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March 2025

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Morse Code in the Spotlight



QST Reviews

Unified Microsystems BevFlex-4X
Receive Antenna System

Frequency Devices TEC-1 Test
Equipment Calibrator

Bench Power Supplies

Hanmatek HM310

Wanptek DPS3010

Siglent Technologies SPD3303C

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* Photo shows the FTDX101MP

*¹ 3DSS: 3-Dimensional Spectrum Stream

*² ABI: Active Band Indicator

*³ MPVD: Multi-Purpose VFO Outer Dial

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David A. Minster, NA2AA
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Dana Kasowitz, KC1SEB
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Terese Newman
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Matt Ali
Layout & Production Specialist

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Production Coordinator

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Janet Rocco, W1JLR
Advertising Relationship Manager

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Steve Ewald, WV1X
Field Organization Supervisor

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Our Cover

As the 415 Amateur Radio Club of Crystal Lake, Illinois, was planning their 2024 ARRL Field Day effort, they received an interesting offer to work with the cast and crew of *Static: Noise of a New Musical*, one of the first musicals to put a spotlight on Morse code. As a result of the collaboration, *Static* cast and crew members visited the club's Field Day operation to learn about different modes — especially CW — and even get on the air, and the club loaned amateur radio gear to the production to aid in its accuracy and realism. Read Kevin Potter's, KD9YYO, article "When ARRL Field Day Becomes Theater" to learn more about this meeting of art and science. [Todd Heintz photo]



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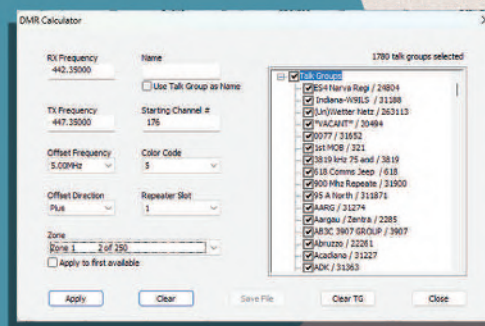
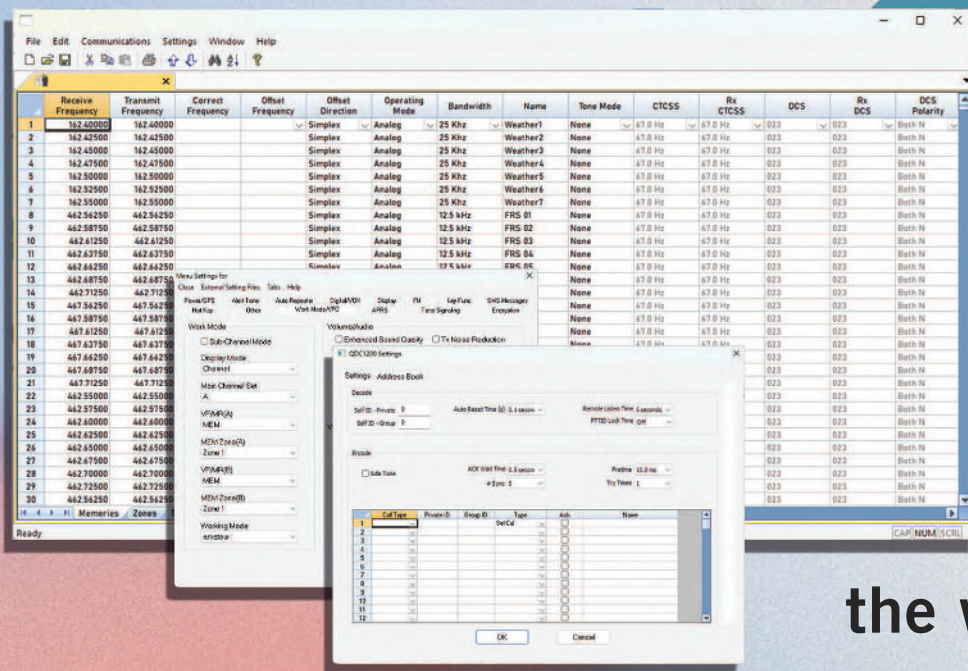
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F718A (Coax Element)	70cm	15	250	N
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SG7500A	2m/70cm	40.6 in.	150	UHF or NMO
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MR77 Series	2m/70cm	20 in.	70	Mag Combo
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Second Century

A Callout to Radio Clubs

Each month, I write this column intending to inspire and inform you about topics related to being both an ARRL member and an active Amateur Radio Operator. Recently, I was very inspired by two gentlemen and their passion and call to action related to radio clubs.

The first was our friend Hayden Honeywood, VK7HH, a YouTube content creator with the channel Ham Radio DX. We've featured Hayden in *QST*, and we continue to be impressed by the work that he does. It should have come as no surprise to me that Hayden, on top of everything else he does, is the president of his local club, the Radio and Electronics Association of Southern Tasmania. The call to action in his recent video on ham radio clubs is twofold, with one of the points being to stop treating general club meetings, which are the entry point for new club members, as business meetings. Keep the running of the club separate from the amateur radio part. Get new people excited about the club and about radio more broadly by having an interesting and engaging meeting.

The other area that Hayden focused on is "sub-groups," as he calls them, with some of them not even, strictly speaking, focused on amateur radio. Here is where clubs can shine! Find areas where there are a few club members who are passionate about an area of the hobby, and give them the space to put together projects or operating events for the club. If the interest is POTA or SOTA, activate a local park or a rare park, or get a group together to build a portable antenna. If it is satellites, do a simple demonstration during a club meeting, or go activate a grid — or again, build an effective satellite antenna. If it is contesting, get a group of club members to operate and submit a club score, or have a little competition within the club for the highest score: the most QSOs, the most multipliers, the most hours on the air, etc. Once you give a small group of passionate people the runway, they'll fly with the idea and attract others to their activities!

Then there's Ed Snyder, W1YSM, the past president of the Meriden Amateur Radio Club here in Connecticut. I have written about Ed before. Beyond him and his wife, Rose, being generous ARRL donors supporting radio club initiatives and our Collegiate Amateur Radio Program, Ed has built a model for strengthening and growing clubs, much in the way Hayden has, but on

a larger scale. During a recent breakfast meetup, Ed and I discussed the program, known as MARCONI — Motivating Amateur Radio Clubs to Open New Initiatives. The Meriden Amateur Radio Club was awarded an ARRL Foundation Club Grant, funded by ARDC, to build out the program for the benefit of the hobby (www.arrrl.org/marconi-program).

How can MARCONI help inspire your club to grow? The program has eight different interest areas: POTA, Foxhunting, CW Training, Satellite Communications, VE Sessions, Served Agencies, NCS Training and Traffic Passing, and Radio Amateur Balloon Science. These areas have been built out so that current and potential new club members have an area of amateur radio where there are experienced mentors ready to help, along with ongoing projects or operating opportunities to participate in and learn new things. We are looking at building out a workbook for club leaders and club members who want to see their clubs get stronger and grow starting with the MARCONI program, which is now being expanded with a phase 2 initiative to help clubs gain 501(c)(3) status and help other clubs by working with, or even merging with, them to make stronger clubs.

How can you get involved? How can you strengthen and grow your club? What are your areas of passion or expertise? Start small. Build out a small group and get going! Clubs are the lifeblood of our hobby, helping newcomers become active radio amateurs. I hope you'll take this challenge to get inspired, be radio active, and be that connector bringing people and your passion for amateur radio together!

David A. Minster, NA2AA
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See review in October 2024 QST page 38

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Member Spotlight

Bob Ideker, WB5BI

Pursuing a lifelong passion for amateur radio, Bob has been a licensed operator for more than 61 years. With the encouragement of his dad, Art, W5CAM (SK), and oldest brother, Jim, W5FVM (SK), he was first licensed as WA5IXM at age 16, and later upgraded and changed his call sign to WB5VUH, which he held for 57 years before selecting the vanity call sign WB5BI.

A Passion for Service

As a Life Member of both ARRL and QCWA, Bob's dedication to amateur radio has been constant. His passion for service extended beyond amateur radio, as his involvement in the Boy Scouts of America significantly shaped his early years while becoming an Eagle Scout, and he was elected Lodge Chief and Vigil Honor member of the Order of the Arrow.

Bob held several leadership positions in amateur radio organizations, including serving as President of the Central Arkansas Radio Emergency Net club in 1989 and as ARRL Arkansas Section Manager from 1990 to 1994. In 1992, he was President of Chapter 158 of the QCWA. He returned as Section Manager for an additional 2 years in 2000, reflecting on these roles as rewarding and enjoyable. Bob noted, "I learned a lot in my 6-year tenure about what helped motivate volunteers, and that was to ask for their involvement [and] support, and being available to other hams." His dedication to service extended to emergency preparedness, evidenced by his completion of 24 FEMA courses.

After retiring in 2011, Bob and his wife moved to Lake Havasu City, Arizona, enjoying 8 years of sunshine and mild winters. While living there, he was appointed Assistant Section Manager for the Arizona Section, helping ham clubs in northern Arizona. In 2019, the couple returned to Arkansas to be closer to their 13 grandchildren. This move strengthened family bonds and allowed Bob to reconnect with his passion for amateur radio.

A Lifetime of Achievements

Since then, he has approached amateur radio with renewed enthusiasm, making more than 28,950 contacts — 14,840 confirmed — using FT8. Recognized with awards like DXCC, he continues to pursue ambitious goals, such as confirming all states across multiple bands. This lifelong hobby has brought him immense joy, camaraderie, and opportunities for growth.

In addition to his contributions to amateur radio, Bob's military service reflects his commitment to leadership and excellence. He served in the Arkansas National Guard and Army Reserve, rising to the rank of Captain in the Signal Corps after completing Officer Candidate School in 1970. Because of his ham license, he was recognized by his peers to become an instructor in communications at Fort Gordon (now Fort Eisenhower) in Augusta, Georgia. "I had a lot of fun working with other instructors and soldiers who wanted to become radio and radio-teletype operators."

His academic achievements include a degree in organizational management from John Brown University.



Professionally, he dedicated 28 years to Entergy Corporation, focusing on Transmission and Nuclear Engineering, followed by 13 years with the Southwest Power Pool.

Continuing Leadership

As State Coordinator for Arkansas's AARP Driver Safety Program, Bob oversees 43 instructors who teach a course for drivers over 50, helping participants earn insurance discounts. His leadership positively impacts thousands statewide, reflecting his lifelong dedication to community service.

Bob has cherished opportunities to connect with others throughout his retirement through volunteer work, amateur radio, and family gatherings. His story underscores the rewards of an active and purposeful retirement, inspiring others to embrace this stage of life enthusiastically.

Bob's full life has consisted of many opportunities to be of service, including serving his country. In reflecting on his various activities over the years, he commented, "We should all try to learn new ways to share our knowledge and interest in our great hobby by being active and becoming an Elmer to others."

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Officers

Founding President 1914-1936
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President
Rick Roderick, K5UR*
P.O. Box 444, Vilonia, AR 72173
501-988-2527; k5ur@arrrl.org

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

Second Vice President
Mike Ritz, W7VO
33643 Burma Rd.
Scappoose, OR 97056
503-987-1269; w7vo@arrrl.org

International Affairs Vice President
Rod Stafford, W6ROD
5155 Shadow Est.
San Jose, CA 95135
408-238-4671; w6rod@arrrl.org

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

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John Sager, WJ7S

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Atlantic Division

www.atldiv.org
Robert B. Famiglio, K3RF
P.O. Box 9, Media, PA 19063
610-359-7300; k3rf@arrrl.org

Vice Director: Marty Pittinger, KB3MXM
4 Pegram Rd., Owings Mills, MD 21117
410-356-7899; kb3mxm@arrrl.org

Central Division

www.central.arrrl.org
Brent Walls, N9BA
2151 E. Bomar Ln., Greenfield, IN 46140
317-557-7224; n9ba@arrrl.org

Vice Director: Joshua Long, W9HT
8725 Edwardsberg Pl., New Haven, IN 46774
260-749-9851; w9ht@arrrl.org

Dakota Division

www.arrrldakota.org
Bill Lippert, AC0W*
2013 6th Ave. SE, Austin, MN 55912
507-993-9181; ac0w@arrrl.org

Vice Director: Lynn Nelson, W0ND
3204 Willow Ln. SE, Minot, ND 58701
701-833-1000; w0nd@arrrl.org

Delta Division

www.arrrldelta.org
David A. Norris, K5UZ
1200 Becky Ln., Redfield, AR 72132
870-613-1606; k5uz@arrrl.org

Vice Director: Ed B. Hudgens, WB4RHQ
1441 Wexford Downs Ln., Nashville, TN 37211
615-630-2753; wb4rhq@arrrl.org

Great Lakes Division

www.arrrl-greatlakes.org
Scott Yonally, N8SY
258 Valley Hi Dr., Lexington, OH 44904
419-512-4445; n8sy@arrrl.org

Vice Director: Roy Hook, W8REH
6611 Steitz Rd., Powell, OH 43065
w8reh@arrrl.org

Hudson Division

www.hudson.arrrl.org
Ed Wilson, N2XDD
P.O. Box 483, Shirley, NY 11967
631-484-8826; n2xdd@arrrl.org

Vice Director: David Galletly, KM2O
540 Wemple Rd., Glenmont, NY 12077
518-421-8324; km2o@arrrl.org

Midwest Division

www.arrrlmidwest.org
Art Zygielbaum, K0AIZ*
6601 Pinecrest Dr., Lincoln, NE 68516
402-421-0840; k0aiz@arrrl.org

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

How to Contact ARRL Staff

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

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New England Division

<https://nediv.arrrl.org>
Tom Frenaye, K1KI
P.O. Box J, West Suffield, CT 06093
860-597-4539; k1ki@arrrl.org

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

Northwestern Division

www.arrrlnwdiv.org
Mark J. Tharp, KB7HDX
P.O. Box 2222, Yakima, WA 98907
509-952-5764; kb7hdx@arrrl.org

Vice Director: Michael A. Sterba, KG7HQ
212 Laurel Dr., Sedro Woolley, WA 98284
360-708-2757; kg7hq@arrrl.org

Pacific Division

www.pacific.arrrl.org
Anthony Marcin, W7XM
6836 Boulder Canyon St., North Las Vegas, NV 89084, 702-984-9589; w7xm@arrrl.org

Vice Director: John Litz, N2Z6Q
1434 Douglas Rd., Stockton, CA 95207
209-687-0774; n2z6q@arrrl.org

Roanoke Division

www.arrrl-roanoke.com
Dr. James Boehner, N2ZZ*
525 Barnwell Ave. NW, Aiken, SC 29801-3939
803-343-9040; n2zz@arrrl.org

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

Rocky Mountain Division

www.rockymountaindivision.org
Jeff Ryan, K0RM*
9975 Wadsworth Pkwy. K2-275
Westminster, CO 80021
303-432-2886; k0rm@arrrl.org

Vice Director: Dan Grady, N2SRK
8706 S. Buchanan Way, Aurora, CO 80016
720-236-7397; n2srk@arrrl.org

Southeastern Division

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

Vice Director: Andrew Milluzzi, KK4LWR
440-829-1187; kk4lwr@arrrl.org

Southwestern Division

www.kkn.net/n6aa
Richard J. Norton, N6AA
21290 West Hillside Dr., Topanga, CA 90290
310-455-1138; n6aa@arrrl.org

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

West Gulf Division

www.westgulfddivision.org
John Robert Stratton, N5AUS
P.O. Box 2232, Austin, TX 78768-2232
512-445-6262; n5aus@n5aus.com

Vice Director: Lee H. Cooper, W5LHC
2507 Autrey Dr., Leander, TX 78641
512-658-3910; w5lhc@arrrl.org

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

Atlantic Division DE, EPA, MDC, NNY, SNJ, WNY, WPA

Delaware: Steven Keller, KC3DSO, 803 Meadow Brook Ln., Milford, DE 19963-3000 240-515-0620; kc3dso@arrl.org

Eastern Pennsylvania: Bob Wilson, W3BIG, 2223 West Helms Manor, Upper Chichester, PA 19061-3325; 484-836-9367; w3big@arrl.org

Maryland-DC: Chris Van Winkle, AB3WG, 24 Tattersaul Ct., Reisterstown, MD 21136-2431; 240-755-4257; ab3wg@arrl.org

Northern New York: Rocco Conte, WU2M, 152 W. Bush Rd., Gloversville, NY 12078-6405; 518-848-9028; wu2m@arrl.org

Southern New Jersey: Ron Fish, KX1W, 29 S. Canary Way, Galloway, NJ 08205-6208; 845-988-6705; kx1w@arrl.org

Western New York: Scott Bauer, W2LC, 1964 Connors Rd., Baldwinsville, NY 13027-9743; 315-430-6368; w2lc@arrl.org

Western Pennsylvania: Joe Shupienis, W3BC, P.O. Box 73, Falls Creek, PA 15840-0322; 814-771-3804; w3bc@arrl.org

Central Division IL, IN, WI

Illinois: Thomas Beebe, W9RY, 3540 Market Rd., Marion, IL 62959-8940 618-534-6282; w9ry@arrl.org

Indiana: Bob Burns, AK9R, P.O. Box 808, Brownsburg, IN 46112 317-520-1188; ak9r@arrl.org

Wisconsin: Jason Spetz, KC9FXE, E5910 490th Ave., Menomonie, WI 54751-5644 715-231-7722; kc9fxe@arrl.org

Dakota Division MN, ND, SD

Minnesota: Bill Mitchell, AE0EE, 7412 Colfax Ave. S., Richfield, MN 55423 510-529-5658; ae0ee@arrl.org

North Dakota: Ralph Fettig, N0RDF, 6650 County Rd. 12 W., Minot, ND 58701-3003 701-822-3467; n0rdf@arrl.org

South Dakota: Chris Stallkamp, KI0D, P.O. Box 271, Selby, SD 57472-0271 605-848-3929; ki0d@arrl.org

Delta Division AR, LA, MS, TN

Arkansas: James D. Ferguson, Jr., N5LKE, 1500 Lauren Dr., Searcy, AR 72143-8477 501-593-5695; n5lke@arrl.org

Louisiana: Houston Polson, N5YS, 309 Arkansas St., Winnfield, LA 71483 318-209-8843; n5ys@arrl.org

Mississippi: Malcolm Keown, W5XX, 64 Lake Circle Dr., Vicksburg, MS 39180 601-636-0827; w5xx@arrl.org

Tennessee: David Thomas, KM4NYI, 205 Linford Rd., Knoxville, TN 37920 865-654-5489; km4nyi@arrl.org

Great Lakes Division KY, MI, OH

Kentucky: Alan Morgan, KY1O, 1711 Willisburg Rd., Lawrenceburg, KY 40342-9555 859-573-5092; ky1o@arrl.org

Michigan: Larry Camp, WB8R, 71 Oakdale Ln., Coldwater, MI 49036-1200 517-617-4883; wb8r@arrl.org

Ohio: Tom Sly, WB8LCD, 1480 Lake Martin Dr., Kent, OH 44240-6260 330-554-4650; wb8lcd@arrl.org

Hudson Division ENY, NLI, NNY

Eastern New York: John K. Fritze, Jr., K2QY, 4 Normanskill Blvd., Delmar, NY 12054-1335; 401-261-4996; k2qy@arrl.org

NYC-Long Island: Jim Mezey, W2KfV, 38 Appletree Ln., Carle Place, NY 11514-1336 516-315-8608; w2kfv@arrl.org

Northern New Jersey: Bob Buus, W2OD, 8 Donner St., Holmdel, NJ 07733-2004 732-946-8615; w2od@arrl.org

Midwest Division IA, KS, MO, NE

Iowa: Lelia Garner, WA0UIG, 145 Front St., Robins, IA 52328-9718 319-213-3539; wa0uig@arrl.org

Kansas: Ronald D. Cowan, KB0DTI, P.O. Box 36, La Cygne, KS 66040 913-757-4456; kb0dti@arrl.org

Missouri: Cecil Higgins, AC0HA, 27995 County Rd. 220, Hermitage, MO 65668-8493 417-493-8208; ac0ha@arrl.org

Nebraska: Matthew N. Anderson, KA0BOJ, 14300 NW 98th St., Raymond, NE 68428-4254; 402-480-5515; ka0boj@arrl.org

New England Division CT, EMA, ME, NH, RI, VT, WMA

Connecticut: Douglas Sharafanowich, WA1SFH, 168 Housatonic Dr., Milford, CT 06460-4936; 203-494-3887; wa1sfh@arrl.org

Eastern Massachusetts: Jon McCombie, N1ILZ, 75 Northwest St., Eastham, MA 02642 508-246-4982; n1ilz@arrl.org

Maine: Philip Duggan, N1EP, 195 Kansas Rd., Milbridge, ME 04658-3120 207-598-5397; n1ep@arrl.org

New Hampshire: Peter Stohrer, W1FEA, 9 Gladstone St., Concord, NH 03301-3130 603-345-1470; w1fea@arrl.org

Rhode Island: Nancy Austin, KC1NEK, P.O. Box 4941, Middletown, RI 02842-0941 401-935-3070; kc1nek@arrl.org

Vermont: Paul N. Gayet, AA1SU, 11 Cherry St., Essex Junction, VT 05452 802-878-2215; aa1su@arrl.org

Western Massachusetts: Raymond Lajoie, AA1SE, 245 Leominster Rd., Lunenburg, MA 01462-2031; 978-549-5507; aa1se@arrl.org

Northwestern Division AK, EWA, ID, MT, OR, WWA

Alaska: David Stevens, KL7EB, 8521 Golden St., Apt. 4, Anchorage, AK 99502 907-242-6483; kl7eb@arrl.org

Eastern Washington: Jo Whitney, KA7LJQ, P.O. Box 2222, Yakima, WA 98907 509-952-5765; ka7ljq@arrl.org

Idaho: Dan Marler, K7REX, 6525 W. Fairfield Ave., Boise, ID 83709 208-914-8939; k7rex@arrl.org

Montana: Kevin Kerr, W1KGK, P.O. Box 69, Plains, MT 59859-0069 406-242-0109; w1kgk@arrl.org

Oregon: Scott Rosenfeld, N7JL, 3662 Vine Maple St., Eugene, OR 97405-4473 541-684-9970; n7ji@arrl.org

Western Washington: Bob Purdom, AD7LJ, P.O. Box 65171, University Place, WA 98464-1171; 253-691-2388; ad7lj@arrl.org

Pacific Division EB, NV, PAC, SCV, SF, SJV, SV

East Bay: Mike Patterson, N6JGA, P.O. Box 30627, Walnut Creek, CA 94598 925-200-8300; n6jga@arrl.org

Nevada: John Bigley, N7UR, 2420 Palora Ave., Las Vegas, NV 89121-2157 702-498-5829; n7ur@arrl.org

Pacific: Alan Maenchen, AD6E, 2164 Kamaile St., Wailuku, HI 96793-5458 408-382-1008; ad6e@arrl.org

Sacramento Valley: Dr. Carol Milazzo, KP4MD, P.O. Box 665, Citrus Heights, CA 95611-0665; 916-259-3221; kp4md@arrl.org

San Francisco: Dr. Antonis Papatsaras, AA6PP, 48 Bayo Vista Ave., Larkspur, CA 94939-1006; 415-861-5053; aa6pp@arrl.org

San Joaquin Valley: Steven Hendricks, KK6JTB, P.O. Box 630, Inyokern, CA 93527-0630; 760-977-2590; kk6jtb@arrl.org

Santa Clara Valley: James Armstrong, NV6W, 2048 Paseo Del Sol, San Jose, CA 95124-2048; 408-679-1680; nv6w@arrl.org

Roanoke Division NC, SC, VA, WV

North Carolina: Marvin K. Hoffman, WA4NC, P.O. Box 2208, Boone, NC 28607 828-964-6626; wa4nc@arrl.org

South Carolina: Matthew Crook, W1MRC, 220 Star Hill Lane, Lexington, SC 29072-6948; 803-386-1069; w1mrc@arrl.org

Virginia: Jack Smith, KE4LWT, 515 New Life Dr., Ruckersville, VA 22968-3045 662-523-0000; ke4lwt@arrl.org

West Virginia: Dan Ringer, K8WV, 18 W. Front St., Morgantown, WV 26501-4507 304-292-1999; k8wv@arrl.org

Rocky Mountain Division CO, NM, UT, WY

Colorado: Amanda Alden, K1DDN, 230 Glenmoor Rd., Canon City, CO 81212-7705 719-315-0434; k1ddn@arrl.org

New Mexico: Bill Mader, K8TE, 4701 Sombrette Rd. SE, Rio Rancho, NM 87124 505-250-8570; k8te@arrl.org

Utah: Pat Malan, N7PAT, 10102 S. Redwood Rd. #95401, South Jordan, UT 84095 801-413-7438; n7pat@arrl.org

Wyoming: Garth Crowe, Sr., WY7GC, 2342 Sagewood Ave., Casper, WY 82601-5018 307-689-1340; wy7gc@arrl.org

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

Alabama: Dennis Littleton, K4DL, 2230 Bishop Rdg., West Blocton, AL 35184-4246 205-718-4410; k4dl@arrl.org

Georgia: Hank Blackwood, K4HYJ, 406 Dawnville Rd. NE, Dalton, GA 30721 706-529-5647; k4hyj@arrl.org

Northern Florida: Scott Roberts, KK4ECR, 2361 Oak Hammock Ln., Orange Park, FL 32065; 904-759-7812; kk4ecr@arrl.org

Puerto Rico: Carmen N. Greene Rodriguez, KP4QVQ, Parc. San Romualdo 52 Calle H, Hormigueros, PR 00660-9735; 787-246-5634; kp4qvq@arrl.org

Southern Florida: Barry M. Porter, KB1PA, 14555 Sims Rd., Apt. 259, Delray Beach, FL 33484; 561-499-8424; kb1pa@arrl.org

Virgin Islands: Fred Kleber, K9VV, P.O. Box 24275, Christiansted, VI 00824-0275 k9vv@arrl.org

West Central Florida: Michael Douglas, W4MDD, 2527 Apple Blossom Ln., Wauchula, FL 33873; 863-585-1648; w4mdd@arrl.org

Southwestern Division AZ, LAX, ORG, SB, SDG

Arizona: Rick Paquette, W7RAP, 1600 W. Sunkist Rd., Tucson, AZ 85755-9561 520-425-6877; w7rap@arrl.org

Los Angeles: Diana Feinberg, AL6DF, P.O. Box 4678, Palos Verdes Peninsula, CA 90274-9618; 310-544-2917; al6df@arrl.org

Orange: Bob Turner, W6RHK, P.O. Box 973, Perris, CA 92572 951-236-8975; w6rhk@arrl.org

San Diego: Bruce Krypton, AG6X, 5755 Castleton Dr., San Diego, CA 92117-4058 619-813-5505; ag6x@arrl.org

Santa Barbara: John Kitchens, NS6X, P.O. Box 178, Somis, CA 93066 805-216-2569; ns6x@arrl.org

West Gulf Division NTX, OK, STX, WTX

North Texas: Steven Lott Smith, KG5VK, 125 Contest Ln., Ben Franklin, TX 75415-3830 318-470-9806; kg5vk@arrl.org

Oklahoma: Mark Kleine, N5HZR, 2651 84th Ave. SE, Norman, OK 73026 405-410-6756; n5hzh@arrl.org

South Texas: Stuart Wolfe, KF5NIX, 408 Cedar Grove Rd., Rockdale, TX 76567 512-660-9954; kf5nix@arrl.org

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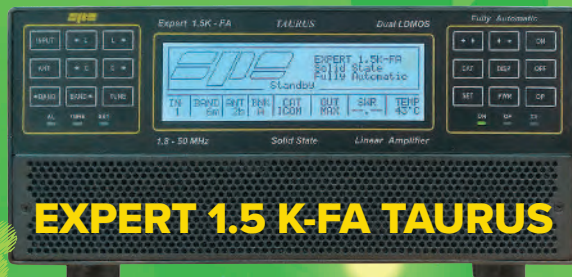
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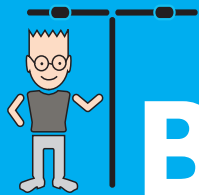


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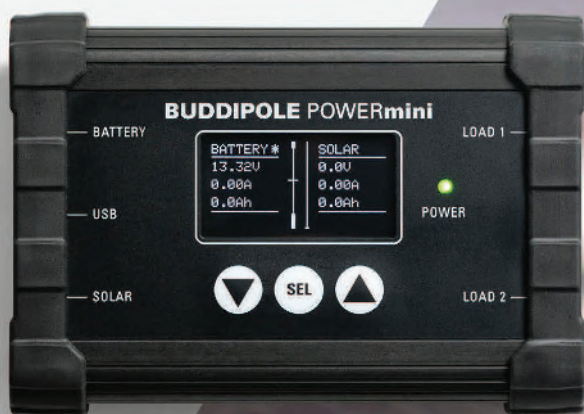
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Up Front

An Edible Heathkit SB-102

Linda Cronk, KD2ZDF, created this amazing delight for the Overlook Mountain Amateur Radio Club's winter dinner and social event. The radio, microphone, pencil, and pad are cake. The knobs even turn. [Mose Howard, KB5BV, photo]



Almost Too Real

Chris Wreck's, K2HVE, daughter, Naomi, created this masterpiece for his 75th birthday. Many thought the cake was a real radio. [Chris Wreck, K2HVE, photo]



This Yaesu FRG-9600 Takes the Cake

For his 80th birthday, Fred Piering's, WD9HNU, wife and daughter conspired to have a special birthday cake fabricated by his daughter's friend (whose dad happens to be a ham, too!). Fred says, "The cake was magnificent, as you can see. It is really cool!" [Fred Piering, WD9HNU, photo]



A Delicious Elecraft K4D

Thomas Schaefer's, NY4I, wife, Beth, surprised him with a cake facsimile of his Elecraft K4D transceiver. Beth took a picture of the radio (apparently when he was working 6-meter FT8) and sent it to a local cake shop. They were able to recreate the exact details of the front panel on a full-sized cake. [Thomas Schaefer, NY4I, photo]



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Correspondence

Letters from Our Members

Discovering the DXCC Challenge

In the mid-1980s some friends suggested I upgrade to General to experience the exciting 10-meter band. Within a year, the challenge of 13 WPM was behind me. The next year, the Advanced license was mine!

All the awards lay ahead of me. I accomplished DXCC with only a tribander. When I retired in 2006, I put up a 40- and 80-meter dipole. It took several years, but I earned the DXCC Award for seven bands. I recently took up FT8, and digital DXCC came quickly.

I never paid attention to the DXCC Challenge and was surprised I had more than 1,500 bands/countries. A friend suggested that I try 30 meters. After a couple of pieces of 24-foot-long wire and 30 nights (not consecutive), I had 100 LoTW contacts on 30 meters. The last time I checked, my DXCC Challenge Award score was 1,800.

Dan Bowman, K1FEV
Peabody, Massachusetts

Restoring Equipment for the Next Generation

My son passed his General license exam at 13 years old in 1993. He had a blast working DX on 20 meters with an AEA PK-232 terminal node controller and an Icom IC-725.

Recently, I renovated my son's 35-year-old IC-725 because my grandson wants to play with his dad's radio and get his license. So,

I set it up with a RIGblaster Nomic interface. I picked an old Sound Blaster USB sound card from my junk box. I hooked up the receive audio from the radio's **HP OUT** jack to the Sound Blaster's **LINE IN** jack. I hooked up the transmit audio from the Sound Blaster's **LINE OUT** jack to the RIGblaster's input, then connected an isolation transformer in the RIGblaster, and finally, a radio cable from the RIGblaster to the IC-725's **PHONES MIC** jack.

I tuned the radio to 17 meters, fired up *WSJT-X* and FT8, and sent out a 10 W carrier. I heard CE1PTT calling CQ on FT8 and called him immediately. He came back after the first try, and I had Chile in the log.

I can't wait for my grandson to pass his exam and put this IC-725 back onto HF SSB.

Barry Feierman, K3EUI
Kennett Square, Pennsylvania

Try Something New

While contests are very popular, not everyone embraces them. If you don't contest, you may want to work a little bit of the contest to snag some rare DX or hard-to-find US states or territories. If you enjoy contesting, there are plenty of opportunities to earn awards, such as Worked All States and ARRL DX Century Club. You can also take on the Worked All Zones challenge.

I'm always surprised to hear that ham radio is expensive. Yes, it can be costly, but you can assemble a quality station for very little. Good

used transceivers can be purchased from hamfests or friends for a few hundred dollars. Then add another hundred dollars for some antenna wire and coax, and you're on the air.

If you're bored with ham radio, maybe it's time to try other modes such as CW, SSB, RTTY, FT8, FM, AM, WSPR, and slow scan TV, or other bands such as LF, HF, VHF, UHF, and microwave. You can work point to point or use Earth repeaters, bounce signals off the moon, work through satellites, and even contact the International Space Station.

You can also have fun operating your state QSO party and club special events. Some ambitious folks try to contact every county in every US state. Others love building their radio gear from well-designed and documented kits or collecting and restoring vintage tube gear. Field Day can be a fun event, too. Many folks hit the road for Parks on the Air and Summits on the Air.

Instead of bailing or setting the hobby aside for several years, try something new until you find your next radio passion.

Scott Freeberg, WA9WFA
Saint Paul, Minnesota
Life Member

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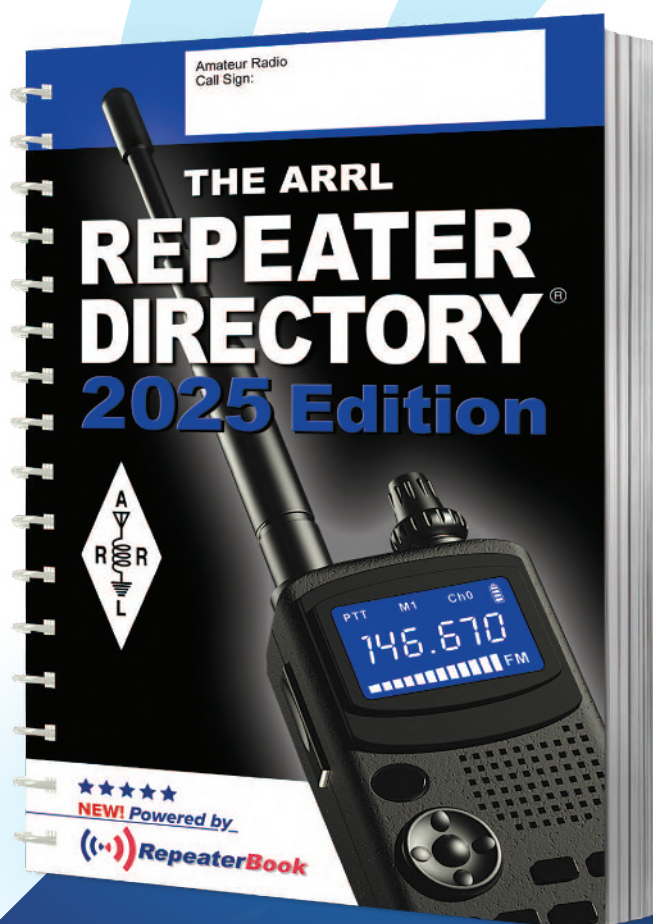
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W1AW Schedule

PAC	MTN	CENT	EAST	UTC	MON	TUE	WED	THU	FRI
6 AM	7 AM	8 AM	9 AM	1300		FAST CODE	SLOW CODE	FAST CODE	SLOW CODE
7 AM-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, 18.0775, 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 2025, Headquarters and W1AW are closed on New Year's Day (January 1), Presidents Day (February 17), Memorial Day (May 26), Independence Day (July 4), Labor Day (September 1), Veterans Day (November 11), Thanksgiving and the following day (November 27 and 28), and Christmas and the following day (December 25 and 26).



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Build a Portable FM Satellite Station

Take a satellite station on your next road trip.

Jim DeLoach, WUØI

Making contacts via amateur radio satellites while on the road is a blast (see Figure 1), and assembling a basic roving station for this purpose is easy. You need only two FM transceivers (one for 2 meters and the other for 70 centimeters — or just a single dual-band rig) and a simple handheld antenna.

Of course, you also need to know when the satellites will be overhead and what their positions will be as they move across the sky. Fortunately, smartphone apps make this part of the process a breeze.

The Satellite Station

An FM satellite is a flying crossband repeater, receiving on 2 meters and retransmitting on 70 centimeters, or vice versa. Your station needs to transmit on one band while simultaneously receiving on the other (see Figure 2). Alternatively, an FM transceiver capable of simultaneously receiving on one band while transmitting on the other can be used, as shown in Figure 3. My current FM satellite kit uses a Kenwood TM-V71A transceiver, which works quite well for this application.

For the antenna, modest gain (6 to 11 dBi) is needed for a reliable connection, and a broad radiation pattern is helpful for tracking the satellite. I recommend a short, handheld two-band Yagi antenna like the Arrow II (<https://arrowantennas.com>), or a dual-band log-periodic antenna like the Elk 2M/440L5 (<https://elkantennas.com>).



Figure 1 — Jim DeLoach, WUØI, enjoys making a satellite contact with his portable station. [Maggie DeLoach, KK6DZS, photo]

Many satellite operators eventually add a few extra features. A headset with mic and push-to-talk switch frees up a hand, while a downlink audio recording interface helps resolve logging questions. Figures 4 and 5 show how to add these capabilities to your kit.

A well-organized kit enables you to quickly stop, set up, make contacts, and then move on. I packaged my rig, battery, audio circuitry, interconnections, and cables in a satchel (see Figure 6). During operation, the cables extend out of the satchel, but the rig and battery stay in place.

Satellite Operating

Satellites are moving at thousands of miles per hour, so operators must compensate for Doppler frequency shifting. The transmit *uplink* frequency must be adjusted so that it is received at the satellite's input frequency. The receive *downlink* frequency must be adjusted to account for the Doppler frequency shift from the satellite to you. This means that when the uplink compensation is positive, the downlink compensation will be negative and vice versa (as shown in Figure 7). Doppler frequency shifts range from about ± 3.5 kHz on 2 meters and ± 10 kHz on 70 centimeters for all current FM satellites.

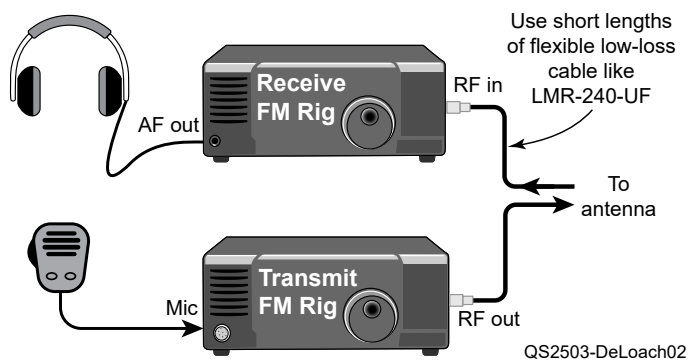


Figure 2 — A basic satellite station requires just one 2-meter FM radio, one 70-centimeter FM radio, and a simple dual-band antenna.

To make these Doppler adjustments, most roving FM satellite operators simply tune the transceiver VFO or step through preprogrammed memories. Due to the FM capture effect, the 5 kHz tuning resolution common in FM rigs is sufficient. You tune to the closest 5 kHz step available given the satellite's frequency and the amount of adjustment needed. On 2 meters, tuning to the published frequency and making no further adjustment usually works, though adjusting +5 or -5 kHz is occasionally helpful. On 70 centimeters, however, it is essential to be able to tune between +10 and -10 kHz.

New satellites launch and old satellites fall back to Earth frequently, so it is essential to check the latest status. Radio Amateur Satellite Corporation (AMSAT; www.amsat.org) is your go-to source for satellite uplink and downlink frequencies, CTCSS values (if any), operational restrictions, and so on. See *QST* in Depth (www.arrrl.org/qst-in-depth) and my website at www.deloach.net/satellite for the most useful links.

As I mentioned previously, mobile apps make it easy to know when satellite passes will occur and where to point the antenna during a pass. Using the phone's location and satellite position information (known as "Keplerian Elements" or "Keps"), these apps display

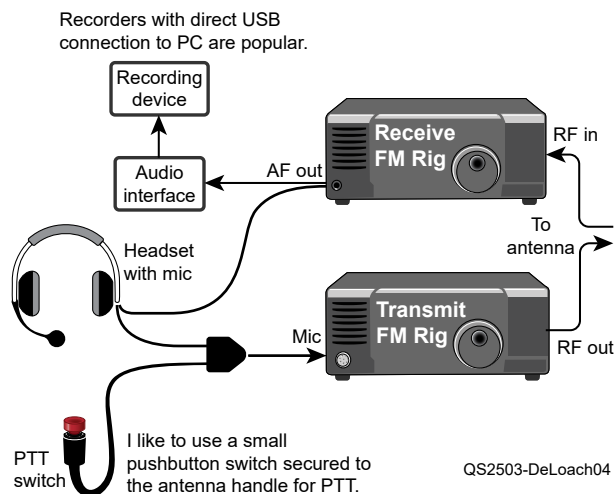


Figure 4 — This setup adds a headset with mic, a PTT switch, and a downlink audio recording capability.

lists of upcoming passes and graphically display a satellite's azimuth and elevation relative to your location during an active pass. I use *Look4Sat* for Android, but numerous other apps are available for all platforms. See my website for links.

Most rovers leave the antenna rotator at home and instead hold a lightweight, portable satellite antenna with one hand (as shown in Figure 1). Aiming the antenna manually is straightforward; just move your antenna in the direction predicted by the app. Once you hear signals, gently move the antenna just enough to maintain maximum audio quality during the pass. You can also rotate the antenna for maximum audio quality to optimize polarization.

Once your kit is ready, practice by listening to a few satellite passes. This confirms that your antenna and radio are working, your app is successfully predicting when and where passes are occurring, and you are comfortable aiming the handheld antenna. Now it's time to make a contact!

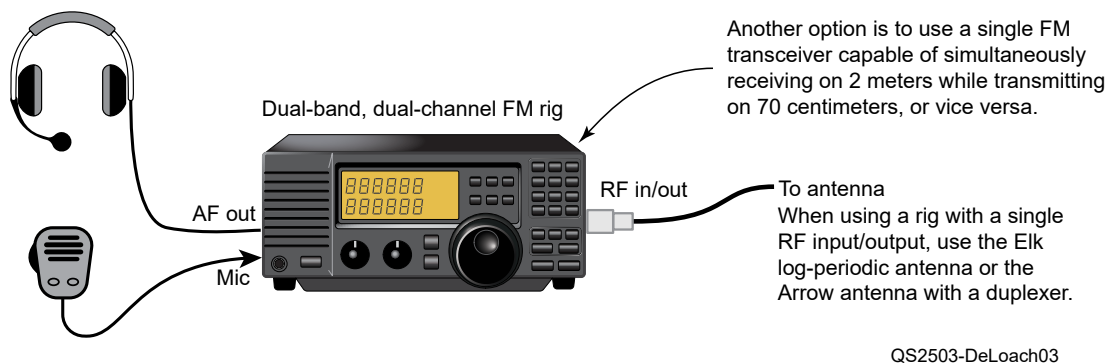


Figure 3 — An FM transceiver capable of dual-band full duplex operation.

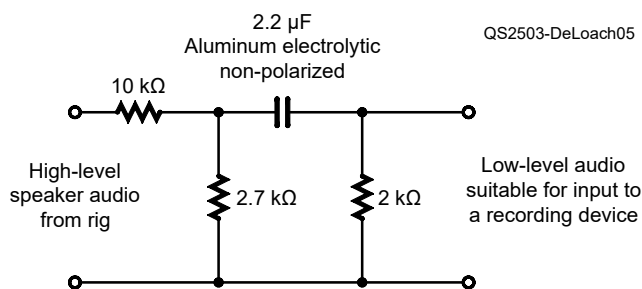


Figure 5 — A simple passive resistor network and dc blocking capacitor for interfacing the receiver speaker audio to a recording device.

With satellite passes lasting at most 13 minutes, there is little time for chitchat. This means a typical contact is simply an exchange of call signs and Maidenhead grid squares. When you hear another station's call sign and grid square, respond with your call and grid square. If the other operator hears you, you'll be acknowledged. That's it — you've made your first satellite contact!

Activation Notification and Travel Planning

Let grid chasers know when you plan to activate rare grids so they will be listening for you. Websites such as <https://hams.at> are popular for publishing activations. If you happen to be in a state, provincial, or national park, be sure to spot your activation on the Parks on the Air (POTA) website (www.parksontheair.com) as well. *QST* in Depth and my website provide additional links and resources for publishing activations, identifying the most in-demand grid squares, and planning activations.



Figure 6 — A well-organized kit speeds deployment and tear-down. [Jim DeLoach, WUØI, photo]

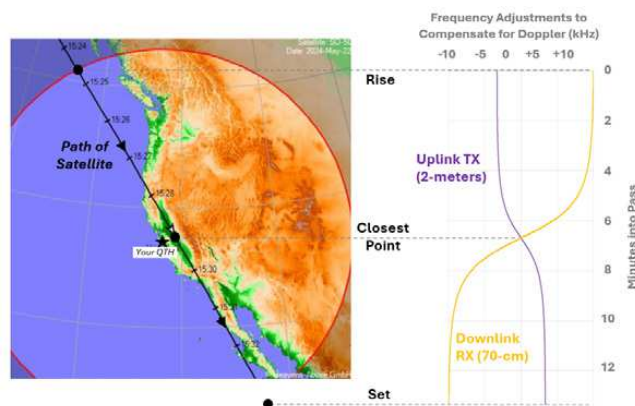


Figure 7 — An illustration of a satellite pass over California. The uplink and downlink frequencies shift throughout the pass, so you will need to compensate accordingly. Notice how your downlink receive frequency should be +10 kHz above the published value at the beginning of the pass, then slide downward until it is -10 kHz at the end of the pass. As you can see, not much uplink frequency adjustment is necessary. It may benefit from being adjusted by -5 kHz at the beginning of the pass and by +5 kHz at the end of the pass to keep your signal sounding as strong as possible.

The Takeaway

Make a portable satellite kit and bring it along on your next road trip or POTA activation. You'll have an exciting time operating this fun mode!

See *QST* in Depth for More!

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

- ✓ Links for publishing POTA activations, helpful Maidenhead grid square information, and other satellite resources
- ✓ An example of how to use a satellite tracking app
- ✓ Information about how to activate two grids at once

Jim DeLoach, WUØI, and his wife Maggie DeLoach, KK6DZS, hit the road frequently to visit family and explore our beautiful continent. They love to activate rare satellite grids, build ARRL Field Day stations wherever they are in late June, and participate in Parks on the Air. You can reach Jim at jim@deloach.net. Jim's satellite resources website is www.deloach.net/satellite.

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

VOTE

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

A Linear Amplifier for QRP Rigs

Modifiable for any band, this design uses RF switching and can turn a 5 W input into a 20 W output.

James Forkin, WA3TFS

I often operate low power, and I've made hundreds of CW and SSB contacts using my homebrew rigs (see "A Simple CW QRP Transceiver for 40 Meters" and "WA3TFS Companion SSB Transmitter for the All-Mode SDR Receiver" in the December 2022 and August 2017 issues of *QST*, respectively). But there are times when I need a bit more power to make a contact. For such cases, I offer a simple RF amplifier design that you can build for your own use. You can find additional pictures of the device at www.arrl.org/qst-in-depth.

Design Requirements

I decided that the amplifier had to provide enough power gain to be useful, include RF switching to simplify hookup, and draw limited power because I



The linear amplifier's front panel.

typically use batteries. I needed a decent match to 50 Ω on the input. A compact size would also be useful, so I chose 5 W input and 20 W output. Low-cost field-effect transistors (FETs) can provide useful output on the HF bands, so I went with the inexpensive and readily available IRF510. This amplifier also had to be linear for SSB and CW operation. Because I mostly operate on the 40-meter band, I decided to start there and leave room to expand the design for other bands as needed. On-board low-pass RF filtering is included for a clean signal.

I chose a small circuit board to simplify duplication. It requires only RF input, RF output, and 12 V power external connections. Two LEDs indicate when power

Table 1 — Complete Parts List (all values shown are for 40 meters)

Quantity	Part Description
1	(K1) 12 V DPDT relay, PB384 or similar
10	(C1 – C4, C7, C8, C10, C11, C15, C17) 50 V .1 μ F ceramic X7Rs
1	(C5) 16 V 100 μ F electrolytic capacitor
1	(C6) 50 V 10 μ F electrolytic capacitor
1	(C16) 50 V 4.7 μ F electrolytic capacitor (optional)
1	(C9) 250 V 390 pF ceramic capacitor, C0G
2	(C12, C14) 1 kV 430 pF ceramic capacitors, NPO
1	(C13) 630 V 820 pF mica capacitor, C0G
3	(D3 – D5) switching diodes, 1N4148
1	(D6) 5.1 V 1 W Zener diode, 1N4733A-TR
2	(Q1, Q2) IRF10 N-channel MOSFETs, IRF510PBF
2	TO-220 transistor insulated mounting kits
1	(Q3) P-channel MOSFET, IRF9530NPBF
2	(R1, R2) 10K Ω $\frac{1}{4}$ W trimmer potentiometers
7	(R3 – R6, R11 – R13) 5% 1000 Ω $\frac{1}{4}$ W resistors
2	(R7, R8) 5% 10 Ω 3 W resistors
1	(R10) 5% 10K Ω $\frac{1}{4}$ W resistor
1	(R9) 5% 100 Ω 3 W resistor
3	(L1 – L3) T50-6 (yellow) toroid cores
As needed	#24 AWG enameled copper wire



Figure 1 — An interior view of the linear amplifier.

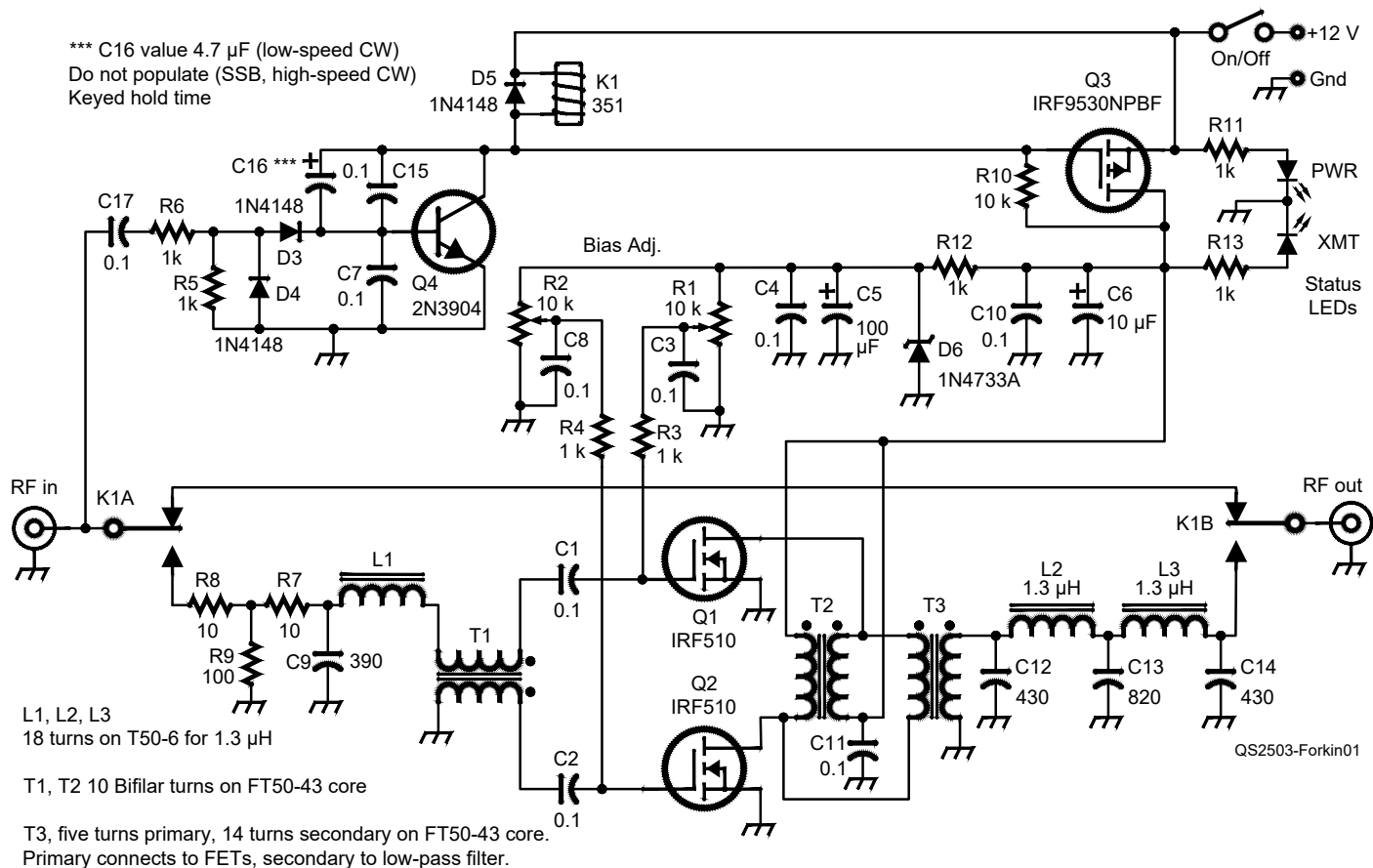


Figure 2 — The schematic for the linear amplifier's PCB.

and transmit are on. I added provision for RF output filtering for a single band, but external filters can be switched in for other HF bands; this keeps the amplifier's size down. For the enclosure, I selected an extruded aluminum case that serves as the heatsink for the FETs, so no external cooling or heatsink is required. The enclosure is adequate for this purpose, but any aluminum enclosure that fits the printed circuit board (PCB) will also work (see Figure 1). The complete parts list is in Table 1, and links to where you can purchase each part are provided at www.arrl.org/qst-in-depth.

All About the Circuit

I provided RF switching with the circuit, which is shown in Figure 2. I used a couple of diodes (D3 and D4) to rectify incoming RF energy and an inexpensive 2N3904 transistor to switch a relay (K1) when RF input is detected. As designed, it will switch reliably with as little as 1 W input. The amplifier will stay on between dots and dashes when used for CW around 10 WPM, and the hold time is good for SSB operation. If you want a longer hold time, you can make the value of C16 larger, or you can make it smaller for quicker switching from transmit to receive. The relay (K1) makes the

change from standby to amplify, and a P-channel FET (IRF9530NPBF) switches dc power to the bias and final stages of the amplifier. LEDs indicating standby and transmit are provided as well. When RF input is not detected, the relay connects the RF input to RF output so that the receiver connects to the antenna. When RF input is detected, the relay is switched to connect the RF output connector to the output filters of the amplifier, and the dc power FET is switched on, supplying dc voltage to the bias and final stage and routing the RF through the amplifier. There are two separate bias adjustments, as the FETs do not usually require exactly the same turn-on voltage. The dc voltage is reduced by a Zener diode (D6). The voltage is filtered and applied to two variable resistors. These are adjusted individually to cause each FET final to draw 30 mA with no RF applied to the RF input.

The attenuator (R7, R8, and R9) and the input low-pass filter (C9 and L1) are used to provide a reasonable 50 Ω match to the transmitter. RF from the input low-pass filter is coupled to a transformer (T1) that splits the RF input into two push-pull outputs, which are then coupled to the gates of the final FETs (Q1 and Q2). The drains of the FETs are coupled to a transformer (T2)

that supplies dc voltage and couples RF to another transformer (T3). This matches the low output impedance of the FETs to the higher 50 Ω input impedance of the low-pass output filter. The low-pass output filter (L2, L3, C12, C13, and C14) then removes harmonics and feeds the RF output via the relay. The low-pass output filter values are selected for the band being used. There is space on the board for one low-pass filter, but others can be constructed and switched in if desired. Values for those components are provided at www.arrl.org/qst-in-depth. It's important to wind each inductor and transformer exactly as specified for the best results. Colored wire makes it easy to identify the various windings. Be sure to clean any coatings on the wires to ensure good solder connections.

Final Adjustments

I can supply PCBs and kits for this design; details are on my website at <http://wa3tfs.com>. For those who use the PCB from my website, a detailed assembly manual for this amplifier is provided at www.arrl.org/qst-in-depth. Of course, you can make your own layout instead, using the schematic in Figure 2.

After you complete the construction, follow this procedure exactly to make the final adjustments:

- 1 Use an ohmmeter to be sure there is no contact between the center pin of each FET and the enclosure or heatsink.
- 2 Connect a dummy load to the RF output connector. Do not attach anything to the RF input.
- 3 Fully turn each bias resistor counterclockwise.
- 4 Connect 12 V (12 – 13.7) to the amplifier via an ammeter (or a multimeter).
- 5 Jumper anode (D5, non-stripe end) to ground for these adjustments.
- 6 Measure and note the amplifier current.
- 7 Carefully adjust the bias resistor (R2) clockwise to add an additional 30 mA to the current reading.
- 8 Carefully adjust the other bias resistor (R1) for an additional 30 mA current. In other words: resting current plus bias 1 current plus bias 2 current. You want each final FET to draw the same current with no RF input.
- 9 Remove dc power from the amplifier.
- 10 Remove the jumper on D5.

You can now connect the transceiver or transmitter to the RF input. When you apply RF to the input, the amplifier will switch on and amplify your input RF, and the transmit LED will illuminate, indicating transmit. If no dc power is switched on, the amplifier will be bypassed, and the antenna will stay connected to the transceiver. The amplifier is designed to work with an input of 4 – 5 W. Overdriving it will not produce more power, but it will dirty the amplified output.

A Dependable Amp

This amplifier design has shown itself to be very reliable when I use it with my various low-power rigs. The 20 W output power has helped me make hundreds of CW and SSB contacts under poor conditions, even during contests and ARRL Field Day. A value of 20 W is only about one S-unit less than a 100 W transmitter, and in most cases, will not even be noticed at the receive station. You should experience similar positive results if you decide to build this amplifier.

See QST in Depth for More!

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

- ✓ More pictures of the amplifier described in this article
- ✓ Links to where you can purchase the components listed in Table 1
- ✓ Component values for all bands
- ✓ A detailed assembly manual

All photos provided by the author.

An ARRL member since 1972, James Forkin, WA3TFS, was first licensed in 1972 as a Novice (WH6HOC) while in the US Army and stationed in Hawaii. He became Advanced-class WA3TFS upon returning home to Pittsburgh. Jim retired from electronics design engineering after 45+ years in the aerospace, medical, industrial, robotics, and electromechanical design industries. He enjoys designing and building receivers and transceivers, and he enjoys low-power operating on CW and SSB, in addition to AM and FM. Jim has been active in several amateur radio clubs. He has published several articles in QST and other ham radio magazines. More information can be found at <http://wa3tfs.com>. You can reach Jim at wa3tfs@arrl.net.

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

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A 6-Meter Turnstile Antenna

If you don't have much room, but want to get on 6 meters, this may be the antenna for you.

Bill Gerhold, K2WH

Early in my ham radio career, as a Technician Plus licensee living in a garden apartment, my main interests were the VHF/UHF bands. At that time, *The Radio Amateur's VHF Manual* offered a construction article for a horizontally polarized 2-meter "turnstile" antenna. I built the antenna as described, and it worked well with my Ameco TX-62 20 W AM transmitter and a 2-meter Ameco Nuvistor downconverter feeding an old 1939 Halli-crafters SX-17 shortwave receiver.

Fast-forward 53 years, and I now have a commercial triband vertical antenna for 2 meters, 1.25 meters, and 70 centimeters, and a horizontal beam for 2 meters and 70 centimeters. What was missing was an antenna for 6 meters.

I decided that a turnstile antenna would satisfy my requirements, as it is horizontally polarized, relatively small, and omnidirectional. So, I ordered an old *VHF Manual* from eBay, found the original article for the 2-meter turnstile, and proceeded to gather the materials needed to upsize the antenna to 6 meters.

Antenna Description

A turnstile is simply two crossed dipoles positioned at right angles to each other and mounted on a non-conductive central hub. To achieve the omnidirectional pattern, one dipole is fed 90 degrees out of phase with the other dipole using a $\frac{1}{4} \lambda$ delay line. I made my delay line from RG-59 75 Ω coax. The RG-59 delay line connects in parallel with the RG-58 feed line (shield to shield and center to center), and then to one dipole. The other end of the RG-59 delay line connects to the other dipole.

It is important for the delay line to be 75 Ω . If the delayed dipole, which should have about a 70 Ω resonant impedance, is fed with 50 Ω line, at $\frac{1}{4} \lambda$ it will transform the delayed dipole impedance to about 33 Ω . When fed in parallel with the un-delayed resonant dipole (also 70 Ω) the power will not divide evenly



between the two dipoles, resulting in a slightly oval-shaped azimuthal pattern, and the input impedance will be about 22 Ω (resulting in a 2.3:1 standing wave ratio [SWR]). With the 75 Ω phasing line, the impedance will be 35 Ω giving about a 1.4:1 SWR, and you will achieve the desired circular pattern.

To calculate the electrical length of the delay line, I multiplied the velocity factor (VF) of the line (0.66 for RG-59) by the $\frac{1}{4} \lambda$ free space length. For the length in feet, this is $(245.9/F \text{ MHz}) \times \text{VF}$. The calculated length of the delay line for a center frequency of 50.125 MHz was 3.24 feet, or 38.9 inches. I fanned out both ends of the coax and installed a crimp lug to the shields and center conductors on both ends. The length is measured lug tip to lug tip.

Antenna Assembly, Tuning, and Construction

The construction details are shown in Figure 1. The center support, consisting of a 4 x 4 x $\frac{3}{4}$ -inch-thick block of clear acrylic plastic I found on eBay, is shown in Figure 2. The dipole elements are 47-inch lengths of $\frac{3}{8}$ -inch OD aluminum tubes (6061 material), slotted on the far end to accept $\frac{1}{4}$ -inch aluminum inserts for length adjustments. All hardware is #10 stainless steel,

6-Meter Turnstile Antenna

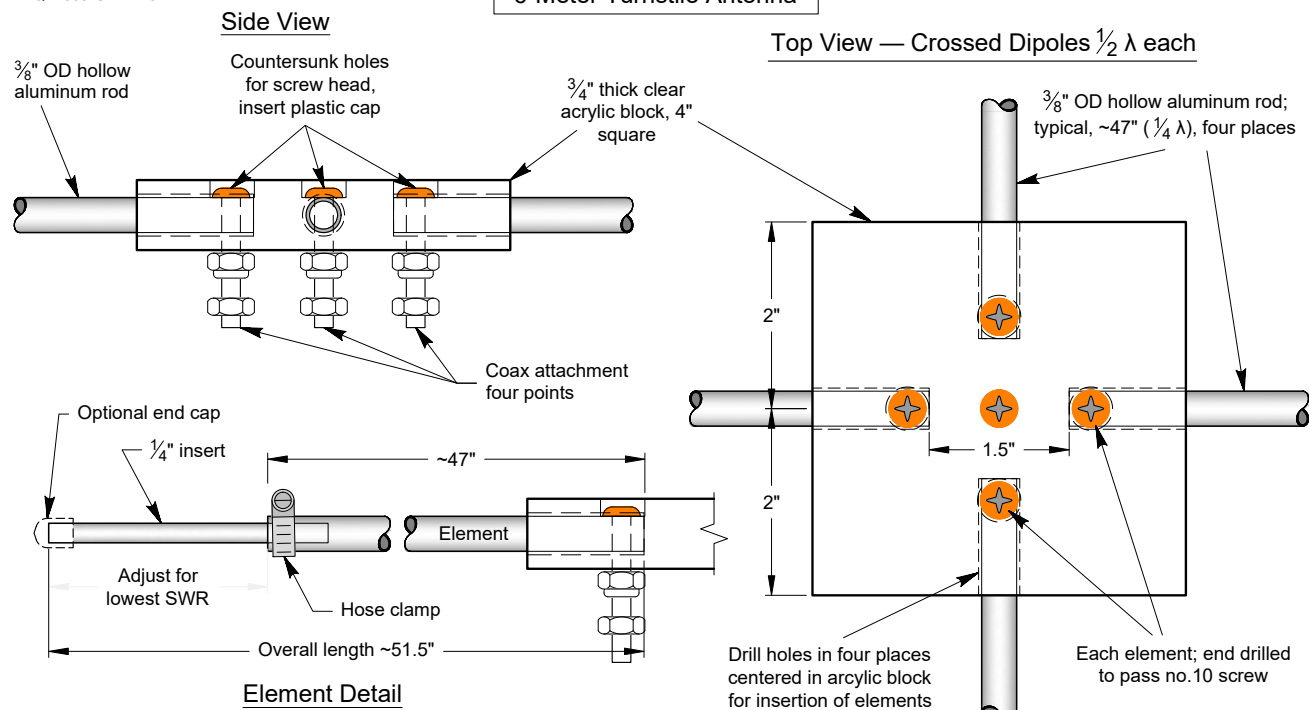


Figure 1 — Six-meter turnstile construction details.

and stainless hose clamps are used to secure the inserts.

Though not necessary, drill bits for drilling acrylic and the use of a drill press can make preparing the center support a bit easier. Finally, I weatherproofed the open ends of the coax with clear silicone rubber. Figure 3 is a close-up view of the fully assembled center support, which includes the delay line. This photo shows the

assembly mounted on a wooden pole with a coaxial balun for initial testing.

Testing and Adjustments

Using an antenna analyzer, I adjusted each dipole for resonance on my desired center frequency with the delay line disconnected. I added four Mix 34 snap-on ferrite cores to the RG-58 feed line at the dipole to eliminate any common-mode currents. I then adjusted



Figure 2 — The center support, consisting of a 4 x 4 x $\frac{3}{4}$ -inch-thick block of clear acrylic plastic.



Figure 3 — The fully assembled center support, which includes the delay line.



Figure 4 — The turnstile is attached to the mast with two **U** bolts and a 90-degree aluminum **L** bracket.

the sides of the dipoles equally. The finished dipole lengths after adjusting the ¼-inch inserts were 51.50 inches, but the overall lengths are not critical.

Next, I attached one end of the 75 Ω delay line to the feed line and one dipole, and then connected the free end of the delay line to the other dipole. I measured a 1.2:1 SWR with a nice dip at 50.313 MHz. The antenna's 2:1 SWR bandwidth was 48 to 56 MHz. As described, the turnstile easily handles 100 W. For higher power, consider using LMR-400 for the feed line and LMR-400-75 for the delay line.

Installation

The turnstile is installed on an 18-foot mast. The bottom three 3-foot mast sections consist of TV masts available at hardware stores. These have swaged ends, so they stack easily. The top section of 2-inch OD $\times$ 8-foot aluminum tubing was obtained in the bathroom section at a hardware store.

The turnstile is attached to the mast with two **U** bolts and a 90-degree aluminum **L** bracket. The bracket is connected to the center of the acrylic block with a #10 stainless-steel bolt, as seen in Figure 4.

Figure 5 shows the feed system with the turnstile mounted in place. Figure 5 also shows the **L**-bracket mount, the delay line, and the ferrite chokes.



Figure 5 — A close-up view of the feed system with the turnstile mounted in place.

Conclusion

This turnstile antenna is perfect if you have limited space. It is compact, does not require a rotator, requires little or no maintenance, and is quite broad banded. It may just be the stealthy antenna you need for 6-meter DX, especially with Cycle 25 at its peak.

My turnstile has been in service for 6 years. I have worked summertime 6-meter DX from the Caribbean to South America, and even Europe using FT8. I also made a meteor-scatter contact during the Perseid meteor shower using MSK144.

I would like to thank Kurt Rieger, K2NNJ, for helping me build this antenna.

All photos provided by the author.

Bill Gerhold, K2WH, was first licensed in 1971 as WA2AEH while in high school. He went on to study electrical engineering at a local university. His career began with the General Electric Company in the transportation and power switchgear division, which included locomotive controls and traction propulsion and HV electrical power systems. After 21 years, Bill moved to a small engineering firm working in industrial power generation, power protection, distribution, and coordination. Bill retired in 2015. He can be reached at k2wh@optonline.net.

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Product Review

Unified Microsystems BevFlex-4X Receive Antenna System

Reviewed by Ward Silver, NØAX
n0ax@arrl.net

My HF station is located in rural Missouri — a very low-noise environment. On the lower HF bands, my background noise level is pretty low, and I can generally hear even weak signals on my quarter-wave verticals and dipoles. However, these antennas are nearly omnidirectional, so they also hear thunderstorms, signals from unwanted directions, and the occasional bit of interference. I can also hear an entire pileup, making working DX challenging at times — the desired station can usually hear me, but I can't hear them clearly enough to make the contact.

The time-honored solution for this problem has been directional receiving antennas. Rejecting “off-axis” noise and interference raises the signal-to-noise ratio (SNR) as if the desired station had increased transmit power. The result is that I can hear the desired signal again and make the contact.

I have experimented with various low-band receive antennas, including K9AY loops, Beverage-on-ground (BOG) or “snake” antennas, phased verticals, and small rotatable loops similar to the transmitting “magnetic” loops, achieving modest success.

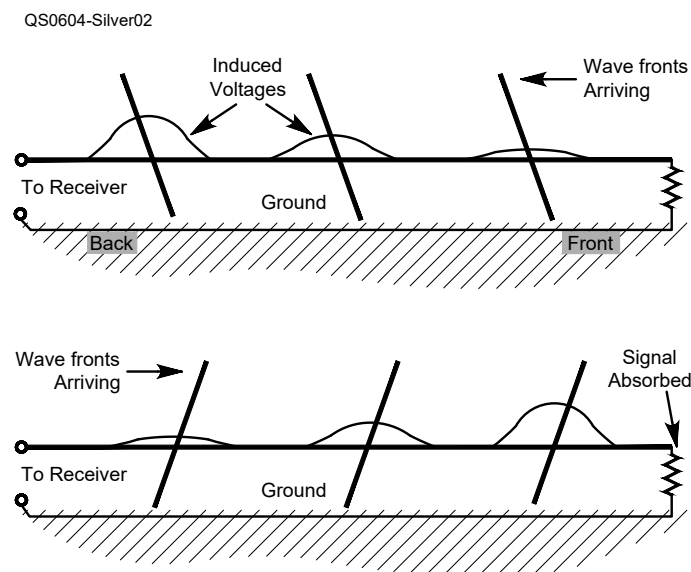


Figure 1 — Voltage waves build up along the antenna and are either transferred to a feed line or absorbed by a terminating impedance.



BevFlex-4X system components. [Courtesy of Unified Microsystems]

My article in the April 2006 issue of *QST*, “A Cool Beverage Four-Pack,” describes how I constructed a four-direction system using window line for a pair of Beverage antennas. It worked well enough that I planned to build a similar system for my new station. The original reversible Beverage system (RBS-1) product was no longer available. However, a new product from Unified Microsystems, the BevFlex-4X, performs the same functions. Its components are shown in the lead photo. Along with the Beverage, receiving loops of various types are also supported, including the EWE, flag, and VE3DO. You can read more about all of these antennas in Chapter 22 of the 25th edition of *The ARRL Antenna Book*.

Receiving Antenna Basics

Beverages can be made from a single wire, twisted pair, ladder or window line, or even coaxial cable. The antennas can be on the ground (a BOG) or elevated 7 to 10 feet. They receive vertically polarized signals that are slightly tilted as they travel along the antenna.

Bottom Line

The Unified Microsystems BevFlex-4X Beverages come with clear installation and operation guidance. The antenna system delivers the expected performance and appears to be well designed and constructed to survive many years of service.

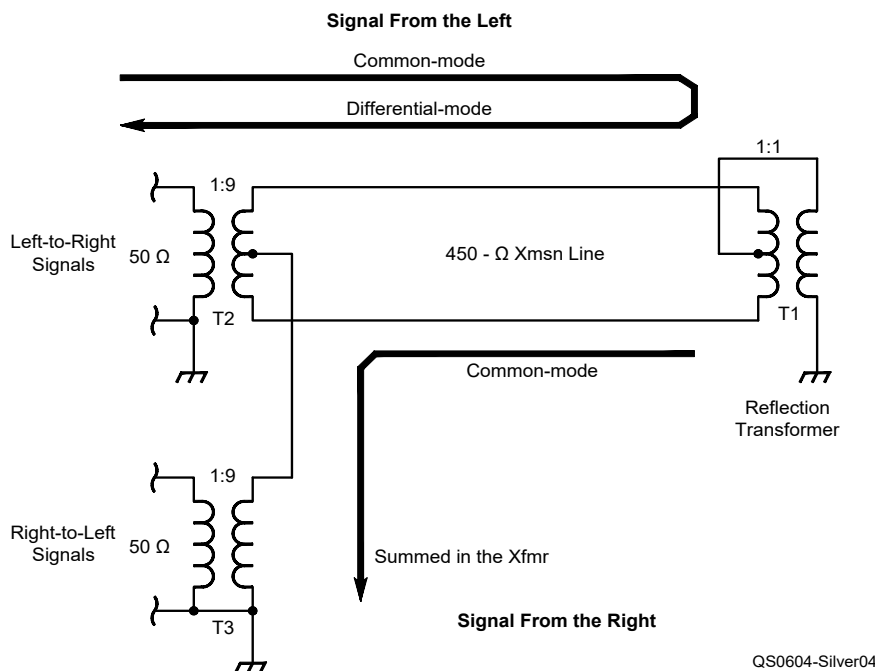


Figure 2 — The two-wire Beverage receives signals as common mode, and transfers signals to a feed point as a transmission line, allowing reception in either direction.

As the tilted wave travels along the antenna, its phase changes along with that of the induced voltage. The result is a steadily building voltage wave, like wind creating a water wave, peaking at the end opposite to the signal's arrival. If a feed line is connected at the end, the signal is transferred to the feed line (see Figure 1 for a graphic of this process).

As shown in Figure 2, for a 450 Ω window line antenna, signals arriving from the left induce equal voltages and currents on each wire as common-mode current, traveling from left to right. The “reflection transformer,” T1, changes the signal to a differential-mode signal traveling right to left within the transmission line. In one direction the open wire line acts as an antenna and in the other as a transmission line! If coax is used as the antenna, the outer shield surface acts as the common-mode current path.

When the differential-mode signal reaches T2, it is transferred to the 50 Ω feed line. Signals traveling from right to left as common-mode current again induce equal voltages and currents on each wire. When they reach T2, they sum together in the center tap, and T3 transfers them to the other 50 Ω feed line. The BevFlex-4X Feed Unit circuit is a more sophisticated version of this arrangement, using 75 Ω feed lines.

The EWE, flag, and VE3DO loop antennas in Figure 3, however, are unidirectional. (The EWE antenna is a

loop that is half above ground, with the other half created by complementary currents in the ground.) Placing a load resistor in series with one of the vertical sides (from 400 to 1000 Ω) creates a phase shift around the loop. This converts the small loop's usual bidirectional pattern with a broadside null to a cardioid pattern with a single null along the axis of the antenna. By switching the leg with the series resistor, the direction of the null is also switched. (The BevFlex-4X can support K9AY loops, but it's not a cost-effective option.)

BevFlex-4X Overview

The BevFlex-4X system allows a single Beverage or loop antenna to receive signals bidirectionally without using relays to switch directions. It is a completely passive system. Instead, dual feed lines are used so that signals from either

direction are selected with a switch inside the station, creating a reversible antenna system. (The BevFlex-4X/Q adds a coax switch so that two antennas can provide reception from four different directions.)

It also allows the use of RG-6 coax as the Beverage antenna, simplifying installation. RG-6 is less expensive than regular 50 Ω cable, twin lead, or window line because it is a consumer product for cable TV, produced in high volumes with lower cost. It is conveniently sold in 500-foot spools that are an excellent length for Beverages on 160 and 80 meters. (Longer Beverages can be constructed from multiple lengths of cable.)

The lead photo shows the three components (showing four with the two terminators) of the BevFlex-4X; the Feed Unit transfers signals from the antenna to the two feed lines. (The antenna and feed lines are not provided.) One Terminator unit is attached to each end of a Beverage or to each side of a loop. There is one output of the Feed Unit for each signal direction, referred to as “Forward” and “Reverse.” A switch located in the station selects which feed line is connected to the receiver.

A unique aspect of the BevFlex-4X is that for Beverage antennas, the Feed Unit interface can be placed anywhere along the antenna. It does not have to be

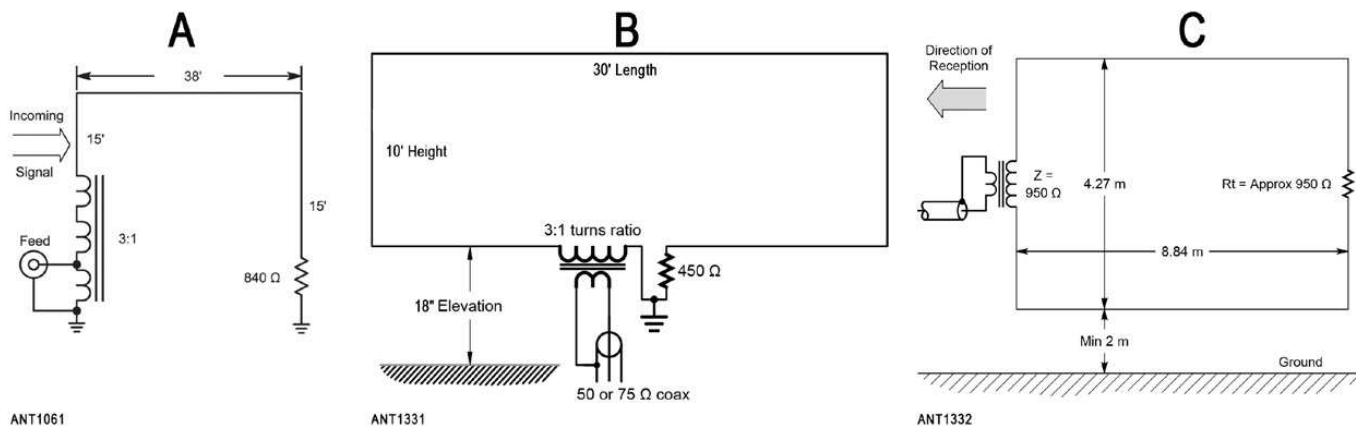


Figure 3 — The EWE (A), VE3DO (B), and flag (C) antennas use resistive loading to create a unidirectional pattern.

at the end. This gives the system builder flexibility for locating and orienting the antenna and for routing feed lines to the receiver. The entire antenna is used, no matter where the Feed Unit is located — at either end or along the antenna.

The Terminator units are placed at the ends of a Beverage antenna. They both terminate the antenna in a ground rod and convert any common-mode RF on the outside of the shield to a differential-mode signal inside the cable for transfer back to the Feed Unit. If the Feed Unit is at one end, one Terminator is attached directly to the Feed Unit. For receiving loops, the Terminator provides the impedance producing the necessary phase shift of antenna current to create the roughly cardioid radiation pattern.

The circuitry inside transfers signals to the appropriate feed line. The exact circuit and components are proprietary, but you can get an approximate idea from Figure 2. Having flexibility in placing the Feed Unit allows much more leeway in laying out your Beverage and helps save on feed-line cable cost, as well.

Installing and Testing

Installing the BevFlex-4X is straightforward. The hardest part is stringing up the antenna! For this review, I installed the BevFlex-4X components in a surplus fiberglass enclosure from a previous antenna project, as shown in Figures 4 and 5. You can see everything mounted on the piece of grounded aluminum flashing with sheet-metal screws into the thin



Figure 4 — The modules installed in the protective enclosure and connected to the white loop wires.



Figure 5 — The enclosure, cables, and ground connection. Note the drip loop on the antenna cable.

BevFlex-4X Block Diagram - VE3DO Configuration

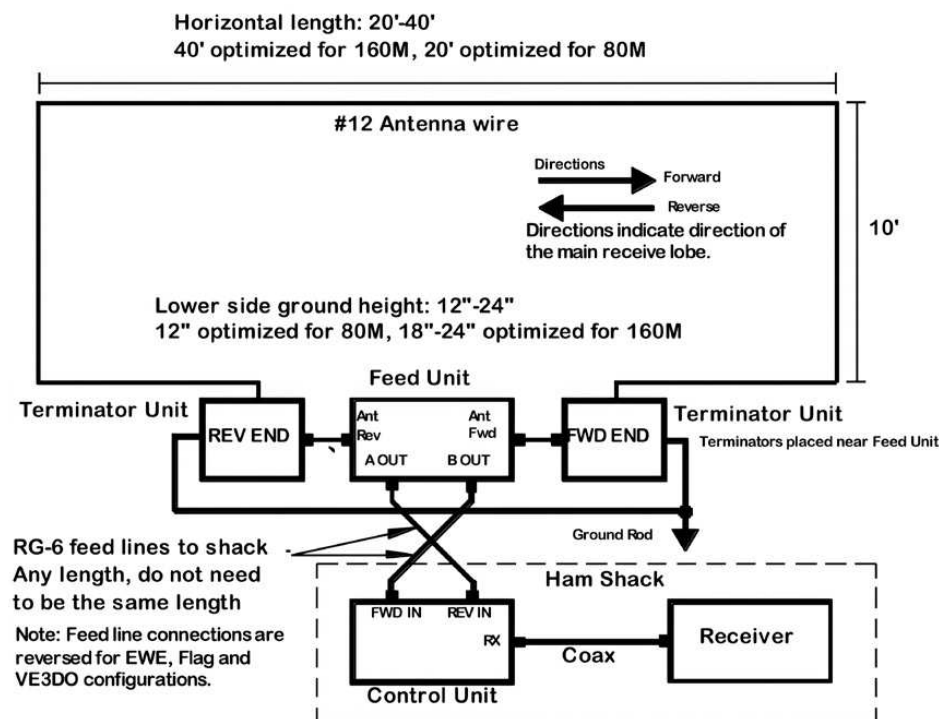


Figure 6 — The BevFlex-4X block diagram for a VE3DO loop configuration. [Courtesy of Unified Microsystems]

was not quite enough, although signals could be heard, so I used a 30 dB preamp, as recommended in the manual. If you will be using a preamp, be sure to take precautions against overload or damage from transmitted signals. The loop had a pronounced null of 20 dB or more in the reverse direction on both AM broadcast and 160- and 80-meter FT8 signals.

After testing the VE3DO loop, I replaced it with a 500-foot Beverage made of RG-6 and reconfigured the components (as shown in Figures 5, 7, and 8). The antenna was aligned approximately northwest/southeast for coverage of the Pacific Rim and the Caribbean/South America.

The Feed Unit was connected to the southeast end of the Beverage with one Terminator

installed in the enclosure (see Figure 5). The other Terminator (see Figure 8) was moved to the northwest end of the Beverage directly on the ground rod, using a stainless-steel grounding bracket (not provided). The antenna coax can be run to a point directly above the ground rod to then drop vertically or slope down to the ground rod. Both arrangements will work, but my usual practice is to slope the antenna down to the termination at 30 – 45 degrees. The Terminator F connector can be taped with Scotch® 33+ electrical tape for waterproofing after installation.

plywood backing. The ground rod for the system is just below the enclosure.

Short jumpers of RG-6 connect the Feed Unit and Terminators. Two 125-foot RG-6 feed lines connect the Feed Unit to the radio room through lightning arrestors (not provided). Use waterproof compression fittings that are easily installed with the proper stripper and crimp tool. All of the coax coming into the enclosure and attaching to the exposed Terminators should have a drip loop so that water will run off the cable before getting to the connectors.

I started with a VE3DO loop oriented southwest/northeast to receive EU stations and reject the strong signals from Texas thunderstorms! The loop size was an average of the optimum dimensions for 160 and 80 meters: 30 feet long, 10 feet high, and 18 inches above the ground. The antenna was constructed from 14 AWG stranded thermoplastic high heat-resistant nylon-coated (THHN) wire. Figures 4 and 6 show the block diagram and a photograph of the BevFlex-4X set up for the VE3DO loop. The white wires of the VE3DO loop come through holes in the bottom of the enclosure and are connected to the Terminator units as specified in the manual.

Because signals from a receiving loop are very weak, a preamp is required. The transceiver's built-in preamp

Beverage performance was as expected on 160, 80, and 40 meters; I observed a front-to-back (F/B) ratio from 10 to 20 dB, depending on the receiving station's location. I used AM broadcast stations through the day and FT8 SNR reports in daylight and night to compare F/B for signals in the forward and reverse direction. Signals to the side of the Beverage were about 20 dB below those along the antenna and did not change strength significantly when switching forward and reverse, as expected.

After using the initial Beverage configuration, as a test I added more RG-6 to the Beverage so that the Feed Unit was about 100 feet from the southeast end. The 500-foot section was unchanged, and the total length was 600 feet. I did not observe a significant difference,

and the BevFlex-4X enabled both configurations to perform properly.

A note about the ground rods for these antennas: If you have good soil, a single 4-foot ground rod is sufficient. Cutting one 8-foot rod in half will provide for the Feed Unit and Terminator ends of a Beverage. The RF currents for this system flow along the surface of the ground, so a full 8-foot rod as used for 60 Hz ac safety grounding is not needed. If you have poor soil, three or four radial wires around 10 feet long will create enough capacitance to couple to the soil surface. This is not a transmit antenna, and a few ohms of loss will not affect the antenna's performance significantly.

BevFlex-4X Q&A

I followed up the installation with a few questions to Unified Microsystems, and they answered promptly. In addition, there is a quick-start guide and a detailed user manual that includes plenty of helpful background information and a lengthy FAQ section about the product and receive antennas in general. These manuals are downloadable as PDFs from the product web page (<https://www.unifiedmicro.com/bevflex4x.html>).

Schematics are not available because the design is licensed, so I asked about protective components, as long antennas are often damaged by lightning. The Terminators and switch unit are protected by gas discharge tubes (GDTs). The GDTs are through-hole parts and can be replaced. The feed-line switch includes a 50 mA fuse to protect against strong

transmit signals. There are more than 250 BevFlex-4X and BevFlex-4X/Q units in the field, with only one report from damage by lightning. The same ferrite cores and GDTs are used in the Unified Microsystems BT-75 Beverage transformers. The GDTs appear to provide sufficient protection, but they can be replaced if necessary, soldering through or scraping off the conformal water-resistant coating. Disconnecting the antennas when storms are possible is recommended.

Common-mode noise being picked up and getting into the feed lines has not generally been an issue. Both the Feed Unit and the switch have 1:1 isolation transformers, which prevent most such problems. Additional ferrite cores can be clamped on the cables at each end if there is a problem.

The switch box has F connectors because that is what the RG-6 feed lines work best with. The output of the switch to the radio receive antenna input is also an F connector, so you'll probably have to supply an adapter (not provided). The mismatch loss from using a 50 Ω cable is insignificant. The switch box is also quite light and moves around on the operating desk due to the stiff RG-6 cables, unless held down or attached to something.

The individual feed lines can be connected directly to a receiver input, such as an SDR for monitoring or a diversity receiving system, but it is important to terminate the feed lines in 75 Ω to avoid upsetting the system's isolation between the forward and reverse directions.

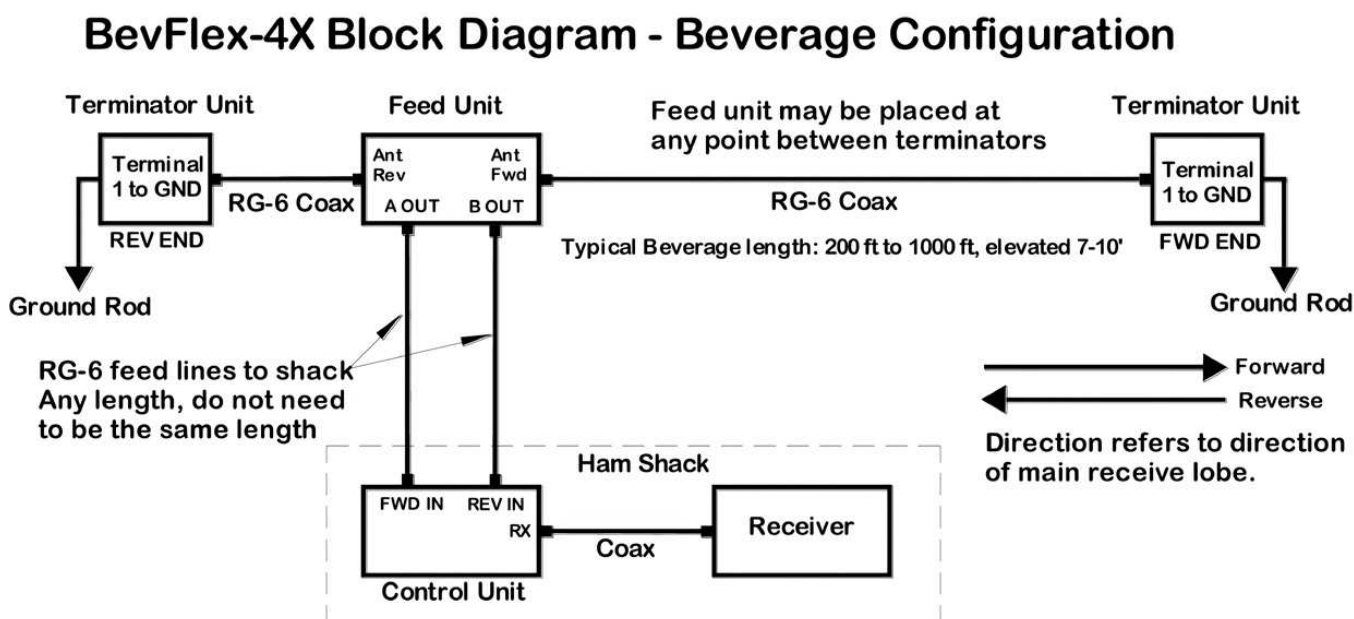


Figure 7 — The BevFlex-4X block diagram for an elevated Beverage antenna. [Courtesy of Unified Microsystems]



Figure 8 — The Terminator at the far end of the Beverage is mounted on a ground rod with the antenna cable attached.

If you decide to send dc power over either of the feed lines, remember that the Feed Unit and switch have isolation transformers that won't pass dc and will present a short circuit at dc.

On the Air

The small loop nulls signals over a smaller angle compared to the Beverage. Both are improvements over an omnidirectional antenna, of course. For example, listening to stations working the Caribbean on 160 meters, both antennas could reject a station from

Kansas City (approximately in line with both antennas) by at least 3 S-units (18 dB). The Beverage, however, had a better SNR because it also rejected more noise to the northeast all the way around to the southwest. I could hear (weakly) a CW station from Alaska on the Beverage, while the same station (with the previous night's conditions) was not detectable by ear on the loop. The Beverage also performed better off the side, rejecting stations from Texas and the Great Lakes more than the loop. A rotatable loop's aim-able null would bring its performance closer to the Beverage, but the controller's ability to instantly switch directions is a real advantage.

Summary

I was pleased with the electrical performance of the BevFlex-4X. I have used Beverages and loops before, so I knew what to expect from them, and the system delivered that level of performance. The details of building the antennas, such as good connections to a ground rod, component layout, connector attachment, and weatherproofing, are all equally important to system performance. It is not an inexpensive product but appears to be well designed and constructed, with clear installation and operation guidance. I expect to use this system for a number of years and will be adding more Beverage antennas as I have time.

Manufacturer: Unified Microsystems, P.O. Box 133, Slinger, WI 53086, www.unifiedmicro.com. Price: dual-direction version (reviewed unit): \$349.99; four-direction version: \$649.95.

Frequency Devices TEC-1 Test Equipment Calibrator

Reviewed by Phil Salas, AD5X
ad5x@arri.net

Sometimes you may question the accuracy of your test equipment, especially if a reading seems odd. Of course, you can always spend the money for professional calibration. However, an interesting alternative is the new TEC-1 Test Equipment Calibrator by Frequency Devices. The TEC-1 permits checking the calibration of voltmeters, current meters, frequency counters, oscilloscopes, and resistance and capacitance meters. Table 1 lists the TEC-1 specifications.



Table 1 — Frequency Devices TEC-1 Test Equipment Calibrator

Manufacturer's Advertised Specifications (not tested in the ARRL Lab)

dc voltage output:	5.000 V $\pm 0.01\%$
ac voltage output:	1.000 V RMS
Total harmonic distortion plus noise:	0.3% or better (on a 2 V dc offset)
dc current source:	1.000 mA $\pm 0.1\%$
ac current source:	1.000 mA $\pm 0.1\%$ RMS @ 1000 Hz
Frequency outputs:	100 kHz, 10 kHz, 1 kHz, and 100 Hz ± 100 ppm
Capacitance standards:	0.001 μ F, 0.01 μ F, and 0.1 μ F (all NPO, drift < 30 ppm/ $^{\circ}$ C)
Resistance standards:	1 k Ω , 10 k Ω , and 100 k Ω (drift < 10 ppm/ $^{\circ}$ C)

Overview

Each TEC-1 is labeled with the actual outputs and standards measured at room temperature, as you can see in Figure 9.

How accurate is the TEC-1? Frequency Devices uses an HP 34401A multimeter to measure ac and dc voltages and currents. The frequency outputs are measured with an HP 53131A frequency counter with an external 10 MHz time base provided by a Leo Bodnar GPS receiver. And the resistors and capacitors are measured with a Stanford Research Systems SR720 LCR meter. All of the above equipment calibrations are traceable to the National Bureau of Standards.

Using the TEC-1

The TEC-1 comes with an ac adapter directly wired to it. There is no power switch or LED indicator. All TEC-1 interfaces are designed for clip-lead probes, as shown in the lead photo.

For my test comparisons, I used my NIST-calibrated Tektronix TDS2022B oscilloscope, an inexpensive Vici VC8045 benchtop multimeter, and an inexpensive FOCHANC DM003 handheld multimeter. The TDS2022B oscilloscope cannot measure current, resistance, or capacitance. And the DM003 cannot measure dc or ac current. My measurements are shown in Table 2.

I was pleased to see that my test equipment measurements were virtually identical to the expected measure-

ments based on the TEC-1. The only fairly major discrepancy was the ac current measurement on my VC8045 (16% low). Based on the other readings,

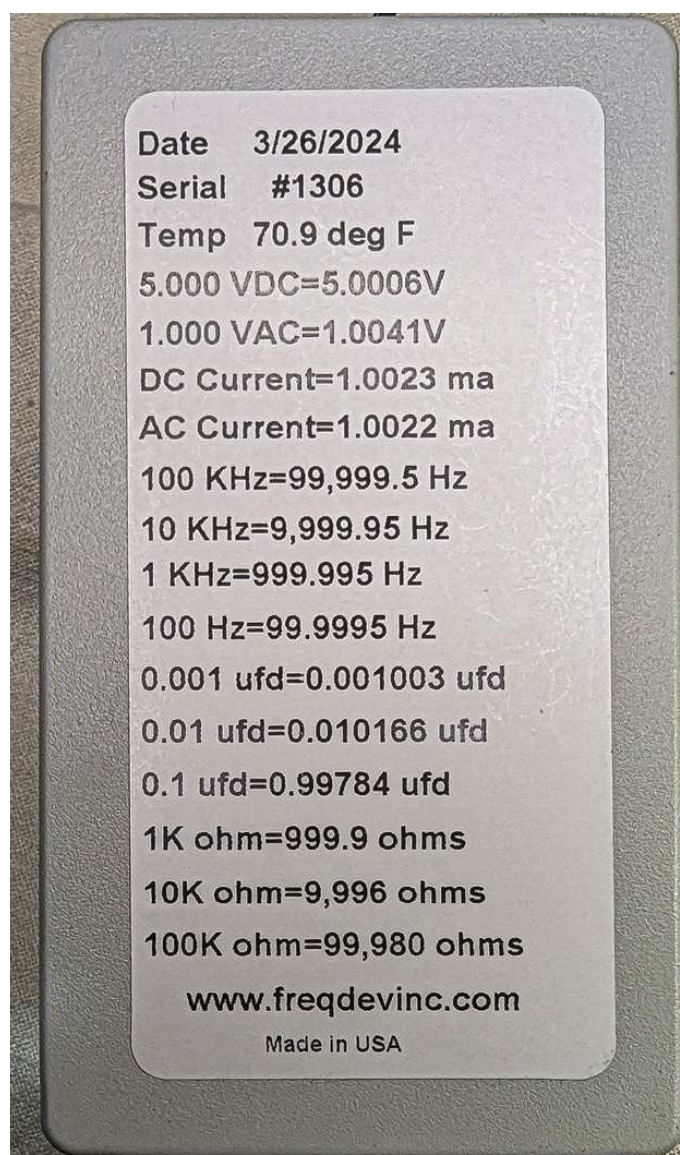


Figure 9 — The TEC-1 custom calibration chart.

Bottom Line

The TEC-1 provides accurate (according to the reviewer's measurements) ac, dc, and frequency outputs, and precision capacitance and resistance references. It is useful for making measurement comparisons with typical bench and handheld instruments.

Table 2 — TEC-1 Measurements, serial no. 1306**(Not tested in the ARRL Lab)**

TEC-1	Tektronix TDS2022B	Vici VC8045	FOCHANC DM003
5.0006 V dc	5.12 V dc	5.002 V dc	5.011 V dc
1.0041 V ac	1.02 V ac	1.004 V ac	1.003 V ac
1.0023 mA dc	N/A	1.002 mA dc	NA
1.0022 mA ac	N/A	0.84 mA ac	NA
99.9995 kHz	100.0 kHz	100.20 kHz	100.0 kHz
9.99995 kHz	10.00 kHz	9.99 kHz	10.00 kHz
999.995 Hz	1.000 kHz	1.001 kHz	1.000 kHz
99.9995 Hz	100.0 Hz	102.0 Hz	99.99 Hz
0.001003 μ F	N/A	0.0009 μ F	0.00099 μ F
0.010166 μ F	N/A	0.0098 μ F	0.0102 μ F
0.099784 μ F	N/A	0.1000 μ F	0.0997 μ F
999.9 Ω	N/A	997 Ω	998 Ω
9.996 k Ω	N/A	9.998 k Ω	9.98 k Ω
99.98 k Ω	N/A	100.05 k Ω	99.8 k Ω

I would probably not trust my VC8045 when making low-current ac measurements.

Wrap-Up

The TEC-1 is an interesting reference instrument that is useful for checking the accuracy of test equipment. Local clubs may be interested in owning one for the benefit of club members when there is concern about the accuracy of a member's test equipment.

Manufacturer: Frequency Devices, Inc., 927 Fosse Rd., Ottawa, IL 61350, www.freqdevinc.com. Price: \$99.95.

Hanmatek HM310, Wanptek DPS3010, and Siglent Technologies SPD3303C: Bench Power Supplies

Reviewed by Paul Danzer, N1II
n1ii@arrl.net

Before you compare several supplies, you may want to answer a bigger question — what are you going to use it for? One fixed voltage or variable, readout accuracy, portability (weight), safety measures (especially if left unattended), and so on.

There are many bench supplies offered for immediate delivery. For this comparison, I selected two models at the lower end of the price scale and one at an intermediate point. There are units available at the high end of the price scale (several thousand dollars), but these were not included in the comparison because these industrial-quality lab units are usually not selected for the ham workbench.

Lab Notes

The ARRL Lab measured the emissions conducted onto the ac mains from all three of these power supplies in ARRL's "pre-compliance" EMC lab. The Wanptek and the Hanmatek exceed the FCC Part 15 limits (even without a load); the Siglent is RF quiet. It's a good example of why you should not necessarily let cost be your driving factor when looking for equipment going into your ham shack. Always try searching for reviews (from other hams, if possible), check for FCC certification, and/or try out any device you may be operating in your shack. We have had numerous hams bring a portable radio to a store and see if there is any objectionable noise coming from a device in question. With respect to

these power supplies in particular, the Hanmatek has an FCC label on its chassis, and the Wanptek and Siglent don't have a label. Siglent claims an exemption from Part 15 technical standards, under 15.103(c) — digital devices used exclusively as industrial, commercial, or medical test equipment. It's arguable whether that applies here (if marketed in a consumer environment), but to the extent the supplies will likely be used sparsely for testing, the RF emissions may or may not be a factor for a particular user. The Lab also found that the USB port in the Wanptek supply was no longer operational, as it was when tested by the reviewer.

— Stephen Anderson, W1EMI, ARRL RFI Engineer

Hanmatek HM310

This adjustable dc power supply (0 – 30 V, 0 – 10 A) is one of six similar supplies offered by this manufacturer. They range from 32 to 64 V and 5 to 10 A maximum output capacity. The HM310 front panel is approximately 6 inches high by 3 inches wide. Depth of this 3-pound box is about 9 inches, excluding knob and connector protrusions.

A pair of power output leads is included with the unit. The leads match the binding post connectors (banana plug type) on the front panel with insulated alligator clips on the other end of the leads. A second output (5 V, 2 A) is connected to the front-panel USB connector. The PC-type line cord plugs into the rear panel. Also found on the rear panel is the **ON/OFF** switch and exhaust fan output.

Instructions (very sparse) and specifications are provided in a 4 × 5-inch booklet in which less than a page and a half of information is repeated in eight different languages. In order to comfortably read this material, I had to run it through a copier set to double the copy size.

Front-Panel Displays and Controls

If you are looking for a simple unit that you can turn on, set the voltage, provide some protection in case of excessive current drain, and so forth, this unit (along with other similar supplies) may not be for you. It has a number of features that you will have to learn (or perhaps learn to work around) to set the basic capabilities you may have been looking for.



Bottom Line

The Hanmatek HM310 is a low-cost electronic bench-stable power supply, but keep in mind that the unit may generate noise on the HF bands.

There are three rows of LED with four-digit displays. There are two rotary knobs to set the voltage and to set the output current or their maximums. Pressing a rotary knob allows setting the value, voltage, or current, one digit at a time. Thus, you do not have to roll through each digit to advance to the next value.

The front-panel **OUTPUT** button (which has a power on/off symbol) actually sets the output voltage (OV), when you press it to show a light red color. Simultaneously, the OV legend next to the top green line lights up. Using the voltage rotary knob, set the voltage you want. Thus, the value you set is also the maximum voltage that the unit will be set to if you switch to the current mode.

Next, pressing the **OUTPUT** button turns it green, and the red overcurrent legend lights on the second line. If you set this value higher than needed for the load attached to the unit, nothing happens, but there is now protection for an excessive load. But if you set it lower than the selected voltage divided by the load resistance, the voltage will decrease to limit the current to the value you set. At the same time, once the current is set (to higher than needed for the voltage or lower), the third line of the display lights up with the calculated value of output power.

To use the unit as a constant voltage supply, set the desired voltage and the maximum current you will allow. To use as a constant current supply, set the desired output current and the maximum voltage you are willing to allow.

Specifications and Problems

As part of the brief instructions, a table provides approximately 20 specified numbers. Seven of the numbers apply to voltage; however, there is no indication as to how these numbers combine to answer the question, “What is the voltage accuracy?” The answer seems to lie in the area of 0.1% claimed plus one digit displayed (the lowest digit). For current, the value seems in the area of 0.2%, again plus or minus one displayed digit.

Online reports of this unit generally include complaints about the instructions or lack thereof — as well as the not-too-helpful accompanying brief videos. However, a bit of experimentation will probably fill in the gaps about the use of the controls and readouts.

Radiated noise for this supply is a problem. The noise is not consistent but varies from amateur HF band to band. It is not limited to the output leads, but an amount also seems to come from the front-panel display.

In Summary

This is a low-cost, stable, and useful design to use on a workbench, providing a reasonable voltage and current output capability as well as a very handy auxiliary 5 V USB supply. But unfortunately, the noise output could be a problem when used for HF circuitry.

Manufacturer: Shenzhen Hanma Precision Technology Co., Shenzhen, China, www.hanmatek.cn. Price: \$69.99. Available at <https://amazon.com>.

Wanptek DPS3010

The DPS3010 is one of a family of power supplies offered by this manufacturer. The model reviewed here is designed to supply up to 30 V at 10 A maximum plus a USB supply rated by the manufacturer as capable of supplying 18 W. Other members of the family run up to 160 V and currents from 2 to 10 A. As often seen with imported electronic products, the unit, at least on the outside, looks very much like other bench power supplies costing about the same. Generally, the controls and displays are arranged in the same way.

You can see this similarity here by comparing the photo of the almost identically priced Hanmatek unit described previously. In this case, even the back panel is similar; here it also contains the fan exhaust and the ac power input. However, this unit sports a line selection switch on the back allowing 115 or 230 V ac input.

Both units have a line fuse, secreted in the ac line input connector. There is one other similarity — the instruc-

tions are very sparse, taking up less than two pages of information (but available in six languages!). There is an extra half page on fuse replacement, but no value given. But there is a warning that it must be replaced by the same value fuse. Another half page describes the input voltage selector switch.

Front-Panel Controls and Displays

Along the bottom of the panel, starting from the left, is a pushbutton **ON/OFF** switch. Booting is accompanied by a loud beep. The connectors along this line are marked for ground, minus and plus. They can be used with banana plugs or spade lugs. A set of power output leads are included with alligator clips on one end and spade lugs on the other. Unfortunately, the spade lugs supplied are a bit large for this use and may be awkward to insert and connect.

Under the display there are two USB connectors. This gives you a choice of connecting with the USB-A or USB-C connector.

Just to the right of the USB connectors is a very important small switch marked **C.C. | OCP**. The **C.C.** position puts the supply in a constant current mode. This is one of the two modes that can be selected. The other position, overcurrent protection (**OCP**), puts the supply in a constant voltage mode.

The main displays are three four-digit units that the manufacturer calls “0.56 inch white light four digit digital tube displays.” They are marked, from the top, as V (for voltage), A (for current), and W (for Watts.). Output settings and protections are set by the four rotary knobs on the right side of the panel. When setting a voltage, the top knob (**V-COARSE**) controls the left two digits of the voltage display line. Each of the knobs includes a pushbutton function. Fast switching between the left two digits is done by pressing the **V-COARSE** knob. Just below it is the **V-FINE** control, which acts the same way for the two rightmost digits. The remaining controls (**A-COARSE** and **A-FINE**) act the same way for setting current values.

Typical Use

To demonstrate a regulated constant voltage supply before connecting a load, set the panel switch to **OCP** and turn the power supply on. Suppose we plan to power a 10 Ω resistor at a fixed 15 V. By Ohm's law, the resultant current should be 1.5 A. Suppose we allow the current to go to 2.0 A before limiting the circuit. First, set the voltage using the top two knobs to the desired 15 V. Next, use the lower two knobs to set the overload point to 2.1 A. Connect the 10 Ω resistor, and



Bottom Line

The Wanptek DPS3010 is a low-cost electronic bench-stable power supply, but keep in mind that the unit may generate noise on the HF bands.

the current should read 1.5 A (values may differ slightly due to resistor tolerance).

To test the overcurrent, change the load to 5 Ω . The expected current should be 3 A. Because the current protection point was set to around 2 A, the overload should be detected. When it is, the power supply starts to beep, shows the OCP error message, and shuts down.

To demonstrate a constant current supply, put the switch to the **C.C.** position. You can set two numbers — the first is the current you want, and the second is voltage. For your selected values, the system will not allow a setting that exceeds either of the two numbers you set with the load attached.

In Summary

The bench test of this dual-mode power supply demonstrated an effective overvoltage/overcurrent protection design. Unfortunately, a considerable amount of noise (probably from its switching-type design) was apparent on several of the HF bands. The noise was heard near the unit, especially near the display as well as near the power output leads. This problem has been reported online.

Manufacturer: Shenzhen Wanptek Electronic Technology, Shenzhen, China, www.wanptek.com. Price: \$59.99. Available at <https://amazon.com>.

Siglent Technologies SPD3303C

Many bench power supplies are offered at prices less than \$100 and even some at \$50 or less. So why spend \$300? This Siglent power supply is very much a bench unit. Weighing almost 17 pounds and measuring 16 × 14 × 11 inches, it has a handle on top to make carrying it easier. It provides several voltages at once or programmability through a USB port.



It is a three-channel unit, with three independent power supplies in one enclosure. Channel 1 can supply from 0 to 32 V at 3.2 A, and channel 2 is identical. These two channels can be combined either in series or parallel — at an extreme 64 V at 3.2 A or 6.4 A at 32 V. The third power supply is switch selectable to 2.5, 3.3, or 5 V at 3.2 A. A pair of slide switches on the rear panel (see Figure 10) selects the input voltage of 100, 120, 220, or 230 V ac.

At the top left of the rear panel is a USB connector. The ac input connector is at the lower right. There is a sticker that covers the ac input connector until you remove it. The sticker acts as a reminder to pick the correct input voltage and fuse. The fuse holder is built into the lower part of the ac connector. The temperature-sensing fan output is also through the rear panel. It goes on only when the unit's internal temperature exceeds the design limit.

Shipped with the physical unit is a calibration certificate that may be needed for some industrial applications. A rather complete 23-page quick-start booklet contains very clear instructions. Five pages of the 5½ × 8¼ booklet describe how to program an external personal computer for control of the power supply; the software is called *EasyPower* and is available on the manufacturer's website (see <https://siglentna.com/service-and-support/firmware-software/dc-power-supplies/#spd3303c-series>).

In addition to the included power cord is a USB connecting cable and two sets of output color-coded leads. Both output leads have alligator clips on one end. One set has banana plugs matching the three sets of output connectors on the front panel; the other set is terminated in spade lugs that can also be used with the output connectors.

Front-Panel Connections

The bottom row of the front panel has a pair of red/black coded connectors — one pair for each channel. A green-colored socket is included as a convenient grounding point. On the left end is a pushbutton on/off **POWER** switch. The channel 3 connectors are on the right. Just above them is a slide switch allowing this output to be selected from the set of 2.5, 3.3, or 5 V.

Bottom Line

The Siglent Technologies SPD3303C is a professional electronic bench power supply that is suitable for industrial use. It comes with a calibration certificate. No HF noise was noticed with this unit.



Figure 10 — Two three-position slide switches allow selection of line voltages 100, 110, 220, and 230 V at 50/60 Hz.

Specific pages in the quick-start booklet are devoted to each of the following configurations: Channel 1/Channel 2 Independent Outputs, Channel 1/Channel 2 Series Mode, Channel 1/Channel 2 Parallel Mode, and Channel 3 Independent Mode.

The value of the voltage (or voltages) or currents is selected by the controls in the upper right corner of the front panel. Coarse adjustment is made by the rotary knob and fine adjustment by pressing the **FINE** button just below the knob. The selected item is picked by the **V** and **A** buttons just below.

Pick Your Mode

Independent use of channels 1 and 2 is selected by making sure that neither the **SERIAL** nor the **PARA** button is illuminated. Then using the corresponding **ON/OFF** buttons, one of the two channels is picked to allow either voltage or current setting selection. Actual output does not turn on until you press the selected channel button. By following the instructions in the quick-start booklet, you can turn on overcurrent protection on each channel. Then, if the load current exceeds the set current value, the channel shuts off.

Channel 3 is slightly different. Its output value (2.5/3.3/5 V) is selected by a slide switch just above the channel 3 output terminals on the lower right of the panel. Maximum allowable current from this output is

3.2 A; when the output current exceeds 3 A, the overload light just above the channel output terminals turns red. Then channel 3 switches from a constant voltage (the value you picked) to constant current mode — limited to 3.2 A.

Parallel and serial modes for channels 1 and 2 are selected by the **SER** and **PARA** buttons to the left of the knob. The result of following the instructions for the serial mode explains that in this mode the two channels are internally linked and controlled by the values selected for channel 1. In the serial mode, the voltage output is twice the value shown for channel 1. In the parallel mode, again channel 1 controls the settings, and the actual current is twice that shown for either channel.

Go Back and Do It Again

Five memories, controlled by the **SAVE**, **RECALL**, and **NO. 1-5** buttons, allow saving the power supply setup. This includes saving each channel mode, voltages, and currents. Instructions are brief; press **SAVE**, press **1-5** to select which memory you want to save to, and press **SAVE** again. To reset the power supply to the saved state, press **RECALL**, **1-5**, **RECALL**.

Finally, the USB Connector

The last few pages of the quick-start booklet describe how the unit software can be upgraded (when needed) through software called *USBTMC*. Remote control can be set using the USB port; again, the additional software listed as either *EasyPower* or *NI Measurement & Automation Explorer* must be installed. However, to do this you are on your own!

In Summary

This is a heavy-duty supply — or more accurately, three supplies. Setup in any of its modes is straightforward, though setting overcurrent protection might take a bit of understanding. Tested with a portable receiver, there was no noticeable trace of noise generation.

Manufacturer: SIGLENT Technologies North America, Inc., 6557 Cochran Rd., Solon, Ohio 44139, **www.siglentna.com**. Price: \$299.00. Available at **https://amazon.com** and from other North American dealers.

Ask Dave

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

SWR Meters, Antennas, and the Ionosphere

When SWR Meter Readings Don't Agree

Q Ed Avila, K6SDW, asks: I operate with an Icom IC-7300 and notice there's a discrepancy between its built-in standing wave ratio (SWR) and power output readings and my MFJ-815D's SWR/power meter readings. Which one is right, or are both meters right?

A Let's look at the power first. The power setting on the IC-7300 is reading what the computer inside the rig tells the transmitter to do. It can be set from 0 to 100 W. The power meter that operates while you are transmitting is what the radio thinks it is sending on an instantaneous basis. Because of the intermittent nature of speech, you can get a steadier reading by transmitting on CW. This is a good time to use a dummy load. I noticed on my IC-7300 that the SWR/power meter showed full output when I was at 92 W. The reading stayed the same as I increased the power to 100 W.

The external power meter estimates the power that passes through the rig's tuner. The power scale on your cross-needle SWR meter is on the left and reads forward power. If your tuner is working hard to send reflected power back to the antenna, the meter measures both the normal forward power plus the reflected power that has been redirected in the forward direction.

Now let's move on to SWR. The IC-7300 reads the SWR before the signal goes to the internal tuner. If that is on (I always leave mine on), the IC-7300 reads a lower SWR than the external meter might read. Your SWR/power meter is of the cross-needle variety, which I find hard to read. Ideally, as the output power fluctuates, the forward- and reverse-power needles will cross over each other. The red line on the meter's face will tell you the SWR. Using CW will get you a better reading because the needles stay in one place. Only a tiny deflection of one of the needles indicates a large difference in the SWR. Your meter has a switch to choose peak or average. I leave mine on peak because it makes steadier readings.

The difference in readings on the IC-7300 and the MFJ-815D is due to differences in accuracy and placement in the chain from the internal computer controlling the transmitter output power to the behavior of the combined feed-line and antenna characteristics.

Do Not Transmit into Receive-Only Antennas

Q Chip Lohman, NN4U, asks: The MFJ-1886 wide-band receive-only loop antenna's manual warns not to transmit anything into it. However, the antenna tuner on my Elecraft KX3 will likely send a weak signal to the antenna to complete its tuning. Is the signal weak enough not to worry about, or is the antenna tuning not necessary for the MFJ-1886 to work optimally?

A Even if the MFJ-1886 could handle the input, the Elecraft KX3 would give an erroneous reading. The KX3's tuner is looking for a reflected signal, which it won't get. It is best to bypass the tuner on the KX3 for your listening.

The MFJ-1886 consists of an untuned loop, meaning the Q is very low, creating a nearly flat gain curve across the medium- and high-frequency bands. The antenna has very little gain compared to a dipole resonant on a frequency of interest; it's quite lossy. So, these receive-only antennas have a low-noise preamp mounted at the loop's two ends. This keeps the noise figure low and raises the signal level so that it can travel down the coax to your receiver. The level of each individual station will be approximately the same as if a much longer wire received it.

In almost all cases, the direct current needed to power the preamp travels over the coax, eliminating the need for an extra power cable. This is accomplished using the bias tee that comes with the antenna kit. The antenna will not operate unless the bias tee is operating.

The preamp often uses microwave components because of its low noise figures. The preamp has a

balanced input (the loop's two ends) and can provide an unbalanced (coax-style) output.

If you transmit into the preamp, even for a short time, you will destroy the preamp. You can get a transceiver interface box that will turn off the receive preamp whenever you key your transceiver, but the best attenuation these boxes can provide is about 40 dB. So, if you transmit 100 W (50 dBm), you are still pushing a fair amount of power (10 dBm, which is 100 mW) at the preamp. Newer preamps can handle this. If your radio does not have a waterfall, you can use an SDR receiver and your receive-only loop to provide the waterfall.

Don't Forget the Ionosphere

Q Kishh Galnimbkar, VU2MZT, asks: I have an Icom IC-7300 and installed a fan dipole to cover 40 and 20 meters, as shown in Figure 1. I have an odd problem — other hams tell me that my signal starts to fade out, and I receive signal reports saying there is QSB on my signal. What is wrong?

A QSB means a signal is fading and then returning, sometimes rapidly or slowly, and sometimes it fades away altogether. It has nothing to do with your radio. Rather, it's strictly a function of the ionosphere.

The F region of the ionosphere, the workhorse layer that carries much of ham radio DX, is an incredibly thin layer of atmosphere at a height above sea level from 100 to 500 miles (150 to 800 kilometers). The pressure in the F region is a hard vacuum for many purposes. Satellites, including the International Space Station, orbit in the F region. Although the vacuum at this altitude is nearly complete, there's just enough air left to slow down satellites.

Although the amount of air (mostly nitrogen and oxygen) is incredibly tiny, it is particularly affected by ionizing radiation from the sun. These are ultraviolet, x-ray, and cosmic-ray radiation. These highly energetic waves turn the ionosphere into a plasma — a combination of positively charged oxygen and nitrogen missing one or more of their outer electrons, plus a vast sea of negatively charged electrons. The Earth has a strong magnetic field, so these charged particles move around at high speeds in unusual paths. The movement of charged particles is an electric current. Because the index of refraction for radio waves varies widely throughout this constantly changing ionosphere, radio waves from our transmitters are scattered everywhere. However, this turmoil is not a hopeless situation. The ionosphere has been studied for more than 100 years now, and much is predictable. When condi-



Figure 1 — Kishh Galnimbkar's, VU2MZT, antennas. A fan dipole for 40 and 20 meters is on the left, and a hexbeam is on the right. [Kishh Galnimbkar, VU2MZT, photo]

tions are good, our signals continue to be refracted to those we're talking to. Because the ionosphere is not smooth, our signals can have multiple paths to the receiving station. Sometimes, these reinforce the signal, and sometimes, they cancel it. It is the latter effect that we refer to as *fading*. As a new ham gains experience with HF, it's possible to get an idea of the right time to be on the air, and there are numerous propagation predictions on the internet (for example, see www.voacap.com).

Sunspots look dark compared to the rest of the sun, but they're busy churning out ionizing radiation. During periods of high solar activity (many sunspots and other phenomena), the ionosphere is charged even more. It can provide stunning signal paths that are clear to the other side of the Earth. When a formerly clear signal starts its fading cycle, it's usually time to say "73" and move to other stations.

Send your questions to askdave@arri.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.

Hints & Hacks

A Flip-Flop Mount; Paint on Aluminum and Plastic; Keep Wire Ends from Flying

A Polarity-Switching Antenna Mount

I operate both 2-meter SSB and FM, which require different polarizations for my small Yagi: horizontal for SSB and vertical for FM. I got tired of having to disconnect the antenna and its support when switching from one orientation to the other, so I devised a special mounting plate to make the job easier.

As shown in Figure 1, I began with an 8-square-inch scrap piece of laminated particle board (a ¼-inch-thick aluminum plate would make for a stronger installation). Along one edge, I drilled holes for U bolts meant to clamp the board to the primary mast.

I attached the Yagi to a short (30-inch-long) ¾-inch aluminum tube. I drilled two holes sized for ¼-20 bolts at points about 1 inch and 5 inches from the opposite end of the tube.

I marked another point on the board, and I drilled a hole for the bolt upon which the bottom of the tube would pivot. I had to choose this point carefully to ensure that the bottom of the tube would clear the nearby U bolt when I rotate it. I marked and drilled a hole in the board to match the upper hole in the tube.

I inserted a bolt into the bottom hole of the tube and passed it through the board. Next, I attached a wing nut to hold it in place securely, but not too tightly. I rotated the tube 90 degrees and marked the point on the board that corresponded to



Figure 1 — The homebrew antenna polarity-switching mount. The Yagi is shown in its horizontally polarized position. [Stephen Peterson, KI7L, photo]

the upper hole. I installed a bolt and a wing nut there as well. Finally, I firmly tightened both wing nuts. The Yagi is vertically polarized in this orientation.

When I want to use the Yagi in its horizontally polarized position, I merely loosen the bottom wing nut, remove the upper bolt and wing nut, swing the tube into the upright position, replace the upper bolt and wing nut, and then tighten both wing nuts. Changing antenna polarity in this fashion takes only about a minute.

— 73, Stephen Peterson, KI7L, scпки7l@gmail.com

Project Painting Guidelines

Before undertaking any painting project, be sure to read the instructions, especially concerning drying times. Most manufacturers say that the second touch-up coat must be applied within a certain amount of time. If you wait too long, the paint may wrinkle.

Aluminum

Preparing aluminum for painting and bonding can be tricky. As a first step, always remove oil and finger grease by washing it with clean water and detergent before wiping it clean with paper towels. After that, sand it evenly with 400-grit emery cloth. Sand all surfaces, sharp edges, and corners. Rinse thoroughly.

To ensure the best bond, microetching the aluminum with a weak acetic acid, such as white vinegar, will help paint adhere. Mix a solution of equal parts water and white vinegar. Soak the aluminum in the vinegar mixture overnight to help open the grain, and then wipe the etched aluminum with warm, soapy water. Rinse thoroughly with clean water, and pat dry with a lint-free towel. Allow the aluminum to dry for at least 40 minutes. Now you are ready to apply primer.

Use a self-etching acrylic primer, such as Rust-Oleum® Self-Etching Primer or similar. Once again, note the drying times between coats. Lay the aluminum on flat newspaper for painting in a well-ventilated area. Mount the parts to be painted on clean wooden strips to ensure the aluminum does not touch the newspaper.

Apply a thin coat of aerosol paint primer on the exposed side. Apply a second thin coat if necessary, per the instructions. Let the surface become dry to the

touch, and then wait 20 minutes. Turn the aluminum over and mount it on new wooden strips. Repeat the process on the opposite side. Allow the aluminum to dry again.

Apply a thin coat of the color of your choice. Consider whether a matte, semi-gloss, or gloss coat is best for your project. Ideally, use the same paint brand for your topcoat as you did for your primer. If the topcoat needs touching up, apply a second thin coat. Let it become dry to the touch, or wait longer. Carefully turn the aluminum over and mount on clean wooden strips again. Repeat the painting process for the opposite side. Let your project dry for at least 24 hours.

Acrylonitrile Butadiene Styrene (ABS) Plastic

Use spray paint specifically formulated to adhere to plastics. There are several available on the market, such as Krylon® Fusion for Plastic, Valspar® Plastic Paint, and Rust-Oleum Paint for Plastic. If you are using regular spray paint, your item will need to be primed.

Wash the ABS enclosure in a mild detergent, rinse, and let it dry for at least 40 minutes. Sand evenly with 300- or 320-grit sandpaper. Wash and dry it again, dust it off, and spray a thin coat of primer, such as Rust-Oleum 2X Ultra Cover or similar. If necessary, apply a second thin coat.

Apply a thin topcoat of the color of your choice within the prescribed time. Again, if necessary, apply a second thin coat. As always, do not wait too long between applications, or the paint may wrinkle. Let your project dry for 24 hours. — 73, *Phil Karras, KE3FL*, ke3fl@arri.net

Restraining Flyaway Wire Bits

Every now and then, I need to trim some larger-gauge solid wire (such as #10 or #12 AWG). I've found that the trimmed ends of these wire pieces often fly away when I cut them. This behavior isn't confined to thick wire, either.

Errant cuttings can end up in places they shouldn't, like in nearby equipment or in thick carpeting, where they'll be painfully discovered when you step on them with bare feet!

Here is a method to keep those bits in place, or at least nearby: simply attach an alligator clip lead to the end — or ends — prior to cutting. In Figure 2, you'll see that I'm preparing a small piece of #12 AWG wire to fit inside an Anderson Powerpole tab. Once the end of the wire is secured within the tab, I can trim the excess,



Figure 2 — Once this wire is secured within the Powerpole tab, the clip lead will keep the excess wire from flying away when cut. [Phil Karras, KE3FL, photo]

and the alligator clip will prevent that excess from becoming airborne.

Figure 3 shows the use of both ends of a clip lead. When I make the cut between the clips, both pieces of wire will remain nearby. By using the alligator clips on both sides of the wire, the extra weight of the clips and their attached leads prevent the wire pieces from taking flight. — 73, *Phil Karras, KE3FL*, ke3fl@arri.net



Figure 3 — In this image, both ends of a clip lead are pressed into service. When I cut between the clips, both pieces of wire will remain nearby. [Phil Karras, KE3FL, photo]

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

QST invites you to share your hints with fellow hams. Send them to hh@arri.org. Please include your name, call sign, complete mailing address, daytime telephone number, and email address on all correspondence. Whether you are praising or criticizing an item, please send the author(s) a copy of your comments.

The Amateur Radio Challenge Course

Test your club's handheld know-how with this five-objective exercise.

Mike Fisher, KG4VDK

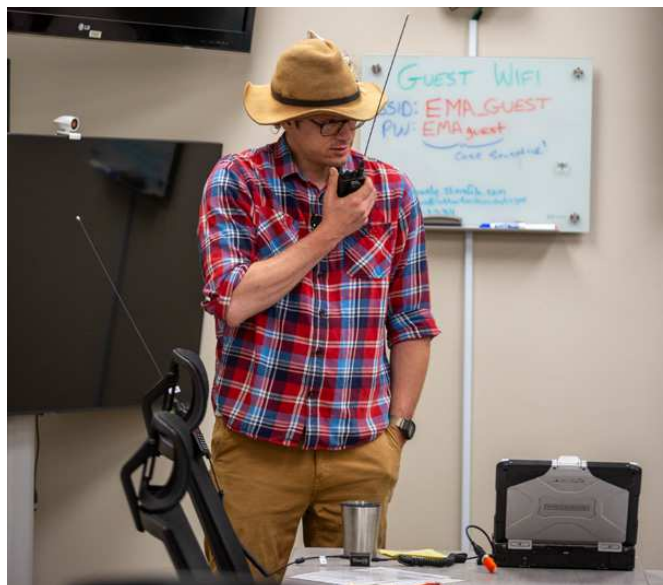
Field readiness requires more than having the right gear. To claim QRV status, an operator needs to know how to skillfully use their equipment. Modern handhelds can be complicated to program manually, which means many operators program their radio with a computer. While it's convenient and quick, this can create usability problems down the road. For example, when operators use a computer to program local repeaters into their handhelds using information from the internet (which is sometimes automated), that information may be out of date, or it can lead to the operator wrongly entering something, like a continuous tone-coded squelch system (CTCSS) tone. In other instances, the alpha tag for a memory might not actually match the local repeater. The operator, having depended on computer programming software, is then unable to rectify the issue on their own. This leads to reliance on outside help or an inability to fully participate in an event or net.

In June 2024, the Tennessee-based Stones River Amateur Radio Club wanted to develop a fun way for operators to become more familiar with field programming, basic net etiquette, and passing simple traffic. While the goal was to build confidence and competence, we also wanted to be inclusive of all operators, regardless of license class, experience level, or budget. With these factors in mind, the Amateur Radio Challenge Course took shape.

Course Layout and Components

Our Challenge Course consisted of several objectives that participants needed to complete with their handheld. The only other required items were a pen and piece of paper, though participants were encouraged to bring their radio manual. They were not allowed to use preprogrammed memories for the duration of the Challenge Course, nor were they allowed to use the internet.

Upon arrival at the Challenge Course location, participants were presented with an Incident Radio Communications Plan (ICS-205). The ICS-205 is an Incident Command System form commonly used for amateur radio events, and we wanted to give participants hands-on experience with it. Our ICS-205 listed all of the frequencies and relevant settings for each of the objectives. The plan also included a note detailing



The author serving as net control and instructing Challenge Course participants. [Dustin Wray, KN4YQP, photo]

which colored flag was associated with a given objective location, and on the back was a sample exchange with a net control station. Each of the objective locations was separated by about 10 yards. The short distances made the Challenge Course accessible to all — even those with mobility issues.

Net control operated one handheld for voice communications with participants. A second handheld was connected to a laptop running a Linux operating system. *Direwolf* was used as a sound card modem, and a Digirig was used as the computer-to-radio interface, while the laptop-based station was used for check-ins, check-outs, and timing. This station was also running an APRS client for mapping participants' progress through the course (see the sidebar "Net Control Notes" for more details).

Course Rundown

The check-in location, marked with a green flag, required participants to program a simplex frequency from the ICS-205 and check in with net control. Once contact was established with net control, each was provided a 10-digit string representing their call sign in dual-tone multi-frequency (DTMF), or Touch-Tone, characters.

Net Control Notes

Net control generated the DTMF call sign of each participant using the `text2tt` utility provided with *Direwolf*. On a Linux machine, use the following command to determine the DTMF call sign:

```
user@arcOS:~$ text2tt kg4vdk
```

Push buttons for multi-press method:

```
"554A4444888355"  checksum for call = 7
```

Push buttons for two-key method:

```
"5B4A48C3A5B"  checksum for call = 3
```

Push buttons for fixed length 10 digit callsign:

```
"5448352358"
```

From the output of that command, use the "fixed length 10 digit callsign." In my case, this is 5448352358.

For participants to appear in the vicinity of net control on the local APRS map, the "TTCORRAL" line in the `direwolf.conf` file provided in the module needs to be modified to reflect your group's Challenge Course location.

Participants were then instructed to send those 10 digits followed by "00#" via the keypads on their handhelds. On the net control laptop, the APRS Touch-Tone functionality in *Direwolf* was used to decode their transmissions. A text-to-speech function responded to each participant with a message informing them of a successful check-in, and their Challenge Course start time was logged to a file. In addition, participants were populated as objects on the APRS map in the vicinity of net control, with a comment indicating their current stage in the Challenge Course. After that, they were instructed to proceed to the first objective.

The first objective was marked with a red flag, and it required participants to program a different simplex frequency and re-establish contact with net control. Once on frequency, net control instructed them to set their radios to low power and lock the keypads. This was designed to reinforce the basic programming of a simplex frequency and familiarize participants with their handhelds' different power settings. Locking the keypad can also help prevent accidental programming changes.

The second objective, marked by a white flag, required participants to modify the simplex frequency used in the previous objective by adding a CTCSS tone on transmit. Net control utilized CTCSS tone squelch to verify that each participant had enabled their transmit tone. To complete the objective, participants were instructed to find a receivable National Oceanic and Atmospheric Administration (NOAA) weather

frequency and report it back to net control. This familiarized them with how CTCSS operates, and how setting an incorrect tone can impact communications. For some, it was the first time they had been exposed to NOAA weather frequencies.

The third objective was marked by a blue flag, and it built on the previous one by requiring participants to add a CTCSS tone on receive — an action known as *tone squelch*. Net control temporarily utilized a wrong tone to verify that each participant had successfully enabled their receive tone. If configured correctly, the participants would not hear net control using the wrong tone. Every participant was also provided with an unopened, "fun-size" package of M&M's®. They were instructed to open the packages and provide color/count reports back to net control. This both familiarized each person with CTCSS operations and provided experience with passing simple traffic over a net.

The fourth objective, marked by a black flag, required participants to program a local repeater into their handhelds. This involved setting the correct frequency offset for transmit and receive, along with a CTCSS transmit tone. They were also provided with a roll-up J-pole antenna. The J-pole had a PL-259 connector and an assortment of adaptors, which allowed them to experience connecting to an external antenna to improve the range of their handhelds. Once the participants contacted net control via the repeater, they were asked to play X-Rays and Oscars (tic-tac-toe) with net control.

The fifth objective was marked with a yellow flag and required participants to program a split transmit and receive on UHF/VHF to access a cross-band repeater. When in contact with net control, each one was asked to perform a battery "swap" to simulate a depleted



Laurie Waldron, KN4FXE, programming an NOAA weather station frequency into her handheld. [Dustin Wray, KN4YQP, photo]



Isaac Flanders, KO4LST, letting net control know he is ready to start the Challenge Course. [Dustin Wray, KN4YQP, photo]

battery and then copy three GPS coordinate pairs. This exposed them to cross-band repeating and reminded them that a spare battery is a great addition to a handheld kit. After confirming the coordinates, they were directed to the checkout location.

The checkout location was marked by a checkered flag. Here, participants needed to switch back to the check-in/out frequency and send their 10-digit DTMF call signs, followed by "73#." When the net control *Direwolf* laptop received each transmission, text-to-speech was used to inform the participant of a successful checkout, and their Challenge Course finish time was logged to a file. I also wrote a script that sent each person a text-to-speech message with how long it took them to complete the Challenge Course. Using this metric, they could run through the course multiple times and track their improvement.



Mike Duvall, KO4EHB, preparing his M&M's report. [Dustin Wray, KN4YQP, photo]

Host Your Own with arcOS

While developing the Challenge Course, I wanted to make it easy for others to replicate. I leveraged a personal project of mine to make this happen: the Amateur Radio Community Operating System (arcOS). It's a free, Linux-based live operating system that boots from a USB drive. Many fundamental pieces of software are preinstalled and configured on arcOS to ease the experience of operators new to digital modes. It also implements a modular system for adding more functions. The Challenge Course is available as a module that contains all of the relevant configuration files and documentation. From the computer/software side, using arcOS, your group can have its own Challenge Course on the air in less than 2 minutes. The ICS-205 form, the net control guide, and a printable certificate of completion are all provided in the module.

Whether you're newly licensed, recently bought a new handheld, or just want to keep your skills sharp, an Amateur Radio Challenge Course is a great way to build and maintain operational proficiency. In the future, our club plans to incorporate digital modes and increase the distances between objectives to make it more challenging.

If you are interested in hosting your own Amateur Radio Challenge Course, check out the arcOS Linux project and the associated Challenge Course module at <https://arcos-linux.com> and <https://github.com/kg4vdk/arcos-linux-modules>.



 Click here to watch the exercise in action, with commentary by Jason Oleham, KM4ACK, on his YouTube channel.

Mike Fisher, KG4V DK, is a Linux system administrator and an Extra-class amateur radio operator. He is passionate about using free and open-source software to increase operational proficiency for himself and others. Mike can be reached at mike@kg4vdk.com.

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Vacation on Pitcairn Island

This relatively rare DX entity was the site of this ham's life-changing holiday-style operation.



Mike Collis, WA6SVT/VP6MC

My family and I were planning our summer vacation to Tahiti and the Gambier Islands and decided to go the extra mile and add Pitcairn Island to our itinerary. Pitcairn Island has a long history with ham radio, first as a communication link to the outside world for the island residents and later for DXpeditions.

There is no airstrip on Pitcairn Island, so the only way to get there is by boat. First we took an inter-island flight from the capital of French Polynesia, Papeete, on Tahiti to Mangareva. Then the last leg of our travel was via the *Silver Supporter* ship that took us to Pitcairn Island. A visa is not required for stays fewer than 14 days, which was not a concern for our 11-day stay. Heather Menzies is the Tourism Travel Coordinator of Pitcairn Island and is the best person to help make travel plans and accommodations on the island.

Operating Preparations

Getting my ham radio license to operate on Pitcairn Island was pretty easy. I spoke with Heather to let her know that I wanted to bring my ham radio gear, and she let Shirley Dillon, Operations Manager at the Pitcairn Island office, know that I wanted to obtain a ham radio license. Hams with a General or higher-class license are eligible for a Pitcairn license that is active during their stay, so I was eligible because I am an Extra-class operator. However, my wife, Laura, KJ6GFI, was not eligible because she has a Technician license. After sending Shirley a scanned copy of my license, she emailed me an invoice that included our stay on the island, the *Silver Supporter* transport,

and a fee of NZ\$100 (about \$56 USD) for my ham radio license. I got to pick the suffix for my VP6 call sign, and the license was mailed to me! I had to sign it and email Shirley the signed copy.

For my trip, I wanted to pack light, have a good station, and fit everything into a backpack so I could bring it as a carry-on item rather than risk putting it in checked luggage. So, my station consisted of an Icom IC-706, an Icom AH-4 antenna tuner, and an Astron SS-30 power supply. My antenna was a 20-foot-long wire for maritime mobile and base operations. Having the radio gear in the backpack made it very easy to get through TSA and security checkpoints.

Maritime Activations

I tried operating from Tahiti but did not have much luck due to the limited space on our second-floor balcony at the resort, and operating time was limited because this was primarily a family vacation. The Gambier Islands were mainly a transit point, so I did not have time to operate there either, but I set up my station to operate on the *Silver Supporter* ship to Pitcairn Island. I needed the captain's permission to operate on board, and Heather was able to reach out to the captain in advance to obtain permission. We were graciously assigned to a top deck cabin, so we had access to an escape window to route the cables. I made a few contacts on our way out of the lagoon and in the open sea between Mangareva and Pitcairn Island. My best bands were 15 and 10 meters during the day and 20 meters during the evening hours.

Island Life

Pitcairn Island is small, with about 50 residents. There are no hotel facilities, so some residents provide homestays, which are the most common lodging option, complete with meals and laundry services. There are a couple of cabins for rent, too. Most homestays are in prime radio locations, and allow you to set up your station.

Adamstown is the only town on the island, and it has a well-equipped food store. Most of the food is locally produced and very good; the rest is imported to the store. There is also a hardware store, museum, church, school, and public square with a hall. The natives walk or use quads to get around the island. There are hiking trails and back roads with scenic views, and fishing is excellent, too, making it an explorer's paradise. Even though Pitcairn is remote, homes have hot and cold running water and electricity. A solar farm powers the entire island. There is internet via Starlink, so there is Wi-Fi to connect portable devices. During our visit, a digital TV channel was added. Many of the islanders are excellent craftsmen and sell carvings and other items, including the best honey I have ever tasted. The residents were friendly, and they treated us like family.

Pitcairn Activations

Our trip was primarily a family vacation and not a DXpedition, but I had enough time to enjoy making many contacts all over the world. Even with my simple station, signals were Q5 with very strong signals during the evening, and the noise was very low. The hardest part of operating for me was the pileups! There were so many stations calling at the same time. I should have used a split frequency scheme. My new friend and the only active ham on the island, Meralda Warren,



Mike Collis, WA6SVT/VP6MC (right), with his wife, Laura, KJ6GFI (center), and their son (left) arriving on Pitcairn Island with their homestay host, Brenda Christian (front).



Meralda, VP6MW, the only active ham on Pitcairn Island, at her station.

VP6MW, said pileups are very common for her. As it turns out, the VP6A DXpedition to Ducie Island (an atoll in the Pitcairn Islands) overlapped the first few days of our trip, and they stopped by Pitcairn before heading home. We had a great time, with a lot of sites to explore and things to do, in addition to Pitcairn Island being the best radio location I have ever operated from!

A Future on Pitcairn

To my surprise, I had the option of retiring 2 years early, so I took it, and now my family and I have begun the process of obtaining permanent residence on Pitcairn Island. Our family now has settlement visas, and in 2 years, if it all works out for us, we may be granted permanent residency. We still have our California residence and will decide if we will sell it once we obtain permanent residency on Pitcairn Island. The cost of living on Pitcairn Island is much less than in California. I have already applied for a piece of land to build a home on the island at a high elevation with a 270-degree view of the ocean, which will be an excellent radio location. To plan an exotic tropical island vacation or DXpedition experience, visit www.visitpitcairn.pn.

All photos provided by the author.

Mike Collis, WA6SVT/VP6MC, was first licensed as WN6SVT in September 1973 and is currently an Extra-class operator. He retired as a senior broadcast engineer from Paramount CBS Television in December 2023. Mike operates and builds much of his HF and microwave equipment. He and his wife have been ARRL members since they were first licensed. They have four daughters and a son. Mike was first introduced to Pitcairn Island in the 1970s when he made a contact with Tom Christian, VP6TC (SK).

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Antipodal Focusing

Chasing the ultimate DX may be easier than you think due to this natural phenomenon.

John Stanley, K4ERO

An *antipode* is the area on Earth exactly opposite to where you are or where you are talking about. The dictionary notes *an-ti-pode* as the correct pronunciation for the singular use of this word and *an-tip-uh-deeze* as the correct pronunciation for the plural use.

Visualizing Antipodes

Every point on Earth is the antipode for another point. This can be visualized by holding a globe so that any particular point is on the top, and the antipode for that point is directly on the bottom. For example, if you do this exercise for London, the exact antipodal (*an-tip-uh-dal*) point is near the southeast tip of the southern island of New Zealand.

As it turns out, this geographically curious factoid has quite a bit to do with radio propagation. First, notice that every great circle that passes through your location also passes through your antipodal point. That means that you are aiming at your antipode no matter what direction you aim your antenna. The easiest way to visualize this is to start from the North Pole, travel south along any line of longitude you choose, and you end up in the South Pole.

Radio signals have a limited range because they weaken as they go farther from the transmitter. This is due to two factors. One is the absorption of the wave by the ground and the ionosphere. The other factor is that the wave spreads as it goes out.

Consider a transmitter sitting at the North Pole of a perfectly conducting Earth-sized sphere, as shown in Figure 1, with a second perfectly conducting shell representing a strong ionosphere just above its surface. The transmitter is connected to an omnidirectional antenna and sends a short pulse, such as a fast CW dit. The power is radiated in all directions so that after traveling 50 miles, it is spread out over a circle of $\pi \times 100$, which equals a 314-mile circumference. By the time it has gone 100 miles, the same total energy is spread across about a 628-mile circumference. This means that the signal has decreased, even with no absorption. The signal is decreasing about as much as the inverse of the distance traveled.

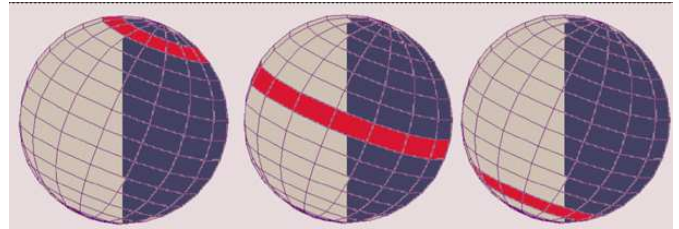


Figure 1 — A globe demonstrating a pulse (in red) traveling from the North Pole to the South Pole after 0.01, 0.03, and 0.05 seconds.

We normally assume that signals decrease as the inverse distance squared. That is true when we are talking about waves in space, but here we are talking about waves traveling near the surface of the Earth trapped between the ground and the ionosphere, thus spreading out in only two dimensions — not three.

How Signals Travel to Antipodes

On a perfect model globe, the radius of the signal on a sphere spreads less rapidly the farther it goes. At 299.8 meters/second, the pulse from the North Pole reaches the South Pole, a distance of 20,000 kilometers, after about 0.066 second. Time is distance divided by speed, so

$$20 \times 10^6 \text{ meters} / 299.8 \times 10^6 \text{ meters/second} = 0.066 \text{ second}$$

As the pulse reaches the point that is $\frac{1}{4}$ around the world from its origin — in this case, the equator — after about 0.033 second, the wave front ceases to expand and begins to contract. As it reaches the antipodes, it theoretically squishes down to a point, and all of the original power is concentrated at that point. It is spread vertically to the bottom of the ionosphere but is still very strong compared to paths without focusing.

Now consider what happens on the real, non-perfectly conducting globe. Signals radiated into the space between the ground and the ionosphere travel around the Earth and still concentrate at the antipodes. However, due to irregularities in the ionosphere, they defocus somewhat so that the focal point is not a point but an area of a few hundred- to a 1,000-mile radius, depending on the roughness of the ionosphere at that moment. Also, the ground partially absorbs the signals by the D layer during the daytime and somewhat

less by the other layers at night. During the nighttime hemisphere, some energy slips through into space or is deflected, etc., so not all the energy makes it to the antipodes. However, focusing still takes place, and its effects can be noticed.

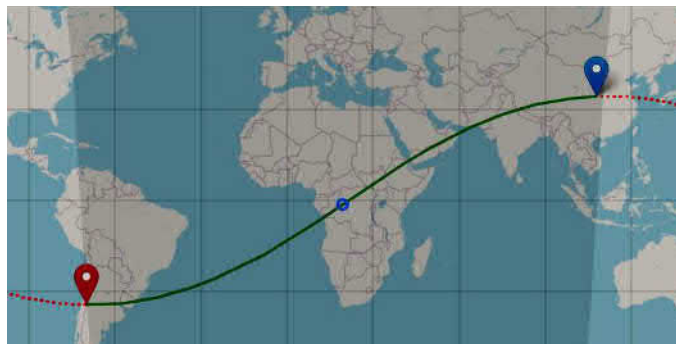
At the antipodes, the short- and the long-path distances are identical, and as mentioned earlier, many different paths will get you there. If this is so, consider how the antenna should be aimed. Ham operators are most likely to do this research because many of them have rotatable beams (at least for the higher-frequency bands). When there is antipodal focusing on 14 MHz, where beam headings can be changed, the optimum direction will likely change dramatically throughout 24 hours, even more than it does for well-known long and short paths. If there is a beam on both ends, aiming the antenna may need to be coordinated, and wide beams may work better than narrow ones.

The paths the signals take with the least amount of loss may remain somewhat of a mystery. A guess is that for the lower-frequency signals, the whole dark hemisphere gets into the act. The signals will also be strongest over saltwater paths because reflecting off the sea is practically lossless, whereas each hop over land takes a toll of several decibels.

Antipode Knowledge Today

In the March 1922 issue of *QST*, a “Stray” commented, “Peculiar radio conditions are known to exist at antipodal points, and it is anticipated that reception there will be much better than at many intermediate [points].” One hundred years later, many hams have never heard of antipodal focusing. One reason may be that only a few (if any) propagation programs include a calculation of this effect. They assume that the signal travels over only the short or long path, and other paths are not considered.

The main reason few hams know of this is that, by a fluke of geography, few hams live in places with other hams at the antipodes. Because more of the Earth's land masses and hams are in the Northern Hemisphere, there are very few pairs of points where this effect is commonly seen. Hawaii has a good chance at southern Africa, and Bermuda and Perth, Australia, are nearly a perfect pair, but hams in the mainland US get an antipodal point in the Indian Ocean, where about the only hope of making a contact would be an occasional maritime mobile, or a DXpedition. Furthermore, Japa-



This map shows one of the many great circle paths between Santiago, Chile and China.

nese ham signals would focus on the barren South Atlantic Ocean. Philippine hams reach Brazil's nearly unoccupied Amazon region, and Central Europe's antipodal point is a desolate area of the extreme South Pacific Ocean.

Yet, in recent years, there have been two exciting places to observe focusing effects. During the autumn of 1994, while near Lusaka, Zambia, I was able to hear the WWVH radio station in Hawaii on 5, 10, and 15 MHz for several hours in the morning and evening with incredibly strong signals despite the effective radiated power (power × antenna gain) from WWVH that was close to what many hams run.

During August 1996, near Santiago, Chile, I heard mainland Chinese stations with amazing signals on the 9 and 11 MHz shortwave bands, even though they were running relatively modest power (for shortwave broadcasters) of 20 to 50 kW. Signals from more powerful stations in other parts of the world closer than the antipodal point were noticeably weaker. This reception was there every time I checked over several days.

In these days of world travel, more interesting propagation pairings may appear. Next time you travel with your radio, get out a globe, find your antipodes, and start listening. The ultimate DX may be easier than you think.

All photos provided by the author.

John Stanley, K4ERO, is retired and lives in Rising Fawn, Georgia, after a career in broadcast engineering consulting, which took him and his wife Ruth, WB4LUA, to 62 countries. John has been an ARRL technical advisor for 25 years and is now a technical editor for *QST*. He can be found on 75-meter SSB and FT8 on many bands. John's main interests include antennas and HF propagation. He can be reached at jnrstanley@alum.mit.edu

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When ARRL Field Day Becomes Theater

A surprise collaboration blends technology and the performing arts.



Sam Haldiman, KC9GPY (second from left), and the *Static* cast and crew at the 415 Amateur Radio Club Field Day operation.

Kevin Potter, KD9YYO

The 415 Amateur Radio Club of Crystal Lake, Illinois, had its first ARRL Field Day in 2018. Although our inaugural attempt had a total of just eight participants, the event has grown rapidly since. As a result, Field Day planning has become a year-round exercise with club members Gary Dembski, W9GD, and Sam Haldiman, KC9GPY, leading the effort.

A Twist for 2024

As the planning process for Field Day 2024 was getting under way, Sam was surprised to receive a phone call from Meredith Schaefer, Director of Marketing and Institutional Advancement at the Raue Center for the Arts, a local nonprofit organization. She was doing research about amateur radio for a new musical that was scheduled to open in July. Meredith was also interested in a collaboration between the Raue Center, the new musical production, and the 415 Amateur Radio Club.

Strange as Meredith's collaboration offer seemed at first, her motivation soon became clear. You see, the name of the show is *Static: Noise of a New Musical*, and it is one of the first musicals to utilize Morse code



Ken Lundgreen, KD9PPX (seated), shows *Static* author Tess Rowan how to send CW.

as a method of dramatic storytelling. The production includes cryptic Morse code clues and secret messages embedded in the music to create an immersive audience experience that's filled with mystery. Imagine an acoustic campfire sing-along mixed with a true-crime podcast and you'll have some idea of how it all comes together!

The musical is the creation of Tess Rowan, a writer, director, and performer from the Washington, DC, area (see the interview on the next page). Tess wrote, produced, directed, and performed in the world premiere of *Static*. After a sold-out run at the 2022 Capital Fringe Festival, *Static* won the Fringe Best Musical and Best Ensemble Awards.

Once Sam and Meredith connected, they arranged for Tess, the cast and the director of *Static*, and several Raue Center representatives to join the 415 Amateur Radio Club at Field Day. By doing so, they would have a valuable opportunity to learn more about amateur radio and Morse code.

Showtime!

Field Day 2024 turned out to be our biggest and best Field Day yet. We operated as Class 3A, complete with a Get on the Air (GOTA) station, UHF/VHF station, digital station, CW station, satellite station, and phone station.

After welcoming the *Static* group to the site, Sam gave an overview of our Field Day operation and all the station locations. Soon after, he guided Tess and the *Static* cast to the GOTA station, where they saw HF phone and FT8 operations. Several of the cast and crew members tried their hands at sending CQs with a straight key and a paddle. They quickly discovered that it wasn't as easy as it looked. Others took turns calling "CQ Field Day" on phone and logging their very first amateur radio contacts.

The next stop was a visit with Ralph Iden, WB9ICF, at the CW station, where they learned about the history of Morse code. Finally, they arrived at the comms trailer, where they were shown the VHF and digital stations. The group was particularly interested in the QSL card collection on the trailer wall.



Sam Haldiman, KC9GPY, assists a *Static* cast member at the GOTA station, as other cast members watch, listen, and learn.



Static Playwright Tess Rowan

Q What inspired you to write the musical?

A I grew up performing in musicals and writing plays and really fell in love with the idea of creating something new. I started writing *Static* when I was 14, without knowing how to play a single musical instrument. I really loved theater and wanted

to create something more than anything. Soon, the story began to revolve around teenagers, radios, and hiking. I'm 20 now, and *Static* has changed so much over the past few years, from the first DC Capital Fringe Festival production in 2022 to the most recent workshop and performances with the incredible cast, crew, and team at The Raue.

Q How did you become aware of Morse code?

A Before writing *Static*, I knew nothing about Morse code, except what I had seen in TV shows and movies. While writing *Static*, I started researching ham radio and became fascinated by the idea of Morse code as a form of music and as an interactive tool for storytelling. Morse code is used as a musical language in *Static*, where the audience is asked to listen and participate in a way that combines a traditional theater experience with radio communication. Many audience members start out knowing as little about Morse code as I did, but by the end of the performance, they are able to decode musical clues and solve a mystery through Morse code.

Q What did you and the cast and crew think of ARRL Field Day?

A We all felt so welcomed by the 415 Amateur Radio Club at Field Day. I found it funny that the actors (including myself) felt a little stage fright at first when it came to getting on the air. The firsthand experiences we had at Field Day helped out in later rehearsals, where the cast and crew had conversations about ham radio, connecting real life to the story we were telling. All the 415 club members were so kind and supportive.

Q What did you and the cast find interesting about your time with the hams?

A We enjoyed exploring the different trailers at the Field Day site and learning more about the technology. It was interesting hearing about the various locations that people had contacted across the world through ham radio. I especially loved seeing how Morse code can be transmitted and was in awe at how easily some hams could decode it.

Q Have you or anyone else in the show considered getting licensed or learning more about radio?

A I plan on learning more about radio in my research as I keep developing *Static*, and I would consider getting licensed down the line. My hope for *Static* is that audiences begin to think more about how we communicate and interact with each other and the world. And who knows, maybe *Static* will inspire someone to learn Morse code or become a licensed ham radio operator!



Ralph Iden, WB9ICF, and Tess Rowan outside the CW station.



An image taken during the performance of *Static: A Morse Code Musical*.

After Field Day, the club organized an outing to see the musical and support Tess and the cast of *Static*. The club also loaned various amateur radio "props" to help make the play more realistic.

The club soon became even more involved in the show. Prior to each performance, a 415 Amateur Radio Club member spoke briefly to the audience about amateur radio and Morse code. We even gave away specially made code practice oscillators to lucky winners before each show.

The performance schedule for 2025 had not been published at the time of this writing. See www.tessrowan.com/static for more information.

All photos provided by Todd Heintz Photography.

Kevin Potter, KD9YYO, is a relatively new ham, having obtained his Technician license in September 2023 and his General the following November. He joined the 415 Amateur Radio Club, where he met his mentors Gary Dembski, W9GD, and Sam Haldiman, KC9GPY. You can contact Kevin at kd9yyo@gmail.com.

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

VOTE

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

Get Ready for “Ham Radio Open House” on World Amateur Radio Day 2025

Sierra Harrop, W5DX, Public Relations and Outreach Manager

To help promote amateur radio science and technology, and to honor the 100th anniversary of the International Amateur Radio Union (IARU), ARRL is inviting radio clubs and schools to organize a Ham Radio Open House on April 18, 2025.

The event is intended to highlight the Amateur Radio Service for its development and practice of the latest radio communications and technology, and as a hands-on pathway into science, technology, engineering, and mathematics (STEM) fields for the next generation.

On April 18, 2025, amateur radio clubs, school stations, and other groups will have the opportunity to advance public knowledge about ham radio by welcoming their communities into their stations for the Ham Radio Open House, as part of World Amateur Radio Day. The focus will be on scientific advancement and demonstrating cutting-edge technology. This is a chance to not only shape the conversation about modern ham radio but also show how it serves as a stepping stone and test bed for many young people pursuing future STEM education and high-tech careers.

One Million Acts of Science



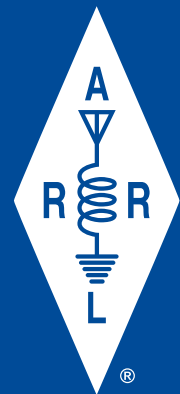
ARRL has teamed up with Ham Radio Science Citizen Investigation (HamSCI) and the science community organization SciStarter to invite the public to participate in One Million Acts of Science

**18
APRIL**



HAM RADIO OPEN HOUSE

World Amateur Radio Day 2025



www.arrl.org/world-amateur-radio-day

during April, which is Citizen Science Month. By hosting a Ham Radio Open House at your group's station on April 18, you'll introduce individuals who might never otherwise find out about today's amateur radio, where science and technology intersect with fun and learning.

Clubs are encouraged to showcase the latest weak-signal modes, such as FT8, using *WSJT-X* or other digital modes. This could be a great opportunity to explore new areas of amateur radio and demonstrate



Lead HamSCI organizer Dr. Nathaniel Frissell, W2NAF, shows a visitor *WSJT* software at W3USR, The University of Scranton amateur radio station. [Photo courtesy of University of Scranton]

how the service is at the cutting edge of electrical engineering.

HamSCI and SciStarter Collaborations

HamSCI

HamSCI (www.hamsci.org) has built a community by connecting radio amateurs and citizen scientists in ionospheric

research. The Solar Eclipse QSO Parties held during the 2023 annular eclipse and the 2024 total solar eclipse provided significant data for researchers studying the ionosphere's response to the eclipses, wrapped into fun operating events.

scistarter
Science we can do together.

SciStarter is working to engage people from all walks of life in one million acts of science during Citizen Science

Month in April (www.scistarter.org/citizensciencemonth), to promote public participation in scientific research. ARRL's Ham Radio Open House provides a unique opportunity to help achieve that goal.

ARRL, HamSCI, and SciStarter are working to help local clubs engage in community outreach for the Ham Radio Open House.

Imagine your open-house visitors seeing a software-defined radio (SDR) waterfall display and then hearing what the signal they see on the screen sounds like — that's an act of science! Taking it a step further, let them take a standing wave ratio (SWR) measurement of an antenna, modify it slightly, and take another

Preparing Your Open House

Enlist the Nearest Club Station. Clubs and schools are encouraged to welcome visitors to their existing club station or organize some other comfortable indoor space (ideal for April weather). This is a different approach than the readiness demonstrations for ARRL Field Day.

A Focus on Innovation. Show off the cutting-edge science and technology behind amateur radio. Create a "wow" factor and be prepared to describe what visitors are seeing and hearing. It's all about highlighting technical advancements and innovations that make ham radio so exciting today.

Make It Modern. Aim to counter the misconception that ham radio is "old" technology. Showcase the high-tech aspects of amateur radio. Think satellite communications, HF weak-signal modes, VHF/UHF/microwave stations, computer networking and integrated devices, constructing antennas, and test and measurement equipment.

Welcome the Community. The Ham Radio Open House should be held in a public space, such as a club or school station, library, or municipal building. If your club doesn't have a facility, consider partnering with local astronomy clubs or other science-minded groups.

reading. They've just gathered data, made a physical change, and measured the impact of their modifications. Not only is that an additional act of science, but it's also a great way to engage people in hands-on learning about ham radio. With this kind of involvement, visitors will be more likely to return for a club meeting or participate in future events.

Clubs will be asked to track those acts of science and submit a report to ARRL detailing the number of acts and the total number of visitors. Find details and information for reporting your club's participation in the open house at www.arrrl.org/world-amateur-radio-day.

IARU Turns 100

World Amateur Radio Day, held on April 18 each year, is celebrated worldwide by radio amateurs and their national associations, which are organized as member-societies of the IARU. It was on this day in 1925 that the IARU was formed in Paris. ARRL co-founder Hiram Percy Maxim was its first president. ARRL is the Secretariat of the IARU.



Happenings

FCC Upholds Record \$34,000 Forfeiture Against Amateur Licensee



The FCC assessed a record \$34,000 forfeiture against an amateur radio licensee for “willfully and repeatedly operating without authorization and interfering with the radio communications of the US Forest Service...while the US Forest Service and the Idaho Department of Lands were attempting to direct the operations of fire suppression aircraft working a 1,000-acre wildfire on national forest land outside of Elk River, Idaho.”

As ARRL News first reported in 2022, the FCC proposed the fine against Jason Frawley, WA7CQ, of Lewiston, Idaho, for allegedly interfering with radio operations of the US Forest Service during firefighting

activities for the Johnson Creek Fire in July 2021. The FCC stated in the Notice of Apparent Liability that Frawley holds an Extra-class license and is the owner/operator of Leader Communications LLC. He also holds eight microwave licenses and one business license.

In response, Frawley acknowledged that he operated on a frequency reserved for government use and for which he lacked authorization, but he argued that he did not cause interference to the government’s fire suppression activities on the channel and acted with “good faith and non-malicious intent to help.” Frawley requested a reduction or cancellation of the proposed forfei-

ture based on the number and duration of the unauthorized transmissions, his history of compliance and corrective measures, and his inability to pay the proposed forfeiture.

In the Forfeiture Order released on January 3, 2025, the FCC rejected Frawley’s request and assessed the full proposed forfeiture of \$34,000. Read more about the story in previous coverage from ARRL News at www.arrl.org/news/fcc-proposes-record-34-000-fine-for-alleged-interference-and-unauthorized-transmissions-during-idaho.

Ham Radio Operators Serve During California Firestorms

As the firestorms across Southern California continue to threaten millions of residents as of press time, trained amateur radio operators are serving critical volunteer roles to help officials spot fires

before they get out of control. Dry conditions and wind gusts of 100 miles per hour have fueled days of devastating wildfires. Entire neighborhoods have been leveled by infernos.

The Eaton fire burned to the top of Mount Wilson, a critical logistical post for broadcast radio and television stations, as well as communications across the Southland. Federal agencies, air traffic control, local emergency responders, radio amateurs, and others all share tower space on the mountain.

While the main fires have been burning north and northwest of the central section of Los Angeles, hams are standing watch to the south. Orange County Fire Watch (OCFW) is a program locally organized by the Orange County Parks Department and the Irvine Ranch Conservancy.

During severe fire weather, volunteers go to preassigned locations within parks and other open spaces to report conditions. Many of them



Damage from the Eaton fire in California. [US Air National Guard photo]

are hams who use the amateur bands to fill in mobile network weak zones.

ARRL National Instructor Gordon West, WB6NOA, is among the deployed volunteers. He said hams are stepping up. "We're all over the ARRL Orange Section on hilltops, reporting the wind and humidity [and] ash seen coming down. [We're] scanning for spot fires (none so far), smoke from the LA fires, guest activity at the parks, and [we're] a presence at trailheads with reflective vests and vehicle signs indicating Fire Watch," he said.

Ray Hutchinson, AE6H, is a retired firefighter who serves as the chief radio officer for OCFW. He says local clubs are key to providing the needed RF infrastructure. "Our local club, the South Orange Amateur Radio Association, an ARRL Special Service Club, provides

linked 2-meter and 70-centimeter repeaters: one high level and one coastal, for use by OCFW hams during deployments. There is a formal OCFW Net Control Station for the entirety of these events," he said.

Radio amateurs are also ready and able to serve at evacuation centers, providing support as needed.

ARRL Headquarters staff have been in touch with ARRL volunteers and other ham radio groups around the affected area, and they are offering material support for any activations. "It has been a busy start to the year for ham volunteers," said ARRL Public Relations and Outreach Manager Sierra Harrop, W5DX. "Whether it's firestorms or ice storms or any other need, ARRL volunteers selflessly serve their communities. We're mindful that large-scale events like this impact

the hams who are actively serving," she said.

ARRL Director of Emergency Management Josh Johnston, KE5MHV, has been on calls with the Federal Emergency Management Agency (FEMA) and other served agencies to offer ARRL resources. Emergency Network Los Angeles, the Voluntary Organizations Active in Disaster group in Southern California, is coordinating efforts locally.

Johnston urges hams in the affected regions to be ready to take care of themselves and their families prior to potential deployment. He points to resources shared by ARRL's Amateur Radio Emergency Service® during National Preparedness Month. "These are stressful events for everyone, and being a ham volunteer is second to keeping yourself and your family safe," said Johnston.

ARRL Teachers Institute Coming to a Town Near You

The ARRL Teachers Institute on Wireless Technology (TI) is going mobile in 2025. In addition to the cohorts hosted at ARRL Headquarters in Newington, Connecticut, there will be several sessions around the US this year. The first, hosted by Staten Island Technical High School in New York City, was held on January 21 – 24.

The duration this year is being shortened from 5 days to 4. That change, along with taking the show on the road, is expected to make it easier for educators to attend, according to ARRL Education and Learning Manager Steve Goodgame, K5ATA. "Especially for educators juggling a busy family life, a 4-day program near them might be an easier option than a 5-day trip to New England." Plans are also being finalized for a session in Kilgore, Texas, in July, as well as another in the southeastern US.



ARRL TI participants ready for a foxhunt at ARRL Headquarters.

Programming and support continue to evolve. "We really want to support these TI graduates after they leave, so we have rolled out a Discord server so they can stay in touch with their peers who are also imple-

menting the material they learned here," said Goodgame.

Providing community support and engagement has proven to be key to the ongoing success of the program. Staten Island Technical

High School's program is led by Everton Henriques, KD2ZZT, a two-time ARRL TI attendee. Henriques has helped many of his students not only get licensed but become genuinely engaged with amateur radio. Henriques will help ARRL Education Specialist Wayne Greene, KB4DSF, teach the program. Visit the digital edition of the February 2025 issue of *QST* (www.arrl.org/qst) to hear Staten Island Technical High School

students talk about the program in their own words.

By developing the network of educators who have benefited from the program, and by offering regional opportunities, Goodgame hopes to receive more applications. TI is free for educators thanks to ARRL Education and Technology Fund donors. There is a \$100 application fee if the educator is accepted.

Goodgame sees a long-term benefit to wrapping fun into this radio-centric curriculum. "Inspiration drives innovation, so if we don't inspire young people to innovate and expose them to RF, they're not going to innovate in those fields," he said. "Somebody will — it's just not going to be our kids."

To learn more about ARRL TI, and to apply to attend, visit www.arrl.org/ti.

ARRL Launches Dream Station Sweepstakes

ARRL has introduced a sweepstakes that gives members a chance to win an Icom Dream Station, which includes a limited edition IC-7760 HF/50 MHz transceiver, an IC-PW2 amplifier, and a microphone, all generously donated by Icom America.

The ARRL Sweepstakes is running from January 3 to December 31, 2025. It is the exciting centerpiece of a year-long campaign to encourage new membership and a fun way for current members to extend their support for ARRL. The lucky winner will also receive a limited edition Seiko watch celebrating Icom's 60th anniversary.

Participation in the sweepstakes is open to full ARRL members in the US. Members will automatically earn sweepstakes entries when they:

- Join or renew membership (earn one entry)
- Set up auto-renewal (earn two entries)
- Donate to the ARRL Diamond Club (earn one entry for every \$50 donated)

Members can earn up to six entries during the year-long campaign.

For more information about the ARRL Sweepstakes and the official rules, visit www.arrl.org/dreamstation.



Between January 3 and December 31, 2025, full ARRL members in the US have a chance to win an Icom Dream Station.

CWops Announces 2024 Advancing the Art of CW Award Recipient

Each year, the CW Operators' Club (CWops), an international organization that promotes and advances Morse code in amateur radio communications, accepts nominations for individuals, groups, and organizations for the CWops Award for Advancing the Art of CW. The award recognizes contributions made toward advancing the art or practice of radio communications by Morse code.

The Radio Officers Association (ROA) is the recipient of the 2024 CWops Award for Advancing the Art of CW. ROA honors and

preserves the history and accomplishments of radio professionals from across the merchant navy, coast station service, and civil aeronautical industries. Its membership includes nearly 400 former professional radio officers — half of whom hold amateur radio licenses. CWops recognized ROA's efforts to preserve CW history through its journal, *QSO*, and for activities that span CW mentoring, on-air nets, and CW-related museum displays and related activities.

The award was recently accepted by ROA's Bill Cross, G0ELZ, at the

organization's annual meeting in Liverpool, England. It was presented by CWops President Stew Rolfe, GW0ETF.



Public Service

Simulated Emergency Foxhunt

My club, the Nittany Amateur Radio Club (<https://nittany-arc.net>) in central Pennsylvania, routinely takes part in simulated emergency drills and public service events. We also have several foxhunts every year. In 2024, we decided to combine a foxhunt with a simulated emergency drill. We settled on a scenario of a simulated missing aircraft, with our emergency volunteers tracking down the aircraft's location. They would have to use foxhunting skills, teamwork, and emergency procedures to complete the mission.

In the spirit of foxhunting competition, we formed teams, each of which would conduct its own search procedure while reporting to a central air-crash headquarters. The event was set to take place on a Saturday in early November. On the prior evening, we held a pre-foxhunt net on our local repeater to discuss the ground rules, the boundary area, safety issues, and various radio direction-finding techniques.

The Hunt Begins

At 7 AM on Saturday, a bulletin was released via our local repeater and our club's email distribution system. Beginning with, "THIS IS ONLY A DRILL. THIS IS A SIMULATED EMERGENCY EXERCISE," the bulletin went on to describe the scenario — a replica World

War I military aircraft had disappeared en route from Scranton, Pennsylvania, to Dayton, Ohio. The FAA and Civil Air Patrol had requested assistance from radio amateurs to help track down the missing aircraft by first determining what frequency its damaged transponder had drifted to, and secondly, using the emergency transponder signal and direction-finding techniques to locate the downed aircraft. The bulletin indicated that hams should coordinate through the air-crash headquarters on the 146.85 State College (Pennsylvania) repeater. Once the crash site had been located, hams were to determine the type and color of the aircraft, and whether there were any survivors.

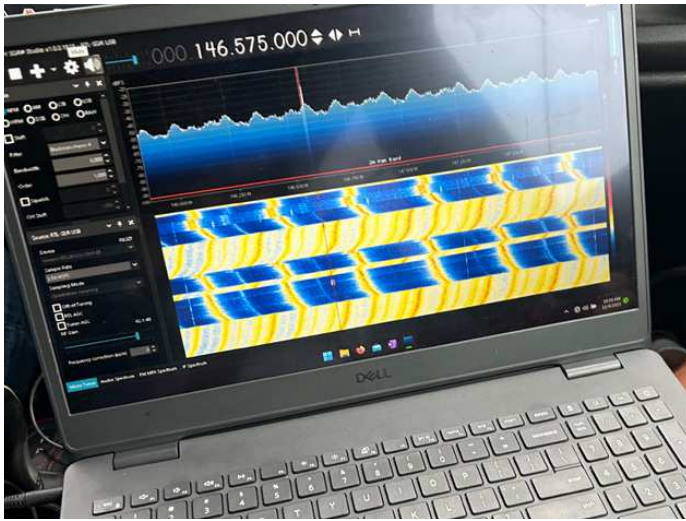
The simulated aircraft in this exercise was a large (4-foot) radio-controlled model airplane that had been painted bright red and decorated to look like the Red Baron airplane. It had previously been crashed into a tree and was broken into large pieces.

The emergency transponder was my "fox box" transmitter that we always use in our foxhunts. The frequency was set to a simplex channel in the 2-meter amateur band (146.580 MHz), and the frequency was not announced in advance. My fox box transmitter is housed in a NATO ammunition box, which contains a handheld transceiver, a computerized controller, and a battery. The transmitter can be turned on and off remotely via radio link.

By 10 AM, the Red Baron aircraft and the simulated emergency transponder were at the crash site, ready for the search teams to locate. I chose a wooded area on the far western side of State College as the crash site. The site was set back about 100 yards from the closest road, and was not visible from the road. There was a convenient parking area nearby, where the field teams could safely exit their vehicles and organize a search on foot. The teams did not know about the parking area ahead of time — they assumed it was a lucky break. Although the overall location was relatively high, the site itself was in a slight local depression. This induced an attenuation of the emergency signal in some directions.



Two family teams at the simulated crash site. At left, the Zwart family: Smita, KC3MVK; Tanya, KC3VMK; Leena, KC3VMJ, and Johan, KC3MVL. At right, Elliot Christian and his dad, Dean, K3IWI. [Dean Christian, K3IWI, photo]



Spectrum analyzer searching for the transponder beacon. [Dan Muthler, K9SDW, photo]

We didn't turn on the simulated emergency transponder (fox box) until ten o'clock, to ensure that none of the teams were wandering around on the highways or in the woods when it was still dark and very cold — we did not want any real emergencies to deal with!

The simulated transponder went on the air at exactly 10 AM. The simulation scenario specified a damaged and intermittent emergency beacon transponder. The actual transmitter I used had a duty cycle of 40 seconds on air, followed by 20 seconds off air. Throughout the transmission there was an audio beep every 3 seconds. Each transmission ended with a call sign ID in code, W3YA/FB — the "FB" was for "fox box."

Teamwork

There were five search teams:

1. Ruth Tillman, KC3AF, and Dan Muthler, K9SDW
2. Kelli Prescott, KC3HIP, and her husband Eric, W3EDP
3. Karl Hosterman, K3ARL
4. Dean Christian, K3IWI, and his son, Elliot
5. Johan Zwart, KC3MVL; his wife, Smita Bharti, KC3VMK, and their children, Tanya, KC3VMK, and Leena, KC3VMJ

Each team picked their own starting location within the published boundaries of the air-crash exercise, an area of more than 30 square miles. Each team started on high ground to listen for the weak, off-frequency, emergency radio beacon.

Air-crash headquarters maintained communications with the search teams through our 146.85 repeater. Search teams reported when they found the transponder frequency, as well as their progress in approaching the crash site. To maintain the spirit of competition between the search teams, each team made up its own search grid nomenclature when reporting to air-crash headquarters. All five search teams acted independently, without cross-team coordination.

Practice Pays Off

Our teams used a variety of equipment to find the unknown frequency. The ground rules declared that the mystery frequency would be located somewhere in the 2-meter ham band. Each team used tunable receivers to search for the beacon, and one team used a spectrum analyzer in addition to a receiver.

Each team used its favorite direction-finding equipment and techniques. Thirty square miles is a lot of territory to cover; it was important to have good directional indications that were accurate and quickly generated. Each team had been practicing locating skills in the days prior to the event. That enabled team members to quickly and efficiently use the equipment they had trained with. There were direction-finding loops, switched and offset attenuators, time-of-arrival antenna arrays, Yagi antennas, and even a handheld radio with a paper-clip antenna. Being familiar with their equipment beforehand made the difference in being able to obtain fast and accurate results. It is important to know how to use your equipment before you need to use it.

All five teams did remarkably well. Each one determined the frequency and located the crash site within 2 and a half hours. The fastest team, K3ARL, arrived on site in 31 minutes due to Karl's lucky choice of a good starting point.

Within our simulated emergency scenario, emergency responders were summoned and the two pilots — who were found alive, but unconscious — were quickly transported to the hospital where they survived due to the fast and professional action of our local hams. Each team was prepared and motivated. They simply knew how to get the job done.

Ellwood (Woody) Brem, K3YV, has been a ham for 62 years. He is a retired RF/microwave engineer and holds a master's degree in electrical engineering from Penn State University. Woody was the 2020 recipient of the ARRL Foundation's Bill Orr, W6SAI, Technical Writing Award. Woody lives in Spring Mills, Pennsylvania, with his wife, Sharon Gaisler, N3SG, and their cat, Schrodinger. You can reach Woody at eeb3568@gmail.com.

Contest Corral

March 2025

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				Bands	Contest Name	Mode	Exchange	Sponsor's Website
Date-Time	Date-Time							
1	0000	2	2359	1.8-28	ARRL International DX Contest, SSB	Ph	RS, SP or pwr	www.arrl.org/arrr-dx
2	0700	2	1100	3.5	UBA Spring Contest, CW	CW	RST, serial, UBA section (if ON)	www.uba.be
2	1200	2	1400	7	SARL Hamnet 40m SET	Ph	RS, serial	www.sarl.org.za
2	1200	2	2200	3.5	NSARA Contest	CW Ph Dig	RS(T), Nova Scotia county or serial	nsara.ca
2	1800	2	2200	3.5	WAB 3.5 MHz Phone	Ph	RS, serial, WAB square or country	wab.intermip.net/Contests.php
3	2000	3	2130	3.5	RSGB 80m Club Championship, Data	Dig	RST, serial	www.rsgbcc.org
4	0100	4	0300	3.5-28	ARS Spartan Sprint	CW	RST, SPC, pwr	ars-qrp.com
4	1900	4	2100	3.5	AGCW YL-CW Party	CW	RST, serial, "YL" (if YL), name	www.agcw.de
5	2000	5	2100	3.5	UKEICC 80m Contest	Ph	6-char grid	www.ukeicc.com
6	0000	7	0300	7	Walk for the Bacon QRP Contest	CW	Max 13 WPM; RST, SPC, name, mbr or pwr	qrpcontest.com/pigwalk40
6	1800	6	2200	28	NRAU 10m Activity Contest	CW Ph Dig	RS(T), 6-char grid	nrau.net
8	0000	16	2359	3.5,7,21, 28,144	Novice Rig Roundup	CW	Name, QTH, optional rig or mbr	www.novicerigroundup.org
8	0800	9	1000	50,144,432	SARL VHF/UHF FM Contest	Ph	RS, 6-char grid	www.sarl.org.za
8	0800	9	1000	1.8-28	SARL Field Day Contest	CW Ph Dig	RS(T), # of transmitters, category, SA province or "DX"	www.sarl.org.za
8	1000	9	1000	3.5-28	RSGB Commonwealth (BERU) Contest	CW	RST, serial	www.rsgbcc.org
8	1200	9	1200	3.5-28	EA PSK63 Contest	Dig	RSQ, EA province code or serial	concursos.ure.es
8	1200	9	1200	28	South America 10m Contest	CW Ph	RS(T), CQ zone	sa10m.com.ar/wp/rules
8	1200	9	1100	3.5-28	DIG QSO Party, SSB	Ph	RS, mbr or none	diplom-interessen-gruppe.info
8	1400	8	2000	3.5-28	AGCW QRP Contest	CW	RST, serial, pwr, mbr or "NM"	www.agcw.de
8	1500	9	1500	1.8	Stew Perry Topband Challenge	CW	4-char grid	www.kkn.net/stew
8	1500	9	2100	3.5-28,50	Oklahoma QSO Party	CW Ph Dig	RS(T), OK county or SPC	k5cm.com/okqp.htm
8	1800	9	0559	3.5,7	Tesla Memorial HF CW Contest	CW	RST, serial, 4-char grid	www.radiosport.yu1srs.org.rs
8	1900	9	1900	1.8-28	Idaho QSO Party	CW Ph Dig	RS(T), ID county or SPC	www.idahoqsoparty.org
9	0000	9	0359	3.5-14	North American Sprint, RTTY	Dig	Other's call, your call, serial, name, SPC	ncjweb.com/Sprint-Rules.pdf
9	0700	9	1100	144	UBA Spring Contest, 2m	CW Ph	RS(T), serial, UBA section (if ON)	www.uba.be
9	0700	9	1700	3.5-28	FIRAC HF Contest	CW	RST, serial, "F" (if mbr)	www.firac.de
9	1000	9	2159	3.5-28	YOTA Contest	CW Ph	RS(T), age	www.ham-yota.com
9	1800	10	0100	No WARC	Wisconsin QSO Party	CW Ph Dig	WI county or SPC	www.warac.org
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
12	2000	12	2130	3.5	RSGB 80m Club Championship, CW	CW	RST, serial	www.rsgbcc.org
13	1900	13	2059	3.5	BCC QSO Party	CW Ph Dig	RS(T), T-shirt size	www.bavarian-contest-club.de
15	0000	15	2359	1.8-28,50	PODXS 070 Club St. Patrick's Day Contest	Dig	SPC	www.podxs070.com
15	0200	17	0159	3.5-28	BARTG HF RTTY Contest	Dig	RST, serial, 4-dig UTC	www.bartg.org.uk
15	1200	16	1200	1.8-28	Russian DX Contest	CW Ph	RS(T), oblast or serial	www.rdx.org
15	1200	16	1200	3.5-28,144	F9AA Cup, SSB	Ph	RS, serial	www.site.urf.asso.fr
15	1400	15	1800	144,432	AGCW VHF/UHF Contest	CW	RST, serial, pwr, mbr or "NM"	www.agcw.de
15	1400	16	2359	No WARC	Virginia QSO Party	CW Ph Dig	Serial, VA county or SPC	www.qsl.net/sterling
15	2300	24	0300	3.5-14	AWA John Rollins Memorial DX Contest	CW Ph	RS(T), name, SP, eqpt year	www.antiquewireless.org
16	0700	16	1100	3.5	UBA Spring Contest, SSB	Ph	RS, serial, UBA section (if ON)	www.uba.be
16	2300	17	0100	1.8-28	Run for the Bacon QRP Contest	CW	RST, SPC, mbr or pwr	qrpcontest.com/pigrun
17	1800	17	2059	3.5,7	Bucharest Digital Contest	FT4	RST, serial	yo3test201x.blogspot.com
17	2000	17	2200	3.5-28	RSGB FT4 Contest	FT4	Signal report	www.rsgbcc.org
19	2000	19	2100	3.5	IRTS 80m Counties Contest	CW Ph	RS(T), serial, EI/GI county (if EI/GI)	www.irts.ie
20	0000	21	0300	14	Walk for the Bacon QRP Contest	CW	Max 13 WPM; RST, SPC, name, mbr or pwr	qrpcontest.com/pigwalk20
20	0030	20	0230	1.8	NAQCC CW Sprint	CW	RST, SPC, mbr or pwr	naqcc.info/sprint_rules.html
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	Africa All Mode International DX Contest	CW Ph Dig	RS(T), serial	mysarl.org.za
23	0000	23	0400	3.5-14	North American SSB Sprint	Ph	Other's call, your call, serial, name, SPC	ssbsprint.com
23	0600	23	1000	50	UBA Spring Contest, 6m	CW Ph	RS(T), serial, UBA section (if ON)	www.uba.be
26	2000	26	2100	3.5	UKEICC 80m Contest	CW	6-char grid	www.ukeicc.com
27	2000	27	2130	3.5	RSGB 80m Club Championship, SSB	Ph	RS, serial	www.rsgbcc.org
28	1900	29	0300	3.5-28	Sasquatch Stomp	CW	RST, SPC, mbr or ZIP code, name	www.pnwqrp.org
29	0000	30	2359	1.8-28	CQ WW WPX Contest, SSB	Ph	RS, serial	www.cqwp.com

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

Field Organization Reports — December 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.

535 AD8CM	190 WD8USA	140 AC0KQ WA3QLW WB9QPM	121 K5OB	104 WA3EZN	94 W8ROY	87 WB8RGE	76 K2MJR	73 KD2TDG K2PHD	71 AF9SC W5XX
380 NW3X	188 WV8Q	KK3F	120 WA4VGZ WC4FSU KT5SR	102 KO4KUS KV8X	93 KT4WX K1YBO W4TTO	86 W2ARP NJ5R	75 WB3FTQ	72 W7MIN KB1NAL K4DH	70 NT1N
305 W7EES	180 N8SY	139 KD8ZCM	AI9F W9FE K3JL KE8DON W2AH KD0HHN KY2MMM	101 W8IM	91 WB9EDL	84 KM4BRQ N0ET	74 KM4WXX KE8HKA		
295 AC8NP	175 AE5MI KD2NMG	137 N3KRX		100 WB4ZDU KZ8Q WB4RJW AA3SB KE8ANW WB8SIQ N8MRS KB8GUN W1KX W4EDN K2MTG K3YAK KB2QO	90 WA3QPX AB9ZA W8GSR KL7RF K8KRA K3RC N8OD WB8YYS K8ED KB8PGW KN4AAG W4KX W2QMI WB2VUF WX2DX	83 KB4OLY	The following stations qualified for PSHR in November 2024, but have not been recognized in this column yet: WD0BFO 267, KA0DBK 74.		
265 W9EEU KT2D	171 W5WMC	132 KC3T				82 KB0DTI WW3S			
248 K3EAM	170 KF8ATJ	130 KN4WX K8MDA KC8PBU KD8UUB KY2D WK4WC KB3YRU WO2H N2JBA	116 KB5PGY	114 N2DW		81 K6RAU	Section Traffic Manager Reports The following Section Traffic Managers reported: AL, AR, AZ, CO, CT, DE, ENY, EPA, GA, IL, IN, KS, KY, MDC, ME, MI, MO, MS, NC, ND, NE, NFL, NLI, NM, NNJ, NNY, OH, OR, SD, SFL, SJV, SNJ, STX, TN, WCF, WPA, WWA.		
235 W9GRG	163 W0PZD		112 KD2LPM			80 AE2EY KR4ST KG5AOP K1XFC KA8BJA			
210 N2LC	161 KA9IKK	128 W3YVQ	110 KO4OL W4NHO W4CMH AD4DO KM4WHO AD3J WB8TQZ N4CNX W2OOD	98 W9BGJ	97 KA2ZHP	78 NI2W	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. W2AH 2,603, KY2D 2,262, W8MAL 1,564, KK3F 989, WA3QLW 697, WK4WC 520, W2PAX 508.		
207 AC8AL	155 W4DNA	125 W2PAX K7OED KE4RS KC8YVF		95 WB8R N3GE	89 N0JAR KB3MXK N2TSO	77 K8RDN			
200 WM5N ND8W KV2J	150 KR4PI								
191 W9RY	143 WM2C								

Strays

US Coast Guard Auxiliary Special Event Recap

On September 14 – 15, 2024, the United States Coast Guard Auxiliary Communications operators put together a special event station to mark the 85th anniversary of the United States Coast Guard Auxiliary. They operated in Cape May, New Jersey, at what was first a boathouse for the United States Life-Saving Service in 1890, eventually becoming the US Coast Guard boathouse. In 1947, the building was reassigned to the US Coast Guard Auxiliary. The event was successful as more than 200 auxiliary members from around the country enjoyed making hundreds of contacts. — *US Coast Guard Auxiliary Public Affairs Officer Mike Slepian, WB2LKO*

Feedback

In the February 2025 issue, the answer to the “Common-Mode Choke Not Required for Verticals” question in “Ask Dave” contains an error. In “Your coax is 50 W, but the classic vertical feed-point impedance is about 36 W...” the W should be Ω in both instances. Additionally, in “Of course, most hams don’t have a perfect radial system, so ground losses will add to the 36 W...” the W should be Ω . These errors have been corrected in the digital edition.

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 December 2024 activity report of the VM Program.

◆ A commendation was issued to an amateur in Simpsonville, South Carolina, for exceptional operating skills and courtesy on 7.210 MHz in October 2024. A commendation was issued to an operator in Etna, Wyoming, for exceptional net control operation and courtesy in the Wyoming Cowboy Net meeting on 3.923 MHz in September 2024.

◆ Technician-class operators in Mississippi, Maine, and Florida received advisories for FT8 operation on 20 meters. Technicians have no operating privileges on 20 meters.

◆ Operators in Louisiana and Arizona received advisories for operation with expired licenses.

◆ A Technician-class operator in Texas received an advisory for FT8 operation on 17 meters. Technicians have no operating privileges on 17 meters.

◆ A Technician-class operator in Florida received an advisory concerning FT8 operation on 15 meters. Technicians have only CW privileges on 15 meters.

◆ An operator in Ohio received an advisory for extended transmissions on 40 meters with no FCC-required identification.

◆ An operator in Virginia received an advisory for deliberate interference and harassment on 3.933 MHz in October 2024 and was advised of the FCC forfeiture amounts for such operation. The operator was also advised that such operation would be an issue in any license renewal proceeding.

◆ There were two case referrals from the FCC to the Volunteer Monitor Program, and there was one FCC meeting regarding interference.

The totals for November 2024 monitoring were 1,527 hours on HF frequencies, and 1,835 hours on VHF frequencies and above, for a total of 3,362 hours.

— Thanks to Volunteer Monitor Program Administrator Riley Hollingsworth, K4ZDH

Congratulations

December 2024
QST Cover Plaque Award Winner

José Luis Giordano
CA4GIO

In his article, "About the Artificial Ground," José explains what artificial ground is, how it works, and some facts about its history.

QST Cover Plaque Awards are given to the author or authors of the most popular article in each issue. *You* choose the winners by casting your vote online at

www.arrl.org/cover-plaque-poll

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

About the Artificial Ground

Its invention, operation, and usefulness.

José Luis Giordano, CA4GIO

The device known as an *artificial ground* is useful to some radio amateurs, while others have never needed it. Furthermore, the circuit and the inventor's name change depending on the reference consulted. The purpose of this article is to clarify what it is and how it works, and to share some facts about its history.

What Is and Isn't an Artificial Ground

The *ground* of an amateur radio station is the reference point of potential between RF circuits, which can be a rod buried outside the shack. On the other hand, *grounding* is the physical connection of the station devices to the ground point, while *bondings* are joints between the chassis of the devices that minimize potential differences between them. The device called an *artificial ground* does not replace grounding or bonding. It does not allow us to do without the radials or the counterpoise of a $\frac{1}{4}$ -wavelength vertical antenna or an end-fed wire. Instead, it is an electrical circuit that eliminates RF present in the grounds, chassis, and shields due to a problem in the station's grounding.

The Circuit

The schematic of the circuit of the first commercial artificial ground, the MFJ-931, is shown in Figure 1. This device was manufactured by MFJ, and the diagram was drawn by Doug DeMaw, W1FB (SK), who took a unit apart to write the April 1988 QST Product Review. "MFJ" are the initials of American electrical engineer and businessman Martin F. Jue, K5FLU, inventor of the artificial ground and President of MFJ (until April 2024, when Mr. Jue announced his retirement). As a radio amateur since the age of 16, Mr. Jue founded MFJ in 1972, and was the owner of Hy-Gain, Cushcraft, and Ameritron, among others. He invented the MFJ-207 antenna analyzer about 30

years ago, and he has a series of patents on amateur radio systems.

How It Works

The artificial ground provides a path to eliminate existing RF in parts of the station that should be at ground potential. The simplest way to do this is to use the magic of transmission lines, placing a short section of line open at the end. When the length of this line is equal to exactly $\frac{1}{4}$ wavelength at the operating frequency, it is seen as a short circuit (minimum impedance), and the line can drain RF current at this specific frequency. However, to work with different bands, the most practical solution is to use a tunable LC-series resonant circuit. By adjusting the variable inductance (L) and capacitance (C), the resonant frequency of the circuit is adjusted to obtain minimum impedance at the operating frequency.

In Figure 1, you can see that between the transmitter chassis and the station ground, the artificial ground is formed by only a tapped coil connected in series with a variable capacitor. The other components correspond to the ammeter that allows the operator to see that the amplitude of the RF current is maximum (indicating resonance).

When It Is Useful or Necessary

If there are no problems with tingling, noise, or interfer-

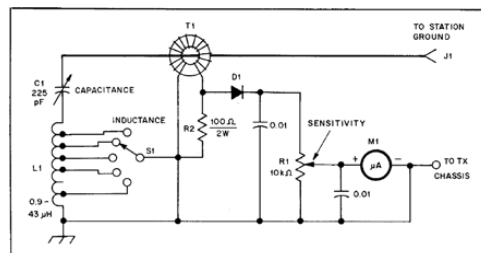


Figure 1 — The MFJ-931 circuit, as depicted in the April 1988 QST Product Review by Doug DeMaw, W1FB (SK).

Life Members

Elected January 6, 2025

Cyndi Albro, KK7AZD
 John R. Anthony, KD8TAE
 Clifford C. Arnett, N5VO
 Keith Austermler, KB9STR
 Jonathan D. Barnes, KQ4VOO
 Rachel B. Barnes, KI4GUW
 Robert R. Beattie, KD4NFC
 David A. Beck, W9RAG
 Tate E. Belden, KA7O
 Carl R. Berry, KC5CMX
 James E. Bond, K6SPY
 Paul A. Bond, KI4WNB
 Robert P. Brady, K5RPB
 Gerry A. Brown, KK7GAB
 Stephen P. Brown, Jr., K1LNX
 Jody M. Browning, KQ4BYL
 Tim Caban, KD3AIS
 Bruce S. Casey, KG4BIB
 Timothy J. Cassidy, WQ1J
 Guy S. Cavaliere, KQ4AEZ
 Paul M. Chesloff, W2PMC
 Robert N. Clark, KQ4WKY
 Alexander L. Clifford, NB1T
 Shannon T. Clopton, KW4A
 James E. Copes, KB9LNR
 Francis E. Corry, Jr., N9CCS
 Philip M. Costanzo, WV3K
 David F. Cowhig, Jr., WA1LBP
 Lyle A. Cox, Jr., KD6EX
 Samuel S. Crew, KC3DGX
 Tom Crosby, K6STC
 Trent B. Curtis, KO4ZML
 William A. Dau, N9OE
 Joseph G. Daugherty, W8JGD
 Brian A. Davis, KN6WKE
 Robert E. Dean, Jr., W9VM
 Parker Dinkins, W5ADD
 Jason Dinsmore, K7BPM
 David L. Doss, KD9WVQ
 Adam Dye, N4NT
 Louis E. Elrod, N9ATF
 James D. English, WO7V
 Kevin S. Farnsley, N0IWT
 Casey J. Freund, KC7E
 David G. Fuller, AB8PP
 Jack A. Gallegos, KK6YWG
 Richard C. Gaus, Jr., WA3INC
 William R. Geddings, KN6RFE
 Bryce K. Gibson, KF0KKC
 Waldemar Gies, KE0SHQ
 John E. Glover, W2QL
 Philip D. Gottlieb, KD2NLP
 Thomas A. Gould, WB6P
 Hubert G. Green, KF5KIY
 Milan B. Greenman, N8MBG
 Dan A. Gustafson, WB4PYL

J. A. Hammonds, W3JAH
 Larry E. Hardman, Jr., KC3EFR
 Christopher G. Hatcher, WV8CH
 Marsha Haworth, KF8CBF
 Richard R. Hensel, N8WLC
 Raymond L. Hightower, KI5CYM
 Stephen W. Ho, KN6DZN
 Laurence L. Homich, KC3ROS
 Keith Hsieh, BU2BB
 Keith A. Hylton, N5KAH
 Christopher Jackson, AD2AW
 William E. Jenkins, Jr., AB5SJ
 Frederick R. Kepner, K3FRK
 Jimmy N. Kerr, N3JIM
 Carl W. Knauss, KI8GM
 Anthony Ku, K3KEK
 Matthew T. Lacy, NQ2U
 David E. Landis, Jr., KE8PNX
 Joseph D. LeBlanc, KO4FRR
 Andrew L. Lenci, WA6QQW
 Brian G. Leon, KL5CU
 Warren Lerner
 Richard M. Lidzbarski, AE7BT
 Arthur Lim, KF5JHJ
 Zach Lummis, KF0IWS
 Essie B. Mack, W5QY
 Glenn D. Markley, KC1CJM
 Stephen A. Marvonek
 Chance McConchie, KC3ZFY
 Donald G. McDonald, N0HQD
 Rob McGregor
 David A. McNair, AC2WU
 David K. McNish, KQ4ZIU
 John S. Mead, W7CU
 Alli Muller, KG6WVL
 Arthur E. Murphy, AI5TG
 Jon N. Nall, AI6W
 Philip J. Narducci, K4PUN
 Samuel W. Nathan, N6TVC
 Ren E. Nehls, III, KD4LTI
 James W. Nicholas, KU4AA
 Michael S. Nicholes, N8XP
 Donald G. Nielsen, WD0NN
 Scott R. Nurnberg, N0OTJ
 Nicholas O'Connor, WE6K
 Edwin Otero, K5BL
 Thomas C. Pactol, W6RUN
 Deshun S. Parker, N3DDG
 Jack W. Parks, IV, KQ4JP
 Robert J. Peterson, K1TXP
 Supparerk Phudtararutchapark, AG6FA
 David P. Proffitt, K3YK
 Andrew S. Quamme, K7ASQ
 Robert G. Riordan, KA4VKN
 James M. Robinson, K0FE
 Arlen Ross, KQ4MVL

Rocco S. Rossetti, KB8WSQ
 Marc Sacco, K7EDM
 Matt T. Sanford, N0TCH
 Stephen E. Sauls, KQ4HTA
 Mitchel B. Sayare, NK3H
 William F. Schauf, WA9B
 John F. Schell, II, W3JFS
 Roger D. Schneider, W9FF
 Norman R. Schutte, Jr., W8TTH
 William R. Seney, NR2P
 Bennett Smith, WB5GVY
 Giri Sonty, AK2I
 RJ Soto
 Peter J. Spinelli, Jr., N4YOT
 Christian L. Stallkamp, KI0D
 Peter E. Steffes, W8AA
 L. D. Steiner, W0XLD
 Christopher Stevens
 William J. Stiles, KR0W
 Jon Suehiro, NN5T
 Donald K. Taylor, K4NAX
 Christian J. Ternus, AC3T
 Arc J. Thames, W4CPD
 Robert E. Thoenen, III, W1HPC
 Mason H. Trimble, IV, AE9IV
 Bryan L. Troxclair, KB5HSC
 Julia E. Tuttle, KV1V
 James E. Tynan, N1JET
 Dallas Vanselow, KC8HQS
 John A. Walke, KI5TQG
 Ian C. Ward, W4NAI
 Charles M. Webberley, KE7IPA
 Roger O. Weed, KV4I
 Gary Wells, WB9AYD
 William R. Wiltschko, KJ6PN
 Joe P. Wolf, III, N5UIC
 Alan Y. Zhao, AK6AD
 Kelly G. Ziadie, K3UQ



The 2024 IARU HF World Championship Results

5,128 entries were received for this popular worldwide event, held July 13 – 14, 2024.

As we march closer to Solar Cycle 25's peak, participants in the 2024 IARU HF World Championship enjoyed and suffered from the effects that a solar flux in the mid-230s can bring to a contest.

Many hams were excited about the prospect of good-to-excellent conditions, with hopes of contacting as many other participants as possible across the 50 ITU zones, 59 national society headquarters and ITU Administrative Council stations, and ITU region special stations. Thankfully, the solar weather that occurred the week before the contest had only a minor impact, but the near-constant barrage of M-class flares and the threat of the occasional X-class flare were simply daily facts of life in this part of the solar cycle. It reminds us that solar conditions can give and take. A successful DX contester has to be ready to adapt in the moment.

Many entrants, particularly in North America, noted the slow start to the contest in the morning hours on Saturday. Space weather events aside, this is common for summertime, but other propagation opportunities make summertime HF contesting very different from autumnal and winter contests.

While the maximum usable frequency (MUF) remained above 14 MHz during the hours of darkness, 20 meters (as well as 15 meters in some areas) remained open between Europe, which has the highest density of participants in this contest, and other parts of the world, including North America. However, it came at the cost of the low bands. While several reports noted that 40 meters was reasonably good, a lot of activity stayed on the higher bands. When most of the Northern Hemisphere dealt with seasonal atmospheric static on the low bands, it is no wonder people seized the opportunity to enjoy the propagation and relatively quieter band conditions on 20 meters overnight, especially after 15 meters was the go-to band for most of the daytime hours.

2024 IARU Special Station Scores

Scoring of IARU station logs provided by World Wide Radio Operators Foundation (WWROF).

IARU Headquarters Stations		IARU Administrative Council Stations	
Call	Score	Call	Score
DA0HQ	24,819,741	SM6EAN	1,610,070
GR2HQ	22,497,548	W5ZN	1,387,429
EF4HQ	21,946,222	VE6SH	101,079
S50HQ	19,997,325	IARU R1	
I0HQ	19,407,115	DJ3HW	439,732
SK9HQ	18,840,374	HB9JOE	258,876
YT0HQ	18,038,916	IV3KKW	94,758
OP0HQ	16,044,315	DL1YO	4,928
SN0HQ	15,265,224	OL7W	3,610
9A0HQ	15,227,593	IARU R2	
LZ0HQ	14,617,144	PT2ADM	154,700
HG0HQ	12,415,728	VE3YV	6,498
OE0HQ	12,059,674	IARU R3	
PA6HQ	11,010,090	JH1NBN	305,732
E7HQ	10,962,468	JA1CJP	240,053
YR0HQ	10,535,196	VJ3O	30,480
OZ1HQ	10,401,430		
R0HQ	9,374,946		
W1AW/4	7,574,644		
LN2HQ	6,195,112		
HB9HQ	6,086,280		
B0HQ	5,829,252		
LT4RCA	4,464,450		
NU1AW	4,097,184		
ER7HQ	4,063,202		
DX0HQ	3,099,432		
EI0HQ	2,918,377		
OH2HQ	2,862,172		
SX0HQ	2,844,308		
8N0HQ	2,776,802		
TC3HQ	2,517,669		
E2HQ	2,270,196		
OA4O	2,021,045		
EX9HQ	1,780,458		
Z30HQ	1,716,048		
Z60HQ	1,677,960		
ZF1A	1,515,976		
UN1HQ	989,912		
HL0HQ	526,875		
3D2TF	447,432		
OY1CT	402,528		
VE5RAC	322,112		
HB0HQ	286,160		
CX1AA	275,502		
HC2GRC	275,356		
C37HQ	190,120		
ZS9HQ	182,476		
LN3HQ	182,343		
4A0HQ	178,125		
CS5HQ	170,937		
ES9A	167,277		
AT1HQ	144,969		
VR2HK	58,276		
3D2HQ	50,504		
VK3WIA	41,175		

Full Results Online

You can read the full results of the contest online at <https://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 next IARU HF World Championship will be held the second full weekend of July (July 12 – 13, 2025).

Top Ten — US and Canada

Single Operator, Mixed Mode, High Power

ND7K (N6MJ, op @N6WIN)	3,529,584
VY2TT (K6LA, op)	3,370,960
K5ZD	3,322,970
AA4NC (N4YDU, op)	3,008,544
N2NT	2,903,103
K4ZW	2,481,388
NT6Q (N5ZO, op @WA6TQT)	2,456,430
NN7CW	2,116,128
K4AB	1,844,280
K6XX	1,675,080

Single Operator, Mixed Mode, Low Power

N1UR	1,350,228
WW4XX (LZ4AX, op)	1,153,680
AD5A	886,512
KD4D	866,725
WQ5L	243,449
VE3KOT	234,883
K6GHA	229,822
N5AW	203,376
K0EA	177,112
VE3UZ	115,280

Single Operator, Mixed Mode, QRP

VA2IW	108,194
VE9QR	4,550
N0LMQ	3,640

Single Operator, Phone Only, High Power

W6AFA	485,692
K9LOE	288,860
AD5XD	286,615
KE8FT	194,228
N4MM	138,480
VE4SG	124,696
WV4E	115,440
K9MWM	76,960
VA3ZNQ	61,320
KE8NBC	55,104

Single Operator, Phone Only, Low Power

KF8N	134,784
WA3LXD	129,686
KO4GAR	91,650
KS2G	75,952
K5DHY	70,348
W8LYO	56,908
W9TCV	51,944
KB4LOA	51,744
K3SNO	49,203
W1JIM	46,495

Single Operator, Phone Only, QRP

W6QU (W8QZA, op)	16,912
W1JCW	14,560
WW0WB	4,114
VA3GMO	2,835
VA2YLB	1,633

Single Operator, CW Only, High Power

K5GN	3,105,384
VE3JM	3,082,560
N9RV	2,709,018
NA8V	2,407,208
W1KM	2,397,549
N2MF	1,838,850
AA1K	1,157,358
W0AAE	1,133,314
K7NT	963,861
K8GL	647,472

Single Operator, CW Only, Low Power

WC1M	1,070,320
VE3TM	1,064,860
K1VUT	811,605
N7VM	642,220
WJ9B	478,116
WB4TDH	429,020
W7YAQ	326,451
KV8Q	301,165
VE6BBP	299,420
KE4R	265,073

Single Operator, CW Only, QRP

W1FJ	180,558
K8CN	117,593
AA4SD	36,427
W7LG	23,316
N2JJ	22,635
N7RCS	15,698
NQ2W	13,524
W4JM	5,017
W0DCX	4,386
N6HI	3,668

Single Operator Unlimited, Mixed Mode, High Power

VA2WA	3,761,648
N2IC	3,259,524
K1LZ	3,203,840
K3MM	2,790,936
K3PA	2,151,513

Single Operator Unlimited, Mixed Mode, Low Power

VE9AA	942,312
NE9U	932,340
VA2CZ	426,384
AA3R	425,204
WN4AFP	413,080
W6FB	239,104
WA2JQK	156,808
KN6VQ	129,440
W4IPC	113,784
W4LT	111,296

Single Operator Unlimited, Mixed Mode, QRP

K8ZT	1,968
K3ZU	444,860
NA4DA	322,138
N8BI	186,098
VE2CSM	164,588
W9NZ	162,162
VE2NTT	117,438
N0GJW	
AE1P (@W3ACO)	116,116
W3ICM	115,272
K4BBH	105,222
	102,794

Single Operator Unlimited, Phone Only, High Power

K3LR	4,897,198
K5TR	2,553,264
K8AZ	2,446,155
K9RS	2,311,770
N7DX	2,093,747
K8LX	1,711,800
N3BB	1,522,788
K4RM	1,445,895
AD4ES	1,436,736
KD1MC	1,309,763

Multioperator, Single Transmitter, High Power

VE3EJ	3,388,704
NN3W	2,346,120
N9NB	2,224,300
K5WA	1,770,030
N4UU	1,360,918
W4AN	1,268,960
W4KFC	906,110
WG3J	678,912
K8LG	332,270
W1FM	223,040

Multioperator, Two Transmitter, Low Power

VE3EJ	3,388,704
NN3W	2,346,120
N9NB	2,224,300
K5WA	1,770,030
N4UU	1,360,918
W4AN	1,268,960
W4KFC	906,110
WG3J	678,912
K8LG	332,270
W1FM	223,040

Single Operator Unlimited, Phone Only, Low Power

VA3IDD	126,904
NQ9N	116,025
WS4AM	105,716
VE9CZ	96,928
WZ8T	84,330
K15MM	73,150
N3BAS	62,790
KC1RWR	55,245
WA4AH	42,316
AB5NX	41,503

Single Operator Unlimited, Phone Only, QRP

W3EK	714
------	-----

Single Operator Unlimited, CW Only, High Power

W3GM (AA3B, op)	3,612,420
K1ZZ	3,229,876
K9CT	2,802,400
N5RZ	2,421,790
N9NC	1,993,522
K9NW	1,661,262
VE3NNT	1,657,611
K3WW	1,612,530
WM9C	1,541,365
VA7RR	1,532,500

Single Operator Unlimited, CW Only, Low Power

NY3A	1,841,231
K1XM	1,505,968
N2YO	1,035,230
N3RS	836,022
NE8P	682,500
VE3WUE	673,719
K0AD	515,124
KM4FOC	454,407
NJ3K	376,974
VE3MA	343,804

Single Operator Unlimited, CW Only, QRP

N4IJ	122,808
K4XL	28,548
WM0G	22,258
K2AL	14,469
K9AXT	11,920
KJ5T	11,528
VE3GMZ	5,488
KK4UZK	224

Multioperator, Single Transmitter, High Power

K3LR	4,897,198
K5TR	2,553,264
K8AZ	2,446,155
K9RS	2,311,770
N7DX	2,093,747
K8LX	1,711,800
N3BB	1,522,788
K4RM	1,445,895
AD4ES	1,436,736
KD1MC	1,309,763

Multioperator, Two Transmitter, Low Power

VE3EJ	3,388,704
NN3W	2,346,120
N9NB	2,224,300
K5WA	1,770,030
N4UU	1,360,918
W4AN	1,268,960
W4KFC	906,110
WG3J	678,912
K8LG	332,270
W1FM	223,040

Top Ten — Worldwide

Single Operator, Mixed Mode, High Power

CR6K (CT1ILT, op)	5,549,856
E7DX (E77DX, op)	4,681,280
ES7A (ES7GM, op)	4,243,316
RT4F (UA4FER, op)	3,926,160
8P5A	3,907,692
EW5A	3,796,500
RA9P	3,777,200
ND7K (N6MJ, op @N6WIN)	3,529,584
DJ5MW	3,383,859
VY2TT (K6LA, op)	3,370,960

Single Operator, Mixed Mode, Low Power

LZ8E (LZ2BE, op)	2,296,018
HA3NU	1,809,087
OL5Y (YL2GN, op)	1,560,216
N1UR	1,350,228
RG5A	1,256,224
WH7T (WH7W, op)	1,178,519
WW4XX (LZ4AX, op)	1,153,680
PY2NY	1,083,840
SO5CW	1,000,873
DG3T (DF5RF, op)	990,850

Single Operator, Mixed Mode, QRP

HG5D (HA8QZ, op)	767,600
HA5PP	560,456
HA5BA	453,474
VA2IW	108,194
JH7UJU	100,985
9A2EY	89,100
SP4LO	84,854
PY2PLL	71,862
SP4NKJ	57,564
HG7J	54,468

Single Operator, Phone Only, High Power

CQ9A (EW6W, op)	3,343,923
R3RZ	1,437,722
ED3C (EA3IBV, op)	1,196,384
F5LIW	987,530
RW9LL	663,780
T15VMJ	647,700
ZW5B (PY5CC, op)	633,532
IU8RIA	502,569
S51CK	499,056
W6AFA	485,692

Single Operator, Phone Only, Low Power

SP3H	755,000
M1T (M0KYB, op)	550,290
CT2HOV	464,784
UA3BL	451,503
ED3D (EA3AYQ, op)	278,694
EA3HXT	252,784
5B4AIF	244,816
KP4PUA	236,910
F4WDL	221,312
HP1XV	221,186

Single Operator, Phone Only, QRP

ES6RW	250,536
HB9EGA	78,720
DL3AN (UT1AN, op)	74,304
HA1TI	33,034
DL6MDG	32,109
IV3LNQ	29,674
GI7JYK (MI5JYK, op)	28,798
W6QU (W8QZA, op)	16,912
DL5EC	16,348
JA2MWW	15,500

Single Operator, CW Only, High Power

P44W (W2GD, op)	4,131,068
K5GN	3,105,384
VE3JM	3,082,560
N9RV	2,709,018

KH7Q (N6TV, op @KH6YY)	2,500,680
NA8V	2,407,208
W1KM	2,397,549
KP2M (KT3Y, op)	2,372,211
R3ZZ	2,059,753
N2MF	1,838,850

Single Operator, CW Only, Low Power

PZ5DX (RA3CO, op)	3,090,464
UB7K	2,146,230
DM7A (DL3JAN, op)	1,771,845
4Z4AK	1,581,848
WC1M	1,070,320
VE3TM	1,064,860
LA2AB (SP2ASJ, op)	957,336
OM7K (OM7RU, op)	925,169
YL5W (YL2GN, op)	892,000
M5W	871,872

Single Operator, CW Only, QRP

ES2MC	449,376
YL3FW	307,065
LZ2RS	305,577
OK2MPB	185,444
W1FJ	180,558
K8CN	117,593
JQ1NGT	111,240
UR5FEO	108,250
SQ2ICX	105,600
SM0GNS	104,958

Single Operator Unlimited, Mixed Mode, High Power

E8ARM	5,289,799
R2AA	5,061,960
OG1F (OH1TM, op)	4,052,680
VA2WA	3,761,648
NP4Z	3,760,923
HG3N	3,698,524
ED8M	3,392,887
LY4A	3,269,700
N2IC	3,259,524
K1LZ	3,203,840

Single Operator Unlimited, Mixed Mode, Low Power

SP9XCN	1,509,072
G0MTN	1,391,104
G3VWW	1,360,000
PA6Z (PA9M, op)	1,185,185
M3AWD	1,166,157
HA9A (HA9AX, op)	1,151,970
LY7R (LY2BKT, op)	1,054,110
OK6Y (OK2PTZ, op)	1,021,992
ED3Z (EA3DZ, op)	1,001,268
E70X	946,096

Single Operator Unlimited, Mixed Mode, QRP

HA8TA	623,806
UR2Y (US0YW, op)	437,090
C37AC (EA3Q, op)	278,784
UX9Q (UR9QQ, op)	267,120
YU1A (YU1LM, op)	256,620
PC2F	169,878
DD0VS	161,814
DA2A	153,111
BI3BX	104,397
DL6OCH	95,488

Single Operator Unlimited, Phone Only, High Power

CR3Y (OM2KW, op)	3,721,140
HA5JI	2,999,642
OR1X	2,231,999
SN7D (SQ7D, op)	2,065,755
RA3OA	1,932,524
9Z4BM (N2TTA, op)	1,842,547
ED7O (EA7EU, op)	1,751,505
A42K (A41CK, op)	1,493,268
IK0PHY	1,476,876
Y07WC	1,352,792

Single Operator Unlimited, Phone Only, Low Power

UZ7C (UT9CZ, op)	865,340
ZV1T (PP1WW, op)	572,760
SV3RPQ	570,472
5K3L (HK3EA, op)	472,560
SN7T (SQ7OTK, op)	351,864
UA9R	315,248
4M5A (YV5RAB, op)	256,601
SO7E	251,502
DF0PW (DK7AM, op)	249,426
SP3WKW	246,698

Single Operator Unlimited, Phone Only, QRP

Y08WW	345,862
YO8OLY	16,897
ON5LS	16,728
M11M	8,128
G1WVK	3,650

Regional Leaders

Boxes list call sign, score, and class: MSHP = Multioperator, Single Transmitter, High Power; M2LP = Multioperator, Two Transmitter, Low Power; SO-CW-HP = Single Operator, CW Only, High Power; SO-CW-LP = Single Operator, CW Only, Low Power; SO-CW-QRP = Single Operator, CW Only, QRP; SO-MIX-HP = Single Operator, Mixed Mode, High Power; SO-MIX-LP = Single Operator, Mixed Mode, Low Power; SO-MIX-QRP = Single Operator, Mixed Mode, QRP; SO-PH-HP = Single Operator, Phone Only, High Power; SO-PH-LP = Single Operator, Phone Only, Low Power; SO-PH-QRP = Single Operator, Phone Only, QRP; SOU-CW-HP = Single Operator Unlimited, CW Only, High Power; SOU-CW-LP = Single Operator Unlimited, CW Only, Low Power; SOU-CW-QRP = Single Operator Unlimited, CW Only, QRP; SOU-MIX-HP = Single Operator Unlimited, Mixed Mode, High Power; SOU-MIX-LP = Single Operator Unlimited, Mixed Mode, Low Power; SOU-MIX-QRP = Single Operator Unlimited, Mixed Mode, QRP; SOU-PH-HP = Single Operator Unlimited, Phone Only, High Power; SOU-PH-LP = Single Operator Unlimited, Phone Only, Low Power, and SOU-PH-QRP = Single Operator Unlimited, Phone Only, QRP.

West Coast Region

(Pacific, Northwestern, and Southwestern Divisions; Alberta, British Columbia, and TER Sections)

ND7K (N6MJ, op @ N6WIN)	3,529,584	SO-MIX-HP	K6KTS	24,882	SO-PH-LP	WB6BDD	492	SO-CW-QRP	WZ8T	84,330	SOU-PH-LP
NT6Q (N5ZO, op @ WA6TQT)	2,456,430	SO-MIX-HP	K7FWP	21,417	SO-PH-LP	KN6ZOO	52	SO-CW-QRP	K7VAP	23,922	SOU-PH-LP
K6XX	1,675,080	SO-MIX-HP	W6MX	10,800	SO-PH-LP	W9CF	27	SO-CW-QRP	KE7NGO	11,550	SOU-PH-LP
W9KKN	416,109	SO-MIX-HP	NZ2S	10,664	SO-PH-LP	NK6A	160,480	SOU-MIX-HP	K2MMT	1,764	SOU-PH-LP
VE7BC	185,409	SO-MIX-HP	W6QU			N6GEO	45,432	SOU-MIX-HP	NS7U	1,394	SOU-PH-LP
K6GHA	229,822	SO-MIX-HP	(W8QZA, op)	16,912	SO-PH-QRP	K6RIM	33,384	SOU-MIX-HP	VA7RR	1,532,500	SOU-CW-HP
WA7BNM	25,185	SO-MIX-LP	N9RV	2,709,018	SO-CW-HP	W6ML			VE7LWW	1,053,550	SOU-CW-HP
VA6RCN	22,848	SO-MIX-LP	K7NT	963,861	SO-CW-HP	(W6KC, op)	8,815	SOU-MIX-HP	K7QA	907,008	SOU-CW-HP
N2JNR	21,982	SO-MIX-LP	W7RM			WT8P	2,470	SOU-MIX-HP	K7WP	304,121	SOU-CW-HP
N9BD	16,218	SO-MIX-LP	(N6TR, op)	626,472	SO-CW-HP	KN6VQ	129,440	SOU-MIX-LP	VA7KO	280,917	SOU-CW-HP
W6AFA	485,692	SO-PH-HP	N6AA	307,998	SO-CW-HP	WU8T	51,336	SOU-MIX-LP	NU6N	150,684	SOU-CW-LP
KE8FT	194,228	SO-PH-HP	N6KI	283,936	SO-CW-HP	KA5WSS	5,904	SOU-MIX-LP	K7TQ	108,570	SOU-CW-LP
NN6U			N7VM	642,220	SO-CW-LP	VE7BGP	3,976	SOU-MIX-LP	WA0WWW	106,212	SOU-CW-LP
(@ K6MTU)	51,430	SO-PH-HP	WJ9B	478,116	SO-CW-LP	AB9BH	2,464	SOU-MIX-LP	K7NEW	52,437	SOU-CW-LP
N6PGQ	11,968	SO-PH-HP	W7YAO	326,451	SO-CW-LP	KN6ZZI	67,680	SOU-PH-HP	KI6OY	32,520	SOU-CW-LP
VE6LRR	7,596	SO-PH-HP	VE6BBP	299,420	SO-CW-LP	N7GCO	40,872	SOU-PH-HP	N7DX	2,093,747	MSHP
K7HKR	40,560	SO-PH-LP	KS7T	122,745	SO-CW-LP	K6DW	12,879	SOU-PH-HP	N6MI	464,156	MSHP
			N6HI	3,668	SO-CW-QRP	NT6X	8,066	SOU-PH-HP	VA7MM	9,810	MSHP
			N7JI	1,785	SO-CW-QRP	WA7BAM	330	SOU-PH-HP	W1DGL	16,414	M2LP

Midwest Region

(Dakota, Midwest, Rocky Mountain, and West Gulf Divisions; Manitoba and Saskatchewan Sections)

VE5CPU	15,960	SO-MIX-HP	K5TXJ	20,458	SO-PH-LP	K3PA	2,151,513	SOU-MIX-HP	W5IOH	17,710	SOU-PH-LP
WE9N	6,118	SO-MIX-HP	NW5Q	18,914	SO-PH-LP	KV0I	202,920	SOU-MIX-HP	K5DXR	11,448	SOU-PH-LP
K5BYN	4,900	SO-MIX-HP	W1JCW	14,560	SO-PH-QRP	K0TRL	26,000	SOU-MIX-HP	N5RZ	2,421,790	SOU-CW-HP
WOXM	4,452	SO-MIX-HP	WV0WOB	4,114	SO-PH-QRP	WD0GT	17,880	SOU-MIX-HP	NS0R	1,261,365	SOU-CW-HP
AD5A	886,512	SO-MIX-LP	K5GN	3,105,384	SO-CW-HP	N0RC	104,666	SOU-MIX-LP	N5TJ	398,385	SOU-CW-HP
N5AW	203,376	SO-MIX-LP	W0AAE	1,133,314	SO-CW-HP	K0MPH	67,235	SOU-MIX-LP	K0AP	346,632	SOU-CW-HP
K0EA	177,112	SO-MIX-LP	N4VI	201,344	SO-CW-HP	K0KX	61,789	SOU-MIX-LP	N0AT	303,050	SOU-CW-HP
KA8HDE	101,136	SO-MIX-LP	K5BG	132,400	SO-CW-HP	VE4DL	40,040	SOU-MIX-LP	K0AD	515,124	SOU-CW-LP
W0IZ	83,505	SO-MIX-LP	K5RX	127,203	SO-CW-HP	W0ADL	21,700	SOU-MIX-LP	A160	172,770	SOU-CW-LP
N0LMQ	3,640	SO-MIX-QRP	NN5T	228,490	SO-CW-LP	N0GJW			KE0IAT	155,257	SOU-CW-LP
AD5XD	286,615	SO-PH-HP	N5XE	137,228	SO-CW-LP	(@ W3ACO)	116,116	SOU-PH-HP	AD1C	135,040	SOU-CW-LP
VE4SG	124,696	SO-PH-HP	K0XF	122,040	SO-CW-LP	AE0MO	50,668	SOU-PH-HP	W2UP	93,366	SOU-CW-LP
K9MWM	76,960	SO-PH-HP	KD2KW	104,400	SO-CW-LP	WA0O	36,504	SOU-PH-HP	KJ5T	11,528	SOU-CW-QRP
KA9OZP	21,784	SO-PH-HP	N5JJ	97,730	SO-CW-LP	N5WQ	8,075	SOU-PH-HP	K5TR	2,553,264	MSHP
KD0JLE	12,240	SO-PH-HP	W0DCX	4,386	SO-CW-QRP	W5ABA	7,332	SOU-PH-HP	N3BB	1,522,788	MSHP
K5DHY	70,348	SO-PH-LP	W0LLN	2,268	SO-CW-QRP	K15MM	73,150	SOU-PH-LP	K5WA	1,770,030	M2LP
W5GUZ	37,012	SO-PH-LP	N9HDE	549	SO-CW-QRP	AB5NX	41,503	SOU-PH-LP			
K10R	28,764	SO-PH-LP	N2IC	3,259,524	SOU-MIX-HP	N7MZW	17,888	SOU-PH-LP			

Central Region

(Central and Great Lakes Divisions; Ontario East, Ontario North, Ontario South, and Golden Horseshoe Sections)

VA3CK	36,270	SO-MIX-HP	N9EAX	19,825	SO-PH-LP	NE9U	932,340	SOU-MIX-LP	WI9WI	628,854	SOU-CW-HP
AC9S	14,469	SO-MIX-HP	VE3GJP	18,684	SO-PH-LP	W9HT	50,320	SOU-MIX-LP	VE3WUE	673,719	SOU-CW-LP
VE3TAZ	14,465	SO-MIX-HP	VA3GMO	2,835	SO-PH-QRP	NC8R	1,755	SOU-MIX-LP	VE3MA	343,804	SOU-CW-LP
KE8E	1,672	SO-MIX-HP	VE3JM	3,082,560	SO-CW-HP	N9VPV	217	SOU-MIX-LP	VE3MV	302,499	SOU-CW-LP
VE3KOT	234,883	SO-MIX-LP	NA8V	2,407,208	SO-CW-HP	KB8ZYE	66	SOU-MIX-LP	AB9YC	269,808	SOU-CW-LP
VE3UZ	115,280	SO-MIX-LP	K8GL	647,472	SO-CW-HP	K8ZT	1,968	SOU-MIX-QRP	KY0Q	250,800	SOU-CW-LP
VE3RRD	42,912	SO-MIX-LP	K8MP	223,008	SO-CW-HP	N8BI	186,098	SOU-PH-HP	VE3GMZ	5,488	SOU-CW-QRP
W9QL	36,419	SO-MIX-LP	VE3KP	203,412	SO-CW-HP	W9NZ	162,162	SOU-PH-HP	K8AZ	2,446,155	MSHP
N9TTX	25,935	SO-MIX-LP	VE3TM	1,064,860	SO-CW-LP	KE8VAM	34,587	SOU-PH-HP	K8LX	1,711,800	MSHP
K9LOE	288,860	SO-PH-HP	KV8Q	301,165	SO-CW-LP	VA3IDD	126,904	SOU-PH-LP	NV9L	1,004,479	MSHP
VA3ZNQ	61,320	SO-PH-HP	N8PE	249,751	SO-CW-LP	NQ9N	116,025	SOU-PH-LP	VE3MIS	247,877	MSHP
KE8NBC	55,104	SO-PH-HP	W1NN	191,864	SO-CW-LP	W8AIT	8,177	SOU-PH-LP	VE3PRD	38,488	MSHP
VE3BFFU	2,080	SO-PH-HP	VE3FH	168,069	SO-CW-LP	KE8JUNU	5,049	SOU-PH-LP	VE3EJ	3,388,704	M2LP
N9UX	184	SO-PH-HP	K9OM	1,236,898	SOU-MIX-HP	W7BAZ	288	SOU-PH-LP	N9NB	2,224,300	M2LP
W8LYO	56,908	SO-PH-LP	W8MJ	693,121	SOU-MIX-HP	K9CT	2,802,400	SOU-CW-HP	K8LG	332,270	M2LP
VE3RVZ	42,042	SO-PH-LP	AJ9C	533,957	SOU-MIX-HP	K9NW	1,661,262	SOU-CW-HP	W8BAP	16,400	M2LP
KE8YXW	26,312	SO-PH-LP	KG9N	323,183	SOU-MIX-HP	VE3NNT	1,657,611	SOU-CW-HP			
			K9WO	233,930	SOU-MIX-HP	WM9C	1,541,365	SOU-CW-HP			

Regional Leaders (continued)

Southeast Region

(Delta, Roanoke, and Southeastern Divisions)

AA4NC (N4YDU, op)	3,008,544	SO-MIX-HP	W9TCV	51,944	SO-PH-LP	N1RM	201,609	SOU-MIX-HP	W1RCR	707,880	SOU-CW-HP
K4ZW	2,481,388	SO-MIX-HP	KB4LOA	51,744	SO-PH-LP	AA4GA	153,912	SOU-MIX-HP	N4KH	561,798	SOU-CW-HP
NN7CW	2,116,128	SO-MIX-HP	NN4SS	223,608	SO-CW-HP	WN4AFP	413,080	SOU-MIX-LP	N2YO	1,035,230	SOU-CW-LP
K4AB	1,844,280	SO-MIX-HP	W8FN	170,800	SO-CW-HP	W6FB	239,104	SOU-MIX-LP	NE8P	682,500	SOU-CW-LP
A14WW	221,107	SO-MIX-HP	W3TB	89,345	SO-CW-HP	W4IPC	113,784	SOU-MIX-LP	KM4FOC	454,407	SOU-CW-LP
WW4XX (LZ4AX, op)	1,153,680	SO-MIX-LP	N4XD	70,400	SO-CW-HP	W4LT	111,296	SOU-MIX-LP	K3IE	316,975	SOU-CW-LP
WQ5L	243,449	SO-MIX-LP	NO5W	66,150	SO-CW-HP	KE4EA	70,252	SOU-MIX-LP	WA1S	266,900	SOU-CW-LP
AB3AI	57,967	SO-MIX-LP	WB4TDH	429,020	SO-CW-LP	NA4DA	322,138	SOU-PH-HP	N4IJ	122,808	SOU-CW-QRP
N4QI	41,720	SO-MIX-LP	KE4R	265,073	SO-CW-LP	K4BBH	102,794	SOU-PH-HP	K4XL	28,548	SOU-CW-QRP
W4BHI	20,672	SO-MIX-LP	K3TW	258,210	SO-CW-LP	K4QQG	88,504	SOU-PH-HP	K9AXT	11,920	SOU-CW-QRP
N4MM	138,480	SO-PH-HP	K4EJ	231,700	SO-CW-LP	WW5L	42,940	SOU-PH-HP	KK4UZK	224	SOU-CW-QRP
WV4E	115,440	SO-PH-HP	WA5SOG	228,096	SO-CW-LP	N5GI	41,028	SOU-PH-HP	K4RM	1,445,895	MSHP
K4JC	43,710	SO-PH-HP	AA4SD	36,427	SO-CW-QRP	WS4AM	105,716	SOU-PH-LP	AD4ES	1,436,736	MSHP
N4MMR	37,275	SO-PH-HP	N7RCS	15,698	SO-CW-QRP	WA4AH	42,316	SOU-PH-LP	K5KG	1,180,850	MSHP
AB4EJ	37,248	SO-PH-HP	W4JM	5,017	SO-CW-QRP	N4BQQ	40,812	SOU-PH-LP	K3QH	195,174	MSHP
KF8N	134,784	SO-PH-LP	N4NM	1,485	SO-CW-QRP	AI4DB	38,184	SOU-PH-LP	W4MLB	72,558	MSHP
WA3LXD	129,686	SO-PH-LP	KE4WKH	320	SO-CW-QRP	K7WWR	22,780	SOU-PH-LP	NN3W	2,346,120	M2LP
KO4GAR	91,650	SO-PH-LP	NO9E	729,105	SOU-MIX-HP	W4NZ	1,068,382	SOU-CW-HP	N4UU	1,360,918	M2LP
			KI5GTR	365,379	SOU-MIX-HP	KM5G	923,281	SOU-CW-HP	W4AN	1,268,960	M2LP
			NF4A	287,313	SOU-MIX-HP	WO4O	800,454	SOU-CW-HP	NN4SA	42,185	M2LP

Northeast Region

(New England, Hudson, and Atlantic Divisions; New Brunswick, Newfoundland and Labrador, Nova Scotia, Prince Edward Island, and Quebec Sections)

VY2TT (K6LA, op)	3,370,960	SO-MIX-HP	KC1QEM	29,264	SO-PH-LP	W3PU (K08SCA, op)	1,774,535	SOU-MIX-HP	N9NC	1,993,522	SOU-CW-HP
K5ZD	3,322,970	SO-MIX-HP	WB2KLD	28,674	SO-PH-LP	W1GD	1,483,182	SOU-MIX-HP	K3WW	1,612,530	SOU-CW-HP
N2NT	2,903,103	SO-MIX-HP	VA2YLB	1,633	SO-PH-QRP	VE9AA	942,312	SOU-MIX-LP	VE9HF	1,349,920	SOU-CW-HP
W2XL	104,842	SO-MIX-HP	W1KM	2,397,549	SO-CW-HP	VA2CZ	426,384	SOU-MIX-LP	NY3A	1,841,231	SOU-CW-LP
N2AXX	8,190	SO-MIX-HP	N2MF	1,838,850	SO-CW-HP	AA3R	425,204	SOU-MIX-LP	K1XM	1,505,968	SOU-CW-LP
N1UR	1,350,228	SO-MIX-LP	AA1K	1,157,358	SO-CW-HP	WA2JQK	156,808	SOU-MIX-LP	N3RS	836,022	SOU-CW-LP
KD4D	866,725	SO-MIX-LP	KR2AA	460,085	SO-CW-HP	WB2NVR	55,590	SOU-MIX-LP	NJ3K	376,974	SOU-CW-LP
K3KU	113,454	SO-MIX-LP	K3UL	443,265	SO-CW-HP	K3ZU	444,860	SOU-PH-HP	K2ZR	275,814	SOU-CW-LP
N1NQD	89,570	SO-MIX-LP	WC1M	1,070,320	SO-CW-LP	VE2CSM	164,588	SOU-PH-HP	WM0G	22,258	SOU-CW-QRP
KA2FIR	79,236	SO-MIX-LP	K1VUT	811,605	SO-CW-LP	VE2NTT	117,438	SOU-PH-HP	K2AL	14,469	SOU-CW-QRP
VA2IW	108,194	SO-MIX-QRP	K1TR	234,362	SO-CW-LP	AE1P	115,272	SOU-PH-HP	K3LR	4,897,198	MSHP
VE9QR	4,550	SO-MIX-QRP	N1QY	136,210	SO-CW-LP	W3ICM	105,222	SOU-PH-HP	K9RS	2,311,770	MSHP
VE2HTC	53,820	SO-PH-HP	K1EP	134,406	SO-CW-LP	VE9CZ	96,928	SOU-PH-LP	KD1MC	1,309,763	MSHP
W3FLH	53,418	SO-PH-HP	W1FJ	180,558	SO-CW-QRP	N3BAS	62,790	SOU-PH-LP	W2A	1,302,245	MSHP
KG1K	16,371	SO-PH-HP	K8CN	117,593	SO-CW-QRP	KC1RWR	55,245	SOU-PH-LP	K3CCR	423,645	MSHP
KB2DX	10,580	SO-PH-HP	W7LG	23,316	SO-CW-QRP	KC1OXM	8,126	SOU-PH-LP	W4KFC	906,110	M2LP
KC3RRF	8,484	SO-PH-HP	N2JJ	22,635	SO-CW-QRP	VA2SCJ	6,900	SOU-PH-LP	WG3J	678,912	M2LP
KS2G	75,952	SO-PH-LP	NQ2W	13,524	SO-CW-QRP	W3EK	714	SOU-PH-QRP	W1FM	223,040	M2LP
K3SNO	49,203	SO-PH-LP	VA2WA	3,761,648	SOU-MIX-HP	W3GM			W3URL	182,409	M2LP
W1JIM	46,495	SO-PH-LP	K1LZ	3,203,840	SOU-MIX-HP	(AA3B, op)	3,612,420	SOU-CW-HP	WA2QAU	107,016	M2LP
			K3MM	2,790,936	SOU-MIX-HP	K1ZZ	3,229,876	SOU-CW-HP			



Ronald Harps, K8NZ (left), and Dan Kovatch, W8CAR (right), operated at Tom Lee's, K8AZ, station. The K8AZ team finished in third place, W/VE in the Multioperator, Single Transmitter category. [Chris Plumblee, W4WF, photo]

The April 2025 ARRL Rookie Roundup — Phone

1800 UTC – 2359 UTC, Sunday, April 13

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

Rookies make as many contacts as possible during this 6-hour event. Rookies work everyone, and non-Rookies work only Rookies. The exchange is your name, call sign, a two-digit year, and state (US or Mexican), Canadian province, or “DX.”

You can enter as a Rookie if:

- ♦ You made, or will make, your first-ever contact this year or during the previous 3 calendar years (send the last two digits of the year of your first contact in your exchange).
- ♦ You haven't made any contest contacts using the contest mode (Phone) before (send the last two digits of the current year in your exchange).

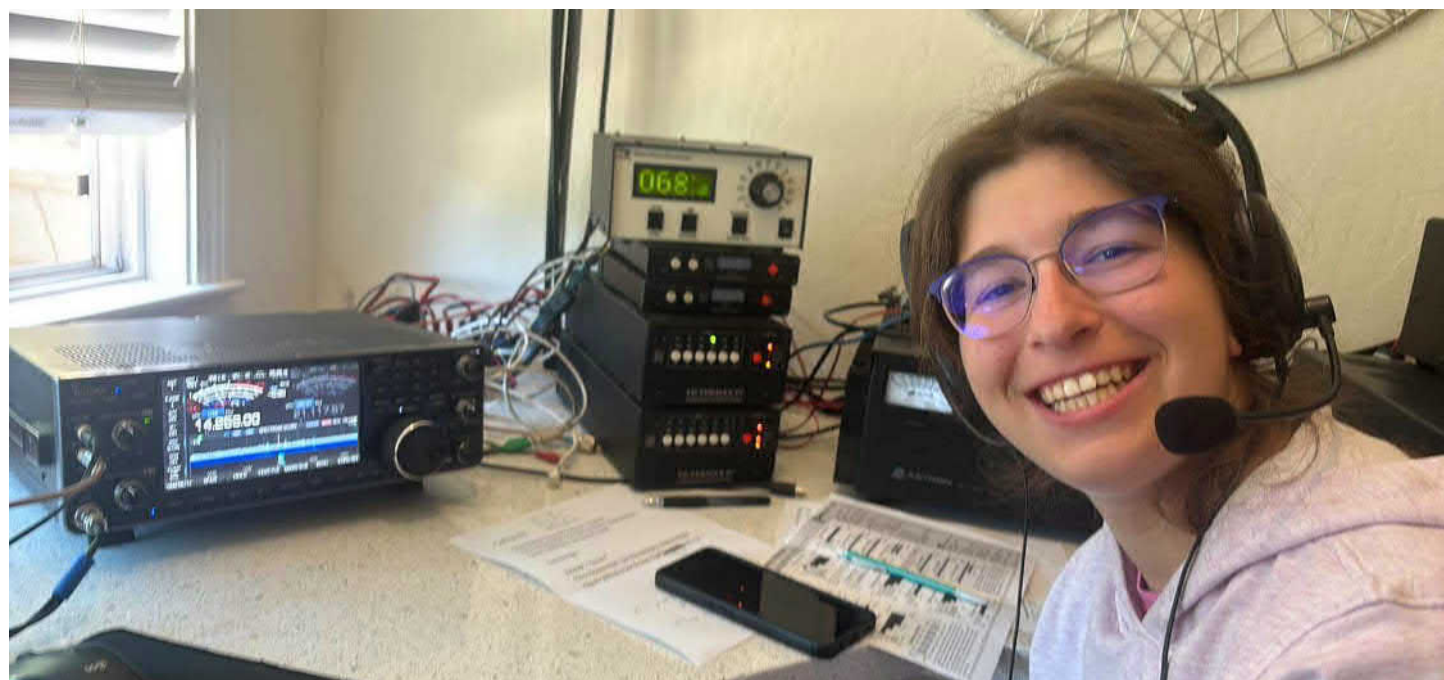
If you are a non-Rookie, send the last two digits of the year of your first license.

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

As a non-Rookie, you can join the fun by calling “CQ Rookies,” encouraging the Rookie operators to call you.

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

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



Angelica Lanfranconi, KN6NAM, participated in her first ARRL Rookie Roundup with her father Max, W6BG, at Tom McShane's, NW6P, station. She placed first in the sixth call area in the Single Operator category. [Max Lanfranconi, W6BG, photo]



Certificate of Code Proficiency Recipients

Sponsored by



www.i2rtf.com

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

June 2024

Robin L. Zinsmaster, N6PHP 25

July 2024

Theodore J. Jacobson, N6ZO 10

Jerry K. Nobles, N5MES 10

Charlene K. Lewis, K8XCO 15

David R. Koberstein, N9DK 20

August 2024

Thomas H. Busch, WB8WOR 10

Jeanne Martin, KC1SPX 10

Thomas S. Wright, ND9Z 10

Richard McCleaf, K3EYJ 15

Stephen C. Brandt, N7VS 30

George I. Levy, NC2M 30

Stephen C. Brandt, N7VS 35

September 2024

Tony Levenson, W4FRV 10

David E. McNeill, N7WMN 10

David W. Risik, WA3HSC 10

Sherrick A. Slattery, KA6NZB 10

Mark C. Guenther, WB7TLK 20

Robert Harrington, VE3OU 20

October 2024

Daniel L. Schaible, KD8UZS 10

John S. Hickman, WW3B 20

David R. Koberstein, N9DK 25

November 2024

Edward K. Metzler, KN9V 10

Paul B. Walp, WB6PIO 10

December 2024

Brian A. Bayani, KT3X 10

Gary L. Carlson, KF5NV 10

Barry G. Fluxe, W4LSV 10

Barry G. Fluxe, W4LSV 15

Franz Willy Odenthal, DK5EQ 15

Kurt Hohler, HB9FMJ 20

Jonathan Leung, VA7JC 20

Gary W. Stephan, AE4GS 20

Kurt Hohler, HB9FMJ 25

Congratulations to all of the recipients.

March 2025 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.

March Qualifying Runs will be transmitted by W1AW in Newington, Connecticut, at the times shown on 1.8025, 3.5815, 7.0475, 14.0475, 18.0775, 21.0675, 28.0675, 50.350, and 147.555 MHz. The West Coast Qualifying Runs will be transmitted by K9JM on Wednesday, March 19, at 9 PM PDT (0400 UTC on March 20) on 3590 kHz. Unless indicated otherwise, sending speeds are from 40 to 10 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 text will be checked against the actual transmissions to determine if you have qualified.

Members of the North Fulton (Georgia) Amateur Radio League (<https://nfarl.org>) are offering to subsidize the total cost of a Code Proficiency certificate or endorsement submission for any

individual age 21 years and younger, and who reside in either the US or Canada. Participants who wish to make use of this offer should indicate on their Qualifying Run submissions they are age 21 or younger, and certify as such via their signature. Eligible participants are not required to send any fee with their Code Proficiency submissions.

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

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



W1AW Qualifying Runs — March 2025 (All times are in Eastern Daylight Time. Blue indicates Eastern Standard Time.)				
Monday	Tuesday	Wednesday	Thursday	Friday
		3/5 4 PM – 2100Z 10 – 35 WPM	3/6 10 PM – 0300Z (3/7 – UTC) 10 – 40 WPM	3/7 9 AM – 1400Z 10 – 35 WPM
	3/11 10 PM – 0200Z (3/12 – UTC) 10 – 35 WPM	3/12 7 PM – 2300Z 10 – 40 WPM	3/13 9 AM – 1300Z 35 – 10 WPM	
	3/18 9 AM – 1300Z 10 – 35 WPM		3/20 10 PM – 0200Z (3/21 – UTC) 35 – 10 WPM	3/21 4 PM – 2000Z 10 – 40 WPM
3/24 10 PM – 0200Z (3/25 – UTC) 10 – 40 WPM	3/25 7 PM – 2300Z 10 – 35 WPM	3/26 9 AM – 1300Z 35 – 10 WPM	3/27 4 PM – 2000Z 35 – 10 WPM	

Club Station

Teaming Up for Radio Merit Badges

Amateur radio clubs are ideally suited to assist Scouts in earning their Radio Merit Badges. Not only do they have a wealth of knowledge among their members, but clubs can also tap local resources to help make their efforts successful. This month, John O'Brien, K3LO, describes how his club did it, not just once, but 2 years in a row.

The Montgomery Amateur Radio Club (MARC), in Montgomery County, Maryland, is an ARRL Special Service Club that was founded in September 1966. MARC's Education Committee Chairman, David Bern, W2LNX, conducts regularly scheduled licensing classes and licensing examinations for which he is always on the lookout for a venue.

David discovered the Rockville Science Center, a nonprofit organization located in Rockville, Maryland, which provides programs and conducts special events. Howard Lichtman, KC3LUE, the Program Coordinator for the Rockville Science Center, graciously made the interactive space available to David for MARC's licensing classes and examinations.

During his conversations with Howard, David learned that there was a demand for the Scouting America Radio Merit Badge, which has four options: Amateur Radio, Broadcasting, Shortwave Listening, and

Amateur Radio Direction Finding. All options require the Scout to have knowledge of several radio-related subjects. All options also require an on-site visit to an actual radio installation, such as an amateur radio station, a broadcast station, or a public safety communications center. The amateur radio option requires the Scout to make an on-air contact.

David began planning a Radio Merit Badge program to be conducted during MARC's 2023 ARRL Field Day operation. This would allow a Scout to complete all of the requirements for the Radio Merit Badge on the same day at one location.

Joint Field Days

For the past 11 years, MARC has partnered with the Damascus Emergency Communications Team (DECT) to conduct joint ARRL Field Day operations. DECT is operated by the Damascus Volunteer Fire Department and provides emergency communications support for the department. The MARC/DECT Field Day operation takes place at the Damascus Volunteer Fire Department Activities Center in Damascus, Maryland.

David's plan involved covering the knowledge requirements with a PowerPoint presentation prepared by Gary Wilson, K2GW, of the K2BSA Amateur Radio Association. This presentation is available online at

<https://k2bsa.net/radio-merit-badge-2/>. The requirements for visits to a radio installation and on-air contacts would be satisfied by a visit to one of the MARC or DECT Field Day stations.

Howard and the Rockville Science Center were publicizing the Radio Merit Badge program and accepting registrations. Howard also made arrangements for adult leaders from the Seneca District of Scouting America to provide supervision and oversight.



David Bern, W2LNX, supervises Scouts Pierce and Weston Pollard as they make contacts.



David Bern, W2LNX (left), and Howard Lichtman, KC3LUE, set up a Field Day station for Scout contacts.

The inaugural Radio Merit Badge program took place on June 24, 2023, at the MARC/DECT Field Day site. Forty-two Scouts attended. Forty Scouts completed all requirements for the Radio Merit Badge at the 2023 MARC/DECT Field Day. The other Scouts completed all requirements shortly thereafter.

ARRL Field Day 2024 and Beyond

Based upon the success of the 2023 program, and upon learning that there was a continuing demand for the Radio Merit Badge, MARC and DECT decided to repeat the Radio Merit Badge program at the 2024 MARC/DECT Field Day operation.

The Alfred E. Friend, Jr., W4CF, Educational Activities Fund, which is administered by the ARRL Foundation, generously awarded a grant to cover the costs of instructional materials for the Radio Merit Badge program. The grant enabled John to compose a comprehensive handout that covered all the knowledge requirements for the Radio Merit Badge and to have it commercially printed.

The Radio Merit Badge program was held on June 22, 2024, at the MARC/DECT Field Day site at the Damascus Volunteer Fire Department Activities Center. As the Scouts arrived, they were greeted by MARC members and were given a double-pocket folder with the handout and an amateur radio station log sheet inside. Sixty Scouts showed up. Adult leaders from the

Seneca District were there to provide supervision and oversight.

After lunch, the Scouts went to one of the Field Day stations. MARC or DECT members explained how the stations worked and mentored the Scouts as they made their contacts.

MARC and DECT members who were at the Field Day site brought handheld transceivers for the Scouts to use. Members who were not at the Field Day site monitored one VHF-FM and two UHF-FM repeaters for contacts with the Scouts.

Fifty-eight Scouts completed all requirements for the Radio Merit Badge at the 2024 MARC/DECT Field Day. The other two Scouts arranged to complete the remaining requirements at the Rockville Science Center.

MARC and DECT will repeat the Radio Merit Badge program at the 2025 MARC/DECT Field Day on Saturday, June 28, 2025.

All photos provided by the author.

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.arrl.org/ssc-application for more information about this program. Below is a list of new and renewing SSCs as of December 30, 2024.



Renewing SSCs

Cuyahoga Falls ARC, W8VPV
Keystone VHF Club, W3HZU

Cuyahoga Falls, OH
York, PA

Sign Up for ARRL Club News

Read the monthly *ARRL Club News* e-newsletter to find out more about what clubs are doing to advance amateur radio in their communities and within the hobby. To opt in to monthly email delivery of *ARRL Club News*, log in to www.arrl.org and select "E-Newsletters and Notifications" on your account web page.

Ham Media Playlist

KK6USY Ham Radio Adventures

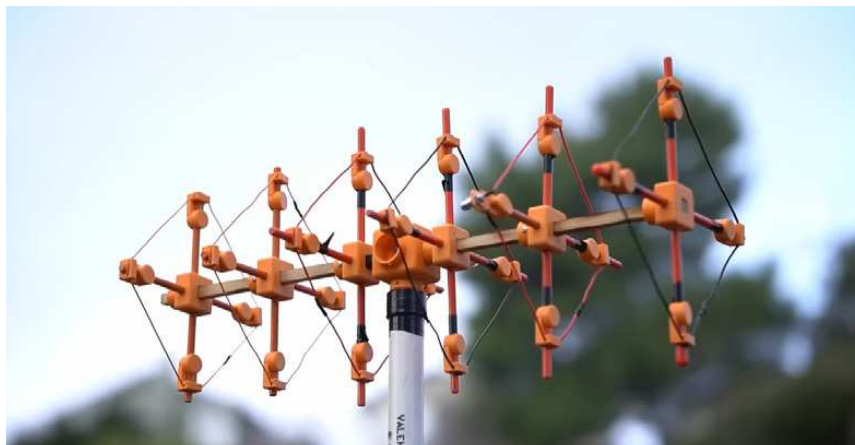
Chuck Thompson, KK6USY, started his adventure into the world of radio when he was in high school, taking an interest in CB radio. Chuck's father had purchased a new radio and antenna, and Chuck helped him install it on the house. As he listened to people on the radio, his curiosity grew.

Later in life, Chuck worked for the fire department and was given an old CB antenna from people he served on a medical call. While doing research on how to restore the antenna, he stumbled across **www.dxwatch.com**. Chuck joined a group of CB and ham radio operators and started learning about amateur radio.

Creating a YouTube Channel

As the 11-meter band slowly died out, Chuck wanted more. He found a site where he could take his amateur radio exam and passed. Having already obtained a Kenwood TS-430S, Chuck knew how to listen to people on the bands, but still didn't understand how to operate the radio otherwise. He had made friends with Gary Killion, W9FNB, while on **www.dxwatch.com**, and Gary became Chuck's mentor, helping him find his way into amateur radio.

As Chuck's interest in amateur radio grew, he started experimenting and building antennas. His friends



Chuck's, KK6USY, completed cubical quad antenna.

often encouraged him to share some of his builds on video. It wasn't until he went on a Summits on the Air (SOTA) trip to Mt. Pacifico with several ham radio operators, including Josh Nass, KI6NAZ, from the Ham Radio Crash Course channel, along with several other YouTube content creators, that Chuck really started to consider creating a YouTube channel. After watching some of the videos that the group of SOTA activators posted, Chuck created his channel, "KK6USY Ham Radio Adventures" (**www.youtube.com/@KK6USYHamRadioAdventures**).

Antenna Builds

Chuck's channel currently has almost 16,000 subscribers. Many of his videos harken back to his early interest in antennas. He tries to create antenna build videos using items that many hams may already have at home, making it easier for the average person to try their hand at antenna building.

An example of Chuck combining everyday materials and other projects, such as 3D printing, to build an antenna is the video titled "DIY Cubical Quad Antenna anyone can Build!" (**https://tinyurl.com/kk6usy-quad**). Chuck starts by going to Home Depot to get pricing on the materials (for those who may not have the items for the build). In this video, Chuck steps viewers through the process of building a portable/hand-held cubical quad antenna.



Chuck, KK6USY, lays out and explains the equipment needed to build a rotatable dipole antenna.



Chuck, KK6USY, demonstrates drilling into the C channel while building his clamp.

Chuck explains some of the challenges he faced, such as when the poles he was using for spreaders were a different size than he had planned for. He demonstrates how he modified the 3D-printed hardware using *Tinkercad*, a free program for modeling 3D objects for printing. It's always nice when HamTubers keep these moments in their videos, as viewers often encounter

similar problems and can learn some strategies to work around them.

Keeping with his love of helping hams build inexpensive antennas, Chuck created the video "Build this cheap rotatable dipole. Great for Field Day and portable use!" (<https://tinyurl.com/kk6usy-dipole>) using plans from *The ARRL Handbook*. In this video, Chuck steps viewers through the build of a 10-meter dipole antenna that can also be used on 15, 17, and 20 meters using ½-inch electrical conduit, scrap wire that's similar to what most hams have on hand, and standard tools.

Chuck then explains hardware choices that he made and why he chose certain sizes. Understanding that hams may want to customize their builds rather than follow instructions verbatim, Chuck gives several options and ideas on how to attach wire to make the antenna resonant on various frequencies.

What good is an antenna without a great way to mount it and get it on the air? If you're crafty and have the right equipment, KK6USY Ham Radio Adventures has an option for you in the video titled "DIY C-clamp, How to build a C-clamp from c-channel for Wolf River Coil, MPAS, or just a outdoor light" (<https://tinyurl.com/kk6usy-clamp>).

Unlike most HamTube videos, this one has no talking. Chuck builds a beautiful clamp mount solution and shows viewers the build. Rather than talking, Chuck does some fantastic camera work and demonstrates the steps, setting the footage to music. This is a great way to foster ideas in viewers and spark their creativity. Note that this build is more involved than many of the builds on Chuck's channel, but the end result is amazing.

If you're looking for a fun channel that will make you want to get into the shack and build something new, check out KK6USY Ham Radio Adventures. Chuck is bound to have something for everyone.



Chuck, KK6USY, demonstrates the completed C-clamp antenna mount.

How's DX?

VU4 — The Andaman and Nicobar Islands



The Andaman and Nicobar Islands were on the first official list of entities for the ARRL International DX Contest, as well as the postwar DX Century Club (DXCC) list published in the February 1947 issue of *QST*. The islands are between the Bay of Bengal and the Andaman Sea, in CQ Zone 26. Currently, the Andaman and Nicobar Islands rank number 53 on Club Log's DXCC Most Wanted List. When I began DXing, it was on many top 10 lists, along with the Laccadive Islands (now called Lakshadweep, VU7).

Previous VU4 Activity

The first activation from VU4 was by VU2PB in Port Blair, around the same time that the postwar list was published. Also active that year was G3BMJ/VU4 on Nancowry Island, which is part of the Nicobar Islands. During the 1960s, DXpeditions were carried out by VU2ANI, VU2NRA, and VU2DIA. More Indian operators activated the islands in the early 1970s as VU9KV and VU7GV. VU2HMD/VU7, VU4APR, and VU4GDG were Andaman and Nicobar DXpeditions by teams from India during the mid-to-late 1980s. Many will remember the 2004 VU4NRO and VU4RBI DXpeditions conducted by members of the National Institute of Amateur Radio, when a major earthquake struck nearby Aceh, Indonesia. Shortly after, Devulapalli Bharathi, VU4RBI (VU2RBI), was on the air giving details of not only the earthquake, but the tsunami that followed. She was busy passing traffic to mainland India. Two years later, I had the pleasure of being one of the 30 international and almost 40 Indian operators conducting the VU4AN DXpedition. There has been an activation almost every other year since then: VU2MY and VU4RG (2008), VU4CB (2011), VU4CB and VU4KV (2014), VU4A and VU4I (2015), VU4YC (2017), VU4G (2018), VU4W (2022), VU4N (2023), and VU4A (2024).

Despite all of this somewhat recent activity, the Andaman and Nicobar Islands are still number 53 most wanted worldwide. The continental breakdown is 153 in Asia, 118 in Oceania, 69 in Europe, 67 in Africa, 49 in South America, and 33 overall in North America. They are 53 in the western half of North America, and 28 in the eastern half. By mode, the islands are 59

most wanted worldwide for CW, 57 for digital, and 54 for SSB.

March VU4X DXpedition

In July 2024, members of the DX Adventure team announced their plans to go to South Andaman Island in March 2025. They have previously been active as 4U100QO in 2023 and JW0X and JW100QO in 2022. This time, they will operate as VU4X on 160 – 10 meters on CW, SSB, FT4, FT8, and RTTY. You can see a list of their targeted transmit frequencies at www.dx-adventure.com/en/vu4x-hf-radio-setup.

Many have asked why they will not be on 6 meters, especially given that we are at the peak of Solar Cycle 25. Unfortunately, India allows only 25 W FM on 6 meters. The team has requested temporary permission for other modes and more power. As of press time, they have not received a final decision or positive response.

They plan to have six stations active around the clock. To do that, they will have 12 operators, including Marc, ON4AMX; Patrick, ON4HIL; Max, ON5UR; Pascal, ON5RA; Karel, ON5TN; Marc, ON6CC; Jonas, ON7FT; Geert, ON7USB; Franky, ON7RU; Francis, ON8AZ; Ron, PA3EWP, and Marcel, PA9M.

The VU4X team's antennas will include five-band Spiderbeams on the higher bands, verticals on 30, 60, 80, and 160 meters, and a four square on 40 meters. They will have separate receive antennas for the low bands.

The pilot stations (the people who are the liaisons between the DXpedition team and the DX community) will be Bjorn, ON9CFG, for Europe; Champ, E21EIC, for Asia, and Peter, W2IRT, for North America. Tim, M0URX, will be handling the QSL duties. You will need to use his online QSL reply system at www.m0urx.com/oqrs/logsearch.php. For the latest information about VU4X, watch the team's website at www.dx-adventure.com/en/home-eng or follow your favorite DX outlet.

DX News from Around the World

VK9 — Indian Ocean

A team of four Germans and two Australians are heading to the Indian Ocean to operate from both VK9 islands. Their first stop will be Christmas Island, and they'll be on the air as VK9XU from February 18 to March 4. The team includes leader Guenter, DL2AWG; Elmar, DF4GV; Heye, DJ9RR; Rainer, DL2AMD; Steve, VK6SJ, and Alan, VK6CQ (VKØLD). They will have three stations running around the clock on CW, SSB, RTTY, FT4, and FT8 (Fox and Hound or SuperFox). Listen for them on 160 – 6 meters. They can run only 400 W on SSB and 100 W on all other modes, per Australian law. For antennas, they will be using a hexbeam on 14 – 50 MHz, a DX Commander on 14 – 28 MHz, a rhombic on 24 and 18 MHz, a vertical for 1.8 and 3.5 MHz, a J-pole on 10 MHz, and a five-element Yagi for 50 MHz. After the Christmas Island operation, they will move to Cocos (Keeling), where they will be operating as VK9CU on March 4 – 11. QSL cards will be handled either directly or by DL2AWG via the German QSL bureau. Three months after the DXpedition, they will upload all contacts to Logbook of The World® (LoTW®). Updates for this double DXpedition can be found at www.qrz.com/db/VK9XU.



The Caribbean

World traveler Michael Noertemann, DF8AN, announced that he's headed back to the Caribbean. His first stop will be the French side of St. Martin on February 19 – 27, and he'll be primarily operating as FS/DF8AN. But during the French REF Contest, he'll be operating as TO8AN. After that, from February 28 to March 1, he'll be on the air as V26MN on Antigua. On March 1 – 9, Michael will be on Montserrat as VP2MMN before heading back to Antigua as V26MN on March 9 – 10. The end of his DXpedition will take him back to St. Martin as FS/DF8AN on March 10 – 11. Throughout his trip, watch for him on 80 – 6 meters on CW, digital modes, and maybe SSB. While operating as VP2MMN, Michael's main goal will be making contacts on 5 MHz, as well as focusing on Asia and Oceania on all bands. QSL directly — only to DF8AN.

TY — Benin

Gerard, aka "GG," F5NVF, will be on holiday operating as TY5C from January 10 to April 2, 2025. Look for him on CW and FT8 and, according to him, "very little SSB." He'll be on HF and possibly 6 meters. GG will have an Icom IC-7300 with wires and a Spiderbeam. QSL via F5RAV and then LoTW. He will be livestreaming the log at <https://clublog.org/livestream/TY5C>.



6Y — Jamaica

During the October 2024 DX Féile Convention, the EIDX Group (EIDXG) announced their upcoming 6Y7EI DXpedition to Jamaica. In a joint statement, EIDXG said, "Although Jamaica is #203 on [Club Log's DXCC Most Wanted] List, the group is expecting to have great pileups and a lot of fun." They plan to be on the air on March 12 – 24 on 160 through 6 meters. The operators will be Heye, DJ9RR; Enda, EI2II; Thos, EI2JD; Pete, EI4GZB; Jim, EI4HH; John, EI4L; Jeremy, EI5GM; Dermot, EI6FM; Charlie, EI8JB; David, EI3IXB; Declan, EI9HQ, and Ken, OZ1IKY. They added that their operating location will be from "the north side of the island, with large grounds and a sea path to North America and Europe." QSL via MØOXO.



QSL Bureau

Do you have DX QSL cards at your incoming QSL bureau? Do you have funds/envelopes on file so that your QSL bureau sorter can mail them to you? Everything you need to know about incoming and outgoing QSL bureaus can be found at www.arrl.org/qsl-service.

Wrap-Up

That's it for this month, with special thanks to DF8AN, DL2AWG, EIDXG, F5RAV, ON5UR, and *The Daily DX* for making this month's column possible. Please send your DX news, DX club newsletter, and photos to w3ur@arrl.org. Until next month, see you in the pileups! — *Bernie, W3UR*.

The World Above 50 MHz

New Year's 6-Meter F2, the Quadrantids, and Another Solar Peak

There were few F2 openings on 6 meters in December 2024. For most of the month, the solar flux was below the magic 200 level. Hopes were high after Christmas, as a big coronal mass ejection (CME) was predicted to impact at that time, but it didn't. A strong G4-class geomagnetic storm took place in the morning on New Year's Day, however, and it sparked F2 on 6 meters for North America. The CME that caused the storm struck on December 31. The impact initially looked like a dud, until the Bz went south, and solar wind poured in. From my location in Kansas, I noted that many strong Caribbean stations were in, such as FG5GH, J69DS, the J75K DXpedition, J73ESL, J88BTI, and several in Puerto Rico. At 1515 UTC, Jean-Pierre, P43A, appeared with a +19 dB signal, and I worked him. There were large pileups for the DX stations on 50.313 MHz. I checked 50.318 MHz for signals, but there was no one there.

A second CME impact took place on January 4 with a G1-class geomagnetic storm. This led to another good F2 opening, and I noted signals from PJ2/KB7Q, XE1L, YV5LMW, and call sign regions HC, HK, HP, KP4, and TI. I made a contact with HC1BI (FI09) at 1529 UTC.

HP2DFA created a large pileup, and there was strong F2 backscatter; I received backscatter stations ranging from K1TEO in New England to Arizona. Mike, KCØY, logged 5K6RM on FT8, and John Lock, KFØM, noted that 5K6RM later went to FT4. John operated on FT4 in December to work TO9W.

Great Conditions During Quadrantids

The Quadrantid meteor shower peaked on January 3 at around 1700 UTC, according to observers. Robert Wood, W5AJ, went to rare Fred Fish Memorial Award (FFMA) grid DM83 that morning and worked 55 stations on 6-meter meteor scatter, some via E_s, and two via F2. He also logged KP4AJ and NP4EI on MSK144, probably as a result of F2. In only 1 minute, I logged Robert on MSK144 at 1627 UTC — his signals were +14 dB! KFØM, KCØY, and WQØP worked W5AJ.

A Possible Second Solar Cycle Peak

In October 2024, the National Oceanic and Atmospheric Administration (NOAA) announced that we have reached the peak of Solar Cycle 25, and some pundits have said 6-meter operations will be heading downhill. But a second Solar Cycle 25 peak could be on the way. If you review the most recent solar cycles (21, 22, 23, and 24), you'll find that each has had two peaks. The second peaks of Solar Cycles 23 and 24 were stronger than their initial ones. Typically, the second peak of a solar cycle occurs about 2 years after the first. This is because sunspots appear on one hemisphere of the sun when a new solar cycle starts, and then they switch to the other hemisphere as the cycle progresses. This is known as *north – south hemispheric asymmetry*. So far, Solar Cycle 25's sunspots have been in the sun's southern hemisphere. If the northern solar hemisphere gets the number of sunspots we're seeing now, hams can look forward to another round of great operating conditions. On this topic, Carl



Robert Wood's, W5AJ, portable setup deployed in rare grid DM83 during the Quadrantids on January 3, 2025. [Robert Wood, W5AJ, photo]

Luetzelschwab, K9LA, said, “I think we’ll have to wait and see.”

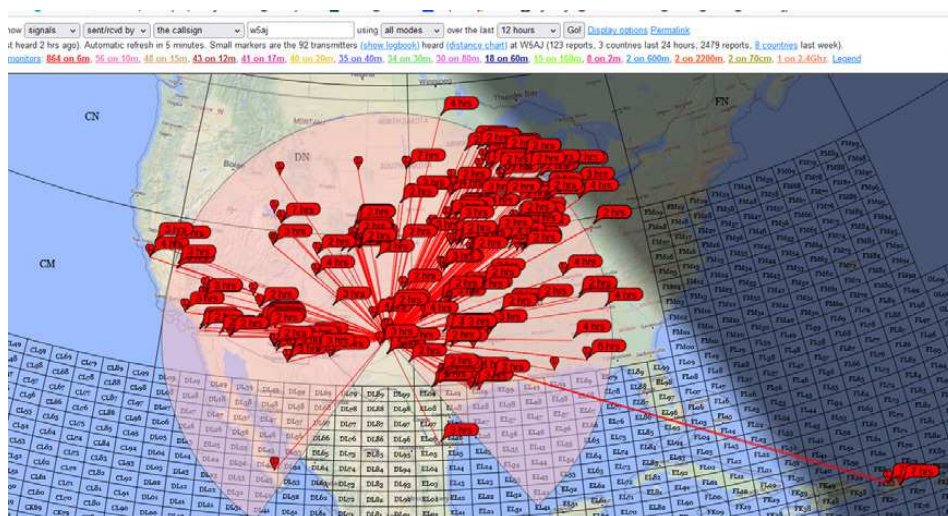
On the Bands

50 MHz. On the afternoon of December 1, Alaska was in to Colorado and Kansas. Jim, AD1C (DM79), noted Alaskan signals for more than an hour and a half. KF0M logged several. EA8AQV worked VU4A at 1707 UTC. On December 3, K1HTV worked EI4DQ. Larry Lambert, N0LL, was in grid EN20 on December 5. He made 25 contacts, which were all on FT8, except for one with K5XI (DM52) on Q65. Bill, K0DEQ, worked Larry on FT8 for a new FFMA grid. UT1FG/MM was in rare FFMA grid EL58, but he made only one contact. On December 9, Steve, NN4X, noted stations in from Europe via F2, including HA8CE in Hungary. Rich, K1HTV, had stations in from Germany and England (G4IFX, G4RRA) that day.

W5AJ went to rare grid DL79 during the Geminid meteor shower. Robert operated that Friday evening and made 33 contacts via MSK144, including one with KF0M and another with KC0Y. He observed that meteor-scatter conditions improved as the evening went on. He made two contacts from grid DM70 on his way home.

On December 19, I logged XE2KK (DL96) and N7BHC (EL15) via E_s . That afternoon, I noted a strong opening to Arizona and worked more than 20 stations, including N7NT (DM43), whose signal was +20 dB. On December 21, there was strong sporadic E across eastern North America that started shortly after sunrise.

Hawaii made a brief appearance in the Midwest that afternoon. Mike, KC0Y, and John, KF0M (both EM17), logged KH6TU on Maui. It’s unclear whether this was the result of multi-hop sporadic E or an E_s link to F2. I observed strong single-hop E_s to California at that time, and I worked Dan, NA6MG/P, in rare grid DM15. Dan was running 500 W to an M2 Antenna Systems 6M5XHP elevated 18 feet. He made 39 contacts from DM15, including one with KH6HI (BL01). Al, WA2VJL (EL16), also worked KH6HI. Mike and John later worked ZL7DX during a short opening that was likely the result of an E_s link to transequatorial propagation (TEP). Mike uses only a Moxon antenna. Ron, K3FR, reported a rare late-night sporadic-E opening to the



A PSK Reporter screenshot taken during Robert Wood’s, W5AJ, portable operation in DM83. [www.pskreporter.info/pskmap]

Midwest on December 22, from 0420 to 0700 UTC. On December 29, Tim, N0TB, logged F4VPC and 21 other European stations via F2. On January 2, Gustavo, HD8FG, was into the Midwest, and WQ0P (EM19) and KF0M logged him at 1604 UTC after calling for almost an hour. WQ0P also worked CE2SV.

144 MHz. On December 7, PY1MHZ worked Garry, ZD7GWM, via TEP from 3,770 kilometers away. Garry was running 50 W and a Diamond Antenna X700 vertical. This was the first known contact between Brazil and St. Helena Island on 2 meters. On December 9, Yuri, UT1FG/MM, worked LU7MC via TEP while south of Florida. On December 14, NZ3M (FN10) worked UT1FG/MM (GM09) on MSK144 at 1308 UTC. K5ND noted that via tropospheric propagation, he logged UT1FG/MM in three grids in the Gulf of Mexico.

1296 MHz. From Delaware, WA3QPX used 250 W and a 12-foot parabolic dish to work Grant, VE6TA, on December 18. The contact led to Grant earning his Worked All States (WAS) Award on 23 centimeters.

Here and There

V26OC is remotely operated by N3OC, and PJ2/KB7Q is remotely operated by KB7Q.

On January 6, Robert Sutton, ZL1RS, earned his WAS on 6 meters thanks to a contact with WA3QOX in Delaware. He had been pursuing WAS on 6 meters for 39 years.

This year’s next major meteor shower will be the Eta Aquarids, peaking at about 57.1 meteors per hour at 9:00 AM CST on May 6. This information is courtesy of K6ML.

US Amateur Radio Bands

US AMATEUR POWER LIMITS — FCC 97.313 An amateur station must use the minimum transmitter power necessary to carry out the desired communications. (b) No station may transmit with a transmitter power exceeding 1.5 kW PEP.



KEY

Note:

CW operation is permitted throughout all amateur bands.

MCW is authorized above 50.1 MHz, except for 144.0-144.1 and 219-220 MHz.

Test transmissions are authorized above 51 MHz, except for 219-220 MHz

- = RTTY and data
- = phone and image
- = CW only
- = SSB phone
- = USB phone, CW, RTTY, and data
- = Fixed digital message forwarding systems only

E = Amateur Extra
A = Advanced
G = General
T = Technician
N = Novice

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

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Amateurs wishing to operate on either 2,200 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.

2,200 Meters (135 kHz)



630 Meters (472 kHz)

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

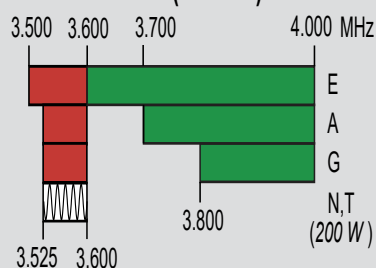


160 Meters (1.8 MHz)

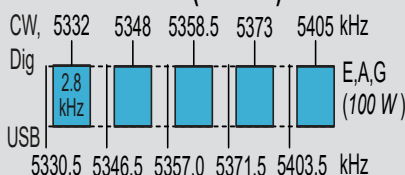
Avoid interference to radiolocation operations from 1.900 to 2.000 MHz



80 Meters (3.5 MHz)

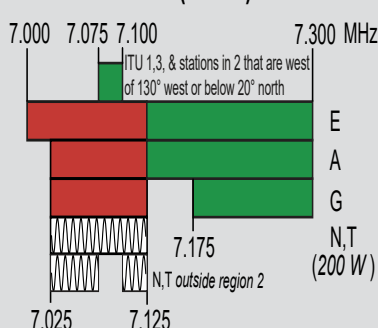


60 Meters (5.3 MHz)



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)



See Sections 97.305(c), 97.307(f)(11) and 97.301(e). These exemptions do not apply to stations in the continental US.

30 Meters (10.1 MHz)

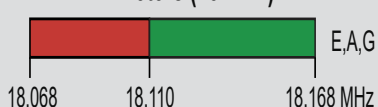
Avoid interference to fixed services outside the US.



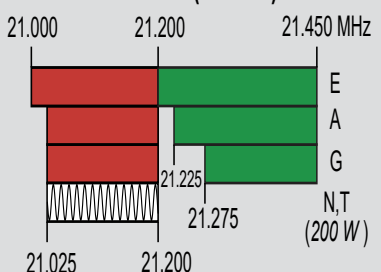
20 Meters (14 MHz)



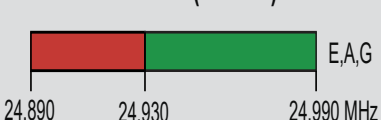
17 Meters (18 MHz)



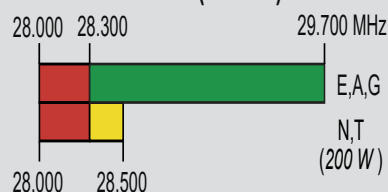
15 Meters (21 MHz)



12 Meters (24 MHz)



10 Meters (28 MHz)



6 Meters (50 MHz)



2 Meters (144 MHz)

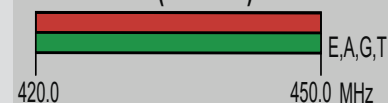


1.25 Meters (222 MHz)



*Geographical and power restrictions may apply to all bands above 420 MHz. See FCC Part 97.303 for information about your area.

70 cm (420 MHz)*



33 cm (902 MHz)*



23 cm (1240 MHz)*



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

2300-2310 MHz	10.0-10.5 GHz ‡	122.25-123.0 GHz
2390-2450 MHz	24.0-24.25 GHz	134-141 GHz
3400-3450 MHz	47.0-47.2 GHz	241-250 GHz
5650-5925 MHz	76.0-81.0 GHz	All above 275 GHz

‡ No pulse emissions

Convention and Hamfest Calendar

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

Abbreviations

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

Alabama (Daleville) — Apr. 5 D F H R T V

8 AM – noon. Spr: Daleville Area Amateur Radio Service. Culpepper Park, 290 S. Daleville Ave. Adm: Free.
<https://daleville.us/daleville-area-hamfest>

Alabama (Fort Payne) — Mar. 22 D F H R T V

8 AM – noon. Spr: DeKalb Co. ARC. DeKalb Co. VFW Post 3128 (fairgrounds), 151 18th St. NE. TI: 147.27 (100 Hz). Adm: \$5. <http://w4dgh.org/meet>

Arkansas (Dardanelle) — Mar. 8 D F H Q R S T V

8 AM – 3 PM. Spr: Arkansas River Valley Amateur Radio Foundation. Dardanelle Community Center, 2059-2099 AR-22. TI: 146.82 (131.8 Hz). Adm: \$10. www.arvarf.com

California (Loomis) — Mar. 22 D F H R S T V

8 AM – 3 PM. Spr: Sierra Foothills ARC. Loomis Historic Train Station, 5775 Horseshoe Bar Rd. TI: 146.535. Adm: Free.
<https://hamfest.w6ek.org>

Colorado (Longmont) — Apr. 5 D F S V

9 AM – 1 PM. Spr: Longmont ARC. Boulder Co. Exhibit Center, 9595 Nelson Rd. TI: 147.27 (100 Hz), 448.80 (88.5 Hz). Adm: \$5. <http://w0eno.org>

Connecticut (Southington) — Mar. 30 D F H V

8 AM – 2 PM. Spr: Southington ARA. Southington High School, 720 Pleasant St. TI: 147.345 (151.4 Hz), 444.20 (151.4). Adm: \$7. Email: k1hsn@cox.net

Illinois (Dixon) — Mar. 16 D H R V

7:30 AM – noon. Spr: Sterling Rock Falls ARS. Sauk Valley Community College Gym, 173 IL-2. TI: 146.85 (114.8 Hz). Adm: \$8 Advance, \$10 door. www.w9mep.org

Illinois (Godfrey) — Mar. 15 D F H S V

7 AM – noon. Spr: Lewis and Clark Radio Club. Lewis and Clark Community College, 5800 Godfrey Rd. TI: 145.23 (79.7 Hz). Adm: \$4 Advance, \$5 door.
<https://k9ham.org/2024/05/21/hamfest-2025>

Indiana (Brazil) — Mar. 22 F H R

8 AM – noon. Spr: Wabash Valley ARA, Inc. Clay Co. 4-H Fairgrounds, 6550 N. State Rd. 59. TI: 146.685 (151.4 Hz). Adm: \$10. www.w9uuu.org/hamfest/hamfest_2025.pdf

Indiana (Columbus) — Apr. 5 D F H R V

8 AM – noon. Spr: Columbus ARC. Columbus North High School, 1400 25th St. TI: 146.79 (103.5 Hz). Adm: \$5.
<http://carcnet.net>

Iowa (McClelland) — Mar. 1 D F H R V

8 AM – noon. Spr: Southwest Iowa ARC. McClelland Town Hall, 117 Main St. TI: 442.225 (136.5 Hz). Adm: \$5.
<https://swiradio.org>

Kentucky (Cave City) — Mar. 22 D F H R S T V

7:30 AM – noon. Spr: Mammoth Cave ARC. Cave City Convention Center, 502 Mammoth Cave St. TI: 146.94 (114.8 Hz). Adm: \$5. <http://ky4x.org>

Kentucky (Elizabethtown) — Apr. 5 D F H R T V

8 AM. Spr: Lincoln Trail Club. State Fire and Rescue Training Facility, 630 College Street Rd. TI: 146.98. Adm: \$10. Email: enginr@comcast.net

Louisiana (Rayne) — Mar. 21 – 22 D F H R S T V

Fri. 3 PM – 8 PM, Sat. 8 AM – 2 PM. Spr: Acadiana DX Association. Rayne Civic Center, 210 Frog Festival Dr. TI: 147.04 (103.5 Hz). Adm: \$10. www.acadianadx.org

Michigan (Lowell) — Mar. 23 D F H R V

9 AM – 1 PM. Spr: Lowell Amateur Radio Youth Club. Lowell High School, 11700 Vergennes St. TI: 147.37, 147.97 (162.2 Hz). Adm: \$7; students, free. <http://amateurradioyouth.club>

Minnesota (Buffalo) — Mar. 22 D F H Q R V

8 AM – noon. Spr: Maple Grove Radio Club. Buffalo Civic Center, 1306 County Road 134. TI: 147.00 (114.8 Hz). Adm: \$10. Email: k0ltc@k0ltc.org

New Hampshire (Hampton) — Apr. 5 F H R T V

8 AM – noon. Spr: Port City ARC. St. James Masonic Lodge, 77 Tide Mill Rd. TI: 145.15 (127.3 Hz). Adm: \$5.
www.w1wqm.org

New Jersey (Parsippany-Troy Hills) — Mar. 22 D F H R

8 AM – noon. Spr: New Jersey Antique Radio Club. Parsippany PAL, 33 Baldwin Rd. Adm: \$7. www.njarc.org

ARRL NORTH DAKOTA STATE CONVENTION

March 29, Bismarck, North Dakota

D F H R S V

8 AM – 1 PM. Spr: Central Dakota ARC. Bismarck Public Schools Career Academy, 1221 College Dr. TI: 146.85. Adm: Freewill donation. <http://w0zrt.com>

Ohio (Cuyahoga Falls) — Apr. 5 D F H Q R S V

8 AM – 1 PM. Spr: Cuyahoga Falls ARC. Emidio & Sons Expo Center, 48 E. Bath Rd. TI: 147.27 (110.9 Hz), 444.85 (110.9 Hz). Adm: \$7 Advance, \$8 door. www.cfarc-hamfest.org

Ohio (Elyria) — Mar. 9 D H

9 AM – noon. Spr: Northern Ohio ARS. Lorain Community College Spitzer Conference Center, 1005 N. Abbe Rd. TI: 146.70 (110.9 Hz). Adm: \$10.

www.noars.net/hamfests/winter-hamfest

Oklahoma (Altus) — Mar. 29 D F H R T V

8 AM – 3 PM. Spr: Altus Area ARA, Prairie Dog ARC. Altus Community Center, 401 Falcon Rd. TI: 442.05 (100.0 Hz). Adm: \$5. <http://ok.arrl.org/altus>

Pennsylvania (Elizabeth) — Apr. 6 D F H R T V

8 AM – noon. Spr: Two Rivers ARC. Lincoln Borough VFD No. 184 social hall, 4312 Liberty Way. TI: 147.12 (131.8 Hz). Adm: \$5.
<https://trarc.org>

Pennsylvania (Greensburg) — Mar. 29 D F H R

8 AM – 1 PM. Spr: Westmoreland Emergency Amateur Radio Service, Inc. Greensburg Masonic Center, 349 Donohoe Rd. TI: 147.18 (131.8 Hz). Adm: \$5. www.wc3ps.org

South Carolina (Batesburg-Leesville) — Apr. 5 T

8 AM – 1 PM. *Spr:* Ridge ARC. Shealy's Bar-B-Que parking lot, 340 E. Columbia Ave. *TI:* 147.255 (123.0 Hz). *Adm:* Free. www.w4rrc.org

Tennessee (Sevierville) — Mar. 15 D H R S T V

8 AM – 2 PM. *Spr:* Sevier Co. ARS. Sevier Co. Fairgrounds, 754 Old Knoxville Hwy. *TI:* 146.94 (118.8 Hz). *Adm:* \$5. <http://seviercountyhamfest.org>

Tennessee (Trenton) — Mar. 22 D F H Q R S T V

8 AM – 2 PM. *Spr:* Area Wide ARA. National Guard Armory, 1460 Industrial Park Dr. *TI:* 146.865 (127.3 Hz). *Adm:* \$5. Email: hcarc.na8x@gmail.com

ARRL WEST TEXAS SECTION CONVENTION

March 15, Midland, Texas

D H Q R S T V

8 AM – 2 PM. *Spr:* Midland ARC. MLK Community Center, 2300 Butternut Ln. *TI:* 147.30 (88.5 Hz). *Adm:* \$10 Advance, \$12 door. <https://hamfest.w5qgg.org>

ARRL TEXAS STATE CONVENTION

March 7 – 8, Rosenberg, Texas

D F H Q R S T V

Fri. noon – 6 PM, Sat. 8 AM – 3 PM. *Spr:* Brazos Valley ARC. Fort Bend Co. Fairgrounds, 4310 TX-36 S. *TI:* 146.940, 167.9. *Adm:* \$10 Advance, \$15 door. <https://houstonhamfest.org>

Virginia (Vienna) — Mar. 9 D F H Q T V

8 AM – 2 PM. *Spr:* Vienna Wireless Society. Oakton High School, 2900 Sutton Rd. *TI:* 146.52, 146.684 (110.9 Hz), 448.375. *Adm:* \$10 Advance plus small service fee, \$15 door. <https://viennawireless.net/wp/events/winterfest>

Wisconsin (Jefferson) — Mar. 16 D F H R V

7 AM – noon. *Spr:* Tri-County ARC. Jefferson Co. Fair Park activity center, 503 N. Jackson Ave. *TI:* 145.49. *Adm:* \$10 Advance, \$15 door. Email: mzore@sterlingtech.net

Wisconsin (Onalaska) — Mar. 1 F H Q R V

8 AM – noon. *Spr:* Mississippi Valley ARA. Onalaska American Legion, 731 Sand Lake Rd. *TI:* 147.09 (131.8 Hz), 145.46 (simplex). *Adm:* \$5. <http://mvara.net>

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. 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 **April 1** to be listed in the **June** 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.

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Special Event Stations

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

Mar. 8, 1700Z – 2359Z, N6IW, San Diego, CA. USS *Midway* Museum Ship. **USS *Midway* Launched in 1945.** 7.250 14.320; 14.070 PSK31; D-STAR on PAPA System repeaters. QSL. USS *Midway* Museum Ship COMEDTRA, 910 N. Harbor Dr., San Diego, CA 92101. www.qrz.com/db/n6iw

Mar. 9 – Mar. 10, 1900Z – 1900Z, K7U, Twin Falls, ID. Magic Valley Amateur Radio Club. **Idaho QSO Party — Spud Run.** 7.260 14.260 21.335. Certificate. K7U, 6424 Ustick Rd., Nampa, ID 83687. *Operating from Canyon County.* www.idahoqsoparty.org

Mar. 14 – Mar. 15, 1800Z – 0100Z, N3P, Princeton, NJ. David Sarnoff Radio Club. **Pi Day.** 7.031 7.227 14.031 14.314. QSL. Don Corrington, AK2S, 7 Pinewald Ln., Burlington, NJ 08016-3421. www.n2re.org

Mar. 15, 1300Z – 1900Z, N4SRC, Kissimmee, FL. Solivita Radio Club. **Solivita Car Show.** 14.074 18.124 21.074 24.980. QSL. Solivita Radio Club, 307 Bell Tower Crossing W., Kissimmee, FL 34759. *FT8 on all frequencies (10 through 40 meters). Frequencies may change. See website for updates.* www.solivitaradioclub.weebly.com

Mar. 22, 1400Z – 2000Z, W4BKM, Macon, GA. Macon Amateur Radio Club. **Cherry Blossom Special Event Station.** 7.225 14.240. Certificate. Macon Amateur Radio Club, 305 Millwood Ct., Macon, GA 31210. www.maconamateurclub.wordpress.com

Certificates and QSL cards: To obtain a certificate from any of the special event stations offering them, send your QSO information along with a 9 × 12-inch self-addressed, stamped envelope (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 **June QST** would have to be received by **April 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.

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 operating — anything relating to operating or the ham radio avocation.

Whether your manuscript has a technical or general focus, a strong “how-to” component will make it stand

out. Readers should come away from the article with specific ideas for recreating your experience.

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@arrl.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.arrl.org/qst-author-guide.

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.

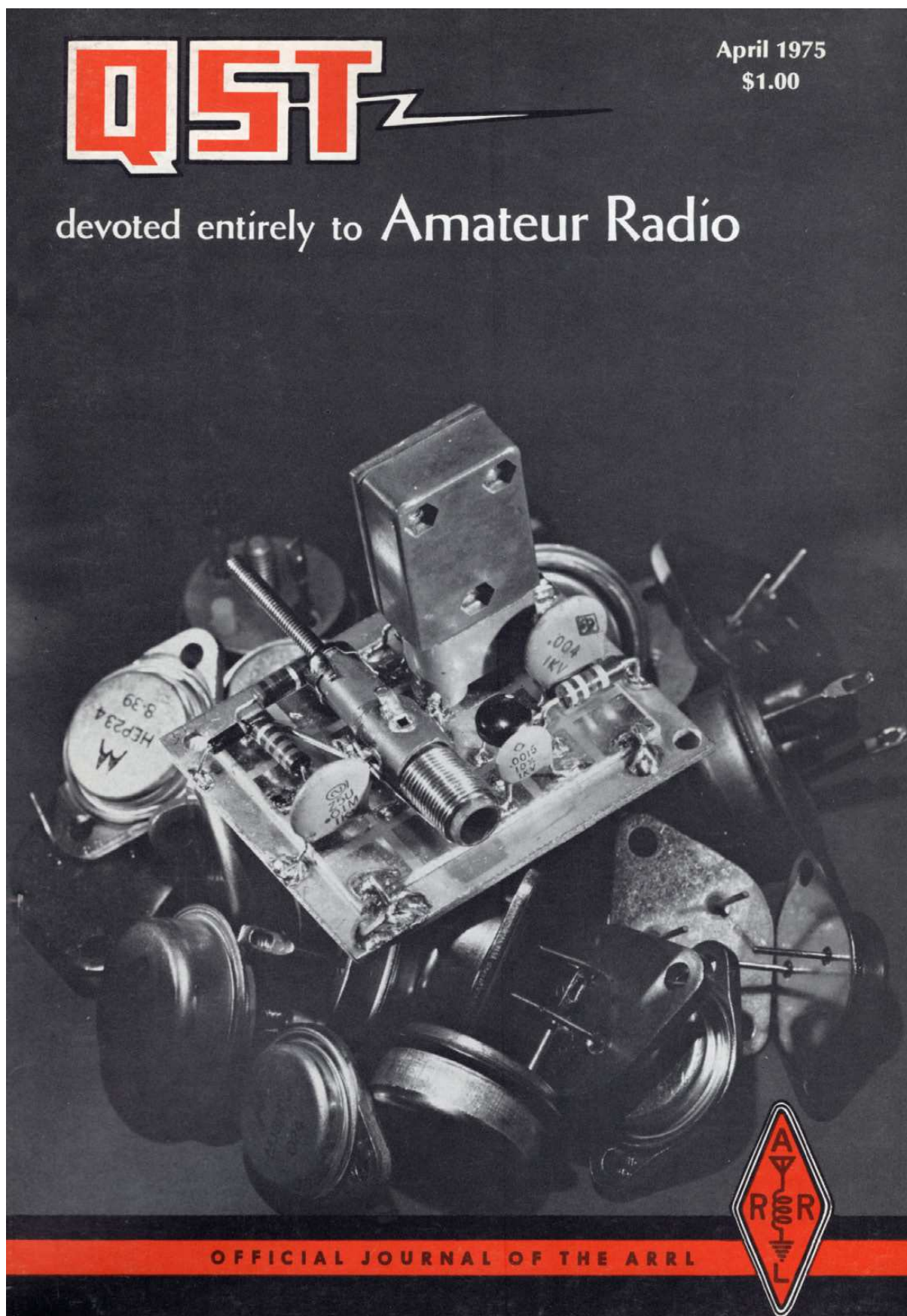
If you are an ARRL VE, you can view your session stats online at www.arrl.org/ve-session-counts.
If you are not a VE, become one today! See www.arrl.org/become-an-arrl-ve.



Volunteer Examiner	Sessions	Accreditation Date	Volunteer Examiner	Sessions	Accreditation Date	Volunteer Examiner	Sessions	Accreditation Date
Atlantic			Hudson			Roanoke		
***Collin Pike, WE4RR	6,982	26-Apr-11	Alan Crosswell, N2YK	523	26-Oct-94	Judy Friel, AC4RG	327	01-Feb-91
James McCloskey, NS3K	354	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	463	27-Sep-94	Terry Sanner, WV8V	262	06-Sep-84
George Brechmann, N3HBT	322	01-Apr-91	John Kiernan, KE2UN	320	01-Jul-91	David Snyder, W4SAR	259	01-May-93
Donald Rees, K3PCT	304	28-Apr-23	Walter Lesnowich, W2EE	312	06-Mar-08	Larry Withrow, AF4HX	238	17-Dec-98
Edward Genoino, WA2NDA	298	10-Jul-85	Thomas Carrubba, KA2D	301	01-Sep-93	David Poe, W8IW	223	13-Mar-07
Cully Phillips, N3HTZ	234	01-Sep-91	Robert Casino, N2GDY	294	03-Jun-08	Henry Wyatt, II, K4YCR	220	28-Jan-98
Michael Harla, N2MHO	224	12-Apr-06	Carlos Prior, KE2TT	272	01-Jun-90	Richard Brannen, Jr., KA3JCA	219	25-Jan-89
William Klepser, Jr., WB2AIV	217	09-Jun-99	Donald Younger, W2JEK	257	30-Jul-86	Edwin Williams, KN4KL	219	01-Jan-92
Robert Worek, AG3U	207	26-Jul-06	Allen Bender, W2QZ	257	02-Feb-88	John Kanode, N4MM	212	07-Jun-85
Ralph Abbott, WA3ELQ	207	30-May-05	Kathy Thee, KT2F	255	31-Oct-01	Maurice Brown, N8VA	194	31-Mar-97
Central			Midwest			Thomas Lewis, W4SIS	194	14-Nov-97
Ed Wagner, AB9FN	430	01-Jul-02	David Bartholomew, AB0TO	812	22-Mar-02	Rocky Mountain		
Allan Bukowski, N9ZD	365	01-Jun-92	Kevin Naumann, N0WDG	713	17-Nov-02	Robert Vosper, KZ1B	749	09-Jul-10
Eldon Boehm, NK9U	350	21-Nov-86	Harry Steger, Jr., W0HMS	675	26-Aug-08	Robert Hamilton, N0RN	435	19-May-87
Donald Hlinsky, N9IZU	341	01-Mar-91	Chris Hunt, N0YH	635	05-Aug-20	Jeffrey Weinberg, W0QO	348	01-Apr-93
Brian Eder, WB9UGX	314	01-Jan-92	Roland Kramer, W0RL	564	21-Jun-01	David Avery, N0HEQ	302	13-Jan-88
Robert Begeman, W9KVK	301	01-Jun-92	Ralph Waldren, N0OTS	543	03-Jan-20	Gary Zabriskie, N7ARE	263	20-Nov-84
Dennis Keyfauber, K3DCK	290	29-Dec-22	Kenneth Simila, KC0VMY	318	18-Feb-07	David Sharpe, K10HG	259	02-Feb-98
Timothy Pechtold, AA9BV	284	01-Nov-92	Edwin Berkel, AE0EB	270	06-Jan-15	Martin Soffran, NM5MS	240	21-Mar-94
James Rinehart, K9RU	274	01-Aug-91	John Mountain, Jr., KJ0MTN	255	28-Sep-09	Peter Brisbane, NM5PB	233	20-Jan-14
Frederick Baguhn, W9GOC	274	16-May-02	Charles Wilmes, KW0K	241	28-Apr-09	David Bratcher, AK0MR	211	23-Sep-08
David Pritchard, W9QL	262	12-Apr-01	New England			Denis Campbell, AA0YX	185	02-Feb-96
Dakota			**Paul Lux, K1PL	2,316	25-Jan-85	Southeastern		
Jeffrey Goodnuff, W0KF	356	17-Jun-03	*Bob Phinney, K5TEC	1,685	20-Jan-14	***Gary Pike, KA4KBX	8,847	28-Jun-90
John Schwarz, Jr., AE0AL	335	26-Oct-94	Gregory Paul, KC1MND	548	03-Jun-20	***Justin Pike, KJ4AXF	7,036	12-Nov-12
Shep Shepardson, N0NMZ	326	12-Mar-01	Phillip Temples, K9HI	519	12-May-89	***Anna Pike, KD4PCU	5,402	18-Aug-09
Joel Dunham, NC1D	287	26-Jul-23	William Poulin, WZ1L	513	01-Sep-91	***Patrick Pike, KJ4AXD	4,052	13-Oct-15
Daniel Royer, KE0OR	256	01-Jul-91	Robert Beaudet, W1YRC	412	01-Aug-90	**Ryan Krenzischek, W4NTR	2,090	04-Jan-13
Douglas Nelson, AA0AW	255	01-May-90	Bruce Anderson, W1LUS	405	11-Feb-88	*John Reynolds, W4TXA	1,191	08-Jun-16
James Rice, II, N0OA	239	04-Dec-00	Barbara Irby, KC1KGS	375	05-Aug-19	Stanley Whitfield, K4SHW	724	26-Sep-19
Larry Larson, KR0K	230	16-Mar-09	Brandin Hess, NL7CW	351	24-Sep-15	Robert Fauci, N1UVO	714	28-Mar-18
Robert Tracy, N0TC	203	30-Jul-86	Stefan Rodowicz, N1SR	327	20-Nov-84	Eddie James, WD3D	617	01-Apr-21
Karl Eriksen, WA2DEE	179	08-Jan-90	Northwestern			Thomas Kocourek, N4FWD	493	09-Feb-04
Delta			Richard Morgan, KD7GIE	448	11-Aug-00	Southwestern		
Loma Westmoreland, KU5J	793	31-Jan-21	Scott Robinson, AG7T	448	01-Aug-91	*Bill Martin, AI0D	1,075	01-Nov-84
Monvel T. Maskew, Jr., K9FQ	767	18-Jul-18	Erin Henrickson, ND7B	440	06-Jan-23	David Morrill, N7TWT	521	20-Jul-00
Terry Partigianoni, W5TMP	647	27-Nov-07	John Clarke, AC7WW	392	20-Jan-03	Richard Buck, KC7OCT	364	21-May-97
Elmer McKenzie, Jr., K5MCK	612	23-Dec-22	Loren Hole, KK7M	381	06-Sep-84	Donald Kramer, Sr., WA6UVW	347	08-May-98
Bryan McCammon, K1SHAV	442	03-Sep-20	David Brooks, N7HT	336	10-Jun-87	Bruce Ziemenski, WA6BZ	321	25-Mar-02
Rodney Webb, W4WRE	360	21-Mar-17	Nathan Zane, KH6IHB	324	01-Apr-93	Pete Morrison, K6VVR	300	03-Apr-07
John Waters, III, KC5FYA	331	14-Sep-21	Joseph Barry, K7SQ	319	21-Jun-95	Ali Hassan, AA6WC	288	01-Jun-90
Joe Lowenthal, WA4OVO	309	25-May-06	Harley Leach, K17XF	302	24-Jun-19	Frank Westphal, K6FW	284	06-Sep-84
Bobbie Williams, W1BEW	307	01-Jun-92	Wayne Schuler, AI9Q	287	01-Sep-91	Norman Pilawski, WT6Y	284	17-Feb-87
Darrell Wiggins, Jr., W4AI	299	02-Jun-23	Klaus Neubert, AC7MG	281	10-Jul-01	William Peters, K1WMP	277	26-Jun-23
Great Lakes			Richard Heasty, KK7VH	263	07-May-01	Dave Martin, AC7FF	276	04-Apr-14
*Charles Tyrrell, KE8PCB	1,431	03-Sep-20	Pacific			West Gulf		
*David Potter, KE8OHG	1,380	03-Jun-20	Brian Torr, N6IY	961	06-Sep-00	*Franz Laugermann, K3FL	1,886	01-Dec-91
Bruce Osmon, KE8LT	902	16-Nov-18	Morris Jones, AD6ZH	589	27-Nov-01	*Tanner Jones, W9TWJ	1,302	31-Jul-07
Earl Paazig, W8BR	754	16-Apr-02	Dieter Stussy, KD6LVW	469	27-Jan-94	Daniel Quigley, N7HQ	793	24-Apr-20
Charles Hall, W8HF	286	01-Jun-92	Larry Loomer, K16LNB	390	03-Dec-08	John Paterson, Jr., KC5LAA	569	16-Mar-09
William Bogle, Jr., KE8FZY	277	08-Jul-20	Robert Perlman, W6BP	380	26-Aug-08	Gerald Grant, WB5R	540	04-Jan-85
Lance Harvala, AB8Y	256	06-Nov-19	Bill Nichols, NN7K	375	01-Sep-93	Adolph Chris Koehler, K5VCR	533	29-Sep-95
Archie Mack, Sr., AF4EB	253	19-Aug-97	Gordon Fuller, WB6OVH	363	06-Sep-84	David Fanelli, KB5PGY	509	01-Oct-91
Stanley Arnett, II, AC8W	238	06-Sep-84	Jim Brunk, N6BHX	321	13-Jul-95	Wilbert Cannonier, KK5JJ	475	03-Nov-95
Chris Anderson, K8VJ	233	09-Feb-90	Dennis Simon, KB7UTV	306	10-Dec-13	Gerald Crenshaw, WD4BIS	465	27-Feb-98
			Jane Garwood, KB7YUZ	299	20-Jan-14	Janet Crenshaw, WB9ZPH	434	02-Oct-97

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

A Look Back





April, 1925

... Editor Warner says a lot of us are still not using "clean" power supplies, and are coupling to the antenna directly instead of inductively, all of which help cause BCI – and also incurs the wrath of the public and the Department of Commerce. Fair warning!

... "The Reflection of Short Waves" is the famous propagation analysis by John L. Reinartz, 1XAM (later W1QP), which won for him the only ARRL Maxim Gold Medal ever awarded. A separate story on ham communication tests during the eclipse of the sun also bears out the principles. Ironically, Silent Keys reports the recent passing of Oliver Heaviside, known for his early theory on ionized layers.

... An early version of "Recent Equipment" is Ralph Batcher's review of the Grebe Synchrophase; the manufacturer doesn't publish a circuit, but it has been traced from the receiver itself and is published for the information of all members. The Browning-Drake "Regenaformer" is also described.

... The U. S. Navy wants to learn more about short-wave communication effectiveness and has put Lt. Fred Schnell on active duty (with seven months' leave from his ARRL Communications Manager post). He will join the fleet on its Australasian cruise this summer to work ham maritime mobile.

... One of the actions of the ARRL Board meeting, the second of a new body elected by us members under the new constitution, clarifies rules and sets new standards for League conventions. Another is authorization for a high-power station at League Hq.

... For the experimenters, Department Editor Hatry describes a model test table setup with battery hookups, rheostats, terminals, and of course a plethora of double-pole, double-throw knife switches.

... For the third quarter, the League shows a profit of \$93.22.



April, 1950

... W1TS has turned out a neat 6AG6-6L6 rig to be featured in *How to Become a Radio Amateur*, and the editor is so impressed he carries the article in this issue as well.

... "Constant Modulation," in which the carrier is varied along with the audio to maintain a high and efficient percentage of modulation, is discussed by W8YHR along with circuit descriptions.

... It's not yet called a "balun," but W3OCZ presents circuits to match balanced and unbalanced lines.

... Clicks and contact bounce are two keying horrors W1DX shows us how to avoid by proper filters and bug adjustment.

... A third instalment ties ribbons on W1DF's treatise on low-pass filter design and construction. It will remain the standard for combatting our increasing problems with television interference.

... The recent go-around with FCC on revising the amateur license setup, which prompted a couple of splinter "national" amateur organizations, has once again shown an inadequate understanding of the League's functional structure. Editor W1BUD covers the whole field, pointing out that basic control is in the hands of members.

... The incisive mind of Larson E. Rapp, W1OU, has tackled the 50-year history of amateur communication from the standpoint of RST reports, with startling disclosures such as the "QSL Effect" – the signal strength report is inversely proportional to the number of amateurs in a country and the resultant scarcity of such cards.

... The annual Sweepstakes is now so big the report is split between two issues of *QST*. This month carries the c.w. results, and who made the highest number of contacts in all New England? None other than: – W1RW

Strays

Alex Lariviere, VE2AB, at right, here is presented with a plaque for fifty years as a member of ARRL by Canadian Director George Spencer, VE2MS. (Photo by Victor Livernois, VE2NK)



More than a hundred years of service to ARRL here – Honorary "Veep" Ed Handy, W1BDI, gets his fifty year plaque from ARRL Treasurer Dave Houghton.

Celebrating Our Legacy

60th Anniversary QSO

On November 11, 1962, I made my first-ever ham radio QSO with Bill Clay, K7UOP, on 7160 kHz. I used a Heathkit DX-40 running 75 W and an Allied Knight-Kit Span Master. The antenna was a folded dipole.

Bill used a home-built single-tube transmitter running 50 W, and a Hallicrafters S-38E. I received his QSL card and kept it safe all these years.

In 2022, I retrieved his QSL card from my collection and verified the upcoming 60th anniversary of the contact. I wondered if Bill was still around and active. After securing Bill's address from the FCC ham radio license search, I wrote a short letter to him, and we exchanged email addresses. We agreed to meet again on 7160 kHz on November 11 — the same date we made our first QSO 60 years earlier.

At the scheduled time, I called Bill on CW. He immediately came back. We congratulated each other on the 60-year milestone, and of course, exchanged RST reports. We finished our commemorative QSO on side-band and agreed to maintain a loose schedule to keep in touch in the future. I think it is grand that we could rekindle our friendship after so many years.

Jack Crabtree, W7JLC
Prescott, Arizona

Reminiscing About a Solar Eclipse Experiment

I got my Novice license as a kid in 1954 and eventually earned the Advanced license. In 1970, I was at the University of Florida, working on my PhD in astrophysics. In the

process, I thought it would be interesting to see what HF radio propagation might be like in the middle of the day if the sun was not radiating into the ionosphere.

One of my associates and two hams in my community rounded up some support to run a constant north/south line between northern Florida and southern Georgia. After putting it all together and testing, we finished the final runs the day before a solar eclipse occurred.

Thirty minutes after the eclipse began, the signals quickly zoomed to nearly the typical nighttime level. This lasted for about 30 minutes, and then they started dropping as the sun began to re-emerge slowly for another 40 minutes. So, we sent a report to a few groups, including QST, and my article "D-Layer Absorption During a Solar Eclipse" was published in the July 1972 issue!

Jim Kennedy, K6MIO
Saint Augustine, Florida

Career Building

My father got me interested in science and the space program. He worked for General Electric's Missile and Space Division in the 1960s and early 1970s, and once took us on a summer trip to visit NASA's Langley Research Center in Hampton, Virginia. Later, I became fascinated with weather and thought that meteorology would be an exciting career.

When I was in seventh grade, my dad bought me a portable multiband radio that had long-wave and short-wave bands. Radiowave propagation was particularly interesting, so in college, I majored in physics and later studied ionospheric physics. I



Richard Eckman, W3IT (right), and his brother (left) at the NASA Langley Research Center in 1966. [Richard Eckman, W3IT, photo]

got my degree in 1985, and eventually, I went to work for NASA — at the Langley Research Center.

I got my first call sign, KD4AUS, in 1991. I quickly learned Morse code and upgraded to the Advanced class. I've held my late uncle's call sign, W3IT, for more than 10 years.

After 33 years, I'm still with NASA, as a program manager in their atmospheric composition focus area at their headquarters in Washington, DC. While I didn't become a meteorologist, I ended up in a closely related field. Who would have thought that an educational family trip would be so influential that I'd be working there 22 years later! Radio has played a huge role in my career choice, and 50 years later, I remain fascinated with all facets of the hobby.

Richard Eckman, W3IT
Yorktown, Virginia

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

Classic Radio

The Last New Hammarlund: The HQ-200

The HQ-200 was the last new radio design developed by Hammarlund. It was a revised version of their earlier HQ-100 and HQ-100A low-end general-coverage receivers, which were produced from 1956 to 1966. The HQ-100 was upgraded to the HQ-100A in 1961. The original HQ-100 combined the BFO and Q-multiplier into a single stage, which meant the Q-multiplier couldn't be used while the BFO was active. This limitation was a significant issue, as it prevented the use of the Q-multiplier when receiving SSB or CW signals. The HQ-200 improved upon the HQ-100 by adding a product detector that incorporated the BFO, while keeping it separate from the Q-multiplier circuit. The Q-multiplier was the sole feature used to improve selectivity.

Tubes and Semiconductors Used in the HQ-200

The HQ-200 replaced the 5Y3GT tube used as a rectifier in the HQ-100 and HQ-100A with solid-state diodes. The gas-filled dc regulator tube was switched to a Zener diode. These two power supply changes allowed Hammarlund to reduce the number of vacuum tubes in the HQ-200 to eight, compared to the 10 tubes used in the HQ-100 and HQ-100A. The tubes employed in the signal path of the HQ-200 were similar to those in the earlier HQ-100 family. Both series of receivers employed a 6BZ6 as the RF amplifier stage,

a 6BE6 as the mixer, a separate 6C4 as the local oscillator, two 6BA6 pentodes for the 455 kHz IF stages on all receivers mentioned, and a 6AQ5 as the audio output tube for all receivers.

The differences between the receivers start with a 12AX7, one-half of which is an audio amplifier for all three receivers. On the HQ-100, the second half of the 12AX7 was both the Q-multiplier and the BFO; on the HQ-100A and the HQ-200, the second half was used only as the Q-multiplier. The HQ-100 used a 6AL5 as the diode detector for all modes. The HQ-100A used a 6BV8 multi-section tube, which served as both the diode detector and the BFO. The HQ-200 used a 6BE6 as the product detector and BFO. Both the HQ-100 and HQ-100A used a 5Y3GT as the rectifier tube and a 0B2 gas regulator tube, while the HQ-200 used solid-state components, including a solid-state diode for the AM detector.

The HQ-200 Compared to the Earlier HQ-100A

The HQ-200 did not support the installation of a clock, unlike most other Hammarlund models. It shared most of the front-panel styling with the HQ-100 and HQ-100A but featured new graphics. All three models had the main tuning dial on the top left and the main tuning knob on the bottom left. On the right side were



The Hammarlund HQ-200. [Photo courtesy of www.rigreference.com]



The Hammarlund HQ-100A. [Photo courtesy of www.rigreference.com]

the band spread dial and knob, with the band switch located in the lower center of the panel on all units.

The HQ-200 was sold from 1968 to 1972, with the price increasing from \$229 to \$338 during that period. The HQ-100 and HQ-100A were for sale from 1956 to 1966, with their prices rising from \$169 to \$200 during that period. All three receivers used the XC-100 100 kHz



The Hammarlund HQ-100. [Photo courtesy of www.rigreference.com]

crystal calibrator option. The clock for the HQ-100 was a 12-hour unit, while the HQ-100A featured a 24-hour clock. The HQ-200, however, did not support an internal clock. Unlike the HQ-100 and HQ-100A, which were offered in an export version that would work on 120 or 240 V ac, the HQ-200 receivers were all capable of being wired for 120 or 240 V ac.

Strays

Portage County Amateur Radio Service Donates to Food Pantry

Portage County Amateur Radio Service (PCARS), K8BF, an ARRL Special Service Club, made a generous donation of \$11,178.51 to the Amelia DiGirolamo Center of Hope in Ravenna, Ohio. For 19 years, PCARS has been actively fundraising for the center, and this year's contribution marks the largest amount they have ever donated. Each year, the Amelia DiGirolamo Center of Hope serves hundreds of families in need by offering hot meals 5 days a week through its dining center, as well as providing emergency groceries.

QST Congratulates...

The Radio Officers Association (ROA) for receiving the 2024 CWops Award for Advancing the Art of CW. This award recognizes an individual, group, or organization that has contributed to advancing the art or practice of radio communications through Morse code. ROA's ongoing efforts preserve CW as a vital communications medium by serving as a repository of the history of the role of CW in maritime and aeronautical communications through the publication of its longtime journal and many activities, including maintaining local ongoing mentoring and training programs and special events to introduce youngsters to the art and value of CW, regularly running a CW net in which transmissions use commercial maritime Q-signals and abbreviations, and supporting wireless- and maritime-related museums, such as the Chatham Marconi Maritime Center.

100, 50, and 25 Years Ago

March 1925

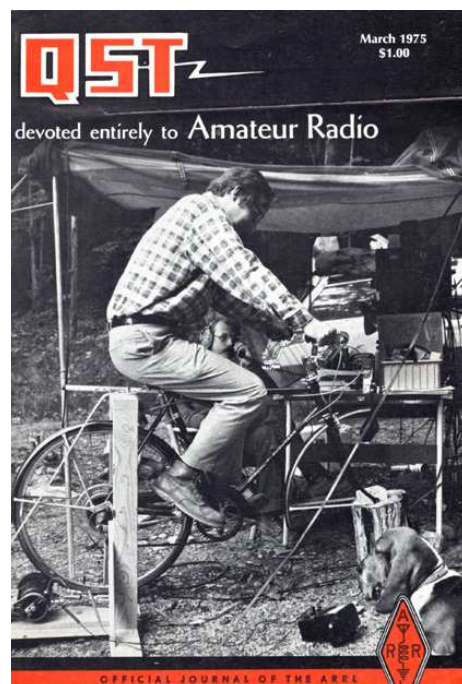
- The cover image screams “Doing away with Static” in reference to the second installment of “The McCaa Anti-Static Devices” in this issue.
- Kenneth Bryant Warner, 1BHW, shares some thoughts about cooperation among the various classes of radio users in “Editorials: Avoiding Trouble.”
- A new vacuum tube for the universal use of radio frequency amplification for broadcast reception and the adoption of low-wave transmission and reception for amateur traffic is described in “The New Magnavox Tube” by Herbert E. Metcalf.
- The first international congress of radio amateurs is heading to Paris for the purpose of forming the International Amateur Radio Union. Details are in “All Aboard For Paris” by K.B. Warner, 1BHW.
- New regulations from the Department of Commerce that took effect January 5, 1925 as a result of the Third National Radio Conference are highlighted in “New Regulations for Transmitting Stations.”
- A.L. Budlong, 1BUD, shares on some of the various reflex combinations commonly used, and an opinion on their desirability in “Notes on Reflexing Receivers.”

March 1975

- The cover photo features a gentleman pedaling a bike to generate power. The related story begins as a 1974 ARRL Field Day exercise regarding Rule No. 11b — 100 bonus points if one or more contacts are made using equipment that is powered totally by a source of energy that is derived from “natural” power. With that incentive, Edward Yadzinski, W2DNZ, shares on “Emergency Electrical Energy via Man Power.”
- A national survey will be sent to members; the results will form the basis for formal comment by ARRL to the Federal Communications Commission. Details are in “It Seems to Us...Membership Opinion Assessment.”
- Pitfalls in double-balanced diode-mixer application as a down-converter, and the appropriate methods of making a commercially manufactured unit work properly are discussed in “Using the Double Balanced Mixer in VHF Converters” by Edward L. Meade, Jr., K1AGB.
- An innovation in SSTV is described in “SSTV to Fast-Scan Converter, Part 1” by Dr. George R. Steber, WB9LVI.
- Theodore J. Cohen, W4UMF, and Lewis G. McCoy, W1ICP, explore new ways RFI is being solved in “RFI: A New Look At An Old Problem.”

March 2000

- The cover features The Tuna Tin 2. Originally printed in the May 1976 issue of QST, this QRP classic is being revived. Ed Hare, W1RFI, updates this weekend QRP project with currently available parts in “The Tuna Tin 2 Today.”
- David Sumner, K1ZZ, explains the basis of the ARRL Certification Program and the opportunity for members to participate from early design stages in “It Seems to Us...Extra Value.”
- Stephen Stuntz, N0BF, explains in “Cross-Country QRP” how reciprocal licensing and the availability of lightweight QRP equipment made his vacation an adventure.
- Lew Smith, N7KSB, shows how you can easily work worldwide DX with his homebrew QRP transmitter and a simple antenna in “A Simple 10-Meter QRP Transmitter.”
- Tiny CW paddles that can be made in just a couple of hours and at almost no cost are described in “The NB6M QRP Paddles” by Wayne McFee, NB6M.
- The upcoming 2000 DXpedition to Clipperton Island, along with some island history, is presented in “How’s DX? Clipperton Island” by Bernie McClenny, W3UR.
- Emil Pocock, W3EP, reports on Dr. Ernest K. Smith’s, N6HQK, career in sporadic-E studies in “The World Above 50 MHz: Dr. Ernest K. Smith, N6HQK — VHF Pioneer.”



Silent Keys

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

K1BXC KA1DT ♦KA1FGA ♦♦K1GLB ♦♦♦N1MD N1OTL	Burbank , Daniel L., Tolland, CT Knight , David P., Nashua, NH Strassel , Peter J., Plymouth, MA Pratt , Nelson C., Jr., Tryon, NC Therrien , Michael, Putnam, CT Fetterman , Robert S., Wilmington, NC Bucur , James, Sandy Hook, CT Pierini , Douglas E., Harwich, MA Elliot , Robert A., North Scituate, RI Haberman , Alfred I., Holyoke, MA Flynn , David W., Granby, MA Kimball , Blaine M., Jefferson, ME Izzo , Anthony M., Pompton Plains, NJ Ellis , John J., The Villages, FL Lech , Chester, Hicksville, NY Efrein , Leonard R., Nineveh, NY Wagner , Kenneth J., Lindenhurst, NY Mumaw , Arthur J., Jr., Livonia, MI Boyce , Henry, Oswegatchie, NY Herdle , Jeffrey C., West Seneca, NY Stein , Lawrence J., Manahawkin, NJ Krupcale , John B., Fulton, NY Fedick , William T., Lancaster, NY Smith , Orrie H., North Haledon, NJ Friedland , Alvin, Califon, NJ Fuller , Thomas D., Tonawanda, NY Hickey , Thomas W., Tampa, FL Kadner , Judith, Albuquerque, NM Fernandez , Joey, Somerset, NJ Newman , George Jerry, Philadelphia, PA Wick , John L., Butler, PA White , James L., Lewes, DE Antonella , Joseph D., McKeesport, PA Lindley , John R., Bowie, MD Geiser , Kenneth G., Coudersport, PA Darr , Delbert E., Reynoldsville, PA Berwager , Ronald W., Riverview, FL Testa , Eldan D., Williamsburg, VA Showalter , Laban R., Hagerstown, MD Moulder , Michael A., Sr., Lansing, NC Peters , George N., Enola, PA Stanish , Tim, Fayette City, PA Burgett , Lewis E., Carlisle, PA Connors , Roy, Cocoa, FL Stormer , Joseph H., Lewes, DE Andrzejewski , Ronald E., Middletown, DE Greenfield , Robert H., Jenkintown, PA Bruton , James M., Granville, OH Honer , Philip M., Murrells Inlet, SC Benefield , Danny J., Bessemer, AL Evans , Kenneth W., Lilburn, GA Humphrey , David L., Kelford, NC Deffenbaugh , Lynn W., Palm Bay, FL Glass , William J., Boynton Beach, FL Helmstetter , Tad W., Lexington, NC Land , Thomas G., Jr., Lenoir, NC	♦KA4HKR ♦WD4HLZ ♦♦AE4HS ♦KE4JSL ♦N4MQ ♦K4NHO ♦♦W4NNN ♦K4PDS ♦♦W4SCH KK4TID ♦W4WDR N4WHB ♦A14XO ♦KJ5AAA ♦N5BSA WD5CGL ♦W5DAD ♦KF5ECK ♦KV5F ♦N5HQR ♦N5KC KA5LAR KM5OI W5OXX KF5QWK N5RKL W5SPP ♦KF5SVH ♦W6DJF ♦KZ6H ♦W6KWM ♦K6LDK ♦K6LFB KG6LFP KJ6NNM WA6ROG W6SUE ♦KK6Y ♦WA7BBI NL7C ♦N07C ♦K7CWS KB7GAZ ♦KL7GQ W7HCO W7HGM KF7HSD ♦KG7INA KF7MTC KC7OWI N8ACQ WD8AFM ♦K8BLL KC8BOG W8CWS N8GOB W8ICQ ♦N8MTP	Dancer , J.F., Jr., Houston, MS Walker , James G., Marion, SC Daniel , James M., West Palm Beach, FL Mims , Jack L., Augusta, GA Woodworth , George, Gainesville, VA Clements , David Thomas, Swannanoa, NC Carter , Robert V., Covington, GA Parker , David S., Maryville, TN Halter , Stan C., Marietta, GA Hanson , Henry N.G., Louisville, TN Lambert , Chet, Birmingham, AL Bowers , Walter H., Jr., Blairsville, GA Pocreva , Robert, Ocean Springs, MS Steele , Bryan T., Casa, AR Perry , Max L., Irving, TX Cox , Foster, Fort Stockton, TX Campbell , Clarence, Aledo, TX Shade , Gerald L., Clovis, NM Frye , Jimmie W., Gravette, AR Wells , Roy D., Temple, TX 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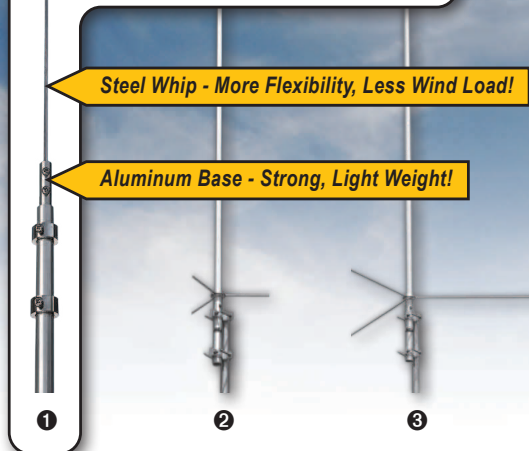
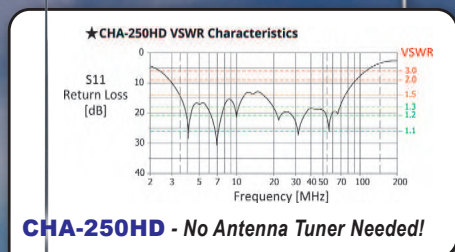
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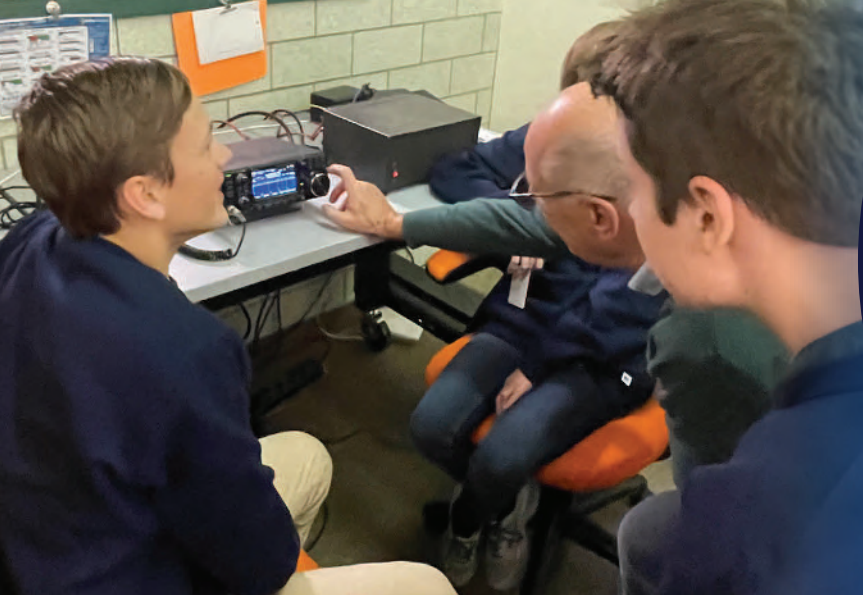
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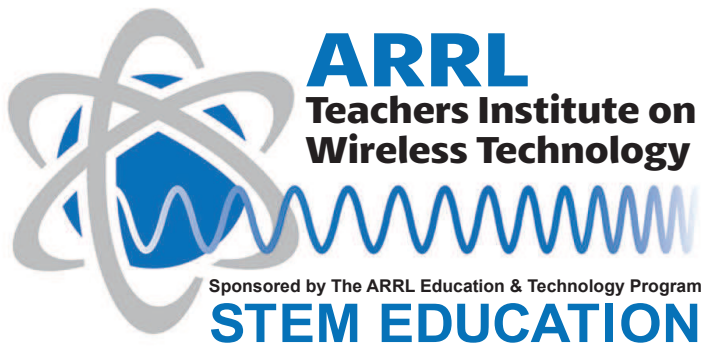
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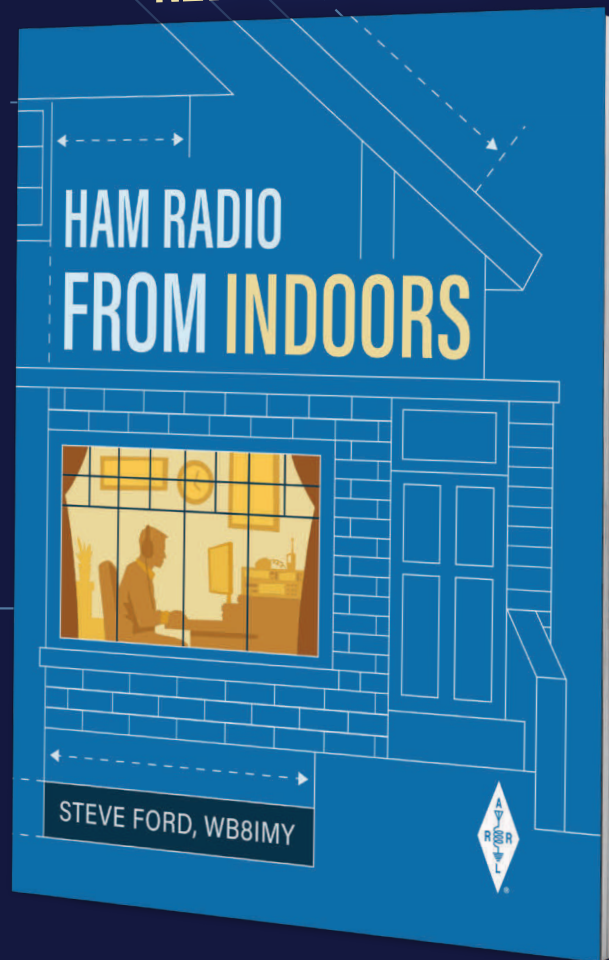
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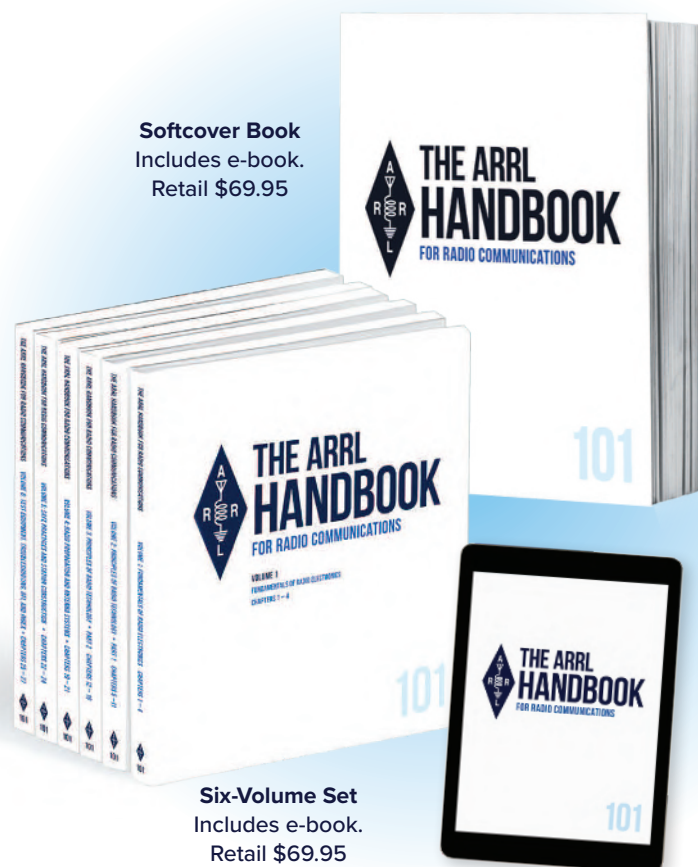
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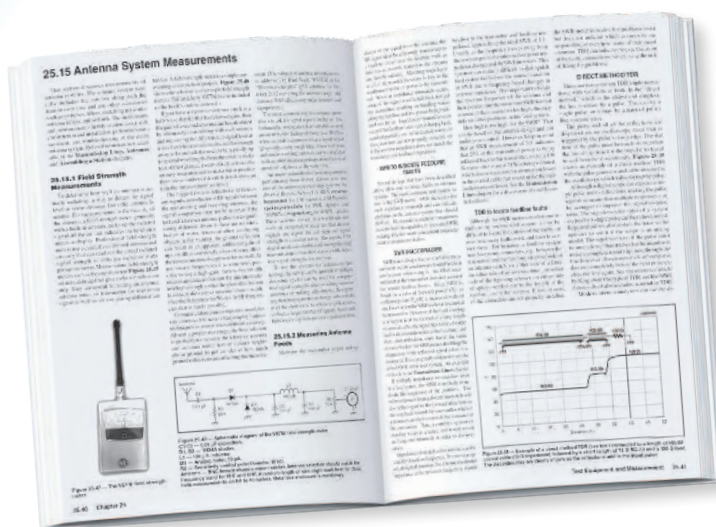
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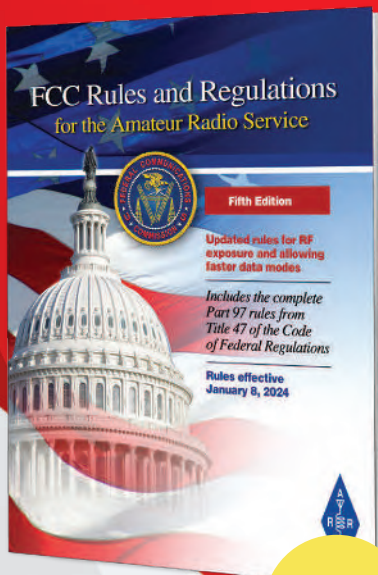
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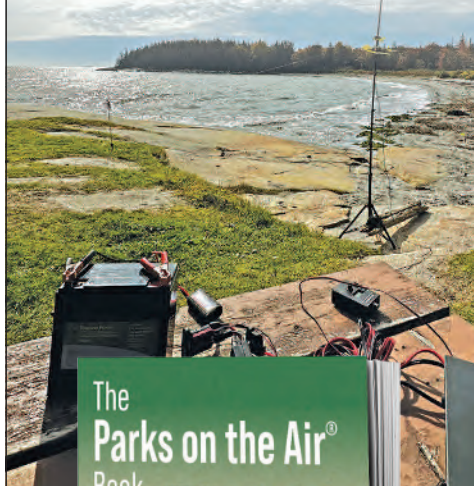
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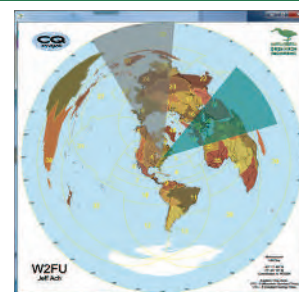
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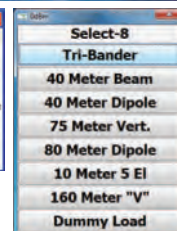
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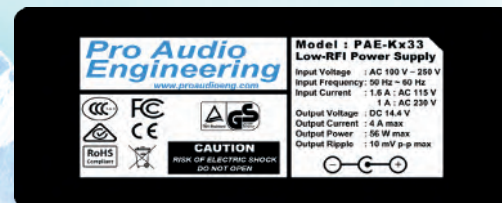
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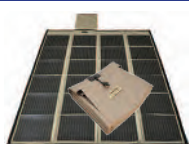
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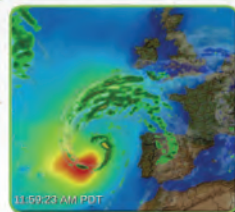
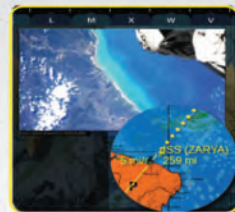
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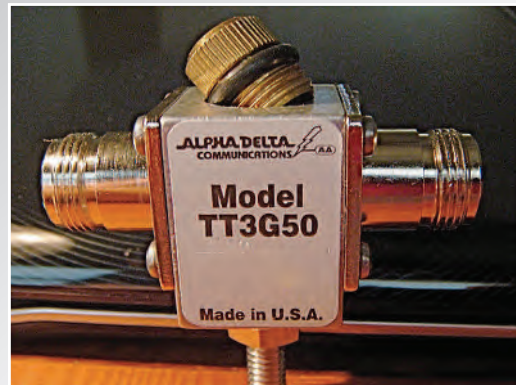
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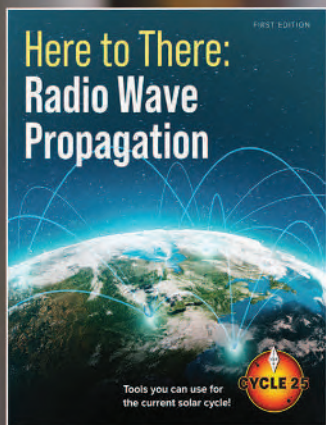
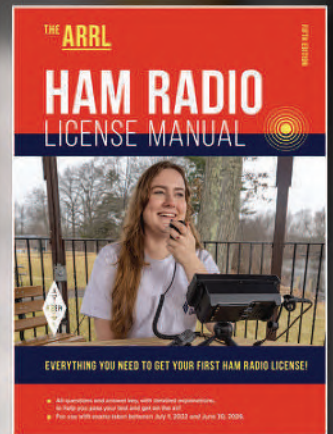
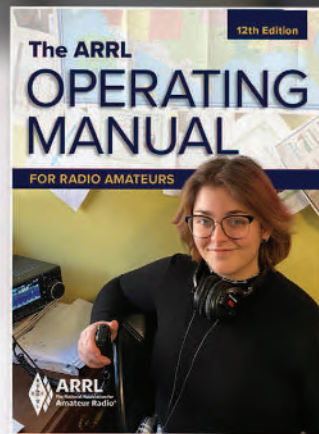
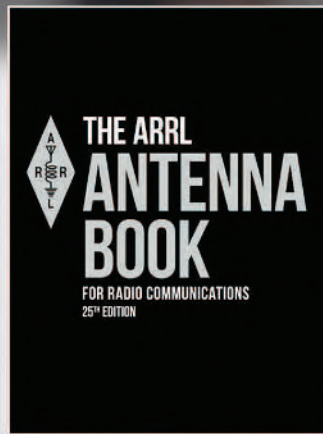
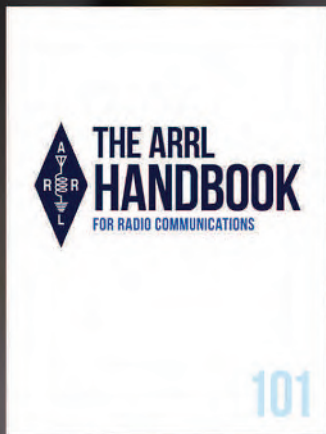


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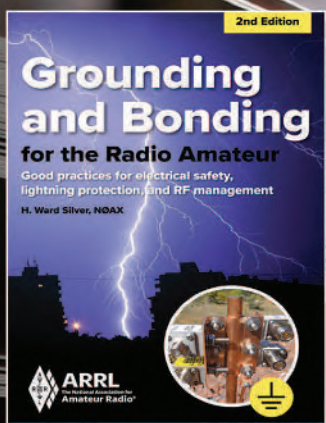
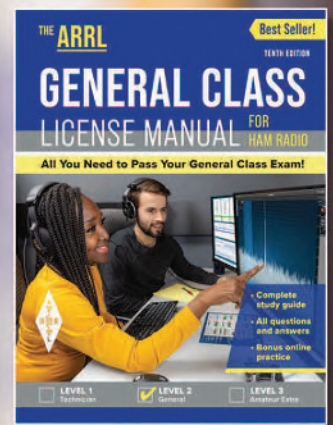
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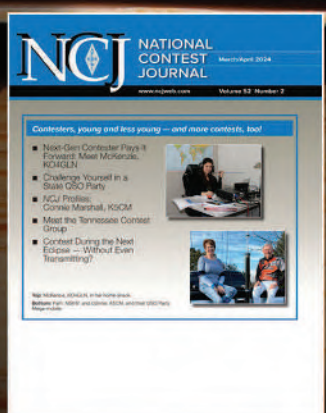
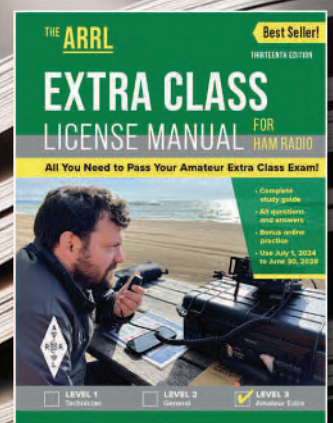


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To keep 60-meters usable for radio amateurs, ARRL is working with the FCC to keep the 100 W power limit and the existing five channel allocation. ARRL is protecting the rights of all Amateur Radio Operators and the advancement of American expertise in wireless technology.



A delegation from ARRL and the International Amateur Radio Union represented our interests at the ITU World Radio-communication Conference 2023 (WRC-23) in Dubai, United Arab Emirates, in November and December. This huge effort at a significance expense needs your support.

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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	4W MIN	4W MIN	4W MIN
Input/Output Impedance	50 ohms	50 ohms	50 ohms
Input/Output Connectors	SO-239	SO-239	SO-239 or N-Type

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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	5W MIN	5W MIN	5W MIN	0.4W
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Output Port: 2



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