Tone 114.8 Hertz

RESERVE your tables now!

Contact Eric af5ig@outlook.com or

Steve n5wxc@hotmail.com or

Joe 504-288-7088 / Joen5ozg@hotmail.com

www.facebook.com/events/greater-new-orleans-hamfest/645888295800409/

MFJ...the World Leader in Ham Radio Accessories!

MFJ 1500 Watt Remote Auto Tuner

Place this MFJ-998RT remote tuner at your antenna to match high SWR antennas/long coaxes – greatly reduce losses for high efficiency

... Match 12-1600 Ohms, 1.5 kW, SSB/CW/Digital, 1.8-30 MHz ... Match coax/wire antennas ... Weather-sealed ... Remotely powered thru coax ... Amplifier, radio, tuner protection ... Output static/lightning protection ... StickyTune™ always tunes when power folds back ... DC power jack ...



MFJ-998RT
\$879.95



Bottom Chassis



Inside View

Tune your antenna at your antenna

Get greatly reduced losses and high efficiencies with long coax runs and high SWR antennas with this new MFJ-998RT 1.5 kW Remote Antenna Tuner.

Weather-Sealed

A tough, durable weather-sealed ABS cabinet with over-lapping lips, sealing gasket and stainless steel chassis protects the MFJ-998RT from all kinds of weather.

No Power Cable Needed!

No power cable needed – remotely powered through coax. Includes MFJ-4117 Bias-Tee with on/off switch for station end of coax. Has 12 VDC jack for power cable, if desired.

Fully Protected

MFJ exclusive algorithms protect your tuner, radio and RF power amplifier from damage.

Automatic inductor and capacitor limiting prevents tuning extreme loads which can destroy your tuner.

Your tuner will not tune if more than 75 Watts with SWR greater than 3:1 is applied or if more than 125 Watts is applied.

Tuner output is static electricity and lightning induced surge protected.

MFJ exclusive StickyTune™

Very high SWR can fold back transmitter power and prevent tuning caused by extreme differences in loads (example: changing bands and other conditions).

But MFJ exclusive StickyTune™ always tunes with a simple on/off power cycle and re-transmit.

Tunes Coax fed and Wire Antennas

Tunes both coax fed and wire antennas. Has ceramic feed-through insulator for wire antennas. 2 kV Teflon® insulated SO-239 – prevents arcing from high SWR.

High Power, Highly Efficient

A highly efficient L-network matches 6-1600 Ohms at full 1500 Watts legal limit SSB/CW and Digital, 1.8 to 30 MHz with Hi-Q Ls, Cs.

MFJ-998RT Learns as you Operate

As you operate, the MFJ-998RT automatically tunes for minimum SWR and remembers your frequency and tuner settings. The next time you operate on that frequency and antenna, its tuner solution is restored in milliseconds and you're ready to operate!

Highly Intelligent, Ultra-fast Tuning

MFJ InstantRecall™ recalls stored tuning solutions from 10,000 memories. For new frequencies, MFJ Intelli-Tune™ measures your antenna impedance and instantly determines the correct matching components. If antenna impedances cannot be measured, MFJ AdaptiveSearch™ searches only the relevant components that can match your antenna giving you ultra-fast tuning.

Field upgradeable firmware. Requires 12-15 VDC at 1.4 Amps maximum or 110 VAC with optional MFJ-1316, \$34.95. Weighs 9.5 lbs. 13 1/4" W x 6 3/4" H x 17 1/2" D inches.

160-6 Meters 43 foot Vertical Antenna

Operate all bands 160-6 Meters at full 1500 Watts with this self-supporting, 43 foot high performance vertical! Assembles in less than an hour. Low profile blends in with sky and trees – barely see it. Entire length radiates. Exceptional low angle DX performance on 160-20 Meters and very good performance on 17-6 Meters. Telescope it shorter for more effective low angle radiation on 17-6 M if desired. One of these wide range MFJ automatic tuners at the antenna easily matches all bands 160-6 Meters. There's no physical tuning adjustments on the antenna – you simply put it up! Requires ground system, at least one radial, more the better. Includes balun and base mount. MFJ-1932, \$44.95. All band ground radial system.



600W Remote IntelliTuner™

MFJ-994BRT – perfect for 600 Watt SSB/CW amplifiers like Ameritron's AL-811/ALS-600/ALS-500M. Matches 12-800 Ohms. Coax/wire antennas, 1.8-30 MHz. Fully weather-sealed for outdoor use. Remotely powered through coax. Tough, durable, built-to-last cabinet, 9 1/4" W x 3 H x 14 1/4" D inches, 4 lbs. Includes MFJ-4117 BiasTee Power Injector.



MFJ-994BRT
\$469.95

200W Remote IntelliTuner™

MFJ-926B, 200 Watts SSB/CW/Digital, 6-1600 Ohms, Coax/wire antennas, 1.8-30 MHz. Includes BiasTee.



MFJ-926B **\$339.95**

300W Remote IntelliTuner™

MFJ-993BRT handles 300 Watts SSB/CW and digital. Has extra-wide 6-1600 Ohm impedances. Coax/wire antennas, 1.8-30 MHz. Fully weather-sealed for remote outdoor or marine use. Remotely powered through coax. Tough, durable, built-to-last cabinet measures 9 1/4" W x 3 H x 14 1/4" D inches. Weighs just 4 pounds. Includes MFJ-4117 BiasTee Power Injector.



MFJ-993BRT
\$349.95

MFJ No Matter What™ Warranty

One year No Matter What™ Warranty
30 Day Money Back Guarantee
(less s/h) on orders direct from MFJ.

MFJ-2990
\$399.95



MFJ Enterprises, Inc. 300 Industrial Pk Rd, Starkville, MS 39759

Phone: (662) 323-5869 ■ Tech Help: (662) 323-0549 ■ FAX: (662) 323-6551 8-4:30 CST, Mon.-Fri.

Add shipping. Prices and specifications subject to change. ©2021 MFJ Enterprises, Inc.
• 1 Year No Matter What™ warranty • 30 day money back guarantee (less s/h) on orders direct from MFJ



MFJ 998RT_061512_QST_060921DS

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**



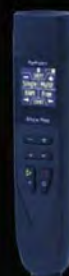
AA-55 ZOOM **HF**



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**

MFJ...the World Leader in Ham Radio Tuners!

MFJ Tuners

New, Improved MFJ-989D 1500 Watt legal limit Antenna Tuner

World's most popular 1500 Watt Legal Limit Tuner just got better - much better - gives you more for your money!

New, improved MFJ-989D legal limit antenna tuner gives you better efficiency, lower losses and a new true peak reading meter. It easily handles full 1500 Watts SSB/CW, 1.8 to 30 MHz, including MARS/WARC bands.

New, dual 500 pF air variable capacitors give you twice the capacitance for more efficient operation on 160 and 80 Meters.

New, improved AirCore™ Roller Inductor gives you lower losses, higher Q and handles more power more efficiently.

New, TrueActive™ peak reading Cross-Needle SWR/Wattmeter lets you read true peak power on all modes.



MFJ-989D \$479.95

Includes six position ceramic antenna switch, 50 Ohm dummy load, indestructible multi-color Lexan front panel with detailed logging scales and legends.

The MFJ-989D uses the superb time-tested T-Network. It has the widest matching range and is the easiest to use of all matching networks. Now with MFJ's new 500 pF air variable capacitors and new low loss roller inductor, it easily handles higher power much more efficiently.

New, high voltage current balun lets you tune balanced lines at high power with no worries.

New, crank knob lets you reset your roller inductor quickly, smoothly and accurately.

New, larger 2-inch diameter capacitor knobs with easy-to-see dials make tuning much easier.

New, cabinet maintains components' high-Q. Generous air vents keep components cool. 12 1/2"W x 6"H x 11 1/2"D inches.

No Matter What™ Warranty

Every MFJ tuner is protected by MFJ's famous one year No Matter What™ limited warranty. We will repair or replace your MFJ tuner (at our option) for a full year.

More hams use MFJ tuners than all other tuners in the world!

MFJ-986 Two knob Differential-T™



MFJ-986 \$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. 15W x 4 1/2"H x 10 3/4"D 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 1/2"W x 10 3/4"H x 4 1/2"D 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-949E deluxe 300 Watt Tuner

More hams use MFJ-949s than any other antenna tuner in the world! Handles 300 Watts Full 1.8 to 30 MHz coverage, custom inductor switch, 1000 Volt tuning capacitors, full size peak/average lighted Cross-Needle SWR/Wattmeter, 8 position antenna switch, dummy load, QRM-Free PreTune™, scratch proof Lexan front panel. 10 5/8"W x 3 1/2"H x 7"D inches. **MFJ-948, \$199.95.** Economy version of MFJ-949E, less dummy load, Lexan front panel.



MFJ-949E \$229.95

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 7"D in. **MFJ-941E, \$179.95.** Tuner Kit - Build your own!



MFJ-945E HF/6M mobile Tuner

Extends your mobile antenna bandwidth so you don't have to stop, go outside and adjust your antenna. Tiny 8W x 2H x 6D in. Lighted Cross-Needle SWR/Wattmeter. Lamp and bypass switches. Covers 1.8-30 MHz and 6 Meters. 300 Watts PEP. **MFJ-20, \$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 1/2"W x 2 1/2"H x 6D in. **MFJ-971 \$159.95**



MFJ-901B smallest Versa Tuner

MFJ's smallest (5W x 2H x 6D in.) and most affordable wide range 200 Watt PEP Versa tuner. Covers 1.8 to 30 MHz. Great for matching solid state rigs to linear amps.



MFJ-901B \$129.95

MFJ-902B Tiny Travel Tuner

Tiny 4 1/2"W x 2 1/4"H x 3D inches, full 150 Watts, 80-6 Meters, has tuner bypass switch, for coax/random wire. **MFJ-904H, \$179.95.** Same but adds Cross-needle SWR/Wattmeter and 4:1 balun for balanced lines. 7 1/4"W x 2 3/4"H x 2 3/4"D inches.



MFJ-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 4W x 2H x 3D in. **MFJ-16010 \$84.95**



MFJ-9201 QRPocket™ Tuner

80-10 Meters, 25 Watts. 12 position inductor, tune/bypass switch, wide-range T-network, BNCs. 4W x 2 3/4"H x 1 1/2"D inches. **MFJ-9201, \$64.95**



MFJ-9201 \$64.95

MFJ-921/924 VHF/UHF Tuners

MFJ-921 covers 2 Meters/220 MHz. **MFJ-924** covers 440 MHz. SWR/Wattmeter. 8W x 2 1/2"H x 3D 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.

Add shipping. Prices and specifications subject to change. ©2021 MFJ Enterprises, Inc.
- 1 Year No Matter What™ warranty - 30 day money back guarantee (less s/h) on orders direct from MFJ



MFJ_989D_MFJ-966_100708_QST_061521DS

The SteppIR Advantage

PROBLEM SOLVED!

Yagi antennas are basically single frequency devices that work well only over a very narrow range, typically 0.5% change in frequency. Fixed length yagis compensate by using a variety of techniques, all of which result in serious degradation of performance, especially in Front to Rear rejection, and added complexity, size, and weight. Dipoles have a much broader bandwidth but still cannot cover the entire 80m and 40m bands and maintain a low SWR (<1.5:1). Our patented solution is to simply adjust all of the antenna elements to the optimal length for the desired frequency with none of the compromises in performance that all fixed antennas require. This is accomplished remotely using an electronic controller that can automatically follow the radios' frequency. SteppIR antennas enjoy optimal performance on all frequencies within their specified frequency range (varies by model), and that includes non-ham radio frequencies as well!

THE INHERENT ADVANTAGES OF A STEPPIR:

Create/Modify Mode

The create modify mode allows the user to change the length of each individual antenna element on all bands of operation -and frequencies outside the ham bands as well - and then save the new antennas to memory. This can be incredibly useful to "tune" out potential objects that may be causing interaction with the SteppIR antenna, or to create your own custom antenna designs.

180 Degree Mode

The 180 degree mode feature is one of the most popular among SteppIR owners. For our Yagi antennas, this feature allows a user to electrically "rotate" the antenna from the forward beam heading, to the reverse (180 degrees) beam heading, with a click of a button - the entire process takes approximately 2 seconds.

Bi-Directional Mode

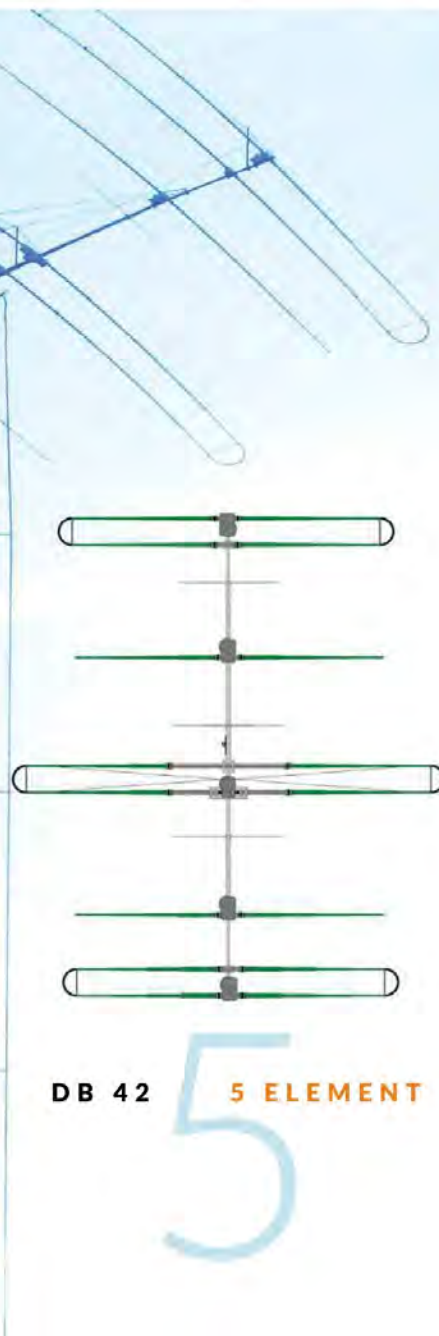
The bi-directional mode works similarly to the 180 function, except when enabled, the Yagi antenna will now be operating with gain in both directions - forward and backwards, simultaneously!

Retract Elements

With a touch of a button, SteppIR antennas can be fully retracted into their housing, which helps to protect the most valuable part of the antenna during extreme weather events.

Emergency Communications

Many times, emergency communications occur outside the standard amateur radio allocated bands of operation. All SteppIR antennas are optimal within the entire scope of their specified frequency range.



**New!
Ver. 2.0**

MFJ-1234B . . . Remotely operate your transceiver from anywhere in the world!

MFJ-1234B has RigPi version 2 software with new powerful Raspberry Pi 4B with 2 GB RAM. Loaded with 30 new features and updates and provides remote CW keying over the internet, support for over 27 new radios, PTT and frequency control knob from the Contour Shuttle controller and Flic Bluetooth PTT switch, antenna switching, power amp control **and much more!**



Apple iPhone operating your rig remotely from anywhere in the world!

net using any browser -- radio, rotor, CW keying, VoIP, digital modes, logging, spot monitoring, callbook lookups, more.

Look-up calls using included FCC database or optional QRZ subscription. Monitor DX spots for un-worked or unconfirmed calls.

Design, maintain multiple logs. Upload ADIF logs to ARRL LoTW server. Send CW from a mobile device, keyboard or paddle.

32 programmable macros.

Two or more hams from different locations can operate different radios at the same time using one MFJ-1234.

Single-click updating, I/Q Input for SDR radios, onboard VoIP server gives outstanding 2-way audio.

Includes email, word processing,

spreadsheet programs, 1000's of Linux programs, including many for ham radio. Modify, program RigPi Station Server features using a text editor.

HARDWARE

RSS is a Raspberry Pi™ computer running Linux and RigPi Keyer and Audio boards. RigPi Keyer uses K1EL WinKeyer3 integrated circuit for key-board/paddle input. RigPi Audio is used for VoIP for remote, digital modes and I/Q spectral display (Panadaptor).

OPTIONS

MFJ-1305RP, \$29.95. 5V, 3A Pwr Supl. **MFJ-1234BSD, \$59.95.** RigPi 2.0 software on SD Card only.

MFJ-1234BOS, \$29.95. Rig Pi Version 2.0 software download.

MFJ-1234AB, \$79.95. Audio Board.

MFJ-1234KB, \$79.95. Keyer Board.

MFJ-1234BC, \$29.95. Metal cabinet for Raspberry Pi 4B, audio, keyer boards.

TECH HELP

- RigPi forum is <https://rigpi.groups.io>
- RigPi website is <https://rigpi.net>

* RigPi trademarked, Howard Nurse, W6HN. Raspberry Pi is a trademark of the Raspberry Pi Foundation

MFJ CW Reader and Keyer Combination

Plug MFJ's CW Reader with Keyer into your transceiver's phone jack and key jack.

Now you're ready to compete with the world's best hi-speed CW operators -- and they won't even know you're still learning the code! Sends and reads 5-99 WPM.

Automatic speed tracking. Large 2-line LCD shows send/receive messages. Use

paddle or computer keyboard.

Easy menu operation. Front panel speed, volume controls. 4 message memories, type ahead buffer, read again buffer, adjustable weight/sidetone, speaker. RFI proof.

MFJ-551, \$39.95. RFI suppressed keyboard, a must to avoid RFI problems.

MFJ-464
\$249.95

(Keyboard, paddle not included.)



MFJ Pocket-Size CW Reader™ and Code Tutor



MFJ-461, \$119.95.

Place this tiny pocket size MFJ Morse Code Reader near your receiver's speaker and watch CW turn into

solid text messages as they scroll across an easy-to-read LCD. No cables to hook-up, no computer, no interface, nothing else needed! Practice by copying along with the MFJ-461. Learn the code and increase your speed as you instantly see if you're right or wrong. Eavesdrop on interesting Morse QSOs from hams all over the world.

MFJ's **AutoTrak™** automatically locks on, tracks and displays CW to 99 WPM. Serial port lets you display full screen CW text on your computer monitor with your computer and terminal program. Tiny 2 1/4 x 3 1/4 x 1 1/2", 5 1/2 oz. Fits in your shirt pocket, take it anywhere. Use 9 Volt battery.



MFJ-418, \$119.95. Morse

Code Tutor. Learn Morse code anywhere! Copy letters, numbers, prosigns or any combination or words or QSOs. ARRL/VEC format. Go from zero code speed to a high speed CW Pro! High contrast LCD, built-in speaker.

Plug & Play FT-8 and all Digital Modes!

MFJ-1205, \$119.95.

Plug&Play all digital modes! Specify your radio when ordering and just plug USB cable into your computer. Download free software from internet and operate: FT-8, JT4, JT-65, JT6M, FSK441, WSPR, PSK-31, EchoLink, APRS, CW, RTTY, packet, Amtor, more. Easy-to-set transmit/receive levels. Transformer isolated audio, PTT sensing eliminates adjustments. Universal, never obsolete.

MFJ-407E Deluxe CW Keyer \$129.95

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



MFJ-557 Code Oscillator/Keyer \$69.95

Practice sending Morse code. Telegraph key, code oscillator, speaker on heavy non-skid steel base. Volume/tone controls. Use 9V battery.



MFJ-550, \$24.95. Key only.

MFJ-561 Tiny Iambic paddle \$39.95



Tiny Iambic paddle is just 1 1/4 W x 3/4 H x 1 1/4 D", just 2 1/2 oz. Precision paddle formed from phosphorous bronze, rugged metal base, non-skid rubber feet, wired.

MFJ-401E Econo CW Keyer \$99.95

Front-panel volume/speed controls (8-50 wpm), tune switch. Internally adjust weight/tone. Solid state keying. Tiny 4x2x3 1/2 inches.



MFJ-564 Iambic Paddles \$119.95

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



MFJ-422E Keyer/Paddle \$239.95



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



MFJ Enterprises, Inc. 300 Industrial Pk Rd, Starkville, MS 39759

Phone: (662) 323-5869 • **Tech Help:** (662) 323-0549 • **FAX:** (662) 323-6551 8-4:30 CST, Mon.-Fri.

Add shipping. Prices and specifications subject to change. (c) 2021 MFJ Enterprises, Inc.

• 1 Year No Matter What™ warranty • 30 day money back guarantee (less s/h) on orders direct from MFJ

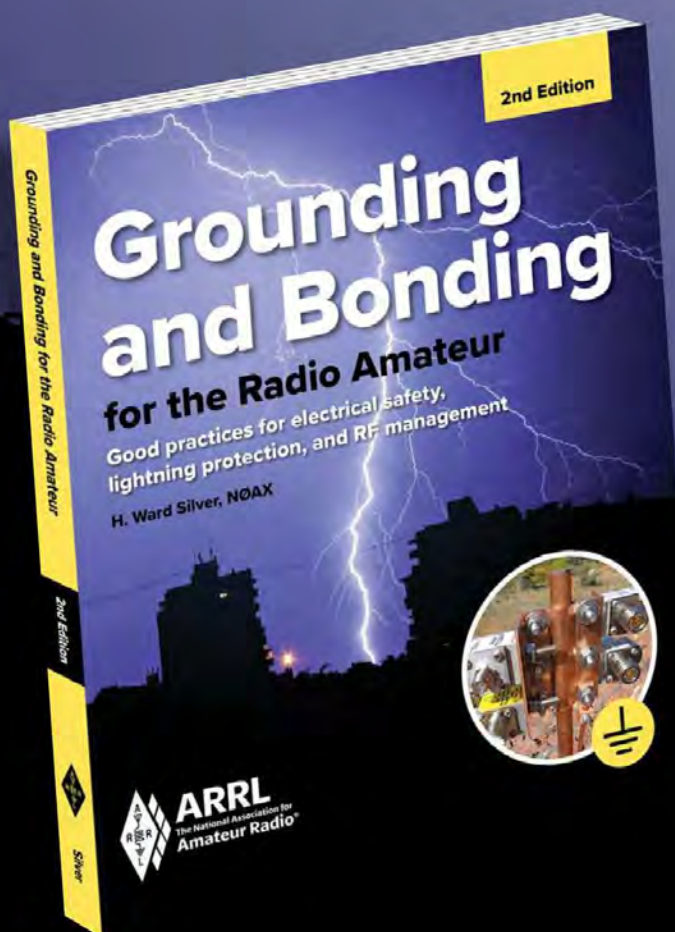


IS GROUNDING YOUR STATION HOLDING YOU BACK?

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®

MFJ . . .the World Leader in Ham Radio Accessories!

MFJ Dummy Loads & SWR/Wattmeters

Dummy Loads

World's most popular Dry 300 Watt HF/VHF Dummy Load

Air-cooled, non-inductive resistor in a perforated metal housing; Has SO-239 connector. Full 300W for 30 seconds. Derating curve to 5 minutes. SWR below 1.1:1 to 30 MHz, 1.5:1 30 to 650 MHz. Compact 2 1/4 x 2 1/4 x 7 inches.

MFJ-260CN, \$59.95. With type "N" connector.

Dry 1.5 kW HF/VHF/UHF Dummy Load

Ham radio's most versatile 1.5 kW MFJ-264 50 ohm dry dummy load covers DC through 650 MHz. SWR 1.1:1 to 30 MHz and 1.3:1 to 650 MHz. Handles 1500 Watts for ten seconds, 100 Watts for 10 minutes. 3Wx3H x9D in. SO-239 connector.

MFJ-264N, \$99.95. With type "N" connector.

Oil-Cooled 1 kW CW, 2 kW SSB 50-Ohm VersaLoad™

Run 1KW CW or 2 KW PEP for 10 minutes. Run continuous duty with 200 Watts CW or 400W PEP. Transformer oil included. SWR 1.2:1 to 30 MHz. Low SWR to 400 MHz. SO-239 connector. Safety vent with cap, carrying handle. 7 1/2 x 6 5/8 x 5D in.

MFJ-250X, \$69.95. No transformer oil.

500 MHz, 100 Watt Dummy Load

Connects directly with built-in PL-259.

Finned aluminum air-cooled heatsink. 15 Watts continuous, 100W peak. SWR < 1.5:1, DC-500 MHz. 1 5/8 inch round by 3 inches long.

MFJ-262B, \$74.95. PL-259. 35 Watts continuous, 200W for 5-seconds. SWR < 1.2:1 DC-1 GHz.

MFJ 2500W fan-cooled Dry Load

MFJ's 2500 Watt fan cooled load handles legal limit amps, 2500W average one minute on, ten minutes off, 300W continuous. DC- 6 Meters. SWR < 1.25, 30 MHz; < 1.4, 30-60 MHz. Detailed power curve. 12 VDC or 110 VAC. 8 1/4 x 4 x 9 1/2 D in. SO-239s. 5 pounds.

Switchable RF Dummy Load

Select 16.6, 25, 50, 100, 150 Ohm dummy loads. Test/calibrate your wattmeters, SWR accuracy. At 50 Ohms it handles 300 Watts for 30 seconds with SWR < 1.1, 60 MHz. SO-239. 4 1/2 x 2 1/4 x 6 1/2 D in. Optional 12 VDC/110 VAC adaptor, MFJ-1312D, \$24.95.

3 GHz, 300 Watts Dry Dummy Load

New high-tech metal film resistor on large heavy-duty air-cooled heatsink. 300 Watts for ten seconds and 125W continuously. SWR < 1.1, 1 GHz; < 1.2, 1.5 GHz; < 1.5, 3 GHz. N-connector. 10 3/4 x 2 1/4 x 5 1/4 D inches.

1.5kW Dry Dummy Load/SWR/Wattmeter

Tune up your transceiver, linear amplifier or antenna tuner into a safe 50 Ohm dummy load at full power. Then instantly switch to your antenna and monitor SWR, forward and reflected power on lighted cross-needle meter. 300/3000 Watt ranges. DC-60 MHz. Test/tune Xceivers, amps, tuners, baluns, filters, coax, stubs.



MFJ-260C
\$54.95



MFJ-264
\$94.95



MFJ-250
\$89.95



MFJ-261
\$39.95
With PL-259
DC to 500 MHz



MFJ-265
\$259.95



MFJ-251
\$179.95



MFJ-263
\$149.95



MFJ-267
\$189.95

SWR/Wattmeters

Compact Cross-Needle SWR/Wattmeters

Large 3-inch lighted Cross-Needle meter covers 1.8-200 MHz in 30/300W power ranges. Read forward, reflected power, SWR simultaneously.

3 1/4 x 3 1/4 x 3 1/4 D in. SO-239 connectors. **MFJ-842, \$79.95.** 140-525 MHz, 15/150W.



MFJ-822
\$79.95

High-accuracy 1.8-60 MHz Digital SWR/Wattmeter

Highly accurate! Auto-ranging select 25W, 250W, 1500W ranges with full 10-bit resolution. Frequency compensated data insures highest accuracy. True peak/average forward/reflected power, SWR and frequency are simultaneously displayed on backlit LCD and large 3-inch lighted cross needle meter. Peak hold. LED, buzzer, amplifier-bypass alerts and protects your amplifier when SWR is high and toggles extra relay. 6 1/2 x 2 5/8 x 6 D in.

MFJ-826B, \$204.95. No meter, amp bypass, control relay.



MFJ-828
\$279.95

MFJ GrandMaster™ SWR/Wattmeters

GrandMaster™ SWR/Power Meters are the Cadillacs of ham radio! Large 3 1/4 x 1 1/4 inch precision illuminated meter gives easy wide-angle viewing of SWR, forward or reflected power. 7 1/2 x 3 1/8 x 4 1/4 D in. SO-239s.

MFJ-870, \$119.95. 1.6-60 MHz. 30/300/3000 Watt ranges.

MFJ-874, \$159.95. 1.8-525 MHz. 5/20/200 Watt ranges.



MFJ giant 6.5 inch SWR/Wattmeter

World's largest HF+6M SWR/Wattmeter has giant 6 1/2 inch meter! Extra-long scales gives highly accurate SWR/power 1.8-54 MHz. Huge numbers make reading easy. True peak or average forward and reflected power. 20/200/2000 Watt ranges. 9 Volt battery, 12 VDC or 110 VAC with MFJ-1312D, \$24.95. 7Wx5 1/2 x 5D in. SO-239s.

MFJ-868B
\$179.95



VHF SWR/Wattmeter plus Field Strength

World's most popular -- and most affordable -- VHF SWR/Wattmeter. Read SWR, forward and reflected power over 144-220 MHz in two ranges, 30/300W. Built-in field strength meter for 1-220 MHz. 4 1/2 x 2 1/4 x 3 D in.

MFJ-812B
\$54.95



Compact Digital SWR/Wattmeters

Displays forward, reflected power, SWR (1.6-60 MHz) and battery all in a single glance! Large 1/2" forward power digits and 5/8" reflected/SWR digits! 0-200W. Power/backlight on/off. SO-239s.

MFJ-847, \$139.95. 125-525 MHz, 0-120W.

MFJ-849, \$219.95. Large 3.5" bright orange LCD displays SWR, forward/reflected power. 1.5-525 MHz, 200W, HF/VHF-UHF switch.



MFJ-845
\$139.95



MFJ HF QRP SWR/Wattmeter

Read forward, reflected power 1.8-50 MHz, 0-5W. Also reads SWR, relative power 100 mW to 50W. SO-239s. 4 1/2 x 2 1/4 x 3 D in.

MFJ-813
\$54.95



VHF/UHF SWR/Wattmeter

Lighted Cross-Needle, SWR/Watts, 144/220/440 MHz, 30/300W Forward power, 6/60W Reflected power.

MFJ-862
\$89.95



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.

Add shipping. Prices and specifications subject to change. (c) 2021 MFJ Enterprises, Inc.

• 1 Year No Matter What™ warranty • 30 day money back guarantee (less s/h) on orders direct from MFJ



Ham Ads

Please contact the Advertising Department at 860-594-0255 or hamads@arrrl.org for further information or to submit your ad.

For information on placing a Classified Ad:
www.arrrl.org/ham-ads-classified-rules-and-rates

QST Ham Ads on the Web
Updated Monthly!

www.arrrl.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.

DFW HAM RADIO 2022. Visit www.DFWham.com for info. AB5L

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@nemoes.com, 508-527-0499

COLORADO CHALET with ham gear for weekly rental, www.lostcreekcabin.com. W0LSD, 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

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 Meier 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

FOR SALE ANTIQUE COLLINS RADIO, complete system, KWM-2b, 305-1, 312B-5, Exciter Final 6146, Exciter Power Supply 516F-2 AC Red Label Collins. Emissions LSB, USB, CW. Made in Cedar Rapids Iowa June 1, 1961. \$10,000 Firm. Contact Jean: 209-261-4498, jeanbarry@sbcglobal.net, California 95340

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@ComerPress.com
www.ComerPress.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 website for useful links and downloadable information: www.kb9at.com

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

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.
NW9ALLIANCELLC2@GMAIL.COM

PRINTED CIRCUIT BOARDS for projects shown in QST, QEX, HR, ARRL HB, 73 and more. Custom boards available. FAR Circuits, 18N640 Field Ct, Dundee, IL 60118; fax/phone 847-836-9148; www.farcircuits.net; mail@farcircuits.net

RF CONNECTORS & GADGETS - Parts - Products and More! www.W5SWL.com

RF SUPERSTORE

Connectors, Adapters, Antennas, Coaxial Cable and more!
High Quality, Low Cost, Ham Friendly
WWW.RFSUPERSTORE.COM

Rohn Tower, telescoping poles, tripods and antenna parts delivered to your door.

www.antennapartsoutlet.com

ROTARY FUNCTION SWITCH REPAIRS and rebuilding. Small and large, late model and vintage types. Free estimates. Joe, KC3JDL 215-801-4362

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. WOMSN www.portablezero.com

Universal Aluminum push up towers. Same day shipping. www.antennapartsoutlet.com

Valmont/Microfect free standing 60' tower, Model #42-L700-60, extendable to 160' with additional sections. Just taken out of service in excellent condition. Includes various additional antenna mounts. Antenna loading is 4.00k at 30 PSF at the top. Current cost exceeds \$8000, sell price \$1250. "Local" delivery possible. Contact wa7qmv@gmail.com or call (360) 703-1906.

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. mkelley917@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@arrrl.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

The **Alpha Delta TT3G50 Series** Coax Surge Protector Design Concept

It was previously thought that lightning discharge energy was in the VLF, Very Low Frequency, spectrum and that a narrow band bandpass DC blocked surge protector in that range provided adequate protection.

However, in a study under the auspices of the U.S. Department of Energy utilizing the satellite FORTE carrying VHF lightning discharge sensors, it was determined that there can be damaging lightning energy emissions throughout the 30-300 MHz VHF spectrum. Therefore the damage threat can be anywhere from VLF through VHF.



Through careful design of the **Alpha Delta Model TT3G50 series broadband** precision constant impedance thru-line and ARC-PLUG™ module, allowing proper firing characteristics, this state of the art surge protector design allows effective protection throughout this entire spectrum.

- **Depending** on the connector style we provide excellent broadband performance through **3 GHz**, compared to narrowband DC blocked designs.
- **The impedance** compensated thru-line cavity design allows control voltages to pass through the device, instead of the "wire around" requirement of DC blocked designs. Our design also allows in circuit cable sweeps.
- **The innovative** field replaceable gas tube ARC PLUG™ module can be removed and replaced in the field with no tools required and without removing the surge protector from the circuit. The knurled knob does the trick. Connectors and knob are O ring sealed for environmental protection.
- **DC blocked** designs require the entire unit to be removed and discarded if hit with a surge beyond its rating. They are not field repairable.
- **As a result** of extensive testing and approvals within the military agencies, the Defense Logistics Agency (DLA) has assigned NSN numbers to our devices. Cage Code 389A5. All of our products are manufactured in the U.S.A. in our ISO-9001 certified facility for highest quality. Various connector styles available.

Also available from **Alpha Delta** dealers.

www.alphadeltaradio.com

for product technical details, installation requirements,
pricing, dealers and contact information

*Eventide honors the
many Radio Amateurs
who are involved in
public safety*

Many hams serve in professional roles, installing, supporting and operating communications systems including P25 radio, 911, Dispatch and LTE.

Other hams have professional or volunteer roles in policing, firefighting, rescue, emergency medical services and more.

Additionally, thousands of hams are equipped and ready to provide reliable emergency communications whenever needed.

THANK YOU!

NexLog DX
SERIES
COMMUNICATIONS RECORDERS



Public safety agencies and other mission-critical communications users worldwide trust Eventide's NexLog recording solutions to reliably capture, store, and reconstruct their important voice communications.

Eventide®

Founded & managed by hams
Little Ferry, New Jersey USA
eventidecommunications.com

Smart CallSign LED Clock

- Great in SHACK/OFFICE! Comes in RED, BLUE, GREEN... USB
- 4" Digits, 24/12Format, Extremely Accurate (TCXO +/- 1min/year)
- FREE Print Name, CallSigns...
- \$65 (35%off) FREE Shipping
- DIY Kits Available Only \$45
- Upgradable WiFi Set/MSG Sign
- Paypal: UltraTek@juno.com
- www.flipperUSB.com/clocks.pdf
- KB6UCO@gmail.com

HAM RADIO SCHOOL
12:03
GORDO WB6NOA

8 inch tall
16 inch wide

THANKS FOR SUPPORT OUR HAM/STEM SCHOOL

Let's bring these radios back!
TS-930 & TS-940 Supply Upgrade Kits

Easy to install, Proven Track Record & Guaranteed!

New TS-930 switching supply & AVR Board

k6iok.com

Compudigital Industries

BevFlex-4X
Low Band RX Antenna System

Configure as a switchable, bi-directional Beverage, BOG, Flag, EWE, or VE3DO low noise receive antenna system. Build the optimal version to fit your location. Feed the Beverage and BOG configurations at the point closest to the shack, not just at the ends.

Also antenna switching, CW keyers, PC-radio digital modes interface, and more!

www.unifiedmicro.com

UM Unified Microsystems

Professional

SuperbHeadsets.com
800-634-0094

Warren Gregoire & Associates, Lafayette, CA - Since 1986



Advertising Department Staff:

Janet Rocco, W1JLR, Advertising Sales Manager
Lisa Tardette, KB1MOI, Account Executive

QST Index of

Advanced Specialties – www.advancedspecialties.net	112
Alfa Radio Ltd – www.alfaradio.ca	108
Alpha Delta Radio Communications, LLC – www.alphadeltaradio.com	125
Ameritron – www.ameritron.com	17
Arcom Communications – www.arcomcontrollers.com	108
Array Solutions – www.arrayolutions.com	12
ARRIS – www.arris-usa.org/donate	106
ARRL – www.arrl.org	26, 100, 104, 108, 110, 112, 122, 128
BeLoud.US – www.beloud.us	100
bhi Ltd – www.bhi-ltd.com	112
Bioenno Power – www.bioennopower.com	126
BridgeCom Systems – www.BridgeComSystems.com	22, 23, Cover 3
Buckmaster International LLC – www.hamcall.net	108
Cable X-Perts, Inc. – www.CableXperts.com	108
California Peripherals & Components, Inc. – www.Californiipc.com	126
Cushcraft – www.cushcraftamateur.com	2
Dr.Duino – www.drduino.com/qst	6
Diamond Antenna – www.diamondantenna.net	8
DX Engineering – www.DXEngineering.com	25
Elecraft – www.elecraft.com	19
Elk Antennas – www.ElkAntennas.com	114
Eventide – www.eventidecommunications.com	125
Expert Linears America, LLC – www.ExpertLinears.com	106
FlexRadio Systems – www.flex-radio.com	21
Global TSCM Group, Inc. – www.kn2c.us	112
Greater New Orleans Ham Fest. – (504) 288-7084	116
Green Heron – www.greenheronengineering.com	110
Ham Ads – www.arrl.org/ham-ad-listing	124
HamEstate – www.hamestate.com	116
Ham Radio Outlet – www.hamradio.com	98, 99
Hammond Mfg. Co. – www.hammondmfg.com	114
Hy-Gain – www.hy-gain.com	10, 103
ICOM America – www.icomamerica.com	101

Foldable Solar Panels

PowerFilm.
Made in the USA SOLAR

5 to 220 Watts

sales@californiipc.com
(877) 487-1213

CaliforniaPC.com

LiFePO4 Batteries

Bioenno Power®

sale@bioennopower.com
(888) 336-7864
www.bioennopower.com

Contact Information:

Toll Free: 800-243-7768
Fax: 860-594-4285
E-mail: ads@arri.org
Web: www.arri.org/ads

Additional advertising information
is available on the web at:
www.arri.org/ads

Advertisers

Intuitive Circuits, LLC – www.icircuits.com	114
K6IOK – www.k6iok.com	126
Kenwood Communications – www.kenwood.com/usa/	Cover IV, 29
LDG Electronics – www.ldgelectronics.com	116
MFJ Enterprises – www.mfjenterprises.com	105, 107, 109, 111, 113, 115, 117, 119, 121, 123
Mosley Electronics – www.mosley-electronics.com	116
Motosports of Ukiah – www.hondashop.com	114
NCG Company – www.natcommgroup.com	3
OCI-Olds Communications Inc. – www.ocicom.com	127
Pacific Antenna – www.qrpkits.com	104
Palomar Engineers – www.Palomar-Engineers.com	112
PreciseRF – http://preciserf.com	11
PreppComm – www.preppcomm.com	108
Quicksilver Radio Products – www.qsradio.com	27
Radio Club of JHS 22 NYC – www.wb2jkj.org	110
RFC2 – www.rfc2.com	100
RF Parts Company – www.rfparts.com	127
Rig Expert Ukraine LTD – www.rigexpert.com	118
RT Systems – www.rtsystems.com	104
SSB Electronic GmbH – www.ssb-electronic.com	104
SteppIR Communications Systems – www.steppir.com	7, 120
SwapMyRigs – www.swapmyrigs.com	114
Tac-Comm – www.tac-comm.com	112
Ten-Ten International Net, Inc. – www.ten-ten.org	104
Tigertronics – www.tigertronics.com	106
Timewave Technology, Inc. – www.timewave.com	102
UltraTek – www.flipperUSB.com/clocks.pdf	126
Unified Microsystems – www.unifiedmicrosystems.com	126
W5SWL Electronics – www.w5swl.com	114
Warren Gregoire & Associates – www.superbheadsets.com	126
West Mountain Radio – http://www.westmountainradio.com	18
Wireman – www.coaxman.com	112
Yaesu USA – www.yaesu.com	Cover II, 1

Filters
Ham - Commercial - Band Pass
www.ocicom.com

From **MILLIWATTS**
To **KILOWATTS**SM
In Stock Now!

**Semiconductors
for Manufacturing
and Servicing
Communications
Equipment**

Visit
Our
Website

- **RF Modules**
- **Semiconductors**
- **Transmitter Tubes**

Se Habla Español • We Export

Phone: **760-744-0700**
Toll-Free: **800-737-2787**
(Orders only) **800-RF PARTS**
Website: **www.rfparts.com**
Fax: **760-744-1943**
888-744-1943
Email: **rfp@rfparts.com**



RF PARTS
COMPANY



ARRL FOUNDATION

Making a Difference for Student Hams – The ARRL Foundation Scholarship Program



Applications for the 2022 ARRL Foundation Scholarship Program will open on November 1, 2021 and will close at midnight on December 31, 2021. Over \$750,000 will be awarded through more than 80 scholarships. All FCC-licensed, active amateur radio operators attending college in the Fall of 2022 are encouraged to apply.

**To learn more about the ARRL Foundation Scholarship Program,
please visit www.arrl.org/scholarship-program.**

**Clubs or individuals interested in creating a scholarship should contact
Melissa Stemmer, KA7CLO, at 860-594-0348 or mstemmer@arrl.org.**

THE WORLD IS OPEN

Take your Ham Radio
journey to the next level.



FREE Super Codeplug

USE CODE: QSTSUPER50 At Checkout



The AnyTone AT-D878UVII PLUS / Skybridge Plus DMR Hotspot Plug n' Play Bundle

BridgeCom[®]
SYSTEMS
816-532-8451
sales@bridgecomsystems.com

CALL: 816-532-8451
TO LEARN MORE

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).



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

www.kenwood.com/usa



KENWOOD

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

ADS#15115