2021 Field Day Results Are Here! | 63

QST

DIGITAL EDITION

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The Centenary of the Transatlantic Tests

A Celebration!

QST Reviews

WA3RNC TR-25 40/20-Meter CW Transceiver Kit

Eton Elite Executive Portable Receiver

MFJ-9232 Mini Loop Tuner

Win4IcomSuite Software

The Best of the Best

A Superb All-around Wide-Coverage Transceiver

FT-991A 100W

HF/50/144/430MHz TRANSCEIVER

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

* External Speaker SP-10: Optional

The New Standard High Performance SDR Transceiver

FTDX10 100W

HF/50MHz TRANSCEIVER

* External Speaker SP-30: Optional

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

The World Leading HF Transceiver with Hybrid SDR

In Homage to the Founder of Yaesu – Sako Hasegawa JA1MP

FTDX101MP 200W

HF/50MHz TRANSCEIVER

The Ultimate

FTDX101D 100W

HF/50MHz TRANSCEIVER

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

* Microphone M-1: Optional

* Photo shows the FTDX101MP

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

YAESU The radio

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

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The Best of the Best

Narrow Band SDR Transceiver

FTDX10

Unrivaled RF Performance
Narrow Band SDR Technology is the Revolution

Inheriting the performance of the FTDX101, which is validated to exceed HF transceivers in laboratories around the world.

The most advanced digital narrow band SDR technology is combined with the RF Front-End engineering, such as the low noise-figure RF amplifier and the very sharp shape factor roofing filter designs that Yaesu has incorporated over the years, resulting in unsurpassed HF receiver performance.

Equipped with the latest MPVD feature, and 3DSS visual display to deliver superior Operability and Visibility.

A New Legend in HF Transceivers debuts

HF/50MHz TRANSCEIVER

FTDX10 100W

- The image is shown with an optional third party external display that may be connected using a DVI-D digital cable.
- Shown with Optional External Speaker SP-30.

YAESU
The radio

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6125 Phyllis Drive, Cypress,
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MA-6B 6-Band Beam

Small Footprint -- Big Signal

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

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

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

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

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

MA-5B, $599.95. Like MA-6B but five bands: 20/17/15/12/10 Meters. 12 and 17 Meters is a single element trapped dipole. ***See cushcraftamateur.com*** *for gain figures.*

Cushcraft 10, 15 & 20 Meter Tribander Beams

Only the best tri-band antennas become DX classics, which is why the Cushcraft World-Ranger A4S, A3S, and A3WS go to the head of the class. For more than 30 years, these pace-setting performers have taken on the world's most demanding operating conditions and proven themselves every time. The key to success comes from attention to basics. For example, element length and spacing has been carefully refined over time, and high-power traps are still hand-made and individually tuned using laboratory-grade instruments. All this attention to detail means low SWR, wide bandwidth, optimum directivity, and high efficiency -- important performance characteristics you rely on to maintain regular schedules, rack up impressive contest scores, and grow your collection of rare QSLs!

It goes without saying that the World-Ranger lineup is also famous for its rugged construction. In fact, the majority of these antennas sold years ago are still in service today! Conservative mechanical design, rugged over-sized components, stainless-steel hardware, and aircraft-grade 6063 make all the difference.

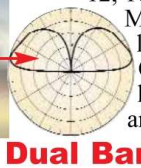
The 3-element A3S/A3WS and 4-element A4S are world-famous for powerhouse gain and super performance. **A-3WS**, **$569.95,** 12/17 M. **30/40 Meter** *add-on kits* available.

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

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

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

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



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

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

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

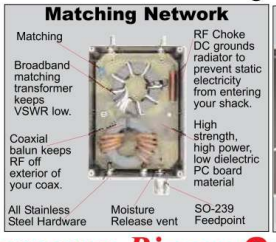
Rugged Construction: Thick fiberglass insulators, all-stainless steel hardware and 6063 aircraft-aluminum tubing is double or triple walled at key stress points to handle anything Mother Nature can dish out.

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

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

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

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



Cushcraft Dual Band Yagis

One Yagi for Dual-Band FM Radios

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

Cushcraft Famous *Ringo* Compact FM Verticals

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

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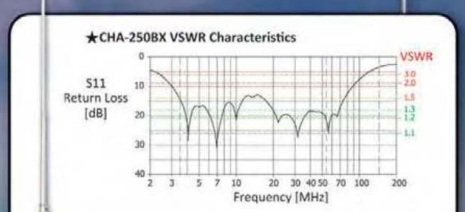


CHA-250B - *No Antenna Tuner Needed!*

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

Base Antennas

❶ 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

❷ 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

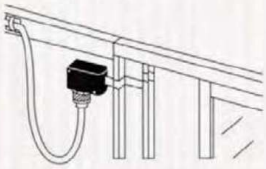
❸ C★MET GP-6 DUAL-BAND 146/446MHZ BASE REPEATER ANTENNA
Wavelength: 146MHz 5/8 wave x 2 • 446MHz 5/8 wave x 5 • Max Pwr: 200W • Length: 10'2"• Weight: 3lbs. 8ozs. • Conn: Gold-plated SO-239 • Construction: Fiberglass, 2 Sections

❹ 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

❺ 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

❻ 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

❼ 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.

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QST

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December 2021 ♦ Volume 105 ♦ Number 12

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Departments

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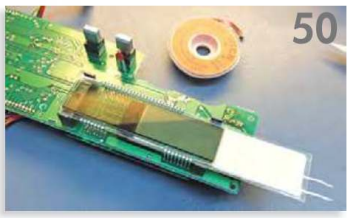
Write for *QST*

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

Our Cover
This month, we celebrate the centenary of the Transatlantic Tests, the December 1921 technological feat that proved amateur radio signals could be heard across the Atlantic Ocean. Station 1BCG in Greenwich, Connecticut was the first of several stations heard in Ardrossan, Scotland by Paul Godley, 2ZE, ARRL's handpicked envoy. The hat depicted on the cover — it's the left and right sides of one hat — was the prize won in a bet about the success of the Transatlantic Tests. Learn more about the bet in "A Wager Won, An Ocean Spanned," in this issue. Ham radio's celebration of this 100-year milestone will extend into 2022! Read more about what's to come in "Celebrate the Transatlantic Tests with ARRL and RSGB." [Chris Zajac photos]



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Merry Christmas and Happy New Year

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Every job needs the right tool

UHF	UHF	UHF	UHF	UHF	UHF	HF	HF	VHF	VHF	UHF
AA-600	AA-650 ZOOM	AA-1000	AA-1400	AA-1500 ZOOM	AA-2000 ZOOM	AA-35 ZOOM	AA-55 ZOOM	AA-230 ZOOM	Stick 230	Stick Pro

It's that wonderful time of year, for some holiday fun and cheer!

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Ugly Holiday Sweater

SPECIAL!

Purchase of any SteppIR Packaged System (SPS) during the sale-period qualifies you for your very own "ugly" sweater with a SteppIR logo imprint! (we think they look pretty good!)

*Offer good through 12/31/2021; $75 value

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DIAMOND ANTENNA

diamondantenna.net

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

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

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

X700HNA Special Features:

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

Here is a small sample of our wide variety of antennas

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

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

Second Century

One Year Down…The Future To Go!

What an amazing first year it has been, serving you as ARRL CEO. The time has flown by incredibly fast! I want to use this month's column to touch on three things of importance: giving thanks, reviewing progress, and looking to the future. Over the course of the many Zoom and in-person appearances I have made, it is has been wonderful answering member questions. This column will be a little longer than usual, so I hope you'll hang in there and get through all of it.

Here we are, just after your Thanksgiving celebration, and hopefully it was a joyful and healthy one. This is my favorite time of year: college football, autumn colors, the cooling of the air and the onset of winter, DX contests, and a time for family — for community — and to give thanks. I want to thank you for your membership in ARRL over the past year, and in particular thank our Life, Diamond Club, and Maxim Society Members. Even though we continue to struggle with the fears and mandates associated with COVID, our community feels as strong as ever. As hard and as diligently as we have worked for you over these past 12 months, we appreciate your interest, involvement, and commitment to ARRL. It is your kind words of support and the smartly constructed ideas that make our efforts feel rewarding.

I also want to thank our Board members and Officers. Our "first among peers," these volunteers spend a tremendous amount of their time working with you and with HQ to improve both ARRL and the hobby at large. We frequently ask the question, "Is this good for ham radio?" Every day, throughout the hobby, I find self-serving and arrogant behavior on the air and on social media that fails this test. This behavior regularly works against efforts to attract newcomers to our ranks, including more youth and women. We must use the lens of a living in a fishbowl to guide how we interact with each other if we have any hope of attracting new people to amateur radio. The Board members and managers at HQ know that everything we do must be intentional, deliberate, collaborative, and positive, to drive amateur radio forward. The support I have received from Board members this past year has been outstanding and has made learning the job, and doing the job, both easier and gratifying.

Before moving on, one thing I want to state clearly and unambiguously is that the notion of a "lack of transparency" is now yesterday's news. I have opened wide the doors to my office for the Board members. I go above and beyond to communicate what is happening at HQ and involve them, not from a micromanagement perspective, but rather one where they want to be involved in the good work that is going on. This has manifested in now monthly Executive Committee meetings where the CEO update is on the agenda every time. There are certain topics that are not for publication, such as some of our efforts in Washington DC, for obvious reasons, but when you see ARRL leadership at hamfests or conventions, questions about these topics are enthusiastically and clearly communicated.

When I came into HQ last year, my mission was clear. I needed to prepare ARRL for a transformation to the digital realm. We have a good news/bad news situation. The bad news is that we are so late to the game. The good news is that there have been many advances that we can now evaluate and pursue without having to develop them (and potentially fail at) using member dollars. In preparation for this journey through digital transformation, the first thing that jumped out at me was the culture of ARRL, both inside and outside HQ.

Collaboration was clearly lacking. Despite past efforts to combat this, the organization operated in a stovepiped way: You stay in your yard, and I'll stay in mine. This does not lead to the kind of thinking and ideas required to create digital products, and to move from a publisher's timeline to real time! As I explained to HQ staff in two different all-hands Zoom calls, "This is going to feel uncomfortable, and not everyone is going to want to go along for the ride." The change has been difficult for some who were embedded in thinking, "We've always done it this way, why do we have to change?" Unlike the Spanish conquistador Cortés, who burned his ships to give his crew the motivation and the clarity that change was non-negotiable, we at HQ are going through a change management process that includes understanding the "why" behind this transformation.

Outside of HQ, ARRL is a challenging environment. Leaders are not hired, they're elected. Volunteers are not managed, they are led. Does this mean the elected leaders are popular? Yes. Does this mean they are qualified to inspire and lead? Sometimes yes, sometimes no.

(Continued on page 30.)

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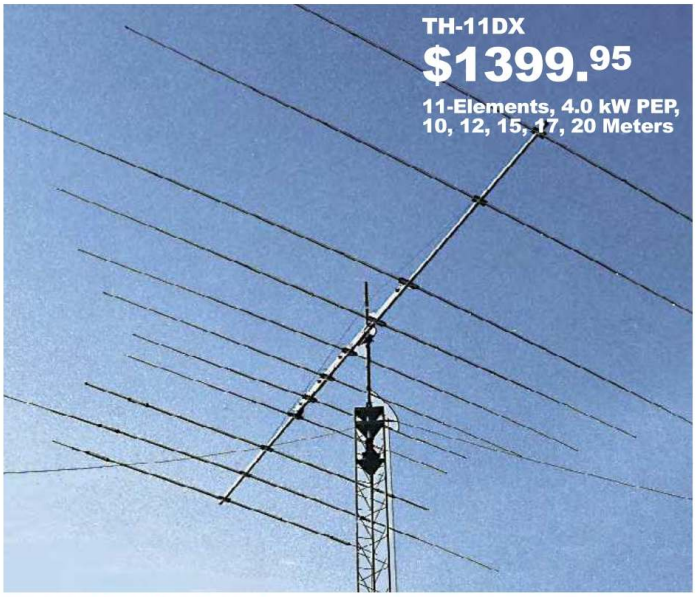
...are stronger, lighter, have less wind surface and last years longer.

Why? hy-gain uses durable tooled components – massive boom-to-mast bracket, heavy gauge element-to-boom clamps, thick-wall swaged tubing – virtually no failures!



TH-11DX, $1399.95. 11-element, 4.0 kW PEP, 10, 12, 15, 17, 20M

The choice of top DXers.

With 11-elements, excellent gain and 5-bands, the super rugged TH-11DX is the "Big Daddy" of all HF beams!

Handles 2000 Watts continuous, 4000 Watts PEP.

Every part is selected for durability and ruggedness for years of trouble-free service.

Features a low loss logperiodic driven array on all bands with mono-band reflectors, BN-4000 high power balun, corrosion resistant wire boom support, hot dipped galvanized and stainless steel parts.

Stainless steel hardware and clamps are used on all electrical connections.

TH-7DX, $1099.95. 7-element, 1.5 kW PEP, 10, 15, 20 Meters

7-Elements gives you the highest average gain of any hy-gain tri-bander!

Dual driven for broadband operation without compromising gain. SWR less than 2:1 on all bands.

Uniquely combining monoband and trapped parasitic elements give you an excellent F/B ratio.

Includes hy-gain's diecast aluminum, rugged boom-to-mast clamp, heavy gauge element-to-boom brackets, BN-86 balun. For high power, upgrade to BN-4000.

Compact 3-element 10, 15, 20 Meter Tri-Bander

For limited space...Installs anywhere...14.75 ft turning radius... weighs 21 lbs...Rotate with CD-45II, HAM-IV

Fits on light tower, suitable guyed TV pole, roof tri-pod

TH-3JRS, $439.95. hy-gain's most popular 3-element 10, 15, 20 Meter tribander fits on most lots! Same top performance as the full power TH3MK4 in a compact 600 watt PEP design.

Excellent gain and F/B ratio let you compete with the "big guns".

Tooled manufacturing gives you hy-gain durability with 80 MPH wind survival.

TH-5MK2, $899.95. 5-element, 1.5 kW PEP, 10,15, 20 Meters

The broadband five element TH5-MK2 gives you outstanding gain.

Separate air dielectric Hy-Q™ traps let you adjust for maximum F/B ratio on each band.

Also standard is hy-gain's exclusive BetaMATCH™, stainless steel hardware and compression clamps and BN-86 balun.

TH-3MK4, $569.95. 3-element, 1.5 kW PEP, 10,15, 20 Meters

The super popular TH-3MK4 gives you the most gain for your money in a full-power, full-size durable hy-gain tri-bander!

You get an impressive average gain and a whopping average front-to-back ratio. Handles a full 1500 Watts PEP. 95 MPH wind survival.

Fits on average size lot with room to spare -- turning radius is just 15.3 feet.

Four piece boom is ideal for DXpeditions. Rotates with CD-45II or HAM-IV rotator.

Features hy-gain BetaMatch™ for DC ground, full power Hy-Q traps, rugged boom-to-mast bracket and mounts on standard 2"O.D. mast. Stainless steel hardware. BN-86 balun recommended.

TH-2MK3, $469.95. 2-element, 1.5 kW PEP, 10,15, 20 Meters

The 2-element TH-2MK3 is hy-gain's most economical full power (1.5kW PEP) full size tri-bander.

For just $339.95 you can greatly increase your effective radiated power and hear far better!

Ruggedly constructed, top-performing, compact 6 foot boom, tight 14.3 foot turning radius. Installs almost anywhere. Rotate with CD-45II or HAMIV. BN-86 balun recommened.

EXP-14, $719.95. 4-element, 1.5 kW PEP, 10,15, 20 Meters

Revolutionary 4-element compact tri-bander lets you add 40 or 30 Meters! Has 14 foot boom and tight 17.25 feet turning radius. Fits on roof tri-pod, mast or medium duty tower.

hy-gain's patented broadbanding Para Sleeve gives you less than 2:1 VSWR. 1.5kW PEP.

BetaMATCH™ provides DC ground to eliminate static. Includes BN-86 balun. Easily assembled.

Truly competitive against giant tri-banders at half the cost!

QK-710, $219.95. 30/40 Meter option kit for EXP-14.

Tooled Manufacturing... Highest Quality Materials

1. **hy-gain's** famous super strong tooled die cast Boom-to-Mast Clamp
2. **Tooled** Boom-to-Element Clamp
3. **Thick-wall** swaged aluminum tubing

Tooled manufacturing is the difference between hy-gain antennas and the others -- they just don't have it (it's expensive!).

Die-cast aluminum boom-to-mast bracket and element-to-boom compression clamps are made with specially tooled machinery.

hy-gain antennas feature tooled swaged tubing that is easily and securely clamped in place. All tubing is deburred and cleaned for smooth and easy assembly.

Durable precision injection molded parts.

hy-gain antennas are stronger, lighter, have less wind surface area, better wind survival, need no adjustments, look professional and last years longer.

Model No.	No. of elements	avg gain dBd	avg F/B dB	MaxPwr watts PEP	Bands Covered	Wind sq. ft. area	Wind (mph) Survival	Boom feet	Longest Elem. (ft)	Turning radius (ft)	Weight (lbs.)	Mast dia O. D. (in.)	Recom. Rotator	Sugg. Retail
TH-11DX	11	For Gain and F/B ratio–See... • www.hy-gain.com • hy-gain catalog • Call toll-free 800-973-6572		4000	10, 12, 15, 17, 20	12.5	100	24	37	22	88	1.9-2.5	T2X	$1399.95
TH-7DX	**7**			**1500**	**10, 15, 20**	**9.4**	**100**	**24**	**31**	**20**	**75**	**1.5-2.5**	**HAM-IV**	**$1099.95**
TH-5MK2	5			1500	10, 15, 20	7.4	100	19	31.5	18.42	57	1.5-2.5	HAM-IV	$899.95
TH-3MK4	**3**			**1500**	**10, 15, 20**	**4.6**	**95**	**14**	**27.42**	**15.33**	**35**	**1.9-2.5**	**CD-45II**	**$569.95**
TH-3JRS	3			600	10, 15, 20	3.35	80	12	27.25	14.75	21	1.25-2.0	CD-45II	$439.95
TH-2MK3	**2**			**1500**	**10, 15, 20**	**3.25**	**80**	**6**	**27.3**	**14.25**	**20**	**1.9-2.5**	**CD-45II**	**$469.95**
EXP-14	4			1500	10, 15, 20 opt.30/40	7.5	100	14	31.5	17.25	45	1.9-2.5	HAM-IV	$719.95

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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.

AS-303U

AS-309H

- Available in SO-239, Type-N, and 7/16 DIN
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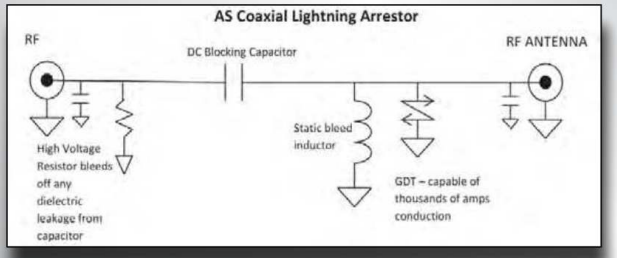
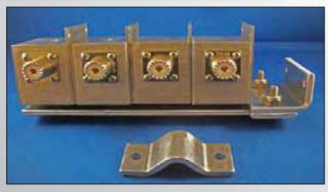
- Unique static bleed system with a UL approved Gas Discharge Tube, also ITU K 12 tested. This system usually prevents the GDT from ever firing unless a direct hit is taken. Saves your radio from static build up on large antennas.
- Models available for 3 kW, 5 kW, 10 kW and higher, details on website. 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





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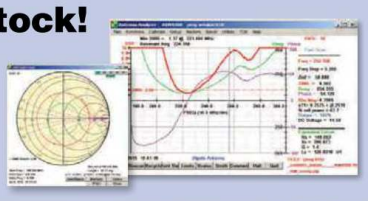
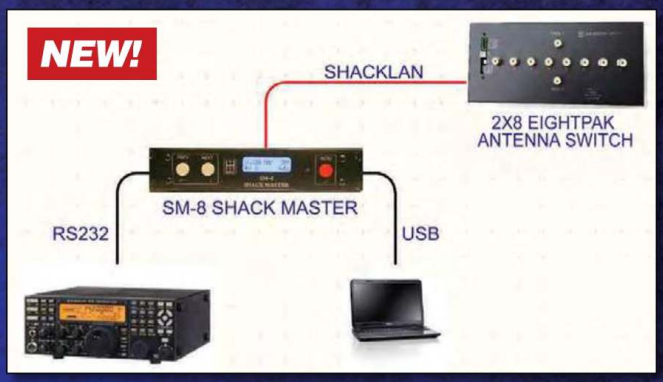


Hamation Station Automation

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:

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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.

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Caroline Kenney, ckenney@arrl.org

Member Spotlight

Bill Meara, N2CQR

First licensed at 14 years old in 1973, Bill Meara, N2CQR, became interested in ham radio through the excitement of technical and scientific pursuits. Building his own equipment was what caught his attention, but forming connections within the ham radio community captured his spirit.

Homebrewing

Bill believes understanding the technical foundation of ham radio is a vital part of participating in the hobby, so homebrewing became Bill's passion. He has built many SSB transceivers and recently recreated his original radio station from 1973, including a Lafayette HA-600A receiver, a Heathkit DX-40, and a Globe VFO Deluxe.

Bill is also interested in QRP (low power) rigs, especially because of the homebrewing community of QRPers. The sense of community is one of Bill's favorite aspects of ham radio, and he remains connected by sharing his technical knowledge. Bill explained, "There is a special satisfaction that comes from putting on the air a rig that you have built yourself."

Bill said it's important for hams to fully understand the gear and how it works. "The key is to build something, to get started, and to become part of a worldwide group," Bill added.

Ham Radio Abroad

Early on, ham radio took a back seat in his life while he pursued a career as a Foreign Service officer.

During his assignment in the Dominican Republic in 1993, at the suggestion of his wife Elisa, he unpacked his original Drake 2-B and his Hallicrafters HT-37, both of which had "dutifully followed [him] around the world." Bill was inspired to get a Dominican license, get back on the air, and start homebrewing again.

Between 1996 and 2000, he was in the US, followed by 10 years overseas, staying in the Azores, London, and Rome. Bill said, "Being a ham and a homebrewer added a special dimension to these overseas experiences. I was able to connect with and relate to members of the local community in a special way."

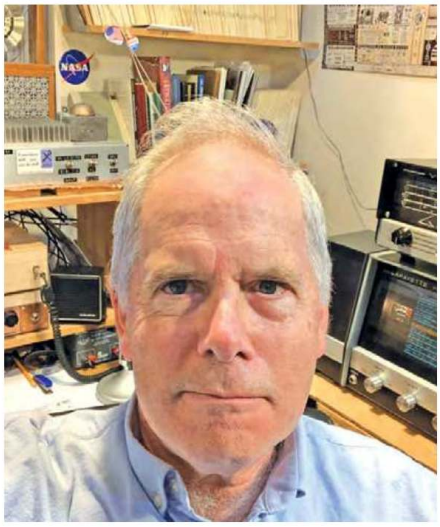
A Global Community

In 2005, while living in London, Bill and his friend Mike Caughran, KL7R (SK), began the *SolderSmoke* podcast. Bill said, "From the beginning, the podcast has been about homebrew radio and about the global friendships that arise among people around the world who build radio gear amidst clouds of solder smoke."

The podcast serves as an inspiration, a collaboration, and a place to share what Bill calls *knack stories* — reminiscences of discovering ham radio young and how the interest in the technical aspects of the hobby have kept everyone active. Bill said these kinds of stories surpass geographical boundaries and connect everyone in the global community of hams.

Faced by the devastating death of Mike in 2007, Bill wasn't sure the podcast would continue, but he said, "Listeners wrote to me saying how much they missed it, and they asked me to continue. So I did."

In 2014, master homebrewer Pete Juliano, N6QW, was interviewed on the airwaves, and the episode was so successful, Bill asked him to stay involved as a new cohost. Pete is renowned for his technical skill and knowledge.



The podcast was born from the desire to create a global community, and Bill says it has been successful in that endeavor. *SolderSmoke* is probably the longest-running ham radio podcast, and Bill explained many of their listeners have been there since the beginning. Bill is also active on the associated blog (**soldersmoke.blogspot.com**), and a segment of the podcast is dedicated to answering listeners' questions. Bill emphasizes that "help and advice is usually just an email away."

Beyond Ham Radio

Bill retired from the Foreign Service in 2019 and has been pursuing technical and scientific interests. Besides the podcast and ham radio, Bill enjoys astronomy, and he even has a telescope set up for backyard stargazing. He also wrote several books based on his experiences abroad: *SolderSmoke: Global Adventures in Wireless Electronics* and *Us and Them*. Both are available on Amazon. For more information about Bill or the *SolderSmoke* podcast, visit **www.soldersmoke.blogspot.com**.

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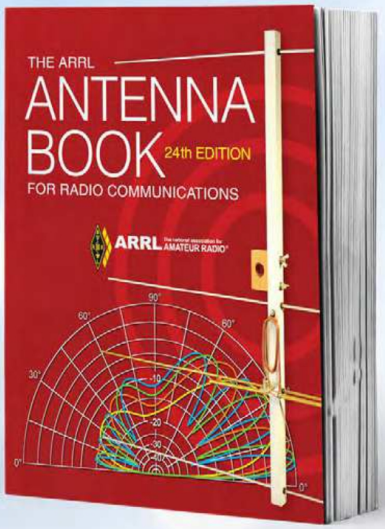

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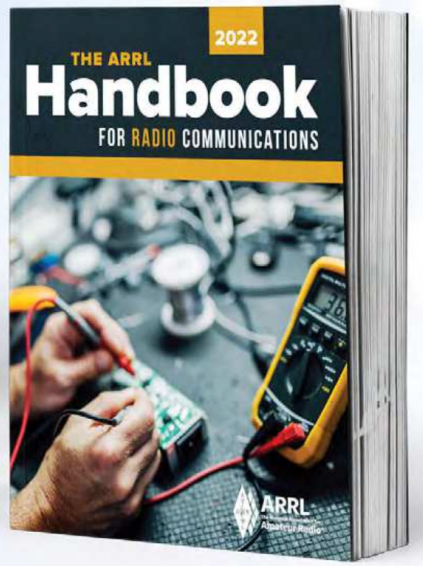

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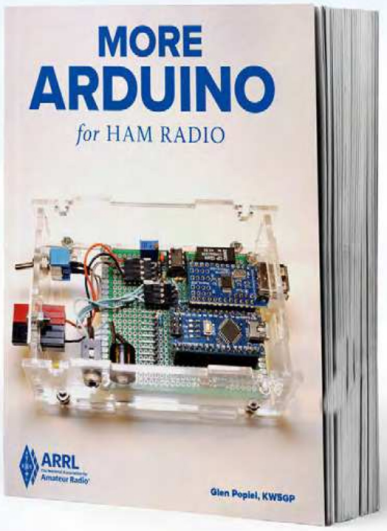

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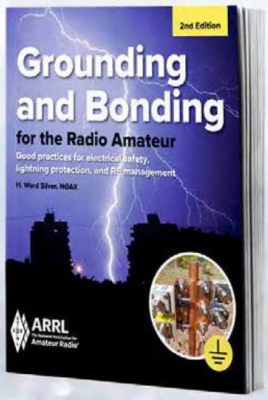

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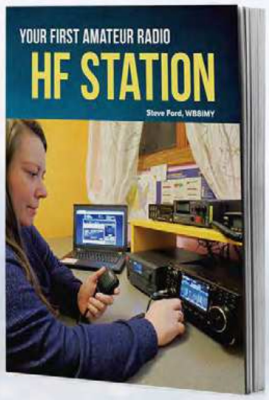

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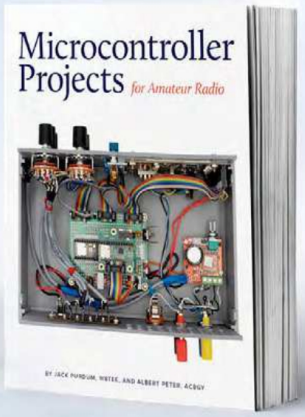

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SWR Protection prevents amplifier damage if you switch to a wrong band, use the wrong antenna or have high SWR.

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

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

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

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

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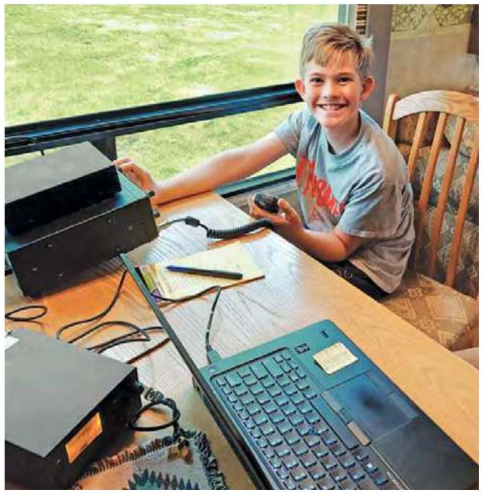
Up Front

NARA's ARRL Field Day display beside Chuck Wagoner's, KØWAG, RV portable setup.

Success in Iowa for ARRL Field Day 2021

Newton Amateur Radio Association (NARA) set up an ARRL Field Day operation in Maytag Park in Newton, Iowa, using Chuck Wagoner's, KØWAG, RV as the operation center and two generators for the power source. They had several visitors, including Harrison Cool, an 11-year-old from Kansas, who got to make several contacts with the help of NARA members Brian Meeker, KEØRMA, and Chuck Miller, NØNC. Other visitors included Iowa House of Representatives Member Wes Breckenridge, Newton City Councilman Mark Hallam, four regulars from the local net, and a local restaurant owner.



11-year-old Harrison Cool after success on the air.

Michigan Backyard On the Air for ARRL Field Day

Karl Schwab, KO8S, has a large antenna farm in Michigan. Knowing this could be considered a luxury to some hams, especially those in HOA-restricted areas, he invited Mike Baker, K8MGB, to operate from his backyard. Karl connected Mike's equipment with his HF triband Yagi, tuned to the 20-meter band, and the signals started to come in. Mike was delighted by the chance to operate from such a well-equipped station. Karl was happy to help — and make a new radio friend.

Mike Baker, K8MGB, who lives in a HOA-restricted location, was given the opportunity to operate during 2021 ARRL Field Day from Karl Schwab's, KO8S, well-equipped station.

Karl Schwab, KO8S, has an antenna farm in Michigan, which consists of a 64-foot aluminum tower, stacked with multiple Yagi antennas to cover a wide spectrum of bands, including 440 MHz, and 2, 6, 10, 15, 20, and 160 meters.

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Letters from Our Members

Celebrating Inclusivity in *QST*

I was pleasantly surprised to see a young female operator on the cover of the October 2021 issue, and enjoyed reading the cover story, "The First-Ever Youth on the Air Summer Camp." As I turned the pages, I found more examples of excellent writing featuring inclusivity and diversity in amateur radio. The issue included things like a "Correspondence" letter supporting a struggling ham trying to make contacts and friends on the air, a "Member Spotlight" of a disabled ham who embraces amateur radio as therapy, and the article, "Grammy-Nominated Musician Raul Midón, AE3RM, Takes Radio on the Road," about a blind musician and ham.

Kudos to *QST* for walking the walk on inclusivity and diversity in amateur radio and ARRL. We need more of this!

Mary Duval, K1MTD
Andover, Connecticut
Life Member

A Plea for Paper QSLs

I have always looked forward to receiving paper QSLs in the mail. When I earned my Novice-class license in 1973, we would exchange our name and signal report using the R-S-T system (Readability-Signal Strength-Tone). Then, for the next 15 – 20 minutes we would send our addresses so we could exchange QSL cards. Most of the time, if you sent a self-addressed stamped envelope (SASE), you got a QSL back.

For over a year, I've been attempting to earn an eight-band Worked All States Award (WAS) using FT8. Many stations I contact show that they use Logbook of The World (LoTW), but I find that many hams don't follow through with their contact uploads.

I prefer confirming a contact the old-fashioned way, with a direct QSL and a SASE. While working on obtaining eight-band WAS, I've sent out dozens of SASEs trying to confirm contacts. Some were sent a year and a half ago, and I've still not received a return. Fewer than 35% of my SASEs receive a return confirmation.

If you get a QSL and a SASE, please respond. It may not be your method of choice, but there are some hams who still enjoy paper QSLs!

Shane Brady, WB2WPM
West Seneca, New York

A Memorable Antenna Mount

I was part of the event featured on the cover of the November 1971 issue shown in the September 2021 "A Look Back" column. The image shows a helicopter mounting a high-gain antenna on top of a 150-foot-high water tower.

The Northwest Florida FM Association, operators of the 2-meter FM repeater WB4KLT, wanted to mount this antenna at their repeater transmitting site in Fort Walton Beach, Florida. They had to use a helicopter because the antenna was too big to carry up the interior steps, and the city didn't want to scratch the paint on the tower by pulling it up.

This method of installation required two trips: one to carry the stainless-steel mounting bracket, and one to carry the antenna. The two-seat helicopter normally carried tourists on sightseeing flights, and charged $1 per minute for use. However, it was worth the expense to ensure a safe trip for the $200 antenna. It took three helicopter passes to get the 25-foot antenna in just the right position to be secured to its mounting bracket.

The antenna was mounted with the dipoles to the north so that the null fell over the Gulf of Mexico. When installing the antenna, there were three hams on top of the tower, one assisting the helicopter pilot, and three on the ground.

After 50 years, the water tower is still in place. Since then, it has been repainted and the antenna was removed. In 1981, our radio club upgraded the repeater to a single-site operation. The receiver for the original repeater was in Destin, while the transmitter was in Fort Walton Beach (about 6 miles away). This eliminated the high cost of a duplexer, but necessitated a 6-mile 440 MHz FM radio link. The link was effective, but required a lot of maintenance on tubes and mechanical relays. We shared the link frequency band with the US Navy, and sometimes a ship in the Gulf of Mexico would bring up the repeater with each sweep of their radar beam.

Eventually, the club bought a duplexer for the water tower site in Destin, where the repeater continues today. The frequency is 147.00, plus offset (147.60) and 100 Hz CTCSS tone. The call sign is W4RH/R, and I continue to monitor it 24 hours a day.

Four of the seven hams who were a part of the antenna mounting in 1971 are now Silent Keys: W4SMS, W4FDJ, WB4TPR, and W4WBW. I've done my best to stay in touch with WA7DVD and WB4EQU over the years, and hope they're both doing well.

Frank Butler, W4RH
Fort Walton Beach, Florida
Life Member

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Building a Crystal Radio Kit Changed My Life, and Now I'm Passing the Torch to The Next Generation!

By: Steve Buffa (5 Minute Read)

When I was younger, I spent a lot of time with my uncle in who was very much into analog electronics. I would especially look forward to the holiday season as I would typically spend the entire winter break with him and my grandmother. One night after he returned home from work, I remember him bringing home a mysterious box full of parts. I was intrigued to say the least!

When I asked him what was in the box, he said it's called a "Crystal Radio Kit". My mind raced with excitement and I couldn't wait to crack into the box and begin building whatever it was. What happened next changed my life forever!

When we finally finished building the kit, he put the earpiece into my ear, and began turning a dial on the unit. To my amazement I could hear someone's voice. I was stunned, where was this voice coming from? After all, there were no batteries, how could I be hearing anything? What he said next really blew my mind. He said, the voice and the power were coming from radio waves which were invisible to the naked eye.

Not only were those some of the best memories of my life, but from that moment forward, I knew I wanted to study everything I could about electronics. In fact, it led to a successful career as an electrical engineer. Now that I'm older and have nieces and nephews of my own, I knew that I wanted to pass this excitement and knowledge to the next generation. But how? Electronics today are far more complicated than they were when I was starting out decades ago.

After a bit of googling, I ran across something called Arduino. It's a super simple to use electronics platform which allows anyone to build some truly incredible projects. It's coded in a basic form of a language called C.

With the holiday's rapidly approaching, I wanted to get my hands on an Arduino based kit so that I could spend some quality time with my nephew and pass the torch to the next generation. 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!

It's perfect for jump starting your Arduino journey, 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!

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As seen in QST Magazine January 2021
Page 48 Product Review Section

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

Revied by Glen Popiel, KW5GP

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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.

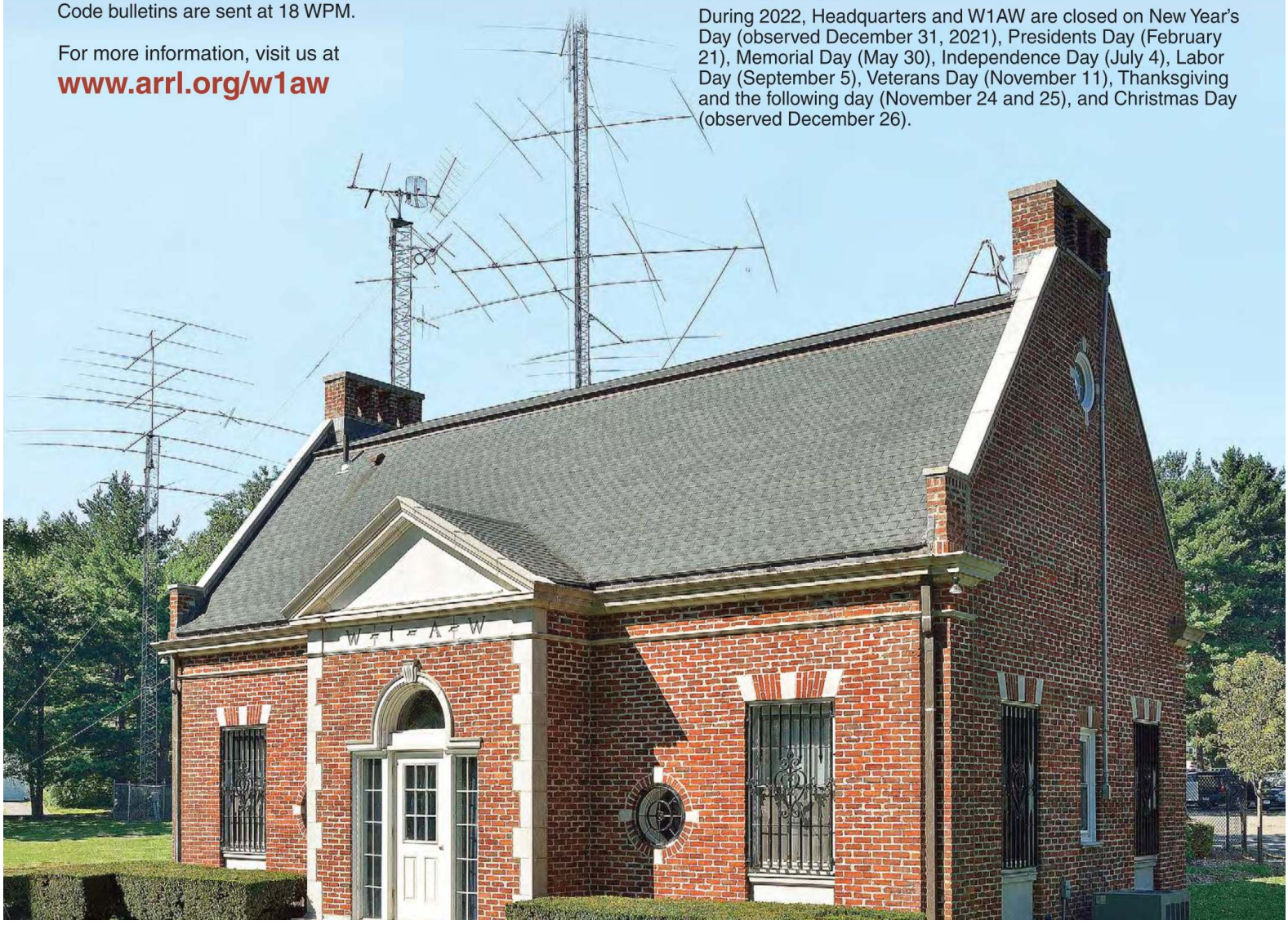
Keplerian elements for many amateur satellites will be sent on the regular digital frequencies on Tuesdays and Fridays at 6:30 PM Eastern time using Baudot and PSK31.

♦ 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 2022, Headquarters and W1AW are closed on New Year's Day (observed December 31, 2021), Presidents Day (February 21), Memorial Day (May 30), Independence Day (July 4), Labor Day (September 5), Veterans Day (November 11), Thanksgiving and the following day (November 24 and 25), and Christmas Day (observed December 26).



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Second Century (Continued from page 9.)

The area that required immediate attention was Field Services. Our Section Managers and Affiliated Club Leaders had been left to their own devices for quite some time, leading some to even claim that clubs are dead. We were doing little-to-no development with these thousands of Field Service volunteers. We have changed that. The Board has established a new standing committee focused on both EmComm and Field Services, and we have hired a dedicated Field Services Manager, Mike Walters, W8ZY, who has jumped right in, developing relationships and communications with Section Managers, as well as working to revitalize clubs through new initiatives.

I went into last January's board meeting with great hope for three new initiatives. The first is creating a 5-year strategy for ARRL. I have not been able to devote the time necessary to this, but I am glad it turned out that way. What I have learned over the past year has shaped my perspective on not just where, but how ARRL needs to move forward strategically. Having a clearer vision will give me the ability to lead this strategic planning effort more successfully.

The second is a review of our development efforts. You won't be surprised to know that member dollars do not cover the ever-growing costs associated with the advocacy and operation of our association. Raising funds for specific initiatives, as well as more broadly for a general endowment fund, allows us to pursue the things that members — and, frankly, non-members too — take for granted. ARRL has always, and will always, be focused on the complex web of relationships that need to be cultivated for both advocacy and defense. We will also seek to fund big projects that will lead to improvement of the hobby from a technical and operational perspective. We are now seeking to hire a manager to take on fund raising on a larger scale, and with a background in both making and receiving grants.

The third initiative is called Project X. This is an effort to create an ecosystem for radiosport. It naturally would include electronic logs and confirmations found in Logbook of The World today, as well as awards. Our vision is to go beyond this, creating live uploading of contacts and the creation of new products for users. For example, it would be possible to create contests within contests through real-time logging and scoring, so that small groups of individuals or small teams could compete against each other, potentially using a different set of scoring rules, to move away from the publishing timeline to real-time gaming environments. Just ask a young ham: Do you want to know who won now, or wait a year to find out?

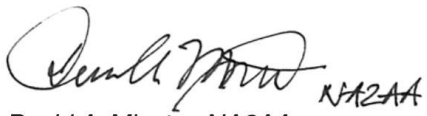
I had hoped to make more progress on this, but what makes LoTW great also hurts progress. The very people who should be involved with moving Project X forward are too embedded in the past, so I have had to find alternative resources to work with. These conversations have led to the view that open-source applications can sit on top of Project X to create innovative features with data that do not exist today. This is extremely exciting stuff.

Another ecosystem we are building is Learning & Licensing. We are taking our educational resources from YouTube to the ARRL Learning Network, on to the ARRL Learning Center, and harmonizing them with all of our licensing materials to create an environment where people can grow in the hobby. To that end, we worked with YouTube content creator Dave Casler, KEØOG, to come on board as a subject-matter expert and to allow ARRL to edit and host his licensing videos for all three exams.

We've also hired another YouTuber, Steve Goodgame, K5ATA, to run our Education and Learning area. Steve has been a successful teacher, finding ways to integrate ham radio into his curriculum, and licensing scores of youngsters as new hams. He also made sure every new licensee received their first radio. Steve will be taking his formula nationally. We've enjoyed continued success with our Collegiate Amateur Radio Initiative (CARI), where regular meetings with college and university ham radio clubs are conducted on Zoom. Our goal here is not to teach operating skills, but rather to instill in younger hams the passion for the hobby we felt as youngsters and letting them run with it — in their own ways — using today's standards.

As I look to the future, I've never seen a brighter horizon. Amateur radio equipment has never been more capable at the price points that are available today. The hobby has never been more diverse, from the perspectives of modes as well as people! Amateur radio is a global hobby and must be viewed from a global perspective. One only need see the IARU meetings and the initiatives ARRL is participating in to witness the diversity!

ARRL is more than an association. It is a community. We are so much more than the list of member benefits enumerated in *QST* every month. ARRL is structure. It is resilience and resolve. It is cooperation and collaboration. It is promotion and protection. Why isn't *every living licensed ham* in the United States an ARRL member? That's a great question. We need to be leaders, to be connectors, to be positive, and yes, even evangelical about amateur radio and ARRL. I wish you a wonderful holiday season. Be radio active, get involved with your local club, and help us grow ARRL for the future.



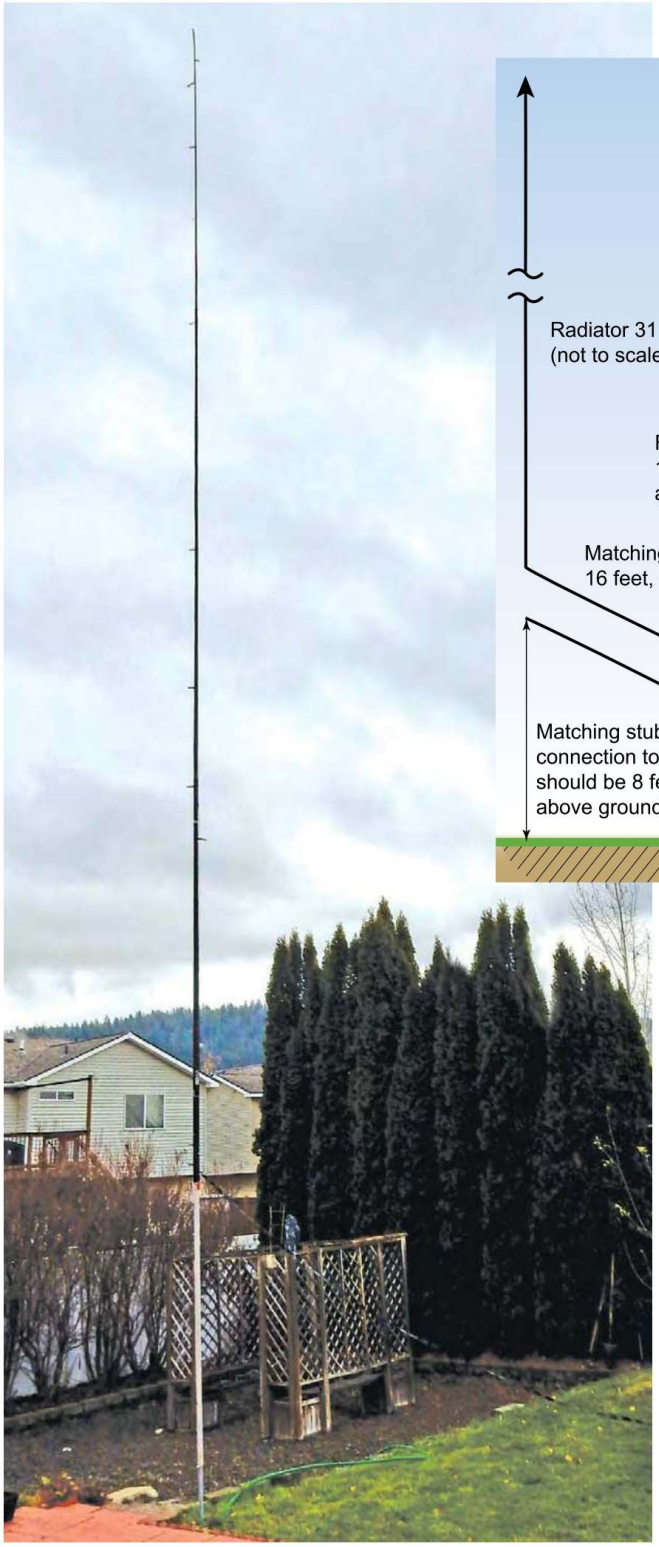
David A. Minster, NA2AA
Chief Executive Officer

Practical Solutions for an End-Fed 20-Meter Vertical

How to use the Zepp (J-pole) matching method on an HF antenna.

Toivo Mykkanen, W8TJM

Putting up a dipole antenna for temporary use can be difficult if trees or tall structures are not available. A Zepp-style, end-fed, half-wave vertical (see Figure 1) can be a good solution because its maximum radiation point is well above ground level, it requires only one mounting point (see the sidebar, "Mounting the Pole"), and it has no need for ground radials.



Overview

The Zepp-style vertical uses a half-wave radiator made from 14-gauge insulated antenna wire zip-tied to a 33-foot telescoping fiberglass pole, which is easy to find. The radiator feed point must be kept more than 8 feet above the ground to reduce the detuning effect of the earth, as well as to ensure that the high voltages at the bottom of the antenna are out of reach (see Figure 2). The base and top of the half-wave vertical have a very high impedance, and the voltages are high when running 100 W. An 8-foot fiberglass tube or stiff drain pipe should be used to support the 33-foot telescoping pole, or a 43-foot telescoping pole could be used to eliminate the bottom support tube. A shorted quarter-wave matching section is used to bring the high radiator base impedance down to a 50 Ω match. This is the same method used to feed the J-pole antenna, except that the quarter-wave section is at an angle rather than being an extension of the radiating section.

◀**Figure 1** — The author's Zepp-style, end-fed, half-wave vertical in his yard.

▲**Figure 2** — The J-pole antenna layout.

Mounting the Pole

There are various methods of supporting the 8-foot bottom tubing (see Figures A and B). A 4-foot-long, ¾-inch galvanized water pipe can be pounded or water-jetted into your lawn as a simple way to install the antenna. The pipe could also be inserted into "A Mast Holder That's Always Ready," which was included in the *Hints and Hacks* column in the November 2020 issue of *QST*. For portable operation, mounting the antenna on a parked vehicle can be easily accomplished by using a 2-foot-long, ¾-inch threaded rod placed on a vehicle trailer hitch.

Figure A (top) — Using a hose to water-jet a pipe support into the ground.

Figure B (bottom) — The pole is mounted using a vehicle hitch.

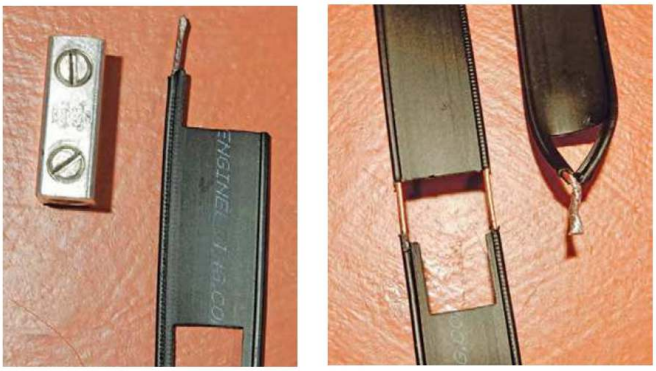


Figure 3 — The upper and lower ends of the antenna's matching section.

Figure 4 — The connection of the balun to the matching section.

Building the Matching Section

A quarter-wave matching section of 450 Ω ladder line shorted at one end is used to transform the high base impedance of the radiator to 50 Ω. Cut the ladder line to 16 feet, 4 inches in length, trim the radiator end, and strip ½ inch of insulation from one conductor. On the other end, strip ½ inch of insulation from each conductor, twist the ends together, and solder it to create the shorted end. Heat-shrink tubing can be applied to the shorted end after soldering, if desired. Scrape away ½ inch of the insulation on both conductors exactly 12 inches from the shorted end. This allows a feed point connection to a current balun (see Figure 3).

Adding the Balun

The current balun is made from 14 turns of RG-58 coax wound onto a FT240-61 core and is used to create a balanced connection to the quarter-wave matching stub. Other ferrite core types may be substituted. The balun should connect to the stub exactly 12 inches from its shorted end. Keep the coax from the balun to the feed point to less than 4 inches (see Figure 4), but any reasonable length of coax can run from the balun to your rig.

Determining Lengths for Other Bands

It is highly recommended that you build the 20-meter version with the recommended materials first, to gain familiarity with this type of antenna. The velocity factors for the radiator and the quarter-wave line are important to consider, as they determine the lengths that provide a good SWR on this antenna. You can then design for other bands with the experience gained from building the 20-meter version.

Note that the resonant frequency of the antenna will be influenced by conductive materials near the elements. This includes buildings, rain gutters, and vegetation, as well as the height above ground Experiment to get the best match.

The dimensions for any frequency can be determined by using these formulas:

- Radiator length (feet) = 448/Frequency in MHz
- ¼-wave line length (feet) = 231/Frequency in MHz
- Distance from shorted end to feed point (inches) = 179/Frequency in MHz

Quarter-wave matching lines are quite effective, as they have a very high *Q* (quality factor) and are easily repeatable. The high impedance of the antenna can be visualized by looking at how close the 50 Ω feed point is to the shorted end versus the distance to the end of the half-wave radiator. Impedances of approximately 8,000 Ω at the half-wave radiator are possible with this design.

Connecting the Radiator

The radiator is made from insulated 14-gauge stranded antenna wire, and should be cut to 31 feet, 6.5 inches in length. Connect the antenna wire to the quarter-wave line with a lug connector or splice reducer. These are very handy for quickly making and breaking antenna connections. Reusable zip-ties are used to attach the radiator wire to the telescoping pole every 2 to 3 feet. The wire can also be loosely spiraled around the pole — about 1 turn for each 2 feet of length.

Getting on the Air

The quarter-wave ladder line matching section should be tightly wrapped with zip ties to the mast a few inches below where it connects with the half-wave radiator. This ensures that it is well supported as it slopes down toward the balun (see Figure 5). Support the balun with a short pole about 2 feet off the ground. I used self-fusing tape to protect the balun from the elements and to seal coaxial connectors. Sealant should also be applied to all exposed conductors to keep moisture from wicking in and causing corrosion.

Figure 5 — The balun is supported above ground with a short pole.

Figure 6 — An antenna analyzer shows the achievable SWR.

Power Capability

The power handling capability of this antenna is limited by the voltage breakdown of the matching section at its termination to the radiator. Arcing could happen at high power, especially in wet conditions. The antenna has been tested at 800 W with no problems.

Results

The dimensions in this article should get you a reasonable standing wave ratio (SWR) if the exact recommended materials are used (see Table 1). The feed point can be moved toward or away from the shorted end to bring the resonant point to your preferred operating frequency (see the sidebar, "Determining Lengths for Other Bands"). The radiator and stub length can also be changed in small increments. You should be able to easily get a good voltage standing wave ratio (VSWR) across the whole band (see Figure 6).

Table 1 — Materials

Item	Source
14-gauge insulated antenna wire	DX Engineering
450 Ω window line	DX Engineering
Wire splice coupling	Lowe's
Toroid	eBay
RG-58 coax	DX Engineering
Fiberglass telescoping pole	GigaParts
Fiberglass mounting tube	MFJ

All photos by the author.

Toivo Mykkanen, W8TJM, is a retired electrical engineer with a BS in electrical engineering from Michigan Technological University. Prior to retirement, Toivo was an RF design engineer at numerous companies, including Collins Radio-Rockwell, Hewlett-Packard, and Agilent Technologies. Toivo is a NIST-certified strategic planner and book author of *Project Management for Strategic Results*. First licensed in 1970, Toivo holds an Amateur Extra-class license and enjoys ragchewing on 20-meter sideband and portable operation in Montana and Idaho. He can be reached at **toivo.mykkanen@gmail.com**.

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

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

Product Review

WA3RNC TR-25 40/20-Meter CW Transceiver Kit

Reviewed by Paul Danzer, N1II
n1ii@arrl.net

The TR-25 CW transceiver kit from John Dillon, WA3RNC, covers two popular bands — 40 and 20 meters — and operates from 9.5 to 14 V dc, which is helpful for portable operation where battery voltage may decline over time. There's an adjustable low-battery indicator that you can set according to your power source. The TR-25's RF output power is adjustable, and the radio delivers up to about 10 W output on 40 meters and 7 W on 20 meters.

One of the more interesting features of the TR-25 is its operating controls. Small kit transceivers often use multifunction controls and cascading menus, and unless you use the kit regularly, you may forget how to use the menus and settings. With the TR-25, there is a knob or a switch for every function — no multi-level menus!

Circuit Highlights

The TR-25 circuitry is divided into two PC boards (see Figure 1). The upper board contains a preprogrammed ATmega328P microcontroller for control functions. The **TUNE** encoder sets the frequency and incorporates a pushbutton switch to select tuning increments (10 Hz, 100 Hz, or 1 kHz). Other functions, such as receiver incremental tuning (RIT, ± 5 kHz), band selection, and the internal CW keyer speed are controlled by the microcontroller as well.

The bulk of the analog/RF circuits are on the lower board. From the BNC antenna connector, a received signal is routed to a band-select relay and then to a band-pass filter for the selected band. The filter output passes through a solid-state TR switch and a gain control, then through a second set of filters and finally to an SA612 double balanced mixer.

An SI5351 phase-locked loop with a 25 MHz crystal as its time base provides a switched local oscillator (LO)

Bottom Line

The WA3RNC TR-25 40/20-meter CW transceiver kit goes together quickly. The finished product is attractive, has a quality feel, and is very easy to use.

Figure 1 — The kit is assembled as two PC boards. The upper board contains the display and controls. On the center right is the microcontroller. This IC is plugged in after the two boards are assembled as a sandwich. The lower board has the final amplifier FET and heatsink in the center. The numbered and matched filter crystals are along the bottom edge.

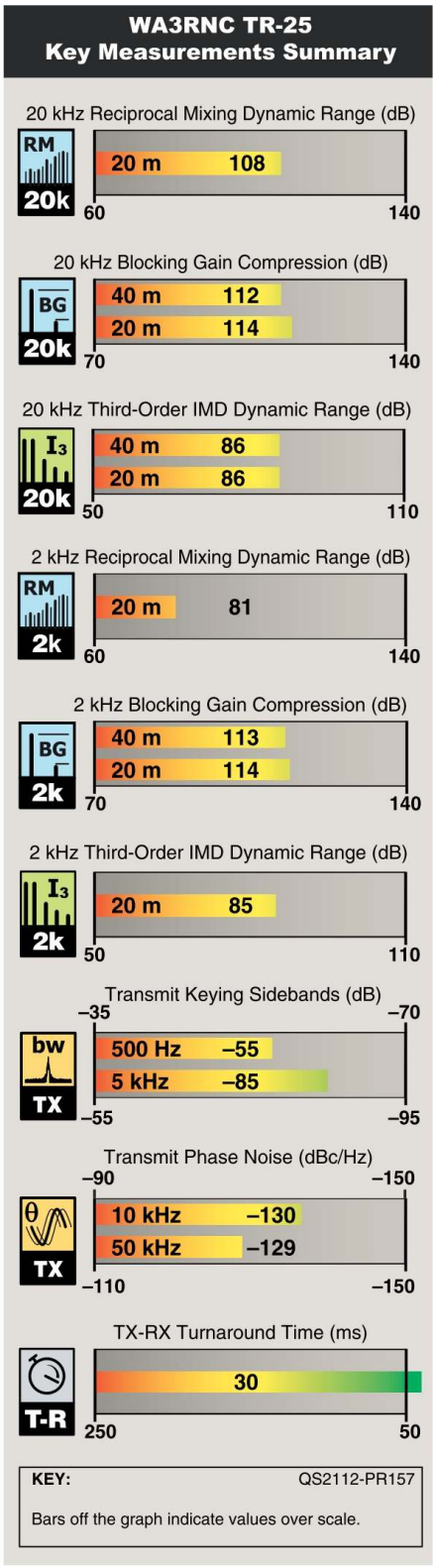


Table 1
WA3RNC TR-25 CW Transceiver

Manufacturer's Specifications	Measured in the ARRL Lab
Frequency coverage: 7.0 – 7.3 MHz and 14.0 – 14.35 MHz.	As specified.
Power requirement: 9.5 – 14 V dc at >110 mA receive; 1.1 A transmit at 10 V.	Receive: 102 mA from 9.5 – 14 V dc. Transmit, 7 MHz/14 MHz: 10 V dc, 1.1/1.07 A; 14 V dc, 1.4/1.3 A.
Mode of operation: CW.	As specified.
Receiver	**Receiver Dynamic Testing***
Sensitivity: –125 dBm.	Noise floor (MDS): 7 MHz, –137 dBm; 14 MHz, –135 dBm.
Noise figure: Not specified.	7 MHz, 11.6 dB; 14 MHz, 13.6 dB.
Blocking gain compression dynamic range: Not specified.	Blocking gain compression dynamic range: *20/5/2 kHz offset* 7 MHz 112/112/113 dB 14 MHz 114/114/114 dB
Reciprocal mixing dynamic range: Not specified.	14 MHz, 20/5/2 kHz offset: 108/104/81 dB.

ARRL Lab Two-Tone IMD Testing

Band	*Spacing*	*Measured IMD Level*	*Measured Input Level*	*IMD DR*
7 MHz	20 kHz	–137 dBm	–51 dBm	86 dB
		–97 dBm	–37 dBm	
		–26 dBm	0 dBm	
14 MHz	20 kHz	–135 dBm	–49 dBm	86 dB
		–97 dBm	–36 dBm	
		–36 dBm	0 dBm	
14 MHz	5 kHz	–135 dBm	–49 dBm	86 dB
		–97 dBm	–36 dBm	
14 MHz	2 kHz	–135 dBm	–50 dBm	85 dB
		–97 dBm	–37 dBm	

Second-order intercept point: Not specified.	+43 dBm at 7 and 14 MHz.
IF/audio response: Better than 350 Hz.	Range at –6 dB points: 600 – 825 Hz (225 Hz).
Transmitter	**Transmitter Dynamic Testing**
Power output: At 14 V dc, 7 MHz, 0 – 9 W; 14 MHz, 0 – 7 W.	7 MHz: 0 – 9.6 W at 13.8 V dc; 0 – 4.5 W at 9.5 V dc. 14 MHz: 0 – 7.2 W at 13.8 V dc; 0 – 3.5 W at 9.5 V dc.
Spurious-signal and harmonic suppression: 52 dB.	>60 dB (see Figure A). Complies with FCC emission standards.
CW keying characteristics: Not specified.	See Figures B and C.
Transmitted phase noise: Not specified.	See Figure D
Transmit-receive turnaround time: Not specified.	S-9 signal, 30 ms.

Size (height, width, depth): 2 × 6 × 3.25 inches including protrusions. Weight, 11 ounces.

Second-order intercept point was determined using S-5 reference.

*Receiver bandwidth is fixed and measured in the ARRL Lab at 225 Hz at –6 dB.

signal to the mixer. Following the mixer is a crystal filter made from four matched and numbered crystals in series. These feed another SA612, which has the beat frequency oscillator (BFO) feeding one of its inputs. The audio output is from an LM386 op-amp on the upper board. One interesting auxiliary circuit uses an LM358 dual op-amp to make an operator-settable alarm that blinks the **LOW BATT** LED when the input voltage falls below the set value.

On the transmit end, the TR-25 uses a BS170 driver and an IRF510 final amplifier operating in Class B. The amplifier output is routed through a bifilar impedance matching transformer and the appropriate bandpass filter at the BNC output.

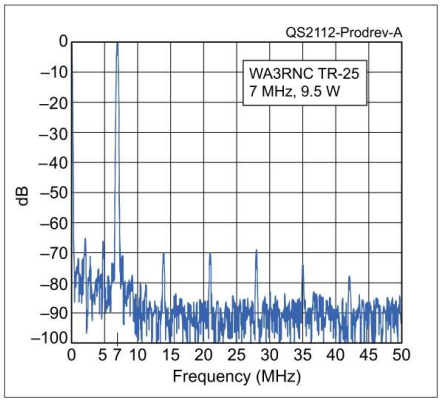


Figure A — Spectral display of the WA3RNC TR-25 transmitter output. Power output is 9.5 W on the 7 MHz band. This plot shows the output spectrum from 0 to 50 MHz. The second harmonic is down 70 dB from the carrier, and the third harmonic is down 69 dB. The vertical scale is 10 dB per division.

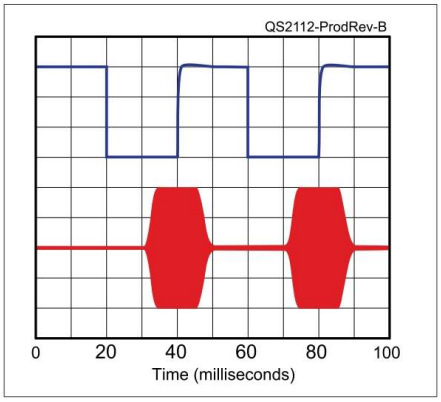


Figure B — CW keying waveform for the WA3RNC TR-25 showing the first two dits using external keying. Equivalent keying speed is 60 WPM. The upper trace is the actual key closure; the lower trace is the RF envelope. Horizontal divisions are 10 ms. The transceiver was being operated at 7 W output on the 14 MHz band. Rise time is 2.1 ms and fall time is 2.9 ms. First dit: on delay, 12.8 ms; off delay, 7.2 ms. Second dit: on delay, 12.8 ms; off delay, 7.2 ms.

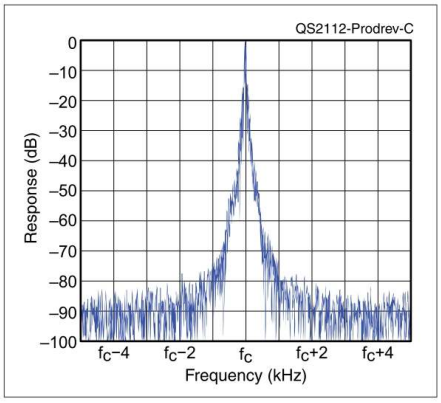


Figure C — Spectral display of the WA3RNC TR-25 transmitter during keying sideband testing. Equivalent keying speed is 60 WPM using external keying. Spectrum analyzer resolution bandwidth is 10 Hz, and the sweep time is 30 seconds. The transmitter was being operated at 7 W PEP output on the 14 MHz band, 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.

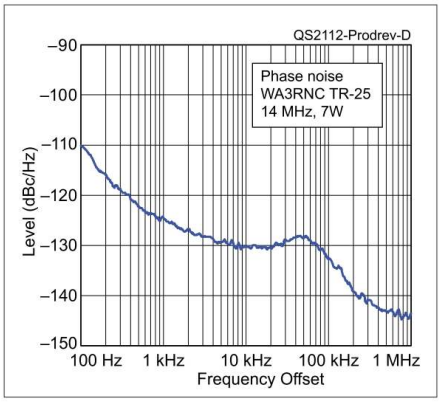


Figure D — Spectral display of the WA3RNC TR-25 transmitter output during phase-noise testing. Power output is 7 W on the 14 MHz band. The carrier, off the left edge of the plot, is not shown. This plot shows phase noise 100 Hz to 1 MHz from the carrier. The reference level is –90 dBc/Hz, and the vertical scale is 10 dB per division.

Figure 2 — The parts are packed in individual bubbles arranged in the order they are assembled. One set is for the lower board, another set for the upper board, and a third set for hardware and connectors.

Building the Kit

In the supplied kit, the two PC boards are populated with about 200 surface-mounted components, leaving 55 through-hole parts for the builder to install. Critical circuits are pre-aligned.

The WA3RNC website offers downloadable instructions as several PDF documents. It's a good idea to read the *TR-25 Pre-Assembly Information* document first, as it gives an overview of how the assembly will proceed, as well as some general notes about things to be aware of as you build. There are separate *Assembly Procedure* documents for the upper and lower PC boards. *TR-25 Final Assembly* and *TR-25 Checks and Tests* explain how to adjust internal controls that are not usually changed very often after initial setup, and also show how to make sure the radio is operating properly. The last document is *TR-25 Operating Instructions*.

The parts are supplied in small bubble-like connected envelopes (see Figure 2) arranged in the same order as the steps in the assembly manuals. I put a 16 × 18-inch aluminum oven liner from the supermarket cooking section on my workbench to catch any parts that I may drop. A few small paper cups are useful for temporary storage of small hardware that will be used in a later step.

Not supplied is clear nail polish, needed to keep a few screws and nuts from loosening, and two clothespin-like plastic clips for holding the PC board and case in place during assembly (you can also use rubber bands). A very small amount of thermal heatsink compound is suggested for the final amplifier transistor heatsink.

The assembly instructions are clear, although in some sections the text is printed as one long extended paragraph, which can make it easy to lose your place. I used a red pencil to put a check mark next to the part number in the text as I mounted each component.

Lab Notes

WA3RNC TR-25 CW Transceiver

The ARRL Lab tested an assembled version of the TR-25, with the results shown in Table 1. The transceiver is rated for operation from 9.5 to 14 V dc and draws just over 100 mA on receive, a plus for conserving battery power during portable operation. Even with minimum supply voltage, our radio put out 4.5 W on 40 meters and 3.5 W on 20 meters.

Receive sensitivity is excellent, and dynamic range is good. If too many strong signals are a problem, turn down the RF gain with the front-panel control. The CW waveform is clean, with good keying sidebands. The transmitter easily meets FCC spectral purity requirements.

During testing, we noticed that output power dropped off after 7.5 to 15 seconds of transmitting a steady carrier at full power. John Dillon explained that the radio does this by design, using a polyfuse whose resistance is dependent on current and temperature. This is a safety measure to protect the final amplifier and does not affect normal operation, except perhaps if you're transmitting for a long time to adjust an external antenna tuner. I set the Lab's keying generator to 35 WPM and transmitted for 10 minutes with no drop in output power.

I thought the radio was well constructed, wonderful to operate (no endless menus to back out of), and all of the controls and switches have a quality feel about them and operate smoothly. — *Paul Cianciolo, W1VLF, ARRL Lab Test Engineer*

Mounting the final amplifier and heatsink requires some care. The FET leads have to be bent over to fit the solder holes. I found that everything fit fine when I bent the leads at the transition of the wide and the narrow sections. As noted in the instructions, be careful with the placement of the plastic washer and mica insulator.

The kit uses six toroids (five inductors and a transformer). The instructions describe how to wind them, but pre-wound and prepared toroids are also available as an option. Winding the toroids is not difficult but does require finger agility and attention to detail. When you use enameled wire for windings, be aware that solder will not adhere to the enamel coating. Therefore, you must prep the wire ends down to clean, bare copper to ensure good solder joints. For this project, though, we chose to use the pre-wound toroids, which came ready to install with pre-tinned leads.

Finishing Touches

The PC boards fit neatly into a two-piece plastic case, but first there are internal trimmer potentiometers that must be adjusted. The process is described in the *TR-25 Final Assembly* manual. The first trimmer controls a blue LED, which is set to just barely light when no signal is present and glow brighter with received signals. The second trimmer sets the operating point for the final amplifier FET in a multi-step procedure detailed in the manual. Once this trimmer is set, you should not have to re-adjust it, but it is accessible with the case removed.

Another trimmer accessible with the case removed sets the sidetone volume. The sidetone is the actual transmitted signal heard in the receiver. When the tone of the incoming signal is matched to the transmit sidetone pitch, it will be perfectly on frequency. The final trimmer sets the threshold of the red low-voltage warning LED from 9 to 11.5 V.

The case is held together with four long self-tapping screws. The knobs are held in place with setscrews, so they can be placed to clear the front panel. The large **TUNE** knob requires more clearance because it also has a pushbutton function. Two toggle switches, POWER and BAND/RIT, are secured to the panel with nuts. A red cover dresses up the POWER switch and a white one does the same for BAND/RIT. A clear plastic cover protects the display. Disassembling the enclosure can be tedious, so it's a good idea to complete all adjustments and fully test the radio before placing the PC board assemblies in the enclosure.

On the Air

The TR-25's connections and controls are refreshingly simple. On the left side are a 2.1 millimeter coaxial dc power jack and two 3.5 millimeter phone jacks. One is for an external key or keyer, and the other for paddles controlling the internal keyer. The right side has the BNC antenna jack and a 3.5 millimeter jack for headphones or a loudspeaker. I found the audio output a bit low, but this is somewhat dependent on the sensitivity of the loudspeaker.

The TR-25 seems to have been designed with human factors in mind; an operator can use it without a long learning process. For example, the pushbutton switch of the large **TUNE** knob selects the tuning steps. A short push of the knob switches between 10 Hz and 100 Hz, but a longer push changes to 1 kHz steps. This prevents you from accidently tuning far away from the station you were trying to hear.

Similarly, all the controls are on the front panel. Keyer speed is adjustable from 5 to 35 WPM. Transmit power is adjustable from 0 to 5 W or more, depending on battery voltage. RF gain and volume are easily adjustable as well.

The **BAND/RIT** toggle switch with the white cap uses momentary contacts. One short click up alternates the band between 40 and 20 meters. One long click up stores the current frequency (one memory per band), and the radio returns to this frequency each time it's turned on. Two short upward clicks recalls the stored frequency. Clicking down toggles the receiver incremental tuning (RIT) on and off. The orange LED reminds you that RIT is on, and the RIT offset is shown in the display.

I found plenty of signals on 40 meters in the evening and 20 meters during the day. Even though the power output is less than 10 W, it wasn't very hard to have many enjoyable contacts. With the slow tuning rate, it was easy to match the sidetone pitch to the received signal and arrive right on frequency. TR switching is silent. The TR-25 is so easy to use that I felt right at home after using it only once or twice.

Manufacturer: John Dillon, WA3RNC, **www.wa3rnc.com.** Price: $250 (kit); pre-wound toroids, $18; precision optical encoder, $30; factory wired and tested, $310.

Eton Elite Executive Portable Receiver

Reviewed by Steve Ford, WB8IMY
wb8imy@arrl.net

While not a "pocket" radio, the Eton Elite Executive packs a lot of functionality into a package that is just 4.1 × 6.6 × 1.2 inches. This compact receiver covers the following frequency bands: long wave (150 to 285 kHz), AM broadcast (520 to 1710 kHz), medium and short wave (1.711 to 29.999 MHz), FM broadcast (87.5 to 108 MHz), and aeronautical (118 to 137 MHz). Receiving modes include AM, FM (in stereo if you're using headphones or earbuds), and SSB.

The Elite Executive sports a 30-inch telescoping antenna. For AM broadcast and long wave, however, it relies on an internal ferrite rod antenna. If you want to attach an external antenna, the Elite Executive accommodates that option with a 3.5 millimeter jack on the side of the enclosure. An adjacent **DX/LOCAL** switch reduces front-end gain to avoid overload when you are using an external antenna.

The receiver includes a 2-inch diameter loudspeaker next to a sizable amber digital display. Main tuning and volume controls take the form of knobs on the side of the case. The entire area below the display is devoted to buttons for accessing the various functions, as well as the memories.

It is interesting to note that in addition to the earbud/headphone jack, the Elite Executive also offers a separate **LINE IN/OUT** jack (see Figure 3). Not only does the radio provide a fixed, line-level audio output signal at this port for recording purposes, or for routing audio to a separate amplifier system, it also allows you to feed audio *to* the radio for listening through its internal speaker. Considering the proliferation of wireless earbuds and speakers these days, I suspect this input would see little use. Regardless, it is still handy to have available — just in case.

The Elite Executive arrives with a nicely designed faux-leather partial case secured to the radio by magnetic disks. When folded back under the radio, the case

Bottom Line

The Eton Elite Executive is a portable receiver that covers a number of different bands, including SSB capability on the HF amateur bands. The audio quality is quite good, especially when listening to the FM broadcast band with stereo headphones.

Figure 3 — The left side of the receiver has an external antenna jack, a DX/local switch to reduce gain if the receiver overloads, a stereo headphone jack, and an external power jack. The right side includes tuning and volume controls and a line in/out jack.

serves as a platform if you wish to position the receiver horizontally with a slight upward tilt. It reminded me of the magnetically attached keyboards and covers you frequently see with tablet computers and other mobile devices. Of course, the covering can be removed completely if you wish.

I powered the Elite Executive with four alkaline AA batteries and enjoyed considerable operating time. Alternatively, you can purchase rechargeable NiMH batteries and charge them when needed with the charger supplied with the radio. While you can also power the radio directly from the charger, the user manual cautions against this, warning of potential "interference." This is true. The dc provided by the module no doubt gets the job done in terms of charging batteries, but it is not well filtered, and the result appeared, at times, as a noticeable buzz.

On the Beach

I was fortunate to have the Elite Executive in my possession during what may have been one of the best times for conducting this type of review — a beach vacation. It gave me ample time to explore the features of the radio and enjoy many relaxing "test sessions."

Being right at the edge of the Atlantic Ocean, I dared to hope that I'd be able to receive long-wave signals from Europe. It was not to be. During my first evening attempt, I quickly discovered that the internal ferrite rod antenna, which the Elite Executive defaults to for this band, just wasn't up to the task. Long-wave listening is a challenge even with the best antennas, so this did not come as a surprise.

AM broadcast listening with the internal antenna offered a much better experience. The radio seemed sufficiently sensitive and selective. As on all bands, you can tune manually, or command the receiver to scan and stop on the strongest signals. You can also enter frequencies directly via the numeric keyboard buttons on the front panel.

Shortwave and Amateur Bands

Extending the telescoping antenna, I was eager to cruise the medium- and short-wave bands. The Elite Executive divides this range into several frequency segments according to wavelength. Repeatedly pressing the **METER** button steps you through the bands.

Naturally, I began by exploring the amateur bands. I pressed the **METER** button to access "41 Meters" and then tuned manually into the 40-meter ham band from there. With the SSB mode enabled (and lower sideband selected), I was able to eavesdrop on several conversations. To successfully tune SSB signals, however, you must first navigate in 1 kHz steps until you get close to the desired signal and then press the tuning knob to enable 10 Hz fine tuning.

While the user manual mentions the **WIDE** and **NARROW** bandwidth buttons, it doesn't provide detail about the bandwidths available. As it turns out, you can select a bandwidth as narrow as 500 Hz when listening to short wave frequencies. The selected bandwidth is indicated by the small icon on the screen, adjacent to the equally small S-meter display.

With the receiver in the SSB mode and the 500 Hz bandwidth selected, I prowled for CW activity and wasn't disappointed. Propagation conditions were mediocre at the time, but I was able to copy signals on various bands, even while using only the telescoping antenna. I attached a 50-foot wire to the external antenna port and, of course, the improvement was dramatic.

To enhance short wave broadcast enjoyment, the Elite Executive offers a synchronous AM mode with selectable sidebands. The purpose of synchronous AM is to mitigate the effects of selective fading by substituting

an internally generated carrier signal for the fluctuating carrier you are attempting to receive. Synchronous AM performance can be a mixed bag among consumer grade receivers, and that was the case here as well. The Elite Executive's synchronous AM feature reduced distortion, but it often did so at a significant cost to the overall fidelity of the signal. When the goal was to make a signal at least listenable, the radio's synchronous AM mode made a major difference, but for the sake of better audio quality, I frequently chose not to use it.

FM Broadcast Band

The FM broadcast listening experience with the Elite Executive was outstanding. With headphones, the stereo audio was full bodied with excellent channel separation. When traveling it is helpful to make a quick scan of the available FM signals. To that end, the Elite Executive provides ATS — Auto Tuning Storage. With a button press, the radio will race through the FM broadcast band and store every signal it encounters into one of seven memory locations in each of its 99 memory "pages" (the radio offers a total of 700 memories). ATS is only available in the FM broadcast band.

The Elite Executive's memory feature is highly versatile. You can copy and paste memory contents from one slot to another, for example. You can also assign alphanumeric labels to each memory, which becomes awfully convenient after you've stored a slew of frequencies and can't remember the station names or call signs.

While browsing the FM broadcast band I came to appreciate the Elite Executive's RDS decoding capability. Known formally as the Radio Data System, RDS is a stream of digital information that many FM broadcast stations in the United States include with their analog transmissions. When decoding RDS data, the Elite Executive will display whatever text is in the stream, such as the station call sign, song title, artist, and more. With the press of a button, you can select the type of information you prefer to see, such as song titles only.

Aeronautical Band

No exploration of the Elite Executive would be complete without venturing into the aeronautical frequencies. These transmissions to and from aircraft use amplitude modulation on frequencies between 118 and 137 MHz. Exchanges are often short but interesting. During an episode of severe weather, I listened to pilots as they responded to air-traffic controllers guiding them around areas of heavy precipitation. Even when using just the telescoping antenna, there were always aviation signals to be found. For this band, the Elite Executive includes a squelch function, which made monitoring much more enjoyable.

Finally, like many consumer receivers, the Elite Executive provides a clock and multifunction alarm. You can awaken to your favorite FM broadcast station, or even to one of the National Institutes of Standard and Technology stations such as WWV, although that wouldn't be the most pleasant way to greet the morning.

Conclusion

The Eton Elite Executive is a well-made portable receiver with a number of convenient features. It is well suited for traveling or casual listening at home. The radio can also double as a test receiver for those times when you need to diagnose a problem with a transceiver.

Although some retail advertising states that the Elite Executive can receive digital HD radio signals of the type heard in the US, or the DAB digital format that is used in Europe, Eton confirmed that the radio does not include that capability.

Manufacturer: Eton Corporation, 1015 Corporation Way, Palo Alto, CA 94303; **www.etoncorp.com**. Price: $150.

MFJ-9232 Mini Loop Tuner

Reviewed by Phil Salas, AD5X
ad5x@arrl.net

The MFJ-9232 Mini Loop Tuner is a 25 W version of the MFJ-933 150 W manual loop tuner. Like the MFJ-933, the MFJ-9232 doesn't function as a traditional small magnetic transmitting loop system, which should normally have a loop circumference of 1/10-wavelength or less. For the best performance, MFJ recommends that the loop wire length should be at least 3/4 of a quarter wavelength on the band on which you are operating. The manual also has recommended fixed wire lengths that will permit operation over about a 1.5:1 frequency range.

Unlike the air-dielectric variable capacitors used in the 150 W manual loop tuners, the MFJ-9232 uses solid-dielectric variable capacitors that use plastic film between the capacitor plates. While these variable capacitors limit transmitting power to 25 W maximum, they do result in a very compact design, which is desirable for low-power home and portable operation. Mechanically, the MFJ-932 loop tuner is quite small, with dimensions of just 1.5 × 2¾ × 4 inches.

Using the MFJ-9232

No manual was provided with the MFJ-9232, but a PDF version is downloadable from MFJ's website. As the manual explains, you must be mindful of safe RF exposure limits because of the high RF power density of any small loop antenna system. At low power levels this is probably not as much of a problem, but it's still a good idea to evaluate RF exposure. (More information and an RF exposure calculator are available at **www.arrl.org/rf-exposure**.)

To start, you select a wire length for the band or bands on which you want to operate. MFJ's recommended wire lengths for single-band and multi-band operation are given in Table 2.

The MFJ-9232 comes with 53 feet of insulated #20 AWG stranded wire and eight ring terminals that fit the threaded post terminals on the tuner (see Figure 4), though it is interesting to note that the MFJ-9232 manual suggests using #10 AWG or larger stranded wire to minimize losses. For my tests, I cut the supplied wire to lengths of 20 feet, 9 feet, and 4 feet, to cover 40/30 meters, 30 – 17 meters, and 17 – 10 meters respectively. If your transceiver does not include an SWR meter, you will need to insert one between your transceiver and the MFJ-9232.

Bottom Line

The MFJ-9232 Mini Loop Tuner works well as a low-power portable loop antenna tuner. It gives you another option for your portable HF operation.

Tuning Procedure

The tuning procedure involves peaking the MFJ-9232 for maximum noise (or S-meter reading), and then applying RF power (no more than 5 to 10 W) and

Table 2
MFJ-9232 Loop Wire Lengths

Single Band Wire Lengths		Multiband Wire Lengths	
Band (meters)	Length (feet)	Bands (meters)	Length (feet)
80	63.0	40/30	20.0
40	28.0	30/20	13.0
30	20.0	30/20/17	9.0
20	13.0	20/15	7.0
17	9.0	17/15/12/10	4.0
15	7.0		
12	5.5		
10	4.0		

Figure 4 — Ring terminals and 53 feet of #20 AWG wire are supplied with the tuner.

readjusting the controls for minimum SWR. The manual is a little confusing in that it says to pre-set the **TUNING** control for **LOW FREQ** and the **MATCHING** control for **MIN C**, but they are only labeled from 0 – 10. So I assumed that 0 meant **LOW FREQ** and **MIN C**. This seemed to work for me.

Finding resonance is an iterative process, wherein you increase the **TUNING** control in small increments while adjusting **MATCHING** through its full range, while listening for a noise peak at each **TUNING** control position. Once you've found the peak, apply RF power and fine tune the SWR. I found that the **TUNING** control was quite sharp, while the **MATCHING** control was broader. Also, regardless of what the manual states, this is not

Adding an Internal SWR Indicator

For portable operation, I prefer a minimum amount of equipment for easy transport, setup, and use. So my one pet peeve with the MFJ-9232 was that you must use an external SWR meter if your radio doesn't include one. As it turns out, there is enough room inside the MFJ-9232 to add a resistive bridge SWR indicator. This modification has the additional advantage of limiting the worst-case SWR your transceiver sees to 2:1 during the tuning process. Figure 5 shows the circuit. The Caddock 50 Ω, 15 W thick-film resistors used take up less room than 2 W resistors with leads would. An ultra-bright LED serves as the SWR indicator.

All the parts are mounted on a 1.2 × 1.2-inch piece of 0.020-inch-thick copper-clad PC board material.

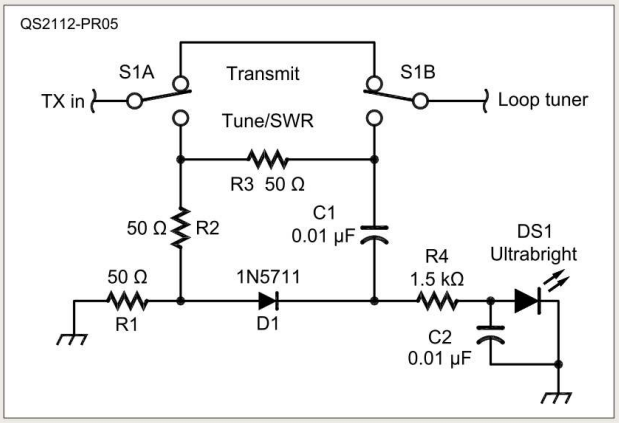


Figure 5 — Schematic of the resistive bridge SWR indicator. Mouser part numbers are given in parentheses (**www.mouser.com**).
D1 — 1N5711 Schottky diode (511-1N5711)
C1, C2 — 0.01 µF, 500 V disc ceramic capacitor (594-D103K69Y5PL63L0R)
DS1 — 10,000 mcd, 5 mm ultra bright red LED (604-WP7113SECKJ3)
R1 – R3 — Caddock 50 Ω, 15 W thick-film resistor (684-MP915-50) plus #2 screws, nuts, and lockwashers for mounting
R4 — 1.5 kΩ, ¼ W resistor (71-CCF071K50GKE36)
S1 — DPDT toggle switch (612-200MDP1T1B1M1QE)

Figure 6 shows the bridge mounted inside the MFJ-9232. Holes were drilled in the front panel of the MFJ-9232 for the new switch and LED. The SWR bridge is mounted to the MFJ-9232 front panel using the switch mounting hardware. I labeled the switch positions (**SWR** and **TX**) using Casio white-on-clear labeling tape.

Now it is very easy to tune the MFJ-9232. After peaking the receiver noise, flip the switch to the **SWR** position, transmit a low-power (5 W or less) signal, and tweak the MFJ-9232 controls until the LED noticeably dims or, preferably, completely goes out. Flip the switch back to **TX** and you're ready to go. During the tuning process, you can apply up to 25 W to the circuit, but there is limited heat-sinking for the resistors available on the copper-clad PC board. Keep tuning time to a minimum if applying that much power. Additional photos are available from **www.arrl.org/qst-in-depth**.

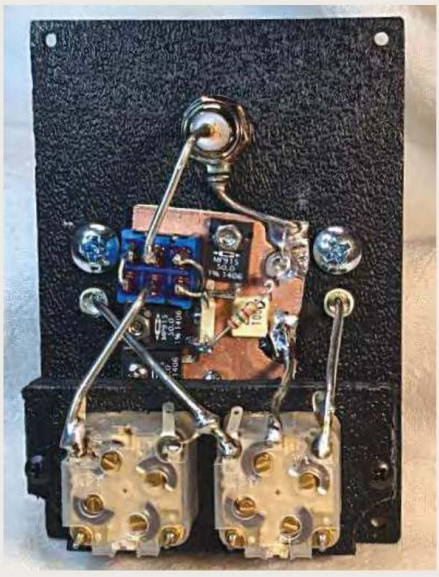


Figure 6 — The SWR bridge can be mounted inside the MFJ-9232.

a very high-Q antenna system when used with the recommended wire lengths. So once the antenna is tuned, you can actually move around within a significant portion of that band without having to retune.

I have three portable radios: a Xiegu G90, an Elecraft KX3, and a QRP Labs QCX-mini 20 meter transceiver. I found that when adjusting the **TUNING** control it was hard to detect noise peaks just by listening, so my starting SWR was often greater than 3:1.

The KX3 was the easiest transceiver to use, as it has a built-in SWR meter and puts out a low-power tuning carrier into even a pretty high SWR. This made it easy to trim the MFJ-9232 SWR.

The G90 also has an internal SWR meter, but the transmitter folds back power when it encounters an SWR greater than 3:1 regardless of transmitting power. This made it difficult to trim the SWR. However, I was able to get close to an optimum tuning solution by looking at the G90's spectrum display, which made it quite easy to see the noise peak differences. This normally got me to an initial SWR of under 3:1, and then I could fine tune the MFJ-9232.

The QCX-mini doesn't have an internal SWR meter, so I used an external one. I was always able to tune the SWR to 1:1 on 40 meters through 10 meters, all the bands on which I tested the MFJ-9232. Tuning was not difficult at all.

On the Air

For my on-the-air tests I used the 20-foot loop on 40 and 30 meters and the 9-foot loop for 20 meters, both of which worked quite well for me. The loop wires were attached to a tree and fence near the picnic table in my backyard. I was easily able to make several CW contacts on all three bands, as well as a few SSB contacts on 20 meters. These would be my wire lengths of choice for portable operation — at least until the higher frequency bands start opening up a bit more. My operating time was somewhat limited due to the summer Texas heat!

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

Win4IcomSuite Software

Reviewed by Steve Ford, WB8IMY
wb8imy@arrl.net

The Icom IC-7300 packs a wealth of features into a compact case — and does so at a reasonable price. No radio is perfect, though. A commercial radio's design is limited by constraints imposed by size, anticipated selling price, and much more. In the case of my IC-7300, I find that the spectrum scope display is smaller than I would like. These days I find that eyeglasses are mandatory operating aids.

I was envious of the displays I saw at other stations. Those lucky hams controlled their transceivers through software and luxuriated in simulated controls, indicators, and, yes, spectrum scopes splashed across large, wide-screen monitors. They tuned frequencies with mouse clicks on colorful waterfall displays. They could see every signal across hundreds of kilohertz at once.

In some instances, their transceivers were in other rooms within their homes, controlled remotely through their Wi-Fi networks while the operator lounged on the couch with a laptop computer. And then there were the radios located hundreds of miles away, yet you could hardly tell; the software control was as smooth as butter.

I soon decided that having software control was a "club" I wanted to join.

Introducing *Win4IcomSuite*

Win4IcomSuite by Tom Blahovici, VA2FSQ, costs just $50 and meets my needs. Not only does it provide remote control of the IC-7300, it also adds flexibility not found in the radio itself.

As the name suggests, *Win4IcomSuite* is a Windows application that works with many recent Icom transceivers. For this review I used it with my IC-7300, but the functions are much the same for other models.

The *Win4IcomSuite* also has six "virtual radios" that can interface to third party software such as *HRDLogbook*, *DM780*, *DXLab Suite*, *N1MM+*, *Log4OM*, and many more. This means that *Win4IcomSuite* can run

Bottom Line

Win4IcomSuite software includes many useful display and control features for the IC-7300 or other Icom transceivers.

Figure 7 — The primary *Win4IcomSuite* control window.

alongside these applications while still handing the tasks of transceiver control.

To get the best performance from *Win4IcomSuite*, you'll need a monitor capable of at least 1920 × 1080 resolution, the 64-bit version of Windows Vista, 7, 8, or 10; and a modern computer (for example, a PC with an Intel Core I3 processor or higher). The recommended minimum RAM is 4 GB, but I'd suggest 8 GB.

A detailed manual is available, and I strongly encourage new users to read it carefully before firing up the software. One aspect that has the potential to be confusing is the initial connection between *Win4IcomSuite* and the radio. To support complex functions such as the spectrum scope display, data must fly back and forth at a fast clip, so a 115,200-baud connection is required. This means you must make some changes in the transceiver menus to allow the radio to support this data rate, and to establish a dedicated line for the software. For example, you may need to "unlink" the IC-7300's USB port from its CI-V remote function.

At my station, I use the IC-7300 with several different software applications, some of which do not support a 115,200-baud data rate. It would be a pain to have to manipulate the IC-7300's menus each time I switch between the *Win4IcomSuite* and the other application. Fortunately, *Win4IcomSuite*'s virtual radio feature solves this issue, although setting up the feature may be a non-trivial exercise for some hams. My approach was to purchase one of the CI-V interface cables you'll find online for less than $30. This allows me to configure *Win4IcomSuite* to use the IC-7300's dedicated USB port exclusively at 115,200 baud, while allowing my other applications to use the transceiver's CI-V port at a different data rate.

Windows Galore

The primary *Win4IcomSuite* control window (Figure 7) is a pleasure to behold. Every function of the IC-7300 is available here. You can switch between transmit and receive, raise and lower the audio gain, activate the built-in antenna tuner, adjust filter bandwidths, and adjust many other settings. Tom has even modeled two "meters" complete with bouncing needles. Right clicking on the meters allows you to select their measurement functions.

The *Win4IcomSuite* **WINDOW** menu reveals all the other companion displays you can open, including the spectrum scope. All the companion windows can be open simultaneously.

Opening the **CLUB LOG SPOTS** window causes *Win4IcomSuite* to query the Club Log DX cluster and display the results (there is a pause of a few seconds while it is making the initial inquiry). If you have a free account with Club Log and upload your logs to the database, you'll see color-coded spots in this window that flag DXCC entities you've worked, or still need. If the spectrum scope is running (see Figure 8), *Win4IcomSuite* will also display any Club Log spots that fall within the frequency range you are monitoring.

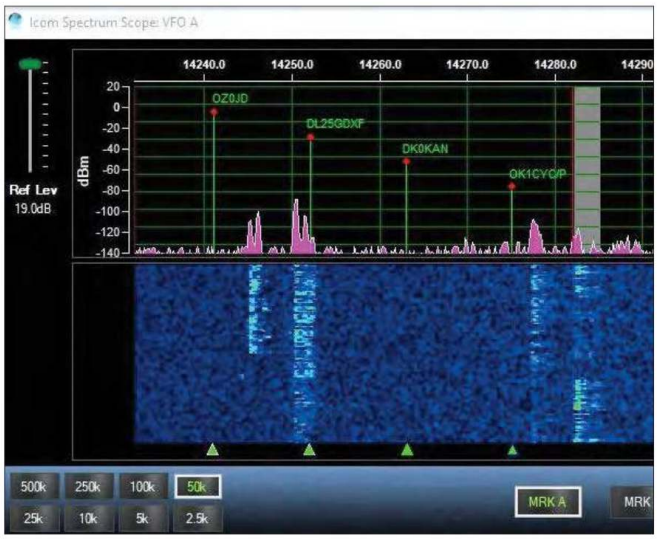


Figure 8 — *Win4IcomSuite* renders the IC-7300's spectrum display in an easy-to-view size (this is just a portion of that screen). When the Club Log DX cluster window is active, spots are displayed within the spectrum scope as well.

Figure 9 — A portion of the EiBi shortwave listening database window.

For shortwave listening, *Win4IcomSuite* includes a window that displays the Eike-Bierwirth (EiBi) shortwave listening database (see Figure 9). The application updates this information on a regular basis, and you can scroll through all the broadcast and utility listings that appear. A mouse click will take you directly to the frequency. You can even sort the list so that it only displays stations known to be on the air at that moment.

Win4IcomSuite includes a separate window for frequency memories. You can store favorite frequencies here and instantly select them with a mouse click. *Win4IcomSuite* includes scanning functions that you can access through a separate window.

Win4IcomSuite also provides a CW sending terminal. This is extremely convenient for DX hunting and contest use, but of course, you can type out a CW conversation as well if you'd rather not use a key. In this window you can even log the contact in *Win4IcomSuite*'s ADIF logbook.

Remote Control

With *Win4IcomSuite*, you can control your radio remotely, either through your home network or at a distance via the internet. There is a separate server program that links with *Win4IcomSuite* to make this possible. This program must be running on a computer connected to the transceiver.

There is also a client application that is installed (along with *Win4IcomSuite*) in whatever computer you are using at your operating position. When everything is installed and configured, you access your transceiver by starting *Win4IcomSuite* and then running the client application that handles receive and transmit audio. I tried it on my home network and it worked perfectly.

The user manual goes into substantial detail about how to set up remote operating. If you're not familiar with the computer networking, you'll need to read this section with particular care. This is especially true if you plan to attempt internet remote control. Tom has made the process as smooth as possible, but you'll still have to jump several hurdles such as possibly opening a dedicated port in your router configuration and dealing with alerts from your firewall software.

Win4IcomSuite has more features than I can cover in a single review. Suffice to say it is a highly attractive, well-written application that is more than worth the price. I'd suggest downloading the trial version first. This version is fully functional for 30 days, giving you plenty of time to make sure it works well at your station. Larger versions of the screen captures in this review and additional illustrations are available from **www.arrl.org/qst-in-depth**.

Manufacturer: Tom Blahovici, VA2FSQ; **icom.va2fsq.com**. Price: $60. There is also a version of this software for Yaesu transceivers at **yaesu.va2fsq.com**. and Elecraft radios at **va2fsq.com**.

Steve Ford, WB8IMY, wb8imy@arrl.net

Eclectic Technology

Can You Upgrade to Windows 11? Maybe Not!

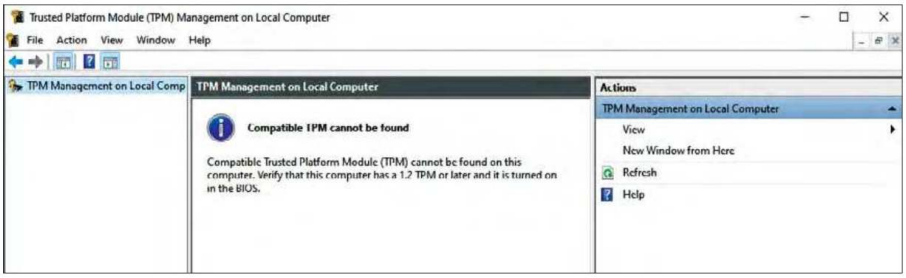


Figure 1 — Bad news from Windows for my station PC. TPM either doesn't exist or hasn't been enabled.

Microsoft has announced the debut of the new Windows 11 operating system. It features a new look, improved performance, and several interesting functions. Best of all, the upgrade is *free* for Windows 10 users.

However, there is a "gotcha" in store for those of us with station computers that have motherboards manufactured prior to 2016. If you're one of these unfortunate folks, when Windows Update attempts the free upgrade you may receive an error message: "This PC can't run Windows 11." That's because Windows Update will only perform the upgrade if you own a "supported system."

The issue involves *TPM*, the Trusted Platform Module, and a function known as *Secure Boot*. These security features must be present and functional before Windows 11 will install. The TPM, in particular, is critical.

If your machine is new enough to include a TPM, but it has been disabled for whatever reason, you can activate it by accessing your PC's BIOS menu. More about that in a moment.

What are TPM and Secure Boot?

TPMs are controversial among security specialists and governments. A TPM is a strong preventative against firmware attacks, but it may restrict the kinds of software your machine is allowed to run.

Secure Boot is a feature in your computer's software that controls which operating systems are allowed to be active on a single PC. It prevents certain types of malware from taking over your machine, but it can also prevent you from being able to install a second operating system on your computer (such as Linux).

Do a TPM Check

Here is a quick test to see if your computer has a version 2.0 TMP enabled. Go to your Windows search box in the lower left corner of the desktop, type **tpm.msc**, and press the **ENTER** key.

If a screen appears saying you have it, you're good to go. If you see a screen like the one in Figure 1, you have a problem.

Meddling with BIOS

There is a chance that your PC has the TPM module, but it hasn't been turned on. To find out, you'll have to enter the Basic Input/Output System, better known as *BIOS*.

Many hams have serious qualms about doing anything to BIOS. This is understandable, as making the wrong changes in the BIOS can wreak havoc on your computer. If you are not confident, stop here and take your station computer to a knowledgeable friend or to a PC service shop.

If you choose to proceed, grit your teeth, turn on or restart your computer, and immediately press and hold the **DEL** key on your keyboard. Keep holding the key down until you are presented with the BIOS menu.

Now look for a security section, or something similar. It may be hiding within an "advanced" menu. When you find it, see if TPM is included among the available options.

If you don't see a menu option pertaining to the TPM, that's the end of the line. Exit the BIOS without saving the configuration.

On the other hand, if you discover that a TPM is present but disabled, enable it. Save your BIOS configuration and exit. Don't touch anything else. When your computer boots up again, rerun the TPM check. With luck, you'll be presented with good news.

If not, your remaining option may be to do a manual Windows 11 install or upgrade from a downloaded ISO file. This approach may work for those running 6th- or 7th-generation Intel Core CPUs or first-generation AMD Ryzen processors.

I'm one of the unlucky, but for now I am content with Windows 10 and my current hardware. No doubt there is a new PC in my future, but not today.

Dave Casler, KEØOG, askdave@arrl.org

Ask Dave

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

Antennas, Transmission Line Losses, and More

160-Meter Antenna Woes

Q Allen Woodruff, KE8CCD, of Ohio writes: I built a single-band 160-meter doublet (dipole) antenna with #14 stranded wire, fed with 100 feet of 450 Ω ladder line into a homebrew 4:1 balun to 50 Ω coax. I used the standard formula of L(ft) = 468/f (MHz) to get the correct length for the dipole. Why do I have such a high standing wave ratio (SWR)?

A There are several things going on here. A single dipole will not cover the entire 160-meter band, because the band is so wide compared to its center frequency. The more important factor is height above ground. For optimal performance, a 160-meter dipole should be ½ wavelength above the ground. At 1.9 MHz (the center of the band), the height would be 123 feet (37 meters) in the air. That takes two very tall poles! When an antenna is lower than that, the feed-point impedance falls from about 70 Ω to about 30 Ω and then rises a bit when it's even closer to ground.

Next, let's look at your feed line. The 450 Ω ladder line is a mismatch to the dipole. If you were to feed the ladder line all the way to your wide-range tuner, that wouldn't be too much of a problem because the feed line's high impedance can handle quite a mismatch. However, a 4:1 balun that's 100 feet down the ladder line and attached to a 50 Ω coax cable multiplies the impedance by four times, or 200 Ω, which is quite a mismatch to the ladder line (you really need a 9:1 balun).

If someone at your local club is a whiz at Smith charts, they can help plot all of this and provide an explanation of what's going on. There's not a lot about Smith charts in the amateur literature, and I'm afraid I know next to nothing about them, except that some people find them useful.

I would suggest dropping the coax and balun and getting more ladder line so that you have a run from the antenna feed point all the way to your tuner. If the SWR is less than 10:1, a wide-range tuner should be able to handle it.

If the antenna is only about 1/10 wavelength off the ground, you'll have a nice near vertical incidence skywave (NVIS) antenna on the band. That's good for local communications over a range of 300 miles or so.

Poor SWR Loses Power in a 50 Ω Feed Line

Q Jim Morgan, W9EMM, of Illinois asks: There's a lot of talk about the radiating power lost when using a tuner. Have you ever used a wattmeter at the transmitter and another at the antenna to see the actual wattages?

A Let's clear up a common misconception: except for very minor resistive losses in its wires, there's no loss in an antenna tuner because all of the components are reactive (usually two capacitors and one inductor). Reactive elements store and release energy; only resistive elements turn current into heat.

The power loss in a system with a tuner is almost all in the ohmic losses of the transmission line or the antenna, or in any reflected power that makes its way back to the transmitter's final amplifier stage.

Using two wattmeters for measurement (like you mentioned) will reveal the power lost in the transmission line for your antenna (see subsection 23.5.4 in the 24th edition of *The ARRL Antenna Book*). I don't have a remote-reading wattmeter to put at the junction of the transmission line and the antenna, but I can easily calculate the line loss, which would be a function of the cable used and the SWR on the line. Let's look at a commonly used coax: RG-8X. Table 23.1 in *The ARRL Antenna Book* shows its loss at 10 MHz (30 meters) and is about 0.8 dB per 100 feet, so it's a good cable for general HF operations.

However, things change with SWR. Higher SWR indicates greater reflected power, so the same energy transits the line multiple times, adding to the total resistive losses. Figure 1 shows this relationship between SWR and line losses. If the transmission line loss is 0.8 dB when the load and line are matched, a bad SWR figure of 10:1 (which can still be handled by most wide-range antenna tuners) will add almost 2 dB of loss, for a total of about 2.7 dB. Therefore, almost half of the transmitter's output

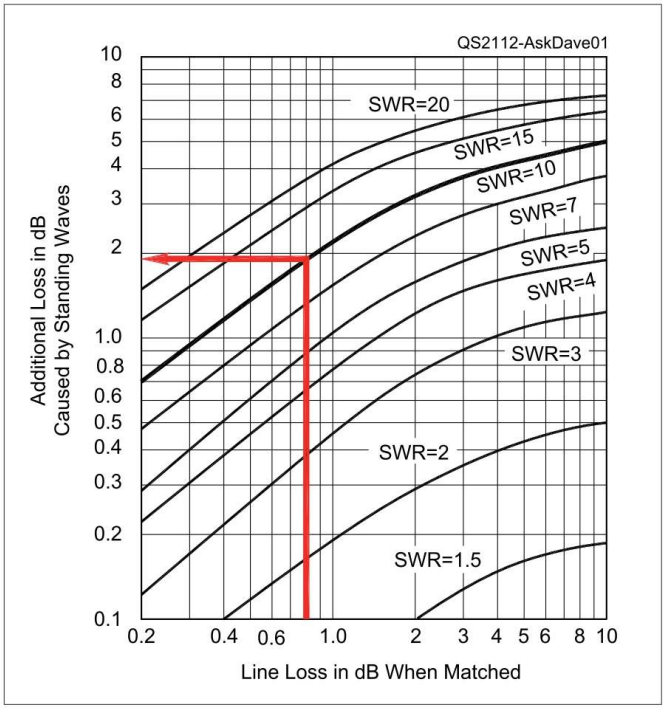


Figure 1 — This figure from *The ARRL Antenna Book* shows the additional loss introduced by high SWR. Although the ohmic loss caused by the coaxial feed line itself is only 0.8 dB, the SWR of 10:1 adds nearly 2 dB of loss, causing almost half the transmitter power to be lost as heat in the line. The long-term fix is to work on the antenna system to improve the SWR.

power will be wasted in the feed line's resistive losses. While this can be workable for temporary operations, it would be wise in the long run to work on the antenna system to lower the SWR as close to 1:1 as possible.

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

Where Are the Radials?

Q Bob Miner, K5JPB, of New Mexico asks: I understand that a vertical antenna should have numerous radials to overcome ground losses. That's especially important in the Southwestern desert, with its dry, sandy, rocky soil. For portable operations, I get good results with eight 10-foot radials. Manufacturers of portable verticals frequently recommend one long "counterpoise." That may work, but it seems to contradict all of the material I've read about radials. What's up?

A The definition of "counterpoise" is rather hazy. Several sources say it's just another name for a tuned radial field, although current usage seems to be more generalized. I tend to think of it as something capacitive (or at least reactive) for the antenna to work against, which is perhaps equally hazy. If the counterpoise is too long it can radiate, putting RF where we don't want it.

I've seen portable antennas with a single wire or element as a counterpoise, but you're correct that it isn't much of a radial field. A vertical antenna with a single-wire counterpoise is decidedly a compromise and less effective than a full-size dipole a half-wave in the air. In a portable situation, however, an antenna like this works well enough, in the sense that "any antenna is better than no antenna." You can make contacts even with portable QRP gear, especially on modes such as FT8, which are designed for low power and non-optimal situations. The fact that these antennas work at all (and many people even use them successfully), has led some manufacturers to make the single counterpoise into a marketing feature.

My primary vertical antenna is a ground-mounted SteppIR BigIR with more than 30 radials of various random lengths. It works like a charm. An elevated vertical can get by with two tuned (resonant) radials per band, although four would be better. For my YouTube channel (**www.youtube.com/davecasler**), I'm testing a DX Commander portable vertical antenna with the extra radials kit, which has 45 radial elements. I anticipate good performance.

The bottom line is that radials matter. Good luck with your portable operations!

Antenna vs. High Brush

Q Bill Brooks, KC3WJB, of Pennsylvania asks: I have an end-fed half-wave (EFHW) dipole strung between my house and a tree that's 150 feet away and up a steep hillside. When I put it up, I cleared brush out of the way. Should I be concerned about the brush, or should I clear it again?

A Although it sounds like your question is about the brush affecting the RF performance, which it will only minimally, my concern is for the physical protection of your antenna. If the brush grows high enough, it could easily snap the wire in high winds. I recommend installing a spring at one end of the antenna (the end at your house would probably would be the most accessible). A screen door spring would work well. You can also use multiple bungee cords if they're protected from the sun inside a plastic pipe or something similar. The idea is to have enough tension on the line to keep it reasonably tight, but also enough give to avoid breakage if the brush hits it.

Or you could hire some local teenagers (with their parents' permission) to cut the brush, and then show them your ham shack. Maybe it would pique their own interest in ham radio!

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.

Hints & Hacks

Reviving Old Scanners; Repurposing Plastic Clothes Hangers

Replacing a Boatanchor Backlight

I've owned two Realistic (RadioShack) PRO-2006 scanners since the mid-1990s and they're still top-quality analog receivers, covering the frequency range from 25 – 1300 MHz and capable of demodulating AM and narrow as well as wideband FM signals.

One of the historical problems with this series of scanners, starting with the PRO-2004, the PRO-2005 and finally the PRO-2006, is that the electroluminescent (EL) backlight that illuminates the LCD display weakens over time. Both of my displays had become almost unreadable, even under good ambient lighting. Fortunately, it is not only possible but surprisingly easy to replace these backlights, and this fix can be applied to other radios as well.

After disassembling the scanner and removing the front panel, the original backlight is easily unsoldered from the printed circuit board. The backlight then slips out from underneath the LCD display (see Figure 1).

The original parts are no longer available, but new EL panels are plentiful and even if they are oversized, they can be trimmed to size to create a suitable replacement. I found new panels on eBay for less than $10 each. You can see the difference in size between the original and the untrimmed replacement in Figure 2. I was apprehensive about cutting the large panel, as I wasn't sure whether the panel's brightness level was in some way related to the surface area of the electrical connection made on the top of the panel (you can see the metal connection from the top pin as it runs up along the left-hand side and across the top of the panel). It turns out, though, that as long as a connection is maintained at some point on the top of the panel it will in fact illuminate fully (the second pin connects to the bottom side of the layered panel).

To successfully trim the EL panel, you need a very sharp pair of scissors or a box cutter with a fresh blade; a dull cutting edge may potentially delaminate the panel's layers, which could cause dark spots or even failure. I taped the replacement panel down to my cutting surface and traced the outline of the old panel on it

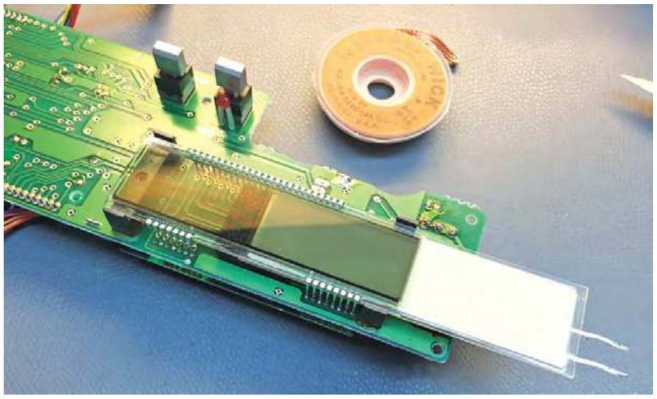


Figure 1 — After unplugging the display board and removing the metal shield, you simply unsolder two leads and slide the original backlight panel out.

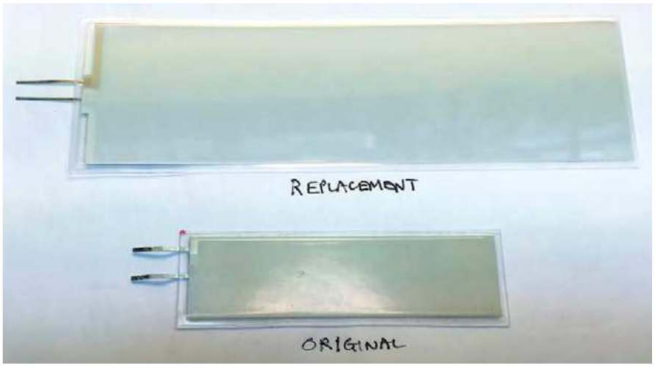


Figure 2 —The size difference between the original panel and the untrimmed replacement is not a problem!

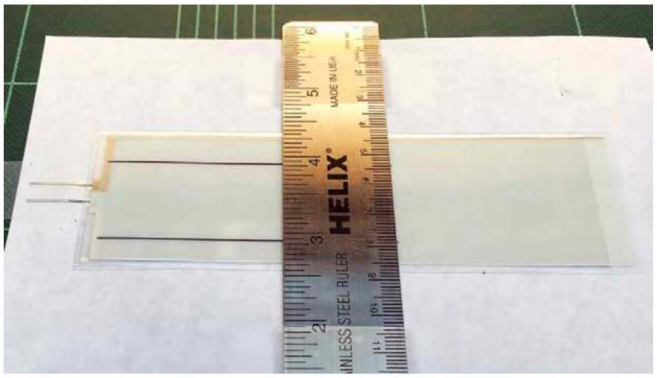


Figure 3 — With a marker and the original panel as a template, trace its outline on the replacement panel prior to cutting. Use a straightedge to guide your blade for clean, accurate cuts.

Figure 4 — It's obvious which scanner has the replacement backlight panel!

(Figure 3). I taped the straightedge down along the lines before making the cuts; that kept the straightedge and blade from wandering as I made the cuts.

After completing the cuts, I applied a small amount of Super Glue® (cyanoacrylate) along the edges to seal them and keep any moisture from migrating into the panel.

With the new EL panel in place, the improvement is remarkable, as you can see in Figure 4.

EL panels use an ac power source, usually a simple inverter circuit producing up to 100 V at a frequency of several hundred hertz or more. Although the current needed to power one an EL panel is low, the relatively high voltage posed a potential shock hazard — another reason to seal the edges.

This inexpensive repair should extend the service life of the scanner by many more years. Knowing now that the procedure works, I even purchased a couple of additional replacement panels to salt away for future needs. — *73, Dino Papas, KLØS,* **kl0s@cox.net**

A Zero-Dollar Insulated Shaft

If you're ever in need of a plastic shaft for a homebrew project such as a receiver, transceiver, or antenna tuner, you can make one in short order from a plastic clothes hanger for almost no cost. A single hanger can provide two shorter lengths and one longer. Simply cut the necessary pieces to length and then grind the ends to fit whatever shaft couplers you are using. — *73, Edward Barbacow, K3ZCY,* **k3zcy@zoominternet.net**.

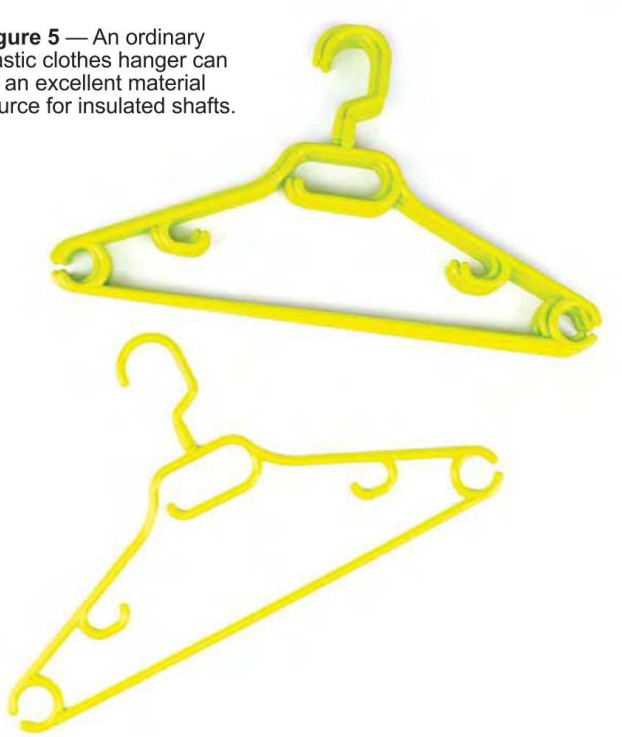


Figure 5 — An ordinary plastic clothes hanger can be an excellent material source for insulated shafts.

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

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

Strays

QST Congratulates…

George J. Whalen, NY9A, on the publication of his book, *The Story of Radio: To 5G Wireless*, which recounts the history of radio technology from the landline telegraph to the beginnings of the 5G rollout. The book is available from **Amazon.com** for Kindle or in softcover. A hardcover edition will be available soon.

How the Transatlantic Test of 1921 Initiated International Amateur Radio Communication

This one-way transmission test has greatly impacted the advancement of amateur radio techniques, technologies, and discoveries over the past 100 years.

Carl Luetzelschwab, K9LA

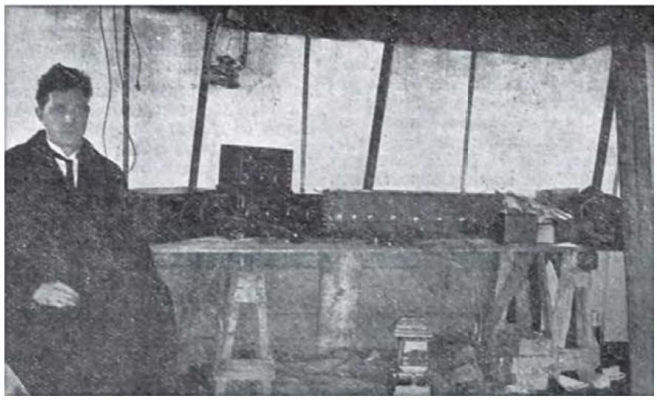
In 1921, signals from huge VLF stations in the US reached across the Atlantic Ocean to Europe, and amateurs communicated from the east coast of the US to California. Many amateur radio operators believed that they, too, could span the Atlantic, even with modest stations.

ARRL strongly believed in this endeavor, and sent Paul Godley, 2ZE, a seasoned operator and accomplished receiver designer, to the UK via the *Aquitania*, to be an auxiliary to the British efforts to listen for American hams. The December 1921 Transatlantic Test was the second to be completed, following the first unsuccessful test held earlier that year. The December test was a one-way transmission. European hams listened for American hams, and successfully received the signals of many US hams in Ardrossan, Scotland, where Godley was, as well as in England, Holland, Germany, and France. Two-way transatlantic contacts weren't completed until 1923.

Here are some of the ways this successful test was the first step forward in the progression of amateur radio.

The Radio Act of 1912

Because of interference to commercial and naval radio operations, the Radio Act of 1912 relegated amateur radio operators to wavelengths of 200 meters and shorter (frequencies of 1.5 MHz and higher). At that time, it was believed that these frequencies were only useful for relatively short distances, and therefore considered to be a "wasteland." Fortunately, the 1921 Transatlantic Test dispelled this myth, and led to greatly increased use of shortwave frequencies for transoceanic contacts.



The Ardrossan station with Inspector E.D. Pearson of the Marconi International Marine Communication Co., who was the checking operator throughout the test. [February 1922 *QST* photo]

Understanding the Ionosphere

The Transatlantic Test of 1921 was one of many factors that brought about new research of the ionosphere. Although American electrical engineer Arthur Kennelly and English mathematician Oliver Heaviside independently postulated the existence of the ionosphere in 1902 from Italian electrical engineer Guglielmo Marconi's transatlantic feat in 1901, it wasn't until 1924 that English physicist Sir Edward Appleton proved the existence of the ionosphere.

We now have a much better understanding of the ionosphere, and realize that our HF frequencies can easily allow long-distance contacts with modest stations.

The Beginning of DX Operation

Although the 1921 Transatlantic Test was only a one-way transmission because of severe restrictions on transmitter power and antenna size for British hams, it set the stage for late 1923, when the first two-way contacts were completed between the US and Europe.

When ARRL sent Godley to the UK to listen for signals from American radio amateurs, it was essentially the first-ever DXpedition. Thus, the Transatlantic Test, and other tests that followed, gave rise to the practice of making DX contacts, as well as hams traveling for DXpeditions.

The Emergence of Receive Antennas

In 1920, the Radio Corporation of America (RCA) tasked Harold Beverage with developing receiving systems (receivers, antennas, and interference reduction techniques) for transoceanic communications. In June 1921, Beverage obtained a US patent for his radio receiving system: the Beverage antenna.

Fortunately, Godley met Beverage aboard the *Aquitania*. Godley tried Beverage's new invention, hoping to improve his reception of signals from America. This was a critical factor for Godley's success during the 1921 Transatlantic Test. This type of antenna is now used by many 160- and 80-meter operators around the world, to improve the signal-to-noise ratio (SNR) on those bands with higher noise levels. The invention of improved receiving antennas emerged from the Transatlantic Test, although radio amateurs didn't use them in meaningful numbers for more than 50 years.

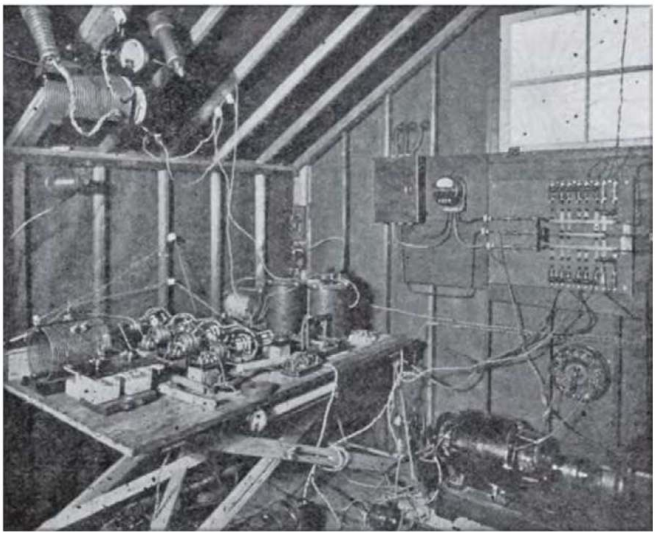
A Rise in CW Transmissions

As reported by The Editor of *QST* in "The Story of the Transatlantics" in the February 1922 issue, Godley, the British, and a few other countries heard many American stations during the 1921 test. Most of these American signals used CW transmissions, and only a few spark transmitters were heard. These results set the stage for the increased use of CW and the demise of spark.

The majority of the American stations that Godley heard used CW, and Godley used a superheterodyne receiver, invented by American electrical engineer Edwin Armstrong in 1918. This sent amateur radio on its way to improved CW transmitters and superheterodyne receivers capable of operation at much higher frequencies.

Summary

The Transatlantic Test of 1921 was a great step forward for amateur radio operators. I'd like to thank those who participated in both the one-way and two-way tests all those years ago for their efforts. They ushered in the dawn of international amateur radio. I'd also like to thank Frank Donovan, W3LPL, for his contributions to this article.



The 1BCG transmitter, organized by members of the Radio Club of America in Greenwich, Connecticut, was the strongest of many stations in the east coast of the US heard by Paul Godley, 2ZE, during the December 1921 Transatlantic Test. It ran about 1,000 W input, and it took up the entire corner of a small building. Now, a modern transceiver with a 1 kW input amplifier would easily fit on a desktop. [Radio Club of America photo]


AMERICAN RADIO RELAY LEAGUE
Amateur Radio Station
282 Fern Street,
West Hartford, Conn.

1MO

Radio F8AB

This will confirm communication with you on 11-27-23 at 10 38 P. M., E.S.T. Wave 103 meters.

Your Signals were heard on ____ at ____ M., E.S.T. Wave ____ meters.

Will be glad to give you a description of 1MO if you want it, OM. Hw?

La QSL de 1MO.
Oui, vraiment FB !

Best 73, J. H. Schnell

F. H. Schnell "FS"
Traffic Manager, A.R.R.L.

Operator

Oh Boy!!! F.B.

A QSL for one of the first two-way transatlantic contacts. [**www.hamgallery.com** photo]

For more information on the Transatlantic Test of 1921 and commemorations of its anniversary, visit **http://arrl.org/transatlantic**.

Carl Luetzelschwab, K9LA, started his radio career as a shortwave listener in the late 1950s, using a National NC-60 receiver. After discovering amateur radio, he received his Novice-class license in 1961. He selected K9LA as his call sign in 1977. Carl enjoys propagation, DXing, contesting, playing with antennas, and fixing/using vintage equipment. He's a graduate of Purdue University (where he earned his Master's degree in electrical engineering) and worked for Motorola (in Schaumburg, Illinois, and Fort Worth, Texas), and for Magnavox (now Raytheon) in Fort Wayne, Indiana, as an RF design engineer. Carl retired in October 2013. He can be reached at **k9la@arrl.net**.

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

Celebrate the Transatlantic Tests with ARRL and RSGB

ARRL and the Radio Society of Great Britain (RSGB) have planned a series of joint events to celebrate the centenary of the successful 1921 Transatlantic Tests by radio amateurs, which spurred technological advances in long-distance and global two-way radio communications. Watch for further information about these events in 2021 and 2022.

160-Meter Transatlantic Centenary QSO Party 0200 – 0800 UTC Sunday, December 12, 2021

Commemorating the very hour 100 years ago, when the first transatlantic message from amateur radio station 1BCG in Connecticut reached the listening station of Paul Godley, 2ZE, in Ardrossan, Scotland, ARRL and RSGB will activate CW-only special event stations for 6 hours.

A team of stations from GMDX Group, a Scotland-based DX society, will share the operations as GB2ZE in Scotland, while ARRL will activate W1AW from Newington, Connecticut. Operations will commence at 0200 UTC and continue until at least 0800 UTC. If propagation conditions across the Atlantic permit, operations will continue beyond 0800 UTC.

GMDX Group will award a *quaich* (a traditional Scottish two-handled drinking cup that commemorates friendship) to the first stations in North America and the UK to complete contacts with both W1AW and GB2ZE during the QSO party. ARRL and RSGB will jointly publish successful contacts, and will offer a downloadable certificate to stations that contact one or both activated stations.

More Events and Commemorations

For more information, visit **www.arrl.org/transatlantic** and **www.rsgb.org/transatlantic-tests**.

Transatlantic Centenary DX Marathon December 2022

ARRL and RSGB will commemorate the centenary of the Transatlantic Tests held between 1921 and 1923 with a DX marathon in December 2022. All radio amateurs will be encouraged to mark these historic events by making contacts throughout the month. Full details will be available closer to the date.

W1AW Commemorative Transatlantic QSL Card

Stations making contacts from December 11, 2021 to December 31, 2022, may request a commemorative W1AW QSL card. US stations send a self-addressed stamped envelope; international stations request a QSL card via the ARRL QSL Bureau.

2021 ARRL 160-Meter Contest

From 2200 UTC Friday, December 3 to 1559 UTC Sunday, December 5, this annual CW contest is most like the Transatlantic Tests of the early 1920s. Visit **www.arrl.org/160-meter** for contest rules and information.

Special Event Call Sign GB1ØØ2ZE

From December 1 to December 26, 2021, the Crocodile Rock Amateur Group (CRAG), based near Ardrossan, Scotland, will activate the special event call sign GB1ØØ2ZE, to commemorate the successful reception of amateur transatlantic signals by Paul Godley, 2ZE. In tribute, RSGB will encourage stations in the UK and Crown Dependencies to add the suffix "/2ZE" to their normal call sign throughout the period.

"A Glorious Page" in the History of Amateur Radio

Bruce Godley Littlefield, grandson of Paul F. Godley, 2ZE, contributed this image of a document that ARRL presented to his grandfather to commemorate the success of the Transatlantic Tests.

Bruce told ARRL, "It is the resolution presented to my grandfather by ARRL, dated February 17, 1922. This is roughly 18" × 28" and a magnificent work of art...I have had it re-matted and re-assembled with archival materials, though the frame and glass remain original. It was professionally scanned at high resolution so that copies could be made as desired, at the request of the other Godley grandchildren and their descendants."

The resolution commends and thanks Godley, who "accepted the invitation of the American Radio Relay League and at Ardrossan, Scotland, in the face of great physical discomforts, unfavorable climatic conditions, and technical handicaps, set up his apparatus and wrote a glorious page in the history of the American Radio Amateur by the unprecedented reception in Europe of twenty-six United States and Canadian amateur stations." It is signed by ARRL President Hiram Percy Maxim, ARRL Traffic Manager Fred H. Schnell, and ARRL Secretary K. B. Warner. [Used with permission; from the collection of Bruce Godley Littlefield, grandson of Paul F. Godley, 2ZE]

A Wager Won, An Ocean Spanned

An unusual artifact from ARRL's museum collection attests to high spirits at the time of the Transatlantic Tests.

In 1921, during the excitement leading up to the Transatlantic Tests, ARRL Secretary K. B. Warner, W1EH, offered to bet "a hand-painted derby hat" that US signals would be heard in Europe during the tests. W. W. Burnham, a well-known manufacturer of ham radio gear, accepted that bet.

As we know now, ARRL's representative in Ardrossan, Scotland — Paul Godley, 2ZE — heard many US signals during the tests. The success of the tests meant that Burnham owed Warner a hat. The use of the term "derby" baffled the British hatmakers (what we call a "derby" in the US is known as a "bowler" in England), so they made their best guess and painted a hat of the type traditionally worn at derby races.

Warner eventually donated the congratulatory topper, which features a hand-painted US flag on one side and a UK flag on the other, to ARRL. The cover of this issue of *QST* shows both sides of the hat and both flags, in honor of what hams on both sides of the Atlantic achieved in the Transatlantic Tests 100 years ago.


The American Radio Relay League, Inc.

Resolution

Whereas, in order to bring the radio amateurs of the United States and Canada and of the several European nations into closer contact, to demonstrate the possibility of transmitting radio signals across the Atlantic Ocean under the legal restrictions of limited power and wave-length prescribed by the governments of the United States and Canada to advance the radio art, and to facilitate the interchange of free messages between the citizens of different countries, the American Radio Relay League conducted certain Transatlantic Transmission Tests in the month of December nineteen hundred and twenty-one and

Whereas, the difficulties attendant upon the reception by European amateurs of American signals of such restricted power and wave length over distances in excess of three thousand miles were considered so great as to endanger the success of the tests and to justify the sending of the most skillful American amateur available to a European site to assist with his apparatus and experience in listening for American signals, and

Whereas, the Board of Direction of the American Radio Relay League was of the unanimous opinion that Paul Norman Godley because of his long experience in amateur work, his thorough knowledge of the requirements of this case, and his achievements as an experimenter and developer of highly efficient short-wave receiving apparatus, was best prepared to bring success to these tests, and

Whereas, the said Godley accepted the invitation of the American Radio Relay League and at Ardrossan, Scotland, in the face of great physical discomforts, unfavorable climatic conditions, and technical handicaps, set up his apparatus and wrote a glorious page in the history of the American radio amateur by the unprecedented reception in Europe of twenty-six United States and Canadian amateur stations, now

Therefore be it

Resolved, that the Board of Direction of the American Radio Relay League doors hereby tender to Paul Norman Godley its warmest congratulations on his remarkable achievement and its hearty thanks for his service to amateur radio in the faithful discharge of the duties accepted and performed by him in so highly commendable and meritorious a manner, and be it further

Resolved, that in testimony hereof these resolutions shall be appropriately inscribed and presented to Paul Norman Godley as certification of the appreciation of the American Radio Relay League.

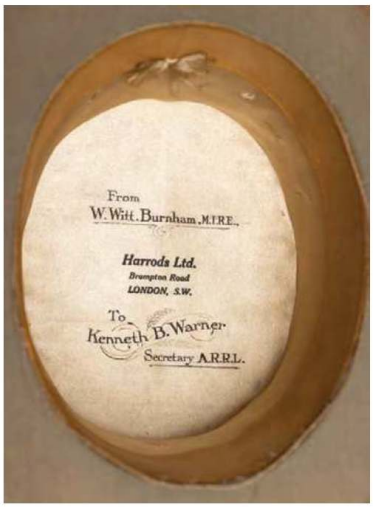
In Witness Whereof the Board of Direction has caused to be affixed hereunto its official seal and the signatures of its headquarters officers, at the office of the American Radio Relay League in Hartford, on this the seventeenth day of February in the Year of our Lord one thousand nine hundred and twenty-two.

Hiram Percy Maxim, President
H. B. Richell, Traffic Manager
K. B. Warner, Secretary


The UK flag adorns the left-hand side of the hat.

The US flag flies on the right-hand side of the hat.

The hand-painted inscription on the hat reads, "In Commemoration of the Success of The Anglo-American Wireless Test Organized by The A.R.R.L., 1921."



The interior of the hat features an inscription from W. W. Burnham to K. B. Warner, along with a label indicating that the hat came from Harrods, a famous London department store.

Happy Holidays and Peace on Earth

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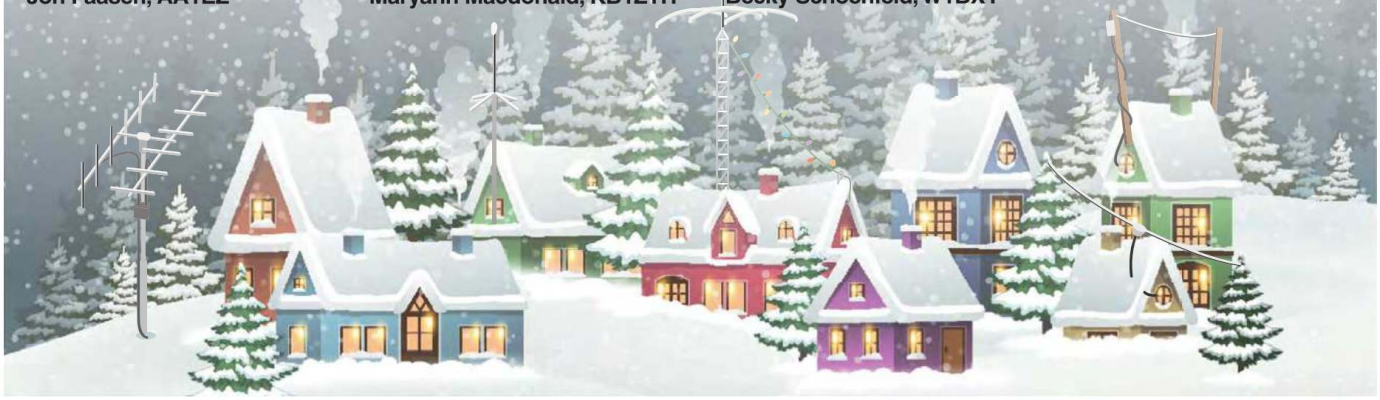
Maty Weinberg, KB1EIB
Joshua Weissman
Kelly Wells
Mark Wilson, K1RO



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 September 2021 activity report of the VM Program.

♦Technician operators in Mansfield, Ohio; Avon Park, Florida, and Pulaski, Tennessee, received advisories after making numerous FT8 contacts on 20 meters. Technician licensees do not have operating privileges on 20 meters.

♦A Volunteer Monitor in Mission Viejo, California, received a Department of Homeland Security, United States Coast Guard Certificate of Appreciation for his efforts in locating a defective transmitter on Marine Radio Channel 16 that was blocking emergency communications on that channel.

♦A former licensee in Durham, North Carolina, received an advisory for operating under a call sign and license cancelled by the FCC.

♦An operator in White Pine, Tennessee, received an advisory regarding operation on 7.137 MHz, a frequency not authorized under his General class license.

♦Operators in Swannanoa, North Carolina, and New Albany, Indiana, received Good Operator notices for exemplary operation during 2021 and for regularly assisting other operators with transmitter adjustments and amateur radio procedures.

♦The VM Program made one recommendation to the FCC for case closure.

♦VM Program statistics for August showed 2,008 hours on HF frequencies and 2,642 hours on VHF frequencies and above, for a total of 4,650 hours. — *Thanks to Riley Hollingsworth, K4ZDH, Volunteer Monitor Program Administrator*

Rick Lindquist, WW1ME, ww1me@arrl.org

Happenings

ARRL Continues Its Efforts to Preserve Amateur Radio Secondary Use of the 3 GHz Band

ARRL President Rick Roderick, K5UR, in a written statement (**www.arrl.org/arrl-statement-on-3-ghz-band-oct-2021**) on the newly filed H.R.5378 before the US House Commerce Communications and Technology Subcommittee on October 6, urged Congress to direct the FCC to preserve Amateur Radio's secondary use of the 3 GHz band. President Roderick's statement was the result of a quick, well-organized response by ARRL to counter the continuing threat to Amateur Radio's secondary use of the 3 GHz band.

Some 10 days earlier, ARRL became aware of a provision in the $3.5 Trillion Budget Reconciliation Bill that would have required that approximately 200 MHz of the 3.1 – 3.45 GHz band be reallocated to the use of 5G vendors. Moving swiftly, the ARRL Executive Committee authorized FCC counsel to begin preparations to respond. But, confronted with the probable delay of the Reconciliation Bill and an uncertain future for the 3 GHz provisions, Subcommittee Chairman Michael Doyle (D-PA-18) and Representative Doris Matsui (D-CA-6) introduced similar reallocation language on September 29 as H.R.5378 (117th Congress, 1st Session) and scheduled hearings on it and related communications bills for Wednesday, October 6, 2021.

The Executive Committee and the Legislative Advocacy Committee immediately tasked ARRL's lobbyists to initiate efforts to obtain support for ARRL's position. Meetings were held

on short notice to request support with the offices of Subcommittee members including Representatives Adam Kinzinger (R-IL-16) and Tim Walberg (R-MI-7), as well as with Representatives John Larson (D-CT-1) and Joe Courtney (D-CT-2).

In addition, ARRL's lobbyists, ARRL Atlantic Division Vice Director Bob Famiglio, K3RF, and ARRL Washington Counsel David Siddall, K3ZJ, met with Chairman Doyle's Chief of Staff on October 1, to explain the importance of Amateur Radio maintaining authority to operate in the 3.3 – 3.45 GHz band.

In his written statement (**www.arrl.org/arrl-statement-on-3-ghz-band-oct-2021**) submitted to the Subcommittee in conjunction with the hearing, President Roderick emphasized that permitting Amateur Radio to continue to have use of the 3.3 – 3.45 GHz band on a strictly secondary, non-interfering basis will provide full protection to commercial licensees with exclusive licenses and further the public interest in providing a means for continued technological innovation.

Despite vigorous opposition from ARRL and others, the FCC in 2020 ordered the "sunsetting" of the 3.3 – 3.5 GHz band in order to auction the spectrum to commercial 5G providers. The Commission allowed amateur operations to continue in the lower 150 megahertz of the band, 3.3 – 3.45 GHz, until it acts in a future rulemaking to address that spectrum. Amateur operations were allowed to continue in the upper 50 megahertz, 3.45 – 3.5 GHz, only until 90 days after the auction including that spectrum has closed. The auction began in early October; it is likely that operations will have to cease in February or March, 2022.

"A core standard of spectrum policy should be to maximize use of this valuable but finite spectrum resource," President Roderick told the panel. "The [FCC] in earlier proceedings adopted a variety of methods to share and maximize use of the spectrum by radio amateurs and others, but in its latest 3 GHz proceeding it did not do so, despite hundreds of comments filed by radio amateurs."

President Roderick said that if the current policy continues, existing spectrum at 3 GHz being addressed in H.R.5378 "will be cleared indiscriminately," leaving "significant spectrum resources vacant into the foreseeable

future while radio amateur experimentation and operation will be forced to cease for no reason except regulatory myopia. It need not be so."

President Roderick pointed out that in earlier proceedings, the FCC adopted methods to ensure unencumbered spectrum access by primary users while accommodating secondary users on a non-interference basis. "These methods work well and remain effective without complaint in other frequency bands, and also should be applied to the 3 GHz band," he said.

Primary commercial users "would rarely use all of their licensed spectrum throughout their entire licensed service areas," President Roderick said. In its recent 3 GHz proceeding, however, the FCC "went beyond merely prohibiting amateur operations in areas and at times when primary Commission licensees might use the spectrum," ruling instead that all amateur operation in the subband being auctioned must terminate within 90 days of the auction's close. President Roderick told the FCC that it is not logical for the Commission to leave spectrum unused before licensees start using it.

"ARRL, on behalf of the more than 750,000 amateur licensees in the United States, respectfully requests that Congress take this opportunity to instruct the Commission in H.R.5378 that radio amateur secondary uses should continue to be authorized in the 3 GHz band," President Roderick concluded. He said there is no technical basis for removing amateur secondary operations from the 3 GHz band where radio amateurs "long have used the bits and pieces of unused spectrum for technological innovation."

H.R.5378 is not yet law, and ARRL's efforts to preserve amateur radio access to 3.3 – 3.45 on a secondary basis will continue.

On behalf of ARRL, President Roderick expressed appreciation for the support and efforts of Chairman Doyle and Representatives Larson, Courtney, Kinzinger, and Walberg to meet with ARRL representatives on short notice and to include ARRL's position on H.R.5378 in the Committee's hearing record. — *Thanks to the ARRL Board of Directors' Executive Committee*

Georgia Gets a New SM; Re-Elected SMs Begin New Terms

Jim Millsap, K9APD, became the ARRL Georgia Section Manager (SM) on October 1. Millsap, of Acworth, was the only candidate to apply by the June 4 nomination deadline. Millsap had been an ARRL Emergency Coordinator and District Emergency Coordinator. He also served as the ARRL Southeastern Division Vice Director from 2012 to 2014. Outgoing SM David Benoist, AG4ZR, decided not to run for a new term after serving since November 2016.

The following incumbent SMs faced no challengers in the summer election cycle and also began new 2-year terms on October 1: Robert Wareham, NØESQ (Colorado); Diana Feinberg, AI6DF (Los Angeles); Carol Milazzo, KP4MD (Sacramento Valley); Bill Hillendahl, KH6GJV (San Francisco); Stuart Wolfe, KF5NIX (South Texas); Monte Simpson, W7FF (Western Washington), and Dan Ringer, K8WV (West Virginia).

Eastern Washington SM Jo Whitney, KA7LJQ, was also the only nominee when the June 4 nomination deadline arrived. Initially scheduled to start her term on October 1, she was appointed to begin on July 1 after outgoing SM Jack Tiley, AD7FO, stepped down before the completion of his term.

ARRL Awards Colvin Grant to 3YØJ Bouvet Island DXpedition

ARRL has awarded a Colvin Grant of $5,000 to Amateur Radio DXpeditions (ARD), the Norwegian nonprofit organization that is sponsoring the 3YØJ DXpedition to Bouvet Island in fall 2022. Co-leaders for the effort are Ken Opskar, LA7GIA; Rune Øye, LA7THA, and Erwann Merrien, LB1QI.

The multinational team plans to activate Bouvet in November 2022. A dependency of Norway, Bouvet is a subantarctic island in the South Atlantic and the second-most-wanted DXCC entity, behind North Korea. Bouvet has not been activated since the winter of 2007 – 2008.

ARD would field a team of 12 operators for a 20-day stay on Bouvet. The DXpedition has set a goal of 120,000 contacts.

The Colvin Award is funded by an endowment established by the legendary DX couple Lloyd Colvin, W6KG (SK), and Iris Colvin, W6QL (SK). The award is intended to support amateur radio projects that promote international goodwill in the field of DX.

The 3YØJ team said that with its overall budget of $650,000, this DXpedition to Bouvet will be the most costly ever. Visit the 3YØJ DXpedition website (**www.3y0j.no**) for more information.

ARDC Grant Provides ARESLAX with Sophisticated Noise Location Capabilities

ARESLAX, an arm of the ARRL Los Angeles Section, has used a $23,600 grant from Amateur Radio Digital Communications (ARDC) to purchase equipment that will help its Amateur Radio Emergency Service® (ARES®) team members to locate and eliminate sources of radio frequency interference (RFI) that could hinder their operations.

"Earthquakes and wildfires are the primary disaster threats this region faces," ARRL Los Angeles Section Manager (SM) Diana Feinberg, AI6DF, explained. "Because these incidents occur without any advance warning, disaster communication groups in the [ARRL] Los Angeles Section must maintain a high degree of readiness."

Thanks to the grant, Feinberg said that ARESLAX purchased a Fluke ii910 Precision Acoustic Imager, which combines ultrasonic detection with visual techniques to pinpoint an interference source, such as power line noise, and produce photographic evidence. ARESLAX used its own funds to purchase a Radar Engineers 243 RFI Locator.

"For an increasing number of [ARRL] Los Angeles Section hams, EMI or RFI issues have made the HF bands difficult or impossible to use for DXing, contesting, emergency communication, or casual operating," Feinberg said. She pointed out that the network of overhead power lines that expanded with the county from 1940 through 2010 has now deteriorated, resulting in arcing. "Additionally, our urban noise floor is rising from the millions of electrical devices used by consumers and businesses, including solar charging controllers and grow lights," she said.

RFI complaints can go unresolved for years, and tracking down interference sources has been the focus of a corps of technical volunteers. The new equipment makes that job far less time-consuming and more successful, ARESLAX said.

This image from the Fluke ii910 Precision Acoustic Imager pinpoints the source of power line noise.

Past AMSAT President and Director, and Amateur Satellite Pioneer Tom Clark, K3IO, SK

Tom Clark, K3IO (SK)

AMSAT-NA Past President and ham radio satellite and digital pioneer Tom Clark, K3IO (ex-W3IWI), of Columbia, Maryland, died on September 28 at the age of 82. He was an ARRL Life Member and a member of the ARRL Maxim Society and ARRL Diamond Club. Clark's accomplishments are legendary, and he left a lasting footprint on the worlds of amateur radio satellites and digital techniques.

"His longtime technical achievements, mentoring to others, and technical leadership will be missed by his many peers and friends the world over," said AMSAT stalwart Bob McGwier, N4HY. To honor Clark, AMSAT rebranded its annual gathering as the 2021 AMSAT Dr. Tom Clark, K3IO, Memorial Space Symposium and Annual General Meeting.

A founding member of Tucson Amateur Packet Radio (TAPR), Clark was a co-founder of the TAPR/AMSAT DSP Project, which led to software-defined radio (SDR). He was a leader in the development of the AX.25 packet radio protocol. Clark served as AMSAT's second President, from 1980 until 1987. He also served on the AMSAT and TAPR Boards.

In concert with McGwier, Clark developed the first amateur digital signal processing (DSP) hardware as part of the TAPR/AMSAT DSP project. This led to the software-defined transponder (SDX) for satellite work.

Clark received a doctorate in astrogeophysics from the University of Colorado. He went on to serve as Chief of the Astronomy Branch at NASA Marshall Space Flight Center and was a Senior Scientist at NASA Goddard Space Flight Center.

In 2016, ARRL awarded Clark with its President's Award, recognizing his 60 years of advancing amateur radio technology. On that occasion, McGwier said, "There would be no AMSAT to inspire all of this work without Tom Clark. Tom... saved the organization and inspired all of us to look to the future and aim for the stars."

Rick Palm, K1CE, k1ce@arrl.net

Public Service

A History of the Altruistic Efforts of ARRL and Public Service Operators

For more than a century, ARRL has been developing disaster and emergency communications programs and services complemented by the ever-advancing technology and technique of radio. The early history of amateur radio emergency communications and ARRL is described eloquently in ARRL Assistant Secretary Clinton B. DeSoto's classic 1936 tome, *Two Hundred Meters & Down — The Story of Amateur Radio*.

Orange County (California) Fire Watch volunteer Steve Graboff, MD, W6GOS, checks in from a deployment location. Ham operators have been contributing to the safety of their communities for over 100 years. [Photo courtesy of Ray Hutchinson, AE6H]

DeSoto described the typical ham of 1936 as a member of an adventurous band of free spirits involved in the radio art for the enjoyment of it. However, he also spoke seriously about altruistic service. Technical advancement of amateur radio is an operator's contribution to humanity as well, but DeSoto specifies emergency communications operators as having an unparalleled service "of matchless heroism in flood and disaster...their great emergency system of communications carrying on when all others have failed. In many years, no community in distress in this country has been without valiant aid from amateur radio."

Traffic handling and message relaying was a major part of the basis of the founding of ARRL in 1914. DeSoto said: "Floods, hurricanes, earthquakes — disasters of all varieties provide a large part of the amateur message total in the form of emergency traffic. Amateurs almost invariably served as the last line of communication in times of natural emergency…" He went on to say that from 1916 to 1936, there had been more than 40 major (and many minor) natural disasters for which hams were the last line of communication. He wrote that the predominant characteristic of the amateur is their altruism, which is still true more than 100 years later.

Early Humanitarian Activities

In 1913, on the heels of invention and development of radio design, the primary interest had become application and practice. In March of that year, "a possible new activity for amateur radio made itself apparent when amateur stations successfully bridged the communications gap surrounding a large, isolated area left by a severe windstorm in the Midwest," DeSoto wrote.

The government and ARRL worked together to prepare for World War I. In 1917, amateurs were ordered off the air, and as the US went to war, thousands of amateurs with the requisite emergency and message handling skills served the war, until the armistice in 1918.

In 1922, state governors hailed amateur radio operators as a "reserve of radio minute men for national emergencies." In 1929, the Army Amateur Radio System (the predecessor to the Military Auxiliary Radio System) organized networks across the country to assist the Army and American Red Cross for disaster relief communications.

In 1931, after years of experimentation with long-distance communications, a few hams realized that there was value in line-of-sight communications, which would ultimately serve as the bedrock for countless Amateur Radio Emergency Service® (ARES®) groups of the future.

DeSoto wrote, "Since 1919, amateur radio has been the principal, if not the only communication link, following nearly 40 major and a great number

of less consequential disasters." He cites the historic floods of March 1936 as the greatest amateur radio emergency public service of that time. As flooding spread over northern New England, normal communications were cut off, and amateur communications systems expanded flexibly and spontaneously to meet the needs of the disaster. It was estimated that 1,000 amateur stations were engaged in providing effective emergency communications for prompt warning of authorities, immediate evacuation of threatened areas, and expedient supply of relief and rescue assistance.

In the last chapter of his book, DeSoto expressed what still holds true today: "The right of amateur radio to exist comes from its public utility. Operators perform a continuing public service in that they train themselves in a highly specialized and difficult field to be of use to the nation in time of emergency."

ARRL and ARES Today

Since those early days, ARRL has devoted vast organizational resources to continue the tradition of developing the radio amateur's ability to provide emergency communications through programs such as ARES, consistent with the FCC's basis/purpose for amateur radio that includes "...the value of the amateur service to the public as a voluntary noncommercial communication service, particularly with respect to providing emergency communications."

Most issues of *QST* reveal how seriously we take that charge. There are well-known incidents, such as the September 11 terrorist attacks, after which radio amateurs risked their lives in an unstable disaster area, as well as the responses to hurricanes Andrew (1992), Katrina (2005), Harvey/Irma/Maria (2017), and most recently, Ida (2021), to name just a few.

And then there are the smaller, but equally important responses. For example, in the "Celebrating Our Legacy" column of the October 2021 issue of *QST*, Craig Moyer, NN2B, represents ongoing ham altruism by saying: "Since 2010, my interest in radio and public safety has led me to take a Community Emergency Response Team (CERT) class, as well as get training to become a structural and wildland volunteer firefighter and EMT..." Without individual interest and participation from numerous hams like Craig, we wouldn't be able to mount responses to large-scale events when they occur.

How to Get Involved

With more than a century of public service and the disaster and emergency communications services behind us — services that radio amateurs continue to provide today — it becomes clear that amateur radio public service is a humanitarian effort.

Find your place on your local ARES team to fulfill your aspirations to serve as a humanitarian. Contact your local ARES Emergency Coordinator or ARRL Section Manager (listed on page 16 of this issue) for local and Section information, and how to join.

Editor's note: The summary of amateur radio communications history was based on an article written by the author and published in the September 2019 issue of The ARES Letter.

Field Organization Reports

September 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**.

638 WA7PTM
495 WA3EZN
446 KE8BYC
444 AC0KQ
437 W7PAT
416 WA2CCN
408 AD3CM
360 N9VC
310 KB3YRU W7EES
280 KB3YYC
270 ND8W
250 KB2RTZ
244 KT2D
240 KK6GXG
235 N5MKY
227 KE8KOC
220 WA0QLW KD2NMG
205 WO2H
190 W8DJG
185 KC9FXE
179 N3KRX

175 W2PH
170 K0FBS
168 NI2W
166 KM8V
162 K0WAV
160 K9ILJ AI9F N1LL N4CNX KW1U
158 K3MIY WM2C
157 WD8USA
155 K0RCJ
150 N8SY
148 KF0BPN
144 W9RY KC8T K3FAZ
143 AL0Y
140 WB9QPM N3XMB W8IM K4IWW KK3F
136 N2DW
135 N2LC W4DNA
131 W3YVQ

130 WB9WKO N2JBA WK4WC KD8ZCM
127 KV8Z
125 AG9G KE5YTA KF5OMH KO4OL
122 KC8YVF
121 WB8YYS
120 WA4VGZ WC4FSU K9LGU KA9MZJ K3JL KA9QWC KY2D KG5NNA KB8PGW NA7G N7IE
116 K8AMH
115 KD0HHN N1TF
114 KD8KBX
112 KY2MMM
111 W3CJD
110 WA1URS N3SW K6HTN AC8NP KC8WH KB2QO AA3SB WB8TQZ N1IQI W1RVY
109 KB1TCE

107 W4EDN
105 W2PAX K1XFC
102 K2VTT
100 W4CMH W1KX WB4RJW AD4DO KZ8Q KN9P NX9K KD8UUB K3RC AC8RV WB8SIQ KL7RF K3YAK W2AH AK2Z KB2YAA W2ZXN N1LAH
98 K8MDA K8RDN
97 N6IET KT4WX
95 W9EEU K1HEJ
94 KB1NMO K1STM
90 W1LBV KB9GO WB6NCT AB9ZA K8KRA N8MRS KB8HJJ WD0BFO KA2HZP N4ZM W4KX K8ED KD2PQP WB4ZDU KC1KVY

89 KB3IN KF5IVJ
87 K6JT
85 WX2DX KA1G KC1HHO
83 AB3WG
82 KA0DBK
81 N2TSO
80 AJ7B KR4ST KM4WHO W9BGJ W8GSR KA2GQQ KB1NAL
79 KB8RCR
78 WB8R KA2JFU WA1LPM
76 W3ZR KE8ANW K2EAG
74 K4FHR
73 KU1U KB0DTI
72 K6RAU KB3MXK
71 N0UMP K2MTG WB3FTQ
70 WB2VUF

The following stations qualified for PSHR in August, 2021, but were not listed in this column yet: K0RCJ 155, WV5Q 147, N7IE, NA7G 120, W5XX 82.

Section Traffic Manager Reports

The following Section Traffic Managers reported: AR, CO, CT, DE, EMA, EPA, IL, IN, KS, KY, LA, LAX, MDC, ME, MI, MO, NC, ND, NE, NFL, NM, NNJ, NTX, NV, OH, OR, SD, SFL, SJV, SNJ, UT, WCF, WMA, WNY, WPA, WWA, WI, WY.

Section Emergency Coordinator Reports

The following Section Emergency Coordinators reported: ENY, EPA, KY, MDC, MI, MO, ND, NLI, NV, OR, SCV, SNJ, TN, UT, VA, WPA, WTX, WY.

Brass Pounders League

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

KK3F 1,182, KY2D 1,084, NX9K 1,052, WB9WKO 694, K6HTN 853, N9CK 580.

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

Contest Corral December 2021

Check for updates and a downloadable PDF version online at **www.arrl.org/contest-calendar**.
Refer to the contest websites for full rules, scoring information, operating periods or time limits, and log submission information.

Start - Finish Date-Time		Date-Time		Bands	Contest Name	Mode	Exchange	Sponsor's Website
1	0230	1	0300	1.8-21	Phone Weekly Test – Fray	Ph	Name, SPC	www.perluma.com/Phone_Fray_Contest_Rules.pdf
1	1300	1	1400	1.8-28	CWops Mini-CWT Test	CW	Name, mbr or SPC or "CWA"	cwops.org
1	1700	1	2000	144	VHF-UHF FT8 Activity Contest	Dig	4-char grid square	ft8activity.eu/index.php/en
1	1900	1	2000	1.8-28	CWops Mini-CWT Test	CW	Name, mbr or SPC or "CWA"	cwops.org
2	0000	2	0300	1.8	QRP ARCI Top Band Sprint	CW	RST, SPC, mbr or power	qrparci.org/contest
2	0000	3	0300	7	Walk for the Bacon QRP Contest	CW	Max 13 WPM; RST, SPC, name, mbr or power	qrpcontest.com/pigwalk40
2	0300	2	0400	1.8-28	CWops Mini-CWT Test	CW	Name, mbr or SPC or "CWA"	cwops.org
2	0700	2	0800	1.8-28	CWops Mini-CWT Test	CW	Name, mbr or SPC or "CWA"	cwops.org
2	1700	2	1900	3.5-14	RTTYops Weeksprint	Dig	Other station's call, your call, serial, name	rttyops.com
2	1800	2	2200	28	NRAU 10-Meter Activity Contest	CW Ph Dig	RS(T), 6-char grid square	nrrlcontest.no
2	2000	2	2200	1.8-50	SKCC Sprint Europe	CW	RST, SPC, name, mbr or "none"	www.skccgroup.com
3	0145	3	0215	1.8-21	NCCC RTTY Sprint	Dig	Serial, name, QTH	www.ncccsprint.com
3	0230	3	0300	1.8-21	NCCC Sprint	CW	Serial, name, QTH	www.ncccsprint.com
3	2000	3	2100	1.8-28	K1USN Slow Speed Test	CW	Max 13 WPM; RST, SPC, name, mbr or power	www.k1usn.com/sst.html
3	2200	5	1559	1.8	ARRL 160-Meter Contest	CW	W/VE: RST, ARRL/RAC Section; DX: RST	www.arrl.org/160-meter
4	0500	5	1000	3.5-28	UFT Meeting	CW	RST, mbr or "NM"	uft.net/les-rencontres-uft
4	0600	4	0800	7, 14	Wake-Up! QRP Sprint	CW	RST, serial, suffix of previous QSO	qrp.ru/contest/wakeup
4	1200	5	1159	3.5-28	PRO CW Contest	CW	RST, serial, "/M" if member	www.procontestclub.ro
4	1300	4	1330	144	Two-Meter Classic Sprint	CW Ph	Serial, 4-char grid square	fwrc.info
4	1800	5	2359	3.5-28	FT Roundup	Dig	W/VE: RST, state/province; DX: RST, serial	www.rttycontesting.com
6	0000	6	0100	1.8-28	K1USN Slow Speed Test	CW	Max 20 WPM; name, SPC	www.k1usn.com/sst.html
7	0100	7	0159	1.8-50	Worldwide Sideband Activity Contest	Ph	RS, age group (OM, YL, Youth)	wwsac.com/rules.html
7	0200	7	0400	3.5-28	ARS Spartan Sprint	CW	RST, SPC, power	arsqrp.blogspot.com
7	1700	7	1900	3.5-14	RTTYops Weeksprint	Dig	Other station's call, your call, serial, name	rttyops.com
8	0130	8	0330	3.5-14	NAQCC CW Sprint	CW	RST, SPC, mbr or power	naqcc.info
8	1700	8	2000	432	VHF-UHF FT8 Activity Contest	Dig	4-char grid square	ft8activity.eu/index.php/en
11	0000	12	2359	28	ARRL 10-Meter Contest	CW Ph	W/VE/XE: RST, state/province; DX: RST, serial	www.arrl.org/10-meter
11	0000	13	2359	1.8-7	PODXS 070 Club Low Band Sprint	Dig	RST, SPC	www.podxs070.com
11	0600	12	1800	3.5-28	TRC Digi Contest	Dig	RST, serial, "TRC" if membr	trcdx.org/rules-trc-digi
11	1200	12	2359	1.8-50	SKCC Weekend Sprintathon	CW	RST, SPC, name, mbr or "none"	www.skccgroup.com
11	1300	12	1300	3.5, 7	ARI 40/80 Contest	CW Ph Dig	RS(T), 2-letter province code	www.ari.it/en/contest-hf
11	1600	12	1559	3.5-28	International Naval Contest	CW Ph	RS(T), mbr (and club) or serial	www.marinefunker.at
12	2000	12	2300	1.8-28	QRP ARCI Holiday Spirits Homebrew	CW	RST, SPC, mbr or power	qrparci.org/contest
12	2100	12	2259	14	CQC Great Colorado Snowshoe Run	CW	RST, SPC	www.coloradoqrpclub.org/contests
13	0100	13	0300	1.8-28	4 States QRP Second Sunday Sprint	CW Ph	RS(T), SPC, mbr or power	www.4sqrp.com
16	0000	17	0300	14	Walk for the Bacon QRP Contest	CW	Max 13 WPM; RST, SPC, name, mbr or power	qrpcontest.com/pigwalk20
17	1600	17	1700	3.5, 7	AGB-Party Contest	CW Ph Dig	RST, serial, mbr (if member)	ev5agb.com/contest/agb_party.htm
17	1800	17	2200	1.8	Russian 160-Meter Contest	CW Ph	RS(T), oblast code or serial	www.topband.ru/rules.htm
18	0000	18	2359	1.8-50	Feld Hell Sprint	Dig	RST, mbr, SPC, grid	sites.google.com/site/feldhellclub
18	0000	18	2359	3.5-28	OK DX RTTY Contest	Dig	RST, CQ Zone	okrtty.crk.cz
18	0000	18	2359	1.8-144	RAC Winter Contest	CW Ph	VE: RS(T), province/territory; Non-VE: RS(T) + serial	www.rac.ca/contesting
18	0000	19	2359	50-1296	ARRL EME Contest	CW Ph Dig	Signal report	www.arrl.org/eme-contest
18	1200	19	1159	3.5-28	Padang DX Contest	Ph	RS, serial	padangdxc.com/rules
18	1400	19	1400	1.8-28	Croatian CW Contest	CW	RST, serial	9acw.org/index.php/rules
18	1500	19	1500	1.8	Stew Perry Topband Challenge	CW	4-char grid square	www.kkn.net/stew
19	1800	19	2359	3.5-28	ARRL Rookie Roundup, CW	CW	Name, 2-digit year first licensed, SPC	www.arrl.org/rookie-roundup
19	2300	20	0100	1.8-28	Run for the Bacon QRP Contest	CW	RST, SPC, mbr or power	qrpcontest.com/pigrun
22	0000	22	0200	1.8-50	SKCC Sprint	CW	RST, SPC, name, mbr or "none"	www.skccgroup.com
22	0130	22	0330	3.5-14	NAQCC CW Sprint	CW	RST, SPC, mbr or power	naqcc.info
25	1200	26	1159	3.5-28	Gedebage CW Contest	CW	RST, serial	olkb.or.id
26	0000	26	1159	3.5-28	RAEM Contest	CW	Serial, latitude and longitute (e.g. 57N 95W)	raem.srr.ru/rules
26	0830	26	1059	3.5, 7	DARC Christmas Contest	CW Ph	RS(T), DOK (or "NM" if not DARC member) or serial	darc.de/der-club/referate/conteste
30	1200	30	2359	3.5-28	YOTA Contest	CW Ph	Age (or average age for multi-ops)	www.ham-yota.com/contest
31	0900	31	2359	3.5, 7	Bogor Old and New Contest	Ph	RS, operator age	contest.orari-bogor.org

There are a number of weekly contests not included in the table above. For more info, visit: **www.qrpfoxhunt.org**, **www.ncccsprint.com**, and **www.cwops.org**. All dates refer to UTC and may be different from calendar dates in North America. Contests are not conducted on the 60-, 30-, 17-, or 12-meter bands. Mbr = Membership number. Serial = Sequential number of the contact. SPC = State, Province, DXCC Entity. XE = Mexican state. Listings in blue indicate contests sponsored by ARRL or *NCJ*. The latest time to make a valid contest QSO is the minute listed in the "Finish Time" column. *Data for Contest Corral is maintained on the WA7BNM Contest Calendar at* **www.contestcalendar.com** *and is extracted for publication in* QST *2 months prior to the month of the contest. ARRL gratefully acknowledges the support of Bruce Horn, WA7BNM, in providing this service.*

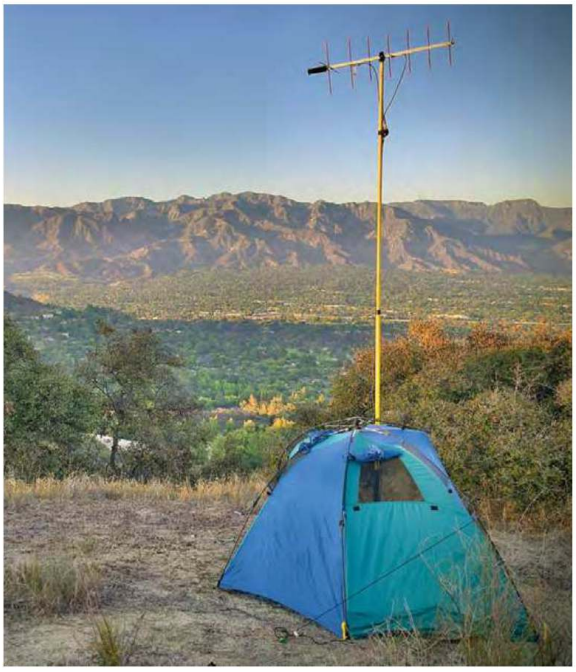
2021 ARRL Field Day Results

Almost 27,000 participants joined in the fun during Field Day this year, making over 1.4 million contacts.

Paul Bourque, N1SFE
ARRL Contest Program Manager

Similar to last year, the 2021 ARRL Field Day was unique because of the COVID-19 pandemic restrictions on gathering. Groups and individuals around the US, Canada, and 13 DX entities successfully demonstrated how they were able to adapt their pre-pandemic Field Day strategies to participate in this year's event.

The two temporary rule waivers that were issued last year due to the pandemic were extended into 2021, allowing Class D (home) stations to count their contacts with other Class D stations for points (standard Field Day rules don't count Class D-to-Class D contacts toward the total score). Additionally, Class D and E stations were limited to 150 W output power for this year. As with last year, all entrants, regardless of their entry class, were able to apply their individual scores to their club's aggregate score.



Ryan Kinnett, NG6F (who took the photo on the right), and Matthew Bennett, AC6X (who took the photo below), operated backpack-style QRP portable from the hills above Rose Bowl Stadium in Pasadena, California, for the 2021 ARRL Field Day.

Because many areas of the US loosened their restrictions on gatherings in public spaces, there was an increase in the number of Class A (groups of three or more) participants compared to last year, comprising almost 18% of the total number of entries for this year's event. The Class D (home stations, commercial power) category had the largest number of entrants, followed by Class E (home stations, emergency power). Class D and E stations comprised roughly 67% of the total entries for the 2021 Field Day event.

This year, there was a total of 5,979 entries submitted and 26,698 reported participants. While the total number of entries

Transmitter Count by Class

Class	Class Definition
A	Three-person or more club/non-club portable using emergency power
AB	Per above, with battery or alternate non-generator power source
AC	Per above, but with commercial power
B1	One-person club/non-club portable using emergency power
B1B	One person per above, with battery or alternate non-generator power source
B1C	One person per above, but with commercial power
B2	Two-person club/non-club portable using emergency power
B2B	Two persons per above, with battery or alternate non-generator power source
B2C	Two persons per above, but with commercial power
C	Mobile stations
D	Home stations using commercial power
E	Home stations using emergency power
F	EOC stations

Count by Class Summary

Class	Entries	Class	Entries	Class	Entries	Class	Entries
A	909	B1B	256	B2C	12	E	1,003
AB	43	B1C	36	C	69	F	140
AC	104	B2	80	D	2,913	Checklog	102
B1	284	B2B	28				

Transmitter Count by Class

1A	153	4AC	13	2D	89
2A	277	5AC	3	3D	28
3A	253	8AC	1	4D	8
4A	111	1B1	276	5D	1
5A	66	2B1	7	6D	2
6A	30	3B1	1	8D	1
7A	9	1B1B	249	1E	905
8A	5	2B1B	7	2E	68
9A	2	1B1C	35	3E	22
11A	1	2B1C	1	4E	6
14A	1	1B2	54	6E	1
15A	1	2B2	26	8E	1
1AB	20	1B2B	15	1F	28
2AB	7	2B2B	13	2F	60
3AB	10	1B2C	9	3F	26
4AB	4	2B2C	3	4F	14
5AB	1	1C	62	5F	7
6AB	1	2C	6	6F	2
1AC	15	4C	1	7F	2
2AC	42	1D	2,784	9F	1
3AC	30				

2021 Field Day Overall Statistics

Number of Participants:	26,698
Total Entries:	5,979
Checklogs:	102
CW QSOs:	604,811
Digital QSOs:	297,418
Phone QSOs:	529,830
Total QSOs:	1,432,059

Entries by ARRL RAC Section/Prefix

Section	Entries	Section	Entries	Section	Entries	Section	Entries
AB	25	MB	5	ONN	9	VI	4
AK	10	MDC	123	ONS	101	VT	15
AL	102	ME	33	OR	84	WCF	61
AR	56	MI	160	ORG	104	WI	111
AZ	135	MN	117	PAC	15	WMA	31
BC	83	MO	129	PE	2	WNY	101
CO	101	MS	39	PR	23	WPA	87
CT	66	MT	28	QC	74	WTX	26
DE	21	NC	215	RI	23	WV	46
EB	53	ND	12	SB	31	WWA	155
EMA	82	NE	28	SC	70	WY	13
ENY	90	NFL	102	SCV	121	DX: VK – Australia	1
EPA	174	NH	40	SD	12	DX: PY – Brazil	1
EWA	38	NL	3	SDG	38	DX: TI – Costa Rica	1
GA	144	NLI	40	SF	40	DX: HI – Dominican Republic	1
GTA	84	NM	44	SFL	56	DX: UA3 – European Russia	3
IA	41	NNJ	94	SJV	31	DX: DL – Germany	1
ID	45	NNY	14	SK	8	DX: YB – Indonesia	2
IL	197	NT	2	SNJ	63	DX: JA – Japan	11
IN	100	NTX	189	STX	149	DX: XE – Mexico	2
KS	47	NV	34	SV	71	DX: HP – Panama	1
KY	66	OH	246	TN	138	DX: SP – Poland	2
LA	47	OK	47	UT	32	DX: S5 – Slovenia	1
LAX	145	ONE	82	VA	195	DX: YV – Venezuela	1
MAR	34						

Entries by BASE Class Summary

Class	Entries
A	1,070
B	704
C	70
D	2,979
E	1,015
F	141
Total	5,979

During the 2021 ARRL Field Day, the ARRL Board of Directors presented a plaque to the Dade Radio Club of Miami to commemorate 75 years of being an ARRL Affiliated Club. From left to right, Jeff Beals, WA4AW, Southern Florida Assistant Section Manager; Julio Herrera, KK4KMO, President of the Dade Radio Club of Miami, and Barry Porter, KB1PA, Southern Florida Section Manager. [Dade Radio Club of Miami, W4NVU, photo]

decreased by 41% from last year, the total number of participants increased by about the same margin, with the number of participants closer to pre-pandemic Field Day numbers. Additionally, this year's event had about 10,000 fewer participants than 2019.

Compared to 2020, this year showed a 23% decrease in the number of contacts reported. However, in comparison to 2019, this year showed a 31% increase.

Activity by Class

Class A — Club or Non-Club groups of three or more people who set up temporary/portable Field Day sites away from their usual station locations: 1,070 entries (17.9%).

Class B — Temporary or portable Club or Non-Club groups, or one or two people who set up temporary/portable Field Day sites away from their usual station locations: 704 entries (11.8%).

Class C — Mobile or rover operators from vehicles, bicycles, and even boats: 70 entries (1.2%).

Class D/Class E — Stations operating from home, using either commercial power (Class D) or emergency power (Class E): 3,994 entries (66.8%).

Class F — Stations operating from or as Emergency Operations Centers (EOCs): 141 entries (2.34%).

Checklogs — 102 entries were listed as checklogs because they were DX stations or were missing the required list of calls sorted by band and mode. Checklogs are acknowledged at the bottom of the page at **www.arrl.org/logs-received**.

This year, almost 99% of the total entries received were submitted via the web applet, which is about the same as in 2020. A few minor changes were made to the applet for clarity, making it easier than ever for you or your group to submit your Field Day results to ARRL.

Soapbox Comments

Some of this year's entrants have posted their stories to the Field Day Soapbox (**http://field-day.arrl.org/fdsoapbox.php**), sharing how they adapted their strategies to meet the changing pandemic guidelines. The MIT Radio Society, W1MX, couldn't use their club station as they had in prior years. Instead, they hung a few dipole antennas at a local park and operated Field Day from there with battery power.

Barry Strickland, AB4QL, intently operated the CW station during the DeKalb County Amateur Radio Club, W4DGH, Field Day event in Fort Payne, Alabama. [Robert Hamilton, W4YPX, photo]

Laguna Mountain WFD, WW6CC, ensured all their participants were fully vaccinated prior to gathering at a location near the Palomar Observatory atop Palomar Mountain in San Diego County, California. They used homebrew antennas, including two that the group constructed specifically for this year's Field Day.

Looking Ahead

Many groups and individuals are already looking forward to Field Day 2022, and are actively planning for the event. Share what your strategies will be for next year with the amateur radio community via the ARRL Field Day Facebook page, at **www.facebook.com/groups/arrlfd**. The 2022 ARRL Field Day will take place on June 25 – 26.

Eleven-year-old Delaney Bailey, KFØFUP, made 50 contacts operating phone during the 2021 ARRL Field Day, while her dad, Morgan Bailey, II, NSØR, handled the logging. They participated as part of the Jackson Amateur Radio Club's event at the Banner Creek Science Center & Observatory in Jackson County, Kansas. [Morgan Bailey, NJ8M, photo]

Scores

Club Aggregate Scores are listed below. Aggregate scores are listed alphabetically by club name, along with the total score of individual entries attributing their score to the club, and the number of individual entries. Due to the high volume of entries this year, full line scores will be posted in the digital edition of *QST* and on the ARRL Field Day Page at **http://field-day.arrl.org**. Please visit that page or the digital edition for full Class A, B, C, D, E, and F line scores.

You can also click here to find Categories A through F results.

Club Aggregate Scores

Club Name	Aggregate Score	Entries
220 MHz Guys	398	1
3 Guys with Radios ARC	900	1
3 Rivers ARC	952	1
3730 Group	3,634	1
4SQRP	3,536	5
510 RG	8,330	1
603 ARC	862	1
618 Comms	410	1
694 Group	194	1
721st Mechanized Contest Battalion	2,276	1
985 Users Field Day Event	2,908	1
ACARES	596	1
Ad Hoc ARS	2,052	1
Adams Co. ARS	3,400	7
Addison Co. ARA	2,404	3
Aero ARC	2,490	1
Aeronautical Center ARC	449	2
Aerospace Employees Assn. ARC	2,690	4
Ak-Sar-Ben ARC	4,218	6
Alabama Contest Group	2,292	2
Alachua EOC RC	3,290	1
Alamance ARC	9,170	6
Alameda Co. RACES	1,042	1
Alamogordo ARC	1,344	1
Alaska Airlines ARC	365	1
Albany ARA	7,514	5
Albemarle ARC	13,330	13
Albemarle ARS	1,626	5
Alberta Clippers	1,350	1
Albuquerque DX Assn.	8,364	4
Alexandria RC	6,838	5
Alford Memorial RC	4,620	2
Algoma ARC	4,826	5
Algonquin ARC & Waltham ARA	2,626	1
All Things ARA	1,400	1
Allegheny Valley RA	1,250	1
Alliance ARC	3,088	1
Almaden RC	324	1
Alpha RC	1,444	1
Amargosa ARC	2,470	1
Amateur Radio of Churchill Co.	1,256	1
America West ARC	854	1
American Legion Post 1 ARC	920	1
American Legion Post 33 ARC	880	1
American Legion Post 91 ARC	876	1
Anaconda ARC	2,856	1
Ancient Modulators	334	1
Anderson Island ARC	956	1
Anderson RC	7,102	6
Andrew Johnson Radio ARC	2,802	1
Androscoggin ARC	1,298	1
Anne Arundel RC	5,740	6
Anoka Co. RC	2,816	2
Anonymous Contest Group	1,678	1
Antelope Valley ARC	970	1
Anthracite Repeater Assn.	3,304	2
Antietam RA	5,662	4
Apple City ARC	1,410	1
AR Assn. of the Tonawandas	730	1
AR Caravan Club	556	2
AR Tower Trailer Team	808	1
ARA of Nebraska	2,802	1
ARA of the Southern Tier	2,102	2
ARC at Univ. of Arkansas	1,640	1
ARC EmComm Service	3,932	3
ARC of Augusta	1,518	2
ARC of Butts Co.	1,072	4
ARC of Columbia Co.	672	2
ARC of Parker Co.	1,270	1
ARC Panama City	264	1
Arctic ARC	246	1
Area 51 Radio Group	1,102	1
ARES of Douglas and Elbert Co.	8,352	1
ARESLAXNW	4,106	2
Arizona ARC	1,126	1
Arizona Outlaws Contest Club	16,110	9
Arkansas Diamond ARC	122	1
Arkansas Radio Emergency Services	810	1
Arkansas River Valley ARF	5,864	8
ARL of Lawrence Co.	1,110	1
Arlington ARC	2,736	1
Aroostook ARA	1,986	1
Arrow Comm. Assn.	4,801	6
ARTS of Louisville	3,244	2
Ascension ARC	1,198	2
Ashe Co. ARC	1,220	1
Assoc. Radio Amateurs of Long Beach	2,746	5
Assoc. Radio Amateurs of S. New England	3,878	1
Atchison Co. ARS	1,078	2
Athens Co. ARA	3,378	2
Atlanta RC	1,102	3
Atlantic Region Repeater Legion	1,394	1
Augusta Univ. ARC	4,542	1
Austin ARC	7,388	9
Austin Area ARC	956	1
AZ DARC	3,464	4
Azalea Coast ARC	2,468	5
Bainbridge Island ARC	964	2
Baldwin Co. ARC	8,986	6
Balihoo ARC	80	1
Baltimore Polytechnic Alumni RC	1,054	1
Bama Ham'ers	2,568	1
Bankhead ARC	2,306	1
Barnstable ARC	11,468	6
Barrie ARC	4,191	11
Barron Co. ARA	1,388	1
Barrow ARC	1,288	1
Barry ARA	2,170	4
Barstow ARC	2,032	2
Basin ARC	3,408	1
Bass Hill Repeater Group	3,330	1
Bastrop Co. ARC	2,118	1
Batesville Area RC	3,040	5
Baton Rouge ARC	2,712	2
Bay Area DXers	5,392	2
BayNet ARC	1,514	3
Bayouland Emergency ARES	1,996	1
Baytown Area ARC	1,544	1
bcars.org	3,496	2
BCI Communications ARC	64	1
BEANOS	6,480	2
Bear Bait RC	2,456	2
BEARS of Manchester ARC	2,672	2
Beaufort Radio Amateur Group	696	1
Beaumont ARC	3,638	1
Beaver Valley ARA	1,698	1
Bedford ARC	960	3
Bedlington Terrior ARC of Tucson	6,008	1
Belews Cove Minions	3,774	1
Bella Vista RC	4,608	1
Bellbrook ARC	5,310	5
Benicia ARC	2,459	3
Benton ARS	7,868	5
Bergen ARA	2,154	5
Bergen Co. Emergency Management RC	926	1
Berger's Bandits RC	6,682	1
Berks Amateur Radio Contest Club	798	1
Bernalillo Co. ARES	1,876	1
Berwick Contest Team	7,480	1
Big Bend ARC	7,090	2
Big Island ARC	2,590	7
Big Sandy ARC	872	3
Big Signal ARC	452	1
Big Sky Contesters	288	1
Big Stefa Memorial FD Group	5,716	1
Bill, Ken, and Marty	1,460	1
Billerica ARS	1,768	2
Binghamton ARA	2,716	2
Birmingham ARC	3,350	2
Bishop ARC	2,949	3
Bitterroot ARC	836	2
Black Diamond ARC	594	4
Black River ARC	2,734	2
Black River Radio Ops	11,864	1
Blackstone Valley ARC	3,258	1
Blazing Paddles FD Team	8,004	1
Bledsoe Co. ARC	1,490	1
Bloomington ARA	1,454	1
Bloomington ARC	1,586	1
Blossomland ARA	5,674	2
Blount Co. ARC	1,162	1
Blue Ridge ARC	4,836	3
Blue Springs ARC	878	1
Bluegrass ARS	54	1
Boaz-Albertville ARC	776	1
Boca Raton ARA	3,904	7
Boeing Employees AR Operators North Soc.	420	1
Boeing Employees ARS	1,684	3
Boeing Employees ARS — St. Louis	8,606	6
Boerne ARC	1,288	1
Bolingbrook Area Radio Contesters	74	1
Bolingbrook ARS	3,894	8
Bonac ARC	4,068	2
Bonner Co. ARES	2,752	4
Boomer Bill ARC	464	1
Boone and Hamilton Co. ARES	1,726	3
Boonville ARC	2,370	1
Bootheel ARC	1,972	2
Border City RC	1,696	2
Boschveldt QRP Club	2,075	1
Boston ARC	4,486	4
Boston Valley Simplex Club	572	2
Boulder ARC	12,366	7
Bourbon Fueled Nerds	664	1
Brainerd Area ARC	4,562	3
Brandon ARC	272	2
Brandon ARS	3,536	1
Brazoria Co. AR Service	318	1
Brazos Valley ARC	7,722	5
Bridgerland ARC	2,394	1
Brightleaf ARC	3,860	3
Bring Back the Band	1,872	1
Bristol ARC	5,277	6
Broken Arrow ARC	910	1
Broken Arrow Emergency Management ARC	2,140	2
Brookings Radio Research Club	160	1
Broughton Memorial FD Grp	15,990	16
Brownwood ARC	832	1
Brunswick Shores ARC	4,750	9
Bryan ARC	3,030	3
Buckhead Contest Club	3,016	1
Bullitt ARS	8,778	4
Burlington ARC	3,495	4
Burlington Co. RC	5,268	4
Butler Co. (OH) ARA	2,494	1
Butler Co. (PA) ARA	4,560	1
Butler Co. AR Public Service Group	5,962	5
Cabarrus ARS	3,946	3
Calgary ARA	5,536	1
Calhoun Co. ARA	2,684	2
Calhoun Co. EOC	3,558	1
California City ARC	1,702	1
California Dept. of Justice ARC	974	1
California DX Assn.	4,014	1
Calvert ARA	1,462	1
Cambridge ARA	1,982	2
Cambridge ARC	388	1
Camden Co. ARS	82	1
Camp Trouten	1,268	1
CANAMARA	526	1
Candlewood ARA	4,352	1
Canton ARC	3,514	2
Cape Ann ARA	1,208	2
Cape Fear ARS	7,194	4
Cape May Co. ARC	1,944	1
Capital Area ARES Unit	758	1
CARA/OBARC	4,376	5
Carbon ARC	114	1
Carbon Co. DXCC	11,864	5
Caribbean Amateur Radio Group	758	1
Carolina Airstream Club	1,082	1
Carolina ARES	656	1
Carolina DX Assn.	5,444	5
Carroll Co. ARC	2,616	2
Carson City Ares	370	1
Carter Co. ARA	560	1
Carteret Co. ARS	518	1
Carteret Emergency Management Vol. ARC	1,904	1
Cascade RC	2,104	2
Cascades ARS	262	1
Case ARC of Case Western Reserve Univ.	1,880	1
Cass Co. Area AR Operators	1,252	1
Castle Shannon VFD ARC	664	1
Cedar Creek ARC	1,266	1
Cedar Grove ARC	1,968	1
CenTor ARC	2,990	6
Central Alberta ARC	1,084	1
Central Dakota ARC	852	1
Central Idaho ARC	4,300	1
Central Illinois RC	1,834	5
Central Indiana ARA	80	1
Central Kansas ARC	624	1
Central Kentucky ARS	11,798	1
Central Louisiana ARC	5,920	3
Central Massachusetts ARA	4,292	3
Central Michigan ARC	4,042	3
Central Mississippi ARA	2,738	1
Central Missouri RA	2,784	3
Central Montana ARC	1,550	2
Central New York ARC	1,088	1
Central New York Contesters	882	1
Central Ohio Operators Klub	1,082	2
Central Oregon Coast ARC	4,538	6
Central Oregon DX Club	5,054	1
Central Texas DX and Contest Club	10,944	1
Central Valley AR Enthusiasts	950	1
Central Vermont ARC	2,130	1
Central Virginia Contest Club	2,550	2
Central Washington ARC	1,400	2
Central West Virginia Wireless Assn.	17,504	8
Centralia ARES	872	1
Champaign ARA	120	1
Chandler Ham RC	1,586	3
Charleston ARS	2,266	3
Charlevoix/Cheboygan/Emmet Co. Pub Srvc Comm. Org.	1,476	1
Charlotte ARC	1,180	1

Charlotte ARS	3,328	1
Charlotte Co. ARC	586	1
Chatauqua AR Service	1,494	1
Chattanooga ARC	1,648	1
Chautauqua and Erie ARC	326	1
Chehalis Valley ARS	1,088	1
Cherokee ARS	4,366	4
Cherokee Capital ARS	1,478	1
Cherryland ARC	4,174	3
Cherryville Repeater Assn. II	2,968	4
Chesapeake AR Service	4,360	5
Chesapeake Bay Radio Assn.	2,998	2
Cheshire Co. DX ARC	2,126	1
Chester ARES	458	1
Chester Co. Amateur Radio	398	1
Chew's Ridge Gang	9,190	1
Chicago Suburban Radio Assn.	3,086	8
Citrus Co. ARC and ARES	2,644	1
City of Cypress RACES	298	1
Clallam Co. ARC	3,352	4
Clark Co. (IN) ARC	3,316	4
Clark Co. (WA) ARC	6,104	6
Clark Co. (WA) ARES/RACES	826	2
Clark Fork Valley ARC	1,126	1
Clarksville Amateur Radio and Pilots Assn.	474	1
Clarksville ARS	978	1
Clay Co. (IN) Auxcomm	2,126	1
Clay Co. (NC) Auxcomm	3,866	3
Clayton Radio Dawgs	4,842	1
Clearwater ARS/St. Petersburg ARC/Upper Pinellas ARC	6,086	2
Cleveland ARC	1,698	3
Cleveland Co. AR Service	7,682	7
Clinton Co. ARA	2,604	1
Clinton Co. Contesters	3,230	1
Club de Radio Amateur Outaouais	7,865	9
Club Groupe Radio Amateur Amical	1,392	1
Club KC5NX	3,845	3
Club Radio Amateur de Québec	17,404	15
Club Radio Amateur Sorel-Tracy	1,102	2
Club Radioamateur De La Vallée Du Richelieu	714	1
Club Radioamateur Drummondville	920	2
Club Sation Répétitrice de Laval	1,364	6
Coast Side ARC	920	1
Coastal ARS	2,366	1
Coastal Plains ARC	2,096	4
Coastline ARA	418	1
Cochise ARA	6,250	7
Coconino ARC	220	3
Collins Aerospace Radio Grp	5,914	1
Collins ARC	6,272	3
Collins Melbourne Comm/Nav	584	1
Colorado QRP Club	7,005	5
Columbia (MD) ARA	4,308	12
Columbia (OR) ARA	1,676	2
Columbia ARC (SC)	626	2
Columbia ARS	2,104	1
Columbia River DX Club	802	1
Columbia-Montour ARC	5,864	12
Columbus ARC	8,158	3
Communications Support Team	322	1
Community ARC	262	1
Comox Valley ARC	7,042	12
Comstock ARA	86	1
Condo Valley ARC	275	1
Conejo Valley ARC	6,188	6
Contest Club Ontario	12,151	8
Contoocook Valley RC	10,228	1
Copper Country Radio Amateur Assn.	1,060	2
Coquitlam ARC	2,893	4
Corona Police Dept. CSV Grp	2,216	3
CorTek RA	1,670	1
Coshocton Co. ARA	4,924	2
Cottonwood Heights ARC	3,210	1
Cove Repeater Assn.	1,538	1
Coventry EMA	4,180	1
Coweta RC	1,778	2
Cowichan Valley ARS	322	1
Cowtown ARC	2,824	1
Coyote ARC	198	1
CQ805	2,172	1
Crawford ARS	4,936	1
Crawford Mountain Boys and One Girl	2,248	1
CRCRST	3,727	3
CRES ARC	3,158	3
Crescenta Valley RC	1,554	7
Crooked River Contest Club	1,542	2
Crookston Pirates	378	1
Cross Co. ARC	656	1
Cross Roads Ham RC	1,614	2
CTRI Contest Group	8,526	1
Culpeper ARA	2,928	1
Culver City ARES	3,139	6
Cumberland ARC	3,976	8
Cumberland Plateau ARC	5,154	2
Cumberland Valley ARC	2,436	1
Cupertino ARES	4,671	12
Cuyahoga ARS	17,278	14
Cuyahoga Falls ARC	11,217	5
CVARC	4,050	1
CWOps	3,254	1
Dade RC of Miami	878	1
Dallas ARC	8,426	11
Dalton ARC	134	1
Dartmouth ARC	486	1
David M. Fiedler Memorial ARC	2,196	1
David Sarnoff ARC	2,770	6
Davie/Cooper City ARC	4,590	3
Davis Co. ARC	2,824	2
Dayton ARA	794	2
Daytona Beach CERT AR Team	2,054	1
DCT ARC	338	1
Decatur ARC	1,872	1
Deep Dixie Contest Club	6,820	2
Deep South ARC	4,898	4
DeForest ARC	1,948	1
DeKalb Co. ARC Ed Ringer Memorial FD Team	5,006	2
Del Mar CERT	4,226	1
Delaware ARA	13,564	4
Delaware Lehigh ARC	1,848	2
Delaware Repeater Assn.	2,062	3
Delaware Valley RA	1,348	1
Delmarva DX Assn.	2,176	2
Delta ARC Memphis	2,464	1
Delta ARS	600	2
Denton Co. ARA	3,532	1
Denver Radio League	828	1
Denver RC	2,654	4
Des Moines Radio Amateur's Assn.	2,846	1
Desert Creek DX Dogs	736	1
Desert Radio Amateur Transmitting Soc.	7,272	18
Desertores FD Squad	2,816	1
Desoto ARC	766	2
Detroit Lakes ARC	608	1
DFW Contest Group	8,160	5
Dial RC of Middletown	12,112	6
Dickson Co. ARC	3,028	2
Disney EARS	2,395	2
District 3 AR Group	436	1
Dixie ARC	2,754	1
Doghouse East	314	1
Douglas Co. ARC	692	2
Douglas Co. Radio Responders	490	1
Downey ARC	4,108	6
Dr. Loomis Memorial Junior Mechanics League	4,398	1
Drake ARC	3,702	1
Draper Ham RA	1,968	1
Dupage ARC	11,900	9
Dutchess Demons	518	1
East Bay ARC	608	1
East Greenbush ARA	1,692	6
East Pasco ARS	1,584	1
East Penn ARC	1,490	1
Eastern Arizona ARS	638	1
Eastern Connecticut ARA	4,140	1
Eastern Fulmont ARC	2,156	3
Eastern Michigan ARC	1,982	1
Eastern New Mexico RC	202	1
Eastern Ohio Contesters	188	1
Eastern Ontario ARC	952	1
Eastern Ozarks ARC	310	2
Eastern Pennsylvania ARA	2,104	1
Eastern Panhandle ARC	1,730	1
Eastern Shore ARC	3,974	10
Easton ARS	2,930	2
Eastside AR Service	1,942	1
Eaton Co. ARC	1,174	1
Eau Claire ARC	622	1
Ed and Joe Tech Club	1,185	1
Edgefield Co. ARC	1,656	1
Edison Amateur Radio Network	286	1
Edmond ARS	12,704	7
Edmonds Woodway ARC	1,838	2
Education Alliance for AR	616	1
Egyptian RC	252	2
El Dorado Co. ARC	9,440	8
El Paso ARC	996	2

Being without a tower didn't stop the Sun Country Amateur Radio Society, KB4KP, in Marion County, Florida, from operating in the 2021 ARRL Field Day. Instead, they suspended one of their antennas from a crane brought in specifically for the event. The crane was secured in a fenced-in area that was adjacent to their three operating positions. [Bruce Richardson, WA4IPU, photo]

El Segunda AR Group	436	1
Elgin ARS	3,708	5
Elk Co. ARA	1,628	1
Elk River Ham Group	1,276	1
Elkhorn Valley ARC	1,194	1
Ellis Co. ARC	2,494	2
Ellsworth Amateur Wireless Assn.	5,785	7
Elmira ARC	2,332	7
Elmore Co. ARC	832	1
Elmore Co. ARES	1,268	1
Emergency ARC of Hawaii	584	1
Emergency Communications Assn.	2,046	5
Emergency Repeater System	2,092	1
Emporia ARS	446	1
Endless Mountains ARC	2,134	3
Englewood ARS	422	1
Escondido ARS	2,032	1
Estes Valley ARC	2,346	5
EUPAR Club	86	1
Everglades ARC	372	2
EVQRP	1,892	4
EWEphoria RC	376	2
Explorer Post 599	2,358	2
F.A.R.G.	1,790	1
Fair Lawn ARC	2,466	5
Fallbrook ARC	4,480	6
Falmouth ARA	4,132	8
FARCE	1,700	2
Farrell-Gray	872	1
Faulkner Co. ARC	2,392	2
Fauquier ARA	6,210	2
Fayette Amateur Radio Transmitting Soc.	690	1
Fayette Co. ARC	5,040	1
FBOM International	1,004	1
FD Philips NEO	850	3
Federación de Radio Aficionados de PR	8,130	9
Fidelity ARC	3,114	1
Findlay RC	2,508	2
First Baptist Church Huntsville RC	1,410	2
First Class CW Operators Club USA	3,030	1
First State ARC	5,052	1
Five Flags ARA	5,086	2
Florence ARC	530	1
Florida Contest Group	12,627	12
Floyd ARS	472	1
Fluvanna ARES Group	2,438	1
FM38 Repeater Group	4,544	1
FMARC	130	1
Fond du Lac ARC	1,280	2
Foothill Flyers RC	400	1
Foothills ARC	614	1
Foothills ARS (CA)	1,482	5
Forsyth ARC	13,074	5
Fort Collins CW	7,634	1
Fort Herkimer ARA	2,836	1
Fort Madison ARC	3,276	4
Fort Myers ARC	416	3
Fort Smith Area ARC	2,422	3
Fort Venango Mike and Key Club	2,212	1
Fort Wayne DX Assn.	7,698	1

Fort Wayne RC	6,488	6
Forx ARC	4,818	1
Four County ARES	1,716	1
Four Lakes ARC	2,591	3
Fox Cities ARC	1,814	2
Fox Mike Hotel Portable Ops Team	718	1
Fox River Radio League	7,064	2
Fox River Relay League	3,798	2
Framingham ARA	4,492	8
Frankford RC	31,386	11
Franklin (NC) ARC	3,472	3
Franklin Co. (MA) ARC	3,916	3
Franklin Co. (NC) ARC	7,590	5
Franklin Co. (OH) Auxiliary Comm. Club	912	1
Franklin Co. (VA) ARC	8,808	2
Franklin Co. ARES	1,062	1
Franklin Springs Hams	626	1
Fredericton ARC	840	1
Fresno ARC	1,268	2
Front	692	1
Fullerton RC	1,034	1
Fulton Co. ARC	14,186	2
FVFD21	5,324	7
G.R.E.A.T. Club	800	1
Gainesville ARS	1,346	3
Garden City ARC	1,246	3
Garden School ARC	896	1
Garden State ARA	5,680	5
Garland ARC	1,692	4
Garrett Co. ARES	3,070	1
Gaston Co. ARS	2,592	1
Gaston RC	692	1
Gateway ARC	7,300	2
GEARS	2,060	2
Geauga ARA	1,076	1
Genesee Co. RC	462	1
Genesee Radio Amateurs	4,264	2
George Co. ARES	906	1
Georgia Auxcomm	485	1
Georgia Tech ARC	1,790	1
Georgian Bay ARC	3,376	4
GLARB	668	1
Gloucester Co. ARC	18,824	5
Glynn ARA	5,714	2
GMARC	390	1
Goddard ARC	466	1
Gold Coast ARA	6,440	5
Golden Spike ARC	1,156	1
Gordon PA Field Day Group	466	1
Goshen ARC	168	1
GOTAHAMS	4,494	4
Grand Rapids ARA	196	1
Grand Strand ARC	1,692	3
Grande Ronde Radio Amateurs Assn.	3,688	1
Granite State ARA	5,590	8
Grassroots ARC	636	1
Gratiot Co. Old Timers	1,472	1
Grayson Co. ARC	4,368	2
Great Bay RA	2,838	1
Great Lakes CWops Club	8,912	3
Great River ARC	996	1
Great Salt Lake Contest Club	3,862	1
Great South Bay ARC	3,288	2
Great Southern DX Assn.	6,890	9
Greater Beloit ARC	5,248	1
Greater Nebraska ARL	1,620	1
Greater Norwalk ARC	6,046	1
Green Bay Mike & Key Club	1,850	2
Green Mountain Wireless Soc.	1,468	2
Green River Valley ARS	1,766	1
Greensboro Digital RA	446	1
Greenwood ARC	1,728	5
Greer ARC	12,684	4
Grundy Co. ARC	1,100	2
Grupong Magellan Org. Search & Rescue Team	1,052	1
GSBARC	526	1
Guadalupe Valley ARC	1,822	1
Guelph ARC	474	1
GVARC/SBCARA	4,298	6
Gwinnett ARS	14,143	9
Haldimand Norfolk ARC	3,790	9
Half Moon Bay ARC	3,152	5
Half Wave Soc.	88	1
Halifax ARC	8,906	13
Hall of Science ARC	776	1
Ham Assn. of Mesquite	3,890	4
Ham Radio Adventures	572	1
HAMARS	1,806	1
Hambuds	3,736	1
Hamfesters RC	2,320	4
Hamilton (OH) ARC	2,442	3
Hamilton (ON) ARC	3,730	7
Hampden Co. RA	8,310	6
Hampstead Hams	1,790	4
HAMsters	852	1
Hancock ARC	3,610	1
Hancock-Hawkins AR Team	978	3
Hannibal (MO) ARC	3,812	5
Harford Co. ARES/RACES	3,018	1
Harris Family	640	1
Hassayampa AR Klub	1,036	1
Hattiesburg ARC	5,820	2
Hays/Caldwell ARC	432	2
Haywood Co. ARC	2,510	1
Hazel Park ARC	7,138	3
HDXCC	136	1
Healing Springs Mtn. VHF Soc.	1,248	5
Heart of America RC	3,184	2
Heartland DX Assn.	3,472	1
Heartland Hams ARC	1,380	1
Helena ARC	1,316	1
Hellgate ARC	10,008	3
Hellgate Contest Club	394	1
Henry Co. ARC	2,512	2
Henry Co. EOC	480	1
Heritage Hunt Hams	5,564	5
Heritage Village Radio and Electronics Club	298	1
Hernando Co. ARA	3,710	1
Hiawatha ARA	546	1
Hiawatha Valley ARC	2,426	3
Hickman ARC	574	1
Hidden Springs Field Day Site	916	1
Hidden Valleys ARC	1,440	1
High Desert AR Group	62	1
High Point ARC	3,830	2
High Sierra Field Day Group	6,682	3
Highland ARA	2,360	1
Highlands Co. ARC	1,098	3
Highlands Hams	520	2
Highline ARC	2,002	2
Hi-Line ARC	376	2
Hilltop Transmitting Assn.	5,964	6
Hinesville ARR Emergency Soc.	200	1
Hiram Percy Maxim Memorial Station	2,983	1
Hocking Valley ARC	644	1
Holiday City ARC	154	1
Holland ARC	1,050	2
Holmesburg ARC	2,698	3
Honeywell-Glendale ARC	428	1
Hood Co. ARC	2,974	1
Hoodview ARC	676	3
Hoosier Hills Ham Club	1,620	1
Hop River RC	74	1
Houston ECHO Soc.	590	1
HP Alumni RC	4,928	4
HP Boise ARC	2,254	1
HRO Milwaukee Employees ARC	424	1
Huber Heights ARC	2,144	1
Hudson Valley Contesters and DXers	5,428	4
Hughes ARC	1,866	5
Humboldt ARC	588	2
Hunt Co. Packet Club	4,420	1
Huntsville ARC	24,497	8
Huron ARA	2,498	2
Hurst ARC	1,138	1
Independent Radio Crew	2,326	1
Indian Peaks RC	1,406	1
Indian River ARC	616	1
Indiana Co. ARC	1,928	1
Indy Midtown ARC	570	1
Indy United ARC	21,236	3
Insurance City Repeater Club	1,570	1
Intercity ARC	2,388	2
Inverhuron Ham RC	3,110	3
Iowa City ARC	2,134	1
Iowa Wireless AR Network	3,684	2
Iredell Co. ARS	158	1
Iroquois Co. ARC	272	1
Irvine Disaster EmComms	4,393	14
Irving ARC	1,068	3
Island Co. ARC	1,482	2
Issaquah ARC	1,694	3
IWARN	526	1
Jackson Co. (MS) ARA	716	3
Jackson Co. AR Service	504	1
Jackson Co. ARC	7,624	2
Jacksonville ARS	1,462	2
Jamestown ARC	1,346	1
JANET Club	1,705	1
Jasper RC	1,494	1
Jay Co. ARC	1,434	1
Jayhawk ARS	978	1
Jefferson (LA) ARC	4,520	4
Jefferson Co. (TX) ARC	3,448	2
Jefferson Co. (WA) ARC	2,396	6
Jefferson Co. ARC	540	1
Jersey Shore ARS	1,588	2
Jim Bell Wireless Assn.	1,786	1
Jims Farm Group	250	1
Johnson Co. Radio Amateurs Club	10,658	1
Johnson Space Center ARC/Clear Lake ARC	5,266	1
Jonathan Sennetti	550	1
Juneau ARC	2,877	2
Juniata Valley ARC	1,296	1
Jupiter Tequesta Repeater Group	2,914	1
K1USN RC	4,036	4
KA3PVM and family, plus N3DRL	1,758	1
Kachina ARC	116	1
Kalamazoo ARC	996	2
Kanawha ARC	7,452	2
Kansas Antenna Club in Johnson Co.	2,644	2
Kansas City Assn. for the Blind ARC	780	1
Kansas City Contest Club	2,558	2
Kansas/Nebraska ARC	1,110	1
KARO-ECHO	1,548	1
Katy ARS	1,310	3
Kaw Valley ARC	3,368	2
Kay Co. ARC	1,882	2
KCARC	220	1
Keeping Amateur Radio Fun	630	1
Kemptville AR Group	2,059	4
Kendall ARS	2,156	5
Kendallville Contesters/ 21 Repeater Group	668	1
Kennehoochee ARC	2,216	1
Kent ARS	1,082	1
Kent Co. ARC	2,178	2
Kentucky Colonels ARC	2,388	1
Kentucky Contest Group	10,352	4
Kentwater ARC	448	1
Keowee Toxaway ARC	1,774	1
Kern Co. Central Valley ARC	1,364	2
Kershaw Co. ARC	44	1
Keuka Lake ARA	2,522	6
Key City ARC	964	1
Kicked Back Contesters Club	1,220	2
Kilocycle Club of Fort Worth, TX	3,002	2
King George AR Operators	3,612	2
King Harbor Yacht Club Radio Fleet	2,324	1
Kingman Amateur Radio CW Operators Club	808	2
Kings Co. and Annapolis Valley ARCs	6,176	4
Kings Co. RC	172	1
Kings Point ARC	4,068	5
Kingsport/Bays Mountain ARC	2,178	1
Kingston Amateurs	9,120	8
Kitchener-Waterloo ARC	8,566	10
Kitsap Co. ARC	2,336	3
Kitsap Co. DX Club	1,930	1
Klamath Basin ARA	2,472	1
Knob Hill Krew	350	1
Knox Co. ARC	1,232	1
KO4HRD-NS2X Team	670	2
Kokomo ARC	1,650	1
Koolau ARC	476	1
Kootenai ARS	1,526	1
Korean ARA	1,886	1
KSC ARC	752	1
KX4PR FD Group	422	1
La Mirada RC	2,248	1
Lafayette DX Assn.	6,368	2
LaGrange ARC	434	1
Laguna Mountain WFD	2,316	1
Lake Agassiz RC	1,674	1
Lake ARA	12,286	3
Lake Area AR Klub	4,360	9
Lake Area Radio Klub	6,542	1
Lake Co. (OH) ARA	10,112	6
Lake Co. RACES/ARES	4,702	2
Lake Conroe ARC	1,900	1
Lake Country AR Service	634	1
Lake Cumberland ARA	558	1
Lake Monroe ARS	6,182	2
Lake of the Ozarks ARC	1,854	1
Lake Oswego ARES	1,014	1
Lake Whitney ARS	440	1
Lakeland ARC	5,856	9
Lakes Area ARC	110	1
Lakes Region Repeater Assn.	1,126	1
Lakeshore RC	940	1
Lakewood ARC	428	1
Lambert Family	904	1
Lambton Co. RC	1,940	4
Lamorinda Area Radio Interest Group	1,284	1
Lancaster Co. ARES	3,684	1
Lancaster RC	5,410	4
L'Anse Creuse ARC	7,100	3
Larkfield ARC	928	1
Las Moras ARC	1,858	1
LaSalle Co. IL RACES	540	1
Laughery Valley ARC	724	1
Laurel ARC	1,340	2
Lebanon Valley Soc. of Radio Amateurs	2,944	2
LEFROG	7,434	2
Lehigh Valley ARC	1,502	1
Leisure World of Maryland ARC	116	2
Lemhi ARC	862	1
Lenoir ARC	2,888	3
Lewis and Clark RC	240	1
Lewisville ARA	150	1
Lewisville ARC	94	1
Lighthouse ARA	2,710	1
Lighthouse Point BBQ Club	426	1
Limestone ARES	2,226	1
Lincoln ARC	5,160	1
Lincoln Co. (ME) ARC	3,370	1
Lincoln Co. (OR) ARC	884	1
Lincoln Co. Volunteer Comm.	1,028	1
Lincoln Hills ARGroup	1,490	1
Lisbon Area ARA	1,374	1
Lithopolis FD Group	2,168	1
Littleton Area RC	2,964	2
Livermore AR Klub	1,374	3
Liverpool Amateur Repeater Club	4,358	2
Livonia ARC	10,534	2
Lockport ARA	2,150	1
Lodi ARC	1,436	3
LOHSEP ARC	248	1
London ARC	8,114	14
Long Island CW Club	766	3
Long Island Mobile ARC	5,168	3
Long Tail RC	1,288	1
Longmont ARC	1,966	4
Loren D Hayes Memorial ARC	910	1
Los Alamos ARC	826	1
Los Angeles ARC	2,812	1
Loudoun AR Group	2,670	5
Low Country Contest Club	2,502	1
Lower Arkansas Ham Operators Group	634	1
Lubbock ARC	650	1
Lucas ARC	3,506	3
Luke-Jack Searchers	212	1
Lynchburg ARC	11,946	9
M.A.R.C	390	1
Mabcom	102	1
Mackenzie Regional RC	360	1
Macon Co. ARC	3,970	5
Macoupin Co. ARC	2,144	1
Mad River RC	16,222	6
Madison Co. Ohio ARC	3,578	1
Magic Valley ARC	1,644	1
Magnolia DX Assn.	528	1
Mahoning Valley ARA	3,862	5
Maine Ham Radio Soc.	562	1
Manatee ARC	450	1
Manhattan Area ARS	1,188	2
Manila Creek Stake ERC	164	1
Manitoulin ARC	282	1
Manotick AR Group	560	1
Mansfield-Johnson ARS	8,048	6
Maple Grove RC	2,300	1
Maple Ridge ARC	510	2
MARC/DECT	7,520	6
MARCA	2,841	5
Marconi ARC of Newfoundland	2,135	1
Marietta ARC	1,278	1
Marple Newtown ARC & Mobile Sixers RC	3,878	4
Marshall (TX) ARC	734	1
Marshall Co. ARC	520	1
Martin Co. ARA	2,894	1
Martinez ARC	990	1
Maryland Mobileers ARC	3,784	1
Masonic Village ARC	2,804	2
Massillon ARC	4,368	1
Masters of Reception	760	1
Matagorda Co. Arc	2,204	3
Maui ARC	3,873	2
Maury ARC	3,696	4
Maury River Rain Dogs	638	1
Maxim Integrated Beaverton & Friends	958	1
Mayerthorpe Flying Tigers	764	1
McDowell ARA	3,770	1

McGregor Memorial EMS ARC	462	1
McHenry Co. RACES/ARES	2,136	1
McHenry Co. Wireless Assn.	16,172	3
McKean Co. ARC	4,604	1
McKinney ARC	4,594	2
McMinn Co. ARC	1,630	1
McMinnville ARC	2,534	8
Mecklenburg ARS	3,694	2
Medina Co. AR Corporation	3,109	2
Medina Co. ARC	6,608	1
Meigs Co. ARC	1,776	1
Mercer Co. ARC	4,648	1
Meriden ARC	4,306	9
Merrymeeting ARA	1,194	1
Mesilla Valley RC	3,608	3
Metro ARC	274	1
Metro Atlanta Telephone Pioneer ARC	1,920	1
Metro Detroit SATERN	620	1
Metro DX Club	7,418	2
Metrocrest ARS	4,154	8
Metropolitan ARC	680	1
Metuchen RC	1,156	1
MGRA/CGARC	3,766	2
Miamisburg Wireless Assn.	440	1
Mich-A-Con ARC	2,340	1
Michigan Amateur Radio Alliance	1,802	1
Michigan QRP Club	300	1
Microhams ARC	4,512	4
Mics & Beers	1,098	1
Mid Island RA	288	1
Mid-Atlantic ARC	802	1
Middle Peninsula ARC	2,084	1
Middle Tennessee ARC	1,194	1
Middlesex ARS	2,744	4
Midland (MI) ARC	476	2
Midland (TX) ARC	9,530	6
Mid-MO ARC	7,788	16
Mid-State ARC	978	1
Midwest ARC	1,214	1
Mike & Key ARC	18,552	11
Mila's Field Day Group	2,064	1
Mile Highlanders Group	582	2
Mile Lake Radio Assn.	2,406	1
Milford (OH) ARC	330	1
Milky Way Wireless Club	1,192	1
Milton ARC	162	1
Milwaukee Radio Amateurs Club	2,883	6
Milwaukee School of Engineering ARC	726	1
Mine Canyon Contest Club	794	1
Mining ARC/St. Paul RC	3,860	3
Minnesota Wireless Assn.	16,394	10
Minnetonka Minnesota RC	144	1
Misfits ARC	4,006	1
Mississauga ARC	1,552	3
Mississippi Coast ARA	208	2
MSU ARC, Magnolia ARC, Lowndes Co. ARC, MFJ ARC	9,418	1
Mississippi Valley ARA	25,406	3
Mississippi Valley DX/Contest Club	906	1
Missouri Illinois ARC	1,902	1
Missouri Outdoor Club	2,582	1
MIT Radio Soc.	528	1
Mizpah Shrine Radio Unit	1,852	3
MM Expeditionary Force	2,158	1
Mobile ARC	3,022	1
Mohawk ARC	6,889	7
Mohegan ARC	1,392	1
Moncton Area ARC	1,390	1
Monessen ARC	1,602	1
Monkey Lover's Radio Consortium	8,288	7
Monroe Co. ARS	1,364	1
Monroe Co. Radio Comm. Assn.	6,488	5
Montachusett ARA	2,514	4
Montezuma Valley AR Operators	3,630	1
Montgomery ARC	13,166	14
Montrose Co. ARC	5,734	2
Montvale OEM	3,200	4
Moose Jaw ARC	1,386	1
Moose Pirates	1,522	1
Morehead ARS	2,562	1
Moreno Valley ARA	932	1
Morocco Mole Contest Club	1,406	1
Morongo Basin ARC	206	1
Morris RC/Hanover TWP OEM	9,460	8
Morrow Co. AR Service	1,294	1
Mother Lode Dx/Contest Club	2,030	1
Motor City RC	1,508	4
Motorola ARC	1,850	1
Mound ARA	5,846	4
Mountain AR Contest Org.	7,544	1
Mountain ARC	1,178	1
Mountain Group	1,710	1
Mountain State Transmitters	956	1
Mountain Top ARA	850	1
Mountaineer ARA	7,080	3
MQBARC	1,558	1
Mt. Airy VHF Club	1,348	1
Mt. Diablo ARC	1,528	1
Mt. Magazine ARC	1,586	1
Mt. Shasta ARC	184	1
Mt. Vernon (OH) ARC	5,390	1
Mt. Vernon (VA) ARC	1,300	4
Mui's Marauders	7,218	1
Muncie Area ARC	1,632	1
Murgas ARC	5,530	4
Murray State Univ. ARC	3,910	1
Muscle Shoals ARC	3,618	1
Muskegon Area AR Council	290	1
Muskogee ARC	13,110	1
Musselshell ARC	642	1
N. New England Field AR Operators	1,936	1
N0OH Field Day	1,694	1
N2LBR Contest Team	5,342	1
N3RRDS	498	1
N4N Field Day Group	9,552	3
N5CST	980	1
Nacogdoches ARC	1,068	1
Nanaimo ARA	2,562	6
Narwhal ARS	1,634	1
NASA Ames Research Center ARC	870	1
Nashoba Valley ARC	6,650	2
Nashua Area Radio Soc.	9,935	5
Nashville ARC	2,104	1
Nassau ARC	4,016	1
Natchaug ARC	538	1
National Electronics Museum RC	2,210	1
National Trail ARC	1,226	1
Naturist ARC	506	1
NC TRI-CLUB	4,398	1
NCAARS/Brock Mtn CG	7,218	1
NE TX QRP Contest Fed.	1,680	1
Neighbor Kids	3,690	1
Nelson Co. Post 42 American Legion ARC	1,320	2
NEMO ARC	5,584	5
NEPA Emergency Services ARC	600	1
New England QRP Group	5,160	1
New England Radio Discussion Soc.	2,542	1
New Jersey Antique RC	2,096	1
New Jersey Institute of Technology ARC	236	1
New Mexico BCARES Team	2,908	4
New Mexico Big River Contesters	1,598	1
New Providence ARC	13,930	13
New River Valley ARC	2,020	1
Newark Ohio ARA	1,292	1
Newport Co. RC	13,222	2
Newton ARA	1,476	2
Newton/McPherson ARC	2,234	1
NF4AC	270	1
NFLARC	491	2
NHRC A.R.S.	1,450	1
Niagara Frontier Radiosport	11,532	11
Niagara Peninsula ARC	9,364	16
Niagara RC	2,068	2
Nittany ARC	4,550	6
Nittany Contest Club	5,152	2
Nixa ARC	1,198	1
NOARS-LCARA	5,780	4
Nodaway Co. Contesters	778	1
Noise Blankers Radio Group	3,934	1
North Augusta Belvedere RC	4,552	7
North Bay ARA	2,214	1
North Coast ARC	2,115	1
North Country ARA	354	1
North East Iowa Radio Amateur Assn.	1,496	1
North East Tarrant ARC	180	1
North Franklin ARS	1,000	1
North Fulton ARL	17,748	18
North Georgia QRP Club	1,174	1
North Georgia ARC	2,568	2
North Georgia QRP Club	1,807	5
North Georgia VHF Soc.	522	1
North Hills ARC	1,734	1
North Hills RC	1,270	3
North Mason ARES	656	1

Nathaniel Frissell, W2NAF, shared a fun moment with his son Anthony, while participating in the 2021 ARRL Field Day. [Nathaniel Frissell, W2NAF, photo]

North Okaloosa ARC	3,514	4
North Okanagan RAC	3,559	10
North Ottawa ARC	864	2
North Penn ARC	2,202	1
North Port ARC	6,966	2
North Richland Hills ARC	6,244	10
North Shore (BC) ARC	2,596	3
North Shore (IL) RC	21,620	24
North Shore (ON) ARC	6,154	14
North Shore RA	218	1
North Texas Homeschoolers ARC	198	1
North Texas Radiosport Assn.	1,804	1
North Yellowstone ARC	628	1
Northeast ARC	3,804	1
Northeast Arkansas RC	348	1
Northeast Iowa Radio Amateur Assn.	2,504	2
Northeast Maryland AR Contest Soc.	13,812	15
Northeast Mississippi Radio Amateurs	2,514	1
Northeast Tarrant ARC	3,890	4
Northeast Wireless RC	2,612	1
Northeast Wisconsin ARC	4,248	1
Northeastern Indiana ARA	4,096	7
Northern Arizona DX Assn.	2,606	1
Northern Berkshire ARC	1,352	1
Northern California Contest Club	1,792	3
Northern Colorado ARC	1,074	1
Northern Illinois Quad Co. AR Group	2,000	2
Northern Lakes ARC	494	3
Northville ARA	494	2
Northwest ARS	626	1
Northwest Arizona Travelers FD	1,526	1
Northwest ARS	3,818	2
Northwest Florida ARC	6,476	5
Northwest Illinois ARC	2,280	2
Northwest Indiana DX Club	642	2
Northwest Ohio ARC	824	1
Not Case ARC	8,134	1
Not Quite Workable Contest Club	4,366	3
Novi ARC	662	1
NS1T Field Day	504	1
NV4H FD Group	3,256	1
Oak Forest ARC	872	2
Oak Hill ARC	8,958	3
Oak Ridge ARC	1,986	1
Oakland Co. ARS	6,466	1
Oakland Radio Comm. Assn.	2,768	7
OCAPA	5,425	9
Ocean Co. ARES	1,868	4
Ocean Monmouth ARC	4,336	1
Ocean State ARG	600	1
Ogden ARC	2,888	2
Ohio Army National Guard Veterans RC	520	1
Ohio Valley ARC	2,300	1
Ohio Valley Experimenters Club	610	2
OH-KY-IN ARS	15,788	7
Okaw Valley ARC	4,656	1
Old Barney ARC	14,160	19
Old Post ARS	1,839	3
Ole Virginia Hams	2,526	1
Onslow ARC	366	1
Orange ARC	928	1
Orange Co. (CA) ARC	16,707	6
Orange Co. (NY) ARC	9,372	13
Orange Co. Radio Amateurs & Durham FM Assn.	35,560	26
Orange Park ARC	4,384	6
Orca DX and Contest Club	3,368	3
Oregon State Police ARA	1,472	1
Oregon Tualatin Valley ARC	4,334	4
Orlando ARC	1,590	1
Orleans Co. ARC	2,962	2
Oro Valley ARC	5,848	6
Oroville ARS	486	1
Orrville ARS	784	1
Otsego Co. ARA	2,916	1
Ottawa ARC	3,440	3
Ottawa Valley Mobile RC	17,307	27
Ottawa Valley QRP Soc.	1,948	2
Outagamie ARES/RACES	634	1
Overlook Mountain ARC	2,620	3
Owatonna Steele Co. AR	4,000	1
Owensboro ARC	2,872	1
Oxford Co. ARES	2,085	1
Ozaukee RC	12,170	5
Ozone ARC	1,428	2
Pacific Co. EOC	98	1
Pacific Northwest VHF Soc.	1,738	1
Paducah ARA	12,962	8
Page Valley ARC	3,506	1
Pahrump Amateur Radio Repeater Assn.	1,354	3
Palatine ARES/RACES/ AuxComm	254	1
Palestine Anderson Co. ARC	708	1
Palm Bay ARC	1,654	1
Palms West ARC	1,200	2
Palo Alto ARA	11,783	9
Palos Verdes ARC	19,786	22
Palouse Hills ARC	1,160	1
Pamlico ARC	1,816	1
Pamlico ARS	3,298	8
Panama City ARC	4,695	7
Panhandle ARC	6,592	2
Panoramaland ARC	3,878	3
PAPA System	576	2
Parker RA	8,000	7
Parkersburg Amateur Radio Klub	2,258	1
Parma RC	632	1
Parsippany-Troy Hills RACES	1,286	1
PART of Westford	7,916	7
Pasadena RC/JPLARC/ CITARC	22,543	27
Paso Robles ARC	4,372	3
Passaic Co. ARES Team	4,022	1
Pathfinders ARC	1,632	1
Patoka Valley ARC	1,330	3

Paul Bunyan ARC	512	1
Paulding ARC	2,596	2
Peace Country ARC	166	1
Peace River Radio Assn.	1,128	1
Peak RA	220	1
Peconic ARC	1,510	5
Peekskill/Cortlandt ARA	3,662	1
Peel ARC	11,055	14
Pella ARC	920	1
Peninsula Radio Operators	126	1
Penn Wireless Assn.	3,808	2
Pennsylvania Ridge Runners United	580	1
Pentagon ARC	604	1
Peterborough ARC	3,184	7
Phillips Co. ARC	2,080	1
Philmont Mobile RC	1,622	3
Pictou Co. ARC	786	1
Piedmont ARC	9,948	5
Pilot Knob ARC	2,676	1
Pin Pals	1,210	1
Pine State ARC	2,836	1
Pine Bluff ARC	972	2
Pioneer ARC	1,660	1
Piscataquis ARC	1,068	1
Plano AR Klub	3,792	4
Platinum Coast ARS	7,932	2
Platte Co. ARG	3,338	2
Plattsmouth ARC	986	1
Plymouth Historical Museum/ Univ. Michigan	306	1
Pocatello ARC	452	1
PODXS 070	7,376	17
Point Loma Radio Ops Group	5,216	1
Pontotoc Co. ARA	338	1
Port City ARC	12,348	1
Port Lavaca ARC	1,796	4
Portage Co. AR Service	14,920	4
Porterville ARA	34	1
Portland ARC	3,318	3
Portola Valley ARC	1,210	1
Portsmouth RC	1,020	1
Potomac Valley RC	22,640	15
Pottstown Area ARC	3,988	4
Poway ARS	1,518	1
Powhatan Area RC	2,336	1
Prairie Dog ARC	12,150	1
Preble ARA	2,458	1
Prescott-Russell ARC	520	2
Presque Isle Co. ARC	434	1
Preston Co. ARC	644	1
Pretty Good Ham Club	164	1
Pride Radio Group	148	1
Prince William Co. ARES	1,412	1
Princeton Ham RC	1,328	1
Proske's Posse	3,516	1
Providence EMA RACES Club	1,208	1
Providence Radio Assn.	7,052	2
Pueblo West ARC	2,382	3
Puerto Rico AR League	2,934	1
Putnam Co. ARES/RACES	492	1
Putnam Emergency Amateur Repeater League	2,116	6
QRP ARC International	3,695	2
QSY Soc.	1,422	2
Queen Anne's ARC	916	3
Queen City Emergency Net	1,252	1
Quinte & Prince Edward RCs	3,974	6
Radio Activity of Savannah	620	1
Radio Amateur Club of Knoxville	1,392	1
Radio Amateur Soc. of Norwich	3,182	1
Radio Amateurs of Greater Syracuse	4,296	2
Radio Amateurs of Northern Vermont	15,900	1
Radio Amateurs of Skagit Co.	4,286	3
Radio Artisans	1,626	1
Radio Assn. of Erie	3,382	1
Radio Assn. of Western New York	1,187	3
Radio Central ARC and Order of Boiled Owls of NY	10,280	4
Radio Club of Redmond	1,738	3
Radio Club of Tacoma	4,634	11
Radio Farm	8,460	2
Radio Operadores Del Este	4,056	4
Radio Soc. of Ohio	2,776	1
Rains ARA	1,966	2
Raleigh ARS	9,244	2
Ramapo Mountain ARC	872	2
Ramona Outback ARS	1,056	1
Randallstown ARC	11,870	1
Randolph Co. Emergency RC	3,676	2
Rappahannock Valley ARC	14,656	2
Raritan Bay Radio Amateurs	1,506	3
Raytown ARC	628	4
Raytown CERT	1,660	1
Reading RC	7,158	7
Red Mountain Radio Amateurs	418	1
Red Mule DX	1,250	1
Red River Radio Amateurs	3,912	2
Red River Valley ARC	1,000	1
Red Rose Repeater Assn.	2,036	1
Redding Veterans ARC	140	1
Redneck Radio Rangers	918	1
Redondo Beach DCS	1,656	3
Redstone Rockets	2,738	2
REDXA/MARS	11,600	10
Reelfoot ARC	5,696	3
Regina ARA	375	1
Renfrew Co. ARC	672	1
Reno Co. ARA	3,914	5
Renton EmComm Services	574	1
Reynolds Brothers Expeditions	454	1
RF Hill ARC	1,436	3
Rhode Island ARES	780	1
Rich and Ron's Field Day	870	1
Richard Olson, K9BWI, Memorial FD Club	4,970	1
Richardson Wireless Klub	5,310	10
Richfield RC	570	2
Richmond Amateur Telecommunications Soc.	902	2
Richmond ARC	718	2
RICOMU/RIEMA	3,556	1
Ridge Runners RC	7,160	1
Rip Van Winkle ARS	2,598	1
River Bend Wireless Operators Club	2,782	1
River City AR Comm. Soc.	626	1
River City ARC	2,642	1
Riverland ARC	1,820	2
Riverside Co. ARA	836	4
Roanoke Valley ARC	4,855	3
Rochester (MN) ARC	5,844	2
Rochester (NY) DX Assn.	17,666	11
Rockingham Co. ARC	1,418	1
Rockwall ARC	294	1
Rocky Mountain Ham Radio	7,518	2
Rogue Valley ARC	4,164	1
Rome RC	646	2
Royal Gorge ARC	1,216	1
Ruckerville Amateur Transmitting Soc.	2,866	3
Rueda Del Bengay	1,434	1
Runestone ARC	1,752	3
Rusk Co. ARC	1,152	1
SAARS	5,740	3
Sabin Field Day 2021	1,448	1
Sachse ARA	1,246	1
Sacksafone Acres RA	264	1
Saginaw Valley ARA	2,658	4
Saguaro Nights ARC	1,550	1
Salem ARC	1,052	1
Saline Co. ARES	616	1
Salkehatchie ARS	6,546	4
San Andreas Faultline FD Survivors	3,786	2
San Angelo ARC	1,692	1
San Antonio RC	1,488	1
San Diego ARES	9,328	10
San Fernando Valley ARC	3,450	5
San Francisco RC	1,492	2
San Gorgonio Pass Amateur Club	2,048	6
San Jose ARES/RACES	1,958	6
San Juan Co. ARS	1,366	4
San Luis Valley ARA	1,166	1
San Mateo RC	5,158	1
Sand Springs Wireless Assn.	1,322	1
Sandhills ARC	3,316	1
Sandia Vista ARC	560	1
Sandy ARC	350	1
Sangamon Valley RC	2,516	5
Santa Clara Co. ARA	2,092	6
Santa Clarita ARC	820	2
Santa Cruz Co. ARC	60	1
Santa Fe ARC	1,574	1
Santa Rosa Co. ARES	2,952	2
Sarasota Emergency RC	686	1
Saratoga Co. ARA	4,884	5
SARC-SEPAR	7,404	7
Sask Alta RC	2,550	1
Saskatoon ARC	64	1
Sawnee ARA	6,388	6
SC4ARC	8,971	10
SCAN/Red Ant Annihilators	1,760	1
Scarborough ARC	418	2
Scenic City ARS	168	1
Schaumburg ARC	3,296	2
Schoharie Co. ARA	1,076	1
Scioto Valley ARC	2,360	1
Sci-Tech ARS	3,432	2
Seattle ACS	2,586	5
Seaway Valley ARC	512	1
Sedalia Pettis AR Klub	1,100	1
Seneca Area Radio Amateurs	360	1
Seneca RC	5,052	1
Seward ARC	686	1
Shannon ARC	154	1
Sheboygan Co. ARC	1,874	3
Shelby ARC/ARES of Clev. Co.	3,430	1
Shelby Co. ARC	2,154	2
Shelby Co. ARES	2,140	1
Shenandoah Valley ARC	3,734	2
Sherlock ARA	214	1
Shiawassee ARA	62	1
Shore Points ARC	754	1
Shreveport ARA	8,746	9
Shy-Wy ARC	3,060	2
Sierra ARC of the High Mojave	2,326	2
Sierra Blanca ARC	2,028	2
Sierra Foothills ARC	9,884	10
Sierra Nevada ARS	5,458	5
Signal Hill ARC	13,234	5
Silver Comet ARS	3,252	4
Silver Springs RC	3,360	2
Silvercreek ARA	2,992	2
Sioux Empire ARC	3,468	2
Six Meter Club of Chicago	1,773	6
SK Contest Club	1,042	1
Ski Country ARC	5,170	3
Sky Valley ARC	2,678	5
Skyline ARC	1,236	1
Skyline Tower ARC	764	1
Skyview Radio Soc.	6,726	4
Sleeping Bag Portables	1,136	1
SLSRC	218	1
SMARTS RC	1,484	1
Smithchart ARS	9,881	5
Smoky Mountain ARC	10,602	10
Snake River ARC	1,310	1
Snohomish Co. Hams Club	3,652	8
Snoring Beagle Field Day Dogs	1,174	1
Soc. of Midwest Contesters	8,252	10
Soc. of Newfoundland Radio Amateurs	1,304	1
Socorro ARA	3,864	4
Solivita RC	1,424	1
Somerset Co. ARC	1,524	5
Sonoma Co. Radio Amateurs	6,452	12
Sooland ARA	862	1
SOTA LEOs	1,412	1
Souris Valley ARC	4,806	1
South Bay ARA	9,153	20
South Bay ARC	1,338	7
South Canadian ARS	5,858	6
South Carroll AR Group	2,924	2
South Central RC	1,814	1
South East Contest Club	386	1
South East Metro ARC	3,012	3
South East Texas ARC	1,630	1
South Georgia ARC	3,566	1
South Halton ARES Group	916	1
South Jersey Radio Assn.	14,384	10
South Lyon Area ARC	8,374	11
South Mountain Radio Amateurs	4,628	8
South Orange ARA	2,864	1
South Pasadena ARC	1,805	5
South Plainfield ARC	4,670	1
South San Francisco Comms.	394	3
South Texas Remote DX Club	4,730	2
South Towns ARS	6,724	2
South Wake ARC	3,662	4
South West Louisiana Amateur Repeater Club	1,652	3
South West Ohio DX Club	1,478	1
Southborough Rod & Gun ARC	1,796	1
Southeast KS ARC	1,060	1
Southeast Louisiana ARC	434	1
Southern Arizona DX Assn.	174	1
Southern Berkshire ARC	1,890	2
Southern California Contest Club	17,906	4
Southern Counties ARA	4,538	5
Southern Indiana Tri-County ARC	478	1
Southern Michigan ARS	1,464	1
Southern Pennsylvania ARC	1,032	2
Southern Pennsylvania Comm. Group	2,430	1
Southington ARA	598	1
Southwest Dallas Co. ARC	6,006	4
Southwest Iowa ARC	262	1
Southwest Mississippi ARC	1,848	3
Southwick RACES	3,798	1
Spa ARA	988	1
SPARGE	525	1
SPARK/HPT/PARC	3,576	1
Spartanburg ARC	4,046	1
Spirit Valley Amateurs	430	2
Splinter Group ARC	4,380	6
Splitrock ARA	10,079	4
Spokane DX Assn.	5,550	4
Spout Springs Repeater Assn.	2,042	1
Spring Hill ARC	478	1
Springfield RACES Club	470	1
Springhill Repeater Assn.	4,164	1
Squaw Island ARC	190	1
St. Charles ARC	9,024	6
St. Clair ARC	2,196	2
St. Cloud ARC	1,146	1
St. Croix ARA	164	1
St. Croix Valley ARC	100	1
St. Louis & Suburban RC	1,892	3
St. Louis ARC	8,390	7
St. Louis QRP Soc.	6,765	1
St. Mary's Co. ARA	2,220	1
Stamford ARA	2,660	2
Stanford ARC	19,766	1
Stanislaus ARA	250	2
Stanly Co. ARC	1,098	1
Stanwood-Camano ARC	6,421	4
Statesboro ARS/Southeast ARA	950	1
Ste. Genevieve Co. ARC	800	1
Steel City ARC	4,250	1
Sterling Park ARC	1,667	4
Steubenville-Weirton ARC	508	1
Stillwater ARA	3,754	8
Stillwater ARC (OK)	1,484	3
Stockton-Delta ARC	3,998	1
Stones River ARC	2,912	1
Story Co. ARC	3,318	1
Straight Key Century Club	200	1
Stratford ARC	382	1
Stubblefield Repeater Club	122	1
Sturdy Memorial Hospital ARCA	2,768	4
Suburban Technical ARS	222	1
Sullivan ARC	2,642	1
Sullivan Co. NY ARES	2,588	1
Sumner Co. ARA	1,636	2
Sumter ARA	2,084	1
Sun City ARC	2,796	3
Sun City Hilton Head ARC	2,144	3
Sun City Peachtree AR Group	1,120	2
Sun City Summerlin ARC	1,370	1
Sun Coast ARC Soc.	628	3
Sun Country ARS	3,592	2
Sun Parlour ARC	3,358	4
SundayNightNet.org	308	1
Sunnyvale ARES	2,940	4
Superstition ARC	2,564	5
Survivors of Broadcast	328	1
Susquehanna Co. ARC	3,542	1
Susquehanna Valley ARC	3,798	1
Sussex ARA	1,074	1
Swamp Fox Contest Group	2,100	1
Swan Ham RC	400	2
Sweetwater ARC	1,172	1
Tallahassee ARS	4,298	4
Tamaqua Wireless Assn.	1,460	1
Tamiami ARC	4,392	3
Tampa ARC	7,358	1
TCARES	1,684	1
Team Cramp/MXG Designs Radio Geeks	2,430	1
Team RU	326	1
Technology in ARC	514	1
Tellico Lake ARC	5,474	5
Telluride ARC	1,308	1
Tenn Rose	4,710	1
Tennessee Contest Group	8,020	6
Tennessee Valley DX Assn.	7,044	1
Terrace ARC	296	1
Terre Haute RC	4,092	1
Texas DX Soc.	5,714	5
Texas Emergency Amateur Communicators	1,536	2
The 415 ARC	6,916	2
The FPL Group	4,438	1
The Great White North II	624	1
The Megamachine Repeater	1,894	1
The Ohio 337 Ragchew Crew	1,290	1
The Road Show ARC	1,672	1
The Villages ARC	4,169	4

The World RC	3,458	1
Theodore Roosevelt ARC	1,314	1
Thibodaux ARC	1,642	1
Thousand Islands Radio Club	2,540	1
Three Amigos	1,354	1
Three Ammonites	1,150	1
Thunder ARC	2,060	1
Thunderbird ARC	2,280	3
TicBite ARA	765	1
Tilson Contest Club	8,174	1
Tippecanoe ARA	6,376	3
Tipton ARS	6,410	1
TLSC Amateur Radio Group	1,996	2
Toccoa ARS	664	1
Toledo Mobile RA	2,678	5
Toledo Radio Amateur Club	3,004	1
Tompkins Co. ARA	1,402	2
Tom's Garage ARC	8,774	1
Top of Michigan ARC	852	1
Toronto ARC	3,220	6
Tortolina RC	530	1
Tortolita RC	13,166	13
Transit On The Rubicon Family FD Excursion	1,112	1
Traveling Amateur Radio Team	1,696	1
Tri-City Radio Amateur Club	1,750	1
Tri-County ARC (NC)	162	1
Tri-County ARC (PA)	1,310	4
Tri-County ARC (TX)	2,012	1
Tri-County ARC (WI)	5,536	4
Tri-County Radio Assn.	6,234	3
Tri-State ARS (IN)	950	5
Tri-County ARA (CA)	1,272	4
Tri-County ARC (TX)	52	1
Trident ARC	4,482	5
Tri-Lakes ARC	5,514	4
Trilogy ARC	578	1
Trine Amateur Radio Club	276	1
Tri-State Amateur Radio Group	462	1
Tri-State ARA	2,984	3
Tri-States ARC	708	1
Tri-Town Radio Amateur Club	6,579	4
Trojan ARC	5,800	1
Troy ARA	1,740	1
Truckee Radio Amateur Soc. Hams	4,910	1
Truro ARC	1,589	5
Tucker Family RC	4,116	1
Tulsa Digital RC	5,985	1
Turkey Heaven Mtn. Repeater Assn.	3,612	3
Tusco ARC	4,272	1
Twin Cities Repeater Club	2,628	2
Twin City ARC	3,524	3
Twin City FM Club	1,264	2
Twin Ops Warriors	1,614	1
Twin Rivers ARC	422	1
Twin State RC	2,612	2
Two Rivers AR Group	1,134	1
Two Rivers ARC	2,670	1
TX Emergency Amateur Communicators	324	1
Tyler ARC	2,964	2
Union City Wireless Assn.	882	1
Union Co. ARC	4,272	2
Union Co. Indiana Bicentennial	234	1
Union Métropolitaine des Sans-filistes de Montréal	5,990	7
Uniontown ARC	5,914	2
United Radio Amateur Club	1,294	4
Univ. of Alabama RC	1,506	2
Univ. of Arizona ARC	4,060	1
Univ. of Southern California ARC	650	1
Univ. of Texas ARC	382	1
Upsher Area ARC	626	1
US West Wireless Club	202	1
USECA	368	1
USS Kitty Hawk ARC	1,702	1
USS Wisconsin RC	212	1
Utah ARC	7,409	2
Utah DX Assn.	1,224	1
Utah Valley ARC	6,764	1
Utica ARC	1,914	1
Utica Shelby Emergency Comm. Assn.	1,360	3
VA2LPQ et al.	706	1
Vaca Valley RC	3,060	1
Valdosta ARC	1,242	1
Valencia Co. ARA	1,302	1
Valley and Massanutten ARA	11,106	9
Valley of the Moon ARC	2,222	2
Valley RC of Oregon	3,320	6
Van Wert ARC	5,386	1
VBARC-VADXCC	4,592	1
VCARS-SSARC	4,608	1
VE3GTM Field Day	850	1
VE6FAR Cycle 25	5,230	10
VECTOR	138	1
Ventura Co. ARC	2,282	1
Ventura Co. ARS	226	1
Verde Valley ARA	844	2
Vermilion Range ARC	2,502	1
Vero Beach ARC	3,452	1
Victor Valley ARC	552	2
Victoria ARC	632	1
Victoria-Haliburton ARA	1,132	3
Vienna Wireless Soc.	9,140	11
Vieques Island ARC	2,150	1
Vilas Co. RC	1,797	1
Village 7 ARC	1,582	1
Village Hams	1,396	1
Villanova Univ. ARC	520	1
Vintage Radio & Comm. Museum of CT ARC	312	1
Virginia Mountain ARC	2,646	1
Vm Okla Nan Ola ARC	6,115	1
Volusia ARES and West Volusia ARS	1,026	1
W/K ARC of Greater Milwaukee	6,600	1
WØRCZ Memorial Station	1,458	1
W3AO PVRC	115,649	37
W6TRW ARC	1,836	1
Wabash Valley ARA	5,690	1
WACOM	690	1
Wahkiakum Co. ARC	5,089	5
Waldo Co. ARA	3,936	1
Walla Walla Valley ARC	1,048	1
Walton Co. Repeater Group and Walton Co. ARES	1,820	1
WARA/GBARC	1,372	1
Warminster ARC	5,080	9
Warren ARA	6,646	1
Warren ARS	1,070	1
Warren Co. EmComm Group	1,318	1
Warren Co. NY RC	6,502	4
Warrensburg Area ARC	1,548	1
Wasco ARS	668	1
Washington Amateur Comm.	2,332	1
Washington Area ARC	1,872	2
Washington Co. ARC	790	1
Watauga ARC	5,026	5
Waterton ARS	5,192	2
Waterton Contest Club	372	1
Watertown ARC	500	2
Wayne ARC	4,786	4
Wayne Co. ARC	4,752	2
WCARC-OH	480	1
WCARC-TX	17,406	17
WCARES-TN	18,544	23
WCARS-Murphy/Cherokee Co. ARES	736	1
WD Contest Group	4,172	2
Weld ARS	418	1
Wellesley ARS	1,635	5
Wellington RC	114	1
West Alabama ARC	1,856	1
West Allis Radio Amateur Club	2,676	4
West Baldwin City ARC	558	1
West Chester ARA	5,242	3
West Essex ARC	2,258	2
West Fork ARC	3,380	1
West Georgia ARS	3,278	2
West Island ARC	572	2
West Jersey DX Group	8,150	1
West Kootenay ARC	632	1
West Point Fire CERT	872	1
West Seattle ARC	350	1
West Texas ARC	1,542	1
West Valley ARA	18,647	13
West Valley ARC	158	2
West Virginia Amateur Radio	3,420	1
Westchester Emergency Comm. Assn.	12,856	3
Westcoast ARA	952	2
Western Carolina ARS	1,040	1
Western CO ARC	1,470	1
Western IL ARC	5,214	4
Western KS ARC	1,940	1
Western PA Wounded Hams	1,886	1
Western Piedmont ARC	380	1
Western Placer ARC	1,798	4
Western Tidewater RA	1,040	1
Western WA DX Club	550	1
Westport Astro ARC & Housatonic ARC	1,687	1
Westside ARC	1,892	1
Wexaukee ARC	1,062	2
Whatcom Emergency Comm. Group/Mt. Baker ARC	1,950	1
Wheaton Community Radio Amateurs	2,210	4
Whidbey Island Trailblazers	2,390	1

The Gloucester County Amateur Radio Club, W2MMD, in New Jersey, operated at night during the 2021 ARRL Field Day, with antennas for the 15-, 20-, and 80-meter CW stations. The antennas were supported by a portable aluminum military mast, which takes about an hour to deploy. [Vincenzo Sallustio, N4NYY, photo]

White Rock ARC	168	1
White Rock Lake ARC	1,848	3
Whitewater Valley ARC	1,466	1
Whitley Co. ARC	4,594	1
Whitman ARC	2,834	1
Whitman Co. ARES/RACES	90	1
Wichita ARS	1,046	1
Wilderness Road ARC	1,488	2
Willamette Valley DX Club	2,358	3
Williamsburg Area ARC	9,146	3
Williamson Co. ARC	142	1
Williamson Co. ARES	826	1
Wilson ARC	3,498	2
Wilsons Wonders	5,210	1
Windmill Amateur Radio Grp	2,400	1
Winnipeg ARC	734	1
Winona ARC	4,904	2
Wireless Assn. of South Hills ARC	4,464	2
Wireless Operators of Winsted/CQ RC	408	1
Wireless Soc. of Lorain Co.	1,335	1
Wireless Soc. of S. Maine	7,710	2
Wisconsin ARC	3,554	7
Wisconsin River Gang	6,520	1
Wisconsin Valley RA	1,324	1
Wistaria Wireless Soc.	1,608	1
Wood Co. ARC	2,568	3
Wood Co. ARES/RACES	2,848	1
Wood Co. Emergency Comm.	3,108	1
Woodbridge Wireless	24,092	4
Woodchuck ARC	1,214	1
Woodford Co. ARC	768	2
Workshop88	2,895	1
WPA FIELD DAY Assn.	3,266	2
WRAET	626	2
WVØH FD Group	2,058	1
WVARC-AZ	804	6
XRX & Monroe Co. ARES RC	4,114	1
XWARN/DARA	3,868	2
Yadkin Valley ARC	1,152	1
Yankee Clipper Contest Club	7,416	3
Yavapai ARC	1,236	1
Yellow Thunder ARC	1,510	1
Yellowknife ARS	1,422	1
Yellowstone RC	1,272	3
YoloARS/MTVACA/SACARC/ Yolo CO ARES/UCDARC	1,754	1
Yonkers ARC	2,288	1
Yooper Dupers	3,574	1
York ARC	1,360	1
York Co. Radio Soc.	630	1
York Co. (SC) ARS	8,320	2
York RC	7,763	5
York Region ARC	9,588	15
Young Co. ARC	602	1
Yuba-Sutter ARC	2,816	6
Yukon ARA	790	1
Zephyrhills Area ARC	1,348	1
Zuni Loop MEF	6,470	7

Please click here jump to page for full Class A, B, C, D, E, and F line scores.

Paul Bourque, N1SFE, n1sfe@arrl.org

2021 ARRL June VHF Contest Results

This year's ARRL June VHF Contest was held June 12 – 14, 2021.

Sponsored Plaque Winners

Thanks to the generous support of numerous clubs and individuals, we are pleased to list the winners of the Sponsored ARRL June VHF Contest plaques below. For more information on plaque sponsorship or to order a duplicate plaque, contact the ARRL Contest Program at 860-594-0232 or **contests@arrl.org**. Plaques cost $80, which includes all shipping charges.

Plaque Category	Plaque Sponsor	Winner
Overall Single Operator, High Power	Charles Dietz, W5PR	K1TEO
Overall Single Operator, Low Power	Jeffrey Klein, K1TEO	AF1T
Overall Single Operator, QRP Portable	Andrea Slack, K2EZ	W6TV (W6YEP, op)
Overall Single Operator, Three-Band	Northern Lights Radio Society	KO9A
Overall Single Operator, FM Only	Andrea Slack, K2EZ	N9UM
Overall Single Operator, Low Power, Rookie	W3ZZ First Log Award — Memorial by Tim, K3LR, and Dave, W9PA	KS1PPY
Overall Multioperator	Directive Systems and Engineering — in memory of W3ZZ and K3CB	W2SZ
Overall Limited Multioperator	Gene Zimmerman, W3ZZ, Memorial — Arizona VHF Society	K5QE
Overall Rover	Andrea Slack, K2EZ	N7GP/R
Overall Limited Rover	Andrea Slack, K2EZ	KA5D/R
Overall Unlimited Rover	Andrea Slack, K2EZ	K5SRT/R
Atlantic Division Single Operator, High Power	Potomac Valley Radio Club	K1RZ
Atlantic Division Single Operator, Low Power	Potomac Valley Radio Club	N2WK
Atlantic Division Multioperator	Al Oldfield, W9KXI, and Ken Kent, KA2LIM	W3CCX
Atlantic Division Rover	George Molnar, KF2T	KF2MR/R
Central Division Single Operator, High Power	Society of Midwest Contesters	K9CT
Central Division Single Operator, Low Power	Society of Midwest Contesters	K2DRH
Central Division Single Operator, QRP Portable	Society of Midwest Contesters	W9SZ
Central Division Single Operator, Three-Band	Society of Midwest Contesters	KO9A
Central Division Rover	Society of Midwest Contesters	K9JK/R
Dakota Division Single Operator, Low Power	Northern Lights Radio Society	WØAUS
Dakota Division Rover	Matt Holden, KØBBC	WØZF/R
Dakota Division Limited Rover	Matt Holden, KØBBC	KAØRYT/R
Delta Division Single Operator, High Power	Memorial to Mike Bruck, W5MRB, from his friends	W5ZN
Hudson Division Single Operator, Low Power	Matthew Ryffel, K2NUD	WA2VNV
Pacific Division Single Operator, Low Power	Northern Lights Radio Society	KE6GLA
Roanoke Division Single Operator, High Power	Potomac Valley Radio Club	N3MK
Roanoke Division Single Operator, Low Power	Potomac Valley Radio Club	N4LAZ
Southwestern Division Single Operator, FM Only	Arizona VHF Society	W6HIP
Canada Single Operator, Low Power	Neil Macklem, VE3SST	VE3DS
Canada Limited Multioperator	Peter Prabucki, VA3ELE	VE3MIS
Canada Rover	Neil Macklem, VE3SST	VE3OIL/R
Canada Limited Rover	Peter Prabucki, VA3ELE	VE3GKT/R
Canada Unlimited Rover	Neil Macklem, VE3SST	VE7AFZ/R

Full Results Online

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

Top Ten

Classic Rover

N7GP/R	264,704
K6VHF/R	137,973
K2EZ/R	101,790
VE3OIL/R	99,990
KF2MR/R	85,595
KJ7JC/R	67,232
N7DSX/R	48,600
AC7FF/R	45,864
N7OW/R	41,526
WØZF/R	41,085

Limited Rover

KA5D/R	84,876
W5TN/R	63,180
NV4B/R	37,570
AL1VE/R	27,324
K5ND/R	25,877
N6GP/R	21,774
W9YOY/R	17,286
K2QO/R	15,879
AA5PR/R	12,640
KC7OOY/R	10,736

Unlimited Rover

K5SRT/R	150,336
NØLD/R	110,313
K6MI/R	75,468
KD5IKG/R	65,040
KG6CIH/R	32,028
W4NF/R	11,520
KE6QR/R	11,040
KJ1K/R	4,309
KI6ARW/R	2,967
KD1RX/R	2,925

Single Operator, High Power

K1TEO	508,348
W5ZN	232,559
K1RZ	228,160
N2JMH	149,445
N1AV	148,575
K5TR	142,814
N3MK	134,420
K1KG	125,904
K9CT	119,250
N3RG	98,384

Single Operator, Low Power

AF1T	150,102
WB1GQR (W1SJ, op)	119,966
N2WK	95,524
NF3R	86,275
K2DRH	69,391
K9KLD	67,158
NØLL	56,363
VE3DS	53,376
W3LL	49,256
K3TEF	42,570

Single Operator, Portable

W6TV (W6YEP, op)	20,539
W7JET	6,290
W3CJD	4,797
WB2AMU	4,488
KD8RTT	4,060
WR6Z	2,684
KD7WPJ	2,232
KK6MC	2,044
K7ATN	1,748
W9SZ	1,710

Single Operator, Three-Band

KO9A	86,907
N3AAA	69,719
KE3JP	52,001
NS4T	46,766
WN3A	45,847
AB5EB	36,855
WQ5L	35,796
W5TRL	35,475
K6RO	29,640
N3DGE	24,934

Single Operator, FM Only

N9UM	4,025
KG7AZY	1,876
N7KN	1,625
VE3RWJ	1,188
N6NFB	792
WG4I	770
W6HIP	637
AF6GM	603
KK6OTK	531
KN6IOC	440

Limited Multioperator

K5QE	302,869
AA4ZZ	279,558
N2NT	220,220
K1WHS	171,600
AD4ES	140,361
W3SO	136,213
NV9L	82,264
W2LV	76,209
KZ9O	67,680
VE3MIS	66,444

Unlimited Multioperator

W2SZ	372,324
W3CCX	271,040
N4SVC	170,400
WQØP	167,300
K3CT	121,923
W4ZST	117,298
WD9EXD	101,990
KD2LGX	86,199
W4IY	85,280
N8GA	69,561

Affiliated Club Competition

Club	Score	Entries
Unlimited		
Potomac Valley Radio Club	885,466	74
Medium		
Mt. Airy VHF Radio Club	1,800,372	41
Arizona VHF Soc.	789,601	13
Rochester VHF Group	557,259	22
Society of Midwest Contesters	538,087	41
Florida Contest Group	433,335	18
North East Weak Signal Group	431,117	19
Roadrunners Microwave Group	371,501	7
Carolina DX Assn.	359,114	8
Frankford Radio Club	353,048	25
Yankee Clipper Contest Club	345,215	18
Fourlanders Contest Team	343,062	10
Northern Lights Radio Soc.	263,813	20
Northern California Contest Club	233,124	33
Contest Club Ontario	208,459	15
Pacific Northwest VHF Soc.	191,616	37
Florida Weak Signal Soc.	184,872	4
Arizona Outlaws Contest Club	154,731	22
South East Contest Club	142,779	10
Kentucky Contest Group	129,097	7
Southern California Contest Club	127,614	16
Central Texas DX and Contest Club	120,748	9
Northeast Maryland AR Contest Soc.	120,593	9
The Ontario VHF Assn.	114,970	10
DFW Contest Group	94,199	11
Badger Contesters	89,203	12
Texas DX Soc.	82,458	5
Swamp Fox Contest Group	81,888	4
Grand Mesa Contesters of Colorado	73,206	11
Tennessee Contest Group	48,754	8
Arkansas DX Assn.	48,044	5
Michigan VHF-UHF Soc.	46,747	5
Minnesota Wireless Assn.	32,120	12
New Mexico VHF Soc.	28,791	5
Oklahoma City Autopatch Assn.	23,602	3
Mad River Radio Club	19,348	6
Wayne County ARC	15,326	4
South Jersey Radio Assn.	14,255	4
Hudson Valley Contesters and DXers	12,572	6
Radiosport Manitoba	11,629	3
Alabama Contest Group	10,337	5
Willamette Valley DX Club	8,694	5
Valley Amateur Radio Assn.	4,732	3
New Providence ARC	2,870	3
Orca DX and Contest Club	2,072	3
Alaska VHF-Up Group	1,105	3
Edmonds Woodway ARC	891	4
Big Sky Contesters	855	3
Local		
Chippewa Valley VHF Contesters	55,470	4
CTRI Contest Group	52,665	5
Nashoba Valley ARC	43,055	6
Niagara Frontier Radiosport	21,327	5
Meriden ARC	17,366	3
Bristol (TN) ARC	12,410	4
Silver Comet Amateur Radio Soc.	11,115	6

Brandon Clark, KL7BSC, operated using the Alaska VHF-Up Group call sign, KL7VHF, from this breathtaking location in Anchorage, Alaska, during the 2021 ARRL June VHF Contest. He made 38 contacts, placing him second in the Classic Rover category in the Northwestern Division. [Brandon Clark, KL7BSC, photo]

Division Winners

Classic Rover

Atlantic	KF2MR/R	85,595
Central	K9JK/R	10,011
Dakota	WØZF/R	41,085
Delta	AG4V/R	21,675
Midwest	WAØCNS/R	1,166
New England	WB2VVQ/R	2,929
Northwestern	K7MDL/R	5,363
Pacific	WB6HYD/R	29,640
Roanoke	KK4BZ/R	528
Southwestern	N7GP/R	264,704
West Gulf	K2EZ/R	101,790
Canada	VE3OIL/R	99,990

Limited Rover

Atlantic	K2QO/R	15,879
Central	W9YOY/R	17,286
Dakota	KAØRYT/R	6,728
Delta	WXØEMT/R	3,990
Great Lakes	K8JH/R	3,610
Hudson	N2DXT/R	5,332
Midwest	AL1VE/R	27,324
New England	AF1R/R	6,888
Northwestern	KC7OOY/R	10,736
Pacific	WB6HUM/R	1,760
Roanoke	KM4OZH/R	8,109
Rocky Mountain	AA5PR/R	12,640
Southeastern	NV4B/R	37,570
Southwestern	N6GP/R	21,774
West Gulf	KA5D/R	84,876
Canada	VE3GKT/R	240

Unlimited Rover

Atlantic	K2DH/R	756
Hudson	KA2YRA/R	935
Midwest	AF4JF/R	756
New England	KG6CIH/R	32,028
Northwestern	KD1RX/R	2,925
Pacific	K6MI/R	75,468
Roanoke	W4NF/R	11,520
West Gulf	K5SRT/R	150,336
Canada	VE7AFZ/R	1,541

Single Operator, High Power

Atlantic	K1RZ	228,160
Central	K9CT	119,250
Dakota	KAØPQW	18,180
Delta	W5ZN	232,559
Great Lakes	KE8FD	37,088
Hudson	N2GHR	55,622
Midwest	WØJW	17,160
New England	K1TEO	508,348
Northwestern	W7EW	23,772
Pacific	K6KLY	31,584
Roanoke	N3MK	134,420
Rocky Mountain	K7ULS	32,512
Southeastern	WA4GPM	77,280
Southwestern	N1AV	148,575
West Gulf	K5TR	142,814
Canada	VE3WY	32,488

Single Operator, Low Power

Atlantic	N2WK	95,524
Central	K2DRH	69,391
Dakota	WØAUS	30,591
Delta	WB5JJJ	20,580
Great Lakes	W5MX	13,135
Hudson	WA2VNV	39,600
Midwest	NØLL	56,363
New England	AF1T	150,102
Northwestern	K7YO	4,980
Pacific	KE6GLA	15,708
Roanoke	N4LAZ	21,060
Rocky Mountain	NØPOH	10,560
Southeastern	W4MAA	41,470
Southwestern	NA6MG	16,184
West Gulf	K5TRA	42,000
Canada	VE3DS	53,376

Single Operator, Portable

Atlantic	N3KCM	1,147
Central	W9SZ	1,710
Dakota	NØSUW	432
Delta	N4QX	12
Great Lakes	WA8RJF	120
Hudson	W3CJD	4,797
Midwest	KD8RTT	4,060
New England	AG1A	96
Northwestern	K7ATN	1,748
Pacific	W6TV (W6YEP, op)	20,539
Roanoke	AB8CI	364
Rocky Mountain	KK6MC	2,044
Southeastern	AB4DX	630
Southwestern	W7JET	6,290
Canada	VE3EG	315

Single Operator, Three-Band

Atlantic	N3AAA	69,719
Central	KO9A	86,907
Dakota	KØVG	21,944
Delta	WQ5L	35,796
Great Lakes	KM8V	24,610
Hudson	K2IW	11,856
Midwest	KØPHP	20,394
New England	N1API	12,792
Northwestern	KA6BIM	4,998
Pacific	W6KAP	15,785
Roanoke	KO4ECD	20,250
Rocky Mountain	WØBX	18,612
Southeastern	NS4T	46,766
Southwestern	K6RO	29,640
West Gulf	AB5EB	36,855
Canada	VE3PJ	20,962

Single Operator, FM Only

Atlantic	KD2VGM	51
Central	N9UM	4,025
Delta	K4NRT	30
New England	KC1OYG	2
Northwestern	N7KN	1,625
Pacific	N6NFB	792
Roanoke	KI4POT	98
Rocky Mountain	KG7AZY	1,876
Southeastern	WG4I	770
Southwestern	W6HIP	637
West Gulf	KG5UNK	93
Canada	VE3RWJ	1,188

Limited Multioperator

Atlantic	W3SO	136,213
Central	NV9L	82,264
Hudson	N2NT	220,220
New England	K1WHS	171,600
Pacific	N6RO	44,530
Roanoke	AA4ZZ	279,558
Rocky Mountain	K5LRW	7,540
Southeastern	AD4ES	140,361
Southwestern	WO1S	1,600
West Gulf	K5QE	302,869
Canada	VE3MIS	66,444

Unlimited Multioperator

Atlantic	W3CCX	271,040
Central	WD9EXD	101,990
Delta	N4QWZ	47,025
Great Lakes	N8GA	69,561
Midwest	WQØP	167,300
New England	W2SZ	372,324
Pacific	K6HS	33,616
Roanoke	W4IY	85,280
Southeastern	N4SVC	170,400
Southwestern	NI6E	26,746
West Gulf	KC5MVZ	17,622

The 2022 ARRL June VHF Contest will be held June 11 – 13, 2022.

The 2022 January VHF Contest

1900 UTC Saturday, January 15 – 0359 UTC Monday, January 17, 2022

A new season of VHF contesting begins during the third weekend of January with the 2022 ARRL January VHF Contest. Take advantage of enhanced propagation modes, such as meteor scatter, winter E-skip, aurora, EME, and tropospheric scatter/ducting on amateur frequencies of 50 MHz and above.

Whether you prefer CW, phone, or one of the newer digital modes, there are plenty of ways for hams of all experience levels to participate in the event.

Assistance is available to all entry classes, so stations can coordinate when to attempt contacts, whether they're at home, portable, or on the road. Coordinate with your local club or group and let them know when and where you'll be on the air for the event.

The contest exchange is your Maidenhead grid square. More information on grid squares can be found at **www.arrl.org/grid-squares**.

10-Day Log Deadline: Logs must be uploaded or postmarked no later than 0359 UTC January 27, 2022. Electronic Cabrillo-formatted logs must be uploaded to **http://contest-log-submission.arrl.org** or paper summary sheets and logs must be mailed to ARRL — January VHF Contest, 225 Main St., Newington, CT 06111.

During the 2021 ARRL January VHF Contest, Sidney Terry, K5SRT, operated in the Unlimited Rover category. He and Alexander Naas, KG9DUK, earned a first-place finish in the category. [S. Schieving, Jr., WØHG, photo]

Complete rules can be found at **www.arrl.org/january-vhf**

The 2022 ARRL International DX Contest

CW: 0000 UTC Saturday, February 19 – 2359 UTC Sunday, February 20
SSB: 0000 UTC Saturday, March 5 – 2359 UTC Sunday, March 6

Ricardo "Rick" Navarrete Lopez, EA4M, operated on 15 meters in the 2021 ARRL International DX CW Contest. He finished third in Spain in the Single Operator, 15 Meters category. [Ricardo "Rick" Navarrete Lopez, EA4M, photo]

Join thousands of amateurs worldwide as they compete in this exciting international contest. Whether you're looking for casual DX contacts, or pursuing new countries toward awards or your DXCC counts, this event has something for everyone.

New Categories for 2022: The Single Operator, Single Band (160, 80, 40, 20, 15, and 10 meters) categories now have three different power level subcategories (QRP, Low Power, and High Power) in both Non-Assisted and Assisted (Unlimited) categories.

- W/VE stations send signal report and state or province; DX stations send signal report and transmit power.
- Upload your Cabrillo-formatted log to the ARRL web app at **http://contest-log-submission.arrl.org** or send paper logs to ARRL — DX Contest, 225 Main St., Newington, CT 06111.
- Log submission deadlines are 7 days after the event. For this event, the CW deadline is 2359 UTC on February 27, and the SSB deadline is 2359 UTC on March 13.

Complete rules can be found at **www.arrl.org/arrl-dx**

January 2022 Kids Day

1800 UTC – 2359 UTC Saturday, January 1, 2022

The first Saturday in January is the time to encourage young people to get on the air and experience what amateur radio is all about!

Sponsored by the Boring (Oregon) Amateur Radio Club, this event has a simple exchange suitable for younger operators: first name, age, location, and favorite color. After that, the contact can be as long or short as each participant likes.

Kids Day is the perfect opportunity for you or your club to open your shack doors and invite kids over to discover the excitement of amateur radio.

Shea Moroney participated in the ARRL 2021 Kids Day along with her father, Michael Moroney, KD7RF. After making a few contacts, Shea felt comfortable calling CQ and handing out signal reports, and she's looking forward to receiving QSL cards from the stations they worked. [Michael Moroney, KD7RF, photo]

Complete rules can be found at **www.arrl.org/kids-day**

The 2022 ARRL Straight Key Night

0000 UTC – 2359 UTC Saturday, January 1, 2022

Start off the new year with the sounds of Morse code! Straight Key Night (SKN) is not a contest, so there's no need for quick exchanges. All you need is your favorite straight key or bug.

Many participants dust off their vintage rigs and keys, but all gear (new or old) is welcome. The number of contacts you make isn't important, and many new and longtime friends get together on the air for the event.

Send your list of stations worked and SKN stories and photos, along with your votes for Best Fist and Most Interesting QSO, to **straightkey@arrl.org** before January 31, 2022. A paper summary of your activity can be mailed to ARRL — Straight Key Night, 225 Main St., Newington, CT 06111. Be sure to post your story and photos at **www.arrl.org/soapbox**.

Complete rules can be found at
www.arrl.org/straight-key-night

ARRL Straight Key Night is the perfect opportunity to dust off your favorite key or bug, or use new gear for the event. [Paul Bourque, N1SFE, photo]

The 2022 ARRL RTTY Roundup

1800 UTC Saturday, January 8 – 2359 UTC Sunday, January 9

The 2022 ARRL RTTY Roundup begins Saturday, January 8. If you're new to digital modes, this can be your opportunity to explore the excitement of digital mode contesting. Getting on digital modes is now easier than ever — all you need is a computer, a transceiver, and a sound card interface. Many of the new HF rigs even have built-in interfaces that allow your PC to be connected directly to your transceiver. If you're new to digital contesting, visit **www.rttycontesting.com** for tips on how to get started.

Exchange: W/VE (US and Canada) stations send signal report and state; DX (outside US and Canada) stations send signal report and consecutive serial number starting with 001.

As specified in the contest rules, a control operator must be present to manually initiate and log each contact. Control may be either local or remote. FT8's Fox and Hound mode is not permitted.

Using modes in which more than one signal is decoded at a time, such as PSK31 and FT8/FT4, requires the participant to enter in the Single Operator, Unlimited or Multioperator category.

Bruce Smith, AC4G, placed second in the Delta Division in the Single Operator, RTTY Only, Low Power category of the 2021 ARRL RTTY Roundup. [Bruce Smith, AC4G, photo]

7-Day Log Deadline: All logs must be received via web app or postmarked no later than 2359 UTC on January 16, 2022. Upload your Cabrillo-formatted logs to **http://contest-log-submission.arrl.org** or mail paper logs to ARRL — RTTY Roundup, 225 Main St., Newington, CT 06111.

Complete rules can be found at **www.arrl.org/rtty-roundup**

Strays

HamSCI's December 2021 Antarctic Eclipse Festival

The Antarctic Eclipse Festival, sponsored by HamSCI, is taking place in December 2021. As the shadow of the moon passes across Antarctica on December 4, it will generate traveling ionospheric disturbances, which will in turn affect radio propagation. The unusual geometry of this year's eclipses will give researchers an opportunity to investigate complicated ionospheric dynamics over the poles, as the long daytime of polar summer is briefly interrupted by the ecliptical night.

You can explore the ionosphere from your home station by participating in Ham Radio Science Citizen Investigation's (HamSCI's) eclipse festivals. During these events, hams and citizen-scientists are asked to collect Doppler shift data from time standard stations, such as WWV. All you need to participate is an HF radio connected to a computer. A GPS-disciplined oscillator is helpful for collecting data, but is not required. Data collection will run from December 1 through December 10, and the results will be made available for scientific analysis.

All ham radio operators and shortwave listeners around the globe are invited to join, even stations that are far from the path of totality. Eclipse Festivals in 2020 included over 100 participants from 45 countries. Instructions are available in multiple languages.

HamSCI is an initiative of ham radio operators and geospace scientists, dedicated to advancing scientific research and understanding through amateur radio activities. Eclipse festivals are pilot campaigns for the Personal Space Weather Station (PSWS) — HamSCI's flagship project. The PSWS team seeks to develop a global network of citizen-science stations. Participants monitor the geospace environment in order to deepen scientific understanding and enhance the radio art.

To learn more about the Antarctic Eclipse Festival and how to participate, visit **www.hamsci.org/festivals**.

The December 2021 Antarctic Eclipse Festival QSL art. [Zo Linker graphic]

Bernie McClenny, W3UR, w3ur@arrl.org

How's DX?

The Changing Landscape of DXpedition QSLing

*For this month's column, seasoned DXer Gene Spinelli, K5GS (**k5gs@arrl.net**), talks about the impact that Logbook of The World (LoTW) has had on DXpeditions and confirmed contacts over the years.*

Before LoTW, DXpedition contacts were confirmed by mailing QSL cards to the QSL manager via a self-addressed envelope, which was also stamped if it was being mailed within the same country. Usually, money (known as "green stamps") or International Reply Coupons (IRCs) would be included to pay for the cost of the returned card and/or a donation to help with project expenses (this was typically about $2 or two "green stamps"). This process worked well for many years. In addition, free confirmations were often available using a QSL bureau.

A Positive Change

Some might say that LoTW and the Online QSL Request System (OQRS) have transformed the entire DXpedition contact confirmation process.

Today, many DXers (for DXpeditions or individual operations) upload their contacts to the OQRS, pay a small fee using PayPal, and process confirmations in LoTW, as well as on a QSL card, which is mailed to the operator. Even if you don't process a request to have your contact confirmed, many DXpeditions will upload their complete log into LoTW within 6 months, free of charge.

Here are some major improvements that the OQRS and LoTW have had on DXpeditions and confirmed contacts:

1 In most cases, QSL cards and envelopes no longer need to be mailed to the QSL manager.

2 In addition to the time saved, not purchasing postage, cards, and envelopes saves money.

3 Less waste is produced, which in turn helps the environment.

4 The QSL manager no longer has to sort through thousands of envelopes to account for money or IRCs, nor do they have to manually input contact information on thousands of QSL cards.

Increasing Costs

LoTW allows you to receive contact confirmations faster than ever before. It's hard to argue that the OQRS and LoTW aren't a tremendous benefit for the amateur radio community.

However, as treasurers of major DXpeditions to rare entities have noticed, it's not unusual for only about 15% of the logged call signs to directly support these projects with a donation. When asked about why they don't donate, many operators said that they wait for the free LoTW upload or QSL bureau cards.

These direct mail QSL cards are pre-sorted with postage, and assembled to receive a volume discount for mailing. [Tim Beaumont, MØURX, photo]

These cards are ready to be sent to QSL bureaus around the world. There are two shipments per year, and each one has about 25,000 cards and weighs approximately 180 pounds. [Tim Beaumont, MØURX, photo]

Over the years, while the confirmation process transformed, other changes were quietly under way. Many of the rare (and some not so rare) DX entities have been placed under administrative control by agencies in the countries that own them, such as the US Fish and Wildlife Service, French Southern and Antarctic Lands (TAAF), Parks Australia, New Zealand Department of Conservation (DOC), Pitcairn Islands Marine Reserve, marine protected areas in New Caledonia, and more.

Marine reserves encompass expanses of ocean that are now subject to landing conditions and permits. Some governments are even managing the number of DXpeditions to certain entities by limiting their frequency to once every 5 – 10 years. Additionally, DXpeditions to entities that are relatively easy to reach have incurred high costs because of requirements such as ship inspections (and/or special permits), significant insurance requirements, operator and equipment biosecurity inspections and quarantine, landing permit fees, a government observer participating at the team's expense, and more.

Despite the increasing costs, it's necessary to field a team large enough to organize a DXpedition to an entity on Club Log's DXCC Most-Wanted List. Covering the popular bands/modes might be possible with two or three operators, but unless they're prepared for a long-term expedition, they probably won't meet the demand for the large number of contacts that a DXpedition to a rare entity often generates.

QSL Policy Adjustments

To meet these new challenges, several DXpedition teams have changed their QSL policies, implementing one or more of the following:

1 Processing of QSL bureau cards may require a nominal fee and may be delayed by at least 12 – 18 months. This fee may not include LoTW, and requests for QSL bureau cards may only be processed through the OQRS. Some QSL managers may no longer accept incoming QSL bureau cards.

2 The DXpedition's complete LoTW upload may not occur until at least 12 months after the project.

3 QSL cards mailed directly to the QSL manager may require a fee and be processed after the OQRS cards.

4 An express LoTW option may deliver your confirmed contact without a QSL card.

5 QSL and LoTW special handling for clubs or foundations may be eliminated.

The DXpedition's leadership team, not the QSL manager, establishes the QSL policy. Not all teams and QSL managers are implementing these changes, so be sure to check the DXpedition team's website or Facebook page for specific instructions on how to request a QSL card confirmation.

It's reasonable to conclude that free QSL bureau cards and an LoTW upload of the DXpedition's full log within 6 months have changed the way people think about confirming their DXpedition contacts.

Requests for direct QSL card confirmations are in decline. Recent examples include the VP8PJ South Orkney DXpedition in 2020 and the VP6D Ducie Island DXpedition in 2018. With 20,519 unique call signs in the VP8PJ log, only 21% of them ordered a direct mail QSL card. Of the 24,934 call signs in the VP6D log, only 18% ordered a direct mail card.

The Importance of Donations

With such a small percentage (about 15%) of call signs in the log donating to the projects, expenses increase for the team. If you're interested in ways you can help, try to minimize duplicate contacts. Use the OQRS to confirm your contacts and donate to the project before it starts. If every call sign in the log applied for a QSL card using the OQRS and added a small donation, it would go a long way toward defraying the expenses of such a large operation, and would put a rare entity on the air for the community.

Wrap-Up

That's all for this month. A special thanks to Gene Spinelli, K5GS. Don't forget to send your DX news, photos, and club newsletters to **bernie@dailydx.com**. Until next month, see you in the pileups!
— Bernie, W3UR

Jon Jones, NØJK, n0jk@arrl.org

The World Above 50 MHz

Update on Noctilucent Clouds and 6-Meter Propagation

After receiving feedback from my October 2021 column on "High Solar Cycle 25 Activity and Noctilucent Clouds," an update was necessary regarding the occurrence of sporadic E and noctilucent clouds (NLCs). Some confusion arose as to whether NLCs propagate 6-meter signals.

Professor Cora Randall, from the University of Colorado's Lab for Atmospheric and Space Research, has made it clear that noctilucent clouds do not cause sporadic E and do not propagate 50 MHz signals. There does appear to be a connection between the amount of meteor dust, meteoric ions in the E layer, and sporadic-E formation. There may also be a connection between meteor dust, ions, and NLC formation. Thus, the abundant noctilucent clouds observed in 2021 may be due to higher levels of meteoric ions, and the meteoric ions may also enhance sporadic E. NLC occurrence may be a marker for sporadic E in the northern hemisphere.

2021 ARRL September VHF Contest

There was some interesting propagation for contestants in the ARRL September VHF Contest (see Figure 1), which was held on Saturday to Sunday, September 11 and 12, 2021. On Saturday afternoon, sporadic E developed from the Midwest to the eastern seaboard on 6 meters. From northeast Kansas grids, FM03 and FM14 were in for about an hour. On Sunday morning, meteor scatter on 50 MHz MSK144 was great for many. NØAN (EN22), K5QE (EM31), WY7DT (DN74), WTØDX (DM79), and others were in on many loud bursts on MSK144 to NØJK portable.

On Sunday afternoon, 6-meter sporadic E openings were present across the Gulf Coast and Florida to the Midwest for an hour. A rare opening popped up Sunday afternoon, and HC2FG (FI07) worked Gulf Coast stations and WA1EAZ (FN42), and he was spotted by WW1L (FN54) on 50.313 MHz on FT8 around 2130Z. This was probably multi-hop E_S (rather than F2), because the solar flux was only 92. K5ND (EM12) found a few California stations on E_S near the end of the contest.

The big news of the contest was the tropospheric propagation, which developed all day on Sunday over the eastern half of North America under a stagnant high-pressure system. On Sunday morning NØLD, operating as a rover on 144 and 432 MHz in the eastern part of EM17, was able to work AA4ZZ (EM96), a contest group operating from a mountaintop in North Carolina. Greg, WQØP (EM19), also logged AA4ZZ on 144, 222, and 432 MHz. From eastern Oklahoma, K5SW (EM25) worked AA4ZZ on 144, 222, and 432 MHz. The tropo didn't make it to EM28 until Sunday evening. I (NØJK) found AA4ZZ with a solid signal on 144.206 MHz on SSB at 0110Z on September 13, and I logged them with my 10 W and single M2 seven-element Yagi.

W4IY(FM08) was in solid on 144.174 MHz on FT8. Andy, K1RA, was with the K8GP group from nearby FM09. They worked W5LUA and AA5AM (EM13) on 2 meters and W5LUA on 222 MHz. K8GP worked 61 grids on 2 meters and 33 on 222 MHz. Just one grid over, W4IY (FM08) was in well over 2 hours. The W4IY group seemed to be in the hot spot, working as far as EL09 and EM00 in south Texas on tropo.

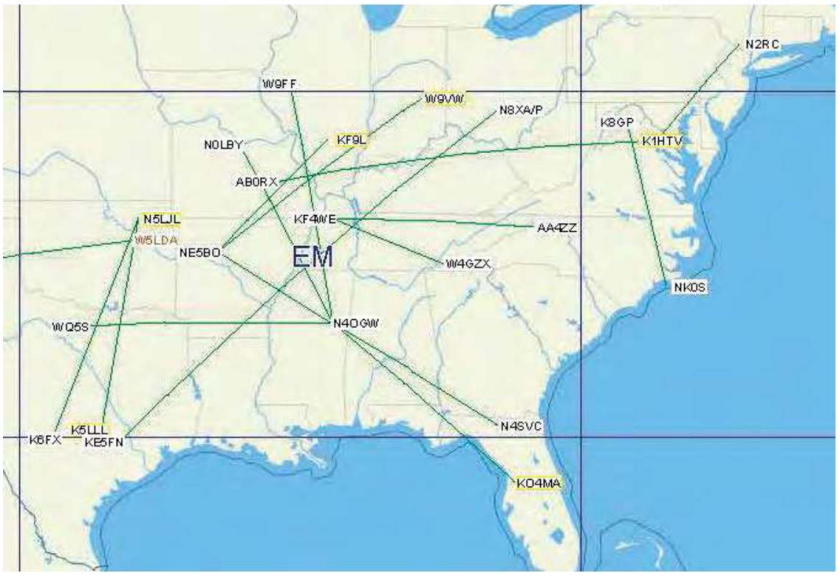


Figure 1 — A DX map of 2 meters on the Sunday morning of the ARRL 2021 September VHF Contest. [**www.dxmaps.com**]

Oddly, 2-meter activity seemed down during the contest. WQØP and I both noted that, while 2 meters was wide open, only a small number of stations were showing up at any time. K5ND worked only four stations on 2-meter SSB, and the rest were on digital. William Hepburn's tropospheric propagation map predicted this opening well.

On the Bands

50 MHz. Lance, W7GJ (DN27), worked AG6EE/P (DN00) on moonbounce (EME) on September 5. AG6EE was using a single Yagi portable (see Figure 2).

On September 8, Ken, AC4TO (EM70), had an "early TEP opening" on 6 meters. Ken said, "I saw some bright traces on the FT8 waterfall that weren't decoding around 2310 UTC, so I CQ'd toward South America. Finally, at 2320 UTC, I had my first QSO with PY2XB, and it improved from there." Ken made 23 contacts with 21 different stations, one of them a new one for him. He worked LU5FF on FT8, CW, and Q65. Ken added, "There seem to be quite a few new stations on 6 meters in… parts of Brazil that I've not heard here before." Ken said the band closed at 0100Z.

Jim, NA6L, operated portable from rare grid DN78 on September 18 and 19 on MSK144, pleasing Fred Fish Memorial Award (FFMA) seekers.

Figure 3 — Gene, KB7Q, set up a portable 23-centimeter EME operation in Wyoming on September 30, 2021. [Gene Shea, KB7Q, photo]

144 MHz. Greg, WQØP (EM19), made seven EME contacts on 2 meters on September 22, including RX1AS. Greg runs 1 kW to a single 17-element M2 Yagi, which is "horizon only."

432 MHz. Gene Shea, KB7Q, made 13 EME contacts from DN82 on October 1. He said he had a "nice visible moon and no wind." Unfortunately, in the UK, G3LTF had high winds and could not keep his dish antenna aimed at the moon to work KB7Q. Gene's station on 432 MHz consists of a nine-wavelength Yagi and 500 W.

1296 MHz. KB7Q worked 31 stations on EME while portable in DN74 in Wyoming, using Q65C-60 mode on September 30 (see Figure 3). He also worked OK1KIR, G4CCH, SM6CKU, G3TLF, and SM2CEW on CW. Gene operated 23-centimeter EME from DN82 on October 2. He made 40 contacts, with five being on CW. On 23 centimeters, Gene uses a 2.4-meter dish antenna and 350 W.

Figure 2 — Petr, AG6EE, set up a portable EME station in the Black Rock Desert of northern Nevada (DN00) during the Burning Man Festival on September 5, 2021. [Petr Suchomel, AG6EE, and Lance Collister, W7GJ, photo]

Here and There

The Geminid meteor shower will peak on December 13 – 14, 2021. It is one of the strongest and most reliable meteor showers of the year, with a zenith hourly rate (ZHR) of up to 150. The meteors are medium speed at 34 kilometers/second. They are great for 28 and 50 MHz meteor scatter, and useable on 144 and 222 MHz. While December may be chilly, this a great shower to consider activating a rare grid. The best paths and times (local) are north to south at 2200 and 0500 – 0700.

Barry, K7BWH, shared an online "rover database." There are over 500 spots for rover locations in North America. He noted Petr, AG6EE, and Jim, NA6L, shared many of their favorite spots to operate. Jeff, WB8LYJ, added some great FM grid locations. Many others contributed to this database. Perhaps you can use this to plan a Geminid meteor shower grid activation. For more information, visit **https://coilgun.info/rover-us/home.htm**.

Special Event Stations

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

Dec. 4, 1500Z – 1900Z, KG4ARC, Atlanta, GA. Atlanta Radio Club and Atlanta Chapter, American Red Cross. **Commemorating the Birth of Clara Barton, Founder of American Red Cross**. 14.250 7.250 3.925. QSL. Atlanta Radio Club, 227 Sandy Springs Pl., Ste D-306, Atlanta, GA 30328. *Check spotting networks for frequencies.* **secretary@atlantaradioclub.org** *or* **www.atlantaradioclub.org/redcross**

Nov. 1 – Nov. 15, 0000Z – 2359Z, W8F, Livonia, MI. The Livonia Amateur Radio Club. **46th Anniversary, Sinking of the SS *Edmund Fitzgerald***. 14.040 14.240 7.040 7.240. Certificate. Mike Rudzki, N8MR, 14071 Fairway St., Livonia, MI 48154. *Saturday Nov. 13, W8F will operate live from the Dossin Great Lakes Museum, Detroit, MI, 1600 – 2030 UTC. See website for QSL information.* **www.qrz.com/db/w8f** *or* **www.livoniaarc.com**

Nov. 10 – Nov. 20, 1200Z – 2330Z, WO4L/W1G, East Berlin, PA. Robert Hess. **158th Anniversary of Lincoln's Gettysburg Address**. 7.185 14.288 3.830 18.155. Certificate & QSL. Robert Hess, 74 Curtis Dr., East Berlin, PA 17316. *Watch spotting nets to see where we are. See* **www.qrz.com/db/wo4l** *or* **www.qrz.com/db/w1g** *for QSL instructions.* **bigbob7388@gmail.com**

Nov. 13, 0800Z – 1800Z, WW1USA, Kansas City, MO. National World War I Museum and Memorial. **102nd Anniversary of Armistice**. 14.250 14.030 7.250 7.030. QSL. c/o Charles Van Way, NØCVW, National World War I Museum and Memorial, 2 Memorial Dr., Kansas City, MO 64108. **ww1usa@theworldwar.org** *or* **www.theworldwar.org/amateurradio**

Nov. 13, 0900Z – 1400Z, NB4RC, Deerfield Beach, FL. North Broward Radio Club. **Hillsboro Lighthouse Special Event Station**. 14.280 14.270 14.260 14.250. QSL. NB4RC, 4116 NW 1 St., Deerfield Beach, FL 33442. **www.joeyjet.com/index.php/amateur-radio/nb-radio-club**

Nov. 30 – Dec. 5, 1600Z – 2300Z, W5C, Carol Stream, IL. Cajun Navy Relief Amateur Radio Club. **Last Day of Hurricane Season 2021 and Volunteer Recognition**. 14.250 7.250 D-STAR DSC/XLX 256i JS8Call. QSL. Cajun Navy Relief Amateur Radio Club, 681 Paxton Pl., c/o Thomas Sarlitto, Carol Stream, IL 60188. **www.cajunnavyrelief.com/W5CNR**

Dec. 1 – Dec. 15, 0000Z – 2359Z, N7C/N7D/N7N, Parker, CO. Friends of Nevada Wing. **80th Anniversary of the Founding the Nevada Wing and the Civil Air Patrol**. 14.250 7.200 147.1; operating SSB in the General portion of the 40- and 20-meter bands, and 147.1 MHz for VHF, as well as FT8. QSL. N7C/N6YEL, 23612 Glenmoor Dr., Parker, CO 80138. *For card, please QSL by February 28, 2022. Other stations may be added.* **weaceves2@gmail.com**

Dec. 3 – Dec. 13, 1300Z – 2200Z, W2W, Baltimore, MD. Amateur Radio Club of the National Electronics Museum. **W2W Pearl Harbor Day Commemoration**. 14.241 14.041 7.241 7.041; operation on 80 meters (3.541, 3.841) and digital modes possible during event. Certificate & QSL. W2W Pearl Harbor, P.O. Box 1693, MS 4015, Baltimore, MD 21203. *Primary operation Dec. 3 – Dec. 7. Additional operation possible in the Dec. 8 – Dec. 13 period, as operator availability permits.* **www.ww-2.us**

Dec. 4, 1000Z – 1600Z, NE1PL, Fall River, MA. USNR. **Remember Pearl Harbor**. 14.258; 20- and 40-meter phone. Other bands and modes possible. QSL. Rick Emord, 135 Wareham St., Middleboro, MA 02346. **www.ne1pl.org**

Dec. 4 – Dec. 5, 1500Z – 2300Z, W9CAP, Saint Charles, IL. Illinois Wing Civil Air Patrol Amateur Radio Club. **80th Anniversary of the Civil Air Patrol**. 28.450 18.125 14.250 7.225. QSL. Lt. Col. Robert Becker, P.O. Box 4027, Saint Charles, IL 60174. **www.qrz.com/db/w9cap**

Dec. 4 – Dec. 11, 0001Z – 2359Z, W2MM, Apopka, FL. Quarter Century Wireless Association. **74th Anniversary**. SSB: 28.325 21.365 14.262 7.244 3.810; CW 28.050 21.050 14.040 7.035 3.540. Certificate. QCWA, John R. Kludt, 1972 Martina St., Apopka, FL 32703.

Dec. 11, 1700Z – 2359Z, NI6IW, San Diego, CA. USS *Midway* (CV-41) Museum Ship. **Pearl Harbor Remembrance Day**. 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 our call sign NI6IW, and Reporting Note to see what reflector we're using.* **www.qrz.com/db/ni6iw**

Dec. 11 – Dec. 18, 1200Z – 2300Z, W9VT, Hazel Crest, IL. Tri-Town Radio Amateur Club. **90th Anniversary**. 14.240 7.240, CW, FT8, and PSK31. QSL. Tri-Town Radio Amateur Club, P.O. Box 1296, Homewood, IL 60430. *Operating during the week as time permits.* **www.w9vt.org**

Dec. 17 – Dec. 19, 0000Z – 2359Z, W4A, Bluff City, TN. N9EN. **Edwin Howard Armstrong Commemoration Special Event**. 3.540 7.040 14.040 21.040. QSL. Brad Anbro, 1118 Walnut Grove Rd., Bluff City, TN 37618.

Dec. 18, 1700Z – 2200Z, WA4USN, Mount Pleasant, SC. Charleston Amateur Radio Society. **50th Anniversary from the USS *Yorktown* CV10**. 21.290 14.296 7.250. Certificate & QSL. William Dean, 30 Lombardi Ln., Hanahan, SC 29410. **www.wa4usn.org**

Dec. 18 – Dec. 24, 1300Z – 2359Z, KC5OUR, Belen, NM. Valencia County Amateur Radio Association. **Bethlehem on the Air**. 21.283 14.283 7.183 3.883. QSL. VCARA, P.O. Box 268, Peralta, NM 87042. **kc5our@arrl.net**

Dec. 23 – Dec. 26, 1500Z – 2359Z, NØT/NØR/NØA/NØI/NØN, Bates City, MO. **Christmas Train — Celebrate Christmas Time and Holiday Cheer through Ham Radio**. 10, 20, 40, and 80 meters; operating as time permits. QSL. Randy Booth, 7562 Copenhaver Rd., Bates City, MO 64011. **rwb22311@outlook.com**

Dec. 26 – Dec. 31, 0000Z – 2359Z, W2T, Trenton, NJ. Delaware Valley Radio Association. **American Revolution Battle of Trenton**. 14.250. Certificate* & QSL. DVRA, P.O. Box 7024, Trenton, NJ 08628. **www.w2zq.com**

Certificates and QSL cards: To obtain a certificate from any of the special event stations offering them, send your QSO information along with a 9 × 12 inch self-addressed, stamped envelope (three units of postage) to the address listed in the announcement. To receive a special event QSL card (when offered), be sure to include a self-addressed, stamped business envelope along with your QSL card and QSO information. *Note: Some clubs may ask for a nominal fee to cover the cost of the certificate or QSL. Request will be made on air during the event or on the club's website.

Steve Ewald, WV1X, sewald@arrl.org; www.arrl.org/hamfests-and-conventions-calendar

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 (Locust Fork) — Jan. 8 D F H R T V
8 AM – noon. *Spr:* Blount County ARC. Locust Fork High School, 77 School Rd. *TI:* 146.70 (91.5 Hz). *Adm:* Free. **w4blt.org**

Florida (Orlando) — Jan. 8 D F H R T
6 AM – noon. *Spr:* South Conway Baptist Church, 6099 S. Conway Rd. Orlando, FL 32812. *Adm:* Free. **k4kdi.org**

VIRTUAL ARRL NEW YORK CITY LONG ISLAND SECTION CONVENTION

January 8, Online

S

7:30 AM, forums start at 9 AM. *Spr:* Ham Radio University ARC. *Adm:* Free. **www.hamradiouniversity.org**

To All Event Sponsors

Before making a final decision on a date for your event, you are encouraged to check the Hamfest and Convention Database (**www.arrl.org/hamfests-and-conventions-calendar**) for events that may already be scheduled in your area on that date. You are also encouraged to register your event with HQ as far in advance as your planning permits. See **www.arrl.org/hamfest-convention-application** for an online registration form. Dates may be recorded up to 2 years in advance.

Events that are sanctioned by ARRL receive special benefits, including an announcement in these listings and online. Sanctioned conventions are also listed in *The ARRL Letter.* In addition, events receive donated ARRL prize certificates and handouts. Once the form has been submitted, your ARRL Director will decide whether to approve the date and provide ARRL sanction.

The deadline for receipt of items for this column is the **1st of the second month preceding publication date**. For example, your information must arrive at HQ by **January 2** to be listed in the **March** issue. Information in this column is accurate as of our deadline; contact the sponsor or check the sponsor's website for possible late changes, driving directions, and other event details. Please note that postal regulations prohibit mention in *QST* of games of chance, such as raffles or bingo.

Promoting your event is guaranteed to increase attendance. As an approved event sponsor, you are entitled to special discounted rates on *QST* display advertising and ARRL web banner advertising. Call ARRL's toll-free number at 1-800-243-7768, or email **ads@arrl.org**.

Life Members

Elected September 13, 2021

Rondal D. Akers, W8BF
James A. Bacher, WB8VSU
Christopher M. Balz, KM6UYN
Yorke Brown, AC4E
John Burgess, AI6VM
Robert M. Chaikin, KB1YOW
Martin Chapman, W2FQ
Kendell Chilton, W1OT
Sabrina Cline, N2BIO
Todd C. Cline, N7KDT
Bruce D. Cram, KD4JFD
John Eckerd, KC3ROK
Jeff W. Emery, W8IP
Eric G. Engelke, K2SL
Kenneth M. Fairchild, KEØDUO
Corey J. Freeman, K5GTO
Timothy B. Harrison
Tom C. Hess, KDØHF
Michael J. Hildreth, WB4WDE
Darrell Hilliker, NU7I
Howard H. Holmes, KF5TK
Roger B. Hughes, AE6MI
Russell B. Hunt, WQ3X
Trent W. Johnson, K5TWJ
Joseph S. Kennedy, WQ6Q
Kristopher B. Kirby, KE4AHR
Shane P. Kuehl, WØSPK
Tamara M. Kuehl, W7TMK
Joe A. Lowenthal, WA4OVO
Michael J. MacKennedy, K1MMK
Wayne A. Mills, N7NG
Calvin W. Myer, AK4QP
Mark D. Pressley, KJ4IWK
Arthur Ricardo, VK1ALR
Annette Ruch, WDØFEU
Dave A. Ruch, NFØJ
Kurt Sauer, KS5K
John C. Shirley, N8DX
Walter A. Shubin, K6WAS
Ronald E. Skovly, K7SSB
Kelley W. Sprout, KB3LR
James A. Stinson, KE8NBC
Richard J. Stirzaker, KB8MIS
Robert B. Tilkin, N3DDS
Jean Paul Vega, K6JPV
Isao Wachi, WF6W
Austin R. Walrabenstein, KJ4EOW
Guangxin Wang, NØBOY
Scott Randell Wilson, KE8SWC
David A. Zumbrunnen, KC4CR

Feedback

■ The "Microwavelengths" column in the October 2021 issue of *QST* contained a mistake in the UHF TV broadcast band listing. As of July 2020, the UHF television band is actually 470 – 608 MHz. *QST* regrets this error.

■ The article, "The DC2020 Receiver," by Harold Smith, KE6TI, from the October 2021 issue of *QST* contained an error in the schematic. The resistor R10 should be 1,500 Ω. *QST* regrets the error.

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.

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. Guerrera, 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, WØAF	20
Victor Denisov, N6DVS	20
Ronald L. Edwards, KE8NCJ	20
David W. Hibbard, NKØK	20
Richard B. Dervan, N1RBD	25

September 2021

Mark D. Nill, W5AT	10
Joseph M. Pagurko, KA9IIE	10
Christopher E. Johnson, WB9FXW	15
Mark D. Nill, W5AT	15
Daniel A. Bostick, KG5SSB	20
George W. Fletcher, AD5CQ	20
William Howard, N4MU	20
Mark D. Nill, W5AT	20
John F. Wasciuk, WA8TON	20
Walter Bilous, K3DQB	25
Stan Dicks, W4AG	30

Congratulations to all the recipients.

December 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.

December Qualifying Runs will be transmitted by W1AW in Newington, Connecticut at the times shown at 1.802.5, 3.581.5, 7.047.5, 14.047.5, 18.097.5, 21.067.5, 28.067.5, 50.350, and 147.555 MHz. The West Coast Qualifying Runs will be transmitted by K6KPH on Saturday, December 18 at 2 PM PST (2200 UTC) on 3581.5, 7047.5, 14047.5, 18097.5, and 21067.5 kHz. Unless indicated otherwise, sending speeds are from 10 to 40 WPM.

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

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

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

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

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

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

W1AW Qualifying Runs — December 2021
(All times are in Eastern Standard Time)

Monday	Tuesday	Wednesday	Thursday	Friday
12/6 4 PM – 2100Z 10 – 35 WPM	**12/7** 7 PM – 0000Z **(12/8 – UTC)** 35 – 10 WPM		**12/9** 10 PM – 0300Z **(12/10 – UTC)** 10 – 40 WPM	**12/10** 9 AM – 1400Z 10 – 35 WPM
	12/14 4 PM – 2100Z 10 – 35 WPM	**12/15** 7 PM – 0000Z **(12/16 – UTC)** 10 – 40 WPM	**12/16** 9 AM – 1400Z 35 – 10 WPM	**12/17** 10 PM – 0300Z **(12/18 – UTC)** 10 – 35 WPM
12/20 4 PM – 2100Z 10 – 40 WPM	**12/21** 9 AM – 1400Z 10 – 35 WPM	**12/22** 10 PM – 0300Z **(12/23 – UTC)** 35 – 10 WPM		**Christmas Eve**
12/27 10 PM – 0300Z **(12/28 – UTC)** 10 – 40 WPM		**12/29** 10 PM – 0300Z **(12/30 – UTC)** 10 – 40 WPM		**New Year's Eve**

ARRL VEC Volunteer Examiner Honor Roll

The ARRL VEC Honor Roll recognizes the top 10 Volunteer Examiners in each ARRL Division according to the total number of ARRL exam sessions in which they have participated since their accreditations. Considering each session requires an average time commitment of 2 to 4 hours or more, the thousands of hours these VEs have invested represent extraordinary dedication! Whether you are one of our VE Teams that tests once a week, once a month, or once a year, we want to express our warmest appreciation to all volunteers for your generous contribution to the ARRL VEC program.

If you are an ARRL VE, you can view your session stats online at **www.arrl.org/ve-session-counts**.
If you are not a VE, become one today! See **www.arrl.org/become-an-arrl-ve**.

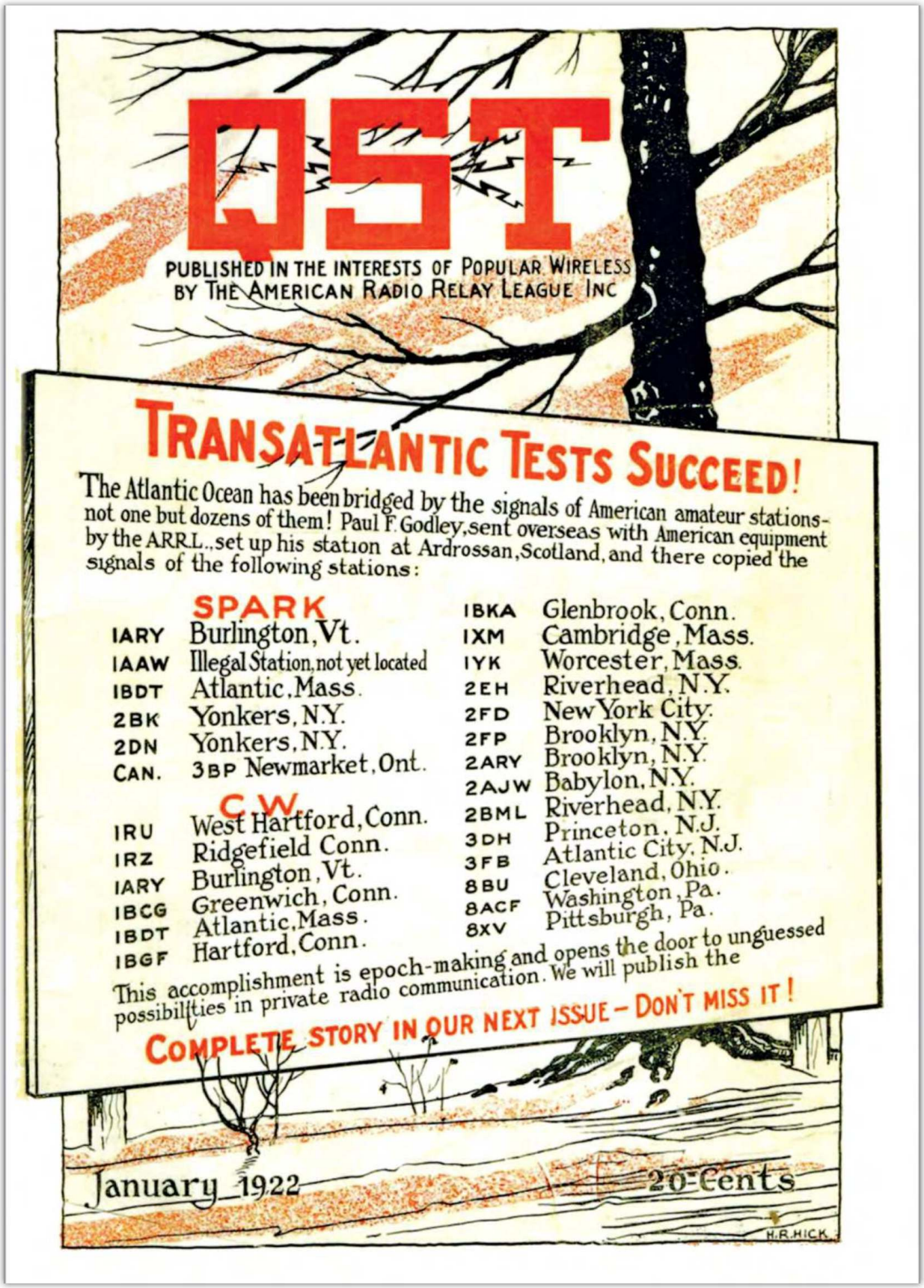
Examiner	Sessions	Accreditation Date
Atlantic		
Jobst Vandrey, AC0LP	324	23-Jun-08
James McCloskey, NS3K	320	14-Nov-94
Edward Genoino, WA2NDA	298	10-Jul-85
George Brechmann, N3HBT	288	01-Apr-91
William Klepser, Jr., WB2AIV	215	09-Jun-99
Cully Phillips, N3HTZ	205	01-Sep-91
Michael Harla, N2MHO	186	12-Apr-06
Ralph Abbott, WA3ELQ	170	30-May-05
Mark Miller, AK3M	165	20-Jan-03
Jeffrey Jones, ND3Z	164	18-Feb-94
Central		
Ed Wagner, AB9FN	376	01-Jul-02
Allan Bukowski, N9ZD	326	01-Jun-92
Eldon Boehm, NK9U	318	21-Nov-86
Donald Hlinsky, N9IZU	317	01-Mar-91
Brian Eder, WB9UGX	285	01-Jan-92
Thomas Gwaltney, N9PDC	263	03-Apr-07
Robert Begeman, W9KVK	257	01-Jun-92
David Nicolaus, W9DN	250	13-Feb-86
Frederick Baguhn, W9GOC	241	16-May-02
James Rinehart, K9RU	239	01-Aug-91
Dakota		
Jeffrey Goodnuff, W0KF	318	17-Jun-03
John Schwarz, Jr., AE0AL	309	26-Oct-94
Shep Shepardson, N0NMZ	268	12-Mar-01
Daniel Royer, KE0OR	239	01-Jul-91
Dennis Ackerman, KB0OQQ	221	15-Jul-96
Douglas Nelson, AA0AW	217	01-May-90
James Rice, II, N0OA	207	04-Dec-00
Larry Larson, KR0K	203	16-Mar-09
Robert Tracy, N0TC	183	30-Jul-86
Edward Van Cleave, Jr., W0VC	169	01-Jun-92
Karl Eriksen, WA2DEE	169	08-Jan-90
Delta		
Monvel T. Maskew, Jr., K9FQ	620	18-Jul-18
Arthur Parry, Jr., WB4BGX	270	01-May-91
Joe Lowenthal, WA4OVO	264	25-May-06
Roger Gray, N5QS	249	01-Mar-93
Bobbie Williams, W1BEW	241	01-Jun-92
Dawn Gray, N5QT	230	01-Mar-93
Daryl Stout, WX4QZ	209	17-Sep-07
William Easterday, KB8FU	209	01-Mar-91
Henry Mitchell, N5SEB	198	10-Nov-94
Robert White, AI4GI	187	18-Jul-05
Great Lakes		
David Potter, KE8OHG	813	03-Jun-20
Charles Tyrrell, KE8PCB	497	03-Sep-20
Charles Hall, W8HF	286	01-Jun-92
Lance Harvala, AB8Y	243	06-Nov-19
Archie Mack, Sr., AF4EB	236	19-Aug-97
Dale Pritchett, KC8HJL	223	26-Mar-98
Stanley Arnett, II, AC8W	223	06-Sep-84
Chris Anderson, K8VJ	220	09-Feb-90
William Bogle, Jr., KE8FZY	213	08-Jul-20
James Viele, W8JV	210	22-Mar-90

Examiner	Sessions	Accreditation Date
Hudson		
Paul Maytan, AC2T	706	06-Sep-84
Stanley Rothman, WA2NRV	477	01-Mar-85
Alan Crosswell, N2YGK	464	26-Oct-94
Fritz Boigris, KB2O	461	26-Oct-84
Sid Markowitz, K2GG	405	27-Sep-94
Gerald Miller, Jr., AA2ZJ	405	05-Dec-95
Daniel Calabrese, AA2HX	305	01-Nov-91
John Kiernan, KE2UN	287	01-Jul-91
Thomas Carrubba, KA2D	280	01-Sep-93
Walter Lesnowich, W2EE	259	06-Mar-08
Midwest		
David Bartholomew, AB0TO	745	22-Mar-02
Kevin Naumann, N0WDG	655	17-Nov-02
Harry Steger, Jr., W0HMS	586	26-Aug-08
Roland Kramer, W0RL	535	21-Jun-01
Jeanette Nordman, AB0YX	460	21-Aug-03
Harold Kunkee, K0KTZ	339	01-Jul-91
Kenneth Simila, KC0VMY	279	18-Feb-07
John Telker, N0TH	267	29-Aug-12
John Mountain, Jr., KJ0MTN	250	28-Sep-09
Ronald Lemons, KB0DIY	209	01-Oct-92
New England		
*Bob Phinney, K5TEC	1,430	20-Jan-14
*Paul Lux, K1PL	1,217	25-Jan-85
Phillip Temples, K9HI	516	12-May-89
Gregory Paul, KC1MND	486	03-Jun-20
Robert Beaudet, W1YRC	398	01-Aug-90
Bruce Anderson, W1LUS	356	11-Feb-88
Lawrence Polowy, KU1L	340	02-Jan-85
Stefan Rodowicz, N1SR	335	20-Nov-84
James Mullen, KK1W	335	01-Mar-91
Barbara Irby, KC1KGS	283	05-Aug-19
Northwestern		
Richard Morgan, KD7GIE	450	11-Aug-00
Loren Hole, KK7M	381	06-Sep-84
Scott Robinson, AG7T	369	01-Aug-91
S. Riley Mc Lean, W7RIL	316	02-Sep-99
David Brooks, N7HT	309	10-Jun-87
John Clarke, AC7WW	302	20-Jan-03
George Ftikas, N7TQZ	302	01-Dec-92
Joseph Barry, K7SQ	275	21-Jun-95
Donald Baune, AC0EX	259	19-Sep-06
Wayne Schuler, AI9Q	253	01-Sep-91
Pacific		
Morris Jones, AD6ZH	509	27-Nov-01
Brian Torr, N6IIY	499	06-Sep-00
Dieter Stussy, KD6LVW	434	27-Jan-94
Gordon Fuller, WB6OVH	359	06-Sep-84
Bill Nichols, NN7K	337	01-Sep-93
Robert Perlman, W6BP	305	26-Aug-08
Jim Brunk, N6BHX	287	13-Jul-95
Larry Loomer, KI6LNB	272	03-Dec-08
Dale Westerterp, WB6TMS	238	16-Jun-00
Kenneth Hall, WO6J	230	18-Mar-86

Examiner	Sessions	Accreditation Date
Roanoke		
Judy Friel, AC4RG	300	01-Feb-91
Alan Ronald Moeck, WA2RPX	264	27-Sep-94
David Snyder, W4SAR	251	01-May-93
Terry Sanner, WV8V	223	06-Sep-84
Thomas Hill, KJ4IV	201	01-Jun-91
Larry Withrow, AF4HX	197	17-Dec-98
Henry Wyatt, II, K4YCR	194	28-Jan-98
Thomas Lewis, W4SIS	191	14-Nov-97
David Poe, W8IW	191	13-Mar-07
Edwin Williams, KN4KL	180	01-Jan-92
Rocky Mountain		
Robert Hamilton, N0RN	399	19-May-87
Jeffrey Weinberg, W0QO	309	01-Apr-93
David Avery, N0HEQ	302	13-Jan-88
David Sharpe, KI0HG	258	02-Feb-98
Martin Soffran, NM5MS	234	21-Mar-94
Orlin Jenkins, K0OJ	233	01-Mar-85
Peter Brisbine, NM5PB	229	20-Jan-14
Gordon Smith, K7HFV	214	06-Sep-84
Gary Zabriskie, N7ARE	212	20-Nov-84
Michael Blenderman, K7IC	199	30-Apr-96
Southeastern		
***Gary Lee Pike, KA4KBX	4,408	03-Sep-09
***Collin Pike, KJ4AXB	3,179	26-Apr-11
***Justin Lee Pike, KJ4AXF	3,143	12-Nov-12
**Anna Grogan Pike, KD4PCU	2,168	18-Aug-09
*Ryan Krenzischek, W4NTR	1,729	04-Jan-13
*Patrick Wyatt Pike, KJ4AXD	1,326	13-Oct-15
Val Jacyno, AK4MM	388	08-Nov-11
Pablo Soto, KP4SJ	380	01-May-92
Robert Cumming, Sr., W2BZY	362	29-Jan-97
Joseph Patti, N4UMB	323	01-Sep-90
Southwestern		
*Bill Martin, AI0D	1,079	01-Nov-84
Fred Bollinger, AB7JF	541	17-Apr-95
David Morrill, N7TWT	453	20-Jul-00
Bruce Ziemienski, WA6BZ	321	25-Mar-02
Richard Buck, KC7OCT	314	21-May-97
Donald Kramer, Sr., WA6UVW	303	08-May-98
Ali Hassan, AA6WC	288	01-Jun-90
Arthur Hoffman, W7ART	278	20-Feb-98
Norman Pilawski, WT6Y	275	17-Feb-87
Scott Swanson, K6PYP	273	01-Dec-92
West Gulf		
*Franz Laugermann, K3FL	1,046	01-Dec-91
Daniel Quigley, N7HQ	793	24-Apr-20
Tanner Jones, W9TWJ	502	31-Jul-07
Gerald Grant, WB5R	499	04-Jan-85
Adolph Chris Koehler, K5VCR	488	29-Sep-95
Wilbert Cannonier, KK5JJ	469	03-Nov-95
David Fanelli, KB5PGY	458	01-Oct-91
Michael Nault, W5OFT	401	06-Sep-01
Barbara Laugermann, KA5QES	373	24-Aug-11
Doug Hutton, W5JUV	346	01-Jan-91

*Denotes participation in over 1,000 sessions. **Denotes participation in over 2,000 sessions. ***Denotes participation in over 3,000 sessions.

A Look Back


QST
PUBLISHED IN THE INTERESTS OF POPULAR WIRELESS
BY THE AMERICAN RADIO RELAY LEAGUE INC
TRANSATLANTIC TESTS SUCCEED!
The Atlantic Ocean has been bridged by the signals of American amateur stations-not one but dozens of them! Paul F. Godley, sent overseas with American equipment by the A.R.R.L., set up his station at Ardrossan, Scotland, and there copied the signals of the following stations:
SPARK
IARY Burlington, Vt.
IAAW Illegal Station, not yet located
IBDT Atlantic, Mass.
2BK Yonkers, N.Y.
2DN Yonkers, N.Y.
CAN. 3BP Newmarket, Ont.
C.W.
IRU West Hartford, Conn.
IRZ Ridgefield Conn.
IARY Burlington, Vt.
IBCG Greenwich, Conn.
IBDT Atlantic, Mass.
IBGF Hartford, Conn.
IBKA Glenbrook, Conn.
IXM Cambridge, Mass.
IYK Worcester, Mass.
2EH Riverhead, N.Y.
2FD New York City.
2FP Brooklyn, N.Y.
2ARY Brooklyn, N.Y.
2AJW Babylon, N.Y.
2BML Riverhead, N.Y.
3DH Princeton, N.J.
3FB Atlantic City, N.J.
8BU Cleveland, Ohio.
8ACF Washington, Pa.
8XV Pittsburgh, Pa.
This accomplishment is epoch-making and opens the door to unguessed possibilities in private radio communication. We will publish the
COMPLETE STORY IN OUR NEXT ISSUE – DON'T MISS IT!
January 1922
20 Cents
H.R. HICK.

QST

A Magazine Devoted Exclusively to the Radio Amateur

Transatlantic Tests Successful

OH, Mr. Printer, how many exclamation points have you got? Trot 'em all out, as we're going to need them badly, because WE GOT ACROSS!!!!!!

As we prepare the copy for this issue of QST our Transatlantic Tests are in progress and we have the highly gratifying news from Paul F. Godley, our special listener in Scotland, that the A.R.R.L. has spanned the Atlantic! For the first time in history the signals of United States and Canadian amateur stations have been heard across the ocean on schedule.

Mr. Philip R. Coursey, in charge of arrangements in Great Britain, radioed us on Dec. 13th as follows:

"Many your stations heard by British amateurs. Details later."

We are most impatiently awaiting receipt of Mr. Coursey's detailed report, the compilation of which necessarily will have to await the collection and examination of the individual logs from the British listeners. It is this phase of the tests in which we are particularly interested—we want the British amateurs, with their normal receiving apparatus, to hear our signals if they can, so that we may hope to move amateur traffic to them on schedule. We trust that Mr. Coursey's report will be received in time for our next issue.

Paul F. Godley, special representative of the A.R.R.L., with special American equipment, located his station at Ardrossan, a small fishing village some twenty miles to the west of Glasgow, Scotland, after experimenting with various locations, and there listened for our signals thruout the ten day period, reporting nightly via radiogram from MUU which was repeated on this side by WII. To date twenty-six stations have been reported by him, as listed on the cover of this issue—six sparks and twenty-two C.W. stations. These are mostly in the eastern part of the country, rather contrary to expectations, the westernmost one being in Cleveland, Ohio. There is but one Canadian reported, 3BP, Rogers of Newmarket, and on his spark at that, but Mr. Coursey's report may show more of our cousins in the Dominion.

Station 1BCG at Greenwich, Conn., was reported on two consecutive nights and indications are that it had the greatest signal strength of any heard. This station was especially erected for the tests and was jointly owned and operated by Messrs. Minton Cronkhite, E. H. Armstrong, George Burghard, John Grinan, Ernest Amy, and Walter Inman. In its testing it has been reported from the Pacific Coast and must have kicked up considerable of a rumpus. Encouraged by the report of their signals, these men attempted to transmit an actual message, and to their credit be it said that they succeeded in putting across the ocean the first private radiogram ever transmitted across this span by an amateur station. The message was transmitted on the night of Dec. 11th, and acknowledged by a cablegram to A.R.R.L. Headquarters by Godley, reporting its reception at 3 a.m. G.M.T. on the 12th. The message read as follows:

"Nr 1 NY ck 12 to Paul Godley, Ardrossan, Scotland. Hearty congratulations. Burghard Inman Grinan Armstrong Amy Cronkhite."

Thus not only have amateur signals been heard overseas in astounding number, but a coherent message has been put over by the same means.

This is all the news we can give you at this writing, fellows. We got over, as we said we would, and our A.R.R.L. did it. It opens the door to big things and the scientists of the world are of course gasping and marvelling that such small powers on such short wave lengths could cover such distances. It will take some weeks to get the official story of the Transatlantics in final form, as we must now await Godley's return and Coursey's detailed report, but we will present it just as quickly as possible. And there will be some more call letters in the British report, you bet!

QST

A Magazine Devoted Exclusively to the Radio Amateur

The Story of the Transatlantics

By The Editor

THE signals of some thirty-odd American amateur radio stations, working on the short wave lengths and low power permitted amateurs, were heard across the Atlantic Ocean in the second series of Transatlantic Sending Tests conducted by the American Radio Relay League in December, 1921. This is a story of that achievement.

The First Attempt

The possibilities of transatlantic tests were first presented to the amateur world in 1920 by Mr. M. B. Sleeper, at that time radio editor of "Everyday Engineering". It is a subject that intrigues the amateur —his greatest desire in life is to get "distance" with his equipment. It has wonderful possibilities, too, in opening the way to world-wide amateur radio. The arrangements for the first tests in February of 1921 were going merrily along, then, when "Everyday Engineering" unfortunately was obliged to suspend publication. Mr. Sleeper requested the A.R.R.L. to take over the management of the tests, which it did in order that his splendid idea might not be lost. In the limited time remaining after our Operating Department took over the management it was not possible to perfect arrangements as we would have liked, and the tests failed. Looking back at them now we believe we can ascribe this to two causes: the length of time assigned the transmitting stations was altogether too short, and most of them were spark stations. At any rate no signals were received which unquestionably could be attributed to American stations.

American ship-operators on transatlantic runs had heard our signals on the other side, however, and we of the A.R.R.L. were still firmly of the belief that signals could be got over on schedule. Gradually the determination crystallized to try it again, and we even made the boast in print that if a dyed-in-the-wool American ham could be sent across the water with a good American regenerator we knew signals could be copied; in fact, we bet our new spring hat on it. Ever since then we have been answering inquiries from England as to just what a "ham" is, particularly one who has been dyed while still in the wool. But we're used to questions.

To Try Again

And so the matter of additional tests was taken up with Mr. Philip R. Coursey, assistant editor of "The Radio Review", London, who had managed the British end of the first tests, and he, finding British amateurs desirous of giving the game a second go too, kindly agreed again to look after the reception end, which this year was perhaps to include France and Holland too. Plans went forward during 1921 and a brief announcement appeared in July QST, while an open invitation to all amateurs to enroll for the preliminary tests was published on page 12 of QST for September, in which the plan was explained and registration form appended.

About this time our First National A.R.R.L. Convention was held in Chicago and our Board of Direction had a meeting there at which plans for the forthcoming tests were considered. Since we were tackling the job we wanted to do a real good job of it and avoid any chances of a second failure. The desirability arose, then, of sending an American listener to Britain to supplement the efforts of the British amateurs, not only so that we might have a double chance of success and so that some comparisons might be made of the relative sensitivity of American and British amateur apparatus but also for a much more important reason—it would then be possible to make the tests really democratic,

as befits our organization, for if only picked stations were to transmit on schedule, obviously the number would be limited, whereas if we could have an A.R. R.L. man there, one used to twirling a mean variometer all night long, the tests could be made a great popular event with free-for-all periods in which the whole country could be invited to participate. This idea was favorably considered and funds were appropriated to send a man to England to make it possible. An invitation was extended Mr. Paul F. Godley, of Montclair, N. J., to undertake the mission in the name of American Amateur Radio, and he was kind enough to accept. Mr. Godley is the man who first adapted the Armstrong regenerative circuits to short-wave work; he originated the variometer regenerators which have made possible the wonderful short-wave DX work of American amateurs since 1914; and he was chosen to go overseas because in the unanimous opinion of the Board he was America's most expert operator in the practical reception of short wave signals. Let it be clearly understood that an American representative was not sent merely because we feared the English amateurs weren't seasoned operators or weren't able to get us with their equipment; instead it was in order that the tests might be expanded into a big popular event without asking the British amateurs to stay up *all* night every night; and Mr. Godley went over as an auxiliary to the British efforts. The French magazine "La T.S.F. Moderne", commenting on the arrangements, suggests that we feared the British weren't sufficiently the hard-boiled owls, but that wasn't it. Incidentally, fellows, you ought to see the French for boiled owls: "des oiseaux nocturnes durs a cuire", literally, "nocturnal birds hard to cook". Have a hi wid us on tt, you tough nocturnal ornithic persons! The big idea was to make sure that American signals got thru to Britain, so that the possibilities of transocean amateur work might be helped along, and that is why Godley was sent.

The Preliminaries

Altho it was decided to divide part of each test night into free-for-all periods it was obviously desirable to give our best stations individual schedules of considerable duration so that careful tuning could be done in Britain and positive reception be recorded. To pick the best stations which would be assigned such individual schedules, eliminating tests were conducted, and the announcement in September QST was an invitation to enter these preliminaries, the books being kept open until Oct. 12th. The hours being limited, there was time for only the better stations in these individual final schedules, and the preliminary qualification was that the stations cover 1000 miles overland. Seventy-eight stations were entered in the preliminaries, which were conducted Nov. 1st to 5th, inclusive, an advance over the original dates made necessary by Mr. Godley's earlier sailing. The time being quite limited, arrangements for the preliminaries were conducted entirely by mail, without chronicle in QST. Instructions were given the transmitters and a thousand copies of the schedules distributed to picked receiving stations thruout our Operating Department with instruction to notify the Traffic Manager direct of all reception. Nov. 10th was set as the final date for the reception of qualifying reports, as the schedules had to be made up in advance of Mr. Godley's sailing. A station did not have to be reported by an official recorder to be eligible in the finals, however—any evidence that it had covered the requisite 1000 miles was sufficient. A number of stations participating in the prelims were heard over a thousand miles and have cards to prove it but still did not qualify, as the cards either came to them instead of to this office, so that no proof was offered, or came to this office too late. Some excellent stations, such as 1UN for example, failed of qualification thru such an accident. Other stations qualified at the last minute by rushing evidence to us, among which was 1AFV who, altho not reported a thousand miles by any of the recorders, filed a card with the Traffic Manager which showed he had covered the DX. Everyone who could show by Nov. 10th that they had made the grade was give a place in the finals, but for fairness' sake the Operating Department held rigidly to the original announcements.

The Finals

The complete scheme for the tests was published on pages 29-32, inclusive, of October QST. For six hours each night for ten successive nights, December 7th to 16th, inclusive, transmission took place and watch was kept on the other side. Each six-hour schedule was divided into two parts, the first part, from 7 p.m. to 9:30 p.m., Eastern Standard Time, being the free-for-all, consisting of ten periods of 15 minutes each and in each period of which all the amateurs in a given inspection district called "Test" and signed. The periods were rotated so that every night a district sent at a different time, sometimes early in the evening, sometimes late, so that if the hour mattered all would have an equal chance. The schedule for these periods appeared on page 30 of QST for October.

Then the second part of each of the six nights, from 9:30 p.m. Eastern Standard Time to 1:00 a.m. of the following date, was devoted to the individual stations who qualified in the preliminaries. Sealed secret

cypher combinations were assigned these stations, with a request that they not be opened until the first night of the tests, and no information was given out as to who had qualified except to the successful contestants themselves.

The following table lists the entrants in the finals:

Call	Location	Type	Wave	Cypher
1AFV	Salem, Mass.	C.W.	200	YLPMV
1TS	Bristol, Conn.	C.W.	200	AOTRB
1RU	W. Hartford, Ct.	C.W.	200	BPUSC
1DA	Manchester, Mass.	C.W.	200	CQVTD
1AW	Hartford, Conn.	Spk.	210	DRWUF
1BCG	Greenwich, Conn.	C.W.	230	GODLY
2BML	Riverhead, L. I.	C.W.	200	FSXVG
2FD	New York City	C.W.	200	GTYWH
2FP	Brooklyn	C.W.	200	HUZXJ
2OM	Ridgewood, N. J.	Spk.	200	JVAYK
2EL	Freeport, L. I.	C.W.	200	KWBZL
3DH	Princeton, N. J.	C.W.	210	LXCAM
4GL	Savannah, Ga.	C.W.	200	MYDBN
3BP	Newmarket, Ont.	Spk.	200	NZFCO
8DR	Pittsburgh, Pa.	C.W.	200	OAGDP
9KO	St. Louis, Mo.	Spk.	200	PBHFQ
9AW	Toronto, Ont.	C.W.	200	QCJGR
1ZE	Marion, Mass.	C.W.	375	RDKHS
2ZL	Valley Stream, L. I.	C.W.	325	TGMKU
3ZO	Parkesburg, Pa.	C.W.	360	UHNLV
5ZZ	Blackwell, Okla.	Spk.	375	VJOMW
6XH	Stanford U., Cal.	C.W.	375	WKPNX
7ZG	Bear Creek, Mont.	Spk.	375	XLQOY
8XK	Pittsburgh, Pa.	C.W.	375	YMRPZ
9ZY	Lacrosse, Wis.	C.W.	260	RZQMY
9ZN	Chicago, Ill.	Spk.	375	ZNSQA
9XI	Minneapolis.	C.W.	300	SFLJT

The three and a half hours for individual schedules was divided into fourteen periods of 15 minutes each, and times assigned to each station, the periods again rotating for fairness. At a suggestion from Mr. Godley the individual stations for the most part transmitted in groups on the same wave length, two stations sending at once permitting double the time for each without jeopardizing the chance of either to be heard. Most of the special schedule stations transmitted in pairs, three being the maximum going in any one period.

In England

These arrangements were by no means for the special benefit of Mr. Godley but were to govern the entire tests. The arrangements in England were entirely in Mr. Coursey's hands and the data on the schedules was communicated only to him. To avoid all criticism Mr. Godley was told nothing except the free-for-all schedule, which was public information, but Mr. Coursey supplied him with a schedule of the times and wave lengths on which to listen, the same as he broadcasted to all British listeners, and kept strictly to himself the identity and cyphers of the various stations. Mr. Coursey being in complete charge, Mr. Godley was on practically the same status as any British listener and was required to submit his reception to Mr. Coursey for verification and to report thru him.

Meanwhile the greatest enthusiasm seems to have greeted the preparations for the tests, on the other side. The EX Nederlandsche Vereeniging voor Radiotelegrafie (Holland) wrote us for particulars and published them in their magazine, "Radio Nieuws", together with recommended Armstrong circuits for short-wave reception; and "La T.S.F. Moderne" did the same thing for the French amateurs. "Wireless World" was the bulletin for the British amateurs, and it was here, of course, that the highest interest centered. Many amateurs seem to have gone to great lengths in their preparations, making special sets with many stages of tuned-output radio amplification—and we are very happy that the outcome of the tests justified their labor.

Godley Prepares

While these arrangements were progressing "Paragon Paul" was busy too, building special amplifiers, testing various tuning arrangements, and experimenting with different aerials. When he succeeded in making 5ZA work a relay in New Jersey without interference from New York amateurs he felt he had things around where they belonged.

On Nov. 14th, the night before he sailed, a very impressive little dinner was given for him at The Engineers' Club in New York City, where our A.R.R.L. officers and our directors within hailing distance and the officials of other radio organizations gathered to wish him success and bid him Godspeed. While the trial was to be a severe one and no man could with surety predict the outcome, optimism was distinctly the keynote and everybody was certain that if it could be done at all Paul would get signals. At this meeting credentials and written instructions were given him, together with a sealed packet for Mr. Coursey in which the secret codes and final schedules were given. There were but two copies of these documents in existence and the duplicate was locked in the Hartford safe. Until the writing of the article it was seen by no eyes in this country save those of our Traffic Manager—not even by the present writer.

Godley sailed on the "Aquitania" on Nov. 15th, amid cheers and waving handkerchiefs of assembled radio friends and relatives, and for a couple of nights out the amateur air was thick with farewells and good wishes for 2ZE, Godley's home call, for everybody knew he would be in the static-room on the "Aquitania".

The second day out we radioed him:

"Bon voyage The entire radio world is pulling for you"—to which he replied:

Confidence increases as distance squared Broadcast my heartfelt appreciation".

Arrangements had already been made with the British authorities thru the kind co-operation of our own State Department and Department of Commerce for special authorization to Mr. Godley to bring in

Read the full February 1922 article, "The Story of the Transatlantics" at **arrl.org/transatlantic**.

Congratulations

September 2021
QST Cover Plaque Award Winner

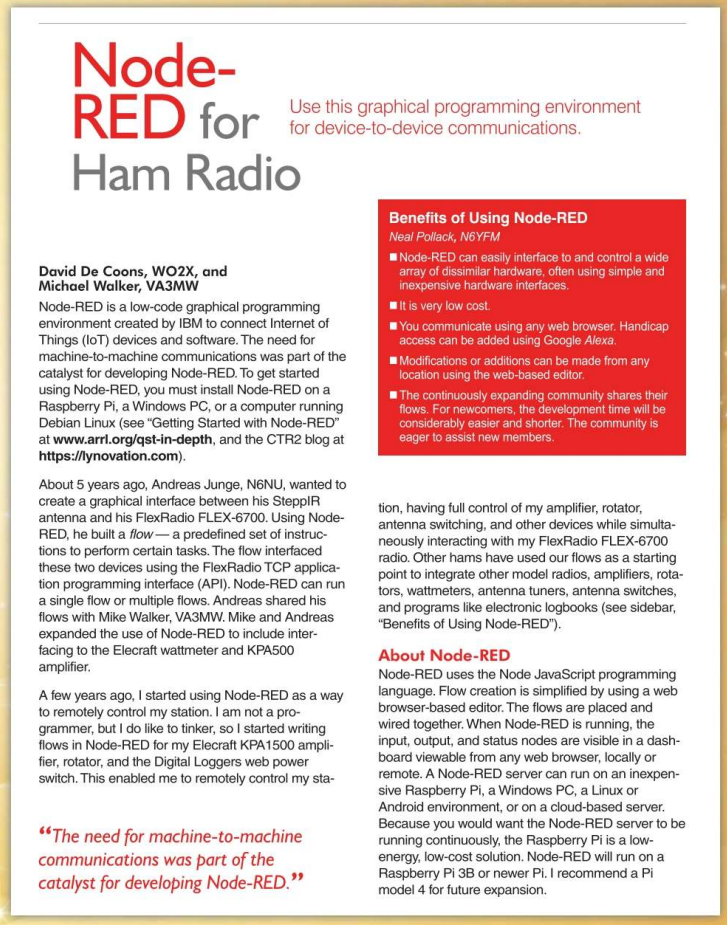
David De Coons, WO2X, and Michael Walker, VA3MW

In their article, "Node-RED for Ham Radio," David De Coons, WO2X, and Michael Walker, VA3MW, use a graphical programming environment to connect Internet of Things devices and software. You can install Node-RED on a variety of computer platforms.

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!



Node-RED for Ham Radio

Use this graphical programming environment for device-to-device communications.

David De Coons, WO2X, and Michael Walker, VA3MW

Node-RED is a low-code graphical programming environment created by IBM to connect Internet of Things (IoT) devices and software. The need for machine-to-machine communications was part of the catalyst for developing Node-RED. To get started using Node-RED, you must install Node-RED on a Raspberry Pi, a Windows PC, or a computer running Debian Linux (see "Getting Started with Node-RED" at **www.arrl.org/qst-in-depth**, and the CTR2 blog at **https://lynovation.com**).

About 5 years ago, Andreas Junge, N6NU, wanted to create a graphical interface between his SteppIR antenna and his FlexRadio FLEX-6700. Using Node-RED, he built a *flow* — a predefined set of instructions to perform certain tasks. The flow interfaced these two devices using the FlexRadio TCP application programming interface (API). Node-RED can run a single flow or multiple flows. Andreas shared his flows with Mike Walker, VA3MW. Mike and Andreas expanded the use of Node-RED to include interfacing to the Elecraft wattmeter and KPA500 amplifier.

A few years ago, I started using Node-RED as a way to remotely control my station. I am not a programmer, but I do like to tinker, so I started writing flows in Node-RED for my Elecraft KPA1500 amplifier, rotator, and the Digital Loggers web power switch. This enabled me to remotely control my station, having full control of my amplifier, rotator, antenna switching, and other devices while simultaneously interacting with my FlexRadio FLEX-6700 radio. Other hams have used our flows as a starting point to integrate other model radios, amplifiers, rotators, wattmeters, antenna tuners, antenna switches, and programs like electronic logbooks (see sidebar, "Benefits of Using Node-RED").

"The need for machine-to-machine communications was part of the catalyst for developing Node-RED."

About Node-RED

Node-RED uses the Node JavaScript programming language. Flow creation is simplified by using a web browser-based editor. The flows are placed and wired together. When Node-RED is running, the input, output, and status nodes are visible in a dashboard viewable from any web browser, locally or remote. A Node-RED server can run on an inexpensive Raspberry Pi, a Windows PC, a Linux or Android environment, or on a cloud-based server. Because you would want the Node-RED server to be running continuously, the Raspberry Pi is a low-energy, low-cost solution. Node-RED will run on a Raspberry Pi 3B or newer Pi. I recommend a Pi model 4 for future expansion.

Benefits of Using Node-RED

Neal Pollack, N6YFM

- Node-RED can easily interface to and control a wide array of dissimilar hardware, often using simple and inexpensive hardware interfaces.
- It is very low cost.
- You communicate using any web browser. Handicap access can be added using Google *Alexa*.
- Modifications or additions can be made from any location using the web-based editor.
- The continuously expanding community shares their flows. For newcomers, the development time will be considerably easier and shorter. The community is eager to assist new members.

Write for *QST*

The membership journal of ARRL is always open to manuscript submissions from ham radio operators.

QST looks for material that appeals to a broad cross-section of readers within the diverse amateur radio community. Feature articles published in *QST* fall into one of two broad categories: *technical* and *general interest*.

Technical articles outline a construction project or a technical concept. General interest articles are "everything else" that's not technical: recaps of DXpeditions, grid expeditions, or public service activities; personal accounts of trying a new mode or style of operating — anything relating to operating or the ham radio avocation.

Whether your manuscript has a technical or general focus, a strong "how-to" component will make it stand out. Readers should come away from the article with specific ideas for recreating your experience.

Please note that *QST* only considers complete manuscripts — we do not evaluate concepts or ideas for manuscripts. The best way to find out whether the editors of *QST* are interested in your idea is to write the article and send it in for consideration via postal mail or email (no phone calls, please).

For more information on what *QST* is looking for, and how to submit manuscripts, see our Author Guide at **www.arrl.org/qst-author-guide**.

Celebrating Our Legacy

A Radio Journey Set Forth by Pearl Harbor

It's been 80 years since the attack on Pearl Harbor. I remember being 7 years old and living in Hawaii. That morning, my father received a phone call stating that Pearl Harbor had been attacked. We immediately tuned in to KGMB AM and listened to Webley Edwards of the radio series "Hawaii Calls" instruct the public to stay off the roads for the sake of the military.

I began listening to shortwave broadcasts of World War II from BBC News (British Broadcasting Corporation) and the Japanese all-female English-speaking radio broadcasters called Tokyo Rose, as well as broadcasts from other countries.

After World War II, a family member gave me an old radio that no longer worked, so I built a crystal set using the antenna coil and the tuning capacitor, as well as some superheterodyne receivers — a one-tube, a two-tube, and eventually a five-tube.

At the age of 13 I learned Morse code, and earned my Novice-class license 3 years later. I got on the air with a 6AG7/6L6 radio that I built from scratch, which ran 25 W on 80 and 40 meters. A few months later, I built a 6AG7/807 transmitter running 70 W and upgraded to my General-class license.

I went to New York City to attend RCA Institutes (which changed its name to TCI College of Technology in 1974, but eventually closed in 2017), where I enrolled in a 2-year program for advanced electronic technology. My first job after graduation was at Bell Telephone Laboratories, where I worked on solid-state physics as part of a group with Dr. William B. Shockley, who, along with John Bardeen and Walter Brattain, invented the first transistor.

I continued my education at the University of Hawaii, where I majored in physics and mathematics, as well as performed graduate work in physics. I had a 35-year career in the aerospace industry, working at Kaena Point Satellite Tracking Station (now known as Kaena Point Space Force Station), in Oahu, Hawaii, as well as Onizuka Air Force Base in Sunnyvale, California.

Ham radio has kept me busy for more than 70 years, and I've loved every minute of running CW, SSB, and numerous digital modes (right now I mostly operate FT8). I'm a DXer at heart, but enjoy running low power or QRP with only wire antennas, such as dipoles, inverted **V** antennas, or verticals. I've confirmed 275 DX countries and made many friendships along the way.

Elmer Harger, N7EL
Queen Creek, Arizona
Life Member

Discovering DX

In the late 1960s, my parents bought me a General Electric portable multiband radio, and I was introduced to the world of Broadcast Band (BCB) DXing. It was fascinating to contact stations from all over the east coast of the US, just by using the rod antenna inside the small cabinet. I then discovered the shortwave band on the tiny 9 V transistor radio, and began listening to hams on 80 and 40 meters with the telescoping antenna.

In my junior and senior years of high school, I purchased an inexpensive Monarch Ham-1 receiver from a local radio shop, and my shortwave listening (SWL) really took off. Although the Ham-1 was a little microphonic, I was excited to have more shortwave coverage and a bandspread control to improve the tuning. I enjoyed listening to broadcasters from around the world, sending reception reports, and collecting QSL cards. I was well-known at the local post office for purchasing so many International Reply Coupons (IRC).

I went to college in 1971 and met two fellow students who were also hams. Dan Gustafson, WB4PYL, introduced me to many aspects of amateur radio, including mobile 2-meter operation. He modified an old Motorola 80D tube transceiver and installed it in his car. When he built a 2-meter repeater in the dorm room, he had a small rack cabinet full of vacuum tubes in the middle of the floor — parts and tools were everywhere.

I earned my Novice-class license during my junior year of college. The following year, I visited an engineer named Jack, W1CWC (SK), who worked with my dad. He gave me a tour of his shack, which included a Heathkit HW-100 and SB-200, and an old National Radio Company receiver. Later that year, I assembled a Heathkit HW-101 and built my station at my parents' house, which included Hallicrafters SX-71 and BC-348 receivers.

After college I began my first engineering job in southeast Georgia and became active in the local amateur radio club. I set up my HW-101, along with inverted **V** antennas, for 80 and 40 meters. I also managed to erect a 15-meter dipole on the steep roof of our two-story rental house. I operated CW on the Novice bands every night and weekend, increasing my code speed so I could earn my General- and Amateur Extra-class licenses. Once I did, I immediately began operating voice on the HF bands.

About a month later, I made my first real DX contact. I was working CW on the 15-meter band when I copied a strange call sign that answered my CQ. I didn't recognize the call sign prefix, but I soon realized that it was a German station!

The thrill of operating DX has never left me, and I continue to enjoy making friends from all over the world.

John Kelly, WA4IGL
Webster, Florida

Send reminiscences of your early days in radio to "Celebrating Our Legacy," ARRL, 225 Main St., Newington, CT 06111 or **celebrate@arrl.org**. Submissions selected for publication will be edited for space and clarity. Material published in "Celebrating Our Legacy" may also appear in other ARRL media. The publishers of *QST* assume no responsibility for statements made in this column.

George J. Misic, KE8RN, ke8rn@comcast.net

Classic Radio

The Collins KWM-380 Transceiver

The Collins KWM-380 (see Figure 1) was the last product Collins made for radio amateurs. It was a nice solid-state transceiver with a built-in ac power supply and speaker. It became available in 1979 and was available until 1983. Art Collins was still alive and affiliated with the company when the KWM-380 was released for sale, but Rockwell International — who had purchased Collins — was fully in charge of the company. It was surprising that an amateur radio transceiver project was done at this time, but it was a lightly modified version of a transceiver Rockwell made for government and military use.

Figure 1 — The Collins KWM-380. [Image courtesy of the *Collins KWM-380 Owner's Manual*]

The unit measured 15.5 × 7.5 × 18 inches without considering the knobs, connectors, or rubber feet. It weighed 50 pounds with the internal power supply and speaker. The unit was tan and brown, rather than the more common gray or black of the time.

The radio included a general-coverage receiver covering 1.60 to 30 MHz, with full sensitivity and performance, and 500 kHz to 1.60 MHz with reduced performance. The digital LED readout showed MHz, kHz, 100 Hz, and the nearest 10 Hz with seven digits. Unlike the Heathkit SB-104, where flicker of the 100 Hz digit was often an issue, Collins seemed to have solved the issue of flicker in the 100 and 10 Hz digits. In the Collins KWM-380, they appeared to be quite stable.

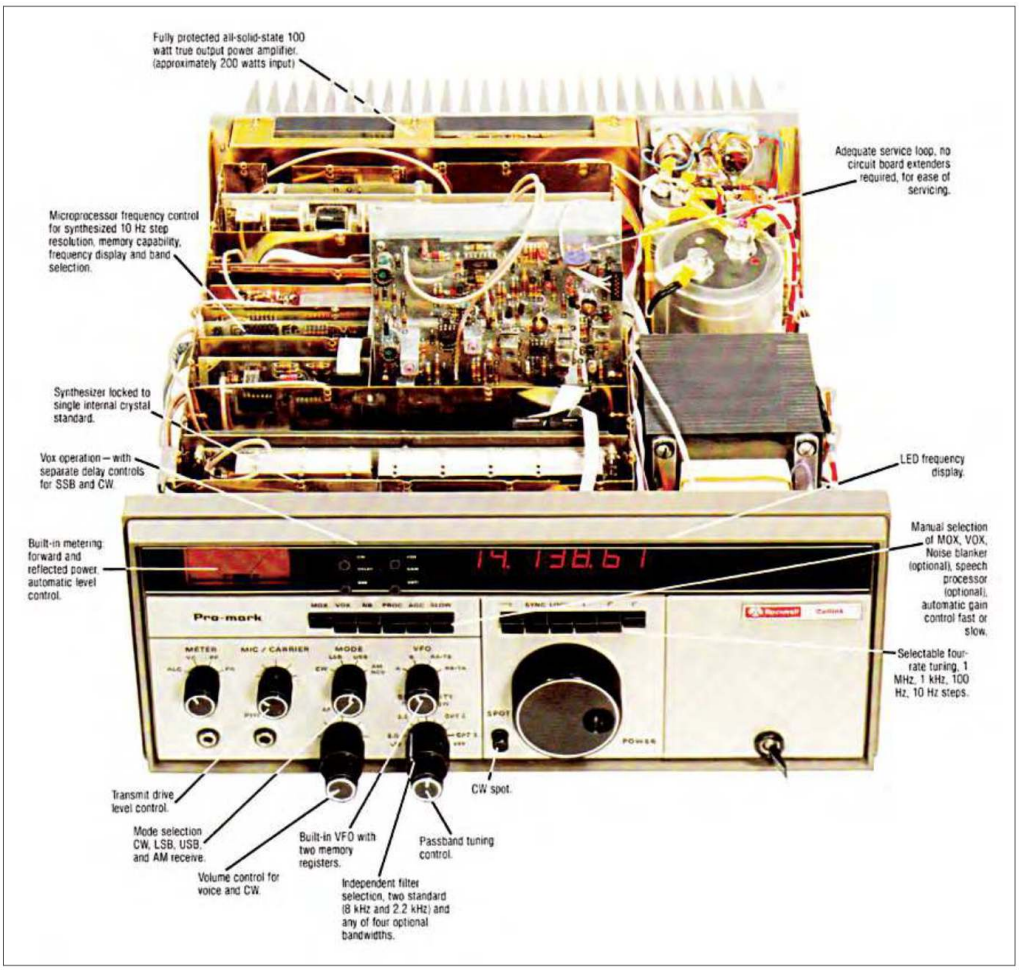


Figure 2 — The internal view of the Collins KWM-380. [Image courtesy of **universal-radio.com**]

Technical Summary

As delivered, the KWM-380 would only transmit on the amateur radio bands, but Collins manufactured a version of the radio for government and military service called the HF-380. The KWM-380 (see Figure 2) could transmit anywhere from 1.60 to 30 MHz with the full 100 W of RF output power into a good 50 Ω load. The radio would deliver full power into a load with a voltage standing-wave ratio (VSWR) of 2.0:1 and automatically ramped down the output power if the VSWR is higher. The unit would receive from 0.5 to 30 MHz, with reduced performance from 0.5 to 1.6 MHz.

The receiver came with a 2.2 kHz bandwidth SSB filter. The bandwidth of 8 kHz came without the benefit of a filter (other than one four-pole filter built in as part of the circuitry). This was the bandwidth with no 455 kHz filter in use, which should have worked for AM signals. The KWM-380 allowed the installation of up to three optional filters of the four available. The first intermediate frequency (IF) used in the KWM-380 was 39.145 MHz, and the second IF was 455 kHz.

Upconversion was not commonly used when the KWM-380 came onto the market in 1979. A frequency of 6.255 MHz was used as the shuttle frequency for the passband tuning feature. The KWM-380, like most other Collins equipment, featured both a product detector for SSB and CW and an equivalent diode detector for AM reception.

The transmitter operated making LSB, USB, CW, and RTTY signals. The ability for AM transmit was not included in the KWM-380, as was typical of Collins SSB-CW equipment. Nominal power of 100 W was available everywhere that the transmitter operated. High VSWR or long duty cycles would cause the KWM-380 to partially shut down to prevent overheating of, or damage to, the RF power amplifier.

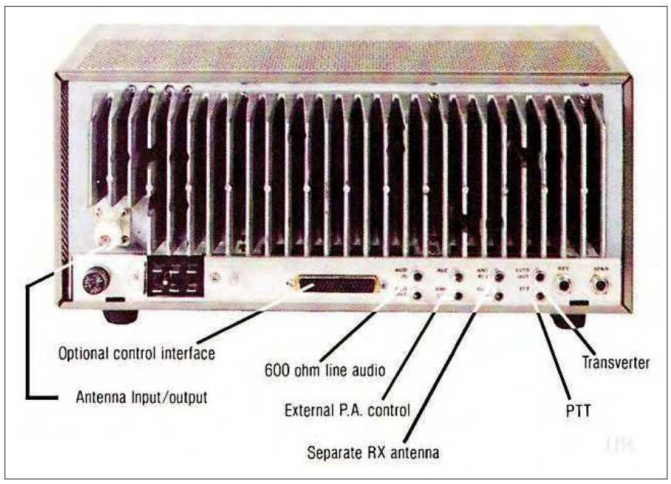


Figure 3 — The rear view of the Collins KWM-380. [Image courtesy of **universal-radio.com**]

The KWM-380 was frequency synthesized to establish the operating frequency. Two independent frequencies could be selected. One was for the receive mode, and the second was for the transmit mode to enable working of DX stations that operated outside the US phone band. The tuning rate could be selected from 10 Hz steps, going up to 1 MHz. The steps were 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz, and 1 MHz. The frequency synthesizer was accurate to within 5 Hz of the frequency set. Drift was essentially zero. An accessory keypad was available to enter a desired frequency.

Additional Options

For an extra cost, the KWM-380 could be personalized with accessories such as a cooling blower, a handheld microphone, a receive noise blanker, a 6 kHz wide AM receive bandwidth filter, a 1,700 Hz RTTY filter, a 500 Hz CW filter (wider), a 250 Hz CW filter (narrow), and a desk microphone.

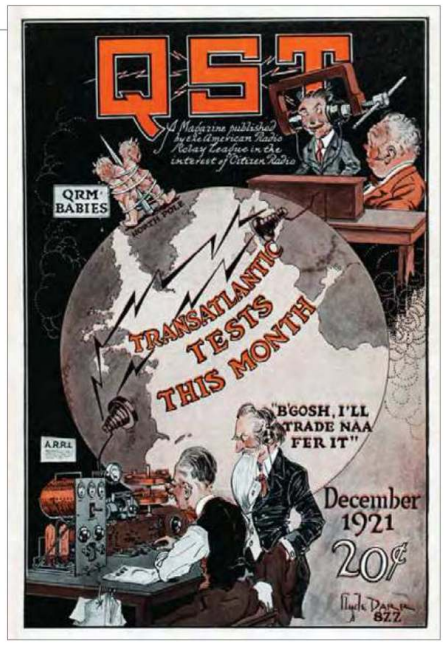
The unit had a ¼-inch, two-circuit phone jack on the front panel for inserting headphones. Using headphones muted the internal speaker and the external speaker jack. A 3⁄16-inch, three-circuit phone jack on the front panel accepted a push-to-talk (PTT) high- or low-impedance microphone with a PTT pushbutton. The specific input impedance of the microphone input is 3,300 Ω, which was considered low for a high-impedance microphone and high for a low-impedance microphone. A crystal or ceramic microphone would have been inappropriate to use with the KWM-380. Manual transmit via a PTT pushbutton or voice-operated transmit (VOX) could be used to select receive or transmit.

The antenna connector was the commonly used SO-239, which mates with the popular PL-259. A ¼-inch, two-circuit phone jack was provided on the rear panel (see Figure 3) for an external speaker (it could be used, but it was not needed). A second jack was provided for a CW key or keyer. The power connector was a Cinch Jones S-406-CCT, and the power input could be 50 or 60 Hz. Voltages could range from 105 to 250 V ac, and a dc input of 12 to 15 V dc could also be used. The unit could draw up to 100 W on receive and up to 600 W on transmit.

Reviews from owners varied from disappointing to exceptional. Personally, I like the KWM-380 and am very impressed with its capabilities, especially when one considers that it entered the amateur radio market in 1979.

Al Brogdon, W1AB

100, 50, and 25 Years Ago

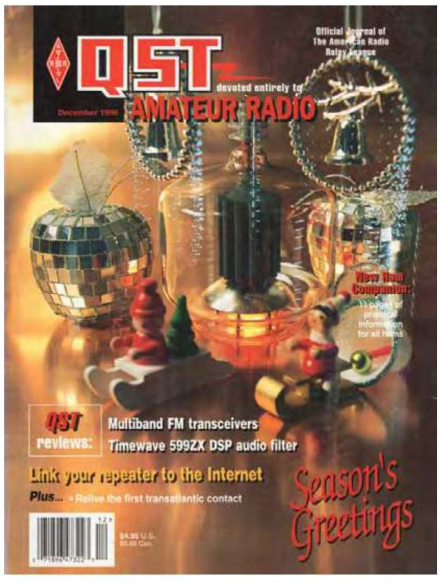


December 1921

- The cover art by Clyde Darr, 8ZZ, heralds the "Transatlantic Tests This Month," and shows hams on both sides of the Atlantic getting ready.
- The editorials cover a variety of subjects, including "The Radiophone." The editor says, "We look forward to that day when every home will have its radio installation — when powerful central stations will broadcast news, concerts, lectures, entertainments, and everyone may get them without stirring from his living room."
- "The Second Transatlantic Tests" outlines the preparations that had been made for the tests.
- Cyril M. Jansky, Jr., describes "A High Efficiency C.W. Transmitter."
- Sumner B. Young, 1AE, discusses "Improving the Relay Spark Transmitter."
- The "New Apparatus" column takes a careful look at the new shortwave R.F. amplifier offered by the Radio Instrument Co.
- The new column, "With The Radiophone Folks," provides an overview of activity on this new medium. It lists the schedule of current radiophone stations KDKA, WBZ, WJZ, 1XE, 6XC, 6XG, and 6XAK. Most of those stations broadcast for 1 hour daily.

December 1971

- The cover photo shows the entrance to ARRL Headquarters, with snow on the ground and the greeting, "Merry Christmas from the ARRL Headquarters Gang!"
- The editorial, "Transatlantics — 1921" looks back on ARRL, the efforts made, and the highlights of the Transatlantic Tests.
- Ben Lowe, K4VOW/WA5UVM, presents "A 15-Watt-Output Solid-State Linear Amplifier for 3.5 to 30 MHz."
- Robert M. Myers, W1FBY, provides Part II of "A C.W. Man's Kilowatt."
- Charles B. Andes, WB2VXR, uses a new twist to give readers a better selectivity, in "Threshold Detectors in a C.W. Audio Filter."
- Edward P. Tilton, W1HDQ, explains how to build "A 5-Over-5 Stacked-Yagi Array for 50 MHz."
- Doug DeMaw, W1CER, presents "Some Thoughts About 220-MHz Operation."
- W. E. English, W6WYQ, describes how to build "A 40-Meter DDRR Antenna."
- Larry Nickel, K3VKC, shares how to build a "Simple Integrated-Circuit Square-Wave Source."
- Irvin M. Hoff, W6FFC, shares information on "Pi and Pi-L Network Design for Amplifiers."



December 1996

- The cover photo shows an EIMAC 3-400Z RF power tube among some Christmas decorations.
- The editorial comments by Robert W. Jones, VE3CTM (elected Director of the International Telecommunication Union's Radiocommunication Bureau in 1994), tells readers they should "Speak With One Voice."
- Bruce L. Kelley, W2ICE, and Donald G. Hudson, KA1TZR, relive the heady days of 50 years ago, in "Hams Span the Atlantic on Shortwave!," complete with an array of historic photos.
- Jacob Makhinson, N6NWP, explains how to build "A Drift-Free VFO."
- James Millner, WB2REM, offers ideas on connecting amateur radio and the web, in "A New 'Band' for Your Radio."
- William Sheets, K2MQJ, and Rudolf F. Graf, KA2CWL, provide Part 3 of "Get on 440-MHz ATV!"
- Garry V. Hammond, VE3XN, talks about a domestic adventure that felt like a DXpedition — "The 1996 *Polar Bear Express* DXpedition."
- In "30 Minutes on 432," Steve Ford, WB8IMY, spins the tale of his introduction to terrestrial UHF operation.
- Donald Cox, AA3EK, urges readers to "Explore HF/VHF Digital and Image Modes on the Cheap."

Silent Keys

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

W1CMF **Francer**, Charles M., Boca Raton, FL
•KC1DD **Carpenter**, Hervey B., Kennebunk, ME
WB1DSP **Pilsbury**, Chandler T., Pittsfield, MA
•W1FKI **McTeague**, William J., South Windsor, CT
•AC1FS **Benulis**, Gregory A., Boxford, MA
KA1GKJ **Taylor**, Donald D., Oakville, CT
♦K1PKZ **Caputo**, Paul J., Van Alstyne, TX
KB1SIN **Brooks**, William H., Yalesville, CT
K2FX **Kolacki**, Paul Jason, Ocala, FL
KD2MGU **Nishina**, Masayoshi "Iggy," Brentwood, NH
KU2P **Rule**, Hollis C., Jr., Nashville, TN
K2SCW **Copenhagen**, Susan, Pittsford, NY
KC2VHU **Gueldenpfennig**, Klaus, Penfield, NY
K2VJF **Green**, James R., Carbondale, PA
KB2WPD **Towsley**, Michael J., Ellsworth, ME
W2WS **Szymko**, William E., Marcy, NY
♦KB2XI **Fox**, Robert D., Rochester, NY
W3CRK **Heydt**, William H., Jr., Millersville, MD
♦W3EKT **Bruns**, Edward L., Glenwood, MD
♦♦♦K3IO **Clark**, Thomas Arvid, Columbia, MD
♦W3IUU **Rasmussen**, Lloyd, Kensington, MD
N3KYZ **Law**, George S., Berwick, PA
N3LGN **Rothwell**, Paul C., Dixmont, ME
N3MPL **Gravelle**, Sally A., Lexington Park, MD
W3OEP **Mertz**, Eugene, Potomac, MD
N3OGT **Ketner**, Andrew J., Mount Union, PA
KC3QO **Snyder**, Tim G., Bath, PA
KJ3R **Bersch**, Charles A., Bethlehem, PA
WA3RR **Ratcliffe**, Robert H., Bethesda, MD
WU3V **Moore**, James Carlton, Damascus, GA
K3VPZ **Nemec**, Chuck C., Jr., Baltimore, MD
KI4AIF **Gardner**, Danny E., Kings Mountain, NC
W4AKG **Grey**, Ansel K., Easley, SC
KN4FEO **Martins**, John, Boca Raton, FL
KB4GKI **Holbrook**, Jimmy L., Ronda, NC
•WA4HMI **Zuercher**, Roger M. "Buddy," Mountain City, TN
AF4J **Conaway**, Donald P., Wilmington, NC
K4JUZ **Alderman**, Maines "Hatz," Shalimar, FL
KD4LIR **Mort**, Robert C., Minersville, PA
K4LOD **Swancara**, John W., Pisgah, NC
KC4LOW **Lowe**, Carroll D., Jr., Millers Creek, NC
K4LQ **Perkins**, Frederick M., Jr., Lake Placid, FL
W4MZP **Horne**, W. Henry, Red Springs, NC
KN4NG **White**, George T., Morrow, GA
KK4PVX **Negrich**, Dennis H., Jr., Port Charlotte, FL
•KJ4PXL **Miller**, Bruce, Louisville, KY
N4QYL **Brown**, Larry D., Montgomery, AL
WA4TCS **Hamm**, Wilford P., Henrico, VA
KI4TGN **McElroy**, Donald A., Heflin, AL
KK4UCC **Muse**, Max H., Carthage, NC
KK4WS **Parsons**, Tim J., Lexington, KY
W5ADY **Price**, Barbara R., Albuquerque, NM
W5GPO **Byars**, Charles "Charlie" T., Wichita Falls, TX
WD5GXO **Engel**, Steven P., Rockford, MI
♦W5JYK **Pulitzer**, Stanley M., New Orleans, LA
♦N5KDR **James**, Thomas W., Ellinger, TX
KF5QIQ **Abramson**, Lawrence R., Olive Branch, MS
KD5RZU **Asebedo**, Roland, Highland Village, TX
KW5T **Kemp**, Paul C., II, Pearl, MS
KE5TOB **Firth**, William C., Albuquerque, NM
WA5VMS **Borovetz**, Joe S., Muskogee, OK
KB5YJF **Enis**, Michael W., Starkville, MS
KA6CMD **Laherty**, James L., San Mateo, CA
KD6CRL **Bruchey**, John D., Tucson, AZ
•K6EHH **Hullette**, Elayne, Arroyo Grande, CA
W6GR **Smith**, Robert W., Madera, CA
N6NPG **Ryan**, Thomas H., Ridgecrest, CA
N6RA **Gallagher**, Thomas A., Santa Barbara, CA
KO6RU **Hanna**, Claude B., Cameron Park, CA
KK6TS **Person**, Jerry K., Los Angeles, CA
W6WTF **Cook**, Matthew E., Antelope, CA
KH6XM **Dragon**, Douglas, Makawao, HI
N7DLT **Hisaw**, Jean A., Clayton, TX
KG7EHR **Pringle**, Steven D., Brookings, OR
K7GCO **Glanzer**, Kenneth W., Bridgewater, SD
WA7GTU **Blanchard**, Don L., Cedar City, UT
KE7GVE **Finnell**, Jerome D., Nampa, ID
W7JAY **Carlson**, Robert D., Tangent, OR
•KG7OY **Tuinstra**, William A., Methow, WA
N7UJF **De Wolf**, Penny A., Portland, OR
K7WST **Davenport**, Arthur K., Bainbridge Island, WA
KB8CQH **Gergal**, Dixie J., New Carlisle, OH
K8DVK **Thomas**, Jack K., Brookville, OH
W8GAZ **Weisbrod**, Stephen P., Minnetonka, MN
N8HKJ **Sweeney**, Ronald D., Troy, OH
♦K8MZH **Hubbell**, Leland, Johnstown, OH
KB8NNS **Gum**, Bradley A., Elkins, WV
•KC8PMC **Cromwell**, Peter M., Reading, MI
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•KC9AGX **Zach**, Robert F., New Berlin, WI
W9GIV **Yanney**, William S., Beavercreek, OH
WD9IEJ **James**, Marlena D., Ridgeville, IN
AK9J **Rogers**, Lee, Lone Tree, CO
AA9KB **Wasmuth**, John P., Jr., Columbia City, IN
•N9WBI **Skidmore**, Barry C., Elroy, WI
KC9QBY **Keely**, Charles C. "Chuck," Neenah, WI
KB9RDO **Baringer**, Michael L., Jamestown, IN
N9WLB **Bonahoom**, Michael J., III, Warsaw, IN
WBØAAT **Brewer**, Harvey D., Durango, CO
WØAES **Ellison**, Jim M., Funk, NE
WØELM **Woelm**, David, Blaine, MN
KØJMN **Pickering**, Donald J., Nebraska City, NE
AKØL **Mosier**, Ricky A., Chattanooga, TN
KCØLRE **Wesley**, Gary L., Toledo, OH
ACØNS **Yedlik**, Edwon G., Vinton, IA
KBØQMF **Cobb**, Michael E., Parsons, KS
KCØSKD **Schaffer**, Donna, Grand Forks, ND
KAØTHW **Marquez**, Robert, Lakewood, CO
KBØVTK **Doran**, Paul, Saint Louis, MO
NØVY **Thompson**, Mack, Boulder, CO
KGØXR **Gilbert**, Frank, Jr., McKinney, TX
♦WXØY **Walters**, Travis, Jr., Anamosa, IA
VE3DBL **Titley**, Gary A., Waterdown, ON, Canada
VE3GIX **Kulbacki**, Marc, Windsor, ON, Canada
VA3HNZ **Reinert**, Heinz G. Kingsville, ON, Canada
♦F9AP **Pettelat**, Andre, Les Angles, France

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

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

Strays

QST Congratulates…

ARRL member and professional engineer Les Kramer, WA3SGZ, will be among the 2020 inductees into the Florida Inventors Hall of Fame on November 5. The Hall of Fame, at the University of South Florida in Tampa, recognizes approximately seven Florida inventors every year for significant contributions to technology and society. Kramer holds 17 US patents and two overseas patents, spanning lower-limb prosthetic devices to advances in electric power generation, IED detection, optical coatings for industrial processes, and dynamic electronic tagging using a sticky polymer. "One of my primary inventions is a prosthetic foot that returns energy to both the heel and the toe of the amputee, thereby giving the user a very lifelike feeling and natural control of the foot," said Kramer, who is Vice President of Engineering and Manufacturing at TaiLor Made Prosthetics, LLC, in Orlando. The prosthetic foot is used by some 3,000 people worldwide, including two Boston Marathon bombing victims. Kramer said amateur radio has played a key role in his success as an inventor. He has been a ham since 1959 and an ARRL member for more than 50 years.

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Special Full-Day Program at the DoubleTree by Hilton Hotel Orlando at SeaWorld

All-Day Training Tracks (choose one):

- Contest University
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- Ham Radio Boot Camp

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- 20W DSP noise cancelling EQ versions: EQ20-DSP and EQ20B*-DSP * Denotes Bluetooth on input

Read the excellent EQ20-DSP review in December 2019 QST!

High-performance DSP noise cancelling..
..giving you a great listening experience

Dual In-Line

Fully featured flexible dual channel DSP noise cancelling unit - 8 Filter levels 9 to 40dB - 3.5mm mono or stereo inputs - Line level input/output - 7 watts mono speaker output - Headphone socket - Suitable for all types of radio incl' SDR - Easy to use controls for quick and easy operation - Enjoy clear intelligble "noise-free"speech from your radio - Replacement for bhi NEIM1031 In-Line

New In-Line Module

New

8 noise filter levels 8 to 40dB - Tone reduction up to 65dB - 5W audio with latest bhi DSP noise cancellation - Audio bypass feature - 3.5mm mono inputs and outputs - Headphone socket - Audio input overload feature - DC power 10 to 16V DC - Dims 135mm x 65mm x 46mm - Replacement for bhi ANEM MKII and NEIM1031MKII

NES10-2MK4

New improved design

- 5W audio - Latest bhi DSP noise cancelling
- 8 filter levels 8 to 40dB
- Three position switch for off/audio bypass mode, power on and DSP filter on - LEDs for Power on, filter on and audio overload
- Headphone socket

Read the excellent NES10-2MK4 review in May QST page 48

New DESKTOP MKII

Latest bhi DSP noise cancelling technology for even better receive audio

- 10W Amplified DSP noise cancelling base station speaker
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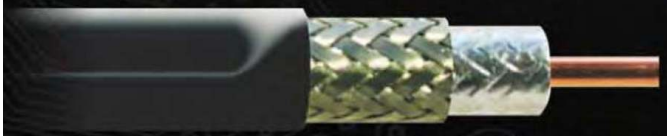

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HAM-IV

The most popular rotator in the world!

HAM-IV **$729.95**

For medium communications arrays up to 15 sq. ft. wind load area. 5-second brake delay, Test/Calibrate function. Low temperature grease permits normal operation down to -30 degrees F. Alloy ring gear for extra strength up to 100,000 PSI for maximum reliability. *Precision* indicator potentiometer. Ferrite beads reduce RF susceptibility. Cinch plug plus 8-pin plug at control box. Dual 98 ball bearing race for load bearing strength and electric locking steel wedge brake prevents wind induced movement. North/South center of rotation scale on meter, low voltage control, max mast $2^{1}/_{16}$".

HAM-VI **$909.95** with DCU-2

HAM-VII **$999.95** *with DCU-3*

TAILTWISTER SERIES II

T-2X **$969.95**

T-2XD2 **$1079.95** with DCU-2

T-2XD3 **$1139.95** with DCU-3

For large medium antenna arrays up to 20 sq. ft. wind load. 5-second brake delay, Test/Calibrate functions. Low temp grease, tough alloy ring gear, indicator potentiometer, ferrite beads on potentiometer wires, weatherproof AMP connectors plus 8-pin plug at control, triple bearing race (138 ball bearings) for large load bearing, electric locking steel wedge brake, North/South center of rotation scale meter, low voltage control, $2^{1}/_{16}$" mast.

MSHD, $149.95. Above tower heavy duty mast support. Accepts $1^{7}/_{8}$-$2^{5}/_{8}$" OD.

CD-45II

CD-45II **$519.95**

For antenna arrays up to 8.5 sq. feet mounted inside tower or 5 sq. ft. with mast adapter. Low temperature grease good to -30 F degrees. *New* Test/Calibrate function. Bell rotator design gives total weather protection, dual 58 ball bearing race gives proven support. Die-cast ring gear, stamped steel gear drive, heavy duty, trouble free gear train, North center scale, lighted directional indicator, 8-pin plug/socket on control unit, snap-action control switches, low voltage control, safe operation, takes maximum mast size to $2^{1}/_{16}$ inches. MSLD light duty lower mast support included.

HAM IV and HAM V Rotator Specifications	
Wind Load capacity (inside tower)	15 square feet
Wind Load (w/mast adapter)	**7.5 square feet**
Turning Power	800 in.-lbs.
Brake Power	**5000 in.-lbs.**
Brake Construction	Electric Wedge
Bearing Assembly	**dual race/96 ball bearings**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight	26 lbs.
Effective Moment (in tower)	**2800 ft.-lbs.**

TAILTWISTER Rotator Specifications	
Wind load capacity (inside tower)	20 square feet
Wind Load (w/ mast adapter)	**10 square feet**
Turning Power	1000 in.-lbs.
Brake Power	**9000** in.-lbs.
Brake Construction	Electric Wedge
Bearing Assembly	**Triple race/138 ball brngs**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight	31 lbs.
Effective Moment (in tower)	**3400 ft.-lbs.**

CD-45II Rotator Specifications	
Wind load capacity (inside tower)	8.5 square feet
Wind Load (w/ mast adapter)	**5.0 square feet**
Turning Power	600 in.-lbs.
Brake Power	**800 in.-lbs.**
Brake Construction	Disc Brake
Bearing Assembly	**Dual race/48 ball brings**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight	22 lbs.
Effective Moment (in tower)	**1200 ft.-lbs.**

Hy-Gain Programmable DCU-3

Digital Rotator Controller

DCU-3 -- $519.95

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

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

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

Calibrate lets you accurately match your display to your *true* beam heading. Has USB/RS-232 ports for computer control. Adjustable LCD sleep time. Field upgradeable firmware. 8.5Wx4.3H x9D".

110 VAC. Order DCU-3X for 220 VAC.

DCU-2 Digital Rotator Controller --$479.95

$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 *AutoReversal*™ for fast longpath operation. All DCU-2 features. Bright blue LCD shows current, dialed-in, computer controlled beam headings, call. USB port for computer control. Extra heavy-duty AC power supply. Fast variable DC motor 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-`886 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.

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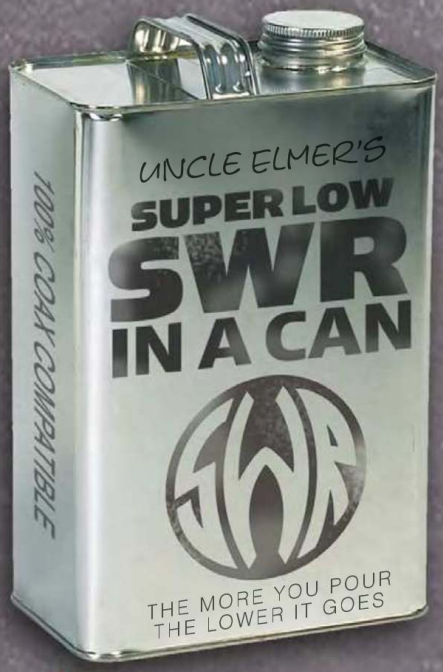

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Null out all types of noise!!! Severe power line noise from arcing transformers and insulators, fluorescent lamps, dimmers, touch controlled lamps, computers, TV birdies, lightning, garage door openers, electric drills, motors, industrial processes. It's much more effective than a noise blanker because interference much stronger than a desired signal can be completely removed without affecting the desired signal. All modes -- SSB, AM, CW, FM, frequences from BCB to lower VHF.

Null out strong QRM on top of weak rare DX ! Null out a strong local ham or AM broadcast station to prevent your expensive receiver from overloading.

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

MFJ-1026
$269.95

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

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

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

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

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

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

MFJ-5008
$249.95

MFJ Power Line Noise Finder

MFJ-852
$159.95

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

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

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

MFJ Low-Noise Receiving Mag Loop

MFJ-1886
$319.95
Receive Loop with Biastee

Clearly hear signals 50 KHz to 30 MHz you never knew existed. Power line noise and static disappears. Rotating the MFJ-1886 eliminates interfering signals or greatly peaks desired signals. Excellent antenna and preamplifier balance gives deep null. Gives excellent strong and weak signal performance without overload. Fully protected state-of-the-art push-pull Gali MMICs preamplifier gives high dynamic range, low IMD and 25 dB of low noise gain. Use inside or outside.

Reduce Harmonics, Avoid TVI with MFJ Low Pass Filters

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

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

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

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

MFJ-854
$159.95

MFJ Clamp-on RF Ammeters

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

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

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

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

MFJ-1164B
$104.95

MFJ AC Line Filter/Protector

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

Ferrite RFI Suppression Chokes

MFJ-700A4, $21.95. .275" diameter 4-Pack
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MFJ-700C4, $34.95. .528" diameter 4-Pack
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ANC-4+ Antenna Noise Canceller

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

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The Premier Sound Card Modem!

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- Quiet - hear what others miss!
- Proven USB Sound Card built-in
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- Complete - Six FTDI COM ports
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- Works well with HRD, M110A, Fldigi, FT8 & many more software programs
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Multimode Data Controller*

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Turn your SDR into a panadapter to see entire bands on frequency/waterfall displays . . .

An inexpensive wide-band SDR dongle receiver lets you see entire bands on frequency/waterfall computer displays!

MFJ-1708B-SDR
$139.95

If you want to know where the activity is, who's generating splatter, what's in the DX window, how wide your audio is or what frequencies are clear, it's all right there! While receiving on your transceiver, MFJ-1708B-SDR switches your SDR to your antenna showing the entire band. On transmit your SDR is switched out and grounded to protect your SDR. PTT and a fail-safe RF sense switches MFJ-1708B-SDR. For HF/VHF/UHF. Monitor multiple bands with multiple SDRs and a multi-coupler.

MFJ-1708B-SDR-S, $149.95. SMA connector for your SDR.

New B series improvements . . .

The original MFJ-1708 series used one relay and wires to connect the SO-239s. The *new B-series* uses *four* relays and connectors on a *single* pc board. This gives you > 50 dB isolation at 300 MHz and > 68 dB at 50 MHz. SWR < 1.16:1 at 50 MHz and < 1.75:1 at 450 MHz at the transmit port. Mute output is a selectable short or open to ground. Use "boat anchors" or modern receivers or key a linear amplifier. Receiver input protection prevents overload from nearby high power signals and from receive to transmit. A hybrid splitter on SDR models reduces loading effect and gives > 15 dB isolation between the SDR REC and XCVR ports to reduce interference. The original MFJ-1708 series is still available.

MFJ Low Noise VLF/HF Receiving Loop

Pull weak signals out of static crashes, atmospheric, man-made and power line noise!

Hear signals 50 KHz to 30 MHz cleaner, quieter than ever before! Power line noise disappears. Rotate its figure 8 pattern and its extremely deep null to completely eliminate an interfering signal or greatly peak a desired one. Fully protected state-of-the-art Gali MMICs in push-pull gives you a preamp with extremely high dynamic range, low IMD and 25 dB of low noise gain. Excellent performance on strong and weak signals without overload. 36-inch dia. loop. 1-in. OD 6061 aluminum.

MFJ *wideband* SDR *Discone* Antenna

Receives 25-1300 MHz

MFJ ultra wide-band *Discone* Antenna receives 25-1300 MHz. Perfect for all band SDR reception. Covers 10, 6, 2 Meters, 220 and 440 MHz and 33/23 CM ham bands and everything in between. It is excellent for monitoring multiple bands simultaneously using multiple SDRs and a multi-coupler. Also test any transmitter 50-1300 MHz using a single discone and single coax. Handles 200W. Includes 50 feet coax, stainless steel elements and mounting hardware.

MFJ-1866, $64.95. Like MFJ-1868 but transmits 144-1290 MHz. Coax and mounting hardware not included.

Tuned Indoor SDR Active Antenna

Make your SDR receiver come alive with HF signals, .3-40 MHz, while rejecting interference with MFJ-1020C *tuneable* indoor active antenna! Gain control, telescoping whip.

MFJ-1020C
$139.95

Untuned Indoor SDR Active Antenna

MFJ-1022, $99.95.

Hear weak, noisy VLF to UHF signals. Noise-less feedback gives excellent low noise reception. Handles strong signals.

Active OutdoorAntenna

MFJ-1024
$209.95

World Radio TV Handbook says "MFJ-1024 is a *first rate, easy-to-operate active antenna, quiet, excellent dynamic range, good gain, very low noise factor, broad frequency coverage, excellent choice . . .*"

Outdoor mounted 54-inch whip/preamp gives maximum signal and minimum noise. Covers .05-30 MHz.

Indoor unit: 20 dB attenuator, gain control, 2 receiver and 2 antenna switches.

HF SDR Preselector

Tuneable

MFJ-1040C
$159.95

MFJ-1040C lets you copy **w**eak, noisy SDR signals from 1.8 to 54 MHz. Greatly tunes out and reject out-of-band interference. Up to 20 dB gain. Has gain control. Cascode FET/bipolar transistor gives low noise, high gain without overloading. Switches for 2 antennas and 2 receivers. SO-239s. Has 20 dB attenuator. Automatically bypasses when transmitting or use PTT. 6½Wx2½Hx4D inches.

MFJ LW/MW/SW SDR Preselector/Tuner

Highly rated series-tuned MFJ boosts your desired signals while greatly rejecting interference and preventing serious overload.

MFJ-956
$109.95

Greatly improves reception 0.15 to 30 MHz. Incredibly effective below 2 MHz.

Super easy to operate, select band and tune!

Bypass tuner and ground receiver switch positions.

Compact 2x3x4 inches. SO-239 connectors.

MFJ RF Sense Transmit/Receive Switch

MFJ-1708B
$139.95.

Switches your antenna from receiver to transmitter using a relay. Shorts your receiver to ground during transmit. Use RF sensing with adjustable delay or PTT line. Has selectable open/short mute.

Auto switch XCVR between 2 antennas

MFJ-1707B
$139.95.

Automatically switches separate transmit and receive antennas on transceivers with only one antenna port. *Example:* Efficient 75M dipole for XMIT and low noise MFJ loop for receive -- *no static crashes!*

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MFJ-4416C *Super* Battery *Booster*

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

MFJ-4416C **$229.95** **Keeps** your transceiver at full power output, provides full performance, high efficiency, prevents output signal distortion and transceiver shutdown. Compensates for run-down battery, wiring voltage drop or when car is off. Provides up to 25 Amps peak with 90% efficiency. Selectable 9/10/11 Volts minimum input voltage prevents battery damage from over-discharging. RF sense turns MFJ-4416C off during receive to save power, increases efficiency and reduces noise. Adjustable 12 to 13.8 VDC output pass-through improves efficiency and lets transceiver run cooler. Has output over-voltage crowbar protection. *Anderson PowerPoles*(R) and high-current 5-way binding posts for DC input, regulated output. 7¾Wx4Hx2⅛D inches. **MFJ-4416BRC, $119.95.** Booster Remote Control.

Super Heavy Duty Battery Booster

MFJ-4418 **$279.95**

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

RFI Filter for DC power

MFJ-1142 **$89.95**

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

Digital Volt/Amp Meter

MFJ-4422 **$69.95**

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

RFI Ferrite Chokes

MFJ-700A4 **$21.95**

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

PowerPole™ DC Outlet Box

MFJ-1104 **$69.95** **One** fused 30 Amp input and 25, 10, 5 Amp fused outputs *with Anderson PowerPoles*™. Has open fuse indicator. Sturdy metal construction, 2¾Wx3¼Hx1½D inches.

MFJ Low Pass Filter

MFJ-704 **$124.95**

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

Lightning Surge Protector

MFJ-270 **$29.95**

Protect your expensive equipment from lightning induced surges on 50 Ohm coax. Use for transceivers up to 400 Watts, 1000 MHz. **MFJ-272, $44.95.** 1.5 kW.

MFJ 30-Amp Power Supply

MFJ-4230MV **$144.95**

World's most compact 30 Amp switching power supply. Switchable Volt/Amp meter. Adjustable 4 to 16 VDC output. Select 120/240 VAC input. 5Wx2½Hx6D in., 3 lbs.

High-efficiency Loop Tuner

New! MFJ-935C **$299.95**

Instantly turn wire or coax into a small, high-efficiency multi-banded loop antenna. 150W, 5.3-30 MHz. Tripod/mast mount included. **MFJ-936C, $349.95.** Relative RF antenna current and Cross-needle SWR/Wattmeter. **MFJ-933C, $249.95.** Like MFJ-935C, no meter.

MFJ Field Strength Meter

MFJ-801 **$44.95** **Relative** field-strength readings .1-500 MHz. Sensitivity control, 1¾ inch meter. 20-inch telescoping whip. Finger contact increases sensitivity.

Tuned Indoor Active Antenna

MFJ-1020C **$129.95**

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

25-1300 MHz Discone Ant

MFJ-1868 **$99.95** **Receives** 25-1300 MHz. Transmits 50-1300 MHz up to 200 Watts.Test various X-mitters on one coax. 50 ft. coax, stainless steel elements.

17-foot Telescopic Whip

MFJ-1979 **$79.95**

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

Telescopic Fiberglass Mast

MFJ-1906HD **$269.95**

Super-strong heavy-duty mast with *QuickClamps*™. 38 ft. ext., 6 ft. collapsed. 2½" OD bottom, 1" OD top. .125" thick wall. Supports "*real*" weight.

Giant 2½ inch LED Clock

MFJ-117 **$27.96** New Low Price!

Giant 2½ inch super bright LEDs -- see from across the street day or night. 12/24 switch, 110VAC, 9V battery backup.

MFJ 2-Position *Remote* Antenna Switch

MFJ-4712 **$109.95**

MFJ 2-position *remote* antenna switch uses a *single* coaxial feedline to feed two antennas, DC power and control signals. Remotely switch HF and/or VHF antennas. Covers 1.8 MHz to 150 MHz. Handles 1500W. Impedance is 50-75 Ohms. Compact 4Wx2⅝Hx1½D". *Outside Switch Box* is fully enclosed and weather protected. Three quality *Teflon*(R) SO-239 connectors for transmitter, antenna one and antenna two. Stainless steel 1½" tall bracket with a U-bolt for masts up to 1½ in. O.D. *Inside biastee* control is 2¼Wx2½Hx1¼ in. Use 12 VDC or 110 VAC with MFJ-1312D, $26.95.

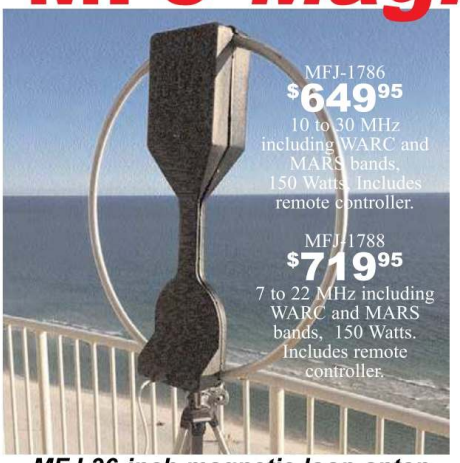
MFJ Artificial RF Ground

MFJ-931 **$149.95**

By tuning out ground wire reactance RF hot spots disappear and your rig is at actual earth ground. Improve signals by resonating a wire into a tuned counterpoise.

MFJ Enterprises, Inc. 300 Industrial Pk Rd, Starkville, MS 39759
Phone: (662) 323-5869 • Tech Help: (662) 323-0549 • FAX: (662) 323-6551 8-4:30 CST, Mon.-Fri.

MFJ *Magnetic Loop* Antennas



MFJ 36-inch magnetic loop antenna lets you operate 7 to 22 MHz or 10 to 30 MHz continuously -- including the WARC and MARS bands! Easily handles a full 150 Watts on SSB/CW/Digital for any transceiver.

Ideal for limited space. Apartments, small lots, motor homes, attics, trailers.

Work exciting DX with low angle radiation and local close-in contacts with high angle radiation when mounted vertically.

Super easy-to-use! MFJ remote control auto tunes to your desired band. Fast/slow tune buttons, Cross-Needle SWR/Wattmeter lets you quickly tune to your exact frequency. No control cable needed.

***World's** most efficient small loop antenna has all welded construction, welded butterfly capacitor with no rotating contacts, large 1.050 inch diameter aluminum radiator -- gives you highest possible efficiency.*

Every capacitor plate is welded for extremely low loss and polished to prevent high voltage arcing. Nylon bearing, anti-backlash mechanism, limit switches, continuous no-step DC motor gives smooth precision tuning. Heavy-duty ABS plastic housing has ultraviolet inhibitor protection.

MFJ-1782, $609.95. Like MFJ-1786 but has fast/slow tune manual control.

MFJ-1780, $399.95. 20-10 Meters, 150 Watt *Portable* *24x24x24" box fan loop with carry handle.* Fast/slow tune control. *See QST July 2019.*

***New* 40-15M and 30-10M 300W *High Efficiency* Welded Loop Antennas**

Carry it anywhere! Easy carry handle, fold-out feet, tripod mount bracket. Portable, lightweight 36x36x4". Deluxe semi-auto controller with SWR/Wattmeter, no control line needed. Welded Low loss *butterfly* air-variable capacitor. 300W SSB.

MFJ-1784, $719.95. 40-15 Meters.

MFJ-1783, $669.95. 30-10 Meters.

Build your own Mag loop!

Motorized Butterfly Capacitors

Super low loss butterfly capacitors, no rotating contacts, all plates welded with no mechanical electrical contacts. Anti-backlash mechanism. DC motor with gear reduction box. Handles at least 150 Watts SSB/CW/Digital.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1. **p/n: 282-1786, $189.95.** 11-128 pF.
2. **p/n: 282-1788, $249.95.** 15-260 pF.
3. **p/n: 80-1786-2SM, $249.95.** Auto band selecting remote controller with SWR/Wattmeter.
4. **p/n: 80-1782-2, $79.95.** Manual remote control, fast/slow tune buttons.

Butterfly Capacitors

5. **MFJ-19, $79.95.** 12-67 pF.
6. **MFJ-23, $109.95.** 18-136pF.
7. **p/n: 729-0142, $19.95.** 6:1 vernier gear reduction drive for loop tuning capacitor.
8. ***36-inch Aluminum Circular Loop with Integrated welded capacitor and mast mounting brackets*** **p/n: 10-1786-11, $129.95.** 1.05 inch OD heavy duty tubing.

MFJ Magnetic Loop Tuners, 150 Watts


C

Turns wire or coax into a small, high efficiency multi-band transmitting magnetic loop antenna!


B

Work the world 3.5 to 30 MHz with a *full 150 Watts* SSB/CW/Digital. No ground, radials or counterpoises needed.


A

New larger matching capacitor is 313 pF. Increases matching range. Butterfly capacitor has no rotating contacts.

Very quiet receiving antenna -- you'll hardly notice static crashes. High-Q reduces QRM, overloading, harmonics. Perfect for apartments, antenna restricted areas and portable operation.

A 13' wire loop covers 30-20 Meters (4' for 17-10M; 7' for 20-15M; 28' for 60-40M; 50' for 80M). Tune *any* shape loop -- circle, square, rectangle, *etc.*

A wire length gives about 1.5 to 1 frequency range (i.e.7-10, 18-28 MHz).

Easy-Carry handle. Mount for PVC Cross loop support on cabinet top. Included tripod/mast mount.

A. MFJ-936C, $359.95. Antenna current meter, Cross-Needle SWR/Wattmeter. 9¼Wx5½Hx9½D".

B. MFJ-935C, $309.95. Antenna current meter. 6¼Wx5½Hx9½D".

C. MFJ-933C, $259.95. 6¼Wx5½Hx9½D".

MFJ-58B, $69.95
PVC Cross Loop support.
60-40M
20-15M
17-10M
loop wires, wire clips.

MFJ Low-Noise Receiving Mag Loop

Clearly hear signals 50 KHz to 30 MHz you never knew existed. Power line noise and static disappears. Rotating MFJ-1886 eliminates interfering signals or greatly peaks desired signals. Excellent antenna and preamplifier balance gives deep null. Gives excellent strong and weak signal performance without overload. Fully protected state-of-the-art push-pull Gali MMICs preamplifier gives you high dynamic range, low IMD and 25 dB of low noise gain. Use inside or outside.

QRP Mag Loop Tuner

MFJ-9232
$79.95

Turns wire around a bookcase, window, tree, etc. *into a small, high efficiency transmitting loop antenna!* Operate 40-10 Meters with included flexible wire loop (80/60 Meters with your bigger loop). No counterpoises, radials, ground needed. 25 Watts. Very quiet reception. Hi-Q reduces QRM, overload, harmonics. Great for apartments, antenna restrictions, portable ops.

VIDEOS: https://m.youtube.com/results?search_query=MFJ-9232

Antenna Rotator

AR-500
$199.95

Perfect for magnetic loops, VHF/UHF, small HF beams, TV, FM antennas. Weather-proof cast aluminum housing with precision all metal gears, steel thrust bearings and automatic braking. Includes rotator, controller, remote control, clamps, hardware. 12 Memories. Digital display. 110/220 VAC.

MFJ Tripods/Masts

Strong, black *steel* triangular braced base. Non-skid feet, strong mast locks.

MFJ-1919, $129.95, Supports 100 lbs. Extends a *whopping* 7.8 ft. Base spreads up to 4.8 sq. ft. 1.4" dia. mast. Collapses to 54" by 6" diameter. 9¾ lbs.

MFJ-1919EX, $199.95. Tripod *plus* mast. 18' extended. 5' collapsed. 1/8" wall, 3/4" dia. top, 1½" dia. bottom.15 lbs.

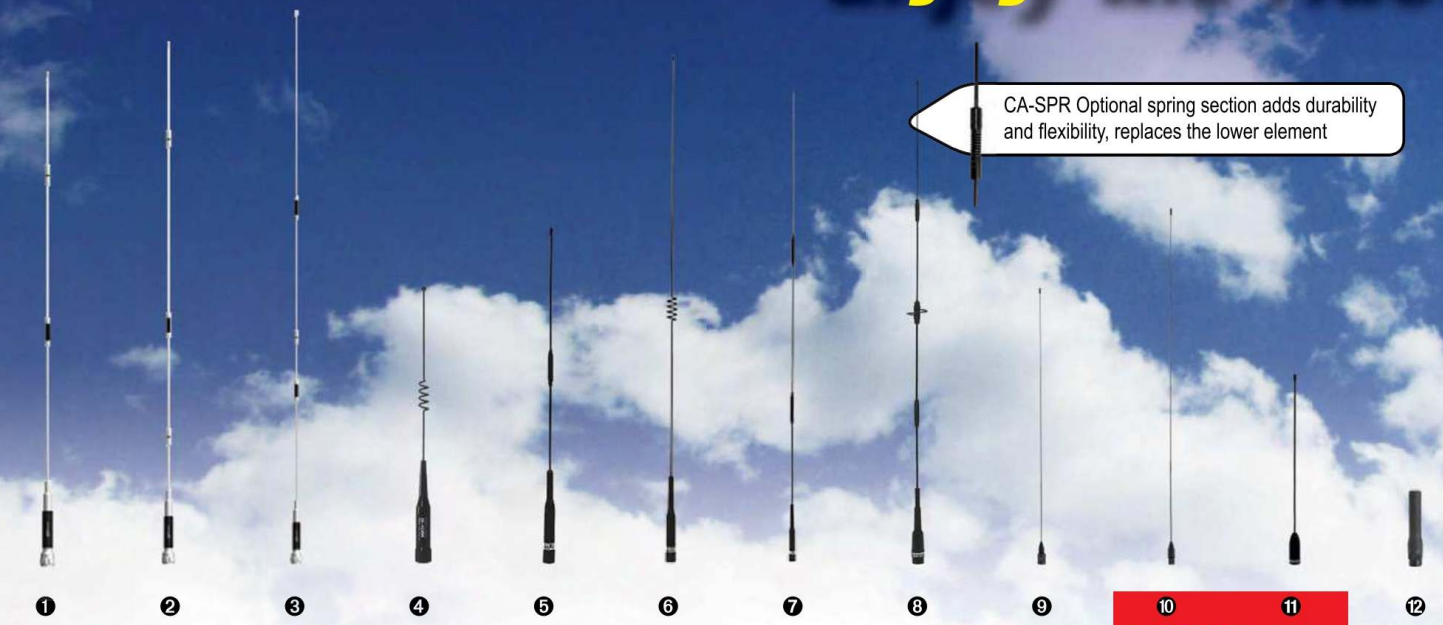
MFJ-1918, $89.95, 6'extended. 38" collapsed, 6¾ lbs.

MFJ-1918EX, $129.95. Small tripod with extension mast. 9½', 3.8 ft. collapsed. ¾"top, 1" bottom. 6.5 lbs.

MFJ Enterprises, Inc. 300 Industrial Pk Rd, Starkville, MS 39759
Phone: (662) 323-5869 • **Tech Help:** (662) 323-0549 • **FAX:** (662) 323-6551 8-4:30 CST, Mon.-Fri.

COMET®

Life is a JOURNEY. Enjoy the ride!



Mobile Antennas

❶ COMET **CSB-750A** DUAL-BAND 2M/440MHz w/FOLD-OVER
2M: 1/2 wave • 440MHz: 5/8 wave x 2 • VSWR: 1.5:1 or less • Length: 42" • Conn: PL-259 • Max. Pwr: 150W

❷ COMET **CSB-770A** DUAL-BAND 2M/440MHz w/FOLD-OVER
2M: 5/8 wave center load • 440MHz: 5/8 wave x 2 center load • VSWR: 1.5:1 or less • Length: 51" • Conn: PL-259 • Max Pwr: 150W

❸ COMET **CSB-790A** DUAL-BAND 2M/440MHz w/FOLD-OVER
2M: 7/8 wave center load • 440MHz: 5/8 wave x 3 center load • VSWR: 1.5:1 or less • Length: 62" • Conn: PL-259 • Max Pwr: 150W

❹ COMET **B-10/B-10NMO** DUAL-BAND 2M/440MHz
2M: 1/4 wave • 440MHz: 1/2 wave • Length: 12" • Conn: B-10 PL-259, B-10NMO - NMO style • Max Pwr: 50W

❺ COMET **SBB-2/SBB-2NMO** DUAL-BAND 2M/440MHz
2M: 1/4 wave • 440MHz: 5/8 wave center load • VSWR: 1.5:1 or less • Length: 18" • Conn: SBB-2 PL-259, SBB-2NMO - MNO style • Max Pwr: 60W

❻ COMET **SBB-5/SBB-5NMO** DUAL-BAND 2M/440MHz w/FOLD-OVER
2M: 1/2 wave • 440MHz: 5/8 wave x 2 • Length: 39" • Conn: SBB-5 PL-259, SBB-5NMO - NMO style • Max Pwr: 120W

❼ COMET **SBB-7/SBB-7NMO** DUAL-BAND 2M/440MHz w/FOLD-OVER
2M: 6/8 wave • 440MHz: 5/8 wave x 3 • Length: 58" • Conn: SBB-7 PL-259, SBB-7NMO - NMO style • Max Pwr: 70W

❽ COMET **CA-2X4SR/CA-2X4SRNMO** WIDE-BAND 140-160MHz 435-465MHz w/FOLD-OVER
2M: 5/8 wave • 440MHz: 5/8 wave x 3 • Length: 40" • Conn: CA-2x4S PL-259, CA-2x4SRNMO NMO style • Max Power: 150W

❾ COMET **BNC-24** DUAL BAND 2M/440MHz HT ANTENNA
RX range: 100-1200MHz • Length: 17" • SuperFlex featherweight whip • Conn: BNC

❿ COMET **SMA-24** NEW! **SMA-24J** DUAL BAND 2M/440MHz HT ANTENNA
RX range: 100-1200MHz • Length: 17" • SuperFlex featherweight whip • Conn: SMA-24: SMA-male / SMA-24J: SMA-female

⓫ COMET **SMA-503** NEW! **SMA-503J** DUAL BAND 2M/440MHz HT ANTENNA
RX range: 100-1200MHz • Length: 8.75" • Conn SMA-503: SMA-male, SMA-503J: SMA-female

⓬ Maldol **MH-209, MH-209SMA** DUAL BAND 2M/440MHz HT ANTENNA
Length: 3" • Conn: MH-209 BNC, MH-209SMA: SMA-male • Soft rubber cover, good performance in a small package!

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

COMET®

MFJ ANTENNAS

MFJ Wire Antennas

G5RV -- *Most popular antenna in the world!*

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

End Fed Half Waves

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

Off Center Fed Dipoles

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

Dual Band 80/40 or 40/20 Dipoles, 1.5 kW

MFJ-17758, $129.95. 80/40 Meters, 95 feet long, ultra-efficient end-loading on 80 Meters. No tuner needed. Super-strong center insulator, built-in SO239, hanghole.
MFJ-17754, $89.95. 40/20M, 42 ft.

MFJ All Band Doublet

MFJ-1777, $99.95.102 foot, 160-6 Meters with tuner/balun. *Extremely low feedline loss.* Super strong fiberglass center insulator provides stress relief for included 100 feet ladder line. *Ceramic* end insulators. 1500 Watts SSB/CW/Digital.

MFJ 1.5 kW Dipoles

7-strand, 14-ga. copper wire.*Ceramic* insulators. Center insulator with SO-239
MFJ-1779C, $59.95. 20-6M, 35 feet.
MFJ-1779B, $79.95. 80-40M,135 feet.
MFJ-1779A, $99.95. 160M, 265 feet.

20M Extended Double Zepp

MFJ-1742, $114.95. See web for gain. 90 ft. long, 100 ft. ladder line. 7-strand, 14-ga. wire. 80-10M with tuner/balun. 1500 Watts SSB/CW/Digital.

80M End-Fed Zepp

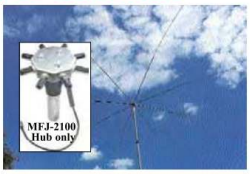
MFJ-1748, $114.95. 125 feet long, 100 foot ladder line included. 7-strand, 14-ga. wire. Use tuner/balun. 1500 Watts SSB/CW/Digital.

MFJ Vertical Mounted Antennas

MFJ 6-Band Cobweb Antenna

MFJ-1836H, $319.95. Six-bands: 20/17/15/12/10/6 Meters, 1.5 kW. *Perfect for restricted space.* Nearly invisible. 9x9x1/2 feet, 8 lbs. Outstanding performance! Horizontally polarized gives less noise, more gain over verticals. Omni-directional. No radials needed! Works great at low heights. Low SWR.
MFJ-1836, $289.95. Like MFJ-1836H, but 300 Watts.

MFJ *4-Band* Dipole Octopus Antenna



Octopus *antenna hub turns hamsticks into four balanced* HF/VHF/UHF *dipoles!* Rotate for maximum signal, minimum QRM/noise. Mount low for local NVIS, high for DX. Perfect for portable, limited space, HOAs, camping, ARES. Balun. No tuner needed.
MFJ-2104, $319.95. Includes 8 hamsticks for 75/40/20/15 M.
MFJ-2100, $139.95. Hub only. Use eight hamsticks.

MFJ Multi-Band Verticals, no radials needed!

Low angle radiation lets you easily work far-away, rare DX!
Efficient end loading gives maximum radiated power.
1500 Watts SSB/CW/Digital. Low SWR. Omni-directional. No radials or antenna tuner needed.
Low profiles blend into any surroundings. Mount them anywhere ground level, roof tops, apartments, houses, small lots.
Efficient high-Q coils. High power air-wound choke balun.
Built-to-last. Solid fiberglass rod, aircraft aluminum tubing.
5 models: Choose your bands 80-2 Meters
MFJ-1796, $359.95. 6 bands: 40/20/15/10/6/2M, 12 feet.
MFJ-1797, $389.95. 7 bands:40/30/20/17/15/12/10M. 23 ft.
MFJ-1797LP, $369.95. Like MFJ-1797, but only 9 feet tall. Narrower bandwidth on 40 Meters.
MFJ-1799, $479.95.10 bands: 80/40/30/20/17/15/12/10/6/2M. 20 ft.
MFJ-1799X, $429.95. Like MFJ-1799, but less 80M.

MFJ 43-foot Vertical, 160-6 Meter

MFJ-2990,$429.95. High performance 43 foot vertical operates 160-6 Meters, 1500 Watts SSB/CW/Digital. 2 square feet wind load. Self-supporting, no guy wires needed. 6063 aircraft aluminum tubing, bottom section 2" OD, .120" wall thickness. 20 lbs. Requires antenna tuner, ground/counterpoise.

BigStick ™ Vertical

MFJ-2286, $149.95. 7-55 MHz, *full 1/4 wave* 20-6M, 40M coil. 17 ft. extended, 28" collapsed. 2 lbs. 1 KW. Mount, radial kit included.

BigEAR ™ Dipole

MFJ-2289, $239.95. 7-55 MHz. *Full-size* 20-6 Meter dipole, 40M air loading coil. Two 17 ft. telescopic whips, 28" collapsed.

MFJ-915, $59.95 RFI Isolator

Prevents unwanted RF from traveling on your coax shield into your expensive transceiver. Prevents painful RF "bites" and erratic operation. 1.5 kW. 1.8-30 MHz.

MFJ-918, $59.95 4:1 Balun

True 1:1 current balun/center insulator. High-permeability ferrite beads on RG-303 *Teflon*(R) coax. 2" dia.x6" long. 14 gauge 7-strand copper wire. 1.5 kW 1.8-30 MHz.

MFJ-913, $59.95, 300W MFJ-919, $84.95, 1.5 kW

True 4:1 current baluns/antenna center insulators transform 200 ohms to 50 ohms, 1.8-30 MHz. Transmission line transformer, low permeability ferrite cores, SO-239, stainless steel hardware with direct 14 gauge stranded copper wire to antenna.

Lightning surge protectors

MFJ-270, $29.95. 400W.
MFJ-272, $44.95. 1500W. Gas discharge tube shunts 5000 amps peak.< 0.1 dB loss. 1 GHz. SO-239s.

2-Position Antenna Switch

MFJ-1702C, $74.95. 2-position antenna switch, lightning surge protection, center ground.

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"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 **$349.95** *New and improved, now covers 280 KHz-230 MHz!*

***World** famous* MFJ-259D gives you a complete picture of your antenna's SWR and Complex Impedance.

MFJ-259D is a complete ham radio test station including frequency counter, RF signal generator, *SWR Analyzer*™, RF Resistance/Reactance Analyzer, Coax Analyzer, Capacitance/Inductance Meter and more!

Read Complex Impedance as series resistance and reactance (R+jX) or as magnitude (Z) and phase (degrees).

Determine velocity factor, coax cable loss in dB, length of coax and distance to short/open.

Read SWR, return loss and reflection coefficient at any frequency simultaneously.

Read inductance (uH) and capacitance (pF) at RF frequencies.

Large easy-to-read two line LCD screen and side-by-side meters clearly display your information.

Built-in frequency counter, Ni-MH/Ni-CD charger circuit, battery saver, low battery warning, smooth reduction drive tuning.

Super easy-to-use! Just set the bandswitch and tune the dial -- just like your transceiver. SWR, Complex impedance displayed instantly!

Fully portable, take it anywhere -- remote sites, up towers, on DX-peditions. Use 10 AA or Ni-Cad or Ni-MH batteries (not included) or 110 VAC with MFJ-1312D, $26.95. Rugged metal cabinet, 4x2x6¾". **MFJ-249D, $329.95.**

MFJ-249D does everything MFJ-259D does with digital display only.

MFJ-269D . . . 280 KHz - 230 MHz plus 415-470 MHz, 12-bit A/D

New and improved. Now covers 280 KHz to 230 MHz and 415 to 470 MHz and 2200 Meter band!

Instantly gives you a complete picture of your antenna.

Read SWR, return loss, reflect-ion coefficient, match efficiency at any frequency simultaneously.

Read Complex Impedance (100 KHz to 230 MHz) as series equivalent resistance and reactance (Rs+jXs) or as magnitude (Z) and phase (degrees). Also reads parallel equivalent resistance and reactance (Rp+jXp).

Determine velocity factor, coax loss in dB, length of coax and *distance to short or open in feet (it's like a built-in TDR).*

New!

MFJ-269D **$449.95**

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. 4Wx2Dx6¾", 2 lbs. Use ten aA batteries or 110 VAC with MFJ-1312D, $26.95.

MFJ-269DPRO™ SWR Analyzer

MFJ-269DPro, $489.95. Like MFJ-269D, but UHF range covers ***430 to 520 MHz***. For commercial work.

MFJ-223 1-60 MHz Color Graphic VNA Analyzer

MFJ-223 **$349.95**

This *pocket-sized wonder* breaks the mold for analyzer design with user-friendly convenience, top notch accuracy, and a vivid TFT multi-color display. Don't let the size fool you, 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-225 1.5-180 MHz *continuous* Two-Port Graphic Analyzer

MFJ-225 **$349.95**

Out in the field, the MFJ-225 is a compact completely *self-contained handheld graphing analyzer.* On the bench it becomes a full-fledged two-port (S21) desktop machine when teamed up with your PC. Using powerful IG-miniVNA freeware, you'll run de-tailed data analysis and print out stunning color-graphic plots to document your work! Built-in back-lighted *3-inch LCD graphic* display. Make fine adjustments using full-screen easy-to-view SWR bargraph, capture vivid swept displays for SWR, impedance, re-turn loss, phase angle, more. DDS generator.

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, $134.95.** Tunable Analyzer Filter, 1.8-30 MHz, for strong RF fields.

E. **MFJ-917, $54.95.** 1:1 Current balun for SWR Analyzers to test balanced line antennas, other loads.

F. **MFJ-7737, $8.95.** PL-259 to BNC Female.

G. **MFJ-7727, $8.95.** PL-259 to SMA Female.

H. **MFJ-5510C, $19.95.**12VDC cigarette lighter adapter.

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Born in the U.S.A.!

Buy American! MFJ automatic tuners are built on American soil by American workers right here in Starkville, Mississippi USA.

MFJ *IntelliTuner*™ Automatic Tuners

The MFJ-998 Legal Limit IntelliTuner™ lets you tune any antenna automatically -- ultra fast and handles a full 1500 Watts SSB/CW and Digital!

made in USA

It's a comprehensive automatic *antenna tuning center* complete with SWR/Wattmeter, antenna switch for two antennas, wire connection and 4:1 current balun for balanced lines.

MFJ-998
$769.95
Full Digital Power!

MFJ's exclusive *IntelliTuner*™, *Adaptive Search*™ and *Instant Recall*™ algorithms give you *ultra fast* automatic tuning with over 20,000 *VirtualAntenna*™ Memories. You get a highly efficient L-network, 12-1600 ohm matching at 1500 Watts SSB/CW and digital, 1.8-30 MHz coverage, Cross-Needle *and* digital meters, audio SWR meter, and *backlit* LCD. MFJ-998 automatically tunes for minimum SWR and remembers your frequency and tuner settings. The next time you operate on that frequency and antenna, these tuner settings are instantly restored and *you're ready to operate in milliseconds!* Use 12-15 VDC/1 amp or 110 VAC with **MFJ-1316, $39.95**. 13Wx4Hx15D". Radio interface cables. See ***www.mfjenterprises.com***

600 Watt MFJ Automatic Antenna Tuner

MFJ-994B, $409.95. Like MFJ-993B but handles 600 Watts SSB/ CW/Digital, matches 12-800 Ohms. 10,000 memories. Doesn't have LCD, antenna switch, balun, audio SWR meter. 10Wx2¾Hx9D inches.

More hams use MFJ tuners than all other tuners in the world!

World's most advanced Automatic Antenna Tuners feature world renowned MFJ AdaptiveSearch™ and AutomaticRecall™ algorithms -- world's fastest ultra-wide range tuning. Nine World Class models! Choose your features: Digital/Analog/Audio SWR-Wattmeter, Antenna Switch, Balun, Radio Interface, Digital frequency readout, Remoteable, Coax/Balanced Lines/Wire Tuning, Field Upgradeable . . .

1500 Watt *Legal Limit*

for Ameritron AL-1500/1200/82 amps

MFJ-993B
$349.95
Full Digital Power!

Automatically tunes unbalanced/balanced antennas, ultra fast and has 20,000 memories. Has antenna switch, efficient L-network, select 300 Watts (6-1600 Ohms or 150W 6-3200 Ohms. 1.8-30 MHz, 4:1 balun, backlit LCD.

300 Watt ...Extra Wide Range

SWR/Wattmeter, 10000 VA Memories

***Extra** wide matching range at less cost.* MFJ's *exclusive* dual power level: 300 Watts for 6-1600 Ohms; 150Watts for 6-3200 Ohms. Cross-Needle SWR/Wattmeter.

MFJ-991B
$299.95
Full Digital Power!

200 Watt ...Compact

Digital Meter, Ant Switch, Wide Range

MFJ-929
$299.95
Full Digital Power!

World's fastest compact auto tuner uses MFJ *Adaptive Search*™ and *InstantRecall*™ algorithms. 132,072 tuning solutions instantly match virtually any antenna with near perfect SWR. Bright LCD Display.

200 Watt *MightyMite*™

Matches IC-706, FT-857D, TS-50S

Full Digital Power!
MFJ-939KIY
$199.95

200W SSB/CW and Digital. Low-profile automatic tuner is great for those tiny new rigs. Just tune and talk! Includes interface cable, 2-year warranty. 6½Wx2⅞Hx8⅜D".

MFJ *Remote* AutoTuners

Get greatly reduced losses and high efficiencies with long coax runs and high SWR antennas. ***Full Digital Power!***

MFJ-926B, $359.95. 200W.
MFJ-993BRT, $369.95. 300W.
MFJ-994BRT, $489.95. 600W.
MFJ-998BRT, $919.95. 1.5 kW.

G5RV Antennas

Cover 160-10 Meters with antenna tuner. 102 ft. long. Use as inverted vee or sloper, 160 Meters as Marconi. 1500 Watts. Superstrong fiberglass center/feedpoint insulators. *Glazed ceramic* end insulators.

MFJ-1778
$89.95

MFJ-1778M, $79.95. 52'. 40-10M.

No Matter What™ Warranty

Protected by MFJ's famous one year *No Matter What*™ limited warranty. We will repair or replace (at our option) for a full year.

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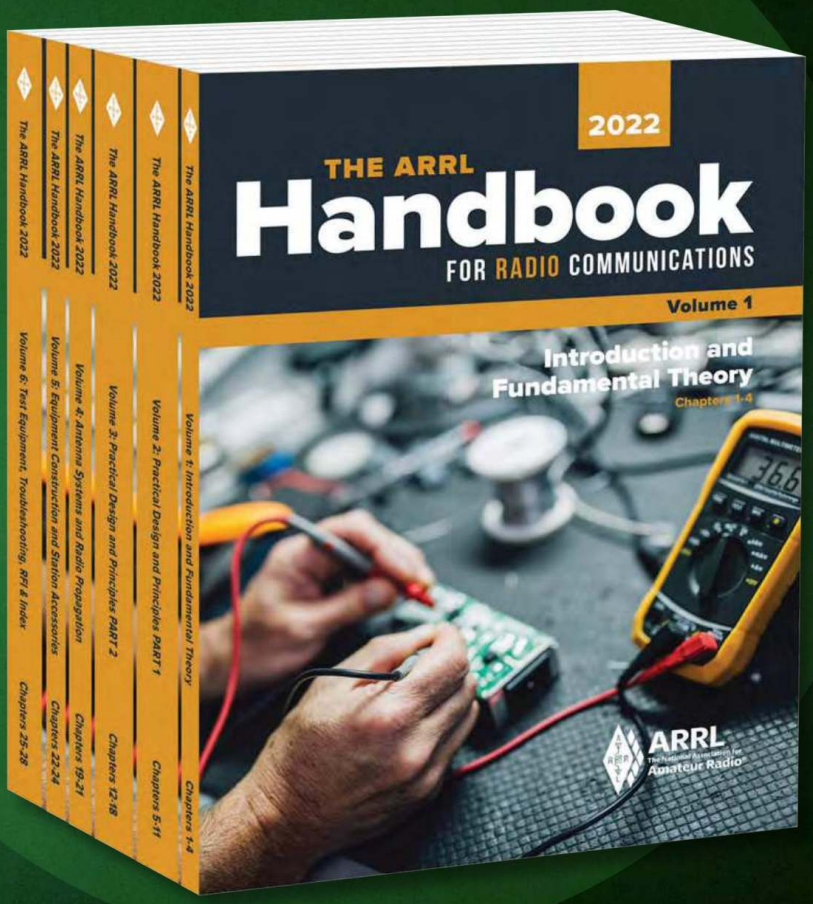
'tis the season

THE ARRL HANDBOOK HAS ARRIVED!



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MFJ...the World Leader in Ham Radio Accessories!

MFJ Tuners

Ham Radio's Most Popular 300 Watt Antenna Tuner

More hams use MFJ-949s than any other antenna tuner in the world!

Why? Because the world's leading tuner has earned a worldwide reputation for being able to match just about anything.

Full 1.8-30 MHz Operation

Tune your antenna for minimum SWR! Works 1.8-30 MHz on dipoles, verticals, inverted vees, random wires, beams, mobile whips, shortwave receiving antennas...Use coax, random wire, balanced lines. Has heavy-duty 4:1 balun for balanced lines.

Custom inductor switch

Custom designed inductor switch, 1000 volt tuning capacitors, Teflon® insulating washers and proper L/C ratio gives you arc-free no worries operation up to 300 Watts PEP transceiver input power.

MFJ-949E $249.95

The MFJ-949E inductor switch was custom designed to withstand the extremely high RF voltages and currents that are developed in your tuner.

8-Position Antenna switch

Antenna switch lets you select two coax fed antennas, random wire/balanced line or dummy load through your MFJ-949E or direct to your transceiver.

Lighted Cross-Needle Meter

Full size 3-inch lighted Cross-Needle Meter. Lets you easily read SWR, peak or average forward and reflected power simultaneously. Has 300 Watt or 30 Watt ranges.

QRM-Free PreTune™

MFJ's QRM-Free PreTune™ lets you pre-tune your MFJ-949E off-the-air into its built-in dummy load! Makes tuning your actual antenna faster and easier.

Plus Much More!

Full size built-in non-inductive 50 Ohm dummy load, scratch-proof Lexan multi-colored front panel, $10^5/_8$ x $3^1/_2$ x 7 inches. Superior cabinet construction and more!

MFJ-948, $219.95. Econo version MFJ-949E. Has all features except for dummy load.

No Matter What™ Warranty

Every MFJ tuner is protected by MFJ's famous one year **No Matter What™** limited warranty. We will repair or replace your MFJ tuner (at our option) for a full year.

More hams use MFJ tuners than all other tuners in the world!

MFJ-989D Legal Limit Tuner

MFJ-989D $499.95

New, improved MFJ- 989D legal limit antenna tuner gives you better efficiency, lower losses and a new true peak reading meter. Easily handles full 1500 Watts SSB/CW, 1.8-30 MHz, including MARS/WARC bands. Six position antenna switch, dummy load. New 500 pF air variable capacitors. New improved AirCore™ Roller Inductor. New high voltage current balun. New crank knob. $12^7/_8$W x 6H x $11^5/_8$D inches.

MFJ-986 Two knob Differential-T™

MFJ-986 $449.95

Two knob tuning (differential capacitor and AirCore™ roller inductor) makes tuning foolproof and easier than ever. Gives minimum SWR at only one setting. Handles 3 KW PEP SSB amplifier input power (1.5 KW output). Gear-driven turns counter, lighted peak/average Cross- Needle SWR/Wattmeter, antenna switch, balun. 1.8 to 30 MHz. $10^3/_4$W x $4^1/_2$H x 15 in.

MFJ-962D Compact kW Tuner

MFJ-962D $399.95

A few more dollars steps you up to a KW tuner for an amp later. Handles 1.5 KW PEP SSB amplifier input power (800W output). Ideal for Ameritron's AL-811H! AirCore™ roller inductor, gear-driven turns counter, pk/avg lighted Cross-Needle SWR/Wattmeter, antenna switch, balun, Lexan front, 1.8-30MHz. $10^3/_4$ x $4^1/_2$ x $10^7/_8$ in.

MFJ-969 300W Roller Inductor Tuner

Superb, AirCore™ Roller Inductor tuning. Covers 6 Meters thru 160 Meters! 300 Watts PEP SSB. Active true peak reading lighted Cross-Needle SWR Wattmeter, QRM-Free PreTune™, antenna switch, dummy load, 4:1 balun, Lexan front panel. $10^1/_2$W x $3^1/_2$H x $9^1/_2$D inches.

MFJ-969 $299.95

MFJ-941E Super Value Tuner

Most for your money! 300 Watts PEP, 1.8-30 MHZ, lighted Cross-Needle SWR/Wattmeter, 8 position antenna switch, 4:1 balun, 1000 volt capacitors, Lexan front panel. $10^1/_2$W x $2^1/_2$H x 7D in. **MFJ-941EK, $179.95.** Tuner Kit -- Build your own!

MFJ-941E $199.95

MFJ-945E HF/6M Mobile Tuner

Extends your mobile antenna bandwidth so you don't have to stop, go outside and adjust your antenna. Tiny 8 x 2 x 6 in. Lighted Cross-Needle SWR/Wattmeter. Lamp and bypass switches. Covers 1.8-30 MHz and 6 Meters. 300 Watts PEP. **MFJ-20, $13.95**, mobile mount.

MFJ-945E $189.95

MFJ-971 Portable/QRP Tuner

Tunes coax, balanced lines, random wire 1.8-30 MHz. Cross-Needle Meter. SWR, 30/300 or 6 Watt QRP ranges. Matches popular MFJ transceivers. Tiny 6 x $6^1/_2$ x $2^1/_2$ in.

MFJ-971 $179.95

MFJ-901B Smallest Versa Tuner

MFJ's smallest (5 x 2 x 6 in.) and most affordable wide range 200 Watt PEP Versa tuner. Covers 1.8 to 30 MHz. Great for matching solid state rigs to linear amps.

MFJ-901B $149.95

MFJ-902B Tiny Travel Tuner

Tiny $4^1/_2$ x $2^1/_4$ x 3 inches, full 150 Watts, 80-6 Meters, has tuner bypass switch, for coax/random wire. **MFJ-904H, $199.95**. Same but adds Cross-needle SWR/Wattmeter and 4:1 balun for balanced lines. $7^1/_4$ x $2^1/_4$ x $2^3/_4$ inches.

MFJ-902B $149.95

MFJ-16010 Random Wire Tuner

Operate all bands anywhere with MFJ's reversible L-network. Turns random wire into powerful transmitting antenna. 1.8-30 MHz. 200 Watts PEP. Tiny 2 x 3 x 4 in.

MFJ-16010 $104.95

MFJ-9201 QRPocket™ Tuner

80-10 Meters, 25 Watts. 12 position inductor, tune/bypass switch, wide-range T-network, BNCs. 4W x $2^5/_8$H x $1^1/_2$D inches. **MFJ-9201, $74.95**

MFJ-9201 $74.95

MFJ-921/924 VHF/UHF Tuners

MFJ-921 covers 2 Meters/220 MHz. **MFJ-924** covers 440 MHz. SWR/Wattmeter. 8 x $2^1/_2$ x 3 in.

MFJ-921/924 $124.95

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, $279.95**, Artificial ground/300 Watt Tuner/Cross-Needle SWR/Wattmeter.

MFJ-931 $139.95

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Phone: (662) 323-5869 ■ **Tech Help:** (662) 323-0549 ■ **FAX:** (662) 323-6551 8-4:30 CST, Mon.-Fri.

MFJ Cobweb Antenna

6-Bands: 20/17/15/12/10/6 M . . . Outstanding Performance!

Restricted space spoiling your operating fun? MFJ Cobweb puts your call back on the map!

This six-band (20, 17, 15, 12, 10, 6 Meters) full half-wave *Cobweb Antenna* is perfect for restricted space or portable operation. Sky-gray fiberglass spreaders and *nearly invisible* wire elements (flat 9x9x1/2 feet square. 8 pounds), blend in with your surroundings while standing tough against nasty weather.

Outstanding performance! Horizontally polarized for less local noise pickup plus solid gain over verticals will allow you to work DX easily -- even on QRP. Omni-directional. No radials needed! Works great at low heights. Low SWR is due to MFJ's exclusive *Spider-Match*™ broadband network. Use lightweight TV hardware to mount on your chimney, balcony, mast.

Low in cost, but big on performance. MFJ *Cobweb Antenna* turns your space problem into a stack of QSL cards from far away places.

MFJ-1836HK34, $169.95. Add-on kit adds 40/30 Meters to MFJ-1836/1836H cobwebs.

MFJ-1838
$489.95

40-6 Meter Cobweb Super Heavy-Duty, 1.5 kW

New! Super heavy-duty 40-6 Meter Cobweb Antenna. Built to survive harsh northern winters, heavy snow, ice and strong winds -- has super-strong large diameter fiberglass and heavy-duty 14 gauge stranded hard copper wire. 8-bands: 40, 30, 20, 17, 15, 12, 10, 6 Meters, 1500 Watts. 12 feet, 23 lbs.

MFJ 20/17/15/12/10/6 Meter Hexbeam

***New* MFJ HexBeams** deliver solid gain and directivity on 20/17/15/12/10/6 Meters with two elements on each band.

MFJ uses an updated G3TXQ element configuration for excellent gain, improved bandwidth, superior front-to-back ratio and low SWR!

MFJ takes the HexBeam's unique balanced-tension framework to a new level with rugged mounting hardware, exceptionally durable spreaders and sliding antenna wire guides -- designed to ensure years of reliable service.

MFJ-1846, $599.95. 6 Bands: 20/17/15/12/10/6M, 2-elements per band, full 1500W. 25 lbs. 11 ft. turning radius.

MFJ-1848, $809.95. 8 Bands: 20/17/15/12/10/6M, 2-elements per band; 40/30M, single elements, full 1500W. 28 lbs. 14 ft. turning radius.

3-Element Hexbeam

MFJ-1856 is ***six*** individually stacked monband yagis!

6 Bands: 20/17/15/12/10/6M. Full 1500 Watts.

Three *full-size* elements on each band gives high gain, high front-to-back ratio and wide bandwidth. Works great at 20 feet. 30 lbs. 17 feet turning radius. Ideal for a small rotator like hy-gain's CD45 II, $449.95.

MFJ Isolator and 1:1 Balun

MFJ-915, $59.95. Stop *RF* traveling down coax line, painful RF "bites" and erratic operation. 1.5 kW 1.8-60 MHz. 2Wx5H". SO-239s.

MFJ-918, $59.95. True 1:1 Current balun & center insulator forces equal antenna currents in dipole elements.

MFJ Dry Dummy Load

MFJ-260C, $59.95. Air-cooled, 300 Watt dry dummy load with a non-inductive resistor in a perforated metal housing.

SO-239 connector. Full load 30 seconds. Silk-screened derating curve to 5 minutes. SWR below 1.1:1 to 30 MHz, 1.5:1 from 30 to 650 MHz.

MFJ 2-Pos. Antenna Switch

MFJ-1702C, $74.95. 2-Position antenna switch has center ground, auto grounding of unused positions, handles 2.5 kW PEP and works to over 500 MHz. Lightning surge protection. Quality SO-239 connectors, heavy duty diecast.

MFJ-1704, $129.95. Like MFJ-1702C but has 4 positions.

MFJ G5RV Antenna

MFJ-1778, $89.95. G5RV antenna covers 160-10 Meters with antenna tuner. 102 ft. long.

Inverted vee or sloper. Use on 160 Meters as Marconi. 1500 Watts. Super-strong fiberglass center feedpoint insulators. Glazed ceramic end insulators. Hand soldered. Add coax, some rope and *you're on the air!*

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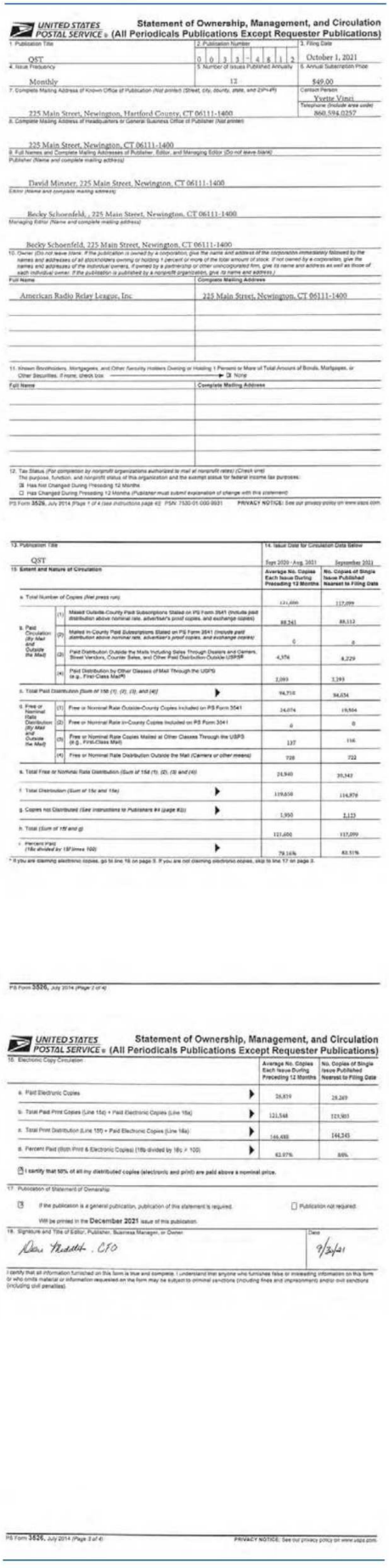

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MFJ 600 Watt *Intelli-Tuner*

IN STOCK!

MFJ-994B, $409.95

600 Watt Intelli-Tuner automatic antenna tuner has 10,000 VirtualAntennaTM 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 $319.95

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 $159.95

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 $109.95

LW/MW/SW Preselector/ Tuner boosts your favorite listening stations while rejecting images, intermod and phantom signals. Greatly improves receptionfrom 0.15 to 30 MHz. Has tuner bypass and ground receiver positions. 2Wx3Hx4D inches.

IN STOCK!

MFJ-260C $59.95

Air-cooled non-inductive resistor is housed ina 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 $99.95

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 $69.95

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. 2.75Wx3.25H x1.5D inches.

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