

QST



DIGITAL EDITION

2024 Field Day



ARRL The National Association for
Amateur Radio®

June 2024

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DEVOTED ENTIRELY TO AMATEUR RADIO

QST Reviews

Icom ID-50A Dual-Band
FM/Digital Handheld
Transceiver

GQ Electronics EMF-390
Multi-Field, Multi-Function
EMF Meter and RF
Spectrum Power Analyzer

Pacific Antenna Active
Antenna Kit

New!

Cushcraft HV-4E

Cushcraft
HV-4E

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Cushcraft HV-4E 40/20/15/10 Meter low-profile Vertical Antenna spans continents and oceans while hiding from sight in your back yard.

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- **Low angle** radiation focuses RF energy on the horizon for optimum DX coverage
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- **Automatic band-switching** uses high-tech parallel end resonators instead of lossy series traps
- **High-Q** top-loading resonators delivers less loss, higher gain on 20/15/10 Meters
- **Center loading** on 40 Meters improves efficiency and lowers center of gravity making HV-4E easier to handle and increases strong wind survivability
- **Individual resonators** are simple to tune for lowest-SWR with to-the-kHz accuracy on every band. No unwanted interactions or compromises!
- **Aluminum**, stainless steel, and fiberglass construction ensure years of reliable service
- **Weights** just 5 pounds and is 19 feet tall. Built in water resistant SO-239 for radio -- no pigtail needed
- **Small footprint**, low center of gravity and lightweight lets you easily install it by yourself almost anywhere. Low profile blends in with natural surroundings

**Compare price and
compare performance.**

*The bands are currently teaming with
DX from around the world, and
the HV-4E is uniquely designed
to put you in the hunt!*

HV-4E-RK, \$49.95. Eight 25 foot Radials(two sets of 4-Radials), each set with solder lug, (200 feet of weather resistance insulated wire).



HV-4E-TB, \$29.95. Sturdy Tilt Base lets you lower antenna to convenient height for easy tuning and maintenance.



Cushcraft HV-4E VS Hustler 4-BTV

Enhanced 40 Meter Performance: Extra-long center loaded radiator improves efficiency	Reduced 40 M Performance: 40M power goes through multiple power wasting series traps
Highly efficient end/center loading: Reduces loss for more power out	Lossy Traps: Power lost in traps
Parallel resonators: Let's you independently tune each band with little or no interaction. Makes tuning easy	Series resonators: Tuning a band interacts with other bands -- may require repeated back and forth adjustments
Parallel resonators: If one resonator fails only that band is impacted	Series resonators: If a single trap fails, multiple bands could be wiped out
Included simple instructions make installation and optimum tune up easy	A "special instruction package" is recommended for teaching users how to retune 4-BTV traps and optimize performance
Low center of gravity: Makes it easy to handle/install and gives better wind survivability	High center of gravity makes it hard to handle
Built-in SO-239 coax connector provides convenient water resistance connection	Requires coax pigtail at extra cost that invites water incursion
Low suggested retail cost \$219.95 and free direct MFJ shipping	STREET price Ranges from \$229.95 to \$295.95 plus shipping

Call your dealer for your best price!

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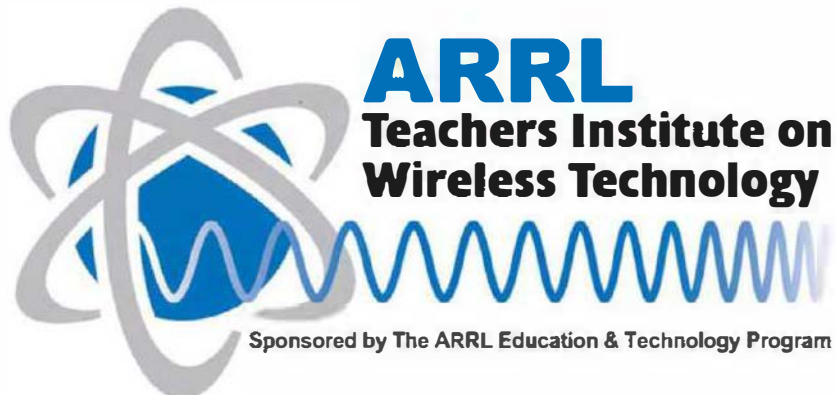
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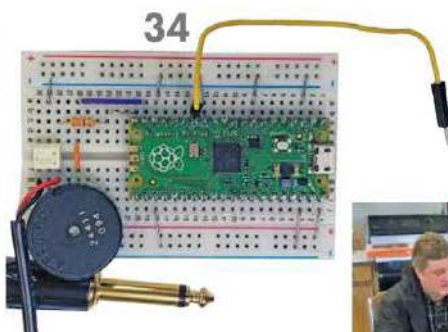
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Our Cover

Shane Weeks, K1BTW, operating the GOTA station at the 2023 ARRL Field Day operation of the Tom's Garage Amateur Radio Club, which used the call N6MI from Tecuya Peak in Los Padres National Forest, Kern County, California. The three-element antenna is for 15 meters and the two-element antenna is a 40-meter Yagi on an AB-577 military surplus mast. The GOTA station made a total of 209 contacts over the course of the weekend. [J. Scott Bovitz, N6MI, photo]



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Build Your Field Day Antenna



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Why an EFHW? The antenna performs nearly as well as a dipole but requires suspending only one end up in a tree or similar placement. It's so easy to build and deploy, every Field Day site needs this antenna in June!

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MTC Radio has formed a new company: **Expert Amps USA, LLC**. Effective immediately, Expert Amps USA will take on the role of North American Distributor for SPE Expert amplifiers. This collaboration ensures that ham operators throughout North America will have access to cutting-edge amplification technology.

MTC Radio and Expert Amps USA will also be offering factory authorized service for SPE Expert amplifiers. The Factory Authorized service center in Florida is continuing its operation and by Summer of 2024 there will be another repair center in Texas.



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Model	Bands	Length Ft.	Max Pwr. Rating	Conn.
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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
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NR22L	2m	96.8 in.	100	UHF
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Second Century



The Most Wonderful Time of the Year!

Well, sort of. June and July must be two of the greatest months for amateur radio, with favorable weather for outdoor activities, lots of operating events planned, and of course the granddaddy of them all: ARRL Field Day! Summertime propagation coupled with the continued rise of Cycle 25 should also carry our signals farther, even on the VHF bands. I hope to inspire you to take advantage of these opportunities over the next 2 months, to make the time to get your station up and running, and to get on the air.

Let's start with 6 meters — the "Magic Band" — which is now coming into its own. The rare opportunity for stations on the east coast to work into Japan should appear this month, right around the summer solstice. It is not uncommon for the band to be completely dormant and then Mother Nature jumps in and creates something exciting, from E skip to aurora, and then it disappears. I spent some great times on 6 meters hill-topping with my club during VHF contests, hitting the CQ button for hours in the middle of the night, then suddenly running dozens of grids from the midwest to the southwest, only to see the band go back to total silence. Exciting! Much of 6-meter activity today is on FT8, so even as a phone operator, check 50.313 MHz for signals to get a sense of whether the band is open.

The ARRL Digital Contest is the first weekend of June, and a fantastic opportunity to use everything digital (except RTTY) right up to FT8. Get those software packages installed and get on the air. This is also an excellent opportunity for Technicians. Propagation couldn't be better on 10 meters, and 6 meters should also provide some great windows to work stations. This is one of those events where your grid square is used to designate your location, and it's great after the contest, especially on 6 meters, to see where you were able to make contacts toward a VUCC award! Remember to use LoTW® after the contest!

The ARRL June VHF Contest, the second weekend in June, has always been a favorite of mine. Antennas are generally smaller and easier to deal with, and the opportunity to get in your car and go rover operating from multiple grid squares is a great challenge in both planning and execution. You may find places to operate where two or four grid squares meet, to really drive excitement from those working you. Again, a big nod to 6 meters for this contest, especially in June. Be sure, even as an FT8 operator, to get on other modes. Get on phone! There will be plenty of stations to work. If you're a newcomer to the band, longtime contesters will want to say hi and welcome you!

ARRL Field Day! It's not just an operating event; for many it is a way of life! There are radio clubs and groups that take the Field Day experience very seriously. Even if you are home and can't get out to a Field Day site, there's a place for you on the air. This is a great opportunity to make the on-the-air experience personal by meeting people face to face and sharing camaraderie. From BBQs to overnight stints on 40-meter CW, Field Day can be a great time. I will never forget seeing Phil, K3UA,

walk out of the tent after doing a nearly all-night 40-meter CW run. This is an event where, for sure, you'll be taking pictures and making memories. Field Day is always the fourth full weekend in June. This issue of QST includes a special 2024 ARRL Field Day section with advice to get you ready!

The IARU HF World Championship is the second weekend in July. Even if you do not like contesting, this is a relatively short contest and it gives you the opportunity to contact IARU headquarters stations around the world. I encourage you to get on and challenge yourself to make 25 or 50 or 100 contacts. Make collecting the HQ contacts a contest within a contest for yourself! Your participation adds to the excitement that the serious competitors are feeling by boosting their contact counts and run rates. This is one contest that you can easily jump into and have some fun with.

Finally, don't forget POTA — Parks on the Air®. This operating activity was inspired by the 2016 ARRL National Parks on the Air event, and participation has exploded! Use the great ideas from our *Parks on the Air® Book* and the army of YouTubers who we try to spotlight. Getting a POTA station together for yourself is relatively simple, and something you can evolve with if you like operating outdoors. It's a great way to experience your own mini Field Day any time you want. But you don't have to limit yourself to being an activator. Someone has to work these POTA stations — and it might as well be you. You will find many of the low-power POTA stations on CW and FT8, and there are plenty of POTA stations on phone as well. You'll hear real excitement on phone when two POTA stations call each other with "Park to Park. Park to Park!" The POTA organization has done an amazing job with their website, <https://parksontheair.com>, which adds to the enjoyment of this part of amateur radio.

With everything in full swing, and some help from Cycle 25, be radio active — there's no better time! Be prolific by trying a bit of everything from bands to modes. Be the connector that gets a new ham or young ham on the air during this great time! I'll be looking for you from FN31.

David A. Minster, NA2AA
Chief Executive Officer

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Member Spotlight

Jeff Geerling, KFØMYB

Jeff Geerling, KFØMYB, is a newcomer to amateur radio. His journey to the hobby began in 2018 with the purchase of an RTL software-defined receiver that he paired with a Raspberry Pi microcomputer. Jeff's goal at the time was to listen to baseball games that were blacked out in his area. After exploring further with the receiver, he began to wonder what it would take to start transmitting in addition to receiving.

According to Jeff, "That was probably the first nudge toward picking up the hobby. I've been around broadcast radio since I was a kid, and my first transmission was on a tiny FM transmitter I built from a RadioShack kit. I would act like I was a DJ at one of the stations where my dad worked!"

In 2023, Jeff made the commitment to earn his amateur radio license along with his father. It wasn't long before Jeff became KFØMYB, and his father, Joseph, was licensed as KFØMYJ. Jeff said, "As a broadcast engineer, my dad has always had great respect for the hams in his sphere, especially all of the work in antenna designing and tuning, and we both thought it would be a great way to keep our minds sharp and continue working with RF in fun, new ways."

The Learning Process

Jeff spent a considerable amount of time learning the culture of amateur radio. As he explained, "I've been on the internet most of my life now, and there are certain ways forums, discussion boards, and now chat servers work. There are certain types of lingo [in] the way people interact. That aspect of communication has always fascinated me, and amateur radio has a much longer history, so there's a deep well to research."



His fascination with software-defined radio (SDR) remains, and Jeff is using ham radio as a tool to spark more exploration. Jeff said, "As someone who's done a lot of software development, visualization, and design, I want to spend some time using and expanding SDR tools to help me visualize — and even teach — radio concepts that used to require thousands of dollars of advanced equipment to learn. Just watching a waterfall and spectrum graphs of various signals can occupy my brain for hours. I think the first time I really dove into it was listening to WWV on 10 MHz."

Keeping Busy

Jeff's four children keep him well-occupied, but he still finds time for all of his other interests. He said, "I still enjoy the odd video game, reading (I just finished the original *Dune* saga!), and photography. Just like amateur radio has given me a way to learn more about RF, photography teaches me a lot about light, which I guess is pretty closely related to RF!"

Jeff also manages two YouTube channels. His main channel, "Jeff Geerling," explores computing with a series of educational videos, such as one describing how to reduce power consumption in a high-performance server (<https://youtu.be/ID9awxmOGG4?si=guG3nqX6baOisJ71>). His second channel, "Geerling Engineering," addresses RF — often broadcast RF — with the help of his father. For example, Jeff describes his attraction to amateur radio at youtu.be/PleavEhUhSw?si=7CHxC6ef2N6jSwnd.

As if all of that wasn't enough, Jeff has published several books about software, as well as one about his lifelong battle with Crohn's disease, titled *You Only Have Crohn's Once!*

Amateur Radio's Future

From his perspective as a new licensee, Jeff feels that amateur radio is at a crossroads. Jeff said, "Communication aspects that attracted people in the past are superseded by the prevalence of the internet. And hams certainly skew older these days. But I also see younger computing and electronics hobbyists making the jump to get licensed, as they want to explore the strange world of RF or communication outside of proprietary chat services and social media."

Jeff believes that ham radio can still grow by attracting "modern 'makers' who dip their toes in the water for a simple thing like an RF remote control for a device they built. They can be drawn in further with demonstrations of moonbounce and long-range, internet-free communication or exotic uses of SDR to show what modern devices can do, even if you don't have that much money to spend."

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Southwestern Division AZ, LAX, ORG, SB, SDG

Arizona: Rick Paquette, W7RAP, 1600 W. Sunkist Rd., Tucson, AZ 85755-9561 520-425-6877; w7rap@arrrl.org
Los Angeles: Diana Feinberg, A16DF, P.O. Box 4678, Palos Verdes Peninsula, CA 90274-8618; 310-544-2917; a16df@arrrl.org
Orange: Bob Turner, W6RHK, P.O. Box 973, Ferris, CA 92572 951-236-8975; w6rhk@arrrl.org
San Diego: Dave Kaltenborn, N8KBC, 630 Alber St., Chula Vista, CA 91911 619-516-8758; n8kbc@arrrl.org
Santa Barbara: John Kitchens, NS6X, P.O. Box 178, Somis, CA 93066 805-216-2569; ns6x@arrrl.org

West Gulf Division NTX, OK, STX, WTX

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AMERITRON new ALS-1406 1.5-54 MHz solid state LDMOS no-tune Amplifier gives you 1200 Watts PEP output on all bands, including 6-Meters. Automatic bandswitching! No tuning! No warm-up! No tubes! Quiet!

Two NXP M/RFE6VP5600 H LDMOS transistors insure reliability. They are mounted on dual heavy duty heat sinks and properly arranged to spread heat out over a large surface.

The ALS-1406 RF deck operates at 50 Volts for efficient, low distortion linear RF power service. It's cooled by a whisper quiet fan. Fan speed is regulated by temperature sensors, assuring minimum noise.

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

ALS-1406 runs up to 1200 Watts of clean SSB output power (just 100 Watts drive gives you the full rated 1200 Watts output) for continuous coverage between 1.5-54 MHz. 10/12 Meters is included.

This compact operator-friendly and attractive desk-top amplifier fits neatly into any station. Just 10Wx6'2Hx18'2D inches. Weighs only 22 pounds.

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

If forward or reflected output power



ALS-1406
\$3499
Suggested Retail

Call your favorite dealer for your best price!



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

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

Front-panel ALC control!

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

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

Automatic Bandswitching!

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

ALS-1406 automatic bandswitching reads band data from your transceiver and automatically changes bands as you change bands. An optional interface cable is required for your particular radio.

Clean, Modular Construction

Ameritron ALS-1406 amplifier has modular construction for easy-servicing, unlike other amplifiers that are so tightly packed they are un-serviceable.

ALS-1406 Power Supply

The ALS-1406 is powered by a 50 VDC switching power supply. Comes with a pre-wired

cable to plug into the ALS-1406.

This hash-free fully regulated switching power supply is only 12 lbs. and measures a compact 10Wx6'2Hx9'2D inches. It can be placed conveniently out-of-the-way. Output is 50 VDC at 50 Amps to the ALS-1306. Wired for 220 VAC, selectable to 110 VAC. Draws less than 25 Amps at 110 VAC; 12 Amps at 220 VAC.

ALS-606S

600W FET Fixed Station Amp

600 Watts PEP/500W CW output. 160-6M with automatic instant band-switching. Desktop size: 9'3/4Wx7'Hx14'1/2D inches. Just 14.2 lbs. It's only 4 dB below 1500W - less than an S-unit - nobody can hear the difference! SWR/thermal protected. extremely quiet, lighted peak reading Cross-Needle SWR/Wattmeter, front panel ALC control. Includes 110 VAC switching power supply. 220 VAC selectable.



ALS-606S
\$2599
Suggested Retail

ALS-606, \$2799, like ALS-606S above, but has transformer power supply.

ALS-500M

500 Watt Mobile Amplifier



ALS-500M
\$1199
Suggested Retail

500 Watts PEP/400W CW output, instant bandswitching, no tuning, no warm-up. SWR, load fault, thermal overload protected. On/Off/Bypass switch. Remote on/off control. DC current meter. Very quiet fan. 1.5-22 MHz (10/12 Meters with MOD-10M, \$29.95). Requires 13.8 VDC. 9Wx3'2Hx15D in., 7 lbs.

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600 Watt FET Amp



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Modular, hybrid architecture adapts to your needs

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

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

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

Comprehensive I/O, plus full remote control

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

K4 KEY FEATURES

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Modular, upgradeable design

7" color screen with touch and mouse control

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Up Front

Field Day Firsts from Virginia

Andrea Cox, N8VBN, received her Technician- and General-class licenses in 2021 after taking a class offered by the Williamsburg Area Amateur Radio Club (WAARC). Because she had only been on the local repeaters and simplex, one of the club members persuaded her to get on HF at the Get on the Air (GOTA) Field Day station during the club's 2023 Field Day operation.



Andrea Cox, N8VBN, with GOTA Coach Greg Pula, K3RM, after making her first HF contact at the WAARC 2023 GOTA Field Day station. [Dan Ewart, WG4F, photo]

The joint Massanutten Amateur Radio Association and Valley Amateur Radio Association's (Staunton, Virginia) 2023 Field Day operation at Rockingham Fairgrounds in Harrisonburg, Virginia, had a brand-new ham take part.

Newly licensed Colton Huffman, KQ4JER, took the mic for K4MRA's 2023 GOTA Field Day station. Colton's license was just 2 days old! His brother Travis is studying for his license. The boys come from a ham family — with mom Kristen, KK4SYT, and dad Matthew, KD4UPL.



Colton Huffman, KQ4JER, at the mic, with brother Travis. [Robert J. Steere, N1QEQ, photo]



GOTAhams' Youngest Licensed Member

Andy Di Meo, KO6CCI, age 6, of Alhambra, California, passed his Technician-class exam in November 2023. Andy's mentor was his dad, Marco, KN6SJQ. Andy and Marco are two of the 182 members of the Get-On-The-Air-Hams (GOTAhams) Amateur Radio Club in Southern California. The club is looking forward to hearing Andy as a regular on its nightly nets and on the WG6OTA repeater. [Dave Wilkie, K6EV, photo]

Solar Eclipse

Taking advantage of the 2023 annular eclipse, the Science Hall of Fame took a group of children to Midland, Texas, the center of the eclipse path. Their goal was to find out how blocking the sun might affect radio propagation. The Science Hall of Fame is a nonprofit organization that promotes science and technology in America's classrooms. Their curriculum includes amateur radio. A special QSL was printed to commemorate the expedition. [Martin Reeves, AB5L, photo]



If you see something ham-related out in the world, take a photo of it and send it to "Up Front" at upfront@arrl.org.

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Correspondence

Letters from Our Members

The Ham Wayback Machine

I always look forward to reading “A Look Back” in *QST*. In the January 2024 issue, the picture of the *QST* cover from the February 1974 issue displayed a windmill with a gentleman standing on the tower. In the February 2024 issue, the “100, 50, and 25 Years Ago” column featured the February 1974 issue, highlighting that the gentleman on the tower was Jim Sencenbaugh, K6TPS.

I never met Jim, but I knew of him and his wind generator design. Like several others of the late 1970s and early 1980s, it was based on the tried-and-true machines of the past, like the old Winchargers and Jacobs wind machines. These designs were three-bladed, upwind, with a furling rotor for speed control. I spent 27 years in the renewable energy industry. My involvement began with sales and siting residential-sized wind machines. I grew to site evaluations for utility wind farms. So, this took me for a little ride in the wayback machine.

In 1974, the wind industry was in its infancy, and people scoured the west looking for old machines of the past to rebuild and put back into service for battery charging. The inverter industry was born, and many windmill startup companies began production of their own designs. Residential machines with capacities from 1 to 15 kW and rotors up to 10 meters were common, with larger, utility-class machines of 50 to several hundred kW designed by aerospace companies like Kaman Corporation, Westinghouse Electric Corporation, General Electric, The Boeing Company, and other smaller companies that started to appear.

Today, very few of these companies are still in existence, but others are forming and forging ahead with the capacity of machines rising to 18 MW with 300-meter rotors. Renewable energy, such as wind and solar, along

with efficiency and conservation, are now playing a bigger part in our energy supply. Thank you, *QST*, for the ride in the wayback machine.

Bill Hopwood, KB1QXJ
Elkins, New Hampshire

ARRL Elevator Pitch

I attend a number of hamfests each year, and I've noticed that while many hamfests are great about having ARRL displayed front and center, where it's easy to find as soon as you walk in, others seem to want to hide the organization in the back or a side room. ARRL's display and representatives should always be one of the first things seen when someone walks in the door.

When I was first licensed, joining ARRL was something you did as soon as you were licensed. At the Tampa Bay Hamfest last year, I had an interaction with a fairly new ham who was not a member, and I tried my best to get her to join.

I would like to see someone come up with an elevator pitch for joining ARRL — something that I could have with me at hamfests and events where, in 30 seconds, I could help a non-member see the value in membership and sign them up on the spot!

Jimmy Russ, AB4KA
Lakeland, Florida

Grounding Tip

Thank you for ARRL CEO David Minster's, NA2AA, excellent “Second Century” column in the March 2024 issue of *QST*. I can certainly relate to issues with all the electronic gadgets we have these days, from the hand sensor on the bathroom sink to the computers in my shack and my LCD 4K TV.

I moved about 5 years ago, and the insulation on the outside walls and the underside of my roof is backed with aluminum foil, which makes using

a handheld radio inside the house almost impossible. I can't even hit the local repeater that's 6 miles away unless I stand next to a window. So, it's imperative that I have excellent grounding for lightning protection because none of the insulation is truly grounded and it contains lots of sharp corners.

All of my equipment is grounded to the main ground system using a copper weld at the breaker box. This has undoubtedly saved my house and electronic gadgets from direct strikes to nearby trees and the chimney. Good grounding will help protect your gadgets from RFI and lightning. However, that lightning bolt may have traveled several miles to make it to your house, so it will be hard to stop it completely.

Kevin Muenzler, WB5RUE
Boerne, Texas

Hooray for the Digital Edition

I have been an ARRL member for many years. In February, I wanted to retrieve an article from a prior issue of *QST*, so I tried the online archive feature for the first time.

Within about 10 minutes, I had successfully downloaded the issue and found the article. I was able to make first-time use of the online resources successfully with little difficulty and no support needed. It is nice to know this resource is comprehensive and works well!

Dave Feldman, WB0GAZ
Lakewood, Colorado

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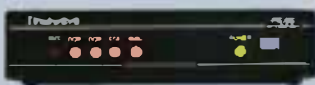
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PAC	MTN	CENT	EAST	UTC	MON	TUE	WED	THU	FRI
6 AM	7 AM	8 AM	9 AM	1300		FAST CODE	SLOW CODE	FAST CODE	SLOW CODE
7 AM- 12 ⁴⁵ PM	8 AM- 1 ⁴⁵ PM	9 AM- 2 ⁴⁵ PM	10 AM- 3 ⁴⁵ PM	1400-1945	VISITING OPERATOR TIME				
1 PM	2 PM	3 PM	4 PM	2000	FAST CODE	SLOW CODE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

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

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

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

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

Code bulletins are sent at 18 WPM.

For more information, visit us at

www.arrl.org/w1aw

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

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

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

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

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

♦ Notes: On Fridays, UTC, a DX bulletin replaces the regular bulletins. W1AW is open to visitors 10 AM to 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 2024, Headquarters and W1AW are closed on New Year's Day (January 1), Presidents Day (February 19), Memorial Day (May 27), Independence Day (July 4), Labor Day (September 2), Veterans Day (November 11), Thanksgiving and the following day (November 28 and 29), and Christmas Day (December 25).



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ADS#3182.3

Simple, Small 2- and 6-Meter Yagis

Gain, pattern, and an easy, wide-band match.

Joe Reisert, W1JR

Sometimes a ham needs a small, efficient handheld 2-meter antenna with moderate performance, especially for emergency communication. They may also need an entry-level 6-meter antenna, especially for chasing DX and utilizing F2 propagation as we approach the peak of Solar Cycle 25.

The basic Yagi is still a good choice for a compact and efficient antenna. Radiation pattern and impedance are determined by the number of elements, the length and diameter of the elements, and the spacing between the elements. Many trade-off studies were conducted 25 years ago on Yagis with 0.1 – 1.0-wavelength booms. The results, which you can read at www.arrl.org/qst-in-depth, were published in the winter 1998 issue of *Communications Quarterly*. For a visual representation of these concepts, see the sidebar, “Yagi Gain.”

A three-element Yagi on a 0.35-wavelength boom can have a gain of 5 dBd. Inserting an additional director between the driven element and the existing director, and readjusting the element lengths and spacing, can improve the radiation pattern. A front-to-rear ratio greater than 20 dB is possible, and the gain will increase to about 6 dBd with a direct 50 Ω match increased bandwidth. The lead image shows this Yagi as built, and its radiation pattern is shown in Figure 1. It uses a $\frac{3}{4} \times \frac{3}{4}$ -inch square boom that is at least 36 inches long, but similar round tubing can be used. Booms with square tubing tend to have improved symmetry and better, long-lasting contact between the elements and the boom.

In this design, the antenna elements are placed on the top and front ends of the boom to leave room for either handheld or mast-mounting clamps on the



The 2-meter Yagi mounted in the vertical polarization. [Joe Reisert, W1JR, photo]

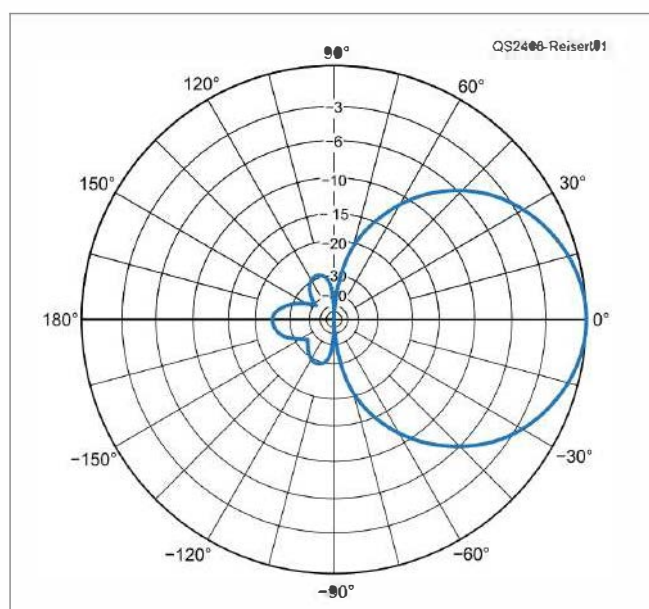


Figure 1 — The NEC calculated pattern for the 2-meter Yagi, redrawn for clarity. The front-to-rear ratio is very good.

Yagi Gain

Most Yagi antennas work to some extent. High-gain Yagis often have narrow bandwidth and low driven-element impedance (typically 20 – 25 Ω), thus requiring special impedance-matching networks. As mentioned, many trade-off studies were conducted 25 years ago on Yagis with 0.1 – 1.0-wavelength booms. Different optimizing software programs and additional background material have also been published. My article “Yagi/Uda Antenna Design,” in the winter 1998 issue of *Communications Quarterly*, is available for reference at www.arrl.org/qst-in-depth.

Nothing has changed since this original study was conducted. Performance detailed in the study has been verified with programs such as *EZNEC*. The final results are shown in this sidebar’s graph; I call it the “Yagi Truth Graph,” and it should dispel any false claims about the gain of Yagis.

One group of short, optimum-length-boom Yagis has a so-called “sweet spot” between about 0.25 and 0.35 wavelength. These designs tend to have higher gain, wider bandwidth, and a typical impedance of 50 Ω . A typical two-element Yagi has a gain of up to about 3.75 dBd, but the front-to-rear ratio is typically low at 8 – 11 dB. A three-element Yagi on a 0.35-wavelength boom can have a gain of 5 dBd.

By inserting an additional director on this Yagi between the driven element and the existing director, and by readjusting the element lengths and spacing, the radiation pattern can be improved. A front-to-rear ratio (90 – 270 degrees) greater than 20 dB is possible and generally considered to be adequate. Also, the gain increased to about 6 dBd, and the 50 Ω impedance match bandwidth increased. A typical radiation pattern for this Yagi is shown in Figure 1 of this article.

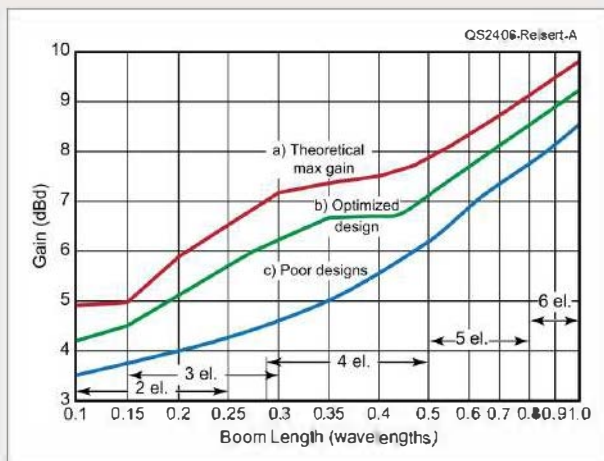


Figure 2 — Dimensions of the 2-meter Yagi.

rear of the boom. The dimensions are shown in Figure 2. It can be used with either vertical or horizontal polarization. The reflector and directors use 0.188-inch-diameter aluminum rods that are connected to the boom with small aluminum clamps. The 39-inch driven element consists of 12-inch-long, 1/2-inch-diameter aluminum tubing with 3/8-inch sliding extensions, and it is split in half at the center to ease feed-line attachment and length adjustment (see Figure 3). The driven element tubes are held in place between resin support blocks, which insulate them from the 2 x 4-inch plate. A 4-inch, low-loss Delrin® or equivalent insulating rod with a 3/8-inch diameter helps support the feed point and keep the split-driven element straight.

The feed line is directly connected to the center of the split driven element. It should be at least 2 feet long and used with a small-diameter coax (such as RG-58), and it should face the rear of the boom. Three or more ferrite beads placed on this feed line choke common-mode currents. Beads with 1/4-inch hole diameters and permeabilities of 800, such as Fair-Rite 2643540002 beads, are widely available on the internet. These are about 1 1/8 inches long with just more than a 1/2-inch outside diameter.

This four-element Yagi design does not require any impedance-matching networks to obtain a 50 Ω impedance match across the 2-meter band. Adjusting the length of the driven element optimizes the voltage standing wave ratio (VSWR) at your operating frequency. A typical VSWR plot is shown in Figure 4.

A graph of the actual gain attainable and the recommended number of elements versus the boom length for a Yagi. The upper curve is the maximum gain attainable if other parameters are sacrificed. The middle curve shows an optimized Yagi. The lower curve represents a poor performance design.

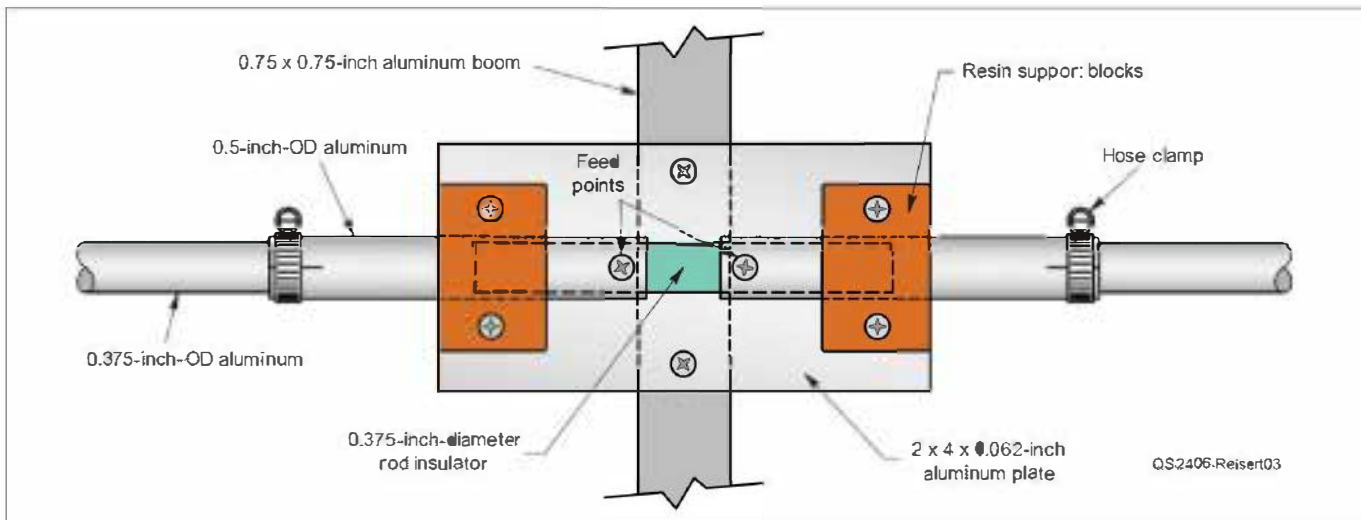


Figure 3 — Driven element construction details.

A 6-Meter Version

I also designed a four-element, 0.29-wavelength 6-meter Yagi. The boom length was shortened slightly in order to accommodate a commonly available, 6-foot-long aluminum boom with only a few tenths of a dB of less gain. The center elements all use 48-inch-long $\times$ $\frac{5}{8}$ -inch-diameter 0.057-inch wall aluminum tubing. The end tubes use $\frac{1}{2}$ -inch-diameter aluminum tubing. Overall recommended element lengths and spacing are shown in Figure 5.

Construction details for the driven element are similar to those for the 2-meter version, except the diameter of the insulating rod should be half an inch. Insulated resin-type clamps similar to those used on the 2-meter Yagi's driven element hold the inner tubing of the driven element. The element mounting plate is larger than that of the 2-meter Yagi to accommodate boom attachment clamps.

It is recommended that the reflector and director elements use the same resin clamp configuration

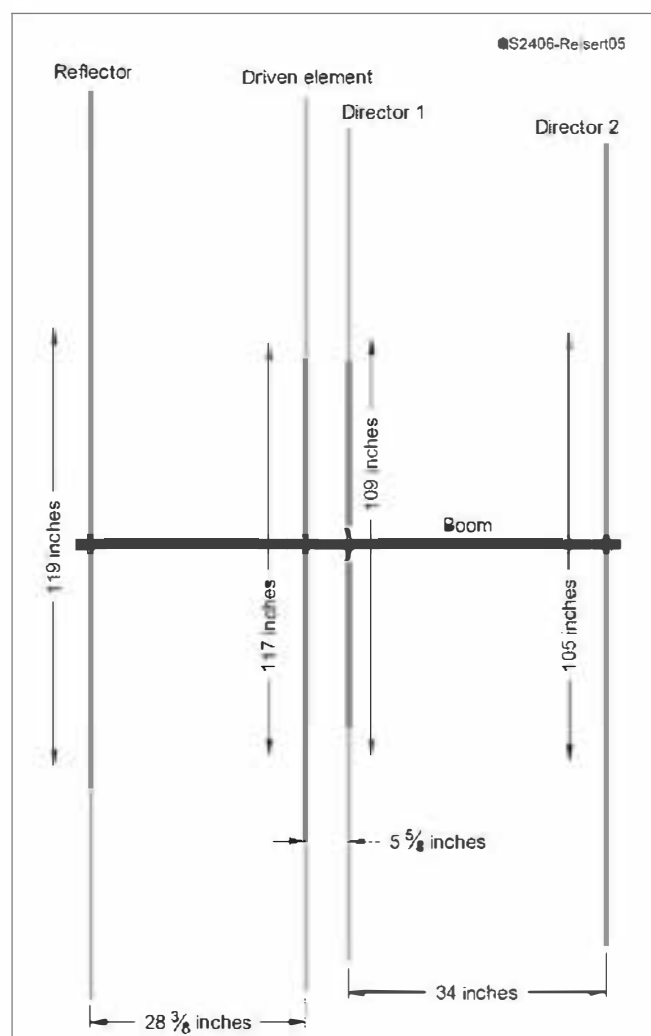


Figure 5 — Dimensions of the four-element, 0.29-wavelength 6-meter Yagi.

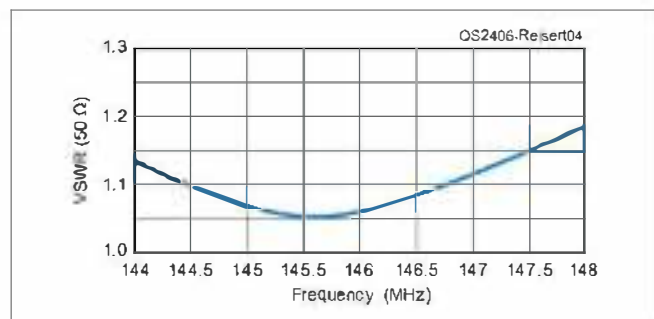


Figure 4 — Voltage standing wave ratio (VSWR) versus frequency, as calculated by NEC and redrawn for clarity.

used on the driven element. The element-holding plates should then be attached to a 6-foot-long boom with at least a 1.25-inch diameter. This mounting method holds the elements firmly and symmetrically in place without boom-to-element interaction. Because only two element tubing diameters are required, the strength of the element is increased.

The feed line should use at least a foot of RG-58 or equivalent coax. Use five ferrite beads for the choke, similar to the ones used on the 2-meter feed line. If high power (greater than 250 W) is being transmitted, it is highly recommended that you use seven ferrite beads and a polytetrafluoroethylene dielectric coax, such as RG-303 or equivalent. Don't forget to put a suitable sealant on the feed points to prevent moisture ingress.

The 6-meter antenna boom should be mounted on a 6 × 6-inch aluminum plate that is at least 0.188 inch thick and attached to a suitable mast using four boom clamps. Remember that feed-line loss between an antenna and the radio decreases the antenna gain when both receiving and transmitting. Therefore, if the feed line is long — especially on 2 meters — a larger-diameter, low-loss coax is recommended.

An SWR meter can be inserted between the antenna and the feed line to test the impedance match. After that, the length of the driven element can be slightly adjusted for minimum VSWR at the desired center frequency.

Both 2- and 6-meter Yagi designs use short, optimum boom lengths. More photos of each design can be seen at www.arrl.org/qst-in-depth. The 2-meter Yagi may be a good candidate for a club project, especially for emergency or portable communications. The 6-meter Yagi can be a starter antenna to help get you active on the 6-meter band. These designs can also be easily scaled for use on the HF bands.

See QST in Depth for More!

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

- ✓ The author's article, "Yagi/Uda Antenna Design," from the winter 1998 issue of *Communications Quarterly*
- ✓ More photos of the 2- and 6-meter Yagis described in this article



Access the digital edition of *QST* (www.arrl.org/qst-in-depth) to watch W1AW Station Manager Joe Cardia, NJ1Q, build the 2-meter Yagi described in this article.

ARRL Life Member and Amateur Extra-class licensee Joe Reisert, W1JR, was one of the first licensed Novices in 1951. In 1956, he received his AAS degree in Electronic Technology from the State University of New York in Farmingdale. Joe has been employed at Sperry, IBM, Lockheed Missiles and Space Company, Fairchild Microwave, The MITRE Corp., Wang Labs, and Cushcraft. In 1992, he founded Antennaco, Inc., and he designed and manufactured commercial VHF, UHF, and microwave antennas. Joe is interested in DX from HF through the microwaves and was an early EME pioneer in the 1970s. He has earned DXCC 392/340, DX Challenge 3180, 13BWAS, 11BDXCC, and DXCC, with 315 entities confirmed on 160 meters. He was inducted into the CQ DX Hall of Fame in 2014. Joe has served on the ARRL DX Advisory Committee and was Chairman of the VHF/UHF Advisory Committee. He has published more than 150 technical papers and given more than 130 invited talks on various amateur radio subjects. You can reach Joe at w1jr@arrrl.net.

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

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A Simple and Inexpensive Keyer for Morse Keyboard Use

This modest keyer uses just four components, yet includes features normally found in more sophisticated keyers.

Ray Kauffman, AJ4YN

This keyer consists of a Raspberry Pi Pico, a 330 Ω resistor, a solid-state relay, and a connector for the transceiver's key line. The Raspberry Pi Pico is an inexpensive microcomputer with some very useful hardware peripherals built in. It can generate frequencies from audio through HF, operate relays, measure voltage, and much more — all on a 1 $\times$ 2-inch printed circuit board. And the software tools for programming and code development are free. If you're new to coding, www.freecodecamp.org is a good resource.

The total cost to build the keyer is less than \$20, but you'll also need a laptop and a USB type B cable. The macro creation, code speed, and CW transmission are controlled from your laptop keyboard, and the keyer is powered by USB. Its features include 10 macros for contest or casual contacts, a type-ahead buffer for CW transmissions, a code practice oscillator that can drive earphones or a speaker, a keyed carrier on 7020 kHz for receiver monitoring, and an opto-isolated keying relay. The parts list is shown in Table 1, and the schematic is in Figure 1.

The simplest version of the keyer is shown in Figure 2. The solid-state relay is mounted and super-

Table 1 — Parts List

Quantity	Description	Source
1	*Seed Studio Raspberry Pi Pico	Amazon
1	330 Ω 1/4 W resistor	Amazon, DigiKey
1	Opto-isolated solid-state relay TLP592J	DigiKey
1	Piezoelectric speaker Murata PKM22EPPH2001-B0	Digikey
1	Phone plug to match your radio's keying jack	Amazon, DigiKey

*Purchase with headers if you use a breadboard. No headers are used for the simpler version of the keyer.

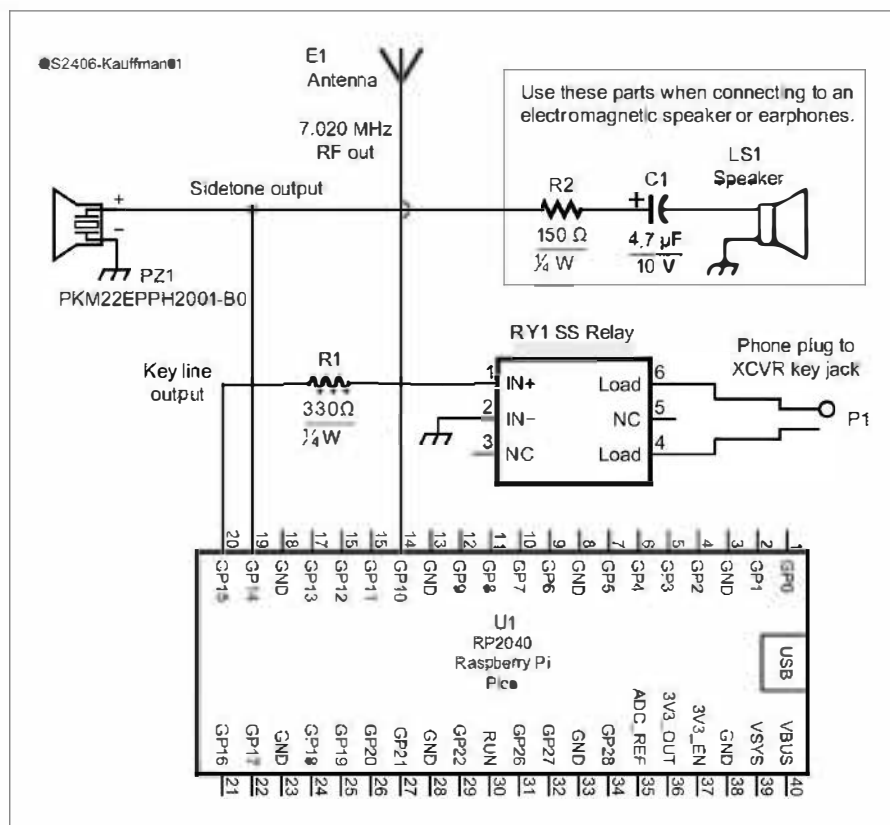




Figure 2 — The simplest version of the keyer.

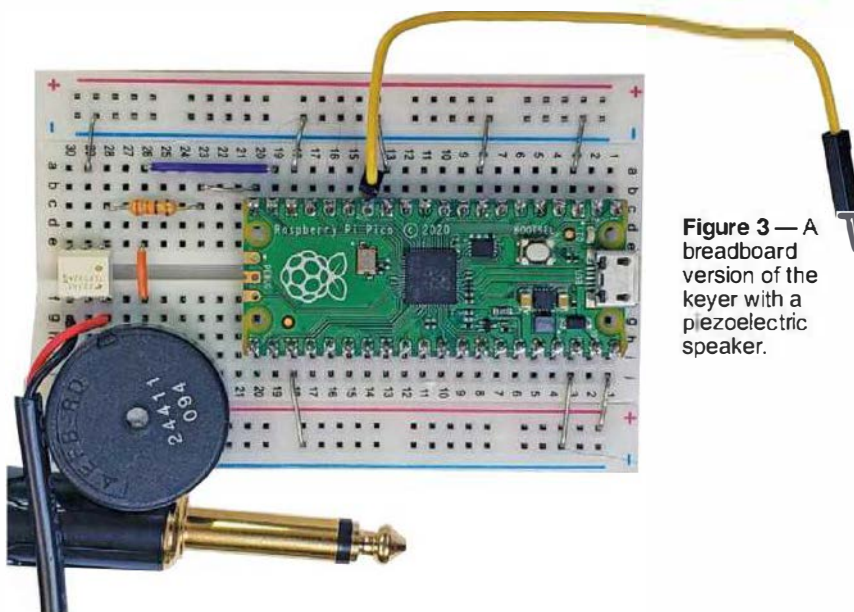


Figure 3 — A breadboard version of the keyer with a piezoelectric speaker.

glued to the Raspberry Pico, dead-bug style. A solderless breadboard version with a speaker and antenna is shown in Figure 3.

I packaged the simplest version of the keyer in a $\frac{3}{4}$ -inch section of PVC pipe that was squeezed into a vise, making a slightly elliptical shape (see Figures 4 and 5). I center-drilled the end cap for the key line and passed it through the hole. I slit the opposite end cap so that the USB cable could slide into the slit.

The Pico also transmits CW on 7020 kHz. This can be useful for adjusting a receiver's automatic gain control, filters, and noise blanker for optimum CW reception. The power level is about 1 mW, and a short wire will radiate enough signal to be heard. A small piezoelectric speaker can be added to produce a sidetone for use as a code practice oscillator. The sidetone's 3.3 V square wave output is capable of providing about 25 mA of drive current. If you use an earphone or speaker for sidetone monitoring, place a 150 Ω resistor and a 4.7 μ F 10 V capacitor in series with either to prevent damaging the Pico.

Programming the Pico

A PDF of *Get Started with MicroPython on Raspberry Pi Pico* is available at no cost from <https://hackspace.raspberrypi.com/books/micropython-pico>. This is an excellent book for those who are new to the Pico.

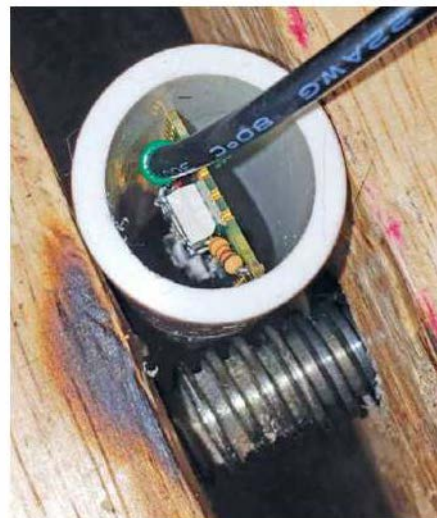


Figure 4 — The keyer installed in a PVC tube.



Figure 5 — The fully packaged keyer.

You won't need to read the whole book, as the first few chapters provide enough information to get started. The keyer is controlled using the free *Tera Term* terminal program (<https://sourceforge.net/projects/tera-term>) that should be installed on your computer. More details on the actual programming of the keyer, the *Tera Term* installation and setup, and the program listings are available on the QST in Depth web page (www.arrl.org/qst-in-depth).

Operating the CW Keyer

The keyer program is not case sensitive. Ten messages can be stored and recalled, and the code speed can be set from 5 to 50 WPM. Anything typed on the keyboard is instantly sent at the selected code speed with full buffering for rapid-touch typists. For code practice, an ASCII file can be transmitted with practically no limit on the length. If you're learning to receive CW, you can write the characters you want to practice learning in a text file using Windows *Note-pad*. To send the text file, just drag and drop it to the *Tera Term* terminal window and it will be converted into Morse code (the keyer must be in CW mode when you do this). An example of the keyer operation is detailed on the *QST* in Depth web page.

This is a fun project that not only results in a simple, inexpensive, and quite functional keyer, but it will also give you experience working with the Raspberry Pi Pico processor.

See *QST* in Depth for More!

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

- ✓ More details on how to program the keyer
- ✓ *Tera Term* installation and setup
- ✓ An operation example of the keyer
- ✓ The program listings

All photos provided by the author.

Ray Kauffman, AJ4YN, was first licensed in 2010, after many years as an avid SWL operator. He has worked in the electronics field since the early 1960s. In 1978, Ray started a small company that manufactured test equipment for the marine electronics industry. He holds several patents, as well as an FCC First Class Radiotelephone Operator's Certificate with Radar Endorsement. Ray sold his business in 2011 and has been retired and enjoying ham radio ever since. He can be reached at rayk2@cox.net.

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This Month in **QEX**

QEX magazine is a forum for the free exchange of ideas among communications experimenters. All ARRL members can access the digital edition of *QEX* as a member benefit (www.arrl.org/magazines). Print subscriptions are available and sold separately; see www.arrl.org/qex.

Coming up in the May/June issue of *QEX*:

- David J. Ahlgren, K1BUK, elucidates the possibility of using standard-impedance cables to make stepped line transformers that match a wide range of impedances.
- Anthony Le Cren, F4GOH/KF4GOH, describes a method of using inexpensive modules to send SSTV images from a sounding balloon.
- Gwyn Griffiths, G3ZIL, details how spectral spread at the transmitter and receiver can be less than 30 mHz, using modestly priced equipment.
- Jacques Audet, VE2AZX, simulates and tests popular 49:1 unun designs and suggests how they may be improved.
- In his essay series, Eric P. Nichols, KL7AJ, discusses how the behavior of hardware demonstrates the truth of the mathematical concepts hams deal with.

QEX is edited by Kazimierz "Kai" Siwiak, KE4PT (ksiwia@arrl.org), and is published bimonthly.

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Strays

QST Congratulates...

■ Al Rovner, K7AR, for receiving the October 2023 *QST* Cover Plaque Award for his article, "An Introduction to WSJT's DXpedition Mode." ARRL Northwestern Division Director Mike Ritz, W7VO, presented the award to Al at a Willamette Valley DX Club meeting in Portland, Oregon.



Director of the ARRL Northwestern Division Mike Ritz, W7VO (left), presents Al Rovner, K7AR (right), with his *QST* Cover Plaque Award. [Photo courtesy of Mike Ritz, W7VO]

SWR Applications in Lines with Resistive Loads

A particular case in transmission lines and what SWR meters actually measure.

José Luis Giordano, CA4GIO

Some radio amateurs find the theory of certain mathematical relationships that are useful when working with transmission lines to be intimidating due to its use of specialized elements, such as complex numbers and hyperbolic functions. However, the mathematical expression of the standing wave ratio (SWR) on a transmission line with characteristic impedance Z_0 (typically 50 Ω) that is connected to a load impedance Z_L (such as an antenna) is considerably simplified when Z_L has no reactance. Although this expression is known, it seems appropriate to emphasize some applications of interest to amateur radio. The important formulas are:

$$SWR = Z_L/Z_0 \text{ when } Z_0 \leq Z_L \quad (1a), \text{ and}$$

$$SWR = Z_0/Z_L \text{ when } Z_0 \geq Z_L \quad (1b).$$

See the sidebar, "Why SWR Is a Simple Ratio between Z_0 and a Purely Resistive Load," for more information. In practice, equations (1a) and (1b) cannot be applied directly, because the transmitter or analyzer (the source) must be connected via a transmission line (see Figure 1). While the SWR on the line corresponds to the reflection at the final end of the line (where the signal meets the discontinuity between Z_0 and Z_L), the value that the source sees (the one actually measured by the analyzer), and what we call SWR_m , corresponds to the reflection at the line input in the discontinuity between the equivalent series impedance $Z_S (= 50 \Omega)$ of the source and the equivalent impedance Z_{in} seen at the line input (an example of this can be found in Chapter 2.6 — "Generator and Load Mismatches" in *Microwave Engineering* by David M. Pozar, 4th Ed. 2012). Therefore, repeating the calculation (carried out for Z_0 and Z_L) for Z_S and resistive Z_{in} , we have,

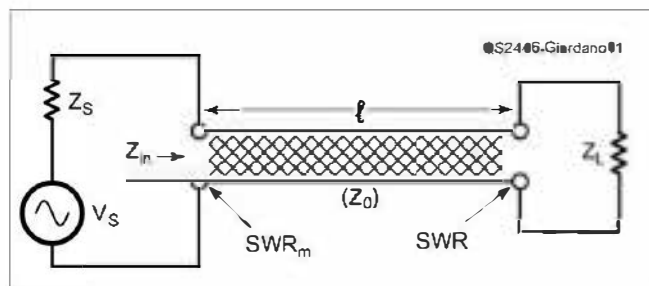


Figure 1 — Schematic of the transceiver connected to the load through the transmission line.

$$SWR_m = Z_{in}/Z_S \quad (2a) \text{ for } Z_S < Z_{in} \quad (2a), \text{ and}$$

$$SWR_m = Z_S/Z_{in} \quad (2b) \text{ for } Z_S \geq Z_{in} \quad (2b).$$

These relationships can be used in several experimental configurations with different lines, such as with Z_0 of 25 Ω (two 50 Ω coaxial cables in parallel), 50 Ω (RG-58), 75 Ω (RG-59), 300 Ω (twinlead), etc., and several non-inductive Z_L (dummy loads).

Applications

Calibration of SWR Meter

When a reference load for calibration and the line are matched ($Z_L = Z_0$), then $Z_{in} = Z_0$. So, the reflection does not occur at the end of the coaxial cable but at the input. Thus, if Z_L is resistive, so is Z_{in} , and then $SWR_m = Z_L/50 \Omega$ or $50 \Omega/Z_L$, and can be used with the SWR meter connected to the load through the line.

For example, if we connect dummy loads and lines such that $Z_0 = Z_L = 50 \Omega$, 75 Ω , 25 Ω , and 150 Ω (for which $SWR = 1$), the respective readings should be $SWR_m = 1.0$, 1.5, 2.0, and 3.0. To have $Z_{in} = Z_L$, you can also use the calibration loads $Z_L = 25 \Omega$, 50 Ω , 75 Ω , etc., with only one $Z_0 = 50 \Omega$ (or the line you have) if its length is half the wavelength of the operation frequency.

Z_L Measurement

The analyzer is connected to the resistive load (a resonant antenna or dummy load, for instance) through a line with negligible losses whose length l is half the wavelength λ of the signal ($l = \lambda/2$), where λ includes the line velocity factor. In this case, we again have $Z_{in} = Z_L$. Then (using the equation above), with the direct measurement of SWR_m , the values $Z_L^+ = 50 \Omega \times SWR_m$ and $Z_L^- = 50 \Omega / SWR_m$ are obtained. For example, if we have measured $SWR_m = 3.0$, then $Z_L^+ = 150 \Omega$, and $Z_L^- = 16.7 \Omega$. To determine which of the two values is Z_L , more information about the load is necessary.

Measurement of Z₀

The analyzer is connected to a dummy load through the line whose characteristic impedance is to be determined. The frequency must be such that the length of the line is a quarter wavelength. In this

case, $Z_{in} = Z_0^2 / Z_L$, and by substitution we can show that

$$Z_0^+ = \sqrt{(50 \Omega \times Z_L \times SWR_m)}$$

$$\text{or } Z_0^- = \sqrt{(50 \Omega \times Z_L / SWR_m)}$$

To determine which of the two values is Z_0 , more information about the line is necessary. Suppose we have a coax that we suspect has $Z_0 = 75 \Omega$ and we want to verify it. If we use $Z_L = 50 \Omega$ and measure $SWR_m = 2.3$, it turns out that $Z_L^+ = \sim 76 \Omega$ and $Z_L^- = \sim 33 \Omega$. So, it's likely that the unknown Z_0 of the line is $\sim 75 \Omega$. The 1% discrepancy could be due to the uncertainty in the SWR_m measurement or the actual Z_0 . John Stanley, K4ERO, proposed this method and created simulations and measurements to verify it. This information can be found on the QST in Depth web page (www.arrl.org/qst-in-depth).

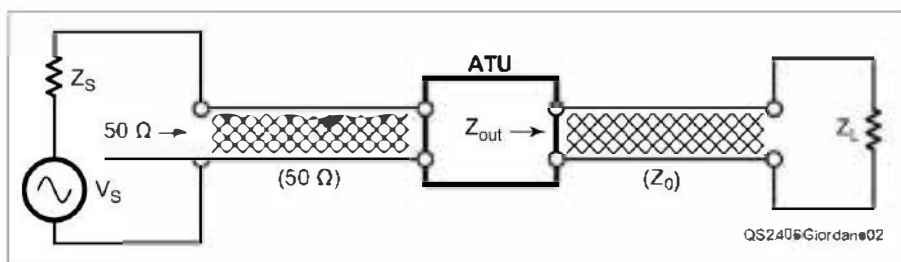


Figure 2 — Schematic of the transceiver connected to the load with the transmission line through an ATU with 50 Ω coax.

Operating Range of a Tuner

Let us now consider that between the signal source and the impedance Z_L there is an antenna tuning unit (ATU) whose input is linked to the source through a 50 Ω coax (see Figure 2). Under the conditions of a perfect impedance match, the source now sees

Why SWR Is a Simple Ratio between Z₀ and a Purely Resistive Load

As a starting point, the reflection coefficient ρ and SWR expressions can be taken. Generally, ρ is a complex quantity that represents the ratio between the voltage of the reflected wave at Z_L (the antenna) and the voltage of the incident (or direct) wave. It can be shown that this quantity is related to Z_L and Z_0 , according to

$$\rho = \frac{Z_L - Z_0}{Z_L + Z_0}$$

On the other hand, the SWR represents the relationship between the sum of the maximum of the incident voltage and the reflected voltage, with respect to the difference between these maximum voltages. Then, in transmission line theory, it's shown that the relationship between SWR and ρ is

$$SWR = \frac{1 + |\rho|}{1 - |\rho|}$$

(These two expressions are reproduced in the 99th edition of *The ARRL Handbook for Radio Communications* on page 20.4.)

Now, consider the case where both impedances have no reactance — that is, Z_0 and Z_L are positive real numbers. Also suppose that $Z_0 \leq Z_L$. Then, we can write

$$Z_L = aZ_0 \text{ (where } a \geq 1),$$

and replace

$$\rho = \frac{aZ_0 - Z_0}{aZ_0 + Z_0} = \frac{a - 1}{a + 1} \geq 0 \text{ and}$$

$$SWR = \frac{1 + \frac{a - 1}{a + 1}}{1 - \frac{a - 1}{a + 1}} = a \geq 1. \text{ Thus,}$$

$$SWR = \frac{Z_L}{Z_0}$$

Now, suppose that $Z_0 \geq Z_L$. Then, we can write $Z_L = Z_0/a$ with $a \geq 1$. Substituting as before, we again get $SWR = a \geq 1$, but this time,

$$SWR = \frac{Z_0}{Z_L}$$

$Z_{in} = 50 \Omega$ at the input of the coax, while the tuner sees Z_{out} at the output. In general, this Z_{out} is not resistive (even when Z_L is). Again, when Z_{out} is resistive, the SWR_{ATU} at the output side of the tuner can be expressed as before:

$$SWR_{ATU} = Z_{out}/50 \Omega \text{ or } 50 \Omega/Z_{out}$$

There are some tuner models whose instruction manuals do not indicate the range of impedances they can match. Instead, they only specify the SWR range at which it performs matching. Although tuners match loads with reactive components, the relationship between SWR and impedance range usually refers to a resistive load. Then, it is sufficient to use the above relationships for SWR_{ATU} .

Let's look at some examples. The built-in ATU in the Xiegu G90 transceiver can match with an "SWR up to 5:1" that corresponds with 10 to 250 Ω . According to specifications, the LDG Z-100A external automatic antenna tuner can match with an "SWR up to 10:1." Then, we see that this tuner can match in the range of 5 to 500 Ω . Finally, it can be noted that both

ranges for the built-in ATU are explicitly shown in the Icom IC-7300 transceiver's basic manual: "16.7 ~ 150 Ω (SWR of less than 3:1)."



In the digital edition of *QST* (www.arrl.org/qst), ARRL Lab Digital RF Engineer John McAuliffe, KD2ZWM, takes a look at SWR and what it means, and explains how to use a tuner to help your radio see the match it needs.

José Luis Giordano, CA4GIO, is a physicist who has worked at the Balseiro Institute and Bariloche Atomic Centre in Argentina, the University of Zaragoza in Spain, and the University of Talca in Chile. Now retired from academic life, José lives in Chile and obtained his amateur radio license in 2021. He is the author of four books, several papers on physics, and articles in *QST* and other ham radio magazines. José is especially interested in HF and broadband transformers. He can be reached at jlgordano@hotmail.com.

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- ✓ Derivation of formulas
- ✓ Details of the Z_0 measurement method

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, or personal accounts of trying a new mode or style of operation — 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.

General interest submissions should be in the range of 1,200 – 1,800 words, with 3 – 5 high-resolution images. Technical article submissions may be longer and include more images, as the subject matter requires (for example, if there are step-by-step instructions for a build project). Please submit images as separate attachments (rather than embedded in your manuscript), and include caption information for all images at the end of your manuscript. Send all manuscripts, with images, to qst@arrrl.org.

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



Certificate of Code Proficiency Recipients

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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.

November 2023

Eric D. Benjaminson, WA9CEK	10
Paul K. Earhart, WD4OQH	10
Paul K. Earhart, WD4OQH	15
Alfred F. Hanzl, K2AL	15
Jerry W. Kerns, K6FN	15
Jerry W. Kerns, K6FN	20
John P. King, KA2F	20
David A. Rose, N8GZ	20
Robert D. Spearman, N5VUC	20
James C. Stekas, K2UI	20
Jerry W. Kerns, K6FN	25
John P. King, KA2F	25
Scott T. McNutt, N3ADP	25
Donald W. Brown, W0AF	30

December 2023

Matthew K. Jamison, K15PGL	10
Andrew C. Kirk, WB2C	10
Richard F. Phillips, AE0QH	10
Erica W. Zavaleta, W7WXR	10
Russell L. Bast, Jr., AD2BO	20
James W. Carter, K7IOL	20
Alfred F. Hanzl, K2AL	20

January 2024

Charles W. Campbell, K0CWC	15
Douglas B. Diegert, N2KGT	15
George Wayne Moore, W8SUN	20

February 2024

Charlene K. Lewis, K8XCO	10
Douglas B. Powers, KD5DBP	10
Timothy J. Sinnott, KE2UM	10
Margot L. Wasz, KM6JWY	10
Lawrence Schall, KB2MN	20
Albert J. Whetter, W9WJ	20

March 2024

Mark A. Jessing, N4OJE	10
Stephen M. Riley, WA9CWE	10
Kenneth F. Robinson, K8SCA	10
Steven L. Myers, AI7OL	20
Bernard A. Poskus, KF0QS	20

Congratulations to all of the recipients.

June 2024 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.

June Qualifying Runs will be transmitted by W1AW in Newington, Connecticut, at the times shown on 1.8025, 3.5815, 7.0475, 14.0475, 18.0975, 21.0675, 28.0675, 50.350, and 147.555 MHz. The West Coast Qualifying Runs will be transmitted by K6KPH on Saturday, June 15, at 2 PM PDT (2100 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://nfarrl.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 — June 2024

(All times are in Eastern Daylight Time.)

Monday	Tuesday	Wednesday	Thursday	Friday
	6/4 4 PM – 2000Z 10 – 35 WPM	6/5 7 PM – 2300Z 35 – 10 WPM	6/6 10 PM – 0200Z (6/7 – UTC) 10 – 40 WPM	
6/10 4 PM – 2000Z 10 – 35 WPM	6/11 10 PM – 0200Z (6/12 – UTC) 10 – 40 WPM		6/13 9 AM – 1300Z 35 – 10 WPM	
6/17 10 PM – 0200Z (6/18 – UTC) 35 – 10 WPM	6/18 9 AM – 1300Z 10 – 35 WPM		6/20 7 PM – 2300Z 10 – 35 WPM	
	6/25 9 AM – 1300Z 35 – 10 WPM	6/26 10 PM – 0200Z (6/27 – UTC) 10 – 40 WPM	6/27 4 PM – 2000Z 35 – 10 WPM	

Product Review

Icom ID-50A Dual-Band FM/Digital Handheld Transceiver

Reviewed by Steve Ford, WB8IMY
wb8imy@arrl.net

In the ID-50A, Icom offers a less expensive version of their popular ID-52A handheld. Unlike the ID-52A, the ID-50A does not include Bluetooth wireless connectivity. While the ID-50A is like the ID-52A in that it includes two separate receivers, the ID-50A restricts you to simultaneously monitoring either two FM signals or an FM and a D-STAR signal — you cannot receive two D-STAR signals at the same time. The ID-50A also lacks the ID-52A's colorful display and the ability to view received images in the display.

All that said, however, the ID-50A has much to offer in the same 2.3 x 4.4 x 1.2-inch, 11-ounce package.

Lots to Hear

The ID-50A has impressive receive capability, with coverage from 137 to 174 MHz, as well as from 375 to 479 MHz. This encompasses two amateur bands, along with considerable range above and below the bands. If you're interested in eavesdropping on aviation, the ID-50A offers AM between 108 and 136.99 MHz. The transceiver even includes FM broadcast reception from 88 to 108 MHz.

When it comes to digital operating, the ID-50A provides D-STAR functionality on 2 meters and 70 centimeters. You can enjoy local simplex or repeater contacts, or chat internationally through gateway-equipped repeaters and stand-alone hotspots.

The front speaker offers decent quality with about 750 mW maximum audio output. There is also a microphone/headset jack.

Out of the Box and All Around

The ID-50A arrives ready to go with a 1880 mAh battery pack (BP-272), a belt clip, and a detachable hand strap. The package includes a flexible helical antenna, better known as a "rubber duck." The antenna screws into a female SMA jack. The SMA gender is worth keeping in mind in case you want to purchase an

Bottom Line

The Icom ID-50A is a versatile transceiver. Exploring this unit is the best part of the fun, which is discovering what it can really do.



adapter to connect the ID-50A to an external antenna.

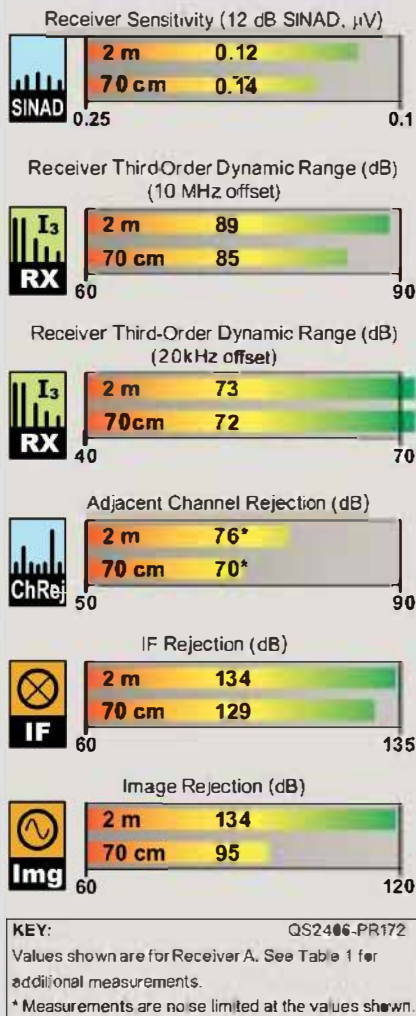
The printed owner's manual is comprehensive, despite being called a basic manual. It even includes a D-STAR operating tutorial. Even so, the ID-50A has so many features it is a good idea to go to www.icom-america.com and download the advanced manual.

The ID-50A is designed to interface with computers and various mobile de-

vices, so to take full advantage of this capability you'll need a USB-C cable. You can use the cable to access a microSD memory card, program the ID-50A's memories, and even set up a D-STAR hotspot. The USB cable can also be used to charge the ID-50A from a computer or a typical USB "wall wart" power supply. Some amateur dealers include the USB-C cable in their packages, so be sure to check the details carefully. I encountered a few dealers that also offered wall chargers.

The case is ruggedly built and has a hefty feel overall. You immediately notice that the various ports are protected with tight-fitting rubber caps. That's a hint that the ID-50A is rated for IPX7 waterproofing, which means that it can withstand immersion in up to 3 feet of water for 30 minutes.

Key Measurements Summary Icom ID-50A



On the left side of the case (when facing front) you find the push-to-talk button, a squelch-disabling monitor button, and the power on/off button. You can capture tiny BMP images of the ID-50A screen by enabling the capture function and briefly tapping the power button.

And speaking of capturing images, immediately below the power button resides the port for a microSD memory card. Icom doesn't supply a memory card with the ID-50A, but

Table 1
Icom ID-50A, serial number 15001102
Firmware version: 1.03

Manufacturer's Specifications

General

Operating modes:
FM/FM-N, AM/AM-N*, DV (GMSK), FM broadcast band (WFM).

Power requirements:
10 – 16 V dc external supply;
7.4 V dc with specified Icom battery pack;
5.5 V dc with specified Icom battery pack.

Current drain (at 7.4 V dc):
Transmit (at 5 W): ≤ 2.5 A.

Receive (max audio output, 8 Ω load):
FM/FM-N, <400 mA.
Digital voice (DV), <450 mA.

Receiver

Receive frequency coverage:
A band, 108 – 174 MHz, 375 – 479 MHz;
B band, 137 – 174 MHz, 375 – 479 MHz;
FM broadcast band, 88 – 108 MHz.

Receiver sensitivity:
A band FM/FM-N, 12 dB SINAD:
137 – 148 MHz: <0.18 μV ;
148 – 174 MHz: <0.32 μV ;

375 – 399.995 MHz: <0.5 μV ;
400 – 475 MHz: <0.32 μV .

A band AM, 10 dB S/N:
108 – 142 MHz: <1 μV .

B band, FM/FM-N, 12 dB SINAD:
137 – 148 MHz: <0.18 μV ;
148 – 174 MHz: <0.32 μV ;
375 – 399.995 MHz: <0.5 μV ;
400 – 479 MHz: <0.32 μV .

FM broadcast band (WFM), 12 dB SINAD:
88 – 108 MHz: <1 μV .

Measured in the ARRL Lab

As specified.

As specified.

Measured at 13.8 V dc, 146 MHz:
High, 1.40 A; Med, 1.05 A; Low1, 0.72 A; Low2, 0.59 A; S-Low, 0.42 A.
Measured at 13.8 V dc, 440 MHz:
High, 1.84 A; Med, 1.30 A; Low1, 0.90 A;
Low2, 0.68 A; S-Low, 0.42 A.
Current drain from internal battery not measured.

Measured at 13.8 V dc, 146 MHz and 440 MHz:
S-9 modulated signal, lights on,
one receiver on, 0.39 A.
No signal, lights on, both receivers
on, 0.41 A.

As specified.

As specified.

As specified.

146 MHz, A band: FM, -125 dBm (0.12 μV);
146 MHz, A band: FM-N, -126 dBm (0.11 μV);
162.4 MHz, A and B band: FM, -123 dBm,
(0.15 μV);
440 MHz, A and B band: FM, -124 dBm
(0.14 μV);
440 MHz, A and B band: FM-N, -125 dBm
(0.13 μV).

120 MHz, A band: -112 dBm (0.54 μV).

As measured for A band on 146 MHz and
440 MHz.

100 MHz, -112 dBm (0.59 μV).

they are available from many retail outlets. I happened to have a 32 GB card on hand, and it worked perfectly. The card is used to store images sent or received via D-STAR, as well as repeater lists, frequency memories, GPS logs, audio recordings, and more. By accessing the appropriate menu setting, the ID-50A's memory card can function like an external hard drive whenever you plug the radio's USB cable into your computer.

FM two-tone, third-order IMD dynamic range: Not specified.	A band, 20 kHz offset: 146 MHz: FM, 73 dB; FM-N, 74 dB; 440 MHz: FM, 69 dB;† FM-N, 71 dB.‡ A band, 10 MHz offset: 146 MHz: FM, 90 dB; FM-N, 85 dB; 440 MHz: FM, 77 dB; FM-N, 78 dB. B band, 20 kHz offset: 146 MHz: FM, 75 dB; FM-N, 76 dB; 440 MHz: FM, 69 dB;‡ FM-N, 71 dB.‡ B band, FM, 10 MHz offset: 146 MHz: FM, 84 dB; FM-N, 85 dB; 440 MHz: FM, 73 dB; FM-N, 74 dB.
FM two-tone, second-order IMD dynamic range: Not specified.	A and B band, FM: 146 MHz: 55.2/90.82 MHz test tones, 86 dB; 440 MHz: 146.02/300 MHz test tones, 106 dB.
Adjacent-channel rejection: FM: ≥55 dB; FM-N, DV: ≥50 dB.	A and B band, FM, 20 kHz offset;‡ 146 MHz, 76 dB; 440 MHz, 69 dB. A and B band, FM-N, 20 kHz offset; 146 MHz, 76 dB, 445 MHz, 71 dB.
IF rejection: Not specified.	A and B band, FM: 146 MHz: >134 dB; 440 MHz, 129 dB.
Image rejection: Not specified.	A and B band: 146 MHz, >134 dB; 440 MHz, 95 dB.
Squelch sensitivity: Not specified.	A and B band: 146 MHz, 0.33 µV (min), 1.1 µV (max); 440 MHz, 0.27 µV (min), 0.99 µV (max).
S-meter sensitivity: Not specified.	A and B band, all-bar indication: 146 MHz, 1.60 µV; 440 MHz, 1.50 µV.
Audio output into 8 Ω: Internal speaker: 0.75 W at 10% THD. External speaker: 0.2 W at 10% THD.	Not measured. As specified.

Transmitter

Power output at 7.4 V dc: High, 5 W; Mid, 2.5 W; Low2, 1 W. Low1, 0.5 W; S-Low, 0.1 W.	Battery power (8.4 V dc) or 13.8 V dc external power:** 146 MHz: Hi, 5.09 W; Med, 2.60 W; Low2, 1.01 W; Low1, 0.53 W; S-Slow, 0.13. 440 MHz: Hi, 4.94 W; Med, 2.46 W; Low2, 0.99 W; Low1, 0.5 W; S-Low, 0.11 W.
Spurious signal and harmonic suppression: <-60 dBc (High/Mid); <-13 dBm (Low2, Low1, S-Low).	Meets FCC requirements: 146 MHz: <-70 dBc; 440 MHz: <-68 dBc.
Transmit-receive turnaround time (PTT release to 50% of full audio output): Not specified.	Band A and B, squelch on, S-9 signal: 144 MHz: 90 ms; 440 MHz: 90 ms.
Receive-transmit turnaround time (TX delay): Not specified.	Band A and B: 146 MHz: 59 ms; 440 MHz: 59 ms.
Size (height, width, depth): 2.3 × 4.4 × 12 inches (with BP-272 battery, not including belt clip). Weight: 10.6 ounces (including battery pack and antenna). *Receive only from 108 MHz to 143.995 MHz. †External voltage specified as 10 V dc – 16 V dc. ‡Measurements phase-noise limited at values shown. **Power output did not vary significantly with external voltage from 10 V dc to 16 V dc, or with use of a fully charged internal battery.	

external dc power port and a USB-C port.

On the front of the ID-50A you have a sizable monochrome display screen. Below the screen there are six convenient pushbuttons surrounding a multi-directional switch. Pressing the side, top, and bottom edges of the switch moves you between menus and submenus, among other things. At the center is a pushbutton to make selections (analogous to the ENTER key on a computer keyboard).

Initial Explorations

After a long press on the power button, the ID-50A sprang to life with a beep. Without even glancing at the manual, I was able to switch bands, modes, and frequencies right away.

But without the manual's guidance, any exploration is likely to be shallow. So, I dug into the booklet, as well as the downloaded advanced documentation, and was astonished at the sheer number of features. This is not to say that the ID-50A is difficult to navigate, but doing some patient reading pays major dividends.

The first item I checked was the RF power setting. There are five power levels available: 5, 2.5, 1, 0.5, and 0.1 W. I found that 0.5 W was adequate for nearby repeaters, and it resulted in considerable operating time when the battery was fully charged.

The manual also informed me about the ID-50A's copious memories. There are 500 frequency memories, and an additional 500 memory channels just to store FM broadcast frequencies (who listens to that many stations?). The radio allocated 300 memories to store GPS data and a whopping 2,500 memory slots for its repeater database.

In addition to the SMA antenna jack atop the ID-50A, you have a Global Positioning System (GPS) antenna and two concentric knobs. The top knob is used for several functions such as frequency control, and the bottom knob adjusts the audio level.

There are two more rubber caps on the right-hand side. The top cap protects the external microphone/headset jacks. The bottom cap covers an

The repeater memories come preprogrammed with an impressive list of FM and D-STAR repeaters. You can update the list, which I did after I noticed that a popular local FM repeater was missing for whatever reason. I downloaded a more recent list from www.dstarinfo.com/RepeaterDownloads.aspx, saved the file to the microSD card, put the card into the ID-50A, and imported the updated information. Icom also offers repeater lists on their website. Thanks to the built-in GPS receiver, the ID-50A also has the ability to use the Near Me repeater function of the DR mode for D-STAR and FM repeaters.

Many radios include speech assistance these days, and just like with their previous model, Icom took an additional step with the ID-50A. Through the menu system you can turn on the speech annunciator and select which information you want to hear spoken aloud, such as frequencies only. In addition — and I thought this was very cool — you can have the speech function announce letters individually, such as “A, B, C,” or announce them phonetically (“Alfa, Bravo, Charlie”).

On the Air

I spent the first several minutes listening to the AM aviation band. Even with just the rubber duck antenna, reception was quite clear. I live in an area with a lot of air traffic, so it didn’t take long to find plenty of chatter.

And, of course, I had to try FM broadcast reception. Once again, the clarity and sensitivity were impressive. The ID-50A only receives in monoaural, but with a single speaker that doesn’t matter.

I noticed a small flashing symbol along the top of the screen. That turned out to be the GPS status indicator, and it flashes until the receiver acquires enough satellite signals to determine your position. Even within my aluminum-sided home, the ID-50A’s GPS received enough signals that it established a fix in less than 60 seconds.

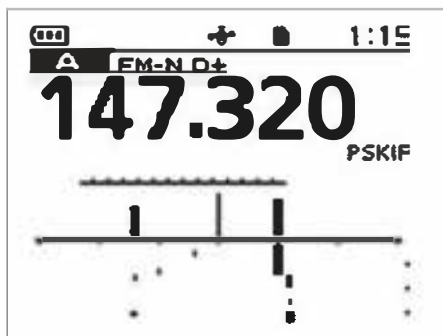


Figure 1 — The ID-50A’s band scope display.

Cruising through the amateur bands was a pleasure with the ID-50A. Reception seemed excellent, and I also received good transmit audio reports through several FM repeaters. I configured the display to show 2 meters as the top, main band and 70 centimeters as the secondary band. It is easy, however, to flip this arrangement as you wish, or display only a single band.

The band scope feature made it easy to spot activity. Even though the scope’s waterfall display is strictly monochrome, I found it highly intuitive to interpret. When I saw an indication of a signal, I simply spun the frequency selection knob to move the cursor to the mark, and I heard the result (see Figure 1).

Speaking of listening, because the ID-50A sports two independent receivers, the dual watch function is particularly slick. This is true dual watch, with both receivers monitored simultaneously. Unlike the dual watch functionality you find in other radios, there is no clicking or popping as the radio bounces from one receiver to another. In the ID-50A, dual watch is as seamless as it gets.

Programming with CS-50

While I found the menu system relatively useful for memory programming, this task is far easier to accomplish with Icom’s free CS-50 software for Windows. With the USB cable connecting the ID-50A to my computer, the CS-50 software established a virtual COM port and quickly located the radio. I was then able to read everything from the ID-50A, modify whatever items I desired (or add new information), and finally write everything back to the radio (see Figure 2). You’ll find the CS-50 application on Icom’s website.

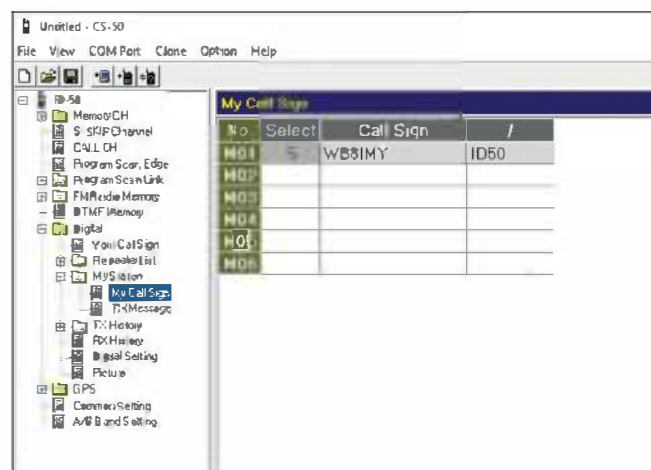


Figure 2 — Programming the ID-50A was a snap with Icom’s CS-50 software.

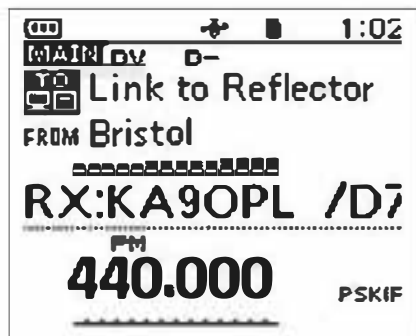


Figure 3 — Connecting to a nearby D-STAR repeater and linking to a reflector.

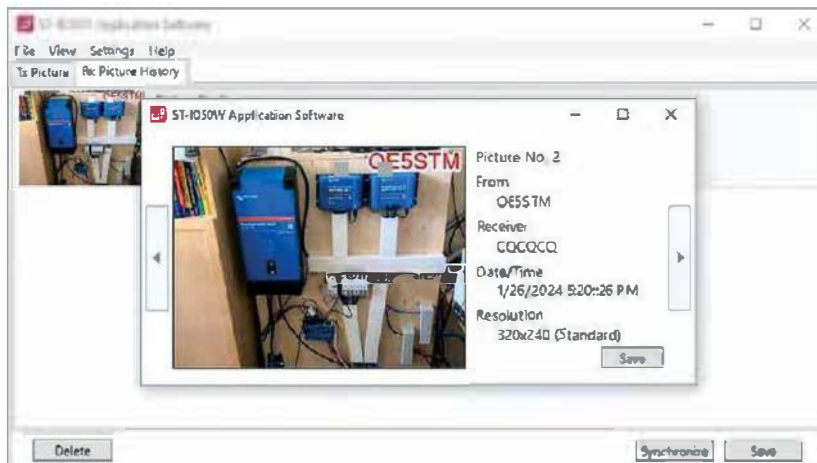


Figure 4 — An image received from OE5STM.

D-STAR

Thanks to the well-written tutorial, operating D-STAR with the ID-50A was a breeze. Within minutes I accessed a repeater, used its gateway to reach a D-STAR reflector (a kind of group chat room) in Indiana, and enjoyed a contact with a fellow near Indianapolis (see Figure 3).

It is important to note that to operate D-STAR you must first add your call sign to the ID-50A's memory. Also, if you intend to access D-STAR gateways, you'll need to register accordingly. The manual tells you how to go about doing this.

Exploring the various D-STAR functions introduced me to one of the most clever features of the ID-50A: the searchable repeater list. When you are in D-STAR mode, it takes just a couple of button clicks to reach the repeater list menu. Thanks to the GPS module, the ID-50A knows your location. So, you can choose to list the nearest D-STAR repeaters. Select a repeater, and the radio automatically configures itself for the proper frequency. It will work this magic for FM repeaters, too.

Imagine taking the ID-50A on a trip. When you reach your destination, you merely switch on the radio, wait for the GPS receiver to achieve a position lock, and then select the nearest repeaters. Operating on the road doesn't get much easier than that.

I'm lucky to have several D-STAR repeaters close to my location, but if you don't, the ID-50A can be used in *terminal mode* to allow you to access the entire D-STAR network via your computer and the internet. If you and your friends have D-STAR-capable transceivers, the ID-50A can also be pressed into service as a hotspot to allow everyone to connect to the network

wirelessly. Both of these functions require software that is available for free from Icom.

I would be remiss if I didn't mention the ID-50A's picture sharing ability. Although it won't display colorful images in the way they appear on an ID-52 screen, you can still capture transmitted images from another station, save them automatically to the microSD card, and then view them on your computer with Icom's free picture utility software, the *ST-ID50W* for Windows PCs. (If you have an Android device, there is also an Icom app, the *ST-ID50A*, that makes image swapping much easier.)

Through a local repeater I accessed reflector REF096D in Austria. Austrian amateurs often use this reflector to exchange images. Sure enough, within about 10 minutes the ID-50A suddenly began beeping. I looked at the screen and saw the RX box that informed me that I was receiving image data. When the transmission finished, I rushed to my PC, grabbed the file with *ST-ID50A*, and was treated to a photo sent by Timm Schneider, OE5STM (see Figure 4). Naturally, I loaded an image of my own to the memory card and sent it to the reflector.

Conclusion

A few printed pages can't describe all the features of the ID-50A, but part of the fun is exploring such a versatile transceiver just to see what it can really do. As D-STAR handhelds go, the ID-50A is considered entry level, at a price of about \$200 less than its up-scale cousin.

Manufacturer: Icom America, 12421 Willows Rd. NE, Kirkland, WA 98034, www.icomamerica.com. Price: \$399.95.

GQ Electronics EMF-390 Multi-Field, Multi-Function EMF Meter and RF Spectrum Power Analyzer

Reviewed by John Leonardelli, VE3IPS
jleonardelli@arrl.net

In this review, we'll delve into the key features of the EMF-390 and discuss its applicability in testing the RF levels in the context of amateur radio operations. It identifies RF sources quickly using sensitive sensors. The RF Radiation mode and RF Spectrum Analyzer mode apply themselves to amateur radio as well. However, bear in mind that this device is not designed as an RF spectrum analyzer but as a multi-purpose, relative-level RF, EMF, and ELF meter. The meter can assist in identifying common EMF/RF sources of power line, Wi-Fi, cell phone, microwave, and commercial broadcast towers. Also, this is not laboratory-grade equipment; the manufacturer doesn't provide any certification of accuracy or calibration, but it can be a fun tool to have around, at least to have an idea of the relative RF field. (See the Lab Notes for more information about the accuracy, or general lack thereof, of this instrument.)

Description

The GQ EMF-390 provides a three-axis top-mounted sensor that includes an electrical field and RF sensor. It also has the capability of providing real-time data logging to a computer. It has audio and visual alarms, and it can also be used for RF detection indoors and outdoors (though it is not waterproof).

The EMF-390 is equipped with a sensitive detector that can pick up even low-level RF signals. This feature is crucial for accurately assessing relative RF levels, especially in environments where weak signals may be present. Its ability to show various transmissions from a broad-spectrum perspective is also useful.



The meter includes a high-contrast black-and-white LCD screen display with a single LED indicator with four function buttons. The LCD display provides real-time readings. The interface is user-friendly, making it accessible for both beginner and experienced operators. The display offers multiple readings and is readable outdoors.

The device comes with a nice protective case, Radiation Safety reference card (with no certificate of accuracy), Quick Guide, and USB-C cable. The device is equipped with a USB port, used for data communication and for external power/charging of the internal rechargeable Li-ion 3.7 V dc battery. Battery life is estimated to be 24 hours before needing a charge. Using the external power source, continuous data monitoring is possible using the free GQ

EMF Pro software, available for Windows and MacOS (see Figure 5).

Software, a USB driver, and an in-depth manual are available for download from their website. They also offer a demo software download that will allow you to experience the meter and use the menu items. I found this to be a great learning tool before reading the manual.

Bottom Line

The USA-designed GQ Electronics EMF-390 is an EMF/ELF diagnostic tool with a built-in RF spectrum analyzer. It offers real-time data logging and is capable of detecting a wide range of EMF sources up to 10 GHz. Because it is not calibrated, nor does it make any claims for accuracy, it cannot be used to assess the safety or compliance of any RF source.

Table 2
GQ Electronics EMF-390 Manufacturer's Specifications
(Not tested in the ARRL Lab)

Audible alarm	Beep/siren
Visual alarm	Green, red LED
Operating temperature and humidity	5 to 40 °C, below 80% relative humidity
Working voltage	3.6 – 3.7 V dc
Display	LCD dot matrix, backlight, 1.2 × 2.6 inches
Power consumption	25 mW to 125 mW (backlight-dependent)
Power	Supply 3.7 V dc Li-ion battery / USB power
Dimensions	5.25 × 3 × 1 inch
Weight	10 ounces
EMF (Electromagnetic Field)	
Triple axis (X, Y, Z) detectable low frequency	0.5 Hz to 150 kHz
Range	0.0 – ~500 mG
Resolution	0.1/1 mG
EF (Electric Field)	
Range	0 V/m to 1000 V/m
Resolution	1 V/m
RF Field (Radio Frequency Field)	
Detectable RF frequency	10 MHz to 10 GHz
RF Spectrum Power Analyzer	
Frequency band 1	50 MHz to 65 MHz
Frequency band 2	65 MHz to 76 MHz
Frequency band 3	76 MHz to 108 MHz
Frequency band 4	240 MHz to 1040 MHz
Frequency band 5	2.4 GHz to 2.5 GHz

Multi-Mode Measurement

The device offers multiple modes of measurement, allowing users to assess EMF levels in terms of electric field, magnetic field, and power density. This versatility is invaluable for amateur radio operators who need to evaluate different types of relative RF emissions. This device is not intended to be used to test RF equipment in the HF range.

Display Modes

There are six versatile display modes that provide an All-in-One mode, a Vertical mode, a Table mode, EMF graphs, an RF Browser, and RF Spectrum.

As the name suggests, the All-in-One mode shows multiple measurements on a single screen. The Vertical mode changes the display from horizontal to vertical. In this mode, you can toggle between reading EMF/EF and RF signals. The Table mode displays data in a table format showing frequency in MHz, dBm, and power. The EMF X-Y-Z sensor mode shows data from the past 45 seconds displayed in a graph format.

RF Browser shows the complete spectrum and total RF emissions (100 kHz to 10 GHz) on the display. It provides instant RF readings in a graph format. I noticed

an interesting utility that estimates total data byte packets for digital RF signals. I am not sure what the best use case is for this. There is a power histogram measurement in graph format as well.

The RF Spectrum mode shows data based on selection of one of the five bands. I understand they are using band-pass filters for the individual bands. These bands do not cover the lower HF amateur bands, but they do cover 6 meters and up, but it doesn't cover the 1.25- and 2-meter amateur bands.

Using the navigation keys you can access the main menu, where you can set user options, display options (backlight, alarm settings, RF settings [sensitivity and scale power units]), and initial setup (time and date).

Audible and Visual Alarms

The device can be set to trigger alarms when certain predefined threshold levels are exceeded. This is an interesting feature, especially in situations when you need to identify relative RF levels. The display LED can change colors based on radiation severity. The display LED can change colors based on radiation severity.

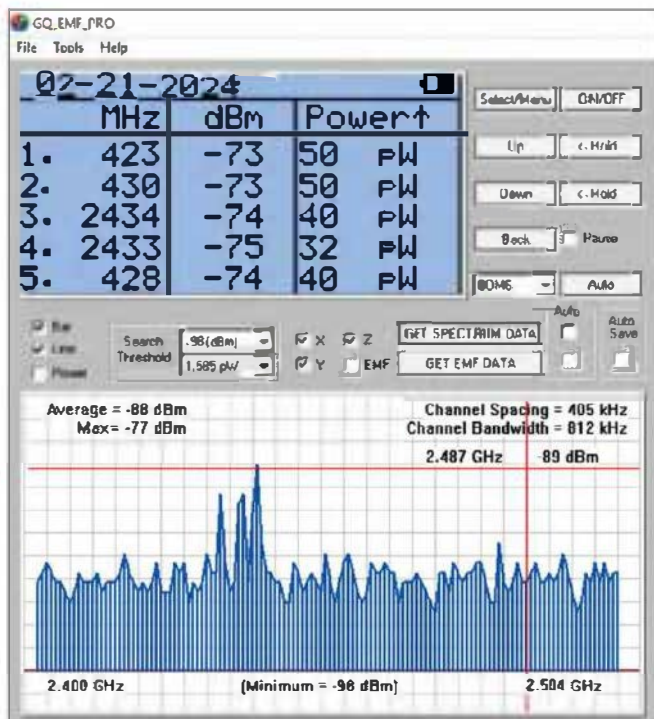


Figure 5 — The GQ EMF Pro software screen capture, which shows more information.

Data Logging and Analysis Software

The EMF-390 has onboard flash memory and a real-time clock for data logging and saving. The data can be logged every second. The companion software, GQ EMF Pro v3.67, allows monitoring measurements on the computer screen and the ability to download historical data, which is provided as a standard .csv file for further in-depth analysis and visualization of the collected data.

Connection of the PC/Mac is via the USB port. It also has the ability to test specific frequency bands with front-end filtering and DSP algorithms being used. This helps the user to focus on the frequencies of interest and investigate and understand any radiation risks. You need to download and install the USB driver before connecting your meter.

If you wish to convert power density levels measured in mW/m^2 into mW/cm^2 , the conversion is easily accomplished by dividing the displayed value by 10,000. Therefore, $39.2 \text{ mW}/\text{m}^2$ is equal to $0.00392 \text{ mW}/\text{cm}^2$, for example.

Applicability in Amateur Radio Testing

The EMF-390 is not well suited for amateur radio enthusiasts who are concerned about the potential health risks associated with prolonged exposure to RF radiation, as there's no accuracy certificate. In fact,

the ARRL Lab used EZNEC antenna modeling software to estimate the field strength near the inverted-v antenna end insulator (see Figure 8) owned by the author, and found that the measurements of this instrument underestimated the EMF readings by approximately 30 dB! This instrument should not be used for any RF-safety or RF-compliance measurements. (See the Lab Notes.)

Its portability lends itself to taking readings outside of the shack. By utilizing its comprehensive measurement capabilities, operators can obtain an indication of the relative levels of electromagnetic radiation emitted by their equipment and antennas.

The RF Browser and RF Spectrum modes will be of interest to us from a broad capture to help identify RF or noise sources.

Furthermore, the ability to record and analyze data over time enables users to identify trends and potentially adjust their setup. The inclusion of audible and visual alarms serves as an additional layer of information, alerting operators when RF levels are high.

My first test was to see what kind of RF was being emitted in my home. I used the All-in-One mode that shows the electric field, the relative RF field, and overall EMF. I was able to obtain a baseline of those emissions. It found and indicated signals from the 434 MHz ISM band that I discovered is my temperature sensor for my weather station (see the lead photo). It also indicated signals at 2.437 GHz, which is my Wi-Fi router on chan-



Figure 6 — The GQ EMF-390 showing Wi-Fi channel 1.

nel 6. I observed signal levels increasing as I got closer to the devices. I have another temperature sensor, which found that too, and I was surprised to see it was on 915 MHz, another ISM band.

I then started to look at the Wi-Fi band using the RF Browser mode, and it showed a sweep of this band. I was also able to pick up my neighbor's Wi-Fi router (see Figure 6 as an example). This mode will detect the RF across the broad radio spectrum from 10 MHz to 10 GHz. Keep in mind that this unit is not specifically designed for hams and that none of the band selection actually has the 2-meter band. In RF Browser mode it will detect the RF level, but the unit won't be able to tell you on which frequency.

I then used the RF Spectrum mode to validate various emissions across the five frequency bands, starting at 50 MHz. These bands are in the amateur VHF and above frequencies. I did look at my Wi-Fi router and was able to trigger an alarm that I set as I got closer.

You can set alerts, change the scale readings, and set sample hold times, as well as other advanced functions. I found that after an hour of taking readings, the battery was still at full charge, indicating that one can get several hours of use without any concern. It also offers a screenshot mode to save data, and the arrow keys can be used to navigate across one of the five bands (see Figure 7). There is a lot of information here, and reading the manual several times will allow you to take advantage of this unit.

I now plan to start a focused approach to capture RF noise emitters in my home, and utility power transformer locations. In conjunction with a small shortwave portable radio, I can listen to the RF hash and also see it on the EMF-390 display.

Real-World Application

Although it really can't be used to assess actual field strength or power density across its entire frequency range, especially for the purpose of assessing compliance with the RF-exposure rules, in my own experience, the EMF-390 has proven its worth during various operating scenarios. Whether assessing RF relative signals in my home station or during portable



Figure 7 — Screenshot saved into the GQ EMF-390.



Figure 8 — The GQ EMF-390 measuring RF on 40 meters, and the “V V V” in CW is shown.

operations, my observation is that the EMF-390 is able to provide a reading. The ability to relocate antennas or adjust setups based on real-time data ensures a proactive approach to assessing RF present in an environment. I found this device very useful in making observations of signals in play. This is a welcome addition to my analog RF/EMF sensors.

Improvements

Having a ¼-inch camera mount on the bottom and back panel would allow the unit to be mounted on a tripod. The ability to have specific or additional radio bands covering the amateur HF segments could also prove useful in the RF Spectrum mode. I did find the software a bit buggy, but I am sure with proper reporting of bugs that they can be resolved in future updates.

Conclusion

Although the EMF-390 can provide operators with a real-time estimation of RF exposure, there is no reference for its precision, so this is not necessarily a reliable tool for amateur radio operators seeking to assess and monitor the RF exposure levels.

The unit itself — as a user-friendly interface, with versatile measurement modes — seems highly sensitive, and advanced features make it a companion for every amateur radio enthusiast's tool kit. It would be nice if the unit covered all of the HF and VHF bands for amateur radio. I also found this meter was able to discover various RF emitters, like ISM band-based sensors, in your home.

Manufacturer: GQ Electronics LLC, 1001 SW Klickitat Way, Suite 110, Seattle, WA 98134, www.gqelectronicsllc.com. Price: \$108.

Lab Notes: GQ Electronics EMF-390 Multi-Field, Multi-Function EMF Meter and RF Spectrum Power Analyzer

Although the text of the review makes it clear that this instrument cannot be used to accurately measure field strength, because the manufacturer's documentation makes reference to EMF exposure, the ARRL Lab took a closer look at this instrument and its accuracy, or, more correctly, its lack of accuracy.

The author of this review had initially hoped that this instrument could be used to perform the required RF-exposure calculation for his station. He was ultimately disappointed. He did a calculation of the needed compliance distances, using the ARRL RF Exposure Calculator found at www.arrl.org/rf-exposure. The calculator showed him that on 7 MHz, even at 1000 W of SSB, exposure to neighboring properties was under the limits (see Figure A).

So far, so good! He then used the instrument to make a measurement of the power density near the end of his inverted-V end insulator. The instrument gave a reading that was approximately 30 dB lower than the expected levels, based on the ARRL calculator.

This raised red flags, so I quickly got out my laptop and used my favorite RF tool for all things antenna-

related — *EZNEC*. (*EZNEC* can now be downloaded free of charge at www.eznec.com.) The near-field calculator that is part of *EZNEC* showed results that reasonably closely agreed with the ARRL RF Exposure Calculator, with field strengths and near-field equivalent power density nowhere near the obviously low reading that the instrument provided.

Field strength and power density can be measured, but instruments capable of providing accurate results cost many thousands of dollars. There are many inexpensive "EMF" instruments in the marketplace, and the ARRL Lab does not know of a single instrument costing less than \$1000 that is accurate enough to assess RF exposure. Although the FCC would permit amateurs to make measurements to assess RF exposure, this instrument will not fit the bill. Amateurs should use the ARRL RF Exposure Calculator, which gives "worst-case" results for all but very small antennas, such as 1-meter mag loops, or use a more accurate calculator, such as *EZNEC*, to ensure that their stations can be operated safely. — *Ed Hare, W1RFI, ARRL Lab Volunteer*

Figure A

RF Exposure Calculator

Parameters

- Power at Antenna: 1000 (watts)
- Mode duty cycle:
Conversational SSB, no speech processing (mode duty cycle=20%) ▼
- Transmit duty cycle: (time transmitting)
You transmit for 5 ▼ minutes then receive for 10 ▼ minutes (and repeat).
- Antenna Gain (dBi): 2.15
- Operating Frequency (MHz): 7.0

☒ Include Effects of Ground Reflections

This calculator should not be used for antennas that are less than 20 cm (8 in) from a person.

Results for a controlled environment:

Maximum Allowed Power Density (mW/cm^2): 18.3673

Minimum Compliance Distance (feet): 1.8068

Minimum Compliance Distance (meters): 0.5507

For an uncontrolled environment:

Maximum Allowed Power Density (mW/cm^2): 3.6735

Minimum Compliance Distance (feet): 2.5551

Minimum Compliance Distance (meters): 0.7788

[Technology](#) >> [Radio Technology Topics](#) >> [Safety](#) >> [RF Exposure](#) >> RF Exposure Calculator

[EXPLORE ARRL](#)

Pacific Antenna Active Antenna Kit

Reviewed by Paul Danzer, N1II
n1ii@arrl.net

This kit consists of a broadband, untuned amplifier designed to be useful throughout the frequency range of 100 kHz to more than 200 MHz. It is built on a high-quality printed circuit board, measuring approximately 2.5 × 3.5 inches. A 38-inch telescoping antenna is included to be mounted on the board, and a single-ended wire can be either substituted or clipped to the telescoping antenna.

The schematic given in the instruction booklet (available online) shows the circuit consists of a single high-gain, wide-bandwidth N-channel JFET, followed by an NPN transistor configured as an emitter follower. Input, output, and interstage coupling are done with a capacitor, so there is no tuning in the circuit.

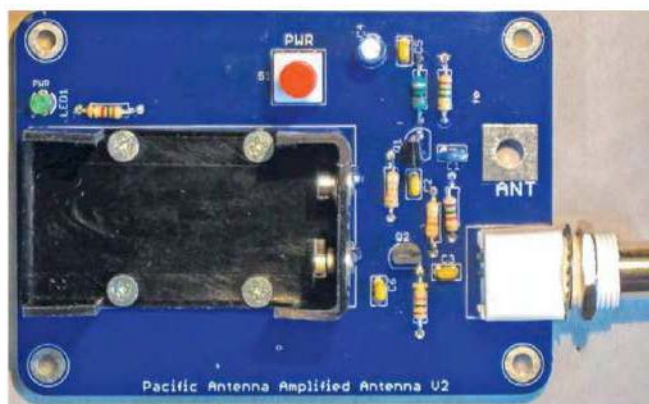
An on-board 9 V battery holder is included to power the circuit with a red-capped pushbutton on/off switch and miniature green LED to remind you when power is on. The only caution needed is a reminder: when connected to a transceiver or signal processing system, don't go key down, because it will result in a degree of destruction!

There are several uses for the unit. The first, and most obvious, is to make up (on reception only) for a longer antenna. It can also be used as the second antenna needed for a synthesized diversity pointing application for either canceling or lobe pointing. Several such units have been reviewed in *QST* in the last few years.

Kit Assembly

The entire kit consists of roughly 20 components and, as such, should not take very long to build. Figure 9 is a 200% enlargement of the bare board. Although the PC board has the component locations clearly marked, the markings disappear once you insert a part. The two-time magnified copy will come in handy if you want to find a particular part that has already been mounted.

The assembly instructions can be summed up in a single word: excellent! The nine pages begin with a brief description followed by a suggested list of tools needed. This is followed by a list of optional tools, including my favorite — a cookie sheet to build on, and it also keeps parts from jumping onto the floor. If you have a piece of carpeting or a mat in front of your workbench, you also know why this cookie sheet is a good idea.



A set of some general construction suggestions are listed. For anyone who is not too familiar with soldering techniques, a reference tutorial is included. Figure 10 illustrates an addition to this list. Look in the "Community" section of the suggested reference for the tutorial. The spacing between solder pads on the board is very tight in some places. So, it's better to use a very small soldering tip versus a typical one.

The manual proceeds to show each component in a small photograph, so take it step by step, as though you have an advisor looking over your shoulder. By comparing the part and the illustrations, you should have no doubt what component goes where.

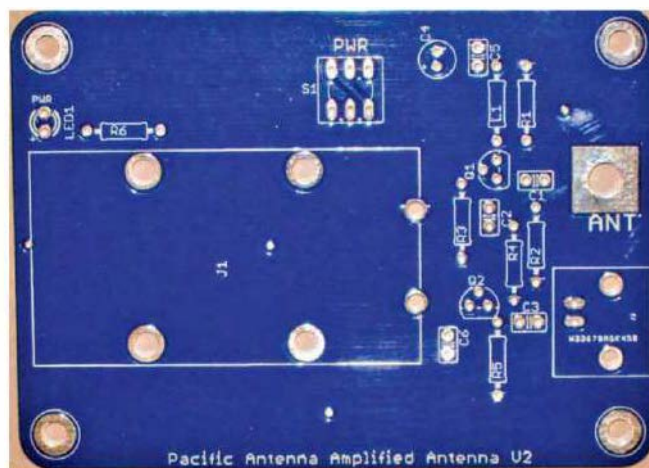


Figure 9 – A twice-magnified photocopy of the bare PC board layout.

Bottom Line

The Pacific Antenna Active Antenna Kit is a low-cost kit that's fun to build for beginners, and it can be useful for shortwave listeners.



Figure 10 — The smaller tip was easier to use than the larger, standard tip in several places. The top scale numbers are centimeters; the smaller divisions are millimeters.

A Few Suggestions

Some components come with a bit of tape on the end of their leads. These are a result of being supplied to commercial users for automated insertion machines. Removing the tape can be tedious; it is unnecessary — the leads are all long enough so you can just cut off the taped end.

You may decide to insert a few components in a group and then reverse the board. Then you can solder these components at the same time without having to flip the board over and over. The next step is to cut off the excess leads, as they all poke up from the solder. As you do, keep count of the number of leads you clip. If you come up with an odd number, this means you forgot to solder or clip one lead — they are usually in pairs.

The Board

The board is an industry-standard two-sided printed circuit board with traces on the top and bottom. Here is where a very small soldering tip might come in handy. The soldering pads surrounding the component lead holes are very small and very narrow. Use a bit of caution, and try not to overheat and destroy any of the pad surface. In many cases, the holes themselves are just big enough to be able to insert the component lead.

The board coating between solder pads serves to help you if you are too generous with the amount of solder used. It is nonstick; if you accidentally bridge two points with solder, the coating allows you to melt the solder and wipe out the excess.

If, for some reason, you do have to unsolder a component, or you accidentally splash solder into a hole that should be used for another component, you may have difficulty cleaning out the hole. If you do have to clean out a hole, check for continuity from the hole to the next connecting point. If there isn't any continuity, use an external jumper.

Tests at HF and VHF

Two sets of tests were run at HF: one at 40 meters and one at 10 meters. There is no way to specifically describe the results as either good (helpful in hearing

signals) or not helpful. When it is used, either with the included telescoping antenna or with a random wire extending the telescoping antenna, any signal may be raised as well as the noise. Whether this improved the readability of the signal or not is, to a good extent, in the mind (and ears) of the tester, and no specific answer can be given.

It was not possible to test the kit as a second antenna element for noise suppression or signal enhancements. However, previous product evaluation tests run here with several different diversity combiners, and a few antennas gave the same spread of results — sometimes yes, sometimes no, and most often cannot really tell.

For VHF, the test used a Yaesu VX-6, which had a 16-inch dual-band whip (145 and 430 MHz). The 162.55 MHz weather broadcast reception at my home is constant but marginal, and signal strength can be varied by changing the location slightly. With the Pacific Antenna unit connected in place of the 16-inch whip, the squelch break point had to be reset, thus showing that there was increased noise (and signal) using the active antenna instead of the usual whip.

Here, more than half the time, the signal readability was improved. Because there was equal gain in noise and signal, perhaps some could be related to the difference, depending on where the gain was applied with respect to where the bandwidth was limited in the narrow FM. No significant difference was seen when the mode was set to AM or wide FM.

One unexpected problem was found in this test with the VX-6. The output of the active antenna is a BNC connector. The VX-6 uses an SMA connector. Because I and many others, including companies advertising their products, are often unable to decide if a connector is male or female, my solution was to buy a set of SMA-to-BNC converting connectors of various polarities.

This kit is designed to allow for listening using a short (wavelength-wise) antenna in cases where a full-size antenna is not practical.

In Summary

Sometimes there was an increase in signal readability, and sometimes it was indecisive. The kit comes with a very good instruction manual and a low parts count, which is suitable for beginner and intermediate kit builders. Ultimately, its price and the fact that it's a fun kit to build make it worth the investment, and it can be handy for improving reception in certain situations.

Manufacturer: Pacific Antenna, P.O. Box 10301, Fayetteville, AR 72703, www.qrpkits.com. Price: \$25.

Ask Dave

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

Antenna and Feed-Line Options

Changing Feed-Line Length Changes SWR

Q Kevin Hastings, VE9XYZ, asks: If my Mosley TA-33 HF beam has very good resonant dips and the standing wave ratio (SWR) matches on all its bands, why does the resonant point change when I attach additional coax so that I can check it with my antenna tuner? I have seen this at the tower's splice box when testing the SWR. I thought that if the antenna showed a good $50\ \Omega$ match with a good $50\ \Omega$ feed line down the tower to the connection box, then adding another short length of $50\ \Omega$ cable to the antenna analyzer wouldn't matter. In other words, if the antenna is $50\ \Omega$, any length of $50\ \Omega$ cable should present a 1:1 SWR to the transmitter, right?

A I studied the assembly instructions for the Mosley TA-33 closely. The driven element is split in half, and the instructions say to connect the coax shield to one half and connect the coax center conductor to the other. This type of feed was the norm for many years. If your coax is connected in this manner, then the problem you are observing can be explained easily.

The Mosley TA-33 is a balanced antenna, but coax is inherently unbalanced. There should be a device or arrangement equivalent to a 1:1 balun between the feed line and the antenna just prior to the connection to the antenna. When you don't have a balun, the outside of the coax shield will conduct RF away from the unbalanced feed point, thus making it part of the antenna. This unwanted RF current is called a “common-mode” current, and it will happily radiate. If this current is not shunted to ground at some point (for example, by means of a grounded coupling at the base of the tower), it can actually travel back into your station, causing RF interference in your equipment.

Depending on how long the coax is, this unwanted current can appear as a different SWR. One way you might be able to tell is by running your hand along the coax or touching the SWR meter. If this causes any change to the SWR reading, you may very well be dealing with common-mode current. The common-mode current can also cause the frequencies showing the best SWR to change.

The solution is to prevent common-mode current. You can install a 1:1 balun at the feed point. You can purchase a transformer balun that can handle plenty of power such as the Balun Designs 1113, available at www.balun-designs.com/model-1113-1-1-balun-1-5-54-mhz-3kw or many other retailers. The other option is to create a choke balun. You can slip several ferrite sleeves over the coax just before the antenna's feed point. Or you can coil 10 turns or so of coax about 9 inches in diameter just before the feed point. These choke baluns do exactly what the name implies — they *choke* the common-mode current by creating a high impedance so that it won't go any further.

Let's consider what would happen if there was no common-mode current. A piece of software that comes with *The ARRL Antenna Book*, called *Transmission Line for Windows (TLW)*, analyzes what happens on a transmission line for a given antenna impedance. Figure 1 shows a snapshot of the *TLW* user interface. Note that there is an underlying assumption that there is no common-mode

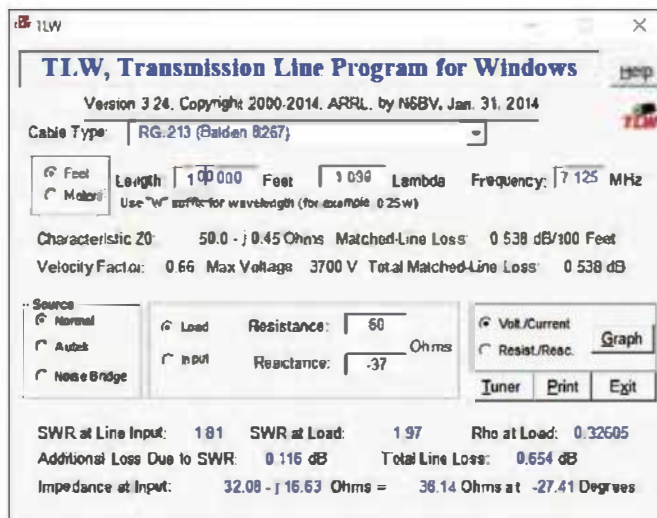


Figure 1 — *TLW* is software that accompanies *The ARRL Antenna Book*. There's an implicit assumption that there's no common-mode current. The software is remarkably useful, and some of its data is at an engineering level. In this example, 100 feet of RG-213 cable is connected to a mismatched antenna — in this case, $60\ \Omega$ resistive and $-j37\ \Omega$ reactive. The SWR at the transmitter end is 1.81:1. When I increase the line length to 150 feet, the SWR changes to 1.74:1. The slight improvement in SWR is due to additional line losses in the longer cable.

current. I ran sample numbers to show that adding or subtracting feed line from even a poorly matched antenna will have only an imperceptible effect on measured SWR at the transceiver end of the cable. SWR is a scalar number (it has no phase angle) and is a function of things not related to cable length.

All transmission lines have ohmic losses. If you put these into the SWR equation, you will find that the longer a lossy cable is, the more power is lost to heat, and thus there's less reflected power. Hence, the SWR falsely appears to be better than it really is. I assume you are using coax such as RG-8U, RG-213, LMR-400, or something equivalent.

Note a case where not all the cable is 50 Ω . Cable that is not 50 Ω , mixed with 50 Ω cable, will create some unusual reflections and possibly cause the SWR to behave oddly. (Many thanks to QST Technical Editor John Stanley, K4ERO, for setting this answer on the right track.)

Apartment Antenna Options

Q Pierre Dupuis, VE2MP, asks: I am moving into an apartment on the ninth floor with a balcony about 16 feet wide. I plan to use 10, 12, 15, and 17 meters only. I will use FT8. I know I will never get a DX antenna, though I will occasionally make contacts. What is the best antenna? A dipole like the Buddipole, a vertical, or a loop?

A No antenna is considered the best, but there are several choices. Many hams are in your situation, so manufacturers make antennas that work for apartments. All antennas for your situation, regardless of what you pay for them, will have unity gain (meaning the gain of a dipole).

The Buddipole can certainly work in the space you have. I am currently reviewing the Chameleon F-Loop 3.0 (also called a magnetic loop) antenna that has a remote tuning option that allows you to be inside while the loop sits on a table on the balcony. The MFJ-1788 antenna would also work. It is weatherproof and will handle a full 100 W.

No matter how you do it, you (and your neighbors) will be sitting close to an RF emitter. You may want to keep the power level down to about 25 W. You can get a more exact figure by using the ARRL RF Exposure Calculator at www.arrl.org/rf-exposure-calculator. Note that it asks you for the antenna gain. In free space, a dipole has about 2.15 dB gain over an isotropic radiator, but above real ground, the gain is more like 5 to 7 dBi. I ran several scenarios through the calculator for you and found that as long as you keep the power to about 50 W, you're likely

okay. If you sit out on the porch to manually tune a small (magnetic) loop, you'll want to cut your power more.

Coax Can Seem Like Magic

Q Lou Childers, N9LTW, asks: The coax for a new antenna and feed-line installation coming into my home will be routed fairly close to my air-conditioning service meter. If the coax is a few inches from internal house wiring, will it cause a problem or interference?

A Coax seems to obey magical laws if the outer shield is grounded properly at both ends. The point of coax is to ensure that what's inside stays inside and what is outside can't penetrate. You can run your coax near internal house wiring without issues. You can put it next to your electricity meter, and it won't matter. You can even run it between ground-mounted radials of a vertical antenna to attach to the antenna's feed point or run multiple coaxial cables taped together.

While this may not seem intuitive at first, you must understand that James Clerk Maxwell's equations describe nature properly. These equations define the electromagnetic field on scales from subatomic to intergalactic.

Note that the cables need to be properly grounded. Any transition from unbalanced lines, such as coax, to balanced devices, such as antennas, must be handled properly. Also, you need to use high-quality 100% shielded coax. Older coax designs such as RG-58 are not 100% shielded and can leak RF both in and out.

In properly designed and implemented coax installations, the entire electromagnetic field stays inside the coax. This is not true of other transmission lines, such as ladder line, window line, or twinlead, but Maxwell's equations describe these properly. They show that the electromagnetic field surrounds the parallel wire lines and extends beyond them. This is why such lines need to be away from walls, metal, water, and the ground to the farthest extent possible. While you can coil up excess coax, you cannot do this with parallel wire lines. The extra can be laid out on the grass in a random, non-crossing manner, or it will self-interfere. My personal favorite coax is RG-8X. I also use RG-213, LMR-400, and some from Messi & Paoloni. They're all 50 Ω coax and can mix and match.

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

Field Day — Safety First!



In this moonrise shot of our Field Day site, LED ground lighting (foreground) has been positioned to illuminate potential tripping hazards near the tent. [Bill Frantz, AE6JV, photo]

Expert advice on keeping your Field Day team out of harm's way in the heat of the contest.

Jim Peterson, K6EI, and Jim DeLoach, WUØI

It was the phone call that no ARRL Field Day coordinator wants to have to make: "Hello, 911, we have an injury here at Henry W. Coe State Park and need immediate assistance." During one of our events, a member of our group had tripped and fallen in the dark. Fortunately, the ambulance arrived quickly, and our friend's injuries turned out to be minor. But this incident got us thinking: What additional steps should we take next time to better protect our team from accidents and injury? In this article, we share what we are doing to keep our Field Day operation as safe as possible.

Planning Ahead for Safety

Planning for safety is as important as preparing the rigs and antennas for each band. Just like rig and antenna preparation, the steps each Field Day station takes to stay safe are different for each operation.

Our battery-powered, low-power Field Day takes place on a dry hill overlooking Silicon Valley. Fire safety precautions are critical. Our site has few trees, so our antennas are mounted on and between self-supported masts with numerous guy lines. Consequently, tripping hazards are a major concern. And with almost no natural shade from the California sun, heat is another issue.

Our site's safety planning therefore stresses fire prevention, minimizing tripping hazards, and managing heat and detecting its effects, along with emergency readiness. There are many other aspects to Field Day safety, and your operation may have different priorities, so be sure to review ARRL's list of tips at www.arrl.org/files/file/Field-Day/2022/2_2-FD%20Really%20Trying.pdf. To give you extra incentive to run a safe Field Day event, ARRL gives a 100-point bonus to groups that have an assigned Safety Officer and follow the types of precautions described in this article (see

Fire Risk

Canada and the western US have experienced increasingly severe wildfires over the past few years, and fire risk during the summer months is of special concern. Because our Field Day site is covered with dry vegetation and has no access to running water, we follow a zero tolerance approach to fire safety; no open flames of any kind are allowed at our site. This includes no smoking, as well as no camp stoves for food preparation. We have meals transported to our site instead.

We also ask each of our Field Day participants to consider bringing fire extinguishers from home. This usually results in six or eight fire extinguishers that we place throughout our site in highly visible and easy-to-access locations.

Tripping Hazards

Field Day can be chaotic with team members moving in all directions in an unfamiliar setting. With temporary antennas, masts, structures, and guy lines everywhere, tripping is a major hazard, particularly at night. Consequently, there are some basic precautions that we try to take each year.

We start by positioning our radio tents so that they surround a central social area with the antennas farther afield. This draws our site's foot traffic away from the guy lines and other tripping hazards of our antenna farm. Keeping all of the cables, power cords, and ropes away from areas where people might walk is critical. We flag all potential tripping hazards with yellow or orange caution tape (see Figure 1). We've found traffic cones to be especially handy for making hazardous locations visible if vehicles might be parked nearby. We also try to avoid using black, brown, or camouflage rope for our guy lines, instead using brightly colored rope whenever possible (see Figure 2).

Nighttime events can be problematic. Late-night operators may be less alert, and structures that are visually prominent in daylight often become totally invisible in the darkness. Our club has found that solar- and/or battery-powered LED landscape path lights (available at all major hardware stores) are a convenient way to provide lighting throughout our site (see the lead photo).

Having LED lighting at your site has an added benefit of reducing unwanted encounters with nocturnal wildlife. A favorite Field Day story of our club involves a late-night trek by one of our operators. After a long evening on single sideband, he had forgotten to bring a flashlight



Figure 1 — Use yellow or orange safety tape to flag all of the guy lines, and place traffic cones to keep vehicles in a safe place. [Steve Sergeant, KC6ZKT, photo]



Figure 2 — Bright neon rope is readily available and can make your guy lines more visible, which can significantly reduce the risk of tripping — or worse. [Jim Peterson, K6EI, photo]



Figure 3 — Use canopies to provide shade, and reflective material to keep tents cool. [Jim Peterson, K6EI, photo]

while on his way to the portable restroom. He was approaching his destination when, in the darkness, he stepped on something long and soft that moved — a large snake! Fortunately, he and the snake were unharmed, and it quickly disappeared into the tall grass.

Heat

Heat is another risk factor for almost all Field Day operations. As mentioned earlier, our club's Field Day site in California is on an open hilltop with few trees and limited shade. Most of our team members have indoor jobs during the week and are not conditioned for working outdoors in hot weather, which makes heat stroke a serious possibility. The risk is increased among older operators, especially as temperatures continue to rise. Here are some factors to consider in keeping your team safe in the heat.

Plan Early

While summer thunderstorms are not an issue here on the west coast, our local weather conditions in late June can range from pleasant (with highs of around 70 °F) to challenging (with temperatures well above 100 °F). As a result, we always factor the uncertainty of the weather into our contingency plans. A couple of days prior to Field Day, we review the predicted highs for the weekend. If temperatures are expected to exceed 95 °F, we adopt our plan B, which involves two changes: shifting our Friday-morning setup an hour earlier to take advantage of early-morning coolness, and scaling back the number of antennas we planned to deploy in order to reduce setup time. Additionally, if the temperature is expected to exceed 100 °F, we further reduce our antenna plans to a bare-bones deployment and potentially reduce the number of transmitters.

Keep Cool

Because of our site's limited shade, we have developed several mitigation strategies for keeping our operators cool and comfortable. The first tactic is to drape sheets of highly reflective Mylar® over the rain fly of each tent (see Figure 3). These are typically sold online as "Mylar emergency blankets." Sometimes we will also deploy an external awning above our radio tents. The combination of Mylar and secondary awnings has the added perk of cutting down on the glare inside each tent that would otherwise obscure a dim laptop screen. Portable, battery-powered misting fans that mount on 5-gallon buckets can also help keep operators comfortable.

Stay Hydrated

We always maintain a large dispenser of ice-cold water in the social area of our club's site, along with a second dispenser of lemonade. The lemonade option is especially popular at our site.

Be Vigilant

We make sure everyone on our Field Day team knows the signs of heat stress, which can include heavy sweating, cold/pale/clammy skin, nausea, vomiting, dizziness, and/or headache. You can see a more complete list of heat-related symptoms and precautions on the Centers for Disease Control and Prevention's website at www.cdc.gov/disasters/extremeheat/warning.html. Keep an eye out for symptoms, and don't hesitate to intervene with team members when needed. Be aggressive about encouraging your team to slow down or take a break.

The Takeaway

Field Day safety should not be an afterthought. Think ahead of time about what your Field Day site's risks are, and encourage your teammates to be aware of their surroundings. A great motto for any Field Day site is "If you see something unsafe, report it and fix it." After all potential problems are addressed, you can focus on having a good time and good luck during the event!

Jim Peterson, K6EI, has been a ham for more than 50 years. Jim recently retired after nearly 4 decades as a systems engineer at Northrop Grumman, and ham radio has become his primary focus. His interests include contesting, chasing DX, operating portable, and coordinating the West Valley Amateur Radio Association's (WVARA's) annual Field Day event. You can reach him at k6ei@arri.net.

Jim DeLoach, WUØI, when not at home with WVARA, brings Field Day along on his summer road trips. Jim's most recent trips took him to Michigan's Upper Peninsula, Indiana, and Alaska. You can reach him at jim@deloach.net.

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



Five Lessons Learned from Low-Power SSB Field Day Operations

Find out how to make the most of your low-power operations during a high-density contact event.

Jack Purdum, W8TEE, and Al Peter, AC8GY

We participated in the 2022 Field Day using our homebrew open-source T41-EP. By operating SSB with this low-power software-defined transceiver (SDT), we learned how to effectively use low power in a high-density contact environment.

Operating Setup

The T41-EP is a homebrew five-band HF transceiver that's capable of up to 20 W of power using SSB or CW. Unlike many other SDTs, the T41-EP doesn't require an external computing device or software. All you need to operate it in the field are a power source, a microphone or key, and an antenna. The T41-EP can view up to 190 kHz of band spectrum, versus as little as 15 kHz for other, smaller SDTs; spectrum width can make a huge difference when operating.

We wanted to embrace the true spirit of Field Day by getting close to nature, practicing operating off the grid, exercising emergency operations, and testing our overall operating skills. We used a battery power source, a microphone built from an inexpensive electret microphone cartridge housed in a 3D-printed case, and an end-fed half-wave antenna.

Lessons Learned

Lesson #1 — A 20 W SSB signal is likely the penultimate signal in a pileup.

We fired up the T41-EP, called a few CQs, and were greeted with several contacts, including a 5-9 plus 10 dB from Alabama. Because we were operating with less than 20 W, we were happy with these test calls. But we knew that making contacts was going to be difficult because the band was almost completely silent. Then, at 1900 UTC, an avalanche of RF hit the antenna — the spectrum display looked like the cutting edge of a chainsaw.



The T41-EP software-defined transceiver

We were on 7.2 MHz when we finally heard someone call CQ Field Day. We returned their call — as did about 1,000 other operators, placing our signal almost last in the order of the pileup. After the station finished their exchange, rather than answer, we listened to the pileup, and it was impressive.

Lesson #2 — Be patient and listen.

The spectrum display can identify strong signals that become good targets for potential contacts. This technique is well known as “hunt and pounce.” However, there are several thousand other hams doing exactly the same thing. Listen to callers' responses after their CQ and before you try to answer their call.

Lesson #3 — Use the hunt, listen, evaluate, and pounce technique.

Look at the spectrum display for strong signals, but also listen to the depth of CQ responses. This can be done using a technique that we like to call “hunt, listen, evaluate, and pounce” (HLEP). HLEP (pronounced H-LEP) uses the spectrum display to identify (hunt) strong stations. Next, you need to listen for a pileup after operators finish their calls. Then, you can evaluate your chances of breaking that pileup with 20 W. If there are only a few stations answering the call, then attempt to pounce. If the station is still working a pileup, move on to a new signal.

Hams often think that competing stations will bury their low-power pounce attempts. This may happen, but keep in mind that a strong signal can result for multiple reasons. One explanation is that the operator is running

a kilowatt into a 100-element Yagi at 200 feet. If so, it's likely that everyone else on the planet hears them equally as loud as you do. However, in other situations, the atmospheric conditions may cause a skip between two stations. That is, you are both spatially positioned in such a way that each other's signal is clear, independent of the power levels involved. Because that connection is spawned by propagation rather than power, it's possible other hams aren't hearing that station as well. Also, if propagation is good, your reduced power is going to be heard by that operator far better than your low power would normally warrant.

Lesson #4 — If Lesson #3 yields little or no pileup, send a pounce call.

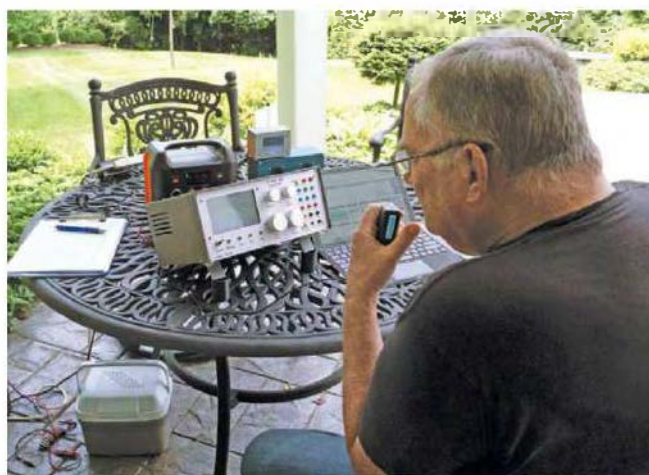
While HLEP is a minor variation of the hunt and pounce technique, it works well for those of us who are using low power. The difference is listening to see if there's a pileup, so you don't waste time jousting with windmills.

Lesson #5 — If time constraints force a choice, operate during the second day of the event.

About 20 minutes after Field Day began, we were ready for the pounce component of our HLEP sequence. But after pressing the microphone button, we didn't get any responses. After a few false starts, the microphone kicked in, only for the same thing to happen again. It turned out that one of the wires in the microphone cable had a break in it, causing intermittent failures. After Al replaced the cable, the microphone performed flawlessly. We were back on track and headed for fame and glory, when Al had to leave to tend to a family emergency. Because I didn't know how long he would be gone, I left and set up the T41-EP at home using a lithium polymer (LiPo) battery pack that I've used with other QRP radios — it was not good. The T41-EP would reboot itself any time I responded to a call or pressed the microphone button.

I called Al, and he suggested that the microcontroller might be starved for power and that the voltage drop could be causing the reboots. I replaced the LiPo battery with a small motorcycle battery, and the T41-EP was back on the air.

Despite spending the majority of our first day troubleshooting, it led to us discovering that by the second day of the event, most of the high-power stations had already contacted each other and were now listening for low-power operators. Our contact rate on day two was more than twice that of day one.



Jack Purdum, W8TEE, operating the T41-EP during the 2022 Field Day. [Jack Purdum, W8TEE, photo]

In Summary

Since operating in the 2022 Field Day, the T41-EP is now a seven-band radio (as opposed to five-band). While there have been a number of improvements in the SDT, none of them materially affect its routine performance.

We believe that operating low power is a viable choice, even in a highly competitive event like Field Day. However, if your goal is to earn a high score, operating low power won't get you there. But that's why there are participation classes that have power restrictions. To us, the real reason for Field Day is to enjoy the challenges of operating off the grid while having fun!

Jack Purdum, W8TEE, has been licensed since 1953 and has been an ARRL Life Member since 1972. He's a retired professor from Purdue University, where he taught various programming courses. Jack enjoys writing and is the author of 20 programming books and dozens of magazine articles. He likes building microcontroller projects to augment his love for QRP operating and is an ardent supporter of all things open source. Jack can be reached at jjpurdum@yahoo.com.

Al Peter, AC8GY, has been a ham since 2010 and an electronics builder and experimenter since the 1960s. He has degrees in physics and mechanical engineering. Al was founder and CEO of a major engineering consulting and software company specializing in CAD and related software and has extensive computer and software experience. He has designed and built numerous microcontroller ham radio projects that have been featured in published articles. Al has also built an add-on board for the uBitx, a high-performance signal generator, and a scalar network analyzer, among other high-end and economical tools for the ham shack. He is the designer of the T41-EP SDT transceiver hardware. Al can be reached at albertfpeter@gmail.com.

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



FCC to Require Two-Factor Authentication for CORES Users

The Federal Communications Commission (FCC) announced a change to the COMmission REGistration System (CORES) that licensees use to pay any application or regulatory fees, manage or reset a password on an existing FCC Registration Number (FRN), or request a new FRN. Since March 29, 2024, multi-factor authentication has been implemented. Users are prompted to request a six-digit secondary verification code, which is sent to the email address(es) associated with each username. The user needs to enter the code into CORES before they can continue.

In a public notice (see <https://docs.fcc.gov/public/attachments/DA-24-219A1.pdf>), the FCC said this change makes the system more secure. "This additional layer of security will further safeguard against unauthorized access, thereby enhancing the overall integrity of information contained within the CORES system and improving the security of user data," it read.

The FCC recommended that users confirm they have access to their username account email and to add a secondary email address, if need be.



Resources are available for those who need assistance with the system. For inquiries regarding the implementation of multi-factor authentication on CORES, submit a help request at www.fcc.gov/wtbhelp, or call the FCC at 877-480-3201 (Monday – Friday, 8:00 AM – 6:00 PM ET).

Amateur Radio Importance Highlighted at National Hurricane Conference

The 2024 National Hurricane Conference was held on March 25 – 28 in Orlando, Florida. Amateur radio was well represented at the event. A series of workshops focused on amateur radio's involvement in hurricane tracking, coverage, and recovery.

Assistant Amateur Radio Coordinator of WX4NHC, the amateur station at the National Hurricane Center (NHC), Julio Ripoll, WD4R, was one of the presenters. Ripoll gave a history of amateur radio's involvement in the NHC, including the use of tube radios in the 1980s and the station's Yaesu FT-DX1200 used today. WX4NHC is also equipped with VHF/UHF radios to access the Florida Statewide Amateur Radio Network and digital equipment to



WX4NHC Assistant Amateur Radio Coordinator Julio Ripoll, WD4R. [Jim Palmer, KB1KQW, photo]

communicate with the Voice over Internet Protocol Hurricane Net, the Internet Radio Linking Project, and Winlink to receive emails via amateur radio.

"We were the only means of communication between the NHC and the National Weather Service Field Office in Slidell, Louisiana, during Hurricane Katrina," Ripoll said. He went on to highlight other instances of ham radio reports that provided mission-critical information and had a major impact on the way the NHC handled storms.

ARRL Director of Emergency Management Josh Johnston, KE5MHV, gave a presentation to the crowd of hurricane experts, meteorologists, and emergency managers about the Amateur Radio Emergency Service® (ARES®).

He spoke of ARRL's role on the board of SAFECOM, a program managed by the Cybersecurity and Infrastructure Security Agency



ARRL Director of Emergency Management Josh Johnston, KE5MHV. [Jim Palmer, KB1KQW, photo]

(CISA) that sets the standards of interoperability procedures. Being a part of the group solidifies the Amateur Radio Service as a robust resource before and during times of crisis.

Johnston shared that in 2023, ARES volunteers contributed at least \$21.8

million in volunteer hours to their local communities. "Is amateur radio still relevant? Absolutely! Are we still involved in the places that are doing things the right way? Amateur radio absolutely is," he said.

Johnston highlighted the relationship between ARRL and the Federal Emergency Management Agency, as well as ARRL's position as a net control station within the SHARED RESources High Frequency Radio Program managed by CISA.

Another presenter was Editor of ARRL's *The ARES Letter* Rick Palm, K1CE. He shared a harrowing tale of his family experiencing a direct hit from Hurricane Idalia in August 2023. The damage and impact he felt gave him a new perspective on emergency communications, as he went from a volunteer communicator to a storm victim. Read more about



Editor of *The ARES Letter* Rick Palm, K1CE. [Jim Palmer, KB1KQW, photo]

his experience in the "Public Service" column in the January 2024 issue of *QST*.

Watch a video of the amateur radio workshops at the 2024 National Hurricane Conference on YouTube (www.youtube.com/watch?v=-43X6wVrqwA), courtesy of Jim Palmer, KB1KQW.

Ham Radio Active during Eclipse

Millions of people across the US got to see a rare solar eclipse on April 8, 2024. The path of totality — the line of darkness where the moon fully occluded the sun — stretched through the South Pacific, Mexico, central Texas, the Ozarks, the midwest, the Rust Belt area, and to New England through the Maritimes. In all, 14 ARRL Sections were directly impacted, and several more were on the fringes of the solar umbra.

Radio amateurs were activated in many locations. In Paris, Texas, hams split shifts at the Lamar County Emergency Operations Center (EOC). Teams of two operators volunteered for 4-hour shifts. The activation doubled as a training opportunity and an equipment test.

The ARRL Indiana Section was in full force with their Amateur Radio Emergency Service® (ARES®) member-volunteers providing radio coverage on HF, VHF, and UHF amateur bands and utilizing the General Mobile Radio Service. While using a mobile command center dubbed "Big Blue," the ARES team in Lake County set up on an overpass above Interstate 65 and was staffed in part by father-and-son volunteer team Chris Lattimer, N9MMR, and Tavas Lattimer, KD9NSC. The Section also utilized Winlink VARA HF to establish a digital connection with the incident command system. In Hamilton County, ARES members volunteered with the county



From left to right: Bill Townsend, KJ5ABG; Jeff Laughlin, KJ5DNA, and Dr. Randy Holland, N5DDDS, at the Lamar County EOC in Paris, Texas. [Steven Lott Smith, KG5VK, photo]

emergency management teams. They fanned out across EOCs, parks, and other locations. One ARES member, who is also active in the Civil Air Patrol, monitored traffic and crowds from an airplane.

Section Emergency Coordinator of the ARRL Maine Section Keith Anoe, KE4UCW, held hourly radio

check-ins with the Maine Emergency Management Agency and other served agencies, in case one of them needed to activate the Maine Emergency Communication Net.

Social media posts throughout the amateur radio space held anecdotes of 146.52 MHz being extremely active during the post-eclipse traffic jam.

In Vermont, several ARRL members, who also happen to be pilots, gathered at the Northeast Kingdom International Airport in Newport to watch the eclipse.

Outside ARRL Headquarters in Newington, Connecticut, staff members and headquarters volunteers took the opportunity to observe the 92% visible eclipse using a solar viewer built by W1AW Station Manager Joe Garcia, NJ1Q.

Across the world, radio amateurs participated in the Ham Radio Science Citizen Investigation (HamSCI) Solar Eclipse QSO Party. It involved operating before, during, and after the eclipse to gather log data. Those logs will be studied by researchers in the coming years to further investigate the sun's impact on the ionosphere.

HamSCI's program leader, Dr. Nathaniel Frissell, W2NAF, was active

from The University of Scranton Amateur Radio Club station. "I'm happy to report that we had an excellent day at W3USR in Scranton and believe that we both had fun and collected good data," he wrote in a message to the HamSCI team.

The organizers request that those who operated in the event upload their logs. If you used *N1MM+* or *N3FJP* loggers, there's a setting for the Solar Eclipse QSO Party. Participants can also submit a Cabrillo or an ADIF file of their activity. All logs should go to <https://seqp.contesting.com/seqpsubmitlog.php>.

New England Division Convention to Celebrate 100th Anniversary

This year marks the 100th anniversary of the first ARRL New England Division Convention. While New England Division conventions have been held over a 100-year span beginning in 1924, there haven't been 100 annual conventions. New England's first ARRL-sponsored Division Convention was held in Springfield, Massachusetts, on March 28 – 29, 1924. Many Division conventions would later go on to be held in Boston, Rhode Island, and Connecticut.

The 2024 New England Division Convention, hosted by the Northeast HamXposition, will be held August 22 – 25 in Marlborough, Massachusetts. While it will share a number of traits with previous conventions, it will have several important distinguishing features.

Festivities will start on Thursday night with a comedy act by nationally known comedian Juston McKenney. Youth activities will be emphasized throughout the weekend. Youth organizations and displays, kit

building, Morse code sending, and the groundbreaking Radiocraft Project (a mod that adds ham radio to the highly popular Minecraft video game) will dominate the hotel lobby area.

HamXposition's theme for 2024 will be Parks on the Air (POTA). A POTA track of talks, workshops, and even an activation at a nearby park are planned.

An emergency communications (EmComm) track will again be offered, complemented with a display

of EmComm trailers and vehicles in the venue parking lot. In addition, contesting and low-power operating tracks will round out the jam-packed convention program.

Finally, HamXposition will feature a live Get on the Air station operating under the Convention's club call sign, W1XPO. Newly licensed amateurs will have an opportunity to operate under the guidance of mentors provided by Rhode Island's Providence Radio Association. For more information, visit www.hamxposition.org.



A crowded hallway at the 2023 Northeast HamXposition. [Rusty Moore, K1FVK, photo]



EmComm Tests in Bosnia and Herzegovina

On February 24, 2024, the Asocijacija Radioamatera u Bosni i Hercegovini participated in an emergency communications exercise to test the effectiveness of the Winiink network in Bosnia and Herzegovina, as well as beyond.

The control station for the exercise was E79RZE. According to coordinator Alen Ruvić, E71AR, the exercise primarily relied on VHF Winlink stations but also included some HF activity. Participating stations exchanged detailed weather reports to simulate emergency traffic.

A New Beacon for Central America

The Belize Amateur Radio Club (BARC) has established a CW propagation beacon on 10 meters. BARC beacon representative Joseph Terry,

V31XE, has started operating the beacon on 28.258 MHz with the call sign V31HQ/B. Signal reports can be emailed to beacon@barc.bz.

Long Live the King

Frederik X is the new King of Denmark. He acceded to the throne following the abdication of his mother, Queen Margrethe II, on January 14, 2024. The Experimenterende Danske Radioamatorer celebrated with a 5-day on-air event featuring six unique call signs and 25 operators distributed throughout the country. The event stations racked up a total of 23,206 contacts with more than 9,000 amateurs in 125 countries. Operating modes included CW, phone, RTTY, FT4, FT8, and several other digital modes.



Denmark's new king, Frederik X. [Royal House of Denmark photo]

According to awards manager Carsten Gjessing, OZ4CG, thousands of certificates had been distributed as of press time.

Earthquake Tests Peru's New EmComm Director

The Board of Directors of the Radio Club Peruano has appointed César Brousek, OA4CLU, as the new Direc-

2024-02-17 18:06	2024-02-17 18:06	260	E79RZE	E79RZE	E79RZE	RA20Ved
2024-02-17 18:06	2024-02-17 18:06	260	E79RZE	E79RZE	E79RZE	e79rzm
2024-02-17 18:06	2024-02-17 18:06	1910	SMTP	SMTP	SMTP	SMTP
2024-02-17 18:06	2024-02-17 18:06	972	SMTP	SMTP	SMTP	SMTP

Message ID: V31XEJY66R	Date: 2024/02/17 18:52 (UTC)
From: S50AJM	To: E79RZE
CC: e79rzm, e79rzm@e79rzm.com	Source: S50AJM
Downloaded from: Telnet:om.winlink.org	Location: 45.812500N, 15.125000E (GRID SQ02JG)
Subject: WX Report: Gorenjska vas pri Smarjeti 54, Smarjanske Toplice, 2024-02-17 18:52:26	

CURRENT LOCAL WEATHER CONDITIONS

** THIS IS AN EXERCISE **

Call sign: S50AJM

Observer Name: Sinisa

Date/Time: 2024-02-17 18:52:26

Location: Gorenjska vas pri Smarjeti 54

Coordinates: LAT: 45.812500 LONG: 15.125000

City: Smarjanske Toplice County: State: SI

Current Conditions: PARTLY CLOUDY

Temperature: 16.3°C

Humidity: 53%

Dew Point: 10.1°C

Barometer: 1025.5 millibars Three hour trend: Steady

Wind Speed: 3.34 mph | 5.38 km/h Direction From: JZ

Wind Gust: 4.44 mph | 7.15 km/h Gust Max: 4.44 mph | 7.15 km/h

Rain 1 HR: 0.00 inches | 0.00 millimeters Rain Total: 0.00 inches | 0.00 millimeters

Snow 1 HR: 0.00 inches | 0.00 centimeters Snow Total: 0.00 inches | 0.00 centimeters

NWS Level: Not issued

◀ An example of a weather report submitted to E79RZE via Winlink during the emergency exercise in Bosnia and Herzegovina in February 2024. [Asocijacija Radioamatera u Bosni i Hercegovini image]



▲ César Brousek, OA4CLU, the new Director of Peru's National Amateur Radio Emergency Network. [César Brousek, OA4CLU, photo]



Station 4S7RS was a major attraction at the 10th National Scout Jamboree in Trincomalee, Sri Lanka. [Radio Society of Sri Lanka image]

tor of the National Amateur Radio Emergency Network. One of his first challenges was a 5.2-magnitude earthquake that occurred on February 15, 2024.

The quake struck at 15:53 local time, with an epicenter about 8 miles north-northwest of Chancay and 40 miles northwest of Lima. The tremor occurred at a depth of 41 miles, and moderate shaking was felt throughout parts of central and western Peru, including Lima, Ancash, Ica, and Huancavelica. Fortunately, there was minimal damage.

César reported that Peruvian amateurs responded quickly and effectively. However, he also said that interference was a frequent problem, and he added that during future events, stations should refrain from

transmitting if they do not have damage to report.

Radio Society of Sri Lanka Welcomes Scouts

The 10th National Scout Jamboree in Trincomalee, Sri Lanka, held on February 20 – 26, 2024, gathered Scouts from across the globe. At the heart of the gathering was the 4S7RS special event station organized by the Radio Society of Sri Lanka.

The Jamboree attracted an impressive crowd of around 12,000 Scouts from Sri Lanka and 28 other countries. 4S7RS was on the air from February 20 to 25 and counted more than 4,000 visitors.

The manager of 4S7RS was Jaliya Lokeshwara, 4S7JL, and he was supported by a dedicated team that included Singhe Wijesinghe, 4S6LEO; Mitsuka Katururunda, 4S6MKM; Nalantha De Alwis, 4S6NAX; Priyankara Perera, 4S5PRI; Jongwook Kim, 4S5KMG; Shamim Ahmed, 4S6SCO, and Nalin, 4S6CNH.

Ofcom Decisions Announced

The Office of Communications (Ofcom) is the government-approved telecommunications-regulating authority in the UK. Earlier this year, Ofcom announced its final decisions

regarding changes to the UK amateur radio licensing system.

Changes include the optional use of Regional Secondary Locators, increased transmitter power levels, and measures designed to bring more newcomers into amateur radio. There are presently less than 100,000 amateurs in the UK.

Throughout 2024, Ofcom will contact all licensees to provide them with their new license documents. Ofcom is aiming to reissue all UK amateur radio licenses before the end of the year.

Further updates to the amateur radio licensing framework, including the issuing of M8 and M9 Intermediate call signs, will be rolled out in two more phases later this year and in 2025.

The Radio Society of Great Britain (RSGB) has published a video, "Updating the amateur radio licensing framework: RSGB overview of key changes," at <https://youtu.be/JZZCqcl6CSY?si=6jCu0m6ZW8mwnbTQ>. In the video, RSGB General Manager Steve Thomas, M1ACB, and RSGB Spectrum Forum Chair Murray Niman, G6JYB, discuss the impact of the new rules.

Our thanks to the RSGB for its contributions to this report.



Jaliya Lokeshwara, 4S7JL, surrounded by curious Scouts at the Radio Society of Sri Lanka exhibit. [Radio Society of Sri Lanka photo]



RSGB Spectrum Forum Chair Murray Niman, G6JYB, discusses the impact of the new Ofcom rules at <https://youtu.be/JZZCqcl6CSY?si=6jCu0m6ZW8mwnbTQ>. [Radio Society of Great Britain photo]

Public Service

An In-Depth Look at Incident Action Plans

Incident Action Plans (IAPs) are used thousands of times per day across the country to help manage incidents and coordinate resources. In this month's column, Hingham, Massachusetts, Deputy Fire Chief and Deputy Emergency Management Director Lou Lachance, KC1PXN, talks about the Incident Command System (ICS) and IAPs and suggests how you can use them during your Field Day operations.

Oftentimes, IAPs are kept inside the head of an Incident Commander (IC) and never written down. A written IAP is used for complex or long-duration incidents that usually involve multiple agencies and disciplines and may include local, state, and federal resources, volunteers, and non-governmental organizations.

It's important to know how to manage large-scale incidents, such as a wildfire crossing local, state, federal, and tribal borders, by implementing the ICS and defining roles and responsibilities. The ICS uses a series of forms that convey information, such as objectives and responsibilities, to help identify the who, what, when, where, and why of an incident. Completing the various ICS forms and compiling them into one document creates a play-book of sorts for each incident, helps to get everyone on the same page, and maintains order.

An Invaluable Resource

ICS forms are completed by those filling the various roles in the ICS, and every form may not need to be filled out. Table 1 shows which roles are responsible for commonly used forms.

The ICS is great because it's adaptable to small, large, emergent, and non-emergency situations. The ICS and IAPs can be used for real-world emergencies, training exercises, and non-emergencies, like a marathon, parade, or local fireworks event. I develop an IAP for several routine events held throughout the year in my community. This way, if something ever happens, we already have a written plan in place that defines roles and responsibilities and will significantly reduce panic and confusion.

We have already identified who is in charge, who reports to whom, where the evacuation routes are, details of first aid stations, where emergency vehicle access is, and what the egress routes are; the plan is ready to go at a moment's notice.

Table 1 — Commonly Used ICS Forms in IAPs

Form Number	Form Title	Preparer of Form
ICS-201	Incident Briefing	Initial Incident Commander
ICS-202*	Incident Objectives	Planning Section Chief
ICS-203*	Organization Assignment List	Resources Unit Leader
ICS-204*	Assignment List	Resources Unit Leader and Operations Section Chief
ICS-205*	Incident Radio Communications Plan	Communications Unit Leader
ICS-205A*	Communications List	Communications Unit Leader
ICS-206*	Medical Plan	Medical Unit Leader (reviewed by Safety Officer)
ICS-207	Incident Organization Chart	Resources Unit Leader
ICS-208*	Safety Message/Plan	Safety Officer
ICS-209	Incident Status Summary	Situation Unit Leader
ICS-210	Resource Status Change	Communications Unit Leader
ICS-211	Incident Check-In List	Resources Unit/Check-In Recorder
ICS-213	General Message (three-part form)	Any Message Originator
ICS-214	Activity Log (two-sided form)	All sections and units
ICS-215	Operational Planning Worksheet	Operations Section Chief
ICS-215A	Incident Action Plan Safety Analysis	Safety Officer
ICS-218	Support Vehicle/Equipment Inventory	Ground Support Unit
ICS-219-1 to ICS-219-8, and ICS-219-10	Resource Status Cards (T-Cards)	Resources Unit
ICS-220	Air Operations Summary	Operations Section Chief or Air Branch Director
ICS-221	Demobilization Check-Out	Demobilization Unit Leader
ICS-225	Incident Personnel Performance Rating	Incident Supervisor

*Critical forms that should be included in every IAP.

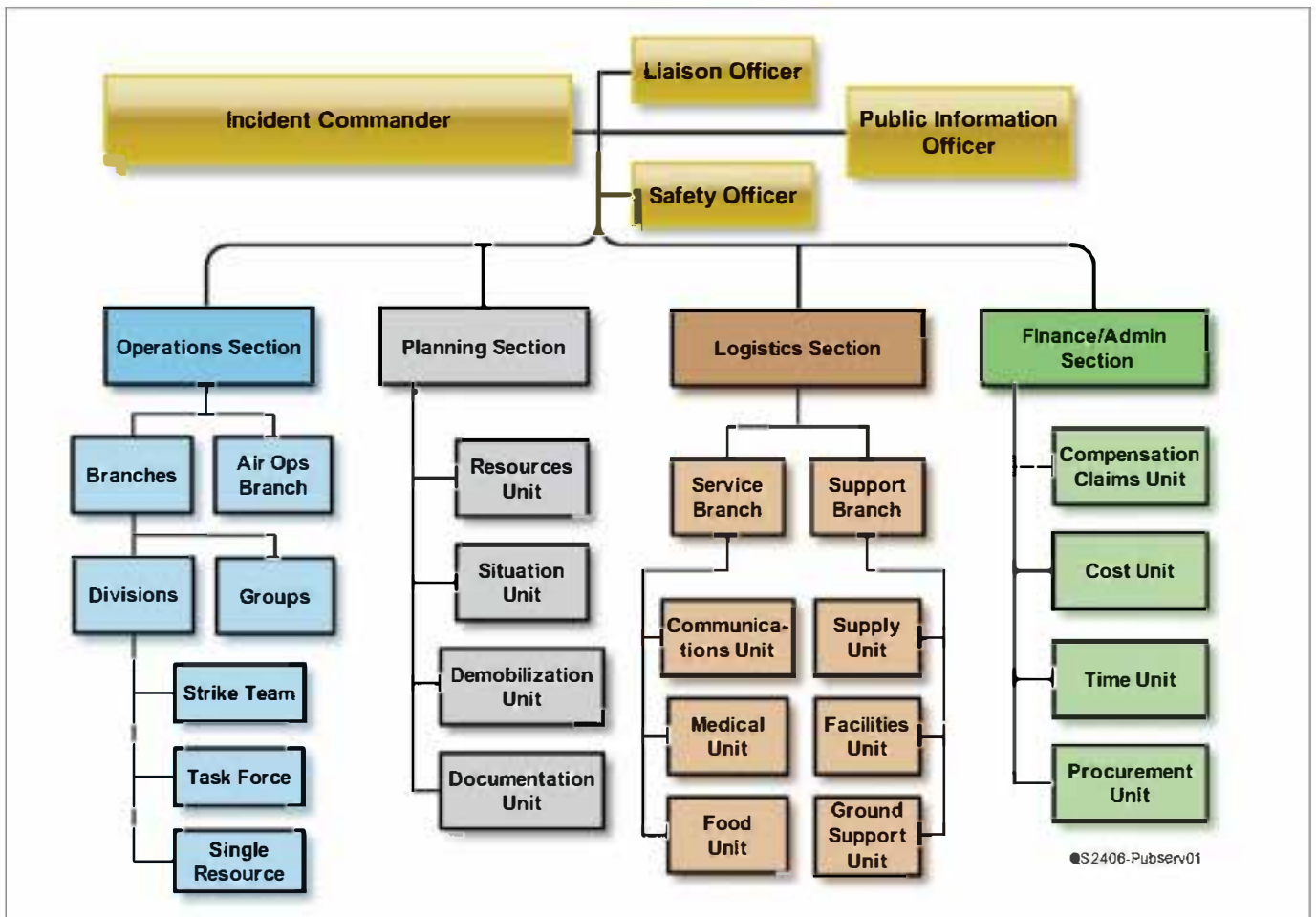


Figure 1 — Incident organization chart example.

Utilizing IAPs during Field Day

Amateur radio clubs should consider completing the ICS forms and developing an IAP for ARRL Field Day. While only a few positions may need to be filled (see Figure 1), you can identify who is responsible for what.

For Field Day, the Operations Section can be responsible for setting up the radio stations and generators and deploying wire or portable antennas. The Planning Section should coordinate with all the other sections to determine who needs what, as well as oversee the entire development of putting the plan together. (Many ICs believe that the Planning Section Chief has the most challenging job during a large-scale incident.) The Logistics Section can gather the supplies required for radio operation and for the facilities (tents, bathrooms, food, etc.). The Communications Unit also falls under the Logistics Section, and should be tasked with developing the Incident Radio Communications Plan (ICS-205). Consider having your club's Secretary/Treasurer be the lead of the Finance/Administration Section so they can track any costs associated with Field Day.

Having a Safety Officer is critical, as they are responsible for identifying and mitigating possible hazards. For example, if the operations personnel are focused on deploying antennas, they might not realize how close they are to overhead power lines. The Safety Officer looks at the big picture, while operations personnel are more focused on their individual tasks and may not notice what's happening around them. Not all positions need to be filled for every event, but a Safety Officer should always be established.

Public Safety Officials often receive requests for public records from the media or citizens, but these requests should be directed to the IC or Public Information Officer. When releasing ICS forms, be sure to redact phone numbers and transmit tones for any public safety agencies listed.

Getting Started

ICS classes are available through FEMA's website (<https://training.fema.gov/emiweb/is/icsresource/trainingmaterials>) at no cost, and fillable ICS forms can be found at <https://training.fema.gov/icsresource/icsforms.aspx>.

2024 ARRL FIELD DAY GUIDE



QST Field Day Section, June 2024
Sponsored by Icom America
www.icomamerica.com

Field Day is where the FUN begins

Additional bands and bonus points



*Optional
CX-10G
10GHz Transverter

IC-905
2M / 70CM / 23CM / 13CM / 5CM



IC-9700
2M / 70CM / 23CM



IC-7300
HF / 6M



IC-7610
HF / 6M

For the love of **ham radio.**



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Understanding the Field Day GOTA Station

BY ARRL CONTEST PROGRAM MANAGER PAUL BOURQUE, N1SFE

Anyone can get on the air during ARRL Field Day, also known as amateur radio's open house. Event rules allow group participants to set up a dedicated Get on the Air (GOTA) station so that new, inactive, and inexperienced hams, as well as visitors from the general public, have the opportunity to experience the excitement of amateur radio.

Station Rules and Operations

The frequency privileges of a GOTA station are dependent on the license held by the control operator overseeing the operations. For example, if an unlicensed visitor or a Technician-class licensee is operating the station while a General- or Amateur Extra-class control operator is present, they may operate in the General or Amateur Extra portions of the bands.

While a different call sign than the one used by the parent (Class A) station must be used, the exchange is the same as the parent station.

The ARRL Field Day rules don't preclude seasoned hams from operating GOTA stations. If a more experienced operator wants to try out a band or mode they don't normally use, that would be well within the purpose of the GOTA station. For example, if an active General-class licensee has never operated HF and wants to try working 20-meter SSB for the first time, they could use the GOTA station to do so.

Tips for a Successful GOTA Station

1. Prior to Field Day, recruit club members to act as GOTA coaches, and create a schedule to make sure someone is available at the station during periods when visitors may be present to greet and assist them. I recall going to Field Day right after I received my license, and everyone was so focused on making contacts that no one even acknowledged me. Needless to say, I didn't stick around very long.
2. Let the public know that your Field Day location will have a GOTA station. The ARRL Field Day Station Locator (www.arrl.org/field-day-locator) can help get the word out and promote your group's event. Use the locator to add your Field Day location to the map. Remember to also include your contact information and if you'll have a GOTA station.
3. Set up your GOTA station in a spot that will attract visitors. It should be accessible and inviting, as well as



Micah Gallant, VY2MIC, and his daughter Arden Gallant, VY2ALG, operated the Charlottetown Amateur Radio Club's GOTA station from Victoria Park on Prince Edward Island, Canada, during the 2023 ARRL Field Day. A total of six new hams, two of which were youth, made their first HF contacts using the club's GOTA station. [Micah Gallant, VY2MIC, photo]

organized and uncluttered. Consider putting up a sign or banner so it can be easily found.

4. Create a written script of the on-air exchange and post it prominently at the control point. Make sure the phone operators are comfortable sending and copying phonetics. Have a band chart and information about the radio's operation readily available.
5. Make sure everyone who wants to operate the station gets the chance to do so. There's no time limit for GOTA operators, but if there's a line of people waiting to use the station, common courtesy dictates that everyone should get a turn.

Station Benefits

A successful GOTA station helps make the public and amateur radio newcomers aware of all the excitement that the hobby can offer, and it can also earn your club's Field Day operation some bonus points! Contacts made by GOTA operators not only count toward your main station's contact total, each GOTA contact is worth an additional five GOTA bonus points. This is a great incentive for having a GOTA station at your club's Field Day event. See section 4.1.1 of the ARRL Field Day rules at www.arrl.org/field-day-rules for more information.

We hope to hear you on the air on June 22 and 23 for 2024 ARRL Field Day!

Improve Your Field Day Operations with Band Planning

BY CARL LUETZELSCHWAB, K9LA

ARRL Field Day is a time to enjoy camaraderie with other hams, to develop skills that meet the challenges of emergency preparedness, to learn how to operate in abnormal situations in less-than-optimal conditions, and to acquaint the general public with the capabilities of amateur radio. Of course, it's also a time for making lots of contacts. Here are some guidelines for how to do just that.

Field Day operations begin at 1800 UTC on Saturday, June 22, which is 2:00 PM on the east coast and 11:00 AM on the west coast. Thus, everyone starts operating in the daylight, goes through the hours of darkness, and ends in daylight on Sunday, June 23. There are six elements that affect which bands are available during these times: the solar cycle, the ionosphere, band characteristics, sporadic E, propagation disturbances, and your Field Day site.

1. The Solar Cycle

We're more than 4 years into Solar Cycle 25, and we're close to solar maximum. Right now, Cycle 25 is stronger than Cycle 24 (which was the fourth smallest in recorded history), but not by much. Thankfully, it's still strong enough to give us propagation on 15 and 10 meters (and sometimes on 6 meters) for several years at appropriate daily and seasonal times.

2. The Ionosphere

Due to solar radiation at various wavelengths impinging on our atmosphere, three regions are formed in the ionosphere: the F region (which can split into the F1 and F2 regions during the day, but we'll focus on the F2 region), the E region, and the D region. In the ARRL book, *Here to There: Radio*

Wave Propagation, these regions are depicted in Figures 2, 19, and 23.

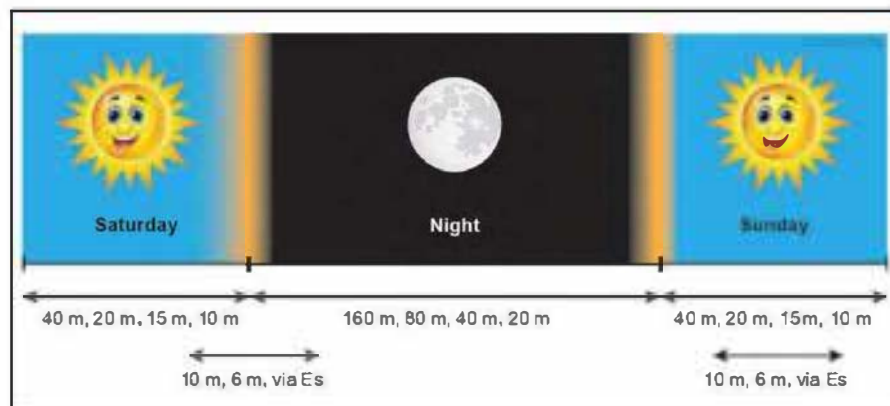
The F2 region is the highest altitude ionospheric region that refracts our signals back to Earth, thus, it gives the longest distance hops (generally best for coast-to-coast propagation). The E region also refracts our signals back to Earth, but it's lower in altitude than the F2 region, thus, it gives the shortest distance hops (generally good for closer-in propagation). The D region does not refract signals back to Earth on frequencies allowed for Field Day — it's simply where ionospheric absorption (more loss) occurs, which reduces the strength of our signals.

3. Band Characteristics

Bands that are critically dependent on ionospheric absorption in the D region of the ionosphere include 160, 80, and 40 meters. During the night, the D region is essentially out of the picture on frequencies allowed for Field Day, but it still affects LF and VLF signals during the night. With the D region at a minimal level, night signals on these three lower bands will be strong and will provide the opportunity to make lots of contacts. Forty meters should be good for closer-in contacts during the day. Of course, strong atmospheric from thunderstorms could be a detriment to these frequencies.

Twenty meters is not as dependent on ionospheric absorption as the three lower frequencies discussed above. It should be good during the day and into the early evening. If Cycle 25 was stronger, 20 meters would offer the chance to make contacts well into the night.

Fifteen, 10, and 6 meters are critically dependent on the amount of ionization in the F2 region of the ionosphere. More ionization means higher maximum usable frequency (MUF) for a specific path at a specific time. Unfortunately, the F2 region has a seasonal dependence that puts summer in the northern hemisphere at a disadvantage with lower MUFs than in the fall and winter months. Your best bet for making contacts during the day will be on 15 meters, but keep an eye on 10 meters (visit www.dxmaps.com/spots/mapg.php?Lan=E and select 28 MHz to check who's contacting whom). If 10 meters isn't productive via the F2 region, hope for sporadic E.



Bands that should be available throughout the Field Day weekend.

4. Sporadic E

The best time to look for sporadic E (also referred to as Es) is during the summer months (June, July, and August) around late morning and early evening local times. If it occurs, this is a great propagation mode for Field Day. Hopefully, we'll have sporadic E during the Field Day weekend to increase your number of contacts on 10 and 6 meters.

5. Propagation Disturbances

The above discussion assumes the sun won't produce a disturbance to propagation during Field Day. Of the three categories of disturbances — geomagnetic storms, solar radiation storms, and radio blackouts (visit www.swpc.noaa.gov/noaa-scales-explanation for more details) — a geomagnetic storm triggered by a coronal mass ejection (CME) on the sun is generally the worst-case disturbance. If a CME occurs and is directed at Earth, you may have to go down in frequency to mitigate this disturbance. But also look for a short-term enhancement on the higher frequencies. Unfortunately, solar maximum (about where we are) is when most CMEs occur (along with big solar flares that cause the other two categories of disturbances).

6. Your Field Day Site

Having good antennas and a quiet location can play an important role in how many Field Day contacts you make. Do the best you can when selecting a site, and be safe when erecting antennas. But remember that there may be contradictory issues in your site selection. For example, a quiet location may put you farther away from a location that will attract more public attendance.

Putting It All Together

Now, you can put together a band plan for Field Day this year. Remember, the ionosphere is quite dynamic, so this plan is only a guideline.

With three operating modes available (phone, CW, and digital) during the event, there's something for everyone.

Make sure to get on your favorite operating mode, and maybe even try a new one to expand your amateur radio horizon; it's a great time to try a new band, too! Take advantage of the available mentors at your site.

Good luck, and have fun!



Field Day is where the FUN begins

Additional bands and bonus points



IC-905
2M / 70CM / 23CM / 13CM / 5CM



IC-9700
2M / 70CM / 23CM



IC-7610
HF / 6M



IC-7300
HF / 6M



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For the love of **ham radio**.





Field Day Media Coverage

Promote your operation like a pro using a smartphone camera and advice from a ham who's also a news professional.

BY CHRIS BRADY, N3CB

Recently, I stepped away from nearly 40 years of television news experience. Here are some tips to help you become a photojournalist for your own event and get your Field Day story into your favorite TV news program or newspaper.

- **Get your camera phone ready prior to the event.** If you're using a newer iPhone, tap your **SETTINGS** icon. Scroll down the list and select **CAMERA**. Here, you'll see the **FORMATS** option near the top of the list. Select it and make sure that you're using the **MOST COMPATIBLE** mode, rather than **HIGH EFFICIENCY**. Even some professional systems have trouble with **HIGH EFFICIENCY** mode, so I recommend avoiding it.
- **Make sure your phone has sufficient memory.** Before Field Day, save existing photos and videos to either an external device or your cloud service to free up some space. Remember that video recordings consume considerably more memory than photographs, so make sure you have several minutes of recording time available.
- **Shoot horizontally.** Television is a 16:9 aspect ratio format, so you must hold your phone horizontally, with the **REC** button to the right. While vertically shot images can be used, they require some editing.

- **Shoot at a wide setting.** Cell phone optics have continued to evolve, but they're still not great. My suggestion for producing quality, steadily shot video is to always shoot with your lens at its widest, least-telephoto setting.
- **Shoot sequences to tell a story.** Sequential images give editors choices, but don't overwhelm them by sending more than a handful of images.

Get these three types of shots:

1. The *establishing shot* (see the lead image). Get close enough to fill the frame with the operators, typically from the connector side of the equipment — let's see some faces! Hit the record button and hold that shot for at least 10 seconds. Resist moving or attempting to use the zoom function. In fact, you should never need to zoom if you follow these techniques.
2. The *medium shot*. Physically move closer with your camera and shoot the operators. If there's a control operator and a visitor, fill the frame with them and their interactions with one another (see Figure 1). Roll for a full 10 seconds, then stop.



GEAR UP FOR ARRL FIELD DAY

Get ready for amateur radio's largest on-air operating event with official 2024 ARRL Field Day merchandise – t-shirts, hats, mugs, pins, patches, and more. The back of the t-shirt includes a check-off list of ARRL and RAC Sections – a fun way to keep track of your Field Day contacts.



ARRL/RAC Sections
on back of shirt



Order online at www.arrl.org/shop/fieldday | Call 860-594-0200

3. The *tight shot* (see Figures 2 and 3). Get a close-up of an operator's face and the microphone, again filling the frame. Ten seconds of video will do.
 4. Repeat the process, moving on to another station at your site, or introducing a fresh set of operators.
- **Get relevant audio.** Be sure that you're rolling right before an operator calls CQ, or try to record the better part of an exchange between your crew and another Field Day site.
 - **Send your photos.** Emailed .jpeg images are almost universally accepted and should be sent in the largest file size possible. Your email service probably has file size limits, so forward files via several emails if needed. Contact the editor first, so they are aware the photos are being sent. Remember to include the names of everyone in the images and a detailed description of the event.
 - **Send your videos.** Make sure they are in either .mov or .mp4 file formats. If you recorded with an iPhone in **MOST COMPATIBLE** mode, the videos will have been saved as H.264 files (.mp4 clips), so they won't necessarily need to be edited before you send them. Ask the broadcaster how they accept video from outside sources; options might include file transfer programs like Dropbox or WeTransfer. A quick call to their assignment editor or a check of the station's website can provide the necessary directions. Emailed files will need to be scaled down, but they will highlight your event all the same.

All photos provided by the author.

Chris Brady, N3CB, was first licensed in 1989. His 40-year career in broadcast television began at WNEP-TV, in Scranton, Pennsylvania. Chris spent his last 39 years as News Operations Supervisor at CBS/Paramount's KYW-TV in Philadelphia, before leaving the station in 2023. Chris can be reached at n3cb@arrl.net.

Figure 1: The medium shot is a more personalized view of what you wish to highlight. **Figure 2:** The tight shot completes the sequence. When all the portions of the sequence are edited together, the result is a view with logically shot images that create a short story of your Field Day activity. It visually walks the viewer through your event. **Figure 3:** Another type of tight shot can be a close-up of an operator sending Morse code or typing a reply on FT8. Regardless, each example could be considered a logical, visual progression from the site-wide establishing shot and the medium shot.



FIGURE 1



FIGURE 2

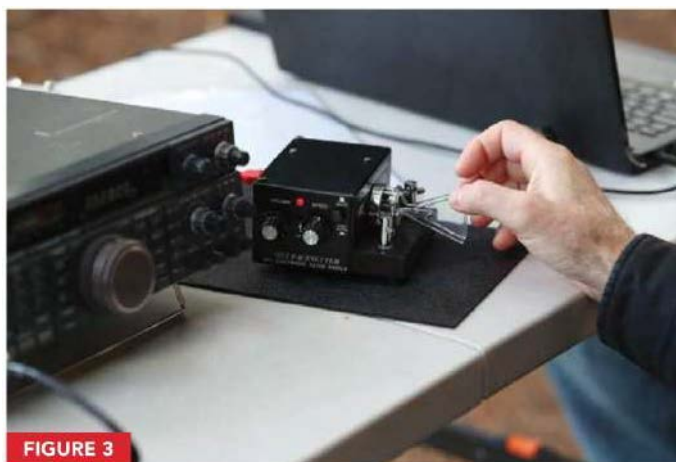


FIGURE 3

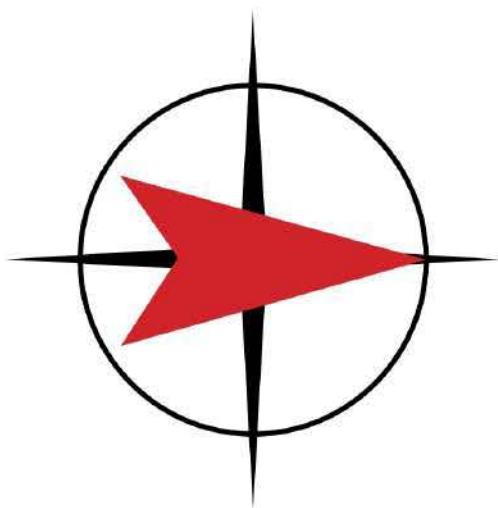
2024 ARRL FIELD DAY PHOTO CONTEST

Use the tips in this article to create your best Field Day photos yet and submit them to the 2024 ARRL Field Day Photo Contest! Upload high-resolution images of your operation to the Field Day Soapbox at <https://field-day.arrl.org/fdsoapbox.php> by August 1, 2024. Be sure to include a model release form (www.arrl.org/photo-video-release-form) with your submission (this form is required for photos with minors). Winners will be notified by October 1, 2024. Winning photos will be used in Field Day coverage, and photographers will receive a cash honorarium upon publication.

ARRL
FIELD DAY 2024
JUNE
22-23



MORE THAN
30,000
Hams Participate
in Field Day
Each Year



1.25
MILLION
CONTACTS
MADE IN 2023



FIND A
FIELD DAY
SITE
[www.arrl.org/](http://www.arrl.org/field-day-locator)
[field-day-locator](http://www.arrl.org/field-day-locator)

Get Your 2024 ARRL Field Day Gear at
www.arrl.org/shop/fieldday

Choose Your Field Day Focus

ARRL Field Day is a picnic, a campout, practice for emergencies, an informal contest, and, most of all, fun! Here are three ways you can participate by demonstrating ham radio's science, skill, and service to our communities and our nation.



Emergency Communications

ARRL Minnesota Section Assistant
Section Emergency Coordinator
Erik Westgard, NY9D

If your club or group is searching for a way to focus your Field Day operation, treating it as a test of your readiness capabilities can be valuable — not only for your group, but for your community as well.

The Minnesota Section ARES group used Field Day 2021 as an opportunity to operate our new 6 kW diesel generators, which led us to discover we had large power loads from recreational vehicles. This test turned into an opportunity to learn about high-current ac power distribution and transformers for load balancing. For this year's Field Day, we've been invited to a large state exercise that will allow us to test the use of multiple communications trailers, to test the use of diesel and solar power, and to test the ability to cover a large area with Wi-Fi and Starlink.

"Try to create a portable field station rather than recreating your home ham shack in the field."

— TOM CORT, VA2NW



Public Outreach

ARRL Public Relations and Outreach
Manager Sierra Harrop, W5DX

Setting up in a visible public place displays something interesting and unusual in a place where the public already is. Don't be afraid to think outside the park — one of the most effective ARRL Field Day locations I've ever seen was in the parking lot of a local Walmart, and the club got foot traffic from lots of people they wouldn't have reached otherwise.

This is an opportunity to tell our story and let our neighbors know what amateur radio does in the local community.

An effective public relations plan, coupled with proclamations from your local dignitaries, will also highlight the value of the event.

Remember, many licensed amateurs are not active hams, so ARRL Field Day is a chance for them to reconnect with the hobby. Create an environment that makes people want to become a part of ham radio and to stay active!

"Start your PR campaign [in early April]! Prepare press releases, start posting on social media, make signs, organize a testing session, and connect with a local Scout troop. Maximizing bonus points and showcasing the hobby to as many folks as possible takes a lot of time and planning."

— ARRL PUBLIC RELATIONS COMMITTEE
MEMBER ANDY MILLUZZI, KK4LWR



Friendly Competition

Hayden Honeywood,
VK7HH/KD9SSB

Even though ARRL Field Day isn't a contest, that doesn't preclude the spirit of competition that inherently energizes participants.

The essence of competition is alive in the pursuit of operational excellence and strategic ingenuity. This blend of serious readiness training with a lighthearted rivalry brings a dynamic flavor to Field Day. In Australia, where Field Days are more openly competitive, this spirit drives amateurs to think critically about their setups, from selecting the most advantageous operating locations to investing in equipment for higher bands, knowing that such strategies might amplify their score through distance-based points and frequency multipliers.

The competitive vibe Field Day creates makes the experience more exciting, mixing the fun of competing with the important mission of using amateur radio to help others.

"Last year, our radio, lights, a fan, and logging software were all powered by solar. The bonus points and multipliers are wonderful under the Field Day rules!"

— DAVID CHASE, K8RXB

BONUS POINTS ADD UP!



Use this Bonus Points Calculator to keep track of your Field Day Bonus Points (see Rule 7.3 for details). Many bonus points require submission of proof and will be verified before being added to your score. Maximum bonus points are listed unless otherwise noted.

POINTS	ACTIVITY	AVAILABLE CLASSES
	100% Emergency Power. 100 bonus points per transmitter; max. 20 transmitters, max. 2,000 points. Bonus stations (such as the GOTA station and satellite station) do not count toward determining the number of transmitters for the class and do not qualify for transmitter bonus points.	A, B, C, E, and F
	Media Publicity. 100 bonus points. Bonus points may be earned for obtaining publicity from the local media. A copy of the media publicity received (newspaper article, news website post, etc.) must be submitted to claim the points.	All
	Set Up in Public Place. 100 bonus points.	A, B, and F
	Public Information Table. 100 bonus points. Bonus points may be earned for making information about amateur radio available to the public at your Field Day site.	A, B, and F
	W1AW Field Day Message. 100 bonus points. Copy, via amateur radio, the special Field Day bulletin transmitted by W1AW or K6KPH, and include an accurate copy of the message with your Field Day entry.	All
	Message Handling NTS/ICS-213. 0 to 100 points max., calculated by taking the Number of Messages (max. 10 messages): $\text{Number of Messages} \times 10$ bonus points for each formal message originated, relayed, or received and delivered during the Field Day period. Copies of each message must be included with the Field Day entry. The message under Rule 7.3.5 does not count. All messages claimed for bonus points must leave or enter the Field Day operation via amateur radio RF.	All
	Message to ARRL Section Manager or Section Emergency Coordinator. 100 bonus points. See Rule 7.3.5 for message format. This message is separate from the messages handled in Rule 7.3.6 and may not be claimed for bonus points under that rule. A copy of the message must be included with the Field Day entry.	All
	A Satellite QSO. 100 bonus points. Satellite QSOs also count for regular QSO credit. List these contacts separately on the summary sheet as a separate "band." The QSO must be between two Earth stations through a satellite. Stations are limited to one completed QSO on any single channel FM satellite.	A, B, and F
	Natural Power QSOs. 100 bonus points. Complete at least five QSOs without using power from commercial mains or a petroleum-driven generator. A separate list of natural power QSOs should be submitted with your entry.	A, B, E, and F
	Site Visit by Invited Elected Official. 100 bonus points.	All
	Site Visit by Invited Served Agency Official. 100 bonus points. Visits from ARRL officials (SM, SEC, DEC, EC, etc.) do not qualify for this bonus.	All
	Educational Activity. 100 bonus points. See the ARRL Field Day website for D and E rules.	A, D, E, and F
	Youth Participation. ☐ For Class A, C, D, E, or F groups: 20 bonus points per participant age 18 or younger who completes at least one QSO; max. 100 points. ☐ For a one-person Class B station: 20 bonus points if the operator is age 18 or younger; max. 20 points. ☐ For a two-person Class B station: 20 bonus points for each operator age 18 or younger; max. 40 points.	All (see specific points per class)
	GOTA. See Rule 7.3.13 for the bonus point breakdown.	A and F
	Use the Field Day Entry Web App. 50 bonus points. Submit your entry using the web app at https://field-day.arrl.org/fdentry.php .	All
	Safety Officer. 100 bonus points. Include a statement with the supporting documentation for your entry, verifying that a designated Safety Officer completed the ARRL Field Day Safety Check List.	A
	Social Media. 100 bonus points. Promote your Field Day activation to the general public via social media (Facebook, Instagram, etc.). Individual participants do not qualify for this bonus. Club websites do not qualify as social media.	All
	Field Day Responsibilities (New for 2024) 50 bonus points. Include a statement with the supporting documentation for your entry, verifying that a designated individual completed the Field Day Responsibilities Check List.	B, C, D, E, and F
	TOTAL BONUS POINTS CLAIMED	



FIELD DAY 2024

ARRL/RAC Section Checklist

UNITED STATES

- ☐ ALABAMA · AL
- ☐ ALASKA · AK
- ☐ ARIZONA · AZ
- ☐ ARKANSAS · AR

CALIFORNIA

- ☐ EAST BAY · EB
- ☐ LOS ANGELES · LAX
- ☐ ORANGE · ORG
- ☐ SACRAMENTO VALLEY · SV
- ☐ SAN DIEGO · SDG
- ☐ SAN FRANCISCO · SF
- ☐ SAN JOAQUIN VALLEY · SJV
- ☐ SANTA BARBARA · SB
- ☐ SANTA CLARA VALLEY · SCV

- ☐ COLORADO · CO
- ☐ CONNECTICUT · CT
- ☐ DELAWARE · DE

FLORIDA

- ☐ NORTHERN FL · NFL
- ☐ SOUTHERN FL · SFL
- ☐ WEST CENTRAL FL · WCF

- ☐ GEORGIA · GA
- ☐ HAWAII/PACIFIC · PAC
- ☐ IDAHO · ID
- ☐ ILLINOIS · IL
- ☐ INDIANA · IN
- ☐ IOWA · IA
- ☐ KANSAS · KS
- ☐ KENTUCKY · KY
- ☐ LOUISIANA · LA
- ☐ MAINE · ME
- ☐ MARYLAND/DC · MDC

MASSACHUSETTS

- ☐ EASTERN MA · EMA
- ☐ WESTERN MA · WMA

- ☐ MICHIGAN · MI
- ☐ MINNESOTA · MN
- ☐ MISSISSIPPI · MS
- ☐ MISSOURI · MO
- ☐ MONTANA · MT
- ☐ NEBRASKA · NE
- ☐ NEVADA · NV
- ☐ NEW HAMPSHIRE · NH

NEW JERSEY

- ☐ NORTHERN NJ · NNJ
- ☐ SOUTHERN NJ · SNJ

- ☐ NEW MEXICO · NM

NEW YORK

- ☐ EASTERN NY · ENY
- ☐ NORTHERN NY · NNY
- ☐ WESTERN NY · WNY
- ☐ NYC/LONG ISLAND · NLI

- ☐ NORTH CAROLINA · NC
- ☐ NORTH DAKOTA · ND
- ☐ OHIO · OH
- ☐ OKLAHOMA · OK
- ☐ OREGON · OR

PENNSYLVANIA

- ☐ EASTERN PA · EPA
- ☐ WESTERN PA · WPA

- ☐ PUERTO RICO · PR
- ☐ RHODE ISLAND · RI
- ☐ SOUTH CAROLINA · SC
- ☐ SOUTH DAKOTA · SD
- ☐ TENNESSEE · TN

TEXAS

- ☐ NORTH TX · NTX
- ☐ SOUTH TX · STX
- ☐ WEST TX · WTX

- ☐ US VIRGIN ISLANDS · VI
- ☐ UTAH · UT
- ☐ VERMONT · VT
- ☐ VIRGINIA · VA

WASHINGTON

- ☐ EASTERN WA · EWA
- ☐ WESTERN WA · WWA

- ☐ WEST VIRGINIA · WV
- ☐ WISCONSIN · WI
- ☐ WYOMING · WY

CANADA

- ☐ ALBERTA · AB
- ☐ BRITISH COLUMBIA · BC
- ☐ GOLDEN HORSESHOE · GH
- ☐ MANITOBA · MB
- ☐ NEW BRUNSWICK · NB
- ☐ NEWFOUNDLAND/LABRADOR · NL
- ☐ NOVA SCOTIA · NS
- ☐ ONTARIO EAST · ONE
- ☐ ONTARIO NORTH · ONN
- ☐ ONTARIO SOUTH · ONS
- ☐ PRINCE EDWARD ISLAND · PE
- ☐ QUEBEC · QC
- ☐ SASKATCHEWAN · SK
- ☐ TERRITORIES · TER



Contest Corral

June 2024

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
Date-Time	Finish							
1 0000	2 2359	28			10-10 Int'l Open Season PSK Contest	Dig	Name, SPC, mbr	www.ten-ten.org
1 0200	1 1459	1.8-28			Tisza Cup CW Contest	CW	RST, CQzone	www.tlszacup.eu
1 0600	1 0800	7,14			Wake Up! QRP Sprint	CW	RST, serial, suffix of previous QSO	qrp.ru
1 1300	2 0100	1.8-28, 50,144			Kentucky QSO Party	CW Ph Dig	RS(T), KY county or SPC	www.kyqsoparty.org/rules
1 1300	2 1300	50			UKSMG Summer Contest	CW Ph Dig	RST, serial, 6-char grid	uksmg.org
1 1500	2 1459	1.8-28			IARU Region 1 Field Day, CW	CW	RST, serial	www.darc.de
1 1500	2 1500	1.8-28			RSGB National Field Day	CW	RST, serial	www.rsgbcc.org
1 1800	2 2359	1.8-28,50			ARRL Int'l Digital Contest	Dig (no RTTY)	4-char grid	contests.arrl.org/dig
3 0000	3 0100	1.8-28			K1USN Slow Speed Test	CW	Max 20 WPM; name, SPC	www.k1usn.com/sst.html
3 1300	3 1400	1.8-28			ICWC Medium Speed Test	CW	Name, serial	internationalcwcouncil.org
4 0000	4 0200	3.5-28			ARS Spartan Sprint	CW	RST, SPC, pwr	arsqrp.blogspot.com
5 0230	5 0300	1.8-14,21			Phone Weekly Test	Ph	Name, SPC	www.perluma.com
5 1700	5 2100	144			VHF-UHF FT8 Activity Contest	FT8	4-char grid	www.ft8activity.eu
6 0000	7 0300	7			Wak for the Bacon QRP Contest	CW	Max 13 WPM; RST, SPC, name, mbr or pwr	qrpcontest.com
6 1800	6 2200	28			NRAU 10m Activity Contest	CW Ph Dig	RS(T), 6-char grid	nrau.net
6 2000	6 2200	1.8-28,50			SKCC Sprint Europe	CW	RST, SPC, name, mbr or "none"	www.skccgroup.com
7 0145	7 0215	3.5-28			Weekly RTTY Test	Dig	Name, SPC	radiosport.world/wrt.html
7 1900	7 1959	3.5-7			HA3NS Sprint Memorial Contest	CW	RST, mbr or "NM"	radioamator.honlapites.hu
8 0000	9 1700	3.5,7,28			Batavia DX Contest	Ph	RS, 2-char province code	batavia.orariotokajakut.or.id
8 0000	8 2359	1.8-28			VK Shires Contest	CW Ph	RS(T), VK shire, or CQ zone	www.wia.org.au
8 1100	8 1300	14.21			Asia-Pacific Sprint, SSB	Ph	RS, serial	jsfc.org
8 1200	9 1200	3.5-28			Portugal Day Contest	CW Ph	RS(T), CT district or serial	portugaldaycontest.rep.pt
8 1200	9 2359	1.8-28,50			SKCC Weekend Sprintathon	CW	RST, SPC, name, mbr or "none"	www.skccgroup.com
8 1400	8 1800	144,432			AGCW VHF/UHF Contest	CW	RST, serial, pwr, 6-char grid	www.agcw.de
8 1500	9 1500	3.5-28			GACW WWSA CW DX Contest	CW	RST, CQzone	www.gacw.ar
8 1600	9 1600	50			REF DDFM 6m Contest	CW Ph	RS(T), serial, 4-char grid	concours.r-e-f.org
8 1800	10 0259	50 and up			ARRL June VHF Contest	CW Ph Dig	4-char grid	www.arrl.org/june-vhf
10 0000	10 0200	1.8-28			4 States QRP Group Second Sunday Sprint	CW Ph	RS(T), SPC, mbr or pwr	www.4sqrp.com
10 1900	10 2030	3.5			RSGB 80m Club Championship, Data	Dig	RST, serial	www.rsgbcc.org
12 1700	12 2100	432			VHF-UHF FT8 Activity Contest	FT8	4-char grid	www.ft8activity.eu
15 0000	15 2359	3.5-28			Pajajaran Bogor DX Contest	Ph	RS, serial	www.pbdx-contest.id
15 0000	16 2359	1.8-28			All Asian DX Contest, CW	CW	RST, 2-digit age	www.ari.org
15 0000	16 2359	50			SMIRK Contest	CW Ph	4-char grid, mbr (optional)	smirk.info
15 1400	16 1400	50			IARU Region 1 50 MHz Contest	CW Ph	RS(T), serial, 6-char grid	www.iaru-r1.org
15 1400	16 1400	50			LZ International 6-Meter Contest	CW Ph	RS(T), serial, 6-char grid	www.radioclub-troyan.bg
15 1500	16 1500	1.8			Stew Perry Topband Challenge	CW	4-char grid	www.kkn.net/stew
15 1600	16 0400	3.5-28			West Virginia QSO Party	CW Ph Dig	RS(T), WV county or SPC	www.qsl.net/wvsarc
15 1800	15 2359	3.5-14,18, 21,24,28, 2 rpters			ARRL Kids Day	Ph	Name, age, QTH, favorite color	www.arrl.org/kids-day
16 0000	16 2359	1.8-28,50			Feld Hell Sprint	Dig	Mbr, SPC, grid	sites.google.com/site/feldhellclub
16 0800	16 1400	50			WAB 50 MHz Phone	Ph	RS, serial, WAB square or country	wab.internip.net/Contests.php
16 1200	16 1300	7			SARL Youth QSO Party	Ph	RS, age	www.sarl.org.za
16 2300	17 0100	1.8-28			Run for the Bacon QRP Contest	CW	RST, SPC, mbr or pwr	qrpcontest.com
17 1900	17 2030	3.5-28			RSGB FT4 Contest	FT4	Signal report	www.rsgbcc.org
19 1700	19 2100	1.2G			VHF-UHF FT8 Activity Contest	FT8	4-character grid	www.ft8activity.eu
19 1900	19 2030	3.5			RSGB 80m Club Championship, CW	CW	RST, serial	www.rsgbcc.org
20 0000	21 0300	14			Walk for the Bacon QRP Contest	CW	Max 13 WPM; RST, SPC, name, mbr or pwr	qrpcontest.com
20 1900	20 2000	3.5-14			NTC QSO Party	CW	Max 25 WPM; RST, mbr, or "NM"	pi4ntc.nl/ntcqp
22 1200	23 1200	1.8-28			His Maj. King of Spain Contest, SSB	Ph	RST, EA province or serial	concursos.ure.es
22 1800	23 2100	All, except WARC			ARRL Field Day	CW Ph Dig	Number of transmitters, operating class, ARRL/RAC section or 'DX'	www.arrl.org/field-day
26 0000	26 0200	1.8-28,50			SKCCSprint	CW	RST, SPC, name, mbr or "none"	www.skccgroup.com
27 1900	27 2030	3.5			RSGB 80m Club Championship, SSB	Ph	RS, serial	www.rsgbcc.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 and times refer to UTC and may be different from calendar dates in North America. Contests are not conducted on the 60-, 30-, 17-, or 12-meter bands. Mbr = Membership number. Serial = Sequential number of the contact. SPC = State, Province, DXCC Entity. XE = Mexican state. Listings in blue indicate contests sponsored by ARRL or NCJ. The latest time to make a valid contest QSO is the minute listed in the "Finish Time" column. Data for Contest Corral is maintained on the WA7BNM Contest Calendar at www.contestcalendar.com and is extracted for publication in QST 2 months prior to the month of the contest. ARRL gratefully acknowledges the support of Bruce Horn, WA7BNM, in providing this service.

2023 ARRL November Sweepstakes

— Phone

Last year's ARRL November Sweepstakes phone weekend was held November 18 – 20, 2023.



Lynna Chenault, KC5ERV, and her husband David, W5CWT, operated in the Multioperator, Single Transmitter, Low Power category during the 2023 ARRL November Sweepstakes phone weekend. With a total of 162 contacts and 64 multipliers, they placed second in the West Gulf Division. [David Chenault, W5CWT, photo]

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

Single Operator, High Power

ND7K (K6JO, op @N6WIN)	291,040
WH7Z (W0CN, op @KH6YY)	271,660
VA7RR	269,110
WC6H	257,040
K4JPD (N4OO, op)	245,650
K4ZW	244,800
VY2TT	244,608
N4OX	236,980
W2RQ	236,980
KL7SB	225,624

Single Operator, Low Power

K2FO	193,722
W4AAA (KK9A, op)	192,270
WY7SS (WY7FD, op)	171,700
AC0W	157,930
VE6SF	155,210
W0EWD	148,920
N8II	143,310
VE4VT	133,728
KU2M	118,660
AH2O	114,750

Single Operator, QRP

ND0C	67,240
K6GHA	43,680
N5EE	39,658
KA8SMA	35,412
K9ARF	23,360
KE6K	22,080
K5NZ	21,190
K0LD (WA0MHJ, op)	20,020
K2PI	18,720
NF2L	17,818

Single Operator Unlimited, High Power

WJ0W (KH6XX, op)	255,696
W7RN (WX5S, op)	241,400
K9CT	240,890
W1SJ	222,432
KD4D	214,200
NN3W (@N4RV)	213,860
K1KD	212,330
W4NF	206,040
K3DNE	205,530
NJ4P (K9TI, op)	205,360

Single Operator Unlimited, Low Power

W4LT	162,180
WZ8T	134,130
N7MZW	123,760
AI0Y	123,520
VE3PJ	119,448
K8BL	119,000
N4ZZ	115,770
K9PW	104,160
W9QL	100,130
K81W	98,784

Single Operator Unlimited, QRP

W06X	46,500
W7LG	20,532
W3EK	16,470
K1EP	14,112
K2AL	11,000
N9NE	10,712
K2GMV	3,640
VE3GMZ	1,488
K8ZT	1,058
KC9BK5	286

Multioperator, Single Transmitter, High Power

K5TR	333,200
K4OV	247,350
N2NT	241,060
KP0P	226,100
W1XX	215,300
NJ8M	211,140
W4RM	209,950
N3OC	205,530
AB0S	201,790
N6RO	200,770

Multioperator, Single Transmitter, Low Power

WX4W	159,290
NC1CC	145,180
NX6T	144,500
K9KE	130,900
K9DA	123,420
KT4XA	114,410
W4TG	107,900
K2APD	106,930
N6MMA	100,300
K8DP	87,210

School Club

K0HC	231,168
W0EEE	121,800
W9JWC	38,776
W8EDU	33,120
W0FLN	25,476
W5YM	1,000

Affiliated Club Competition

Club	Score	Entries
Unlimited		
Potomac Valley Radio Club	11,934,598	191
Society of Midwest Contesters	7,184,322	114
Minnesota Wireless Assn	5,257,720	106
Yankee Clipper Contest Club	5,242,304	84
Frankford Radio Club	4,573,072	92
Florida Contest Group	3,261,300	53

Medium

Mother Lode DX/Contest Club	3,157,382	39
Arizona Outlaws Contest Club	2,665,842	36
Contest Club Ontario	2,620,738	48
Tennessee Contest Group	2,389,856	38
Southern California Contest Club	2,268,250	38
South East Contest Club	2,209,318	26
Northern California Contest Club	1,828,878	44
Central Texas DX and Contest Club	1,650,848	14
Mad River Radio Club	1,511,688	27
DFW Contest Group	1,368,566	25
Grand Mesa Contesters of Colorado	1,340,474	23
Kentucky Contest Group	1,211,528	24
Alabama Contest Group	1,050,520	17
Kansas City Contest Club	1,040,612	14
Big Sky Contesters	1,005,310	12
Western Washington DX Club	996,260	17
Niagara Frontier Radiosport	925,716	18
Great Places Contest Club	918,498	8
Swamp Fox Contest Group	807,606	16
Order of Boies Owls of New York	753,868	10
Willamette Valley DX Club	745,974	11
Hudson Valley Contesters and DXers	684,954	17
Saskatchewan Contest Club	611,792	8
Orca DX and Contest Club	599,656	7
North Coast Contesters	544,888	10
Bella Vista Radio Club	501,090	4
Bay Area DXers	457,114	7
Texas DX Soc.	446,108	8
Radiosport Manitoba	431,606	7
Deep Dixie Contest Club	294,586	3
Rochester (NY) DX Assn.	282,826	8
South Jersey Radio Assn.	278,074	8
Heartland DX Assn.	222,940	3
Northeast Maryland Amateur Radio Contest Soc.	163,952	5
Maritime Contest Club	153,168	4
New Providence ARC	143,608	7
Carolina DX Assn.	140,762	9
Allegheny Valley Radio Assn.	135,956	4
Motor City Radio Club	116,646	8
Lake Area Radio Klub (SD)	110,822	4
Oklahoma City Autopatch Assn.	102,300	3
Granite State ARA	66,560	4
North Texas ARS	54,440	3
Silver Comet ARS	45,194	4
American Red Cross EmComm Service	38,444	4
Sierra Nevada ARS	23,964	3
Portage County Amateur Radio Service	20,750	3

Local

Radio Amateurs of Northern Vermont	516,726	3
CTRI Contest Group	462,950	9
Pizza Lovers 259	458,632	6
Iowa DX and Contest Club	402,200	3
Central Oregon DX Club	301,330	3
Bristol (TN) ARC	222,158	4
The Villages ARC	188,536	3
Lake Area Amateur Radio Klub	150,894	5
OHKY-IN ARS	149,912	3
Alexandria Radio Club	116,642	6
Meriden ARC	81,632	3
Stoned Monkey VHF ARC	71,648	3
Metro DX Club	45,864	4
Central Virginia Contest Club	41,234	3
TX Emergency Amateur Communicators	32,488	3
Ventura County ARS	17,080	3

Plaque Sponsors

ARRL is pleased to award a Sweepstakes Plaque to the Overall and Division Leaders in each category, thanks to Icom America, clubs, and individuals who sponsor these awards. 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 \$90, which includes all shipping charges.

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AWARDS
SPONSOR**

Winner	Division	Category	Sponsor	Winner	Division	Category	Sponsor
ND7K (K6JO, op @N6WIN)	Overall	Single Operator, High Power	Icom America	K0HC	Midwest	School Club	Icom America
K2PO	Overall	Single Operator, Low Power	Icom America	AF1T	New England	Single Operator, High Power	Icom America
N9BC	Overall	Single Operator, ORP	Icom America	K1VUT	New England	Single Operator, Low Power	Icom America
WJ0W (KH6XX, op)	Overall	Single Operator Unlimited, High Power	Icom America	KM7N	New England	Single Operator, ORP	Icom America
W4LT	Overall	Single Operator Unlimited, Low Power	Icom America	W1SJ	New England	Single Operator Unlimited, High Power	Icom America
W06X	Overall	Single Operator Unlimited, ORP	Icom America	KB1W	New England	Single Operator Unlimited, Low Power	Icom America
K5TR	Overall	Multioperator, Single Transmitter, High Power	Icom America	K1EP	New England	Single Operator Unlimited, ORP	Icom America
WX4W	Overall	Multioperator, Single Transmitter, Low Power	Icom America	W1XX	New England	Multioperator, Single Transmitter, High Power	Icom America
K0HC	Overall	School Club	Icom America	NC1CC	New England	Multioperator, Single Transmitter, Low Power	Icom America
K3TC	Atlantic	Single Operator, High Power	Icom America	KL7SB	Northwestern	Single Operator, High Power	Icom America
KZ2I	Atlantic	Single Operator, Low Power	Icom America	K2PO	Northwestern	Single Operator, Low Power	Icom America
NF2L	Atlantic	Single Operator, ORP	Icom America	W7PT	Northwestern	Single Operator, ORP	Icom America
K4D4	Atlantic	Single Operator Unlimited, High Power	Icom America	K7RL	Northwestern	Single Operator Unlimited, High Power	Icom America
N3AAA	Atlantic	Single Operator Unlimited, Low Power	Icom America	W2BT	Northwestern	Single Operator Unlimited, Low Power	Icom America
W7LG	Atlantic	Single Operator Unlimited, ORP	Icom America	W1AW/KL7	Northwestern	Multioperator, Single Transmitter, High Power	Icom America
N3OC	Atlantic	Multioperator, Single Transmitter, High Power	Icom America	KD0LHI	Northwestern	Multioperator, Single Transmitter, Low Power	Icom America
K2APD	Atlantic	Multioperator, Single Transmitter, Low Power	Icom America	WH7Z (W0CN, op @KH6YY)	Pacific	Single Operator, High Power	Icom America
K9BGL	Central	Single Operator, High Power	Icom America	KM9R	Pacific	Single Operator, Low Power	Icom America
N9EAX	Central	Single Operator, Low Power	Icom America	K6GHA	Pacific	Single Operator, ORP	Icom America
K9ARF	Central	Single Operator, ORP	Icom America	W7RN (WXSS, op)	Pacific	Single Operator Unlimited, High Power	Icom America
K9CT	Central	Single Operator Unlimited, High Power	Icom America	K6OK	Pacific	Single Operator Unlimited, Low Power	Icom America
K9PW	Central	Single Operator Unlimited, Low Power	Icom America	K2GMY	Pacific	Single Operator Unlimited, ORP	Icom America
N9NE	Central	Single Operator Unlimited, ORP	Icom America	N6RO	Pacific	Multioperator, Single Transmitter, High Power	Icom America
N9SJ	Central	Multioperator, Single Transmitter, High Power	Icom America	N6ACL	Pacific	Multioperator, Single Transmitter, Low Power	Icom America
K9KE	Central	Multioperator, Single Transmitter, Low Power	Icom America	K4ZW	Roanoke	Single Operator, High Power	Icom America
W9JWC	Central	School Club	Icom America	W4AAA (KKG9A, op)	Roanoke	Single Operator, Low Power	Icom America
W0SD	Dakota	Single Operator, High Power	Icom America	K2P	Roanoke	Single Operator, ORP	Icom America
AC0W	Dakota	Single Operator, Low Power	Icom America	NN3W (@N4RV)	Roanoke	Single Operator Unlimited, High Power	Icom America
ND0C	Dakota	Single Operator, ORP	Icom America	W4KAZ	Roanoke	Single Operator Unlimited, Low Power	Icom America
WJ0W (KH6XX, op)	Dakota	Single Operator Unlimited, High Power	Minnesota Wireless Assn. — In memory of Tod Olson, K0TO	K40V	Roanoke	Multioperator, Single Transmitter, High Power	Icom America
AI0Y	Dakota	Single Operator Unlimited, Low Power	Minnesota Wireless Assn. — In memory of Jim Dokno, K0FVF	W4TG	Roanoke	Multioperator, Single Transmitter, Low Power	Icom America
K0AJW	Dakota	Multioperator, Single Transmitter, Low Power	Icom America	K5TA	Rocky Mountain	Single Operator, High Power	Icom America
K5TS	Delta	Single Operator, High Power	Icom America	WY7SS (WY7FD, op)	Rocky Mountain	Single Operator, Low Power	Icom America
W0SDJW	Delta	Single Operator, Low Power	Icom America	N1XIH (GV0NVN, op)	Rocky Mountain	Single Operator, ORP	Icom America
NJ4P (K9TI, op)	Delta	Single Operator, ORP	Icom America	K7UT	Rocky Mountain	Single Operator Unlimited, High Power	Icom America
N4ZZ	Delta	Single Operator Unlimited, High Power	Icom America	N7MZW	Rocky Mountain	Single Operator Unlimited, Low Power	Icom America
W5NX	Delta	Single Operator Unlimited, Low Power	Icom America	K2KR	Rocky Mountain	Multioperator, Single Transmitter, High Power	Icom America
W5YM	Delta	Multioperator, Single Transmitter, High Power	Icom America	K0UK	Rocky Mountain	Multioperator, Single Transmitter, Low Power	Icom America
ND4Y	Great Lakes	School Club	Icom America	K4JPD (N4OO, op)	Southeastern	Single Operator, High Power	Icom America
K8BB	Great Lakes	Single Operator, High Power	Icom America	KY4KP	Southeastern	Single Operator, Low Power	Icom America
K8SMA	Great Lakes	Single Operator, Low Power	Icom America	N4NM	Southeastern	Single Operator, ORP	Icom America
N8CWU	Great Lakes	Single Operator, ORP	Icom America	K3TW	Southeastern	Single Operator Unlimited, High Power	Icom America
K8BL	Great Lakes	Single Operator Unlimited, High Power	Icom America	W4LT	Southeastern	Single Operator Unlimited, Low Power	Icom America
K8ZT	Great Lakes	Single Operator Unlimited, Low Power	Icom America	K0BKS	Southeastern	Single Operator Unlimited, ORP	Icom America
ND8DX	Great Lakes	Single Operator Unlimited, ORP	Icom America	WW4XX	Southeastern	Multioperator, Single Transmitter, High Power	Icom America
WX4W	Great Lakes	Multioperator, Single Transmitter, High Power	Icom America	KT4XA	Southeastern	Multioperator, Single Transmitter, Low Power	Icom America
W8EDU	Great Lakes	Multioperator, Single Transmitter, Low Power	Icom America	ND7K (K6JO, op @N6WIN)	Southwestern	Single Operator, High Power	Icom America
W2RQ	Hudson	School Club	Icom America	N6OKU	Southwestern	Single Operator, Low Power	Icom America
KU2M	Hudson	Single Operator, High Power	Icom America	KE6K	Southwestern	Single Operator, ORP	Icom America
K2YG	Hudson	Single Operator, Low Power	Icom America	K6LL	Southwestern	Single Operator Unlimited, High Power	Icom America
W2GDJ	Hudson	Single Operator, ORP	Icom America	W7AWE	Southwestern	Single Operator Unlimited, Low Power	Icom America
N2MC	Hudson	Single Operator Unlimited, High Power	Icom America	WQ6X	Southwestern	Single Operator Unlimited, ORP	Icom America
K2AL	Hudson	Single Operator Unlimited, Low Power	Icom America	AB7YQ	Southwestern	Multioperator, Single Transmitter, High Power	Icom America
N2NT	Hudson	Single Operator Unlimited, ORP	Icom America	NX6T	Southwestern	Multioperator, Single Transmitter, Low Power	Icom America
K1RO	Hudson	Multioperator, Single Transmitter, High Power	Icom America	N5RZ	West Gulf	Single Operator, High Power	Icom America
N7WY	Hudson	Multioperator, Single Transmitter, Low Power	Icom America	W5PKK	West Gulf	Single Operator, Low Power	Icom America
W0EWD	Midwest	Single Operator, High Power	Icom America	K5NZ	West Gulf	Single Operator, ORP	Icom America
N0KIS	Midwest	Single Operator, Low Power	Icom America	W5SR (N5ZC, op)	West Gulf	Single Operator Unlimited, High Power	Icom America
N0XR (@N0NI)	Midwest	Single Operator, ORP	Icom America	WA8ZBT	West Gulf	Single Operator Unlimited, Low Power	Icom America
W9LG	Midwest	Single Operator Unlimited, High Power	Icom America	K5TR	West Gulf	Multioperator, Single Transmitter, High Power	Icom America
KR0P	Midwest	Single Operator Unlimited, Low Power	Icom America	W5AFV	West Gulf	Multioperator, Single Transmitter, Low Power	Icom America
N0MMA	Midwest	Multioperator, Single Transmitter, High Power	Icom America	VA7RR	Canada	Single Operator, High Power	Icom America
		Low Power	Icom America	VE5SF	Canada	Single Operator, Low Power	Icom America
				VA2W	Canada	Single Operator, ORP	Icom America
				VE4GV	Canada	Single Operator Unlimited, High Power	Icom America
				VE3PJ	Canada	Single Operator Unlimited, Low Power	Icom America
				VE3GMZ	Canada	Single Operator Unlimited, ORP	Icom America
				VE3UZ	Canada	Multioperator, Single Transmitter, High Power	Icom America
				VE3MIS	Canada	Multioperator, Single Transmitter, Low Power	Icom America

Division Winners

Single Operator, High Power

Atlantic	K3TC	107,734
Central	K9BGL	108,896
Dakota	W0SD	206,040
Delta	K5TS	175,610
Great Lakes	ND4Y	189,890
Hudson	W2RQ	236,980
Midwest	N7WY	81,260
New England	AF1T	170,340
Northwestern	KL7SB	225,624
Pacific	WH7Z (W0CN, op @KH6YY)	271,660
Roanoke	K4ZW	244,800
Rocky Mountain	K5TA	223,440
Southeastern	K4JPD (N4OO, op)	245,650
Southwestern	ND7K (K6JO, op @N6WIN)	291,040
West Gulf	N5RZ	208,590
Canada	VA7RR	269,110

Single Operator, Low Power

Atlantic	K2ZL	106,250
Central	N9EAX	53,300
Dakota	AC0W	157,930
Delta	W0SDJW	67,744
Great Lakes	K8BB	44,162
Hudson	KU2M	118,660
Midwest	W0EWD	148,920
New England	K1VUT	111,180
Northwestern	K2PO	193,722
Pacific	KM9R	34,310
Roanoke	W4AAA (K9A, op)	192,270
Rocky Mountain	WY7SS (WY7FD, op)	171,700
Southeastern	KY4KP	70,684
Southwestern	N6OKU	89,744
West Gulf	W5PKK	43,902
Canada	VE5SF	155,210

Single Operator, QRP

Atlantic	NF2L	17,818
Central	K9ARF	23,360
Dakota	ND0C	67,240
Delta	N5EE	39,658
Great Lakes	KA8SMA	35,412
Hudson	K2YG	13,904
Midwest	N0KIS	14,742
New England	KM7N	144
Northwestern	W7PT	12,096
Pacific	K6GHA	43,680
Roanoke	K2PI	18,720
Rocky Mountain	N1XIH (GW0NVN, op)	3,848
Southeastern	N4NM	9,256
Southwestern	KE6K	22,080
West Gulf	K5NZ	21,190
Canada	VA2IW	17,690

Single Operator Unlimited, High Power

Atlantic	KD4D	214,200
Central	K9CT	240,890
Dakota	WJ0W (KH6XX, op)	255,696
Delta	NJ4P (K9TI, op)	205,360
Great Lakes	N8CWU	146,370
Hudson	W2GDJ	108,970
Midwest	N0XR (@N0NI)	179,180
New England	W1SJ	222,432
Northwestern	K7RL	132,770
Pacific	W7RN (WX5S, op)	241,400
Roanoke	NN3W (@N4RV)	213,860
Rocky Mountain	K7UT	118,944
Southeastern	K3TW	112,548
Southwestern	K6LL	171,870
West Gulf	WE5R (N5ZC, op)	197,710
Canada	VE4GV	156,740

Single Operator Unlimited, Low Power

Atlantic	N3AAA	93,956
Central	K9PW	104,160
Dakota	A0Y	123,520
Delta	N4ZZ	115,770
Great Lakes	K8BL	119,000
Hudson	N2MC	36,188
Midwest	W9LG	63,796
New England	K81W	98,784
Northwestern	W28T	134,130
Pacific	K6QK	32,700
Roanoke	W4KAZ	43,650
Rocky Mountain	N7MZW	123,760
Southeastern	W4LT	162,180
Southwestern	W7AVE	36,646
West Gulf	WA8ZBT	77,922
Canada	VE3PJ	119,448

Single Operator Unlimited, QRP

Atlantic	W7LG	20,532
Central	N9NE	10,712
Great Lakes	K8ZT	1,058
Hudson	K2AL	11,000
New England	K1EP	14,112
Pacific	K2GMY	3,640
Southeastern	KC9BKS	286
Southwestern	WQ6X	46,500
Canada	VE3GMZ	1,488

Multioperator, Single Transmitter, High Power

Atlantic	N3OC	205,530
Central	N9SJ	175,440
Delta	W5NX	164,560
Great Lakes	ND0DX	190,400
Hudson	N2NT	241,060
Midwest	KR0P	226,100
New England	W1XX	215,390
Northwestern	W1AW/KL7	178,616
Pacific	N6RO	200,770
Roanoke	K4OV	247,350
Rocky Mountain	K2KR	141,610
Southeastern	WW4XX	108,630
Southwestern	AB7YQ	112,320
West Gulf	K5TR	333,200
Canada	VE3UZ	105,230

Multioperator, Single Transmitter, Low Power

Atlantic	K2APD	106,930
Central	K9KE	130,900
Dakota	K0AJW	69,046
Great Lakes	WX4W	159,290
Hudson	K1RQ	23,360
Midwest	N0MMA	100,300
New England	NC1CC	145,180
Northwestern	KD0LH	15,892
Pacific	N6ACL	54,600
Roanoke	W4TG	107,900
Rocky Mountain	K0UK	56,406
Southeastern	KT4XA	114,410
Southwestern	NX6T	144,500
West Gulf	W5AFV	44,320
Canada	VE3MIS	4,452

School Club

Central	W9JWC	38,776
Delta	W5YM	1,000
Great Lakes	W8EDU	33,120
Midwest	K0HC	231,168

The 2024 ARRL
November
Sweepstakes phone
weekend will be held
November 16 – 18,
2024.

Top Ten Limited Antenna Overlay

Call	Section	Score	Contacts	Multipliers	Call	Section	Score	Contacts	Multipliers
Single Operator, Low Power					Single Operator Unlimited, High Power				
W3GRF	MDC	100,640	592	85	N4IQ	SC	127,670	751	85
NS3T	MDC	80,510	485	83	W7ZR	NV	109,368	651	84
WN0G	IA	78,894	487	81	AB2E	SNJ	97,410	573	85
KK0SD	SD	69,888	416	84	K4QQG	SC	94,122	567	83
KD9QS	MDC	68,880	410	84	W3UL	EPA	84,830	499	85
WD5DJW	AR	67,744	464	73	N9EP	IL	83,980	494	85
VE3GJP	GH	66,470	391	85	WT2P	IL	75,402	531	71
KF0IDT	CO	66,420	405	82	WA2JOK	ENY	71,380	430	83
N9EAX	WI	53,300	325	82	N2FT	VA	67,728	408	83
VE9CZ	NB	52,416	364	72	AL2F	AK	61,904	424	73
Single Operator, High Power					Single Operator, QRP				
K5TA	NM	223,440	1,330	84	K9ARF	WI	23,360	160	73
KH7X	AZ	179,446	1,081	83	KE6K	AZ	22,080	160	69
K4BAI	GA	103,842	641	81	N0KIS	MO	14,742	117	63
W8FN	NC	84,530	535	79	N8OCJ	OH	11,880	110	54
KB0JI	CO	80,000	500	80	KN3A	EPA	11,800	118	50
W9YZR	WI	67,878	419	81	KZ3MW	EPA	8,208	76	54
N1EK	MDC	64,800	400	81	AC2N	NFL	7,560	84	45
WA2MCR	ENY	54,448	328	83	A19K	IL	6,320	79	40
W9PDS	IL	51,040	319	80	N2JNR	NV	5,880	70	42
K0IDX	ND	48,972	318	77	K9JK	IL	3,990	57	35
Single Operator Unlimited, Low Power					Single Operator Unlimited, QRP				
N7MZW	WY	123,760	728	85	W3EK	DE	16,470	135	61
K8BL	OH	119,000	700	85	N9NE	WI	10,712	103	52
K9PW	IL	104,160	620	84	K2GMY	EB	3,640	52	35
W9QL	IL	100,130	589	85	K8ZT	OH	1,058	23	23
N3AAA	WPA	93,956	566	83	KC9BKS	NFL	286	13	11
N8BV	OH	85,680	504	85					
NG0C	MN	81,008	488	83					
KF5WVJ	MS	72,540	465	78					
W6FB	LA	67,872	404	84					
VA3IDD	ONS	67,320	396	85					

Top Ten Youth Overlay

Call	Section	Score	Contacts	Multipliers
Single Operator, Low Power				
VE3QMV	GH	25,194	221	57
N9QZ	NTX	13,750	125	55
K15WES	LA	8,624	88	49
KD9VZP	IN	4,346	53	41
K15ZNS	STX	1,176	28	21
KC3VFB	DE	756	21	18
KC1RXB	CT	690	23	15
KJ7AGQ	WWA	680	20	17
Single Operator, High Power				
ND7K (K6JO, op @N6WIN)	AZ	291,040	1,712	85
KD0MSU	KS	24,180	186	65
Single Operator Unlimited, Low Power				
NC8R	MI	26,398	197	67
W5IOH	STX	2,520	45	28

2023 ARRL 160-Meter Contest Results

Last year's contest was held December 1 – 3, 2023.

Top Ten — DX

Single Operator, High Power	Single Operator Unlimited, High Power
F6FYA 2,880	ZF2VE 95,628
OK1DOL 540	PJ2T (K8ND, op)
9Z4A (N2TTA, op)	HQ9X (W1UE, op)
GM4Z (GM4ZUK, op)	LY4A 3,074
YV4ABR 312	DQ2C (DI-2SAX, op)
F4DVO 72	G4AMT 2,756
JN7FAH 60	DR5X 2,552
ON4WW 60	G6XX (G4FAL, op)
SP6AEG 32	YL7X (YL2LY, op)
JA9FHB 30	DK9JP 598
Single Operator, Low Power	Single Operator Unlimited, Low Power
XE2X 63,450	V26OC 6,942
ON7EH 608	TM6M (F1AKK, op)
XE2T 418	XE2B 300
F5TFW 264	LZ2ZG 112
JE1SPY 84	JH1BBT 84
JA7KPI 30	PA3EVY 2
DL0NG (DK8NC, op)	EU2F 0
JE1TSD 12	
EA1FCH 2	
JA4YPE 2	
JH4CES 2	
SP1D 2	
Single Operator, QRP	Single Operator Unlimited, QRP
XE2S 1,734	HI3K 532
CO6EC 140	
JE3AKU 2	
Multioperator, Single Transmitter, High Power	
P40L 33,000	
JA3YBK 1,302	
OL4N 32	

Top Ten — US and Canada

Single Operator, High Power	Single Operator Unlimited, Low Power
K3ZM 269,339	VE3MGY 130,086
WF2W 233,168	WB8JUI 129,899
NA8V 230,202	N3HEE 125,160
N0TT 208,791	NJ3K 101,304
W2FU (K2TJ, op)	KK0U 100,575
K1LZ 170,874	N9CO 81,840
K1DG 125,760	KX9RT 79,971
NO9E 124,886	K8BL 70,064
K9AY 121,758	N9TF 68,770
W4CB (W2RU, op)	WE9R 67,760
Single Operator, Low Power	Single Operator Unlimited, QRP
KG9X 134,460	KA4RRU 35,834
K8NVR 97,217	K1EP 25,440
W0UO 96,560	K2YAZ 11,400
WD8DSB 94,116	N9SM 7,776
NS4T 81,774	KB9RPG 6,600
W8WTS 75,411	KO1H 6,016
K8FH 68,376	K8ZT 5,040
KG5OA 63,308	KQ2RP 3,654
N8LI 53,298	W0GJ 352
K1GU 53,010	W6JPL (K6ICS, op) 40
Single Operator, QRP	Multioperator, Single Transmitter, High Power
K1ZM 53,460	WJ9B 289,170
W3TS 41,830	W2GD 251,856
K4XL 23,040	N0NI 233,512
WU2M (WW2G, op)	K3AJ 208,386
WJ4G 15,132	K4TCG 181,884
N2AWE 13,684	K5CM 174,244
WB4MSG 13,112	K8LX 161,656
WBPMN 12,960	K3JO 143,201
WC4X 12,540	NA7TB 124,852
N7IR 12,480	N4HB 116,366
Single Operator Unlimited, High Power	Multioperator, Single Transmitter, Low Power
N1LN 272,064	KT4XA 94,725
VE3EJ 263,410	W9KM 70,380
AA1K 243,256	W4TG 59,582
K1LT 227,200	KA9VVO 26,961
K1KI 206,316	N1SOH 8,192
N5OT 192,178	W4FOC 6,156
VA2WA 186,813	W6OFM 1,344
W0AIH (K0TG, op)	
167,214	
N9SE 164,472	
K2AV 163,680	

Affiliated Club Competition

Club	Score	Entries
Unlimited		
Potomac Valley Radio Club	3,505,769	87
Society of Midwest Contesters	2,662,938	61
Frankford Radio Club	2,244,556	55
Yankee Clipper Contest Club	2,010,469	72
Minnesota Wireless Assn.	1,381,352	52
Medium		
Contest Club Ontario	1,005,091	26
Mad River Radio Club	969,454	12
Tennessee Contest Group	737,358	19
Arizona Outlaws Contest Club	463,702	19
South East Contest Club	422,662	8
Florida Contest Group	365,532	16
Niagara Frontier Radiosport	359,091	12
Bay Area DXers	301,301	7
North Coast Contesters	298,367	8
Kansas City Contest Club	294,035	9
Central Texas DX and Contest Club	291,741	11
Northern California Contest Club	279,956	23
DFW Contest Group	277,817	13
Swamp Fox Contest Group	192,092	6
Alabama Contest Group	186,562	8
Rochester (NY) DX Assn.	160,193	8
Kentucky Contest Group	150,406	7
Southern California Contest Club	119,979	8
Big Sky Contesters	114,825	3
Hudson Valley Contesters and DXers	113,265	10
North Texas Contest Club	109,801	3
Willamette Valley DX Club	109,411	5
Grand Mesa Contesters of Colorado	92,899	8
Carolina DX Assn.	88,585	5
Northeast Maryland Amateur Radio Contest Soc.	83,061	4
599 DX Assn.	52,873	3
Heartland DX Assn.	18,560	3
Arkansas DX Assn.	13,561	3
Texas DX Soc.	12,420	3
Lake Area Amateur Radio Klub	3,640	3
Local		
Medina County ARC	195,417	3
Not Quite Workable Contest Club	138,687	3

Continental Winners

Asia

Single Operator, High Power	JN7FAH	60
Single Operator, Low Power	JE1SPY	84
Single Operator, QRP	JE3AKU	2
Single Operator Unlimited, High Power	JF1AMX (JF1HYA, op)	546
Single Operator Unlimited, Low Power	JH1BBT	84
Multioperator, Single Transmitter, High Power	JA3YBK	1,302

Europe

Single Operator, High Power	F6FYA	2,880
Single Operator, Low Power	ON7EH	608
Single Operator Unlimited, High Power	LY4A	3,074
Single Operator Unlimited, Low Power	TM6M (F1AKK, op)	4,340
Multioperator, Single Transmitter, High Power	OL4N	32

North America

Single Operator, Low Power	XE2X	63,450
Single Operator, QRP	XE2S	1,734
Single Operator Unlimited, High Power	ZF2VE	95,628
Single Operator Unlimited, Low Power	V26OC	6,942
Single Operator Unlimited, QRP	HI3K	532

Oceania

Single Operator, High Power	VK2GR	2
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South America

Single Operator, High Power	9Z4A (N2TTA, op)	476
Single Operator Unlimited, High Power	PJ2T (K8ND, op)	82,198
Multioperator, Single Transmitter, High Power	P40L	33,000



David Tessitore, K1DT, operated as part of the W1AW/1 multioperator team from the Providence Radio Association's club station, W1OP, during the 2023 ARRL 160-Meter Contest. The club was honored to represent ARRL during the 2023 Volunteers on the Air event. [David Tessitore, K1DT, photo]

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.

The 2024 ARRL 160-Meter Contest will be held December 6 – 8, 2024.

Division Winners

Single Operator, High Power

Atlantic	WF2W	233,168
Central	K9AY	121,758
Dakota	N0OK	19,769
Delta	W4DAN	45,441
Great Lakes	NA8V	230,202
Hudson	KR2	57,176
Midwest	N0TT	208,791
New England	K1I.Z	170,874
Northwestern	N9RV	66,143
Pacific	N6XI	19,136
Roanoke	K3ZM	269,339
Rocky Mountain	N2IC	58,806
Southeastern	NO9E	124,886
Southwestern	W8KA	102,080
West Gulf	K5RX	84,321
Canada	VA3AR	100,768

Single Operator, Low Power

Atlantic	KN3A	35,156
Central	KG9X	134,460
Dakota	NG0C	32,200
Delta	K1GU	53,010
Great Lakes	K8NVR	97,217
Hudson	N2RI	25,506
Midwest	A16O	52,461
New England	AA1ON	31,328
Northwestern	W7TMT	20,075
Pacific	K6RAD	12,833
Roanoke	N8II	50,232
Rocky Mountain	W0ZW	6,808
Southeastern	NS4T	81,774
Southwestern	KE6K	5,539
West Gulf	W0UO	96,560
Canada	VA3OKG	28,106

Single Operator, QRP

Atlantic	W3TS	41,830
Central	W9OL	1,978
Dakota	KE0TT	2,552
Delta	W3GW	240
Great Lakes	W8PEN	12,960
Hudson	WJ2M	
	(WJ2G, op)	20,746
Midwest	N0LMQ	1,786
New England	K1ZM	53,460
Northwestern	KK7A	96
Pacific	NH6O	2
Roanoke	K4XL	23,040
Rocky Mountain	KF7MD	4,680
Southeastern	WC4X	12,540
Southwestern	N7IR	12,480
West Gulf	WG5F	3,969
Canada	VE9QR	986

Single Operator Unlimited, High Power

Atlantic	AA1K	243,256
Central	W0AIH	
	(K0TG, op)	167,214
Dakota	WJ0W	
	(KH6XX, op)	120,858
Delta	AD4EB	141,416
Great Lakes	K1LT	227,200
Hudson	N2GC	100,959
Midwest	N0AV	73,188
New England	K1KI	206,316
Northwestern	K7QA	46,060
Pacific	WJ6P	68,780
Roanoke	N1LN	272,064
Rocky Mountain	K7NJ	129,770
Southeastern	KP4AA	90,112
Southwestern	KC7V	52,125
West Gulf	N5OT	192,178
Canada	VE3EJ	263,410

Single Operator Unlimited, Low Power

Atlantic	NJ3K	101,304
Central	N9CO	81,840
Dakota	K0RC	59,126
Delta	N9TF	68,770
Great Lakes	WB8JUI	129,899
Hudson	W2GDJ	25,256
Midwest	KK0U	100,575
New England	NJ1Q	21,555
Northwestern	N7YY	5,394
Pacific	WQ6X	380
Roanoke	N3HEE	125,160
Rocky Mountain	K0UK	12,150
Southeastern	W04O	45,880
Southwestern	NT5A	1,818
West Gulf	K5LJ	12,582
Canada	VE3MGY	130,086

Single Operator Unlimited, QRP

Central	KB9RPG	6,600
Great Lakes	K2YAZ	11,400
Hudson	KO2RP	3,654
Midwest	W0GJ	352
New England	K1EP	25,440
Roanoke	KA4RRU	35,834
Southwestern	W6JPL	
	(K6ICS, op)	40

Multioperator, Single Transmitter, High Power

Atlantic	W2GD	251,856
Central	W9XG	44,220
Delta	K4TCG	181,884
Great Lakes	K8LX	161,656
Midwest	N0NI	233,512
New England	K3JO	143,201
Pacific	KH6AQ	107,653
Roanoke	N4HB	116,366
Southeastern	WJ9B	289,170
Southwestern	NA7TB	124,852
West Gulf	K5CM	174,244

Multioperator, Single Transmitter, Low Power

Central	W9KM	70,380
New England	N1SOH	8,192
Pacific	W6OFM	1,344
Roanoke	W4TG	59,582
Southeastern	KT4XA	94,725

The 2024 IARU HF World Championship

1200 UTC Saturday, July 13 – 1159 UTC Sunday, July 14

The objective of this contest is to support amateur self-training in radiocommunications, including improving operating skills, conducting technical investigations, and communicating with other amateurs around the world (especially IARU member-society headquarters stations) using the 160-, 80-, 40-, 20-, 15-, and 10-meter bands.

- ♦ The exchange is a signal report and your ITU zone.
- ♦ Single-Operator entrants choose from High, Low, or QRP Power, and Mixed Mode, CW Only, or Phone Only.
- ♦ Stations from IARU member-societies around the world will be active. Get on the air to find out how many headquarters stations you can work.
- ♦ Seven-day log submission deadline: Upload Cabrillo-formatted logs to the web app at <https://contest-log-submission.arrrl.org> no later than 1159 UTC July 21. Mail paper logs (postmarked by July 18) to IARU HF Championships, c/o ARRL Contests, 225 Main St., Newington, CT 06111 USA.



Members of the DX1EVM Multioperator team setting up an antenna they used during the 2023 IARU HF World Championship. They took first place in Oceania and set a new continental record in the Multioperator, Two Transmitter, Low Power category. [Elvin Apostol, Jr., DV1IIV, photo]

Up-to-date rules, paper log forms, and ITU zone maps can be found at www.arrrl.org/iaru-hf-world-championship.

Congratulations

March 2024
QST Cover Plaque Award Winner

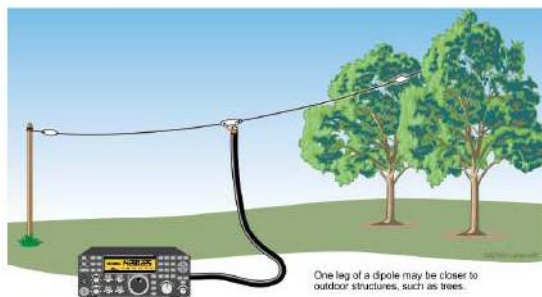
Larry Lamano,
WAØQZY

In his article, "Common-Mode Current and Common-Mode Chokes," Larry gives an overview of common-mode current using a coax-fed antenna to illustrate the concept, and explains how current chokes work to correct unbalanced current.

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

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



Common-Mode Current and Common-Mode Chokes

An overview of CM current, and what hams can do to correct it.

Larry Lamano, WAØQZY

When it comes to HF antennas, regardless of the type of feed line, one dipole leg may be closer to things like the ground, a tree, or a building (see the lead image). Coax-fed HF antennas are also inherently unbalanced because one side of the antenna goes to the coaxial braid or shield, and the other goes to the coaxial center. These factors unbalance the currents flowing in the legs of the antenna and the feed line. In this article, I will use the coax-fed antenna as an example to illustrate this concept. When current in the shield and the center conductor of the coax is not balanced, the difference is referred to as *common-mode* (CM) current. Radiation from balanced currents cancels outside of the coax, but the unbalanced CM current flowing between the antenna and the transmitter produces radiation. The coax effectively becomes an antenna that can cause interference to nearby electronics — and in severe cases, RF bites. Adding a grounding strap to where the coax enters your shack may not help, as it becomes another part of the unwanted antenna.

CM current changes the radiation pattern of the antenna. It can also detune the antenna, change the standing wave ratio, and add noise.

Minimizing current requires increasing the impedance in the current's path. In amateur radio antennas, we reduce current by placing a CM current choke or current balun in the CM current path. This tends to force equal currents in both halves of the

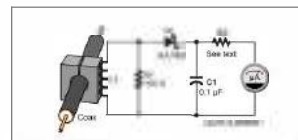


Figure 1 — A CM current choke. The choke has 10 turns of small wire (12) wound through a 1000-ohm resistor on the core. It becomes a high-impedance transformer. The CM current, made on the wire, also flows through R1. R2 sets the meter's sensitivity.

Club Station

Four Ways Clubs Can Make Field Day Their Own

Each year, more than 1,700 clubs get together during the fourth full weekend of June to operate in ARRL Field Day — one of the largest and most well-known events in amateur radio. Every club and individual operator can benefit in different ways from participating, as it's not a one-size-fits-all event. In this month's column, ARRL Field Services Manager Mike Walters, W8ZY, shares the different ways in which your club can participate.

The wide variety of interests available within amateur radio, paired with the different operating categories for the event, allow participants to make Field Day their own. Here are a few ways that clubs can utilize the event to showcase not only what amateur radio can do, but what clubs can do for their members and local communities.

Provide Contesting Practice

Many hams wonder why they can earn points and see published results if Field Day is not a contest. Simply put, the point system and published results exist so that operators can gauge their activity with others. No individual operator or club wins the event, and there are no awards for the best, largest, smallest, or most elaborate stations. Instead, the operating rules are designed for safety and to avoid interference.

With that, Field Day is a great way for clubs to introduce new operators who are interested in contesting to the routines, exchanges, and processes of a contest, as well as provide practice for novice testers. The elements are available for trying logging software, a new antenna, or a different mode. Because Field Day isn't a contest, it allows clubs the chance to expose new operators and members to HF operation and contesting without the pressure that comes along with participating in a contest.

Demonstrate EmComm Capabilities

Demonstrating emergency communications capabilities to local emergency management agencies by setting up stations under emergency conditions, using alternate power, and utilizing antennas that are in a temporary installation is a popular Field Day activity for clubs. The event can be used as a nationwide drill that shows the



NARA members operating during Field Day. John Wittmann, N1YV (at right), called and Chris Lundgren, N1CPL (at left), logged. [Mike Walters, W8ZY, photo]

community how your club might respond to an emergency.

Invite local served agencies to watch your operations at your event location. Better yet, get them on the air to make some contacts. You can also invite local emergency management agencies, such as fire and police departments and ambulance leaders. Remember to include agencies that engage in local shelter management if they are not part of the other groups.

Recruit New Members and Prospective Hams

With a focus on reaching new and prospective hams, this is a weekend-long opportunity for clubs to display what amateur radio is, the benefits of being part of a club, and just how much fun the hobby can be. I'm a member of the Northville Amateur Radio Association (NARA), NA1RA, and we often attract youth hams by using *N3FJP* logging software (www.n3fjp.com/fieldday.html) because we can display a map of the locations that we're contacting throughout the event. Having a visual of a map filling up with contacts shows the younger generations that you can still reach people around the world without using a cell phone. (See the sidebar, "Attract New Members with Field Day," to see how NARA participated in a recent Field Day with a focus on membership.)

Attract New Members with Field Day

Last year, NARA experimented with using postcards to invite hams to Field Day. This isn't necessarily original, but it did work. First, we picked an area around our Field Day site and gathered all the zip codes for that area. Then, we requested a list of all the licensed hams in that area, not just our club members, from ARRL (Affiliated Clubs can visit www.arrrl.org/affiliated-club-benefits for more information about requesting mailing lists). Next, we had postcards printed that looked like a QSL card from our club, but they were actually an invitation to join us on Field Day. Lastly, we mailed the postcards around June 1 so the invitation would not arrive too early.

In total, we sent out about 200 cards, and this prompted around 25 folks who weren't members to drop by our Field Day location. Some were amazed that we had such a club, and others were just passing through while out running errands. Of those who visited, five became new club members. One new member in particular was a General-class licensee in his early 80s who wanted to upgrade, and he was happy that we held VE sessions locally. The project was an investment for the club, but well worth meeting new friends and gaining new club members.



A Get on the Air (GOTA) station is a great way to help new hams operate on the air for the first time. The station should be set up for new or inactive hams to experience HF during a time frame that allows just about anyone with a radio to make a contact. Make it easy for new or prospective hams to feel like they're a part of the event. Because they are often intimidated by getting on the air, your club should consider writing the event exchange on large cards for them to read while operating, as opposed to having them try to remember what to say.

Don't forget to have a sign-in sheet for visitors and operators, so you can reach out to them after the event and invite them to a club meeting or another event.

Have Fun and Socialize

Many clubs participate in Field Day to get members together and experience a day of fun and fellowship. It's important to have all-member gatherings where they can enjoy food and get to know each other outside of the hobby and regular club meetings. After all, amateur radio is the original social network. Invite non-club members and inactive members to your event.

Going beyond including members and their families, clubs also like to use this opportunity to involve their local and state government officials. Invite the mayor to stop by and see what you do. Work with your town and state governments to issue proclamations declaring Field Day as a dedicated day for ham radio. This could lead to media coverage and more visibility for your club and its activities.

Adding your event to the ARRL Field Day Locator (www.arrrl.org/field-day-locator) allows folks to see where your club will be set up so they can visit your location. When adding your station location to the locator web page, be sure to list your club's website. Use social media, as well as any local advertising and promotion means your club has available, to make the event known to the public so they can see your club at work. When posting content from Field Day, use hashtag #ARRLFD to receive 100 bonus points!

Field Day 2024

The 2024 ARRL Field Day takes place on June 22 – 23, from 1800 UTC Saturday to 2059 UTC Sunday. Visit www.arrrl.org/field-day for more event information and additional resources, including a list of suggested logging software, entry forms and information packets, event rules, and more. I hope to see your club on the air during the event!

Write for "Club Station"

QST's "Club Station" column is a designated space for clubs to share specific and practical ideas about what has contributed to their success, in the hope that the information will help other clubs grow and thrive. Visit www.arrrl.org/qst-club-station-guidelines-and-profile-form for more information, including author guidelines and a Club Profile Form (this form is required in order for "Club Station" submissions to be considered complete).

ARRL Special Service Clubs

ARRL offers the Special Service Club (SSC) program for clubs that demonstrate that they're working to improve the amateur radio community by completing special projects, holding license classes, and working with local groups on events, among other activities. Visit www.arrrl.org/ssc-application for more information about this program. Below is a list of new and renewing SSCs as of March 25, 2024.



Renewing SSCs

Dallas ARC, W5FC	Lewisville, TX
Great South Bay ARC, W2GSB	West Babylon, NY
Butler County Amateur Radio Club, K3PSG	Prospect, PA
Bloomington ARC, K9DIY	Bloomington, IN
Seneca Radio Club, W8ID	Tiffin, OH
SW Louisiana Amateur Repeater Club, W5BII	Lake Charles, LA
Candlewood ARA, W1QI	Brookfield, CT

Ham Media Playlist

Coastal Waves & Wires — Low-Power Operating at the Beach

Some hams enjoy combining amateur radio with another hobby. Walt Hudson, K4OGO, is one of those individuals, as he combines his love of radio with his love of the beach.

Discovering Radio

Walt first discovered the thrill of radio at a young age. He spent hours spinning the dial on his little **AM** radio and listened to stations near and far. Growing up, his bedroom window overlooked a harbor, and it didn't take long for him to find that signals improved the closer he got to the water.

It wasn't until the mid-1970s that he had the opportunity to see the same phenomenon held true when transmitting, taking advantage of the multitude of signals on CB radio. This discovery led him to short-wave listening and eventually to amateur radio.

Low-Power Operating

Walt has always enjoyed low-power operating, and this interest led him to an argument in a Facebook group. He was scheduling a trip to Kauai, Hawaii, and planned to operate from the beach with a small 5 W transceiver. Several people in the group said it would be impossible for him to be successful at such low power in the middle of the Pacific Ocean. Never one to



Walt, K4OGO, makes a contact from the beach in Hawaii.

be deterred, Walt not only took up the challenge, but he filmed it as proof.

This argument-spurred operation led him to post a video titled "QRP on the Beach in Kauai, Hawaii" on YouTube (<https://tinyurl.com/walt-first>). Walt filmed a short introduction, calling out those who claimed that what he wanted to do could not be done, and calling himself "Salty Walt." Thus, his channel Coastal Waves & Wires was born. The video is a true joy to watch, as Walt finds success in spite of a number of challenges. The wind was high, the antenna he bought was a counterfeit, and he duct-taped his antenna to a pole to keep it in the air — it appeared everything was against him. Using his Xiegu X5105, he made a contact using single sideband to Chuck Cartwright, AH7Y, on the Big Island, a distance of 325 miles.

While many might consider that to be enough to claim victory, Salty Walt kept calling, and his persistence paid off. Walt worked Ross Biggar, ZL1WN, in New Zealand, a distance of 4,603 miles. This experience served as the catalyst to launch what is, at the time of this writing, a YouTube channel with 16,500 subscribers.



Walt, K4OGO, shows the equipment he will use to attempt his first-ever QRP contact from a beach.



Walt, K4OGO, makes a QRP contact from the beach at Nags Head, North Carolina, to Australia.

Helping Fellow Hams

Walt continues to create content for YouTube for a few reasons. He enjoys low-power portable operating from coastal areas, and loves sharing that radio can be fun and fit into a number of adjacent hobbies. Additionally, several viewers have sent him messages letting him know that his videos encouraged them to upgrade their licenses so they could be more active on the HF bands.

Walt enjoys not only operating, but also talking about his portable setup. In his video titled "Vertical Half Wave Antenna — QRP Portable" (<https://tinyurl.com/walt-vertical>), Walt discusses his vertical setup and explains how he sets up the antenna and station. He jumps right into the video with a contact from Nags Head, North Carolina, to Marty Martin, VK6RC, in Australia, a contact of 11,665 miles using only 10 W. Then Walt has the pleasure of VK6RC "handing him off" to allow other Australian stations to have a great contact.

Never one to miss a moment to help people experience something new, Walt pauses to let viewers see how someone using a metal detector nearby creates noise on the air, then jumps right back into working stations in Australia.

One struggle many hams have is breaking into a pileup. When operating low power, that problem is magnified. In his video "Breaking a Pileup with Low Power" (<https://tinyurl.com/walt-pileup>), Walt shares some of his techniques to get into the pileup. He starts by advising people to listen for a while. This is advice that we hear often, but Walt advises listen-

ing to get a feel for the rhythm of the pileup. Once you have a feel for the pileup, he lets you in on some of his tips. One thing I really like about Walt's advice is that while he is giving tips for getting in, he reminds us to "be good hams" in how you operate. He also reminds us that this is supposed to be fun, so if you are getting frustrated, make a note of the frequency, spin the dial, and come back later.

Falling in line with his enjoyment of helping fellow hams learn something new, Walt gets a lot of questions from his viewers. So many people commented about purchasing one of his radios of choice, a Xiegu G90, that he decided to make a quick start guide to help people get it on the air quickly. In his video titled "Xiegu G90 — Quick Start Guide" (<https://tinyurl.com/walt-g90>), Walt does a fantastic job of quickly guiding viewers through the most basic functions of the radio. Then he gets into some of the important functions that many hams new to HF don't understand, such as how to set up the radio to work "split." Walt explains that hams often hear a station saying "listening five up" or something similar, so he explains what that means and how to make those contacts.

Coastal Waves & Wires feels like a breath of fresh air on YouTube. Walt's presentation style is straightforward and down to earth. It is obvious that he enjoys what he does, and he only does what he enjoys. Whatever is on his mind while he is operating dictates what his videos will be about. Be sure to head over to www.youtube.com/@COASTALWAVESWIRES and enjoy great scenery and great videos.



Walt, K4OGO, guides viewers through the basic operations of the Xiegu G90 transceiver.

How's DX?

Temotu Province — H4ØWA 2024 DXpedition Recap

In this month's column, guest author Robert Fanfant, N7QT, details the effort that went into the H4ØWA team's Temotu Province DXpedition in the Solomon Islands, as well as its successful conclusion.

In 2019, I activated Temotu Province as H4ØTT from the Ngarando Island Resort (NIR) on Pigeon Island with Grant Saviers, KZ1W. After noticing that H4Ø was still relatively high on Club Log's DXCC Most Wanted List, I decided to reactivate it in 2023. NIR owner Ben Hepworth confirmed that he was open to hosting another amateur radio expedition. I mentioned this to Paul Ewing, N6PSE, and we recruited a talented group of eight experienced operators, all of whom we had worked with on prior DXpeditions. In March 2023, I was able to obtain a 1-year license with the call sign H4ØWA.

Putting the Plan in Motion

Meanwhile, Paul and I started ordering equipment. The plan was to run four stations with a complement of antennas from 6 to 160 meters, as well as one RX antenna (a BevFlex-4X/Q). We thank DX Engineering for supporting our project and providing us with an assortment of coax, crimpers, connectors, and the RX antenna system for this operation.

It was extremely difficult to find a customs broker or freight forwarding company in Honiara, the capital of the Solomon Islands, that could process our equipment through customs and onto Temotu Province. In May 2023, I flew to Honiara, in part to find a customs broker for the H4ØWA project. I found a company known as BJS Agencies willing to handle our equipment. BJS stated that it would take them only 5 days to get our equipment through customs and onto the next ferry destined for Temotu. This ferry runs monthly, though not on a fixed schedule.

In June 2023, Paul and I met in San Jose, California, to prepare the equipment for shipment. Everything was shipped to Honiara via airfreight a few days later, arriving in early July. Instead of the 5 days BJS had quoted, it took more than 2 months to get our equipment through customs. The ferry scheduled to take our equipment to Temotu was then delayed another 4 weeks due to equipment breakdown and bad weather. After this, it was rerouted to pick up seaweed at another island. We had



H4ØWA team members participated in the single sideband portion of the 2023 CQ World Wide DX Contest. Scott Jasper, NE9U, is in the foreground; Jay Lopes, AC7DC, is directly behind Scott, and Don Dubon, N6JRL, is on the right. [Rob Fanfant, N7QT, photo]

no choice but to postpone the DXpedition until February 22 – March 7, 2024.

Most of our original team had other March commitments, so we found a new set of operators for the activation. The team members included myself, Bruce Bern, K3NQ; Jay Slough, K4ZLE; Dave Flack, AH6HY; Don Dubon, N6JRL; Paul Ewing, N6PSE; Jay Lopes, AC7DC, and Scott Jasper, NE9U. Unfortunately, Dave was ultimately unable to make the trip.

Equipment and Operators Make Landfall

Our equipment was delivered to NIR in November, a full 4 months after arriving in Honiara. The H4ØWA team met in Los Angeles, and we traveled to Honiara together via a short layover in Fiji. We spent several days in Honiara, visiting a few World War II memorials in between preparing for our expedition. The average daytime temperatures were around 89 °F, and the average nighttime temperatures were about 84 °F. Extreme humidity made the day temperatures feel closer to 102 °F.

On departure day, Solomon Airlines announced that there would be two flights to Lomlom, Temotu Province, and that the team would be split between the flights. Team members on the earlier flight waited for the other

team half to arrive 45 minutes later. We landed on a dirt/coral airstrip and were met with what appeared to be the entire village community. The domestic terminal was an open-air market where villagers were selling local fruits and vegetables. The terminal itself was a small, thatched hut approximately 10 x 20 feet. Temperatures in Lomlom seemed hotter and more uncomfortable than in Honiara. Once the plane was unloaded, we gathered all of our checked bags and personal items before hiking more than a third of a mile to the lagoon edge. A few locals helped carry our heavier checked bags to the two small boats waiting for us. We waded into the lagoon with our gear and loaded the boats for the 45-minute trip through mangrove swamps to the open sea.

Upon arrival at Pigeon Island, we surveyed our living quarters to plan antenna placements and station setup, and then we settled in for the night. The following morning, we unpacked the containers of equipment shipped from San Jose. Team members were given various assignments, such as laying out the coax to each of the antenna locations, installing the Starlink satellite system, or setting up the networking and stations. We found a suitably strong signal from Starlink while suffering short-duration signal losses multiple times per hour. Due to the high heat and humidity, it took the team 2 full days to complete setup. Many of us suffered dehydration and needed frequent water breaks. At the end of the second day, we had successfully installed the four stations and the antennas. Our radio equipment consisted of Elecraft K3S transceivers and a variety of amplifiers (a Gemini DX1200, a FlexRadio PGXL, and Elecraft KPA500s). Antennas included a five-element 6-meter Yagi, vertical dipole arrays for 10 – 20 meters set up close to the water's edge, and 30/40/60/80-meter quarter-wave verticals. The 160-meter inverted L and the DXE BevFlex-4X-Q

receive antenna were installed 6 days after the start of our activation.

Three teams of two or three people operated two 4-hour shifts each day, rotating shifts every 4 days. This way, each team member was able to operate all hours of each day during the operation.

The operation started in the morning on the third day with large, challenging pileups — particularly from stations in Europe. Signals were weaker than expected, even though we had a very low-noise environment. The upper bands would open just before daybreak and remain that way until early morning the following day. Each midday saw a lull of activity across all bands for a few hours, but the bands would roar back to life at around 2:30 PM local time.

A Look at the Results

We monitored DXMaps (www.dxmaps.com) for 6-meter openings. Following a solar storm, we caught a great opening into Japan that yielded nearly 600 6-meter contacts. Many Japan-based operators told us it was their first-ever 6-meter contact with Temotu Province. Our contacts with stations in Europe and Asia were evenly split, each making up 35% of our total contacts. North and South America contacts comprised 25% of our total. Our total contact count was just more than 60,000, with contacts on the high bands accounting for more than 75%. Ten meters was our most productive band, with more than 11,000 contacts (about 20% of our total).

Given the heat and humidity, we ended the operation a few days early in order to ease teardown. All of our equipment needed to be put back into its respective shipping containers, which took a bit of time to complete.

Most team members lost weight during this trip. Every meal consisted of fresh bread, a can of tuna and liverwurst, cucumbers, and a sweetened lime drink called bush-lime. Breakfast included cornflakes, powdered milk, and sometimes fresh eggs and oatmeal. Dinner would include fried reef fish, fried or boiled chicken sausages, rice, and cooked squash. We ended each meal with a fresh slice of papaya.

Lomlom is a remote location with one scheduled flight per week. If rain is forecasted, Solomon Airlines cancels the flight. It rained the day we were scheduled to leave, and after another week of waiting, we finally made the March 14 flight from Lomlom to Honiara. This delay caused an unexpected financial burden to each team member, as all of our flights had to be rescheduled at significant expense. However, we all arrived home safely after spending a full month in what we all would agree was a challenging environment. The H40WA team would like to thank our corporate sponsors, the amateur radio community, and clubs for their support.



H40WA team members at the Lomlom airport domestic terminal, awaiting their flight home. Pictured from left to right is Jay Slough, K4ZLE; Don Dubon, N6JRL, and Jay Lopes, AC7DC. [Rob Fanfant, N7QT, photo]

The World Above 50 MHz



CME Sparks Strongest Geomagnetic Storm of Solar Cycle 25

An X-class solar flare from sunspot region 3615 hurled a huge coronal mass ejection (CME) directly toward Earth on March 23, 2024. The CME rapidly crossed the distance between Earth and the sun, and “arriving hours earlier than expected, the CME struck Earth’s magnetic field on March 24th at 1437 UTC,” according to a post on Spaceweather.com. The post continued, “The impact opened a crack in our planet’s magnetosphere and sparked a severe G4-class geomagnetic storm — the strongest since [September] 2017.”

Initially, there was no 6-meter propagation bump in the Western Hemisphere. But starting at around 1915Z, 6 meters exploded with activity. I, NØJK, picked up 9Y4D at the beginning of the opening. The band was extremely crowded. Rick, HD8MD, appeared at around 2000Z while he was running *MSHV* mode on 50.313 MHz; he logged 345 stations. Trey Garlough, N5KO (CM97), picked up HD8MD for his first HC8 contact from the US, as well as the rare PJ7AA, who was reportedly using a Buddipole antenna. Later, several stations in the Falkland Islands appeared. At 2040Z, I had VP8WA (GD08) in at +4 dB. Bobby, VP8WA, contacted many stations in North America while running 250 W and using a hexbeam. Rich, K1HTV (FM18), worked LU7XZ and CE8EIO on FT8, and then he worked VP8LP on FT4. Mike, VP8NO, was also active and looking for new states.

Frank Donovan, W3LPL, observed:

Today’s mid-latitude propagation was far too widespread to be sporadic E. March is one of the worst months for sporadic E, and today’s propagation was spectacular. VP8WA and many [Argentina stations] were stronger than all but the strongest local signals here. It was likely that today’s excellent mid-latitude DX propagation was [transequatorial propagation (TEP)] coupled to mid-latitude F2, both enhanced by equatorward electron drift driven by today’s severe geomagnetic storm. Today’s propagation to [the Canary Islands, Ecuador, and Peru] was likely via reflection from only the northern TEP zone.

Galápagos Islands on 6 Meters

Dr. Rick Dorsch, NE8Z/HC1MD/HD8MD, had fortuitously timed his March 20–29, 2024, trip to the Galápagos Islands, as it coincided with the CME impact on March 24. Rick operated from Shipwreck Bay in Puerto Baquer-

izo Moreno (grid EI59ec), which is the capital of the Galápagos Province and located on San Cristóbal Island. His plan was to conduct a “DXpedition-lite” operation, and to provide HC8 as an all-time new one for as many operators as possible. He prioritized 6 meters. Rick noted, “I made exactly 1,000 contacts on 6 meters and 10,671 contacts on the 40–10-meter HF bands. I decided to use mostly FT8 *MSHV* in order to give out as many 50 MHz Galápagos contacts as possible.” *MSHV* is a multi-stream digital mode similar to — but different from — *WSJT-X* Fox and Hound. For more information about *MSHV*, visit www.lz2hv.org/mshv. Rick could make multiple contacts on each FT8 cycle. He made a few 6-meter CW and single sideband contacts when requested.

Rick said, “The solar disturbances that occurred during my stay certainly enhanced 6-meter propagation for me. I had 1 day with a clear F2 opening to the US that lasted hours, yielding 671 6-meter contacts.” Rick’s station consisted of a Kenwood TS-590SG, 100 W with a 40–6-meter Windom, and a PAR Electronics two-element 6-meter Moxon model SM-50. Both antennas are located at 75 feet above sea level, and he was able to switch between the two while operating. During this same trip, HD8MD worked 29 different DXCC entities on 6 meters. Their prefixes are as follows: 3D2, 8P6, 9K2, 9Y4, CO, CE, EA, EA8, FG, FM, FS, HC, HI, HK, HKØ,



Dr. Rick Dorsch’s, HD8MD, station in the Galápagos Islands. [Rick Dorsch, HD8MD, photo]



A PSK map showing Dr. Rick Dorsch's, HD8MD, signal being received throughout much of North America. [Rick Dorsch, HD8MD, photo]

HP, J3, J8, K/W, KH6, NP2, PJ4, PY, TG9, TI, VE, XE, YV, and ZF. Rick added:

I worked 17 new DXCC entities to go towards my HC8 6-meter DXCC. I have now worked 247 DXCC entities from HC8 since the mid-1970s. Maria, HC1MM/HD8MM, and I had plenty of time to explore the island when the bands died from the solar storms. The Galápagos Islands are a magical, prehistoric world full of amazing scenery, flora, and fauna. I monitored DX-Maps and PSK Reporter 24/7 for any and all 6-meter band openings. I set up the entire station ahead of time at my HC1MD/2 location, and then I tested everything. I packed only the basic, necessary items and headed off to HC8. I didn't forget to take anything on this trip. [QSLs were done] via K8LJG or NE8Z. At the request of many hams, I have opened a Club Log account with OQRS. Gennady, UX5UO, is printing some nice color cards, which can be seen on my HD8MD QRZ web page.

Rick uploaded his log to Logbook of The World, with contact matches appearing on March 31. He thanked:

[Agencia de Regulación y Control de las Telecomunicaciones] Ecuador for issuing me the special HD8 prefix and the license, Quito Radio Club officers HC1BG and HC1KE, WB2REM for tech support, NØJK for the daily propagation forecasts, W4OP of PAR Electronics, David and Nancy Campoverde for renting us their Airbnb room and for their ham-friendly hospitality, and Ted Pauck, K8NA, for funding the QSL printing.

On the Bands

50 MHz. On March 16, an afternoon F2 opening took place from North America to South America. KØGU (DN70) and WQØP (EM19) worked J88IH. KØGU had a PSK flag in the Canary Islands. I, NØJK, logged HC1DAZ and HC5VF. John Lutz, N9JL (EN51), worked his first 6-meter DX entity. He uses a dipole elevated about 10 feet. John reported:

With the tuning dial parked at 50.313 KHz, I listened and watched for approximately 45 minutes. The band was generally quiet, and the few signals I heard were coming from stations no more than 100 or so miles away. Several times I called CQ but received no replies. Just when I was about to switch off the radio, I noticed that HC2FG was finishing his exchange with WDØBGZ — I was suddenly hearing an Ecuador station! A moment later (at 1836Z), HC5VF also appeared on my WSJT-X display — two Ecuador stations. Surely, this must be the magic of the "Magic Band." Better yet, the signal from the second station was strong (+5 dB), and he was calling CQ. I pounced with both feet! Fausto immediately responded, giving me a report of -14 dB. This was my first-ever DX contact on the 6-meter band.

Mike, K7ULS (DN41), worked HC2FJ, HK6RF, PJ2LS, PJ2BR, and PJ4MM on March 24. K6UHF picked up HD8MD, J88IH, PJ4MM, PJ7AA, HI8GSP, and multiple stations in Argentina. Dan, K7SMA (DN13), worked Costa Rica. N5KO worked CBØZIX in the rare Juan Fernández Islands on March 25. Larry, NØLL (EM09), worked HD8MD and called AH6FX in Hawaii many times on March 25. I copied HD8MD on my mobile setup. John Lock, KFØM (EM17), worked HD8MD and ZL7DX. K1HTV copied FK8CP sending RR73 to 7Q6M at 2101Z!

On March 26, HD8MD was in again to North America, along with Argentina and Falkland Islands stations. Darryl, KJ6UD (DM03), worked HD8MD, HK3X, LU8DRH, TI3GB, and HC2FG. Dave, W6DE, worked ZL7DX and noted that 9K2GS was copied in northern California at around 2124Z. Bill, K1CT, in San Diego copied 9K2GS while using a dipole. Steve Sacco, NN4X, sent me a PSK map showing that 9K2GS was received from Florida to California.

Here and There

Steve, N4JQQ/C6AFP, said his 6-meter beacon is still operational from grid FL16is in Green Turtle Cay, an island in the Bahamas. It runs 35 W to a horizontal non-directional antenna on 50.040 MHz.

The 2024 International EME Conference will be held on August 9 – 11 near Trenton, New Jersey. Join more than 100 fellow Earth-moon-Earthers (EMEs) who have already registered from around the world. In addition to the multiple-day conference, there will be a 1-day "EME 101" class. This information is courtesy of Paul, N2EME. For more details about the conference, visit www.eme2024trenton.org.

Special Event Stations

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

May 4 – Jul 21, 0000Z – 0000Z, TM24JB, Fort Blackmore, France. F1SXC. **Homage to Josephine Baker, the Voice of the Paris Olympic Games 2024**. 7.124 14.154 18.124 28.424. QSL. David, F1SXC/Radio-club de Saint Quentin-en-Yvelines, F6KRK, 1 bis, avenue des Frênes, Montigny-le Bretonneux 78180, France. www.qrz.com/db/tm24jb

May 12 – May 18, 0001Z – 2359Z, K3FBI/0-9, Fredericksburg, VA. FBI Amateur Radio Association. **National Police Week — To Honor Our Fallen Heroes**. 7.060 14.275; all bands, all modes. Certificate. Jay Chamberlain, NS4J, 27 Fox Run Ln., Fredericksburg, VA 224053303. *Downloadable certificate will be available by the end of June at QRZ.* www.qrz.com/db/k3fbi or k3fbi@arri.net

June 1, 1400Z – 2000Z, W2A, Christiansburg, VA. New River Valley Amateur Radio Club. **Audie Murphy, America's Most Decorated Soldier from World War II**. 14.240. QSL. Danny Wylam, 710 McDaniel Dr., Christiansburg, VA 24073-3848. dannywylam@gmail.com

June 1 – June 2, 1400Z – 1830Z, K8E, Toledo, OH. Toledo Mobile Radio Association W8HHF. **National Museum of the Great Lakes Museum Ships Weekend Event**. 7.039 7.260 14.239 14.260. QSL. Col. James M. Schoonmaker, P.O. Box 9673, Toledo, OH 43697. www.qrz.com/db/k8e or www.w8hhf.org

June 1 – June 2, 0000Z – 0359Z, W4BSF, Oneida, TN. Big South Fork Amateur Radio Club and the USS Tennessee BattleShip Museum. **Museum Ships Weekend Event — USS Tennessee**. 40, 20, 15, and 10 meters. QSL. W4BSF USS TN BB43, P.O. Box 5029, Oneida, TN 37841. *Check spotting networks. QSL by July 15, 2024.* www.bsfc.org/museum-ship-weekend-2024

June 1 – June 2, 0001Z – 2359Z, NJ2BB, Camden, NJ. Battleship New Jersey Amateur Radio Station. **Museum Ships Weekend Event**. 7.044 7.272 14.044 14.262. QSL. Margaret Burgess, 150 Schooner Ave., Barnegat, NJ 08005. www.nj2bb.org

June 1 – June 2, 0001Z – 2359Z, NI6IW, San Diego, CA. USS Midway Museum Ship. **Museum Ships Weekend Event**. 7.250 14.320; 14.070 PSK31; D-STAR. QSL. USS Midway Museum Ship COMEDTRA, 910 N. Harbor Dr., San Diego, CA 92101. www.qrz.com/db/ni6iw

June 1 – June 2, 1300Z – 2100Z, K3SAV, Baltimore, MD. Nuclear Ship Savannah Amateur Radio Club. **Museum Ships Weekend — Nuclear Ship Savannah**. 7.100 14.110 21.100 28.100. QSL. K3LU, 980 Patuxent Rd., Odenton, MD 21113. *Check spotting networks.* www.qrz.com/db/k3sav

June 1 – June 2, 1400Z – 2000Z, NB9QV, Francis Creek, WI. USS Cobia Amateur Radio Club. **USS Cobia Special Event**. 7.240 14.240. E-certificate. Send QSL information to kc9yl@arrl.net www.qrz.com/db/nb9qv

Jun 1 – Jun 14, 1300Z – 2200Z, W2D, Hunt Valley, MD. Amateur Radio Club of the National Electronics Museum. **W2D D-Day Commemoration and the Role of Electronics in World War II**. 7.044 7.244 14.044 14.244. Certificate & QSL. K3NY, 108 Brent Rd., Arnold, MD 21012. *Primary*

operation will be June 1 – 6 with additional operation possible during June 7 – 14, as operator availability permits. Operation on 80 meters (3.544, 3.844), additional bands, and digital modes possible during the event. www.wv-2.us

June 1 – June 15, 0000Z – 2359Z, W9CEQ, Batavia, IL. Fox River Radio League. **100th Anniversary**. 7.035 7.260 14.035 14.260. Certificate & QSL. FRRL/K9MMS, P.O. Box 673, Batavia, IL 60510. www.frll.org

June 6, 1500Z – 2000Z, W2W, Cottage Grove, MN. South East Metro Amateur Radio Club. **80th Anniversary Commemoration of D-Day**. 7.040 14.040; SSB General portion of 40 and 20 meters. QSL. Brian McInerney, 2523 Cochrane Dr., Saint Paul, MN 55125. www.semarc.org

June 6 – Jun 9, 2200Z – 0600Z, W4G, Germantown, TN. Nashoba Amateur Radio Club. **Germantown Charity Horse Show 75th Anniversary**. 14.275 28.470. QSL. Fred Miller, 8265 Green Holly Cv., Germantown, TN 38138. www.nashobaarc.org

June 7 – June 9, 1300Z – 1900Z, W3R, Reading, PA. Historical Military Impressions. **Mid-Atlantic Air Museum's World War II Weekend**. 3.885 7.270; AM or CW modes only. QSL. Garet Scott — W3R, 10236 Birch Hill Ln., Knoxville, TN 37932. *Frequencies may change; see website for updates.* www.readingairport.org/maam-wwii-weekend or www.w8bug.com/w3r

June 8 – June 9, 0630Z – 2200Z, various, Totnes, United Kingdom. Torbay Amateur Radio Society. **80th Anniversary Commemoration of the D-Day Landings — Operation Overlord**. 3.744 7.144 14.144 28.344. Certificate. E-QSL to individual SES call signs as referenced. *SES call signs will be listed before the event.* www.torbayars.org

Jun 8 – Jun 22, 1400Z – 2300Z, W5V, Waco, TX. Heart Of Texas DX Society. **Waco Village 175th Anniversary — W5V**. 28.437. Certificate & QSL. Larry Merritt, 3200 Colcord Ave., Waco, TX 76707-1814. *Operation will be in the General-class segment of the 40-, 20-, 15-, and 10-meter phone bands. See website for instructions on receiving a QSL or certificate.* <https://w5dxs.tripod.com>

Jun 9 – Jun 10, 1400Z – 2300Z, W7WYO, Torrington, WY. High Plains Amateur Radio Club. **Honoring Pioneer Women at Fort Laramie, Wyoming**. 7.250 14.275 21.375 28.400. Certificate & QSL. Lee Milner, K7WY, 123 Arrowhead Rd., Torrington, WY 82240. *We will be operating from Fort Laramie National Historic Site.* arrowhead273@gmail.com

June 12 – June 18, 1300Z – 2100Z, K3S, Baltimore, MD. Nuclear Ship Savannah Amateur Radio Club. **Maryland Fleet Week**. 7.100 14.110 21.100 28.100. QSL. K3LU, 980 Patuxent Rd., Odenton, MD 21113. *Check spotting networks.* www.qrz.com/db/k3s

June 15, 1400Z – 2100Z, W8MOP, Bluefield, WV. East River Amateur Radio Club. **Streets of Coal**. 7.220 14.250. QSL. East River Amateur Radio Club, P.O. Box 1362, Bluefield, WV 24701. www.erarc.com

June 15 – June 23, 0000Z – 2359Z, W5M, Greenville, TX. Sabine Valley Amateur Radio Association. **Audie Murphy's 99th Birthday Celebration.** 7.235 14.280 21.400 28.450; CW FT8 SSB. QSL. K5GVL/Sabine Valley Amateur Radio Association, P.O. Box 843, Greenville, TX 75403-0843. www.k5gvl.com/audie-murphy

June 22 – June 23, 1800Z – 2059Z, W4ZBB, Fort Walton Beach, FL. Playground Amateur Radio Club. **ARRL Field Day 2024.** 7.225 14.325 21.250 28.305. QSL. Playground Amateur Radio Club, 17A First St. SE, Fort Walton Beach, FL 32548. parcfwb@gmail.com or www.w4zbb.org

June 23 – June 24, 1800Z – 1959Z, N6R, Thousand Oaks, CA. Ventura County Amateur Radio Society and Simi Setters Amateur Radio Club. **Field Day 2024.** 3.810 7.260 14.255 21.320. QSL. Peter Heins, 1559 Norwich Ave., Thousand Oaks, CA 91360. www.vcars.org

June 29 – Jul 6, 1700Z – 2200Z, N4V, Sewanee, TN. National Speleological Society (K7NSS). **83rd Annual National Speleological Society Convention.** 7.050 7.195 14.050 14.285. QSL. Sam Rowe, KG9NG, 2749 Commercial Ave., Madison, WI 53704. n4v@nssces.org

Certificates and QSL cards: To obtain a certificate from any of the special event stations offering them, send your QSO information along with a 9 × 12-inch self-addressed, stamped envelope (3 units of postage) to the address listed in the announcement. To receive a special event QSL card (when offered), be sure to include a self-addressed, stamped business envelope along with your QSL card and QSO information.

Special Events Announcements: For items to be listed in this column, use the ARRL Special Events Listing Form at www.arrl.org/special-events-application, or email information to events@arrl.org.

Submissions must be received by ARRL HQ no later than the 1st of the second month preceding the publication date; a special event listing for **September QST** would have to be received by **July 1**. In addition to being listed in **QST**, your event will be listed on the ARRL Web Special Event page. **Note:** All received events are acknowledged. If you do not receive an acknowledgment within a few days, please contact us. ARRL reserves the right to exclude events of a commercial or political nature.

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

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 March 2024 activity report of the VM Program.

◆ Operators in Arizona, Tennessee, Virginia, and South Carolina were issued advisory notices concerning wideband operation — 7 kHz to 8 kHz wide, contrary to FCC rules. Section 97.307(a) provides that “no amateur shall occupy more bandwidth than necessary for the information rate and emission type being transmitted, in accordance with good amateur practice.”

◆ Technician-class operators in Colorado and North Carolina received advisory notices for operating FT8 on 20 meters. Technicians have no 20-meter operating privileges.

◆ An operator in New York received an advisory notice for failure to identify during long transmissions of more than 30 minutes.

◆ A General-class operator in Idaho received an advisory notice for SSB transmissions on 14.150 MHz. General-class privileges start at 14.225 MHz on that band.

◆ Operators in Florida received commendations for work on the 146.625 MHz W4JUP Repeater, assisting new licensees learn repeater procedures, and setting up equipment. An operator in Oklahoma received a commendation for work on the 146.97 W5BLW Repeater for SKYWARN and emergency operations procedures.

◆ During March there was one referral from the FCC to the VM Program, and one meeting with the FCC.

The totals for February 2024 monitoring were 1,942 hours on HF frequencies, and 1,935 hours on VHF frequencies and above, for a total of 3,877 hours. — *Thanks to Volunteer Monitor Program Administrator Riley Hollingsworth, K4ZDH*

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

Florida (Dade City) — June 22 **FHRTV**

8 AM – 1 PM. *Spr*: Green Swamp Chapter NAQCC. Dade City Masonic Lodge, 13642 21st St. S. *Ti*: 147.135 (146.2 Hz). *Adm*: \$5. Email: gmento@gmail.com

Indiana (Bloomington) — June 8 **DFHIRSTV**

8 AM – noon. *Spr*: Bloomington ARC. Community Bldg., Monroe Co. Fairgrounds, 5700 W. Airport Rd. *Ti*: 146.64 (136.5 Hz). *Adm*: \$8. www.bloomingtonradio.club

ARRL MAINE STATE CONVENTION

June 15, Augusta, Maine

DFHQRSTV

8 AM – 5 PM. *Spr*: Androscoggin ARC. Augusta Civic Center, 76 Community Dr. *Ti*: 147.255 (114.8 Hz). *Adm*: \$10. www.w1npp.org/convention

Maine (Hermon) — June 1 **DFHIRSTV**

8 AM – noon. *Spr*: Pine State ARC. Hermon High School, 2415 Rte. 2. *Ti*: 146.94 (136.5 Hz). *Adm*: \$5. Email: k1gup@roadrunner.com

Maryland (Upperco) — June 16 **DFHQRST**

7 AM – noon. *Spr*: Baltimore ARC. Arcadia Fairgrounds, 16020 Carnival Ave. *Ti*: 146.67 (107.2 Hz). *Adm*: \$5. www.w3ft.com

Michigan (Midland) — June 15 **DFHRTV**

8 AM – noon. *Spr*: Midland ARC. Salvation Army Bldg., 330 Waldo Ave. *Ti*: 147.00 (103.5 Hz). *Adm*: \$5. www.w8kea.org

Michigan (Monroe) — June 16 **DFHQRST**

7:30 AM – 1 PM. *Spr*: Monroe Co. Radio Communications Association. Monroe Co. Fairgrounds, 3775 S. Custer Rd. *Ti*: 146.72 (100 Hz). *Adm*: \$7. www.mcrca.org

Minnesota (Plymouth) — June 15 **FHRT**

8 AM – 11:30 AM. *Spr*: Twin City FM Club. West Medicine Lake Community Club, 1705 Forestview Ln. N. *Ti*: 146.76 (114.8 Hz). *Adm*: \$10. www.tcfmc.org

Missouri (Braymer) — June 22 **FR**

7:30 AM – 1 PM. *Spr*: Missouri Five Co. ARC. American Legion Hall, 9th St. *Ti*: 147.225 (98.5 Hz). *Adm*: \$5. Email: preamp62@yahoo.com

New Jersey (Piscataway) — June 29 **DFHQRSTV**

8 AM – 1 PM. *Spr*: Raritan Valley Radio Club. Piscataway High School, 100 Behmer Rd. *Ti*: 146.625 (141.3 Hz). *Adm*: \$7. www.w2qw.org

New York (Lockport) — June 8 **FHRTV**

8 AM – noon. *Spr*: Lockport ARA. Cambria Volunteer Fire, 4631 Cambria-Wilson Rd. *Ti*: 146.820 MHz (107.2 Hz). *Adm*: \$8. www.lockportara.us

Ohio (Mansfield) — July 6 **FHRTV**

8 AM – 3 PM. *Spr*: InterCity ARC. Richland Co. Fairgrounds, 750 N. Home Rd. *Ti*: 146.940 (71.9 Hz). *Adm*: Free. www.w8we.org

Ohio (Wauseon) — June 1 **DFHRTV**

8 AM – noon. *Spr*: Fulton Co. ARC. Roth Family Woodlot, 105 Hill Ave. *Ti*: 147.195 (103.5 Hz). *Adm*: \$5. www.k8bxq.org/hamfest

Pennsylvania (Harrisburg) — July 6 **DFHQRST**

7 AM – 1 PM. *Spr*: Harrisburg Radio Amateurs Club. Harrisburg Postal Employees Picnic Grounds, 1500 Roberts Valley Rd. *Ti*: 147.075 (128 Hz). *Adm*: \$10. www.w3uu.org

Pennsylvania (Lime Ridge) — June 15 **DFHRTV**

7 AM – 1 PM. *Spr*: Columbia-Montour ARC. Lime Ridge Community Center, 6360 Hughes St. *Ti*: 147.225 (85.4 Hz). *Adm*: \$5. www.qsl.net/cm-arc/newsletter/current/hamfest_flyer.pdf

Pennsylvania (Plains) — July 7 **DFHRTV**

8 AM. *Spr*: Murgas ARC. Polish American Veterans Club, 2 S. Oak St. *Ti*: 146.610 (82.5 Hz). *Adm*: \$9. www.murgasarc.org

Pennsylvania (Somerset) — July 7 **DFHIRSTV**

7 AM – 1 PM. *Spr*: Somerset Co. ARC. Somerset Co. Technology Center, 281 Technology Dr. *Ti*: 147.195 (123.0 Hz). *Adm*: \$5. www.k3smt.org

ARRL DELTA DIVISION CONVENTION

June 15, Knoxville, Tennessee

DFHQRSTV

8 AM – 4 PM. *Spr*: Radio Amateur Club of Knoxville. Wallace Memorial Baptist Church, 701 Merchant Dr. *Ti*: 147.30 (100 Hz). *Adm*: \$8 Advance, \$10 door. www.w4bbb.org

Wisconsin (Oak Creek) — July 6 **DFHRT**

6 AM – 2 PM. *Spr*: South Milwaukee ARC. American Legion Post 434, 9327 S. Shepard Ave. *Ti*: 149.910 (127.3). *Adm*: \$5. www.wi9sm.org

Wisconsin (Stoddard) — June 15 **DFHQRSTV**

7 AM – 1 PM. *Spr*: Riverland ARC. American Legion, 414 Broadway St. *Ti*: 146.97. *Adm*: \$5. www.rarc.qth.com

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 July 1 to be listed in the September 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.

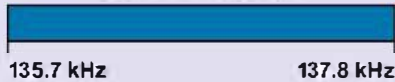
US Amateur Radio Bands

Operator license classes: E = Amateur Extra A = Advanced G = General T = Technician N = Novice
CW operation is permitted throughout all amateur bands. Except as noted, all frequencies are in megahertz (MHz).

■ = RTTY, data, phone, image
 ■ = USB phone, RTTY, data and CW
 ■ = RTTY and data
 ■ = phone and image
■ = SSB phone
CW = CW only

LF – Low Frequency band

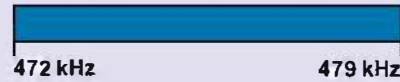
2200 Meters (135 kHz) E,A,G
1 W EIRP maximum



Amateurs wishing to operate on 2200 or 630 meters must first register with the Utilities Technology Council online at <https://utc.org/plc-database-amateur-notification-process/>. You need only register once for each band.

630 Meters (472 kHz) E,A,G

5 W EIRP max, except in Alaska within 496 miles of Russia where the limit is 1 W EIRP



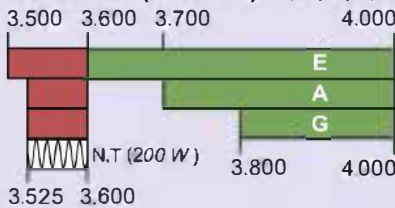
MF – Medium Frequency bands

160 Meters (1.8 MHz) E,A,G

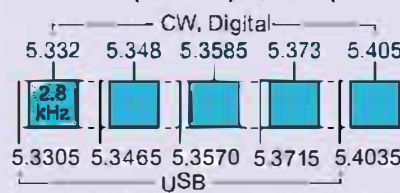


HF – High Frequency bands

80 Meters (3.5 MHz) E,A,G,T,N

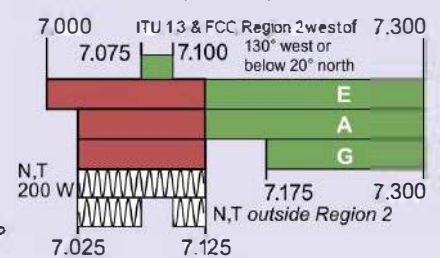


60 Meters (5.3 MHz) E, A, G (100 W)

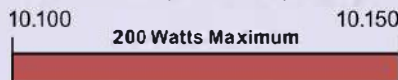


General, Advanced, and Extra licensees may operate on a secondary basis with a maximum ERP of 100 W (relative to a half-wave dipole antenna).

40 Meters (7 MHz) E,A,G,T,N



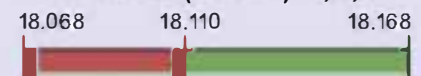
30 Meters (10.1 MHz) E,A,G



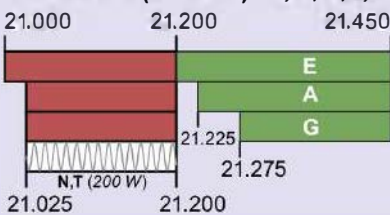
20 Meters (14 MHz) E,A,G



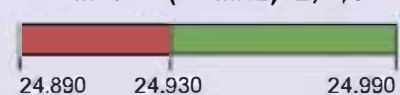
17 Meters (18 MHz) E,A,G



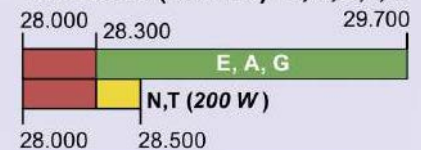
15 Meters (21 MHz) E,A,G,T,N



12 Meters (24 MHz) E,A,G

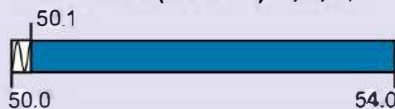


10 Meters (28 MHz) E,A,G,T,N



VHF – Very High Frequency bands

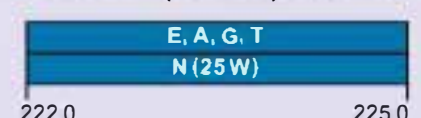
6 Meters (50 MHz) E,A,G,T



2 Meters (144 MHz) E,A,G,T

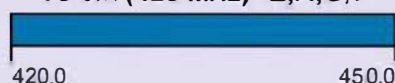


1.25 Meters (222 MHz) E,A,G,T,N



UHF – Ultra High Frequency bands

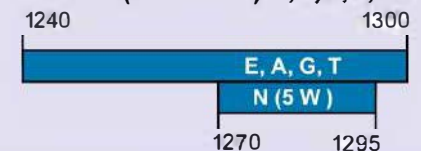
70 cm (420 MHz) E,A,G,T



33 cm (902 MHz) E,A,G,T



23 cm (1240 MHz) E,A,G,T,N



SHF&EHF – Super and Extremely High Frequency bands

All licensees except Novices are authorized all modes on the following frequencies:

2300-2310 MHz	3300-3450 MHz	10.0-10.5 GHz	47.0-47.2 GHz	122.25-123.0 GHz	241-250 GHz
2390-2450 MHz	5650-5925 MHz	24.0-2425 GHz	76.0-81.0 GHz	134-141 GHz	All above 275 GHz

See www.arrl.org/band-plan for detailed band plans.

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OTAbands rev. 11/16/2023

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.

Volunteer Examiner	Sessions	Accreditation Date	Volunteer Examiner	Sessions	Accreditation Date	Volunteer Examiner	Sessions	Accreditation Date
Atlantic			Hudson			Roanoke		
***Collin Pike, KJ4AXB	6,437	26-Apr-11	Alan Crosswell, N2YGK	515	26-Oct-94	Judy Friel, AC4RG	320	01-Feb-91
James McCoskey, NS3K	348	14-Nov-94	Fritz Boigris, KB2O	498	26-Oct-84	Alan Ronald Moeck, WA2RPX	264	27-Sep-94
Jobst Vandrey, AC0LP	324	23-Jun-08	Sid Markowitz, K2GG	451	27-Sep-94	Terry Sanner, WV8V	254	06-Sep-84
George Brechmann, N3HBT	313	01-Apr-91	John Kieman, KE2UN	314	01-Jul-91	David Snyder, W4SAR	254	01-May-93
Edward Genoino, WA2NDA	298	10-Jul-85	Walter Lesnowich, W2EE	301	06-Mar-08	Larry Withrow, AF4HX	230	17-Dec-98
Cully Phillips, N3HTZ	228	01-Sep-91	Thomas Carrubba, KA2D	294	01-Sep-93	Henry Wyatt, II, K4YCR	213	28-Jan-98
Michael Hara, N2MHO	219	12-Apr-06	Robert Casino, N2GDY	288	03-Jun-08	David Poe, W8IW	213	13-Mar-07
William Klepser, Jr., WB2AIV	215	09-Jun-99	Carlos Prior, KE2TT	264	01-Jun-90	Edwin Williams, KN4KL	212	01-Jan-92
Ralph Abbott, WA3ELQ	198	30-May-05	Donald Younger, W2JEK	257	30-Jul-86	John Kanode, N4MM	205	07-Jun-85
Robert Charles Worek, AG3U	193	26-Jul-06	Allen Bender, W2QZ	255	02-Feb-88	Thomas Lewis, W4SIS	194	14-Nov-97
Central			Midwest			Maurice Brown, N8VA	191	31-Mar-97
Ed Wagner, AB9FN	418	01-Jul-02	David Bartholomew, AB0TO	802	22-Mar-02	William Grindle, N8RLR	184	14-Oct-97
Allan Bukowski, N9ZD	354	01-Jun-92	Kevin Naumann, N0WDG	704	17-Nov-02	Rocky Mountain		
Eldon Boehm, NK9U	341	21-Nov-86	Harry Slegar, Jr., W0HMS	658	26-Aug-08	Robert Vosper, KZ1B	612	09-Jul-10
Donald Hlinsky, N9IZU	333	01-Mar-91	Roland Kramer, W0RL	556	21-Jun-01	Robert Hamilton, N0RN	429	19-May-87
Brian Eder, WB9UGX	307	01-Jan-92	Chris Hunt, N0YH	491	05-Aug-20	Jeffrey Weinberg, W0QO	340	01-Apr-93
Robert Begeman, W9KVK	295	01-Jun-92	Ralph Waldren, N0OTS	411	03-Jan-20	David Avery, N0HEQ	302	13-Jan-88
Timothy Pechtold, AA9BV	282	01-Nov-92	Kenneth Simila, K00VY	315	18-Feb-07	David Sharpe, K0HG	259	02-Feb-98
James Rinehart, K9RU	267	01-Aug-91	John Mountain, Jr., KJ0MTN	255	28-Sep-09	Gary Zabriskie, N7ARE	253	20-Nov-84
Frederick Baguhn, W9GOC	263	16-May-02	Edwin Berkel, AE0EB	252	06-Jan-15	Martin Soffran, NM5MS	240	21-Mar-94
David Pritchard, W9QL	257	12-Apr-01	Charles Wilmes, KW0K	225	28-Apr-09	Peter Brisbane, NM5PB	232	20-Jan-14
Dakota			New England			David Bratcher, AK0MR	204	23-Sep-08
Jeffrey Goodhuff, W0KF	347	17-Jun-03	**Paul Lux, K1PL	2,200	25-Jan-85	Denis Campbell, AA0YX	185	02-Feb-96
John Schwarz, Jr., AE0AL	331	26-Oct-94	*Bob Phinney, K5TEC	1,664	20-Jan-14	Southeastern		
Shep Shepardson, N0NMZ	316	12-Mar-01	Gregory Paul, KC1MND	548	03-Jun-20	***Gary Pike, KA4KBX	8,252	03-Sep-09
Joel Dunham, NC1D	287	26-Jul-23	Phillip Temples, K9HI	519	12-May-89	***Justin Pike, KJ4AXF	6,487	12-Nov-12
Douglas Nelson, AA0AW	252	01-May-90	Robert Beaudet, W1YRC	410	01-Aug-90	***Anna Pike, KD4PCU	4,838	18-Aug-09
Daniel Royer, KE0OR	248	01-Jul-91	Bruce Anderson, W1LUS	395	11-Feb-88	***Patrick Pike, KJ4AXD	3,520	13-Oct-15
James Rice, II, N0OA	231	04-Dec-00	William Poulin, WZ1L	381	01-Sep-91	**Ryan Krenzischek, W4NTR	2,081	04-Jan-13
Larry Larson, KR0K	229	16-Mar-09	Barbara Liby, KC1KGS	364	05-Aug-19	John Reynolds, W4TXA	803	08-Jun-16
Dennis Ackerman, KB0OQQ	221	15-Jul-96	Stefan Rodowicz, N1SR	318	20-Nov-84	Eddie James, WD3D	555	01-Apr-21
Robert Tracy, N0TC	197	30-Jul-86	James Mullen, KK1W	296	01-Mar-91	Robert Faudi, N1UVO	551	28-Mar-18
Delta			Northwestern			Stanley Whitfield, K4SHW	513	26-Sep-19
Loma Westmoreland, KU5J	773	31-Jan-21	Richard Morgan, KD7GIE	448	11-Aug-00	Pablo Soto, KP4SJ	400	01-May-92
Monvel T. Maskew, Jr., K9FQ	765	18-Jul-18	Scott Robinson, AG7T	444	01-Aug-91	Southwestern		
Bryan McCammon, K15HAV	427	03-Sep-20	Loren Hole, KK7M	381	06-Sep-84	*Bill Martin, A10D	1,075	01-Nov-84
Terry Partigiani, W5TMP	420	27-Nov-07	John Clarke, AC7WW	379	20-Jan-03	David Morrill, N7TWT	514	20-Jul-00
Elmer McKenzie, Jr., K5MCK	334	23-Dec-22	Erin Henrickson, ND7B	360	06-Jan-23	Richard Buck, KC7OCT	350	21-May-97
John Waters, III, KC5FYA	329	14-Sep-21	David Brooks, N7HT	330	10-Jun-87	Donald Kramer, Sr., WA6UVW	342	08-May-98
Joe Lowenthal, WA4QVO	294	25-May-06	Joseph Barry, K7SQ	309	21-Jun-95	Bruce Zieminski, WA6BZ	321	25-Mar-02
Rodney Webb, W4WRE	294	21-Mar-17	Brandin Hess, AL0B	307	24-Sep-15	Ali Hassan, AA6WC	288	01-Jun-90
Bobbie Williams, W1BEW	290	01-Jun-92	Wayne Schuler, A19Q	279	01-Sep-91	Norman Pilawski, WT6Y	284	17-Feb-87
Roger Gray, N5QS	281	01-Mar-93	Klaus Neubert, AC7MG	270	10-Jul-01	Frank Westphal, K6FW	275	06-Sep-84
Dawn Gray, N5QT	262	01-Mar-93	Richard Heasty, KK7VH	261	07-May-01	Gary Hamman, K7GH	263	01-Aug-92
Great Lakes			Pacific			Dave Martin, AC7FF	262	04-Apr-14
*Charles Tyrrell, KE8PCB	1,337	03-Sep-20	Brian Torr, N6IY	921	06-Sep-00	West Gulf		
*David Potter, KE8OHG	1,277	03-Jun-20	Morris Jones, AD6ZH	575	27-Nov-01	*Franz Laugermann, K3FL	1,728	01-Dec-91
Earl Paazg, W8BR	730	16-Apr-02	Dieter Slussy, KD6LVW	463	27-Jan-94	*Tanner Jones, W9TWJ	1,261	31-Jul-07
Bruce Osmon, KE8LT	678	16-Nov-18	Larry Loomer, K16LNB	373	03-Dec-08	Daniel Quigley, N7HQ	793	24-Apr-20
Charles Hall, W8HF	286	01-Jun-92	Bill Nichols, NN7K	372	01-Sep-93	Gerald Grant, WB5R	533	04-Jan-85
William Bogle, Jr., KE8FZY	277	08-Jul-20	Robert Perlman, W6BP	367	26-Aug-08	John Paterson, Jr., KC5LAA	531	16-Mar-09
Lance Harvala, AB8Y	254	06-Nov-19	Gordon Fuller, WB6OVH	363	06-Sep-84	Adolph Chris Koehler, K5VCR	524	29-Sep-95
Archie Mack, Sr., AF4EB	252	19-Aug-97	Jim Brunk, N6BH-X	312	13-Jul-95	David Fanelli, KB5PGY	497	01-Oct-91
Stanley Arnet, II, AC8W	235	06-Sep-84	Dennis Simon, KB7UTV	299	10-Dec-13	Wilbert Cannonier, KK5JJ	475	03-Nov-95
Chris Anderson, K8VJ	230	09-Feb-90	Jane Garwood, KB7YUZ	292	20-Jan-14	Gerald Crenshaw, WD4BIS	432	27-Feb-98
						Janet Crenshaw, WB9ZPH	430	02-Oct-97

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

Celebrating Our Legacy

An Outlet for Personal Improvement

When I first got bitten by the ham radio bug at the age of 12, it was an escape for me. I was nonverbal as a kid. I found an old Silvertone radio in a neighbor's attic. The radio had a shortwave band, and I discovered another world I never knew existed.

What I thought I heard on the radio was one of the strangest things: "Seek you for dee." I listened to the voice talk to stations all over the Midwest. I had no idea what "Seek you for dee" meant, but I knew I had to learn more.

I found two ham radio operators who were kind enough to take me into their shacks and show me their stations. I figured out that you didn't need to talk to use the radio. You could talk with your hands using a telegraph key. I was transfigured from that point on.

One of the hams in my neighborhood offered to take me to a store that sold equipment for hams and shortwave listeners. That's where I learned that "Seek you for dee" meant one ham was looking to talk to another, and he was actually saying "CQ 40."

I met Bill Pendergraft, W9BJM, and he invited me to see his shack, which was in his attic; you had to get there via a collapsible ladder. There was a large black box at the foot of the ladder. It was a Coast Guard communications receiver, and Bill asked me if I could take it home. I agreed, and when I plugged it in at home, I heard Radio Moscow, London, and international air traffic control.

Now I needed a transmitter. Bill suggested that if we stripped the Silvertone, we would have enough parts to make an acceptable Novice transmitter. Within 3 weeks, I took and passed the Novice exam and built my first CW rig. The words I could not say with my voice poured out through my telegraph key.

Now, as I look back, I can hardly believe that I am a published author with

two PhDs and an MD, as well as having been a Navy pilot. Ham radio took me places I would never have dreamed of, and led me to people who helped me learn to use my voice. I was glad to be one of their guinea pigs, with nightly conversations on 75 meters. Being a ham may not affect your life as much as it did mine, but I can promise that you will meet some wonderful people who will open doors for you.

Dr. Frank W. Tidack, K9GHM (SK)
Pekin, Illinois

Homebrew Radio Accomplishment

Fred MacLean, W2BZU, drew me to amateur radio in the early 1950s. He didn't live far from me, and when I spotted the wooden tower and beam in his backyard, I knocked on his door. Fred graduated as an engineer in 1929 and taught me the theory I needed to pass the Novice license test; learning CW and FCC regulations was up to me.

I knew the receiver was the most important part of the station, so I saved up \$125 for a Hallicrafters SX-28. I recall waking up at 5 AM to practice CW by listening to Novices. CW practice records were the norm, but I had no money left to buy them after buying the receiver, and I still had to save up for a transmitter.

In September 1953, my father took me to the FCC office in New York City, where I passed my Novice test. Several weeks later, my first call sign, KN2GBH, came in the mail. I built my first transmitter based on a model that appeared in the January 1953 issue of *QST*. I remember biking 5 miles with the article to the radio parts store to purchase the parts. The toughest part of the construction was cutting the chassis mounting hole for the power transformer. It was square with bolt mounting holes at each corner. All I had to work with was a hand drill, a tube

socket punch, and a file to cut and drill the holes perfectly.

After building the transmitter and hooking it up to the long wire antenna, my first QSO qualified as a ragchew. It went on for more than 3 hours! In the 1980s, I built a duplicate and measured the output power. It was about 6 W. So, in 1953, I was transmitting on low power and didn't even know it!

Herb Sweet, K2GBH
Hyde Park, New York

A Ham Hero's Legacy

My father, Albert A. Fernández, W3YZF, of Croydon, Pennsylvania, passed away in 1984 when he was 72. He built his Barker & Williamson ham radio. He is listed in the archives of the



Albert A. Fernández, W3YZF, with his Barker & Williamson radio. (Photo courtesy of Priscilla Reese)

Bucks County Courier Times of Levittown, Pennsylvania, for saving the lives of two children via amateur radio in the early 1960s (www.newspapers.com/article/philadelphia-daily-news/41237988). I still have his call sign license plate hanging in my basement.

Priscilla (née Fernández) Reese
Danielsville, Pennsylvania

Send reminiscences of your early days in radio to 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.

Classic Radio

The Ins and Outs of Heathkit's Mohican Receiver

The Heathkit GC-1A Mohican receiver was historically important, as it was the first solid-state shortwave listening (SWL) and ham radio receiver that was fully transistorized. Heathkit promoted the receiver in kit form from 1960 to 1968 and, for a brief time, also sold it as an assembled product for \$193. The receiver's price as a kit fluctuated throughout the 8 years that it was available, starting out at \$99.50, reaching \$109.50, and eventually coming down to \$89.50. Even though it was available until 1968, it had been withdrawn from Heathkit's catalog about 5 years earlier.

Roger Mace was an engineer and Heathkit's first amateur radio operator who often chose American Indian names for Heathkit's products. The Mohican was the last product released prior to his retirement, making it the last product to get an American Indian name. It wore the two-tone green colors that became identifiable as Heathkit products and had brushed or polished chrome knobs, like the ones used on the Mohawk RX-1 and Apache TX-1 receiver and transmitter.

Overall Design

The Mohican was a single-conversion superheterodyne receiver with a 455 kHz intermediate frequency. It covered 550 kHz to 32 MHz on five bands. Sensitivity was rated at 10 μ V on the broadcast band and 2 μ V everywhere else. It had a built-in speaker and a large 54-inch whip. The unit used 10 germanium transistors; integrated circuits and field ef-



The Heathkit GC-1A Mohican receiver was the first solid-state SWL and ham radio receiver that was fully transistorized. [Photo courtesy of www.radiopics.com]

fect transistors weren't used, as they were not readily available around 1960, when the receiver was designed. The circuitry of the Mohican

was mostly built on a large printed circuit board. The RF amplifier, mixer, and local oscillator were mostly wired point to point to the band switch. The main tuning capacitor was a three-section capacitor that tuned the local oscillator and RF amplifier input and output circuits. See the sidebar, "Mohican GC-1A Specifications," for more information.

Mohican GC-1A Specifications

Receiver type: 10-transistor, general-coverage, single-conversion superheterodyne

Intermediate frequency: 455 kc

Selectivity: 3 kc wide at 6 dB down

Battery life: up to 400 hours of normal intermittent service

Output: 400 mW at 10% distortion

Power required: 12 V at 3 mA, 50 mW output

Weight: 17 pounds

Dimensions: 6 $\frac{1}{4}$ inches high $\times$ 12 inches wide $\times$ 10 inches deep

Bandspread Operation

The bandspread variable capacitor was a single-section capacitor that only tuned the local oscillator. On the 80/75- and 11/10-meter bands spread ranges, the error in the tuning of the RF amplifier was fairly substantial, because the bandwidth of the bandspread range was about 10% of the operating frequency — a good bit more than it was on 40, 20, and 15 meters. The input of the RF amplifier

could be corrected by the antenna trimmer control, but there was no way to correct the RF amplifier output tuning.

BFO and Detectors for AM, SSB, and CW

A beat frequency oscillator (BFO) was included in the Mohican so it could receive CW and single side-band (SSB) stations. Like most receivers of its type during this time, the Mohican did not have a product detector. The automatic gain control and automatic noise limiter didn't function with the BFO on, which was typical for operating SSB and CW on nearly all receivers without a product detector. For many years, amateurs got by without product detectors for operating CW and during the early days of SSB. The simple diode detector worked well for AM operations, and everyone lived with it when oper-

ating CW and SSB until product detectors became common.

Batteries, Power, and Lights

The receiver had a dial light that could be lit by pushing and holding its switch; it was spring-loaded to conserve battery life. The receiver was powered by eight C batteries that fit into the battery holder located in the rear panel of the receiver. The XP-2 120 V ac power supply could be used in place of the battery holder in the rear panel. The Mohican's transistors were placed in sockets that made replacement easy, but oxidation of the transistor leads could cause operation problems.

Power Supply Wiring and Manual Errors

Two issues existed in the documenta-

tion for the GC-1A. The first issue was that all of the transistor voltages were shown as being positive when they were all negative. The positive side of the batteries or the XP-2 ac power supply was connected to the common ground, so the power was set up as a positive ground design. Thus, all the measured voltages were actually negative. The second error was with the drawing of the battery. The positive and negative signs were correct as drawn and could be relied on, but the pin numbering was incorrect. The nine-pin plug from the radio that plugged into the battery pack or ac power supply was in error on the schematic in the GC-1A manual, as was the drawing of the nine-pin plug. Because the plug was the same pin out of a nine-pin miniature vacuum tube, it's hard to understand how Heathkit got it wrong.

Field Organization Reports — March 2024

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.

896 AD8CM	215 W0PZD	140 WA3QLW WB9QPM	121 W5WMC	109 KT5EM	95 KT4WX W1FEA	85 N5RH K2MTG KE8HKA WW3S	83 KM4WXX K4FHR WB8RGE	KG5AOP WB4RJW WA2BBS	K5OB KB4OLY	74 W3ZR	KB3MXK
405 N9VC	208 W9RY	KE4RS WO2H	120 WA4VGZ N0DMP K9LGU WB9WKO	108 KC1HHO	92 K1CFI	84 AA3N WD8USA	79 W7MIN W4TTO	77 KN4AAG N2TSO W1LEM	72 K2PHD K3RB	70 K6RAU KA1G WA3FIR KB1SYL	
390 WM5N	195 W4EDN	137 WM2C	107 W1RVY	106 KC8T	90 KB9GO KC9UC N0ET		80 AE2EY KR4ST KA8BJA	78 N0JAR	75 KA0DBK	71 KF0BPN W8IM	
380 WA3EZN	190 K8AMH ND8W	136 KV8Z	105 KA9IKK	104 KD0HHN KB3YRU	88 K8KRA KB8HJJ N8OD K3RC W4KX N2GS W2QMI WB8R K8RDN N3GE WX2DX W1TCD N1CVO						
352 KE8ANW	187 KC8YVF	135 AG9G W3YVQ KD8ZCM	118 N12W KV2J	110 KA9MZJ K5ANP KO4OL KB8GUN K7OED KB2QO K1UAF W1INC AD4DO KM4WHO WB8TQZ NW3X N1IQI N1ILZ	100 NX9K KA5AZK AA3SB KD2TDG WB8SIQ N4CNX K3YAK KA2HZP WB2VUF W2OOD KZ8Q K8ED KB8PGW N1LAH W4NHO KF7GC KA2GQQ						
340 W8MAL	185 AC8NP W4DNA	130 W2PAX K8MDA WK4WC N2JBA KW1U N1UMJ WZ0C	115 KL7RF								
306 KE8BYC	175 N8SY	126 KE8DON	114 N2DW								
286 KD2LPM	160 AC0KQ KC9FXE	125 KB9IME KE5YTA KD2YYK									
280 N2LC	151 KD8UUB										
255 KT2D	150 KR4PI W4CMH KC8WH										
238 KB5PGY	146 K4NWX	123 W9GRG									
231 KT5SR	142 WB8YYS										
218 KO4KUS											

The following stations qualified for PSHR in previous months, but were not acknowledged in this column yet. (Feb.) W9RY 204, WB9OPM 140, A19F 135, KY2D 120, WA1URS 110, KA9MZJ 110, W1KX 100, NT1N 94, KB1TCE 85.

Section Traffic Manager Reports

The following Section Traffic Managers reported: AL, AR, AZ, CO, DE, EM, ENY, EPA, GA, IL, KY, LA, MDC, MI, MO, NC, ND, NE, NFL, NH, NLI, NM, NNJ, NNY, NTX, NV, OH, OR, RI, SFL, SJV, STX, TN, WCF, WI, WMA, WPA.

Section Emergency Coordinator Reports

The following Section Emergency Coordinators reported: AL, CT, ENY, EPA, GA, IN, MDC, MI, MO, NLI, NNY, NV, PAC, SCV, SNJ, STX, TN, UT, VA, 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.

NX9K 2,562, W2AH 1,065, KW1U 951, WA3QLW 835, N9CK 807, WB9WKO 741, KE5YTA 724, KB9GO 573, N1IQI 537, K8ED 505.

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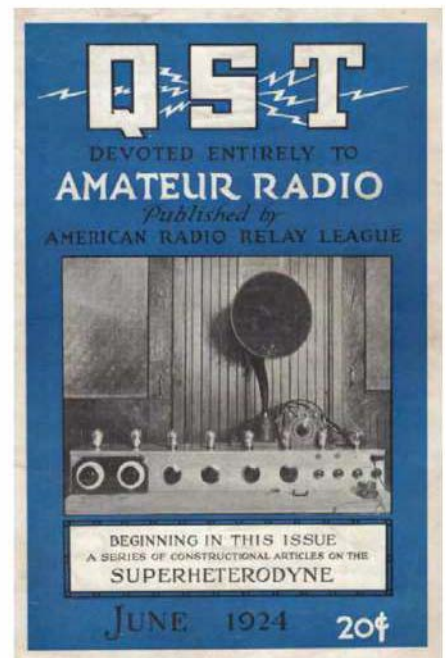
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100, 50, and 25 Years Ago

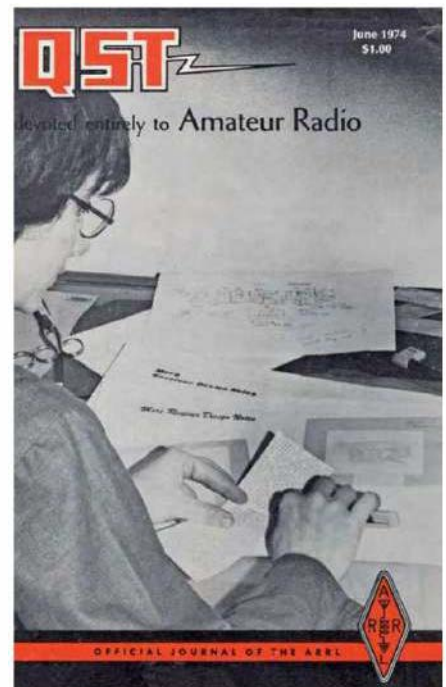
June 1924

- The cover shows a receiver, and a banner introducing the beginning of a series of articles on the superheterodyne. The first in the series, "Building Superheterodynes That Work — Part 1," edited by S. Kruse, 10A, includes receivers using Neutroformer, fixed air-core, and fixed iron-core amplifying transformers.
- Summertime issues, including reminders to adhere to "Standard Time for Quiet Hours!" and the "Expansion of Silent Period During Summer," are discussed in "Editorials."
- "Practical Master Oscillator Sets" are not mysterious new circuits. E.A. Laport, ex-1CBO, explains how this is not correct.
- A new A.R.R.L. practice in relaying is announced in "How To Number Messages" by F.H. Schnell, 1MO.
- Philip Laskowitz, 9DHI, describes "A Good Break-In System" that does away with the disadvantages of other methods, but still retains all the advantages.
- An attempt to explain several things that seem to have gotten pretty badly mixed up in amateur radio — and otherwise — is in "Unscrambling Things."



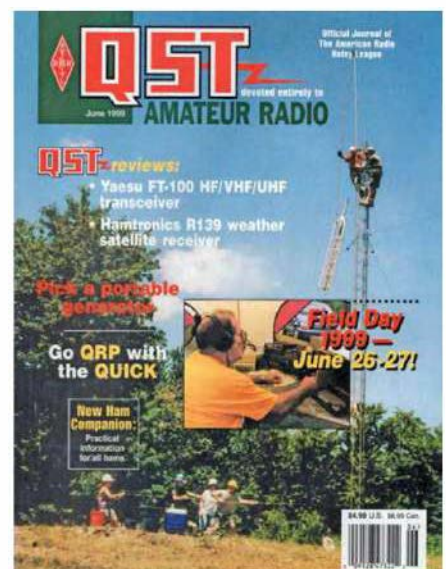
June 1974

- The cover shows graphic design artist Barbara Dirrigl working on graphics for "More Receiver Design Notes, Part 1" by Doug DeMaw, W1CER.
- "It Seems to Us...More Rules?" reports on, and discusses the consequences of, the FCC's rules on an Amateur-satellite Service, and suggests that the FCC is proposing new regulations where none are needed.
- This single-wire transmission line has interesting and unique properties, and is very low loss at uhf and lower parts of the microwave spectrum. George A. Hatherell, K6LK, shares what he's learned in "Putting the G Line to Work."
- Wishing to operate portable, Russell Dunaja, W3BBF, decided to build "A High-Power SCR Inverter." Construction information appears in the "Gimmicks and Gadgets" column.
- A dramatic example of the usefulness of amateur repeaters in public service communication appears in "Repeaters are Public Service Machines" by A. Stewart Johnson, W1UVE.
- "Oscar News: Using Oscar 6 on Field Day" relays that Field Day rules make special provisions for use of Oscar 6, as it is expected to be available for use during Field Day.
- In "Strays: A Cure for a Tough TVI Problem," Mike Faulkner, G3IZJ, tells the story of how he solved his TVI problem by moving his antenna to the property of a generous neighbor — St. Michael Benedictine Abbey and Monastery.



June 1999

- The cover shows the crew topping a tower at N1FD, the Nashua (New Hampshire) Area Radio Club Field Day site. Read about this mammoth operation in "Please Copy Twenty-Six Alfa, New Hampshire" by Jim Heedles, WW1Y.
- David Sumner, K1ZZ, gives an update on the Members Only section of the ARRL Web site, and shares new features to look for in "It Seems to Us...50,000 Members Can't Be Wrong."
- Get control of your QRP transceiver using a keyer as the control center. Rod Kreuter, WA3ENK, explains in "The QUICK: QRP Under Integrated Control from the Keyer."
- Gregory D. Lapin, N9GL, presents a case study of Field Day 1998 with the North Shore Radio Club in Village Green Park, Northbrook, Illinois, in "RF Safety at Field Day."
- Al Brogdon, W1AB, describes "A Simple Killer Antenna" — 40 meters (and more), fifteen bucks, and lots of DX.
- Some practical advice about choosing the right generator and using it safely is given in "How to Choose and Use a Portable Power Generator" by Kirk A. Kleinschmidt, NT0Z.
- A circuit that makes more efficient use of generated solar power is shown in "Hints & Kinks: The Solar K.I.S.S." by A.W. (Bill) Edwards, K5CN.



Silent Keys

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

♦ KC1BT **Machell**, Allan R., Barre, VT
 ♦ K1DHB **Bourne**, Daniel H., Albuquerque, NM
 WA1HXK **Stenning**, Gordon J., Portsmouth, RI
 ♦ WA1IDA **Salow**, S. Robert, Natick, MA
 KA1KJV **Trussell**, Robert, Plantsville, CT
 ♦ K1RG **Gallant**, Ronald, Hampton, NH
 ♦ WA1VDX **Reluga**, Henry G., West Granby, CT
 KD2ABX **Stumpo**, Mark G., Haddon Heights, NJ
 ♦ AA2AC **Siegel**, Vernon H., Clarence, NY
 ♦ W2HYN **Shaw**, William, Bloomfield, NY
 ♦ KC2ILL **Clayton**, Russell E., Utica, NY
 ♦ KC2JAL **Fyles**, Paul H., Fairport, NY
 N2NUJ **Nettleton**, Bridget, Troy, NY
 ♦ N2OMC **Hoyt**, Robert R., Hollywood, MD
 KB2TNH **Murray**, Frank L., Jr., Ventnor City, NJ
 N3DKA **Burgoon**, James F., Emporium, PA
 WX3EMT **Schmid**, Michael J., Grand Island, NY
 ♦ W3HII **Wood**, Harold, Weirsdale, FL
 K3MRM **Kulesza**, Francis J., Crownsville, MD
 W3PDW **Umbrell**, Brian L., Chambersburg, PA
 ♦ W3SVJ **Firestone**, Nathan S., Pittsburgh, PA
 ♦ K3UMX **Drager**, Pamela S., Hagerstown, MD
 ♦ W3VBY **Hoffman**, Harry W., Jr., Sinking Spring, PA
 ♦ W4ATK **Rogers**, James T., Hoover, AL
 ♦ W4BBW **Fletcher**, James D., Ider, AL
 ♦ KG4CPM **Arnold**, Edward R., Cameron, NC
 ♦ WD4DMR **Dodson**, Stewart R., Henrico, VA
 ♦ KP4ED **De Jesus**, Luis E., Bayamon, PR
 ♦ KE4GDL **Lewis**, Leslie E., Ewing, KY
 ♦ K4ITL **Hampton**, Wade Daniel, Jr.,
 Willow Spring, NC
 N4MRF **Camp**, J. Gary, Cullman, AL
 KD4MYE **Allen**, Glenn R., Wake Forest, NC
 K4PHR **Crane**, Austin L., Geraldine, AL
 ♦ WA4PUB **Budner**, David S., Marietta, GA
 KN4QKS **Johnston**, James R., Jr., Littleton, NC
 ♦ KX4RR **King**, Bryan R., Navarre, FL
 KO4RTU **Morton**, Michael A., Kannapolis, NC
 ♦ KC4SGT **Glover**, Albert "Kent," Jr.,
 Virginia Beach, VA
 N4TN **Simms**, Bobby R., Dadeville, AL
 N4UOQ **Phelps-Breeden**, Eleanor N.,
 Raleigh, NC
 K4VFO **Owen**, Richard B., Harvest, AL
 W4WRB **Bee**, William Randy, Shelbyville, TN
 W4ZU **Lemar**, Thomas W., Supply, NC
 WA5BTI **Basham**, Roy R., Jr., Cleburne, TX

WD5DFK **Romine**, Larry, Del City, OK
 K5FXB **Puckett**, Daniel W., Jr., Fayetteville, AR
 ♦ W5LE **Lewis**, Gene, Mounds, OK
 ♦ KC5MDF **Harris**, Charles L., Temple, TX
 N5MMQ **Wright**, Nancy, San Angelo, TX
 N5MNX **Knight**, Jerry L., Jr., Redfield, AR
 ♦ KM5QX **LaPuzza**, Michael J., Mustang, OK
 ♦ KB5REX **Pettengill**, Robert L., Terrell, TX
 AF5RJ **Figueroa**, Michael A., Sr., Saginaw, TX
 KE5SP **Medina**, Luis J., San Antonio, TX
 ♦ N5TAO **Gonyer**, Roy A., Desha, AR
 ♦ WB5W **Beurlot**, Rayland J., Jr., Alexandria, LA
 ♦ K6AWL **Leslie**, Allan W., Menifee, CA
 ♦ WA6BPN **Wong**, Michael K., Palo Alto, CA
 ♦ W6KKG **Gibbons**, Ronald E., Santa Barbara, CA
 ♦ W6LPW **Wentz**, Ray, Jr., Ben Lomond, CA
 ♦ WA6MTY **Miller**, Robert D., Reno, NV
 N6NS **Stockwell**, Norman D., Redondo Beach, CA
 ♦ WA6OGM **O'Connor**, John J., Salem, OR
 ♦ W6SHA **Ballantyne**, John L., Union Bridge, MD
 K16SLX **Frantz**, Arlita Peri, Peterborough, NH
 ♦ KC6UJA **Gerbis**, Bodo J., Sr., Land O' Lakes, FL
 ♦ K6WZO **Reagan**, Michael J., Pasadena, CA
 ♦ KC6ZTU **Warwick**, Kenton S., Mission Viejo, CA
 K7AIK **Olsen**, Melissa K., Lovelock, NV
 ♦ WA7BBJ **Lewis**, Gary L., Monroe, WA
 ♦ KC7BPR **Brooks**, Bobby A., Everson, WA
 ♦ KE7CCR **Wassink**, Harley, Powell, WY
 ♦ K17DG **Williams**, Charles L., Okanogan, WA
 KK7DKD **Deuel**, Daryl, Malad City, ID
 ♦ N7DNJ **Fell**, James, Scottsdale, AZ
 ♦ W7EBY **Eby**, Erwin B., Elk Grove, CA
 ♦ K7EIT **Wright**, Jerry R., San Tan Valley, UT
 KE7GRV **Ryan**, James T., Peoria, AZ
 ♦ WL7LZ **Newby**, Mark A., Eskridge, KS
 KK7RAY **Brongil**, Ramon A., Bandon, OR
 WI7T **Crowley**, Larry P., Tacoma, WA
 ♦ KF7TN **Leone**, Gene J., Worland, WY
 N8BVJ **Brewer**, Russell A., Charlottesville, IN
 ♦ W8DRM **May**, David R., Akron, OH
 N8GXR **Glor**, James H., Williamsville, NY
 ♦ K8OBL **Murray**, Michael J., Cincinnati, OH
 W8RDX **Smith**, David M., Battle Creek, MI
 ♦ NU8V **White**, William H., Atlantic Mine, MI
 ♦ K8VOR **Bell**, Robert A., Urbana, OH
 ♦ W9ADJ **Beyer**, James B., DeForest, WI
 K9AKU **Cowan**, Harold R., Indianapolis, IN

WD9AUP **Liddell**, Loren, Grafton, WI
 N9BE **McLane**, William C., Hendersonville, NC
 KN9C **Richardson**, Rudell W., Greenwood, IN
 W9DJF **Fritchie**, Daniel J., Oblong, IL
 KC9E **Harrison**, Troy M., Michigan City, IN
 K9EXY **Jackson**, Rick, Bloomfield, IN
 ♦ N9HM **Mackey**, Henry R., Columbia City, IN
 ♦ W9IEI **Schneider**, Gregory J., Appleton, WI
 ♦ WC9J **Roberts**, John Charles, Archer City, TX
 ♦ WA9KIX **Mack**, Patricia B., Indianapolis, IN
 ♦ K9KLR **Lash**, Nick G., Hebron, IN
 ♦ W9KUW **Priest**, Nyles, Fond du Lac, WI
 ♦ KA9OTV **Paxson**, William, Wateloo, WI
 ♦ K9PIG **Snyder**, Duane D., Normal, IL
 KC9ROO **Newman**, Eric R., Bend, OR
 AA9SF **Francis**, Scott J., Rockford, IL
 WB9TZX **Langsfeld**, Robert E., Hoffman Estates, IL
 W9YSX **Franke**, Manfred R., Fairland, IN
 K9ZFC **Meys**, Wilfred A., Superior, WI
 ♦ WA0ABG **Johnson**, Orville W., Plymouth, MN
 ♦ WD0AQJ **Chapman**, Dan M., Sioux City, IA
 ♦ WB0BNN **Levandowski**, Richard E.,
 Minneapolis, MN
 ♦ KD0E **Giesman**, Ralph E., Denison, IA
 KB0EHC **Hammond**, Agnes M., Atkins, IA
 ♦ AB0HF **Yeager**, Wayne D., Marshalltown, IA
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FTDX101D | HF + 6M Transceiver

- Narrow Band SDR & Direct Sampling SDR • Crystal Roofing Filters Phenomenal MultiSignal Receiving Characteristics • Unparalleled - 70dB Maximum Attenuation VC-Tune • 15 Separate (HAM 10 + GEN 5) Powerful Band Pass Filters • New Generation Scope Displays 3-Dimensional Spectrum Stream



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FT-891 | HF+50 MHz All Mode Mobile Transceiver

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FT-2980R | Heavy-Duty 80W 2M FM Transceiver

- 80 watts of RF power • Large 6 digit backlit LCD display for excellent visibility • 200 memory channels for serious users



FTM-200DR | C4FM/FM 144/430MHz Dual Band

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FTM-500DR | C4FM/FM 144/430MHz Dual Band Xcvr

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- System Fusion Compatible • Large Front Speaker delivers 700 mW of Loud Audio Output • Automatic Mode Select detects C4FM or Fm Analog and Switches Accordingly • Huge 1,105 Channel Memory Capacity • External DC Jack for DC Supply and Battery Charging



FT-5DR C4FM/FM 144/430 MHz Dual Band

- High-Res FullColor Touch Screen TFT LCD Display • Easy Hands-Free Operation w/Built-In Bluetooth® Unit • Built-In High Precision GPS Antenna • 1200/9600bps APRS Data Communications • Supports Simultaneous C4FM Digital • Micro SD Card Slot



FT-65R | 144/430 MHz Transceiver

- Compact Commercial Grade Rugged Design • Large Front Speaker Delivers 1W of Powerful Clear Audio • 5 Watts of Reliable RF Power Within a compact Body • 3.5-Hour Rapid Charger Included • Large White LED Flashlight, Alarm and Quick Home Channel Access



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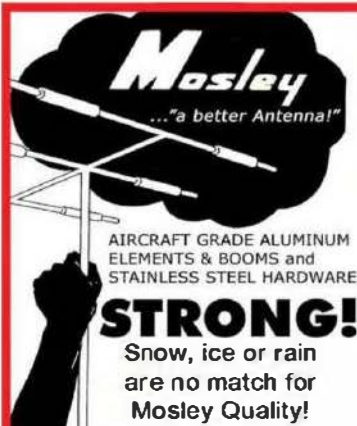
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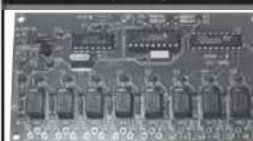
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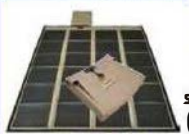
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MFJ-1778M, \$79.95. 52' JUNIOR for limited space. 40-10M, 1.5 kW.

80-10M EFHW antenna

Get-on-the air on all bands

80-10 Meters with just one wire and one support (pole or tree) and no tuner or long counterpoise. Installs anywhere in minutes! Rugged insulated-wire radiator prevents detuning when contacting limbs/branches. "No-sag" end insulator slides over branches, leaves. Toss over a high limb for inverted-V or sloper or go vertical with an inverted-L. Great for emergencies. EFHWs naturally resonate on the 1/2-wave fundamental frequency and odd/even harmonics. No traps, stubs or resonators. Broad-band matching transformer at feed point gives SWR so low you may never need a tuner. 800W SSB/CW. 132 feet antenna wire.



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Includes weather-stripping/lock stick.

MFJ-4601, \$89.95. 6 coax connectors, ground post. 1500 Watts.

MFJ-4602, \$104.95. 3 coax, balanced line feed-thru insulators, wire, ground.

MFJ-4603, \$129.95. 4 coax, 1 N, 1 F type, pair ceramic feedthrus, 5-way posts, and adaptive cable feedthrough.



18' Telescopic Tripod with Mast

MFJ-1919EX, \$199.95.

Put your antennas up high anywhere with this super-strong 18 foot telescoping fiberglass mast and MFJ-1919 heavy duty steel tripod. QuickClamps™ lower mast to 5 feet. Mast has thick 1/8 in. wall, .75" top, 1.5" bottom dia. 15 lbs. Steel tripod has braced triangle base, non-skid feet, mast lock.

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Tripod only. Base spreads to 4.8 sq. ft. MFJ-1906H, \$239.95. 33 foot telescopic fiberglass mast with QuickClamps™.



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Giant Tripod

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Giant tripod base spreads to 8 feet! Supports massive antennas. Adjustable length non-skid legs accommodates uneven ground surfaces. Mast not included. Optional foot anchors, MFJ-1905, \$44.95.

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MFJ-915
\$49⁹⁵ MFJ-915 RF Isolator prevents unwanted RF from traveling on the outside of your coax shield into your transceiver. This unwanted RF can cause painful RF "bites" when you touch your microphone or volume control, cause your display or settings to go crazy, lock up your transceiver or turn off your power supply. In

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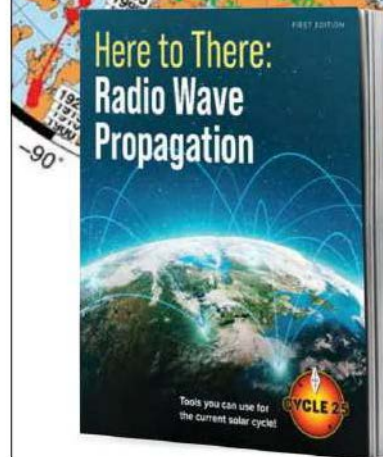
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MFJ-270
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3/8-24 Hamstick Mount Mount 3/8-24 HF/VHF hamsticks vertically or horizontally on masts up to 1 inch OD. Built-in SO-239 for coax.



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Learn Morse Code

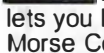
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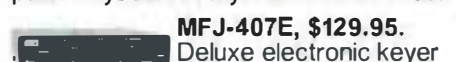
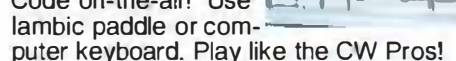
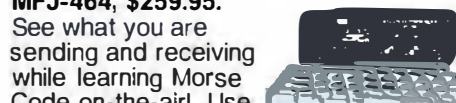


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MFJ-260C
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G5RV Antenna, RFI Isolator, Dipole Mount

Operate 80-10M 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.

MFJ-915, \$49.95.

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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.

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MFJ-16C06
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6-Bands
\$299⁹⁵

MFJ-1838
8-Bands
\$489⁹⁵

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MFJ-4712
1.8-150 MHz
\$109⁹⁵

6-Position Switches

MFJ-1700C, \$179.95. Six position Antenna/Transmitter manual switch.

MFJ-1701, \$139.95. Six position antenna manual switch.

MFJ Apartment Antenna

MFJ-1622 Apartment Antenna covers 40-2 Meters, mounts outdoor to windows, balconies, railings, and works great indoors mounted to desks, tables, and bookshelves! Its universal mount/clamp lets you easily attach it to window frames, balconies, and railings. Its not a five element yagi, but you'll work your share of exciting DX!

MFJ-2286
40-6M Vertical \$149⁹⁵

Rugged 17' stainless-steel collapsible whip (Collapses to 28") is paired with an adjustable high-Q air-wound coil for 7.0-55.0 MHz coverage. 1 kW. Backpack portable. Just over 2 lbs. Includes MFJ-342T mount, counterpoise radials kit.

MFJ-2286PKG, \$239.95. Adds tripod, 25 ft. coax, carrying case.

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! Has gain control, telescoping whip antenna.

MFJ-1020C
\$129⁹⁵



MFJ Low-Noise Receiving Mag Loop

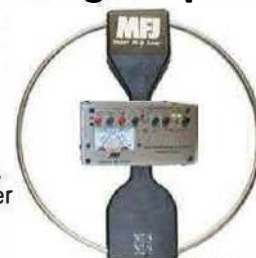
Clearly hear signals 50 KHz to 30 MHz. Power line noise and static disappears. Excellent antenna/preamplifier balance gives deep null. Excellent strong and weak signal performance without overload.



MFJ-1886
\$329⁹⁵
Receive Loop with Bias-Tee

MFJ 36" Hi-Q Transmitting Loop

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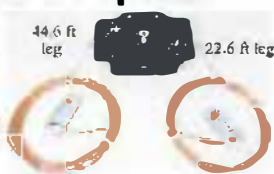
auto tunes to desired band. Cross-Needle SWR/Wattmeter lets you quickly tune to your exact frequency. No control cable needed. All welded construction, welded butterfly capacitor with no rotating contacts, large 1.050 inch diameter aluminum radiator. MFJ-1788, \$719.95. Like MFJ-1786 but covers 40-15 Meters. Includes control. MFJ-9232, \$69.95. QRP Loop Antenna Tuner with wire loop, 10-40 Meters. Handles 25 Watts. Backpack portable.

MFJ-1786
\$659⁹⁵

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transformer to give low SWR and maximum bandwidth on 40/20/10/6 Meters. A Guanella current balun kills feedline radiation, pattern distortion, SWR shifts, RFI and noise pickup. Install anywhere and get the same predictable performance regardless of feedline length. You get ground reinforced gain over verticals. Use horizontally, inverted vee, sloper. 98% efficient, 14 gauge, 7-strand copper wire, ceramic end insulators.



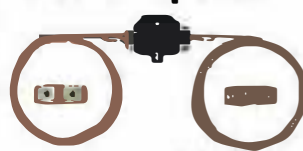
MFJ-2010
\$89⁹⁵
300 Watts

MFJ-2012
\$89⁹⁵
1500 Watts

Single Band Dipoles

Ultra high quality center fed dipoles give years of trouble-free service.

Custom injection-molded UV-resistant center insulator has built-in SO-239 and hanging hole. Glazed ceramic end insulators. 7-strand, 14-gauge hard copper antenna wire. 1500 Watts. Use horizontally or as sloper or inverted vee. Simply cut to length with provided cutting chart. MFJ-17758, \$129.95. 80/40M trapped di-pole. 95'. Full size 40, end load 80M. MFJ-17754, \$89.95. 40/20M trapped di-pole. 42'. Full size 20, end load 40M.



MFJ-1779A
\$99⁹⁵
160M, 265 ft.

MFJ-1779B
\$79⁹⁵
80-40M, 135 ft.

MFJ-1779C
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20-6M, 35 ft.

All Band Classic Doublet Antenna

MFJ 102 foot all band doublet covers 160-6 Meters with balanced line tuner. Super strong custom fiberglass center insulator relieves stress on 100 foot ladder line. Uses glazed ceramic end insulators. 1500 Watts.



MFJ-1777
\$129⁹⁵

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MFJ-2774K Everything you need to build several antennas. Multi-purpose insulators, nylon rope, copper wire, PL-259s, RG-58 reducers, SO-239s, ceramic insulators, hardware.



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Power Rating	1.5KW (1.8~60MHz) 1KW (144MHz)	2KW (1.8~60MHz) 1KW (144MHz)	200W (140~525MHz)
Tolerance	±10% at Full Scale	±10% at Full Scale	±10% at Full Scale
SWR Measurement	1:1~1:∞	1:1~1:∞	1:1~1:∞
SWR Detection Sensitivity	4 WMIN	4 WMIN	4 WMIN
Input/Output Impedance	50 ohms	50 ohms	50 ohms
Input/Output Connectors	SO-239	SO-239	SO-239 or N-Type

CN-501 Economy Series

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Power Range: Forward	20/200/2KW	30/300/3KW	20/200W	2/20W
Tolerance	±10% at Full Scale	±10% at Full Scale	±10% at Full Scale	±10% at Full Scale
SWR Measurement	1:1~1:∞	1:1~1:∞	1:1~1:∞	1:1~1:∞
SWR Detection Sensitivity	5 WMIN	5 WMIN	5 WMIN	0.4W
Input/Output Impedance	50 ohms	50 ohms	50 ohms	50 ohms
Input/Output Connectors	SO-239	SO-239	SO-239 or N-Type	N-Type

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Output Port: 2



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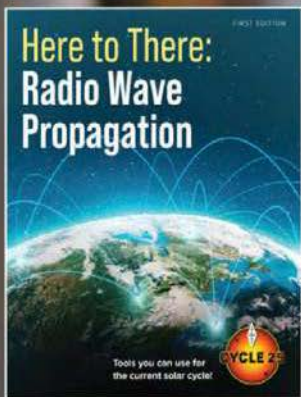
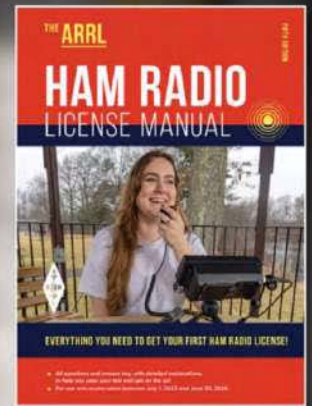
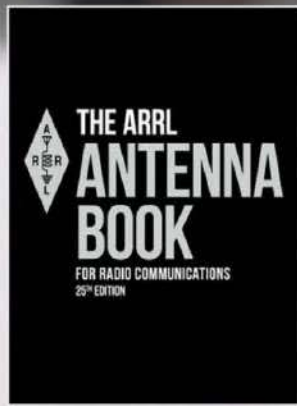
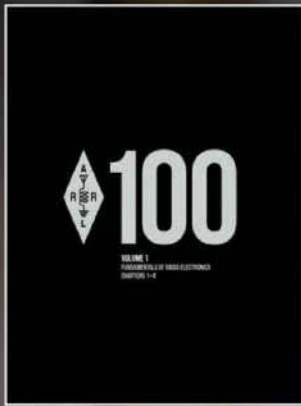
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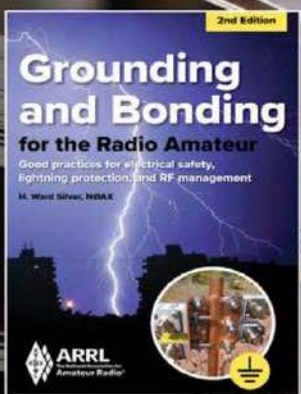
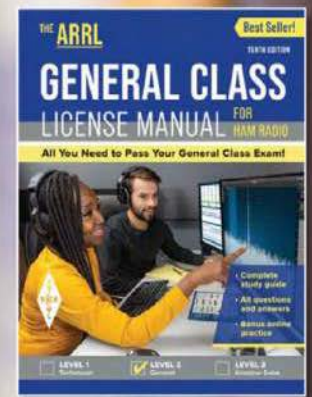

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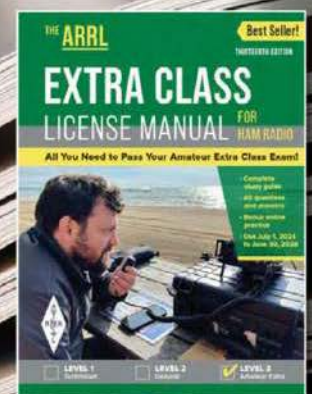


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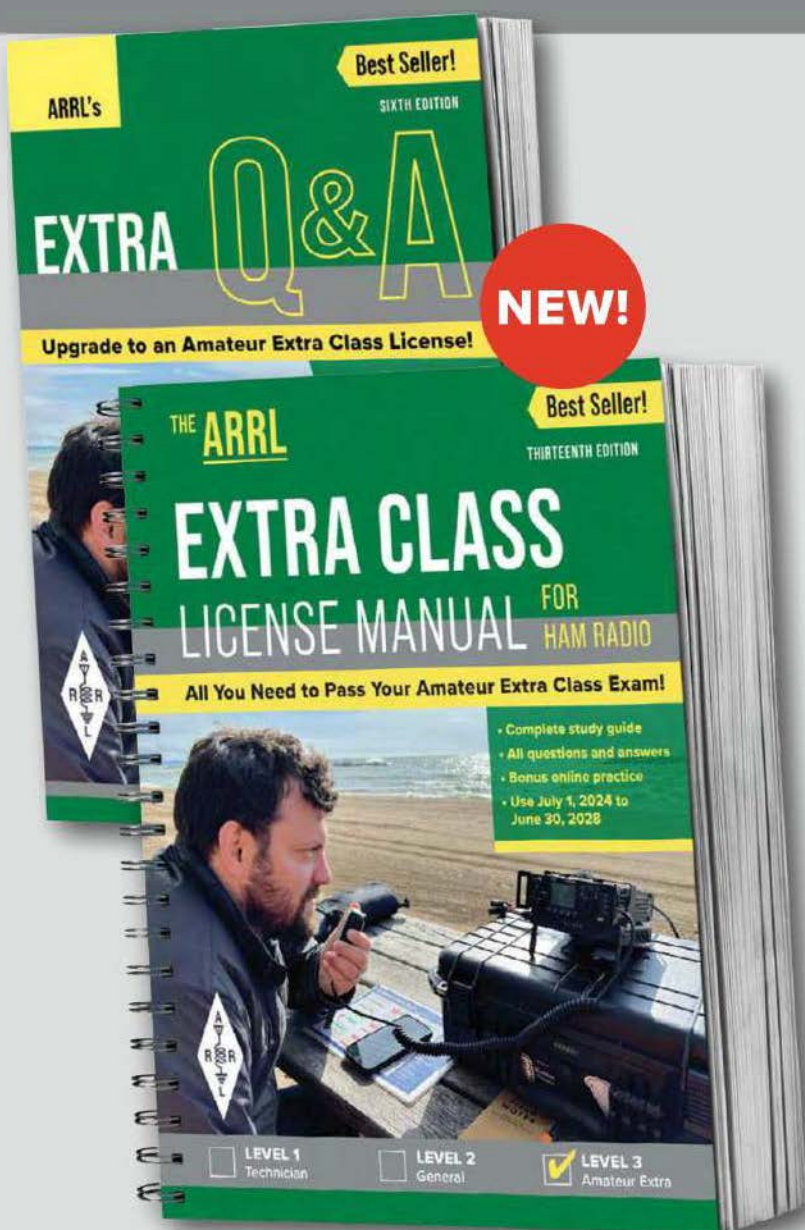


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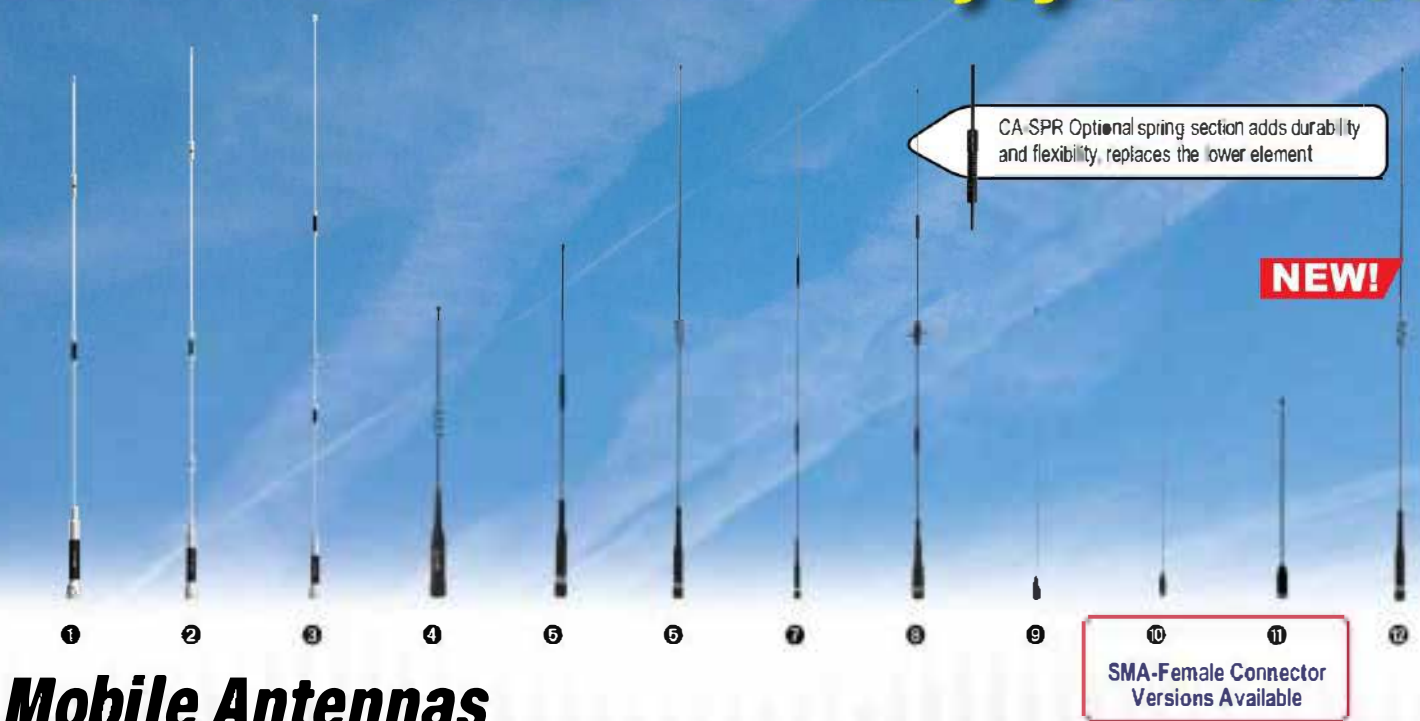
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2 COMET CSB-770A DUAL-BAND 2M/440MHz w/FOLD-OVER

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3 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

4 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

5 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 - NMO style • Max Pwr: 60W

6 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

7 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

8 COMET CA-2X4SR/CA-2X4SRNMO WIDE-BAND 140-160MHz 435-465MHz w/FOLD-OVER

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9 COMET BNC-24 DUAL BAND 2M/440MHz HT ANTENNA

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10 COMET SMA-24, SMA-24J DUAL BAND 2M/440MHz HT ANTENNA

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11 COMET SMA-503, SMA-503J DUAL BAND 2M/440MHz HT ANTENNA

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12 COMET NEW! FC5/FC5NMO DUAL-BAND GMRS & MURS w/FOLD-OVER

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