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QST

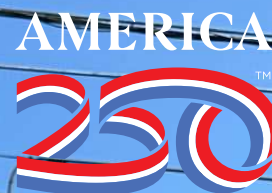


February 2026

DIGITAL EDITION



NATIONAL PARTNER



Finding Power-Line RFI

QST Reviews

KiwiSDR KiwiSDR 2: Standalone
SDR Network Receiver

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Antenna

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Telescopic Mast

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Our Cover

RFI from power lines is a common problem that many hams need help and guidance with. Mike Gruber, W1MG, describes how ARRL has worked with the FCC and IEEE on this matter in "IEEE Recommendations for Locating Power-Line Gap Interference Sources," and points readers to the IEEE document that can assist with RFI problems. [Conrad Trautmann, N2YCH, photo]

Digital and Mobile Editions

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www.arrl.org/qst-author-guide
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NCJ, National Contest Journal, is ARRL's bimonthly magazine by and for the ham radio contesting community, presenting information and advice from top contesters, operator profiles, and scores for the North American QSO Party and North American Sprint. www.arrl.org/ncj



QEX, A Forum for Communications Experimenters, is ARRL's bimonthly forum for research, theory, and projects on the cutting edge of RF communications. www.arrl.org/qex



On the Air is ARRL's bimonthly magazine for beginner to intermediate ham radio licensees, presenting jargon-free, easy-to-understand explainers, practical information, and projects. www.arrl.org/ota

QST (ISSN:0033-4812) is published monthly as its official journal by the American Radio Relay League, Inc., 225 Main St., Newington, CT 06111-1400, USA. Volume 110, Number 2. Periodicals postage paid at Hartford, CT, USA and at additional mailing offices.

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

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Indexed by Applied Science and Technology Index, Library of Congress Catalog Card No: 21-9421.

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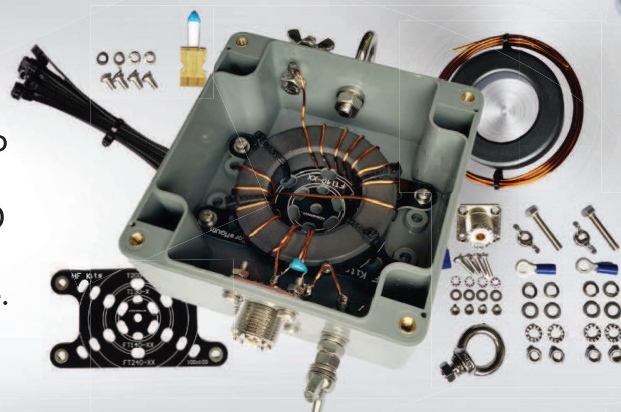
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X300A (2 Section)	2m/70cm	10	200	UHF or N
X200A (2 Section)	2m/70cm	8.3	200	UHF
X50A (1 Section)	2m/70cm	5.6	200	UHF or N
X30A (1 Section)	2m/70cm	4.5	150	UHF
Monoband Base Station/Repeater Antennas				
F23H (3 Section)	144-174 MHz (W/ Cut Chart)	15	350	UHF
F22A (2 Section)	2m	10.5	200	UHF
CP22E (Aluminum)	2m	8.9	200	UHF
F718A (Coax Element)	70cm	15	250	N
Dualband Mobile Antennas				
SG7900A	2m/70cm	62.2 in.	150	UHF or NMO
SG7500A	2m/70cm	40.6 in.	150	UHF or NMO
NR770H Series	2m/70cm	38.2 in.	200	UHF or NMO
MR77 Series	2m/70cm	20 in.	70	Mag Combo
AZ504FXH	2m/70cm	15.5 in.	50	UHF
AZ504SP	2m/70cm	15.5 in.	50	UHF
NR7900A	2m/70cm	57 in.	300/250	UHF
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Second Century

A Question of Leadership

With this being the Year of the Club, it's a good time to ask yourself, how active are you with a local radio club? Perhaps you get involved in one aspect or another, from Field Day, to POTA outings, to exam sessions, to public service events. Clubs can have myriad activities throughout the year. The one thing every club must have is leadership. After all, volunteers cannot be managed — they need to be led.

Being a leader in a club can be a challenging and rewarding experience. It can also put you in the cross-hairs of criticism or, at times, a lack of appreciation. The first fundamental truth club leaders must accept is that every member involved and engaged is a volunteer. They are trading away their time and experience to participate in some aspect of the club, but they cannot simply be managed. When working with volunteers it is important to discern the difference between leaders and managers. Leaders inspire, build influence, and motivate people to follow them; managers hold authority and ensure tasks get done.

Consider the role of the club president, or an ambitious club member who takes on the organizing role for this year's Field Day. These leaders are often driven individuals, sometimes with professional leadership backgrounds, who step up to plan events, create agendas, and move the club forward. They'll likely look to others for help, assigning club members to various tasks. They'll concern themselves with funding sources and expenses. Then they'll take on the job of managing the teams to get things done. Have you seen this model? The clubs will accomplish much — but can leave certain members feeling like they've missed the fun or enjoyment that originally drew them to the club or activity, ultimately leading to resentment.

Club members don't just want to be part of a system accomplishing tasks. Rather, they're most likely looking for experiences — amateur radio experiences — and outcomes that satisfy the reason they became a ham in the first place.

How can club leaders avoid being task masters? A Field Day volunteer who only shows up to follow instructions may complete tasks, but one who learns why decisions are made — and gets to share the results — comes back next year eager to help again.

A first step is acknowledging that volunteers are motivated by purpose, not assignment. This comes through using the foundation that this monthly column tries to establish: to inform and inspire.

Club leaders should use their considerable experience to give guidance and training to club members. Use the opportunities presented, such as monthly club meetings or weekly tech nights, to drive learning and create curiosity with members. Inspire them by helping to take small steps that lead to success. Give a group, again such as a POTA activation group, not just the framework to go out and operate, but to learn from the experience and to share the experience with the rest of the club. All the while, stand at the side of the room, giving them the spotlight.

At Headquarters, we know very well that members love to tell their story and to earn recognition. Staff learn quickly that our role as leaders is not to finish members' sentences. Rather, ARRL's role is to inspire members and non-members alike to be radio active and to connect — to share their experiences with others. It is all about creating programs that help draw out the various voices and experiences our members are having, and making, with amateur radio.

As I always do, I am encouraging you this year to be radio active — get in with your local clubs, and get involved with the various areas your fellow members are pursuing in the hobby. Be a connector — bring more people into the club, especially those with unique experiences and demonstrated skills. And choose to lead — gently and in purposeful ways that inspire others to participate and share their voices. Choose to put yourself out there, all the while basking in the bright light of your club's success.

David A. Minster, NA2AA
Chief Executive Officer

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Find more 2026 events on the ARRL Hamfests and Conventions Calendar

www.arrl.org/hamfests

Club Spotlight



W4GR



Gwinnett Amateur Radio Society

Founded: 1973 Voting Licensed Amateur Members: 292 Members: 357 Section: Georgia	ARRL Affiliation Date: Sept. 11, 1982 Meetings: Monthly Website: www.gars.org/gars Focus: Education, Public Svc., Community
---	---

A History of Service and Recognition

For more than half a century, the Gwinnett Amateur Radio Society (GARS) has been a pillar of amateur radio activity in Georgia. With a mission built on education, public service, and community, GARS has grown into one of the largest and most active clubs in the state — welcoming new hams, supporting schools, advancing emergency communications, and continuing to expand what a modern amateur radio club should be.

GARS became an ARRL Special Service Club in 1992, passed the 100-member mark the following year, and established regular VE sessions in 1994. By 2014, the group received national recognition as Dayton Hamvention Club of the Year, and membership topped 300 by 2018. GARS received the honor of Georgia Club of the Year at the 2022 Atlanta Hamfest and, in 2023, celebrated its 50th anniversary.

Growth, Innovation, and Education

Community involvement remains

a defining trait for this club. One of its earliest achievements was the construction of a homebrew repeater installed at Buford Hospital, a project that set the tone for GARS's collaborative and technically inventive nature.

GARS also supports the annual Memorial Day parade held in Dacula, Georgia; provides communications for a local dog show; and assists ARES and local agencies with emergency readiness and infrastructure. Members volunteer for the Stone Mountain Hamfest, and one of the club's most anticipated events each year is GARS TechFest, which is a free, hands-on exposition now entering its 27th year. TechFest features demonstrations, forums, vendor booths, exams, a chili cook-off, and groups ranging from AUXCOMM to digital mode enthusiasts. The event embodies what GARS does best: creating an atmosphere where learning, experimenting, and welcoming new people happens naturally.

The GARS licensing and education program is impressive. The club

hosts 12 monthly exam sessions, HamCram weekends, TechFest examinations, on-demand test sessions, and VE teams that bring testing directly into local schools. Anyone age 21 or under is granted free membership as part of GARS's commitment to youth outreach and STEM engagement. GARS also gives all newly licensed hams their first year of GARS membership for free, regardless of age.

They also actively collaborate with schools to establish amateur radio clubs, support ARISS student contacts with the ISS, and organize mini Field Days and foxhunts. Monthly meetings feature dual-track programming geared toward both newcomers and experienced hams. Mentorship also happens informally through weekly Friday lunches, Saturday breakfasts, and active online communities on groups.io, Discord, Facebook, and YouTube. The club newsletter, "GARzette," helps everyone stay connected.

The Future of GARS

The club continues to innovate. GARS is developing a topic-based net to encourage repeater activity, planning more social outings, hosting local contests, improving repeaters, and working toward an ambitious long-term goal: interconnecting its entire repeater network for expanded coverage and more operating flexibility.

When asked what keeps GARS thriving after 50 years, members point to one core idea — the club listens. Surveys, feedback, and open communication shape club development, creating a culture where members feel valued and involved. It's a model built not just on radios, but on people.

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Up Front



[Photo courtesy of Linda Mison, W4LRM]

Teaching Ham Radio in the Philippines

In honor of World Thinking Day, an international Girl Scouts/Girl Guides holiday celebrated every year on February 22, Girl Scouts from various schools in Pasay City in the Philippines worked with the Philippine Amateur Radio Association to participate in the 2025 International Friendship Exchange and DX Contest. The 15 Girl Scouts who participated received lessons on basic ham radio topics, assisted in installing an antenna on the roof of the Pasay City Girl Scouts of the Philippines Council office, and made 40- and 15-meter radio contacts. By the end of the contest, the Scouts and their mentors had made 98 contacts, including 84 international contacts.

A “Nested” Tower

Michael Mardit, WA2VQW, looked out his bedroom window one morning to find an unexpected occupant in his antenna tower. This mother bird had built her nest on the tower to protect her eggs from the weather. Her eggs eventually hatched and, once the babies were big enough to fly, the whole family flew the coop. Talk about a “nested” tower!



[Michael Mardit, WA2VQW, photo]



[James Fischer, photo]

A Treasure in a Photo Album

While flipping through one of his parents' photo albums, James Fischer came across a piece of early ham radio history — one of his grandfather's QSL cards from the 1920s. His grandfather, Donald H. Stover, 9AFN, had these pre-printed QSL cards handy to send to any hams he managed to contact from his home station in Freeport, Illinois. According to James, 9AFN helped run a store that assembled, sold, and serviced tube radios and used his own radio to send daily weather instrument observations to the National Weather Service.

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



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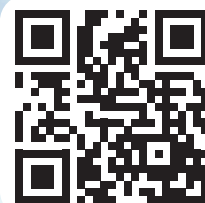
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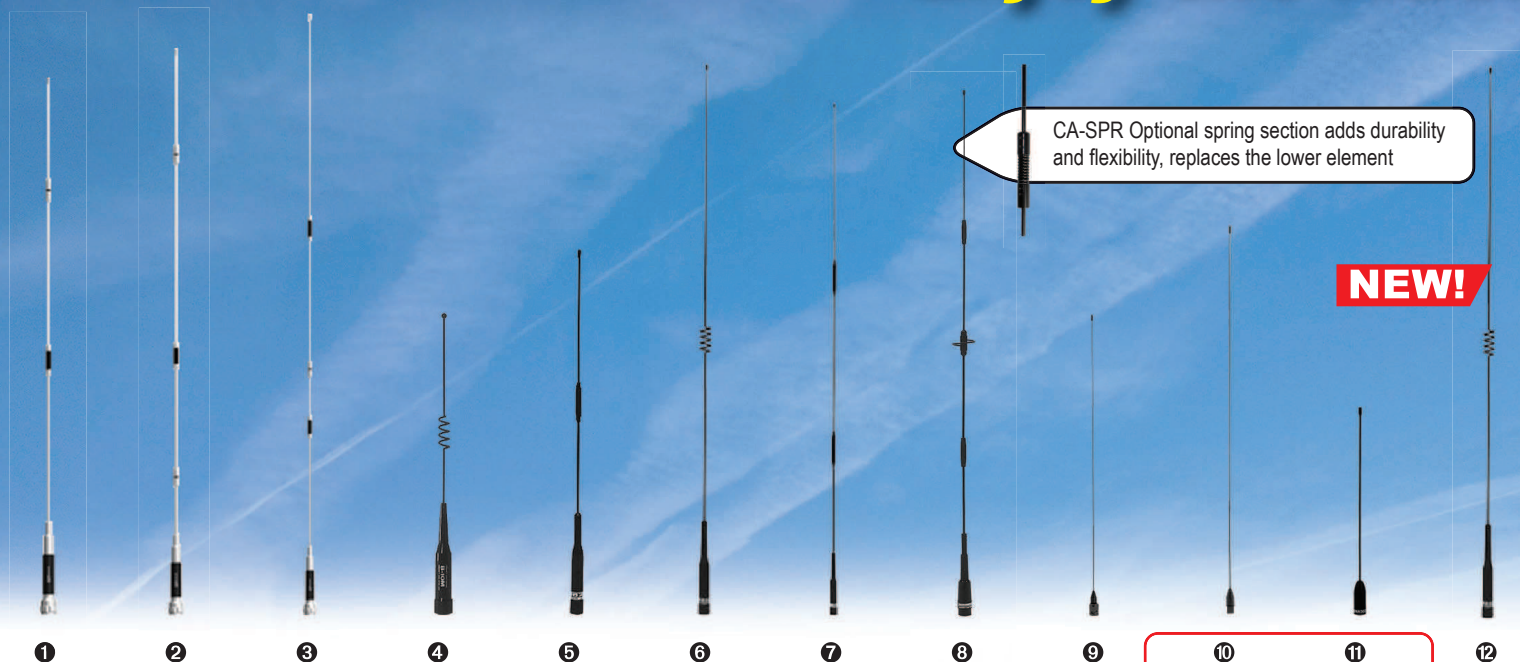
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2M: 5/8 wave center load • 440MHz: 5/8 wave x 2 center load • VSWR: 1.5:1 or less • Length: 51" • Conn: PL-259 • Max Pwr: 150W

❸ COMET CSB-790A DUAL-BAND 2M/440MHz w/FOLD-OVER

2M: 7/8 wave center load • 440MHz: 5/8 wave x 3 center load • VSWR: 1.5:1 or less • Length: 62" • Conn: PL-259 • Max Pwr: 150W

❹ COMET B-10/B-10NMO DUAL-BAND 2M/440MHz

2M: 1/4 wave • 440MHz: 1/2 wave • Length: 12" • Conn: B-10 PL-259, B-10NMO - NMO style • Max Pwr: 50W

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2M: 1/4 wave • 440MHz: 5/8 wave center load • VSWR: 1.5:1 or less • Length: 18" • Conn: SBB-2 PL-259, SBB-2NMO - MNO style • Max Pwr: 60W

❻ COMET SBB-5/SBB-5NMO DUAL-BAND 2M/440MHz w/FOLD-OVER

2M: 1/2 wave • 440MHz: 5/8 wave x 2 • Length: 39" • Conn: SBB-5 PL-259, SBB-5NMO - NMO style • Max Pwr: 120W

❼ COMET SBB-7/SBB-7NMO DUAL-BAND 2M/440MHz w/FOLD-OVER

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⓫ COMET SMA-503, SMA-503J DUAL BAND 2M/440MHz HT ANTENNA

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Letters from Our Members

Recommended Propagation Q Signals

After an exchange of emails with my buddy Dan Zeitlin, K2YWE, I was looking at some DX spots, and it occurred to me that we might benefit from a shorthand code specifying the path being used during a contact or in a spot. The QP series of Q codes hadn't ever been assigned, and I thought they could be useful for path descriptions. I created the following signal suggestions that could be used for a variety of propagation modes as easily remembered QP signals: QPA (aurora), QPB (backscatter), QPD (tropospheric ducting), QPE (sporadic E), QPL (long path), QPM (meteor scatter), QPP (what's the propagation mode?), QPQ (skew path), QPR (rain scatter), QPS (normal short path), QPT (tropospheric scatter), and QPU (unknown).

The Q signal can be followed by the degree heading from the sending station's location and/or grid locator.

Roland Anders, K3RA
Elkridge, Maryland
Life Member

Avoiding Amateur Radio Extinction

I always enjoy Japanese-sponsored contests because the contact exchange is usually your RST and your age. Several of the station operators I contacted during the most recent Japanese Amateur Radio Teleprinter Society RTTY contest were in their 70s and 80s (and I am 81) — only a few were younger. I fear that our hobby is aging out.

New hams (not necessarily young hams) seem to be only interested

in cheap VHF/UHF radios and repeater operations, instead of making HF DX contacts and building stations that can make these kinds of contacts (which aren't too costly). Those of us who joined the hobby during the 1950s through the 1990s need to mentor new hams if we expect ham radio to endure the inevitable changes.

We need to show the public what we do, why and how we do it, and why it's a significant benefit to the community (e.g., emergency communications) and their kids. Ham radio demonstrations at schools, connecting students with astronauts on the International Space Station, and involving local and state politicians can help.

Alan Swinger, K9MBQ
Charlottesville, Virginia

Preserving Amateur Radio as a Service

Our FCC licenses place us within a recognized communications capability relied upon by communities and public agencies. This role has purpose and responsibility, and it deserves to be spoken of in a way that reflects its importance.

Routine nets, community events, and training exercises are more than conversations among operators — they help maintain the readiness and reliability expected of a service that may be called upon at any time. When our on-air presence reflects calm, courteous, and practiced operating, it reinforces the value of our role.

Our appearance and demeanor during deployments matter as well. A clean and appropriate appear-

ance, along with respectful interactions, signal that we take our responsibilities seriously. It reassures agency staff that they can count on us as part of their overall communications strategy.

Technical experimentation, learning, and camaraderie are meaningful parts of our experience, but they all serve a larger purpose: strengthening our ability to provide communication when it's needed most. Describing amateur radio in terms that focus on its service mission helps keep that purpose at the forefront.

Jim Norman, N4CFB
Knoxville, Tennessee

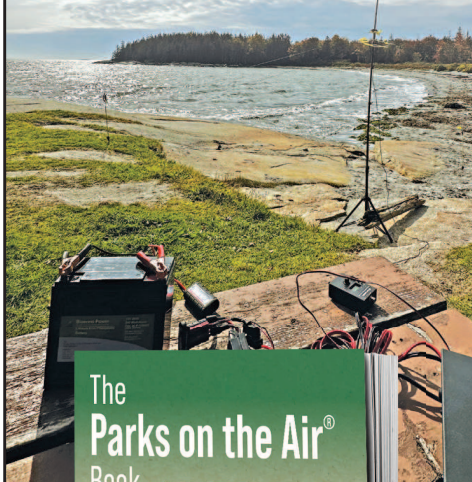
Searching for Special Event Station Frequencies

I love to operate special event stations, but it's exhausting trying to find the frequency being used in the spread of 80, 40, or 20 meters. It would be helpful if events gave a short spread of frequencies, such as 3.5 to 3.6 MHz. Another solution would be to give a center frequency, such as 3.85 MHz, plus or minus 0.05 MHz. In either case, it would make finding the special event station easier and could increase check-ins on their end.

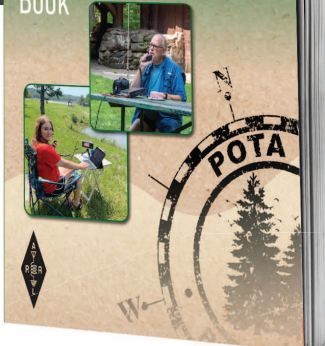
Larry Sloop, NC4WX
Lewisville, North Carolina

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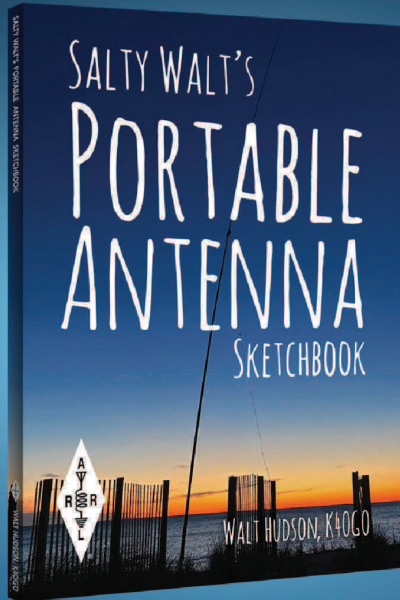


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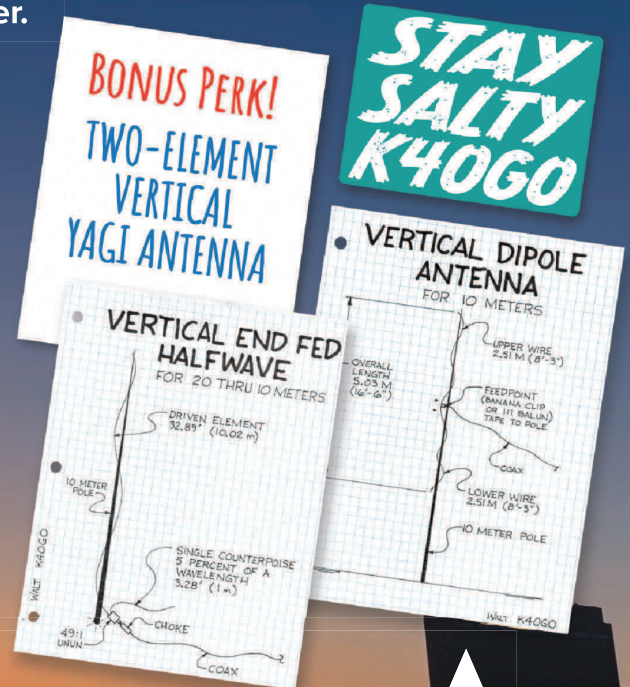


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W1AW Schedule

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

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

♦ Morse code transmissions: Frequencies are 1.8025, 3.5815, 7.0475, 14.0475, 18.0775, 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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Creating Antenna Matching Networks Using a NanoVNA

Learn how to use your device's **L/C MATCH** capability on almost any single-band antenna.

Michael Foerster, WØIH

I use a NanoVNA SAA-2N to take various measurements around my shack. The NanoVNA is typically priced anywhere between \$50 and \$150, and it allows you to measure not only standing wave ratio (SWR), but feed-line losses, choke balun performance, and more. I discovered that it has a **MEASUREMENT** menu with an **L/C MATCH** setting; this generates suggested coil and capacitor values to provide a 50 Ω match for an antenna. The solution is similar to what a tuner would find. Not all NanoVNA firmware has this option — my NanoVNA has firmware developed by DiSlord. If yours doesn't have a **MEASUREMENT** selection on the

main menu, visit www.github.com/DiSlord for a build that fits your device.

While it's preferable to make the measurements at the antenna feed point, I made mine at the base of my tower rather than in the shack. This eliminates some losses that would occur through the coax from the amplifier output to the tower base.

Project 1: An 80-Meter Dipole

I use an 80-meter dipole with a 1500 W amplifier. The problem is that the best SWR I can get with the dipole is about 1.7:1 because its center height is only about 35 feet above ground, and one of the ends is at 20 feet. This doesn't leave me with much tuning range on the band before I get above 2:1, which is where the solid-state amplifier will shut down. I prefer to forego using a tuner. The dipole is my own design (see it in my article "The WØIH Tunable 80 Meter Dipole" in the March 2015 issue of *QST*, as well as in the ARRL book *HF Dipole Antennas for Amateur Radio*), and I can adjust its length by pulling on the coax, which allows the dipole to fold in on itself via pulleys on both ends and at the center. I can set the resonant point almost anywhere in the band as a result. However, that adjustment requires me to go outside to make the band change. I wanted a little more flexibility in the band-width.



The NanoVNA's **L/C MATCH** function helped the author change the operating frequency of this Decibel Products DB-224.



Figure 1 — The un-tuned dipole's SWR curve and **L/C MATCH** readings for 3.767 MHz. The middle horizontal line is the 2:1 SWR mark.

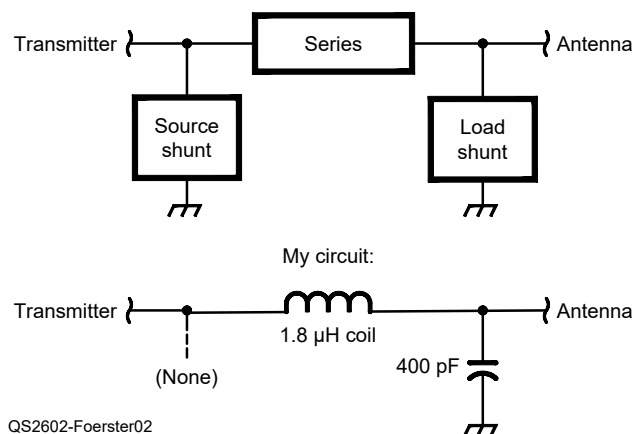


Figure 2 — The circuit showing the values of the **L/C MATCH** for 50 Ω .



Figure 3 — The circuit constructed for the tuning box.

The NanoVNA **L/C MATCH** measurement provides an L-network (single coil, single capacitor) solution for the antenna (see Figure 1). It may provide either source shunt or load shunt values depending on the tuning needed. My circuit in Figure 2 shows the suggested values of the **L/C MATCH** for 50 Ω . Either of the solutions — **SERIES** 1.8 μH and **LOAD SHUNT** 327 pF or **SERIES** 1 nF and **LOAD SHUNT** 3.5 μH — can be used to create a tuning circuit.

Exact values are not required, but I recommend using values as close as you can. I was able to acquire a high-voltage 400 pF capacitor (for the 327 pF capacitor), which is more than sufficient for a 1500 W amplifier, and I constructed a coil using PVC pipe and enameled wire.

It is important to choose a capacitor that has sufficient voltage for the power level that you will be working with. For 100 W or less, you can use a 500 V capacitor, and for 1500 W, you should use — at minimum — a 2,000 V capacitor. A mica capacitor is a good choice for this type of RF circuit. Additionally, be sure to use coil wire of sufficient diameter (#16 AWG or larger) and spacing for the power level.

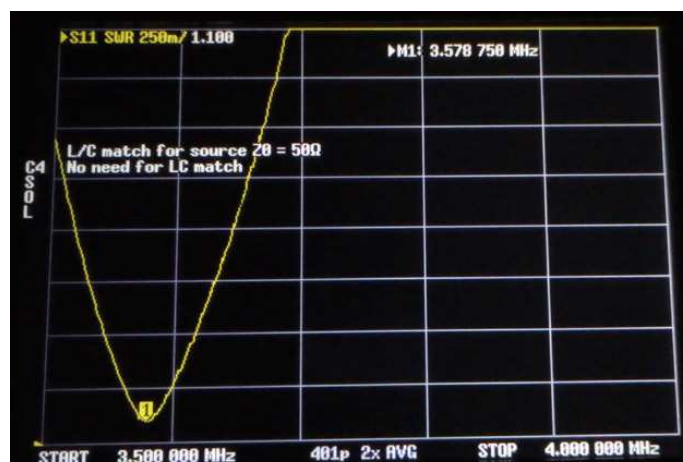


Figure 4 — The SWR chart with the antenna length extended.

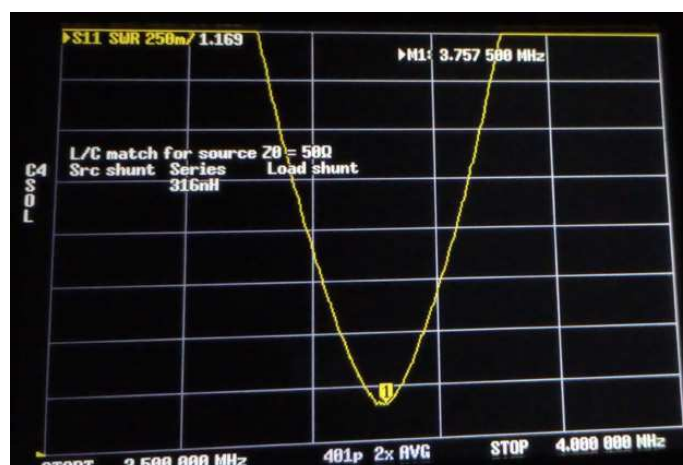


Figure 5 — The SWR chart with the antenna at mid-band.



Figure 6 — The SWR chart with the antenna length shortened.

I found a website (www.66pacific.com/calculators/coil-inductance-calculator.aspx) that calculates the inductance of a coil, which helped with winding. Using a 1.3-inch-diameter form, I varied the number of windings and the length until I reached a value relatively close to the 1.8 μH indicated on the NanoVNA's **L/C MATCH** function; this amounted to 10 turns over a 2-inch length for a value of 1.6 μH .



Figure 7 — The circuit constructed for the DB-224.

I quickly constructed the circuit from junk-box parts and used it for the tuning box shown in Figure 3. The input (source) is the coaxial lead (PL-259 not shown; note the shield ground soldered to the inside of the box) on the left. The output is the SO-239 connector (load) on the lower right. I mounted the box at the base of the tower and at the output of my remote antenna switch.

The circuit yielded the following SWR charts (see Figures 4, 5, and 6) for the 80-meter band, between 1.1 and 1.2:1 as I adjusted the antenna's length through its range. This provides me with a greater tuning range for any given antenna length.

Project 2: A Decibel Products DB-224

Another project with which I found **L/C MATCH** useful was rebuilding an older Decibel Products DB-224 antenna (see the lead photo) to change the operating frequency of 150 – 160 MHz to work in the 2-meter band between 144 – 148 MHz (www.repeater-builder.com/antenna/db/pdfs/db-224e-diagram-dz.pdf).

To lower the operating frequency, I had to lengthen the coaxial harness, dipole loops, and mast. Once completed, I found that the SWR of my “re-cut”

antenna was 1.67:1 at our club's repeater transmitter frequency of 146.64 MHz. Duplexers for a repeater work better with low-SWR antennas. The **L/C MATCH** on the NanoVNA showed the following values: **SERIES** 51 nH and **LOAD SHUNT** 4 pF, as well as **SERIES** 23 pF and **LOAD SHUNT** 67 nH. I chose the first solution, and using the coil-winding data from the referenced calculator, I constructed the circuit shown in Figure 7 from junk-box parts.

The power level for the repeater that this is used on is less than 25 W to the antenna. I thought that the variable capacitor in my junk box would suffice, considering the initial installation for this antenna would be temporary. With the fixed coil value, I was able to adjust the tuning of the coil (expanding and contracting), and I adjusted the variable capacitor to a 1.15:1 SWR — a good match for the duplexers.

A Versatile and Effective Technique

The solution I provide in this article could be applied to nearly any single-band antenna. The antenna feed point is the ideal point for measurements and mounting the matching circuit. However, I found it more convenient to mount the circuit at the base of my tower. Coaxial loss calculations (made via www.easycalculation.com/physics/electromagnetism/coax-calculator.php) showed that with 35 feet of coax from my matchbox to the antenna, the difference in power output is about .05 dB, or less than 19 W of additional power drop from the coax and SWR losses for a 1500 W output. In any case, you should make the NanoVNA measurements where you plan to mount your matching network. Make sure that the parts you choose for the matching network (coax, inductor, and capacitor) will work at your intended power level.

All photos provided by the author.

ARRL member Michael Foerster, W0IH, holds an Amateur Extra-class license and has been licensed since 1969 (he was previously WA0VNH). A retired software test engineer, he is currently the club repeater trustee for the Winona Amateur Radio Club, W0NE. Michael enjoys working with antennas and Arduino projects, and he enjoys ragchewing on HF with his Elecraft K-Line transceiver and classic rigs. You can reach him at w0ih@arrl.net.

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



IEEE Recommendations for Locating Power-Line Gap Interference Sources

Released in 2024 after years in the making, this comprehensive document helps to resolve harmful interference to radio spectrum.

Mike Gruber, W1MG

On September 20, 2024, the Institute of Electrical and Electronics Engineers (IEEE) released *Std 1897™-2024*, a recommended practice for locating sources of radio interference from power lines. Long in the making, this document provides a thorough approach to helping utilities and others, including radio amateurs, better address cases of harmful interference to radio spectrum. In addition to detailed information on modern noise-locating equipment and techniques, it includes information on the cause and effect of power-line noise, FCC rules and requirements, plus recommended complaint-handling procedures for utilities. There's also information on how to locate sources of non-power-line interference, such as from switching-mode power supplies and other types of consumer devices.

Power-line noise can cause interference to radio communications, including amateur radio. It's typically caused by arcing or sparking on the power lines or related hardware as a result of a defect and is considered an abnormal function of the hardware. A characteristic raspy buzz is often the first and most obvious symptom of this problem. It's also a broadband type of noise that covers a wide and continuous portion of the spectrum. FCC Part 15 rules, Unlicensed RF Devices, classify power lines and related equipment as *incidental radiators*. As such, the rules do not specify absolute emissions limits; however, they do prohibit harmful interference from such devices. Part 15 further defines *harmful interference* as "any emission, radiation, or induction that endangers the functioning of a radio navigation service or of other safety services or seriously degrades, obstructs, or repeatedly interrupts a radiocommunications service operating in accordance with this chapter."

The same or similar FCC rules also apply to interference caused by consumer devices, another common problem affecting amateur radio with one significant difference: Manufacturers of many types of electronic consumer devices, when classified as *unintentional radiators*, must also meet minimum emissions requirements. However, the FCC emissions limits are still

high enough to cause harmful interference to nearby radio reception. Regardless of the source, the same rule concerning the prohibition of harmful interference applies. See the sidebar "FCC Definitions and Examples of Three Common Radiators" for more information on these devices.

Responsible Parties for Correcting Harmful Interferences

The FCC rules place the burden of correcting harmful interference on the operator of the offending device: If the device is in your home, you're responsible for correcting the problem; if it's in a nearby residence, it's your neighbor's responsibility, and if it's from power lines, the burden to find and fix it falls on the utility. Unfortunately, as many hams have discovered, this is where things can get difficult.

A ham locating a consumer device can be problematic if the source isn't in their home, especially if their neighbor is uncooperative. In the case of power-line noise, they must file a complaint with their utility; however, many are not familiar with this type of problem, and others may not understand their responsibilities under the FCC rules. To make matters worse, the FCC doesn't have the resources to investigate or even address most of these issues. As a result, many hams suffering from interference problems are often left with protracted cases that are difficult, if not impossible, to solve.

ARRL Responds to a Need

In the early 2000s, interference complaints were on the rise, so ARRL and the FCC created what became known as the Cooperative Agreement in 2001. Although ARRL doesn't have enforcement power in radio frequency interference (RFI) matters, it operates as a partner with the FCC, providing technical help, guidance, and other resources. The goal of this agreement is to solve cases with minimal or no FCC involvement, allowing the FCC to focus its resources on enforcement. ARRL has also assisted other services when needed, particularly regarding public safety, such as with police and fire departments and air-traffic frequencies.

ARRL developed a database to help track the reported RFI cases, and some patterns quickly emerged with power-line noise cases. Some cases involved utilities routinely and quickly finding and fixing power-line noise sources on their equipment, while other utility cases dragged on with little or no results. It became apparent that utilities didn't know how to find sources of interference originating from their equipment. In some cases, the utility came out only to verify that the customer had power. Others attempted random guesses to correct the problem, including tightening hardware, removing vegetation, or even replacing a transformer or other hardware. Others fixed everything they could find, often reporting huge expenses with no results. In the end, none of these approaches proved successful.

A Better Approach

Successful utilities and RFI investigators were using modern, commercially available radio direction-finding equipment and techniques. One notable example is the use of *signature analysis*. Just like fingerprints, every arc (and therefore every power-line noise source) has a unique pattern or signature when observed in the time domain. A signature match between the interference at the affected equipment and a source in the field helps identify the correct source. Now, only those sources contributing to the actual interference problem need to be fixed, thus eliminating guesswork.

These techniques and equipment provided utilities a far more economical way to fix interference problems: the utility's obligation under the FCC rules is met, the customer is happy, and, most importantly, a potentially hazardous situation may be averted if there had been a serious defect on the utility's system.

Seeking to further understand the issues and gain practical experience in these matters, ARRL acquired commercially available locating equipment for the ARRL Lab's RFI Department. After some practice and a little time at W1AW, I found that a typical single noise source might take only an hour or two to locate. In some cases, interference sources could also be narrowed down to the specific hardware on a utility pole — right from the ground — using a professional-grade ultrasonic locator. With a little more practice, I was able to use the test equipment to locate interference sources for cases previously reported to ARRL. In some of these cases, the utility had already spent considerable time and money fixing sources without results.

Standards Were Needed

Although the FCC rules clearly prohibit harmful interferences from power lines, there were no standards

FCC Definitions and Examples of Three Common Radiators

- 1. Incidental radiator** — A device that generates radio-frequency energy during its operation, although it's not intentionally designed to generate or emit radio-frequency energy. Examples include power lines and other associated hardware. Incidental radiators are often sparking- and arcing-type sources. These devices don't have any specified emissions limits under the FCC rules, only a requirement that their operation doesn't cause harmful interference to a licensed radio service.
- 2. Unintentional radiator** — A device that generates radio-frequency energy for use within the device, or that sends radio-frequency signals by conduction to associated equipment via connecting wiring, but which is not intended to emit RF energy by radiation or induction. Examples include many common-consumer electronic devices, such as switching-mode power supplies, computers, microwave ovens, televisions, and superheterodyne radios.

These types of devices generate RF at greater than 9 kHz but aren't designed to intentionally radiate it. Unintentional radiators have specified emissions limits under the FCC rules and a requirement that their operation doesn't cause harmful interference to a licensed radio service.
- 3. Intentional radiator** — A device that intentionally generates and emits radio-frequency energy by radiation or induction. Examples include remote controls for garage door openers, Wi-Fi routers, and cellular phones. These devices have specified emissions limits under the FCC rules and a requirement that their operation doesn't cause harmful interference to a licensed radio service. In practice, these devices have rarely been the source of interference to amateur radio operators.

concerning the methods and equipment used to find them. Furthermore, additional ARRL experience showed a real need for a technically correct recommended practice for resolving these issues. ARRL Laboratory Manager Ed Hare, W1RFI (SK), already had considerable experience with IEEE and electromagnetic compatibility (EMC) matters. He soon convinced me, the Lab's EMC engineer, that an IEEE-recommended practice was needed.

After filing a Project Authorization Request with IEEE, I assembled a working group and created a rough draft of what eventually became *Std 1897™-2024, IEEE-Recommended Practice for Location of Power Line Gap Interference Sources*.

I served as the working group's chairman, and we met virtually for the first time on December 10, 2015. Membership soon included a wide range of stake-

holders, viewpoints, and interested parties. Some examples include (but are not limited to) seasoned RFI investigators from several utilities in different parts of the US, members with related utility backgrounds, a professional RFI investigator with decades of consultant experience, members with cable television and telephone backgrounds, a former broadcast engineer working for a contractor to help with Federal Emergency Management Agency and US Department of Homeland Security matters, a retired FCC Special Counsel previously involved in amateur radio interference enforcement, members with an ARRL and Cooperative Agreement background, and a radio amateur that had interference to his station. The group consisted of 22 members, and it should be noted that each of these individuals volunteered their time and expertise during this committee work.

The working group's effort proved harmonious and careful in its approach toward producing the best possible document. We met approximately once a month over the course of almost 8 years. The group's work concluded on February 15, 2024, when the IEEE Standards Association (SA) Standards Board approved the proposed document as a new recommended practice. (The final document underwent additional IEEE editing before its official release on September 20, 2024.)

Conclusion

Interference from power lines and consumer devices remains a common problem that can disrupt a variety of intended radio communications, including amateur radio and communications vital to public safety. These problems have been around since the dawn of radio communications and broadcasting, but with complaints on the rise, something needed to be done. The *IEEE Recommended Practice* document describes the procedures that electric utilities and others may use to better respond to interference complaints and problems of interference to radio and television reception. It also describes procedures used to determine if reported noise is considered to be harmful interference to a licensed radio service under the FCC rules, as well as modern noise-locating techniques, equipment, and protocols that use time-domain noise signatures to investigate and identify radio noise in the field.

In summary, *Std 1897™-2024* offers a practical and real-world approach toward solving interference problems. The full standard is available from the IEEE at <https://standards.ieee.org/ieee/1897/6837>.

ARRL's Participation in Industry Committees

By ARRL Laboratory Manager
George Spatta, W1GKS

ARRL Lab staff are involved with several industry groups and committees. Having seats at these tables allows us to be a voice for amateur radio and its interests. Our participation in the development of standards has proven to be an ongoing asset to all amateurs. ARRL is currently represented in the following organizations:

IEEE EMC Society — This group is focused on reducing electromagnetic interference, while concentrating on developing standards as well as testing and measurement procedures. Historically, ARRL staff have been involved (as IEEE members) with one or two of the 12 technical committees within the EMC Society.

American National Standards Institute C63® EMC Committee — This committee develops and maintains standards that are often turned into FCC regulations. The focus of its eight subcommittees includes measuring noise and testing devices for immunity to RF. Over the years, ARRL has been heavily involved with C63, and Lab staff held chair positions in some of the subcommittees.

National Radio Systems Committee (NRSC) AM Improvement Working Group (AIWG) — ARRL's participation in this group is mostly focused on the effects of environmental RF noise on AM reception. The AIWG studies some of the same sources of interference (power lines, LED lighting, and other consumer electronics) that affect amateur radio and, as such, is another group of experts for ARRL to be involved with.

ARRL remains committed to being part of the standards development process to ensure representation of amateur radio. Our committee involvement over several decades continues to be a valuable benefit to our members.

For a brief description of ARRL's involvement with standards and other committees, see the sidebar "ARRL's Participation in Industry Committees."

Mike Gruber, W1MG, was first licensed in 1974 as a Novice. Now retired, he spent nearly 25 years in the ARRL Lab, primarily as a test and EMC/RFI engineer. Previous experience also includes aerospace and air-traffic control systems.

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A High-Selectivity CW Filter

If you need more receiver selectivity for CW operation, check out this audio filter with a bandwidth of 200 Hz.

Jim Forkin, WA3TFS

When operating in the CW portions of the HF bands under crowded conditions, it is sometimes difficult to separate one signal from another. Many older transceivers — and even some modern ones — lack CW selectivity at less than 500 Hz. A simple solution is to add an audio filter with a narrow bandwidth to the receiver. The filter presented here can provide much-needed selectivity improvement for many receivers.

The Filter's Design

This filter (see the lead photo) is small and inexpensive, and it has a center frequency of 700 Hz with a bandwidth of around 200 Hz. The filter consists of two op-amp stages. I selected an MC1458P dual op-amp because it has been in production for many years, it's readily available, and it's cost effective. This active filter requires a single supply of 9 – 12 V dc and can be inserted before the audio gain control in a receiver. You can easily switch it in and out of the audio path with a small double-pole, double-throw switch (see Figure 1). To do this, break the connection going to the top of the volume control and insert the filter. The filter input (IN) connects to the broken audio connection, and the output (OUT) connects to the top of the volume control. By connecting it in this way, the volume control works as normal. You can wire it in without using the switch, but due to the high selectivity, you may want a wider bandwidth to find your CW contact before activating the filter.

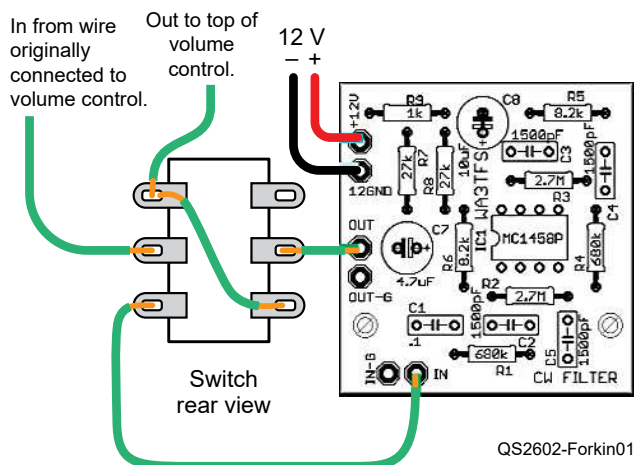
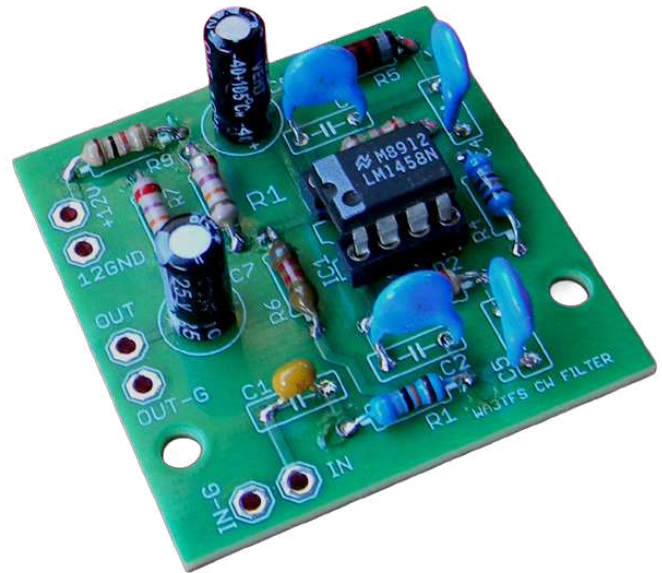


Figure 1 — The CW filter with receiver audio and switching connection information.



The CW filter printed circuit assembly. [Jim Forkin, WA3TFS, photo]

Only through-hole parts are used to make duplication easy for most builders. No adjustments are necessary, and no test equipment is required. The filter measures only about 1.5 × 1.5 inches, ensuring it will fit inside almost any receiver. Alternatively, the filter can be used externally with headphones. Figure 2 is the schematic, and Table 1 lists the necessary components (if there is too much audio level reduction when inserting the filter, replace R1 with a jumper wire).

Circuit Description and Notes

The audio input is applied through C1 and R1 to the first filter stage. The MC1458 IC has two op-amp stages in an eight-pin dual in-line package device. Each filter stage is identical, and the output of the

Table 1 — Parts List

Qty	Description	Designator	Value
2	Resistor	R1, R4	680 K Ω ¼ W 5%
2	Resistor	R2, R3	2.7 M Ω ¼ W 5%
2	Resistor	R5, R6	8.2 K Ω ¼ W 5%
2	Resistor	R7, R8	27 K Ω ¼ W 5%
1	Resistor	R9	1 K Ω ¼ W 5%
1	Capacitor	C1	0.1 μ F 25 V ceramic
4	Capacitor	C2 – C5	0.0015 μ F 25 V ceramic
1	Capacitor	C7	4.7 μ F 25 V electrolytic
1	Capacitor	C8	10 μ F 25 V electrolytic
1	IC	IC1	MC1458 dual op-amp

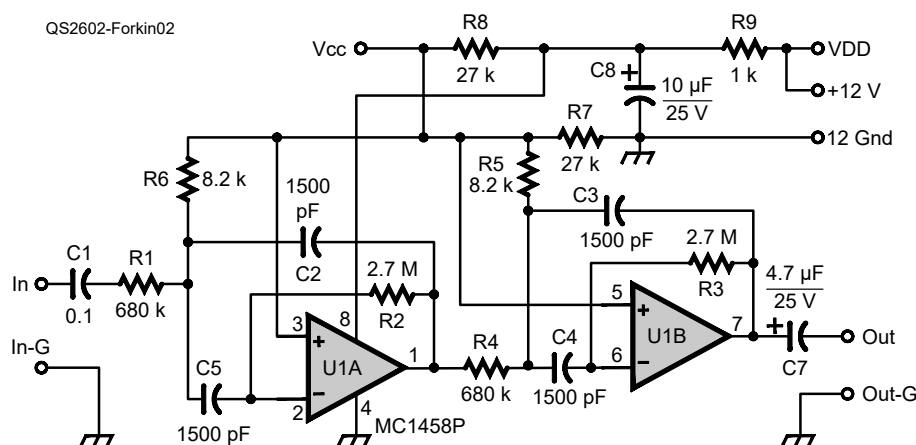
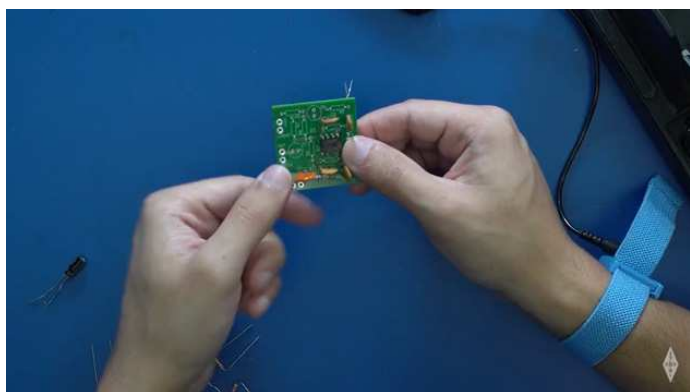


Figure 2 — The schematic of the 200 Hz bandwidth audio filter.

second stage couples to the volume control by C7. Bias for the MC1458 is provided by resistors R7, R8, and R9. Capacitor C8 provides filtering for any noise that may be on the dc input. As stated earlier, the components shown result in the desired filtered audio bandwidth of 200 Hz, with a center frequency of 700 Hz. If desired, the center frequency of 700 Hz can be modified by a change in R2 and R3 values. A decrease in resistance will raise the center frequency.

When the filter is incorporated within the receiver, 12 V dc must be sourced from the receiver circuitry. If the filter is used externally, it should be connected between the receiver headphone jack and your headphones. In this case, the filter can be powered by an external 9 V battery or the 13.8 V dc station power supply. If shielded cables are used, connection pads are provided on the circuit board at the input (IN-G) and output (OUT-G) for the cable shield grounds. These ground points will need to be used when the filter is used externally. However, when the filter is mounted inside a receiver and wiring connections are short, shielded wire should not be necessary.



Access https://youtu.be/9bt4_9G4-gQ to watch ARRL Lab Digital RF Engineer John McAuliffe, W1DRF, build the high-selectivity CW filter.

A Well-Rounded Tool

This inexpensive filter design is easy to duplicate, requires no adjustments, and is small enough to fit most applications. It brings out individual CW signals from the crowd and greatly lowers detected atmospheric noise on weak signals. There is no tendency to ring, so it is comfortable to use. I believe that if you build this filter, you will be very pleased with its performance. The Gerber files are provided at www.arrl.org/qst-in-depth.

See QST in Depth for More!

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

- ✓ Gerber files for the device described in this article

Jim Forkin, WA3TFS, was first licensed in 1972 as a Novice (WH6HOC) while he was stationed in Hawaii with the US Army. He upgraded to Advanced class upon returning home to Pittsburgh, when he received his current call sign. Jim retired from electronics design engineering after more than 45 years in the aerospace, medical, industrial, robotics, and electro-mechanical design industries. He enjoys designing and building receivers and transceivers, and he also enjoys low-power operating on CW and SSB. Jim operates SSB, CW, AM, and FM, and he has been active in several amateur radio clubs. He has published several articles in *QST*, *The Spectrum Monitor*, and *Ham Radio* magazines. You can visit Jim's website at <http://wa3tfs.com>, and you can reach him at jforkin@verizon.net.

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The W4BOH Fox

Build this simple, affordable transmitter for your next direction-finding adventure.

Peter Lamb, KM4DNU

When our local ham radio club, McDowell Amateur Radio Association, W4HOG, in North Carolina started regularly holding foxhunts on Friday afternoons, my son Hugh and I wanted to improve our direction-finding skills. We needed a simple fox to practice with, so I started looking for something to build that would make noise on 2 meters (see Figure 1).

I found an article online from the November 1998 issue of *73 Magazine* by Dave Pelaez, AH2AR, titled, “Build the Fox TTL Foxhunt Transmitter,” about building a small, low-power beacon transmitter as an addition to a balloon tracking device. Dave wanted something that was simple and low cost, and would run longer than the balloon’s primary transmitter — I wanted to build something similar. See Table 1 for a complete list of parts.

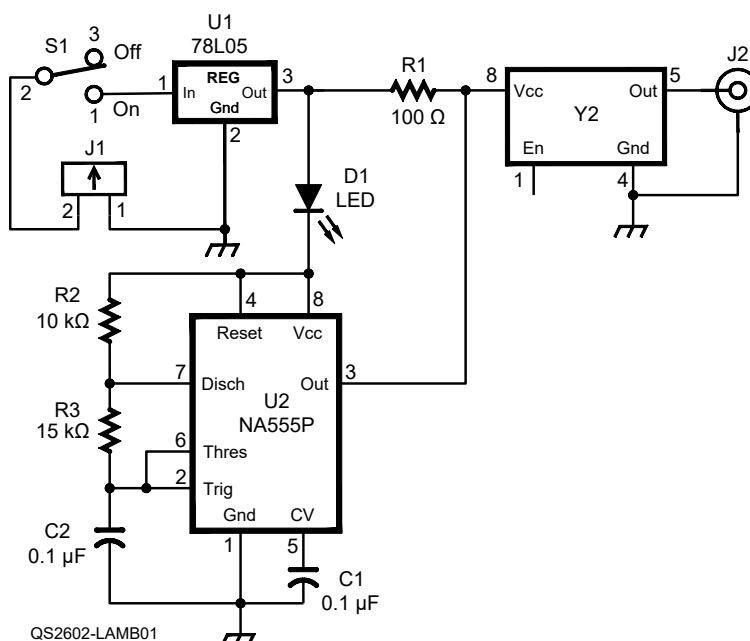


Figure 1 — The final version of the W4BOH Fox.

The Transmitter's Progression

Version One

The base design of AH2AR's fox consists of a voltage regulator, a crystal oscillator, and a 555-timer integrated circuit (IC). The voltage regulator lets you power the fox with 7 to 20 V. The 555 IC generates the tone, and the crystal oscillator generates the carrier. In his article, AH2AR used a 48.3 MHz oscillator, which created a third harmonic on 144.900 MHz and is within the 2-meter amateur band. The band-pass-filter design helped keep the fox from transmitting on the fundamental and second harmonic, leaving only the 2-meter signal. Unfortunately, I could not find 48.3 MHz crystals — the closest I could find were 49.152 MHz, which gave a third harmonic of 147.456 MHz. Later, I found 48.000 MHz crystals, which gave us a 144.000 MHz third harmonic. This is easier to get on, but also not great because we have a fair amount of local noise on 144 MHz.

My next step was to order a printed circuit board (PCB) from FAR Circuits (<https://farcircuits.net>). I assembled the unit, and I found it to be as unstable as AH2AR warns about in his article. The oscillator circuit is susceptible to environmental changes, causing the oscillator to shut down. I couldn't find the special "critical" capacitor that he said was needed to fix the instability issue. This led me to version two.

Qty	Component
1	Crystal oscillator ½ can
1	100 Ω resistor
1	10k resistor
1	15k resistor
1	78L05 TO-92 5 V voltage regulator
2	0.1 uF capacitor
1	Dip switch
1	Flashing LED
1	Antenna connection
1	Packaging

If you're using a low-frequency crystal, you'll need two 18 pF capacitors, two 5 pF capacitors, and three 0.15 uH chokes.

Version Two

I worked with my friend Jason Ross, KG4RVN, to learn about how 555 timers work and how to use a 555 calculator online. The 555 Monostable Circuit Calculator at <https://ohmslawcalculator.com/555-monostable-calculator> allows you to adjust the values to get the timing interval you desire. With this new information, I modified the first version of the circuit described above to include a second 555 timer



Figure 2 — Version two in a 3D-printed case.

to create the transmit interval function, instead of using a flashing light-emitting diode (LED), as AH2AR did in his design. I also added an LED to indicate when the unit is powered on. I studied how to use online PCB design software such as *KiCad* (www.kicad.org) and created a schematic and the necessary Gerber files, then I sent the files to a custom PCB printer.

The first iteration of version two was packaged in an Altoids tin, but I set it down on the roof of my van and forgot about it — it flew off the roof never to be seen again. So, I 3D-printed a custom box (see Figure 2). This gave me much more space but was clunky and cumbersome.

Version Three

Version two worked great, but after looking at the schematic, my father, Wilson Lamb, W4BOH, felt he could simplify it even more, which brings us to version three.

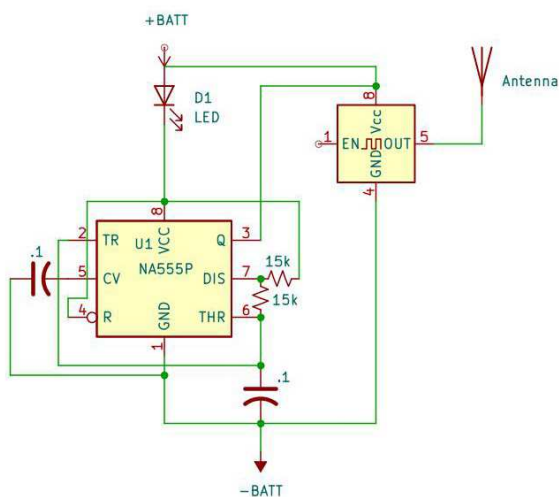


Figure 3 — Version three of the schematic, originally drawn by my dad.



Figure 4 — Version three in an Altoids tin.

I took his circuit (see Figure 3), added the band-pass filter from AH2AR's design, and created a new circuit board. After the boards were printed and delivered, I assembled the fox and packaged it in an Altoids tin (see Figure 4).

Version 3.2

I finally deployed the fox for our group to hunt; it was hidden in a briar patch on the ground. Jim Elkins, KG4IKQ, used his TinySA and read the signal as -54 dB from 1 foot away. At 100 feet away, it was in the noise floor. We had good participation, and everyone seemed to enjoy being able to foxhunt on their own schedule. But I was a little disappointed in its battery life, despite getting about 48 hours of run time out of a 9 V battery.

This brings us to version 3.2 — the same design but with different capacitors and resistor values to get a better tone, and an 18650 power pack for better battery life. I installed this version in a medicine bottle (see Figure 5) rather than an Altoids tin.



Figure 5 — Version 3.2 installed in a medicine bottle.



Figure 6 — The final version of the W4BOH Fox in a key-hiding container.

Version Four

Version 3.2 worked very well, especially when paired with a $\frac{1}{4}$ -wave ground-plane antenna, and I renamed it the W4BOH Fox. But rather than continue to use the 48 MHz crystals, I learned that you can order a crystal programmed to whatever frequency you want, so I ordered one programmed to 146.00 MHz. After the new boards arrived, I assembled the board and packaged it in a key-hiding container (see Figure 6).

Unfortunately, the new crystal will run for only about 12 hours on a 9 V battery. Changing the 9 V battery to two 18650 batteries extended the run time to more than 100 hours.

In Summary

As you can see, these little foxes can be packaged in a variety of ways, from Altoids tins to medicine bottles to custom-printed enclosures. The antenna can be anything from an old handheld transceiver to a 50-centimeter/19.5-inch wire. Power and switch connections can be board- or remote-mounted to an enclosure, whichever works best for you; they are a lot of fun to hunt. The longer run time we gained by using the 18650 batteries lets our members who can't get out on Friday afternoons have all weekend to decide when they want to hunt.

Foxhunts have been a great tool for our club to get members active in the hobby. It also helps to engage our younger members, some of whom are not yet hams. This is a very simple project that anyone can assemble with just a pair of wire cutters and a

soldering iron. As is always the case, your fox's range will vary based on where you put it, what's around it, and what antenna you attach to it. Due to its extremely low power and limited range, it does not cause any objectionable interference.

All photos provided by the author.

Peter Lamb, KM4DNU, has been a ham since 1988, but he's been around ham radio all his life. He can be reached at plamb914@gmail.com.

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

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Strays

Amateur Radio Enthusiasts Host Picnic in Mazovia

Polish radio enthusiasts gathered for the eighth annual Mazovian Amateur Radio Picnic in September 2025. The event took place in a nature reserve in the historic region of Mazovia, in mid-northeastern Poland. Activities included demonstrations of various radio equipment, a hunt for a hidden transmitter, a barbecue, an educational appearance by local firefighters, and a presentation from Przemek Golembowski, SP7VC, about his recent radio trip to northern Finland and Norway. The event concluded with the release of a helium balloon containing a UHF telemetric transmitter that sent images from above.



Between 150 and 200 people attended the Mazovian Amateur Radio Picnic in September 2025 in Poland. [Henryk Kotowski, SMØJHF, photo]

Product Review

KiwiSDR 2: Standalone SDR Network Receiver

Reviewed by John Leonardelli, VE3IPS
jleonardelli@arrl.net

Over the past few years, I've often used WebSDR applications to monitor my signals remotely, or to listen to regional stations worldwide. These applications are connected to network-based SDR receivers connected to the internet by hosts. They've been helpful tools, especially for exploring the HF bands. But I always assumed running one of these original KiwiSDR systems myself would be too complex, involving routers, port forwarding, and a fair bit of patience. The newly updated KiwiSDR 2 now offers an easy plug-and-play setup, improved RF front-end performance, and a richer set of decoding (open-source) applications refined over 10 years of evolution from the original KiwiSDR.

For HF enthusiasts, shortwave listeners, and amateur radio operators, this is available as an appliance, simplifying your setup. It's ideal for remote listening, propagation studies, or simply keeping an ear on your SDR while you're away from the shack. Personally, I've found it invaluable as a real-time monitoring platform, making it ideal for comparing antennas, studying band openings, and checking my transmitted signal across the spectrum.

With up to 30 MHz of instantaneous bandwidth, it can receive the entire 10 kHz – 30 MHz VLF/LF/MF/HF spectrum at once — something few other SDRs can match. What really sets it apart is how seamlessly the software, web interface, and decoding tools are integrated. Everything works right out of the box.

The built-in decoders for a wide range of digital modes — all running directly within the browser — make it truly plug and play. No cables, no software downloads, no sound cards, no hassles. This is exactly the kind of self-contained radio appliance I was looking for to take my experimentation and HF listening to the next level.

Bottom Line

The KiwiSDR 2 SDR network receiver eliminates the hassle of complex setup using a PC with many drivers. Just connect it using an Ethernet cable, and you're ready to start. It's one of those set-and-forget tools that quietly becomes part of your radio day.



Once it's powered and connected to the internet network, you can log in from anywhere — your living room or even halfway across the world — and be listening to your own antenna back home.

Owners can even share their KiwiSDR online with up to four simultaneous users, each with their own frequency and mode controls, making it perfect for sharing with club members or putting it on the public KiwiSDR network. Please note that when you are sharing the radio, you can have one or more channels with a password if you want to restrict the access to friends or club members or reserve a channel for yourself.

The full technical specifications are shown in Table 1.

Configuration and Setup

The KiwiSDR 2 hardware is built around a BeagleBone-based embedded computer (AM3358) with a web server and loaded with software decoding and RF tools (called extensions) running on Debian Linux.

The radio comes with a serial number, default proxy address (**xxxxxx.proxy.kiwisdr.com**, where xxxxxx is the serial number), administration password, as well as a backup SD card with the software. It is only intended

Table 1 — KiwiSDR 2: Standalone SDR Network Receiver S/N 22265, Firmware 1.701**Manufacturer's Specifications**

Frequency coverage: Receives up to 30 MHz.

Power requirements: +5 V dc, 2 A maximum.

Modes of operation: CW, AM, SAM, USB/LSB, and FM wide/narrow.

Receiver

SSB/CW sensitivity: Not specified.

AM sensitivity: Not specified.

FM sensitivity: Not specified.

Reciprocal mixing dynamic range: Not specified.

Blocking gain dynamic range: Not specified.

Two-tone third-order intermodulation distortion (IMD) testing (400 Hz bandwidth):

Two-tone second-order intercept point: Not specified.

FM adjacent channel rejection: Not specified.

FM two-tone third-order IMD dynamic range: Not specified.

Spectral display sensitivity: Not specified.

S-meter sensitivity: Not specified.

Notch filter: Not specified.

Squelch sensitivity: Not specified.

Receive bandwidth: Not specified.

Receive processing delay time: Not specified.

Size (height, width, depth, including protrusions): 2.1 × 2.9 × 4.9 inches.

Weight: 0.45 pound.

Measured in the ARRL Lab

Receive only, 500 Hz – 30 MHz.

Receive current, 650 mA typical.

As specified.

Receiver Dynamic Testing

Noise floor (MDS), 400 Hz bandwidth:

0.137 MHz –125/0.13 dBm/μV

0.475 MHz –126/0.11 dBm/μV

3.5 MHz –128/0.09 dBm/μV

14 MHz –128/0.09 dBm/μV

29 MHz –128/0.08 dBm/μV

10 dB (S+N)/N, 1 kHz tone, 30% modulation, 9.8 kHz BW:

1.02 MHz –94/4.31 dBm/μV

3.88 MHz –95/3.98 dBm/μV

29.4 MHz –96/3.69 dBm/μV

12 dB SINAD, 3 kHz deviation, 12 kHz BW:

29 MHz –102/1.69 dBm/μV

400 Hz BW, AGC off:

Offset 20 kHz 5 kHz 2 kHz

3.5 MHz 90¹ dB 88 dB 88 dB14 MHz 83¹ dB 82 dB 81 dB

400 Hz BW, AGC off:

Offset 20 kHz 5 kHz 2 kHz

3.5 MHz 115¹ dB 115¹ dB 115² dB14 MHz 114¹ dB 114¹ dB 114² dB28 MHz 112¹ dB 112¹ dB 112² dB

Band	Spacing	Measured IMD Level (dBm)	Measured Input Level (dBm)	IMD DR (dB)
3.5 MHz	20 kHz	–128	–53	75
14 MHz	20 kHz	–128	–62	66
14 MHz	5 kHz	–128	–62	66
14 MHz	2 kHz	–128	–62	66

14 MHz; +59 dBm¹

	FM Wide	FM Narrow
29 MHz	60 dB	84 dB

FM narrow mode:

Offset 20 kHz 10 MHz

29 MHz 81 dB 96 dB

Waterfall: 14 MHz, –136 dBm; 29 MHz, –136 dBm.

400 Hz BW:

1 MHz –71/59.5 dBm/μV

14 MHz –73/50.1 dBm/μV

29 MHz –74/44.1 dBm/μV

4 – 40 dB attenuation, 12 ms attack time.

At threshold, FM, 29 MHz, 0.52 μV; SSB, 14 MHz, 0.29 μV.

Range at –6 dB points (bandwidth):

CW narrow (60 Hz BW): –44 to +33 Hz (77 Hz)

SSB wide (2400 Hz BW): 307 to 2653 Hz (2346 Hz)

AM (9.8 kHz BW): 0 to 3718 Hz (7436 Hz)

794 ms.

¹ “OVL” indicator illuminated at this value, indicating onset of ADC overload.² “OVL” indicator illuminated, and spurious tone was heard in audio at this value.

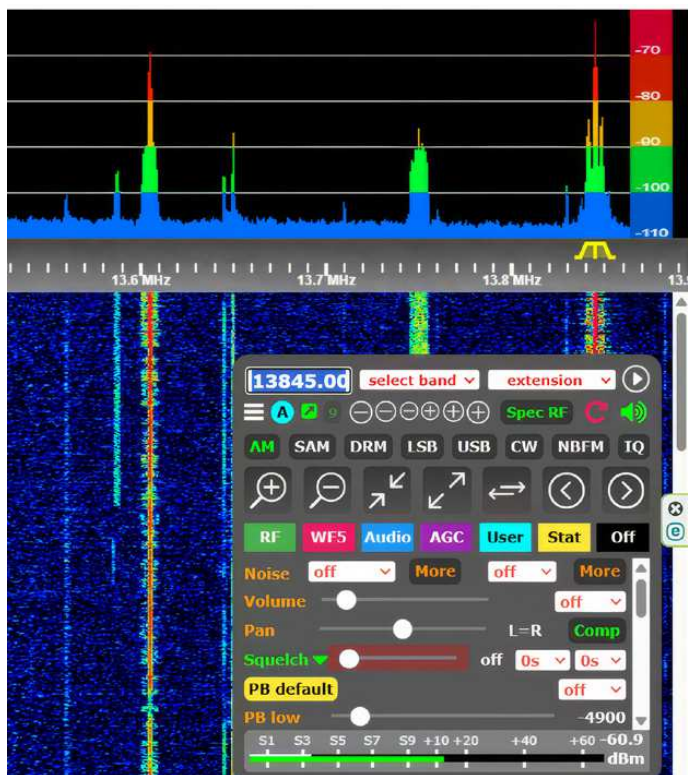


Figure 1 — KiwiSDR 2 web interface tuning keypad.

as a backup, as the software is preloaded before quality-control-testing the receiver before shipment.

A clean linear 5 V dc supply rated for at least 2 A should be chosen to minimize any RF hash. I used the recommended power supply with the standard 2.1 × 5.5-millimeter male connector (center positive). The metal cabinet has excellent airflow and shielding.

Once powered, with an Ethernet connection to the internet, an antenna, and a 60-second boot process, the radio can be accessed from anywhere in the world. An SMA patch cable is included for running a self-test.

Normally, you would connect the KiwiSDR's Ethernet port to your home internet router. However, I chose to connect the Ethernet port to a Wi-Fi extender, allowing me to place the receiver in a spare bedroom for its initial testing.

In the lead photo, the shown KiwiSDR 2 is always on 24/7.

Once powered and networked, the KiwiSDR 2 uses a fully integrated web-based software suite that runs right on the device — no external PC software or drivers are required. The KiwiSDR 2 built-in web server delivers: a KiwiSDR web interface that tunes and behaves like a conventional receiver, a real-time spectrum display and waterfall, and access to a growing library of software “extensions” for decoding and analysis. Everything oper-

ates through a standard web browser (Chrome, Firefox, Safari, or Edge). I tried a laptop, an iPad, and my Android smartphone with expected results.

There's no need for a public IP address or complicated network configuration. KiwiSDR provides a built-in proxy service that securely bounces through a US-based proxy server, keeping my setup simple and reliable.

The antenna uses an SMA antenna input for wideband reception. I chose a small active loop, and I tried simple long wires with a 9:1 unun. The loop was the most quiet.

I use clip-on common-mode choke ferrites on all antenna and power cables to keep any local noise away. You'll be amazed how much quieter the spectrum becomes when you do this.

I opened a Chrome browser to my.kiwisdr.com. It does a network scan and presents links to the admin and local port connections tied to my receiver. Click on the link, and the familiar KiwiSDR web interface appears, complete with waterfall display and tuning controls.

You can now tune, listen, and decode right from your browser using the computer's audio processor. This easily supports using Bluetooth headphones for listening from your device.

All the features you would expect from a traditional receiver are available for easy mouse click, drag, expand, and double-click to navigate the radio spectrum. Drop-down menus offer an extensive list of choices. See Figure 1 for the tuning keypad.

From the web interface, click the “Admin” link. You'll be prompted for a password (as supplied with the serial number).

Inside the admin interface, you'll find several key tabs to fill in to customize your receiver via the web page.

NETWORK is where you can configure a dynamic IP address (DHCP) or assign a static IP. **RECEIVER CONTROL** sets the number of users (1 – 4), sample rate, and bandwidth limits. **GENERAL** adds a custom station name, location, and short description that appears on the KiwiSDR directory map. **GPS** views satellite lock status and confirms timing stability. **EXTENSIONS** enables/disables digital decoders such as FT8, CW, FAX, SSTV, DRM, etc. **WEB INTERFACE** customizes color themes, S-meter scaling, and display preferences.

The internal GPS module provides frequency calibration and timing synchronization. I placed the included GPS antenna on a windowsill with a clear view of the sky. After a few minutes I had a lock on several satellites. Once locked, your KiwiSDR will automatically apply

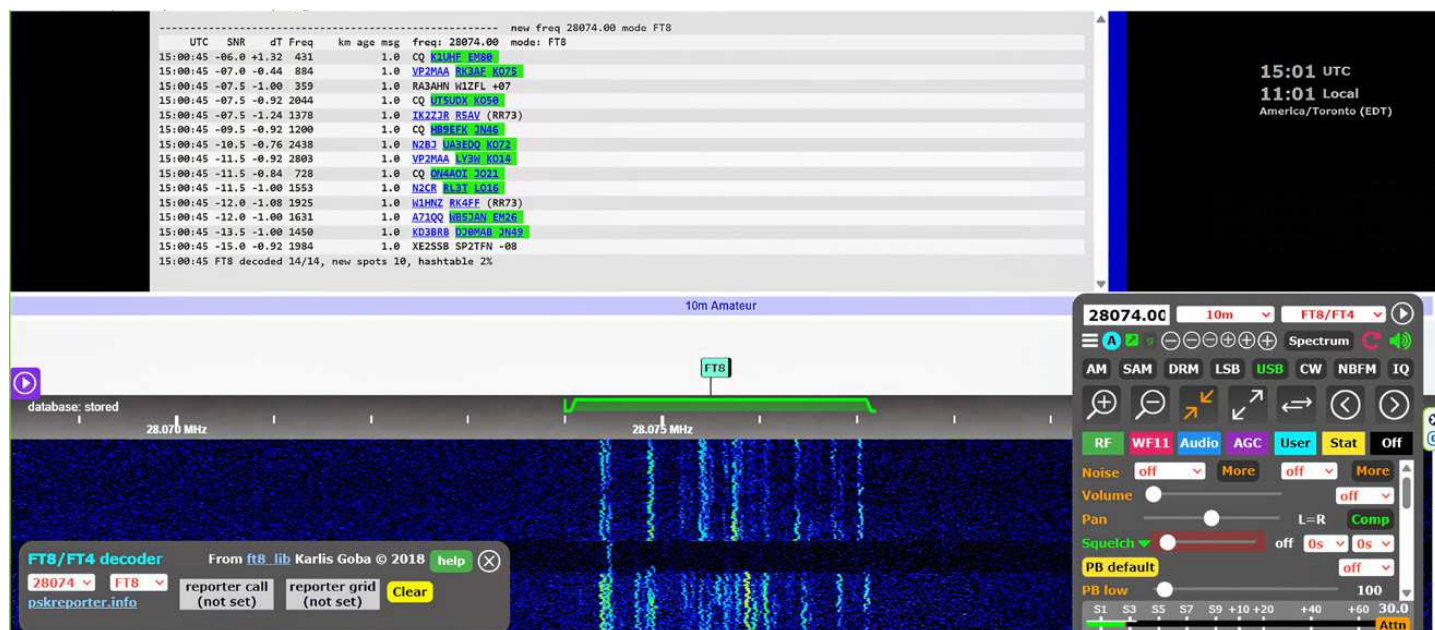


Figure 2 — KiwiSDR 2 FT8 reception on 10 meters.

a frequency correction factor to increase performance and improve stability.

I would check the network tab and check that proxy connection is activated. Within a minute or two, my radio was live on the internet.

There are a lot of admin settings and even one that allows you to customize your access web page.

The user forum contains a wealth of information by the active user community. The user guide has a lot of information on IP networking, JSON, and scripting, as well as all the features available for advanced users.

I found that I can modify or add DX labels that appear on the user interface to add common nets or add my favorite frequencies with a label.

The product is always improving with regular updates that add new decoders and features via open-source collaboration.

Common Extensions and Their Applications

Many of these extensions are software decoding and RF applications that are open-source and contributed by various authors. This is the real power of the brand and value the KiwiSDR 2 brings to users: a wideband multi-user HF receiver loaded with RF software tools for decoding and analyzing signals that serves multiple use cases. Plug it in and turn it on.

When an extension (software application) is active, the KiwiSDR 2 routes a copy of the IQ, baseband,

and audio data stream through the appropriate DSP-decoding routine, and shows the result in the browser (or draws graphics, as in SSTV or weather fax [WEFAX]). The audio from the KiwiSDR 2 is internally routed to the extension application without any additional cables or software.

Some of the most popular extensions include:

- CW Decoder: real-time Morse decoding with adjustable thresholds.
- FT4/FT8: weak-signal digital mode monitoring.
- WSPR: results can auto-upload to WSPRnet.
- SSTV/FAX/RTTY/NAVTEX: visual and text digital decoders for maritime, ham, and aeronautical signals; weather maps are included.
- DRM Decoder: for decoding shortwave digital broadcast radio.
- Time Difference of Arrival (TDOA): collaborative features using multiple KiwiSDRs worldwide for direction finding of HF transmitters.
- AM/SSB/CW/NBFM Demodulators: built-in demods with fine-tuning and IF shift. Automatic Link Establishment, Second Generation (ALE-2G) decoding with scan lists for ham, government, MILCOM, and utility included. Pre-loaded with frequency markers, bands, channels, and DX labels.

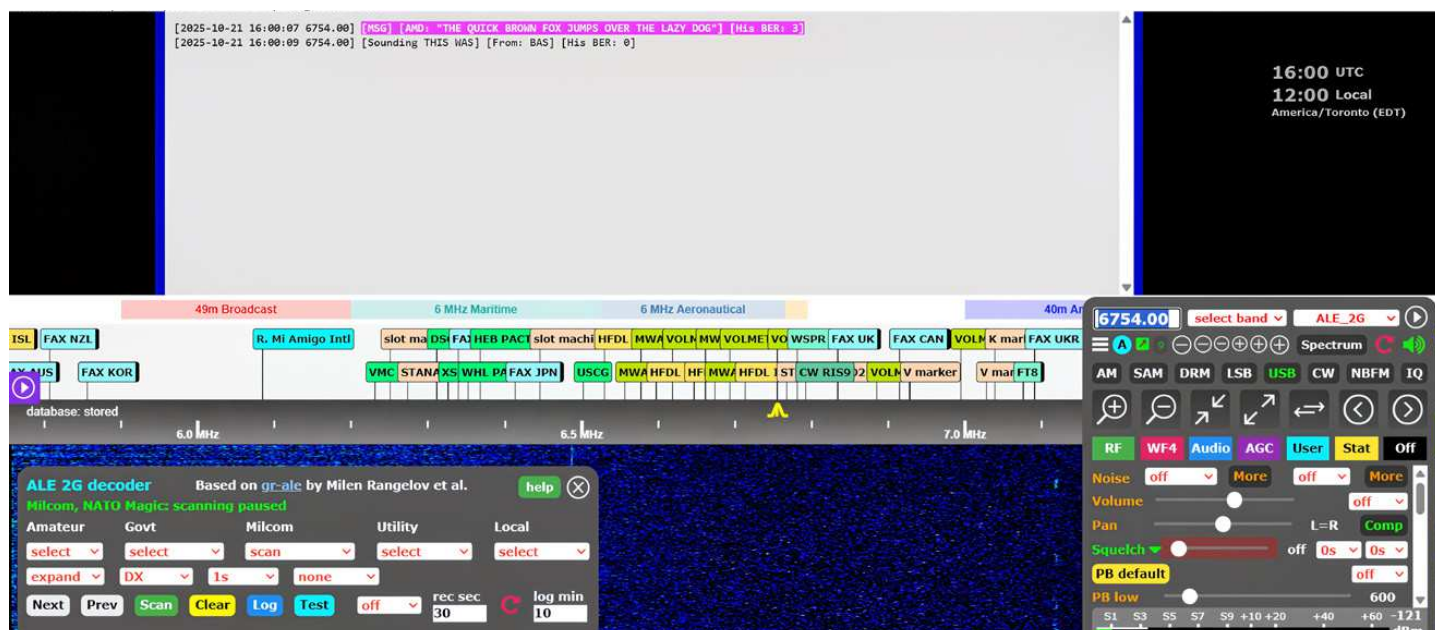


Figure 3 — KiwiSDR 2 ALE-2G is used by hams, governments, the military, and utility companies.

Performance and Field Experience

This is not just another “waterfall and tune” SDR. The KiwiSDR hardware and software have been tuned for HF performance monitoring. You can view up to 30 MHz in a single sweep, zoom into narrow band slices, and use the built-in decoders for CW, RTTY, and various digital modes. The waterfall display is smooth and detailed, allowing you to spot faint DX signals. The receiver’s direct-sampling architecture means no fiddling with upconverters or IF stages — it’s clean, linear reception straight from the antenna and purpose-built for HF coverage only.

Noise blanking and IF filtering are very good. As expected with wideband receivers, very strong local broadcast stations can overload the front-end receiver. I can hear an unidentified medium-wave broadcast station in the background mixed into the noise floor. It depends on what antenna I am using and the time of day. Adding an external RF pre-selector or the SDR medium-wave filter solved the problem. I found an amplified loop antenna to be a great choice to cover the whole 30 MHz bandwidth and to null out the strong broadcast station. If I plan to do some broadcast band listening, then I can easily remove the medium-wave filter and connect a beverage antenna to the radio. The ability to attenuate up to 30 dB is also a new feature in the receiver.

I did some basic testing with other SDR receivers and HF transceivers I own, and performance is on par with them. The KiwiSDR 2 shines with low-noise audio, excellent sensitivity, and a rich operating user interface. It seems I am always learning a new interface, and the

KiwiSDR 2 is no exception. But without reading the manual, I had figured out enough to spend a few hours tuning the spectrum and trying different features. I try to use and understand new features regularly as I work my way through the manual.

A well-used feature is the “Bands” drop-down tab function, which allows for easy access to **BROADCAST**, **UTILITY**, **AMATEUR**, **BEACONS**, **AERO**, and **MARKERS** bands. With the world at my fingertips, I spent much time exploring the utility and aero bands and hunting for WEFAX transmissions. Frequencies are already in memory and labeled for point-and-click tuning. Searching for beacon markers was also interesting. The spectrum is also labeled, making signal hunting a lot easier.

Accessory Filters

Signal overload from medium-wave broadcast stations and from nearby transmitters will degrade signal quality. Purpose-built filters will protect and enhance your listening enjoyment and should be in every RF toolbox. The following filters are not included and are sold as options.

SDR Medium-Wave Filter (Optional)

This band-stop filter attenuates signals in the medium-wave band — 500 kHz to 1.5 MHz — for locations that have very high levels from a nearby broadcast station. It is band stop — not high pass — so the VLF and HF bands are unaffected. I have a local station causing intermodulation on some of my HF transceivers and other SDRs. The filter was found to improve reception and remove the offending station from the signal path.

Lab Notes

Starting with this review, we are adding a bit more detail to the FM receiver testing. The ARRL Lab performs two related FM receiver tests that measure the radio's ability to reject unwanted signals: the adjacent channel rejection test and the two-tone third-order dynamic range test. The adjacent channel rejection test measures how well the radio will reject a single nearby strong signal, and the two-tone third-order dynamic range test indicates how well the radio can tolerate multiple nearby strong signals without generating spurious signals. In the past, we published test results for the adjacent channel rejection test for the radio using its widest FM mode, which is worst case, and pub-

lished results for the two-tone third-order dynamic range test for the radio on its narrowest FM mode. Because these two tests are closely related and are performed at similar frequency spacings, the published results can sometimes be in conflict due to the use of different FM modes. We also felt that it would be informative to publish the improvement in rejection gained by using a narrower FM mode. So, with that in mind, we will now be reporting adjacent channel rejection for both wide and narrow modes, if a radio has them. We will continue to test and report the two-tone third-order dynamic range test results using only the FM narrow mode.

— Rick Ciervo, W1CIE, ARRL Senior Laboratory Engineer

SDR Protection Circuit (Optional)

SDR radios can suffer serious damage due to nearby lightning storms, as well as transmitting into an antenna close to the KiwiSDR antenna. The SDR protection device uses two 50 Ω RF balun transformers and a dual transient voltage suppression diode. The circuit has a 1 dB insertion loss from 0.1 – 30 MHz that will not have any noticeable effect on HF SDR operation. It has been designed for KiwiSDR radios but will work with any receiver and has been tested with 100 W fed directly into the receiver. I classify this as a must-have accessory if you plan to have a transmitting antenna nearby.

Conclusion

What began as a simple evaluation of a network SDR receiver quickly turned into a deep dive into a true RF powerhouse. In the past, setting up a network SDR was often a complex and time-consuming process, but now installation and configuration take only a few minutes. The seamless integration of the built-in decoders and RF tools makes operating the receiver a pleasure.

The receiver operates as well as my other radios. Using the mouse takes some getting used to (notably “spinning the dial”), but the extensions bring immense capability that makes it a lot more useful and engages you a lot more with exploring new modes and frequencies.

When using a long wire antenna, I did notice static crashes at times causing some receiver overload. The S-meter will indicate a red **OV** when this occurs, and using the RF gain control and attenuator helped in preventing overload.

With four tabs open, all four instances running Chrome used 2 GB of memory and less than 2% CPU time. All DSP processing runs onboard, thus freeing your PC or tablet completely and not being bogged down by high CPU cycles.

The ability to have multiple software decoding applications or RF tools running at the same time has started to change my listening habits. In fact, I open four tabs automatically whenever I launch my browser on my laptop. I can easily launch several applications or enter frequencies to check and quickly look at what propagation conditions are like.

I wish the KiwiSDR 2 covered 6 meters and the VHF/UHF bands like similar SDRs, which would make for networked listening of simplex channels, 2-meter FT8, satellites, or repeater frequencies an interesting use case.

The KiwiSDR 2 stands out as a brilliant, purpose-built receiver for HF monitoring and remote listening. It's always on, and multi-user HF capability makes it ideal for propagation studies, antenna comparisons, and club-based receive networks. It's an essential companion for operators seeking to host their own global ears platform and wanting the ability to receive and decode various modes for signal exploration and analysis. The KiwiSDR 2 is probably the most plug-and-play network SDR.

Manufacturer: KiwiSDR, www.kiwisdr.nz. Price: \$395; optional SDR medium-wave filter, \$28; optional SDR protection circuit, \$28.

COMPACtenna PERFECT 10 Antenna

Reviewed by Richard Lawn, W2JAZ
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It has taken some time to provide this antenna the careful consideration it deserves, as 10-meter conditions have been largely disappointing with only occasional openings. However, the band opened for the CQ WW SSB contest in October 2025. Improved conditions presented an opportunity to give this single-band antenna a thorough test, especially during contest conditions.

Description and Design

The antenna, which is only about 65 inches, is fabricated from aluminum and stainless components featuring an effective design that uses a flat, horizontal aluminum coil that, according to the website, efficiently maximizes resistance, inductance, and capacitive matching. This unique design makes it quite different from other shortened vertical antennas that employ traps or vertical loading coils for matching. Practically speaking, Dr. Jack Nilsson, N8NDL, designed this antenna to be relatively quiet and less susceptible to band noise. See Table 2 for the full technical specifications.

Tuning is adjusted by shortening or lengthening a whip and securing a ferrule with two screws. If necessary, the whip could be trimmed to raise the resonance point, but I did not find this necessary. An auto

antenna tuner permitted all-band operation without adjustments. In mast-mounting the antenna, I had to extend the whip to its full length to achieve resonance in the SSB portion of the 10-meter band. SWR is confirmed by the included image from a RigExpert AA-600 that

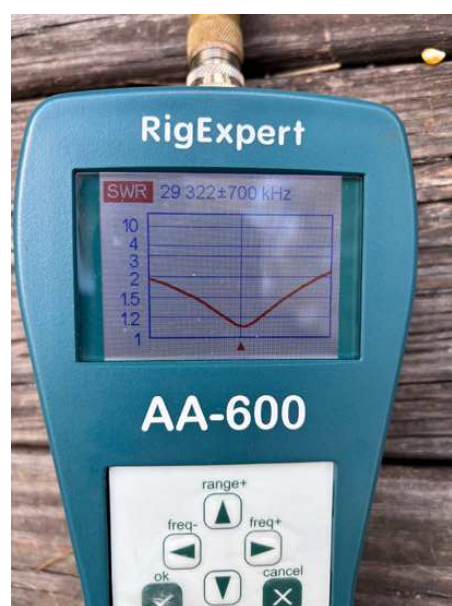
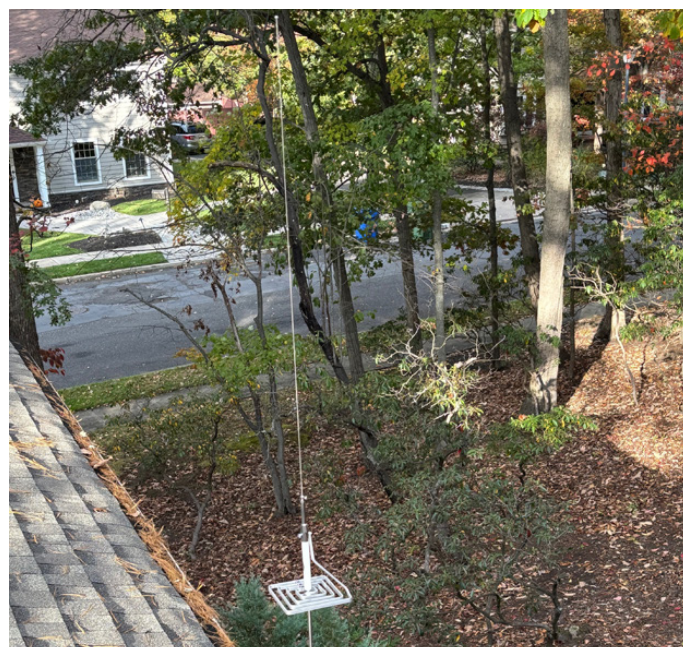


Figure 4 — The SWR curve at 29.3 MHz. The whip would have to be raised to lower resonance.



shows a reasonably wide frequency range at 2:1 SWR and a near-perfect 1:1 at resonance (see Figure 4). The antenna will handle up to 1500 W in SSB; 500 W in AM, FM, and CW; and 250 W in digital (see Table 2 for the specifications). A closer look at the antenna can be seen in this HamRadioConcepts YouTube video (see www.youtube.com/shorts/1zRURdNVz_c).

Installation Possibilities

The manufacturer offers a number of suggestions about how to install the antenna as well as environments to avoid. For example, the one-page manual suggests magnetic mobile mounts, various clamps,

Table 2 — COMPACtenna PERFECT 10 Antenna

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

Operating band:	10 meters
Connector:	SO-239
Impedance:	50 Ω
Power rating:	SSB 1500 W, AM/FM/CW 500 W, digital 250 W
SWR bandwidth:	Nominal < 2:1 (often 1.1 – 1.5:1)
Gain:	Nominal 7(+) dB mean effective gain

Bottom Line

The COMPACtenna PERFECT 10 performs very well for its size, and may surprise the most skeptical.



Figure 5 — The PERFECT 10 attached to the jaws clamp.

and brackets that allow house, shed, or sturdy metal gutter mounting, metal railings, and even metal roofs, which offer an excellent ground plane. The company's website offers a number of helpful suggestions and photos to stimulate ideas about installation options (<https://compactenna.com/installations>).

The antenna is versatile in this regard, offering mobile and base station options, though it does not come with any hardware for this purpose. It terminates at the base in a standard $\frac{3}{8}$ -inch threaded stub. A magnetic mount could be used in the bed of a truck, though I'm not sure I'd be comfortable riding down the highway at 70 mph with such an assembly on the roof of a car.

I chose to mount the antenna using a jaw-like clamp (see Figure 5) on top of a 10-foot galvanized pipe mast (see the lead photo). It is fairly close to a gutter, but that did not seem to have any negative impact.

The manual specifies that the antenna does require a ground plane as a counterpoise for base station operation in order to tune properly, though I did try unsuccessfully to see if I could find a good resonant point without a radial. I installed only one 8-foot radial wire at a downward angle. There is no doubt that height above ground and the number of radials would likely affect the signal pattern and SWR.

The manufacturer claims a gain of nominally 7(+) dB mean effective gain. I had no way to verify this or whether the antenna has any particular pattern, though it would seem that as a vertical it would be essentially omnidirectional.

Performance

When I first tried this antenna, the conditions were poor at best with virtually no real activity in the CW or SSB portion of the band. I was, however, able to work a few stations in Latin America using FT8 and with

**Table 3 — COMPACTenna PERFECT 10
Abbreviated Log Entries**

Date	Call	Mode	Report S/R
10/24/25	VE7BSM	FT8	+00/-01
10/24/25	KK5JY	FT8	+16/-07
10/24/25	N7DNF	FT8	+14/-10
10/24/25	N6YG	FT8	-03/-02
10/24/25	VE5DLC	USB	55/55
10/24/25	K6ACW	USB	57/57
10/24/25	JM7OLW	CW	559/339

respectable reports, especially considering the poor conditions.

A day before the CQ WW SSB contest began, I decided to re-mount the antenna in a different location and give the antenna another try. To be frank, I was amazed at its performance! Table 3 shows only a portion of the SSB, CW, and FT8 contacts made on October 24, 2025. Two days later during the CQ WW SSB contest, during a brief period of operation, the antenna enabled me to make at least one contact in the following countries: Balearic Islands, Netherlands, France, England, Scotland, Czech Republic, Madeira Islands, Poland, Serbia, Croatia, Italy, Germany, Portugal, Kaliningrad, Bulgaria, and Ireland.

It isn't worth stating the universal 59 contest signal report, but it is worth mentioning a comparison I made with a CW station in Japan (shown also in Table 3). My hexbeam at 35 feet was compared with the PERFECT 10 during our QSO, and Suke rated the hexbeam about 2 – 3 S-units stronger. It is also worth mentioning that while working FT8, a mini pileup of stations started calling me! My signal was definitely being heard by many stations.

Conclusion

Prior to the review, I admit that I was not convinced that this antenna would perform well, but my opinion changed significantly. It is an excellent performer considering its profile, making it a great choice especially for Technician-class operators looking for an easy way to get in on the fun on 10 meters when the band is open. There are many installation possibilities, and the antenna is a fine choice for portable operation. For example, a simple magnetic mount would make it easy to deploy for a POTA operation. You won't be disappointed with its performance if the band is open.

Manufacturer: COMPACTenna, www.compactenna.com. **Distributed by** DX Engineering, www.dxengineering.com. **Price:** \$299.

N6ARA MiniSWR Indicators

Reviewed by Phil Salas, AD5X
ad5x@arrl.net

The N6ARA MiniSWR in-line indicators are designed for the QRP operator. These are completely passive, as energy to light the LEDs is taken from the RF that passes through the unit. Three versions are available: 80 – 20 meters, 40 – 15 meters, and 20 – 10 meters. This review covers the 80 – 20-meter and 20 – 10-meter versions. Table 4 gives the published specifications for these devices.

In the lead photo, you will find the MiniSWR indicators for 80 – 20 meters on top and 20 – 10 meters on the bottom. The frequency band coverage is stamped into the upper side of the metal cases.



Performance Testing

Because some energy is required to illuminate the LEDs, I first checked the loss through the units under matched conditions. I found it to be 4 – 5 percent depending on the band. This is with just the FWD LED illuminated, so loss will be a little higher when more LEDs are illuminated. Of course, you are using the MiniSWR to adjust for a matched condition.

Next, I ran a number of SWR accuracy tests with precision high-impedance and low-impedance SWR loads of 1:1, 1.5:1, 2:1, 3:1, and 4:1. Figure 6 shows the test setup.

Table 4 — Specifications for the N6ARA MiniSWR Indicators

Tested by the reviewer, Phil Salas, AD5X

Forward RF power LED (green)

1:1, 2:1, and 3:1 SWR indicator LEDs (red)

Power rating: 3 – 5 W

Band coverage: 80 – 20 meters, 40 – 15 meters, 20 – 10 meters (three versions)

BNC male input connector, BNC female output connector

The SWR LED indication responses:

SWR < 1.2:1 = FWD green, SWR LEDs unlit

SWR 1.2:1 – 1.5:1 = FWD green, 1:1 LED red

SWR 2:1 = FWD green, 1:1 and 2:1 LEDs red

SWR 3:1 or greater = FWD green; 1:1, 2:1, and 3:1 LEDs illuminated

SWR 5:1 or greater = FWD dark; 1:1, 2:1, and 3:1 LEDs illuminated

Table 5 — Indications at 5 W for Low-Z SWR

LEDs Bands	1:1 SWR				1.5:1 SWR				2:1 SWR				3:1 SWR				4:1 SWR			
	F	1:1	2:1	3:1	F	1:1	2:1	3:1	F	1:1	2:1	3:1	F	1:1	2:1	3:1	F	1:1	2:1	3:1
80M	✓	D	X	X	✓	✓	✓	D	✓	✓	✓	D	✓	✓	✓	✓	✓	✓	✓	✓
40M	✓	X	X	X	✓	✓	✓	D	✓	✓	✓	D	✓	✓	✓	✓	✓	✓	✓	✓
20M	✓	X	X	X	✓	✓	D	D	✓	✓	✓	D	✓	✓	✓	✓	✓	✓	✓	✓
20M	✓	D	X	X	✓	✓	✓	D	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
15M	✓	X	X	X	✓	✓	D	D	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
10M	✓	X	X	X	✓	✓	D	D	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

✓ indicates the LED was reasonably illuminated.

D indicates the LED was dimly illuminated.

X indicates the LED was dark.

Table 6 — Indications at 5 W for Hi-Z SWR

LEDs Bands	1:1 SWR				1.5:1 SWR				2:1 SWR				3:1 SWR				4:1 SWR			
	F	1:1	2:1	3:1	F	1:1	2:1	3:1	F	1:1	2:1	3:1	F	1:1	2:1	3:1	F	1:1	2:1	3:1
80M	✓	D	X	X	✓	✓	D	D	✓	✓	✓	D	✓	✓	✓	✓	X	✓	✓	✓
40M	✓	X	X	X	✓	✓	X	X	✓	✓	✓	D	X	✓	✓	✓	X	✓	✓	✓
20M	✓	X	X	X	✓	✓	X	X	✓	✓	D	D	X	✓	✓	✓	X	✓	✓	✓
20M	✓	D	X	X	✓	D	X	X	✓	D	X	X	✓	✓	✓	✓	X	✓	✓	✓
15M	✓	X	X	X	✓	X	X	X	✓	D	X	X	X	✓	✓	✓	X	✓	✓	✓
10M	✓	X	X	X	✓	X	X	X	✓	D	X	X	X	D	D	D	X	✓	✓	✓

Lab Notes

We tested two samples of the N6ARA MiniSWR indicators in the ARRL Lab — one built to cover 80 – 20 meters, and another built for 20 – 10 meters. Both were purchased pre-assembled from the factory. They were easy to use, requiring no setup or power (they are powered by the signal they are measuring). We tested the unit with 5 W of forward power into a test fixture capable of producing a fixed set of mismatches (2:1, 3:1, 4:1, and 8:1) both greater and less than 50 Ω . The nature of the product made it difficult to provide results in a typical tabular format, so instead, here are some general observations of the performance on the test bench:

- Accuracy (the ability to report the correct level of mismatch) generally degraded as frequency increased. The unit built for 80 – 20 meters appeared more accurate overall, with a more predictable display as frequency and mismatch increased. The unit configured for 20 – 10 meters performed poorly above 18 MHz; accuracy and resolution degraded substantially.
- Resolution (the ability to distinguish and report different levels of reflected power) was generally poor; it was difficult to distinguish between levels of mismatch greater than 2:1 on all bands.
- Both units cover 20 meters, but the unit designed for 20 – 10-meter operation had better performance on 20 meters.
- When presented with impedances less than 50 Ω , both units illuminated all indicators, which represents a $> 3:1$ mismatch, regardless of impedance value. Very low impedances (less than 10 Ω , or $> 8:1$) were not properly indicated as very high SWR. Mismatches for impedances greater than 50 Ω were reported more accurately and properly indicated very high SWR for ratios greater than 4:1.

— Rick Ciervo, W1CIE, ARRL Senior Laboratory Engineer

Bottom Line

While the SWR is not very accurate, the N6ARA MiniSWR indicators can give a relative SWR indication for adjusting a manual antenna tuner, but for more precision it might be worthwhile to use a traditional SWR meter.



Figure 6 — The reviewer's SWR test setup.

Tables 5 and 6 show the testing results for low-impedance SWR loads and high-impedance SWR loads, respectively. The ✓ indicates the LED was reasonably illuminated. A D indicates the LED was dimly illuminated. Finally, an X indicates the LED was dark. Dropping the power to 3 W resulted in less LED brightness. There was no indication on any LED at 2 W or less.

From the tables, you can see that the indications are not terribly accurate. However, when used simply to minimize SWR, tuning an external tuner or adjusting an antenna so that only the FWD green LED is illuminated does result in a 1:1 SWR.

Final Thoughts

If you need a very small SWR indicator for your QRP setup, these MiniSWR indicators might be worth looking into. However, you will need to purchase at least two units to cover the 80 – 10-meter ham bands. For more information, you can read the user/assembly/test manual on the N6ARA website.

Manufacturer: N6ARA Electronics, www.n6ara.com.

Price: all versions assembled, \$39.99.

Ham Radio Dude Lil Dude 6 Telescopic Mast

Reviewed by John Leonardelli, VE3IPS
jleonardelli@arri.net

One of the most useful items for a portable radio operator is a telescopic antenna mast. The masts come in various materials, including fiberglass, carbon fiber, and aluminum, and vary in length. Recently, I purchased a 20-foot mast for travel and also found it highly portable for domestic operations. Its collapsed size makes it ideal for packing in a backpack. After about a dozen activations, I realized that having a second mast would be beneficial for antennas requiring dual support and as a backup. I recently acquired an end-fed half-wave (EFHW) antenna from Etsy and also found a vendor selling masts.

Ham Radio Dude is a retail effort by Sean Klechak, W9FFF, who found the Etsy marketplace an excellent alternative to other online platforms. Sean also has a video on his YouTube channel (www.youtube.com/watch?v=qBEQ255OrI4) with mods for his mast.

The Ham Radio Dude Lil Dude 6 (LD6) is ideal for portable operations, offering a balance of portability, durability, and performance. Whether activating parks, chasing DX, or operating in the field, this lightweight carbon fiber mast exceeded my expectations.

Collapsing down to just 15.75 inches and weighing less than 1 pound, the LD6 is easy to pack and carry. Built from high-quality carbon fiber, it provides strength while remaining lightweight for reliable, long-term use. The mast extends to 18 feet 4 inches (5.6 meters) and supports a variety of antennas, including dipoles, verticals, and EFHWs. Please note that the latest LD6 version now includes a 3D-printed TPU topper.

Out in the Field

The LD6 mast's compact collapsed size makes it easy to transport in various go-bags and backpacks. My primary use has been supporting an EFHW antenna in an inverted-V configuration, though I have also used it for a



sloper. More recently, I have experimented with inverted-L and half-square antennas, which require two masts.

For Winter Field Day, I deployed an EFHW as an inverted V, covering 40, 20, 15, and 10 meters, pointed north-south using another mast that I previously reviewed for QST. Meanwhile, I used the LD6 to support a PackTenna 40/20 linked dipole pointed east-west. This setup allowed me to switch between antennas to optimize signal reception, particularly for working W6 and W7 districts. Reviewing my logs on a map confirmed the benefits of having two antennas in opposite directions.

I also use an end-fed 9:1 antenna with a 29-foot vertical radiating element. Normally, I use a custom mount with a ground spike for grassy deployments, but not in the winter. I have a collapsible lightweight camera tripod, and I found that the mast fits right on top of the tripod extension arm (without the 3D ball head) with the legs splayed out (about 18 inches long each). I deployed my antenna on the sidewalk (see Figure 7). A quick gust of wind almost brought it down, so I added a grip bag to weigh it down. When deploying, be careful that power lines are not nearby, to avoid the chance they may fall onto a car or person.

I also set up a small square loop (VE3DO loop antenna) for low-band listening in my backyard, using two rugged AV tripods that are 32 feet apart to hold up two masts. Using #22 stranded wire minimized strain on the masts, providing a quieter 160- and 80-meter listening experience. For extended outdoor use, I recommend taping the mast joints to prevent water intrusion and avoid collapsing due to wind-induced vibrations.

Bottom Line

The Lil Dude 6's portability and ease of use make it a popular choice for operators who prefer to travel light and engage in all forms of portable operation.



Figure 7 — The Ham Radio Dude LD6 mast sidewalk deployment.

Design Features and Enhancements

The LD6 mast includes several improvements over its competitors. A 3D-printed ABS top cap with a red paracord loop prevents loss of the rubber stopper-style cap and the pass-through of an antenna wire with an insulator. The top mast element (4.5-millimeter diameter) can be press-fitted into a hole on the cap. Additionally, side eyelets on the top cap allow for antenna wire pass-through.

The wide (36-millimeter) base provides improved stability and strength when deployed. A small eyelet on the bottom cap allows for attachment of a carabiner, so the cap can be clipped to a backpack when removed, preventing loss.

One challenge I encountered is that the wider mast base does not fit into some custom mounts I've made. Ham Radio Dude also offers specialized ground mounts for added deployment flexibility.

Ham Radio Dude notes that the tip is flexible and unsuitable for supporting heavy baluns, insulators, or thick

wire antennas. Antennas using #26 stealth wire posed no issues, but hanging a balun caused noticeable bending. To compensate, I secured the balun with a tie-wrap and an eyelet at the 15-foot mark.

As with any carbon fiber mast, caution is necessary to avoid contact with power lines. Awareness of surroundings is critical to safety. Exercise care when extending or collapsing the mast.

Conclusion

I appreciate vendors who rigorously test their products in outdoor conditions and incorporate enhancements into their designs. Instructions for the LD6 are available on YouTube, and a thank-you letter along with a Ham Radio Dude sticker were a pleasant surprise. Having used the LD6 for multiple winter activations, I can confidently say it has exceeded my expectations. It's a simple, robust, and well-made telescopic mast, perfect for portable ham radio operations.

Manufacturer: Ham Radio Dude, www.hamradiodude.com. Available at the Ham Radio Dude Etsy store, <https://www.etsy.com/listing/1772235734/portable-ham-radio-mast-hrd-ld6-lil-dude>. Price: \$80.

Strays

The 2026 Annual Southeastern VHF Society Conference

The 2026 Southeastern VHF Society (SVHFS) conference will be held April 16 – 19 in Macon, Georgia. All interested in VHF and above amateur operation are invited to attend. The conference begins with a Thursday-night social at a local establishment. The technical conference starts

Friday morning and will include a luncheon with a guest speaker and technical presentations in the afternoon. The event continues with an evening flea market and hospitality suite. The technical presentations continue through early Saturday afternoon, when the antenna range and rover display opens. The conference ends with an in-house banquet including a guest speaker, awards, and door prizes.

The SVHFS websites at www.svhfs.org and <https://groups.io/g/SVHFS> provide further information, including hotel and conference registration details, and a call for papers.



Ask Dave

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

Cables, Fading Signals, and Great Circles

Pushing Window Line Through Walls

Q Mark Ihde, K7SFA, asks: I want to switch from a coax-fed resonant HF wire antenna to a non-resonant parallel feed-line wire antenna. I would like to use the same $\frac{3}{4}$ -inch entry hole in the side of the house that my RG-213 cable uses. A 300 Ω twinlead will fit in the hole, but 450 Ω window line will not. Can I run a roughly 8-inch section of 300 Ω twinlead feed line through the hole and connect it to 450 Ω window line on each side of the wall? Obviously, this is physically possible, but will it work? What will it do to the overall characteristic impedance of the feed line?

A The best answer would be to forego the twinlead and run the RG-213 coax you already have through the wall, connect it to the low-impedance side of a 9:1 balun, and then use window line from the balun to your antenna. This has three virtues. First, it avoids an impedance bump in the feed line, which can cause minor issues with your standing wave ratio. Second, it keeps the window line out of your shack, where it can cause interference (ask me how I know). Third, you can run the coax to a lightning arrestor, then put the 9:1 balun in place and run the window line to your antenna.

Alternatively, if your tuner has the requisite balanced feed-line output, you can squeeze the window line through the hole, or you can slightly enlarge the hole to allow the window line through — again, not bothering with the 300 Ω twinlead. The window line's impedance is slightly affected by stucco, because stucco is typically held to the wall by a net of metal lath. If you have wood siding, like me, then you shouldn't have a problem.

And, if neither of these appeals to you, then you can instead do as you originally suggested and bridge the window line using the 300 Ω twinlead. This approach will create an impedance bump, but it will likely still tune.

You can experiment with different methods and decide which way you want to go. I'm a big fan of proper lightning mitigation, so I recommend running the RG-213 to a lightning arrestor properly attached to a ground rod, then running a short piece of coax to the 9:1 balun and using the window line from there to your antenna.

Ionospheric Fading

Q Doug Yarnold, N4CQD, asks: I do lots of HF operating from my truck with my Yaesu FT-891 and my mobile antenna, a Yaesu ATAS. I've found DXing difficult lately due to signals fading in and out. What causes this?

A The upper regions of the atmosphere are subject to intense bombardment by the sun's radiation. Ultraviolet and X-rays cause the atoms in the high upper atmosphere to shed electrons, creating a plasma we call the ionosphere. Eventually, the free electrons recombine with the positively charged ions; however, while they are free, the charged particles — the negatively charged electrons and the positively charged ions left behind — will interact strongly with the Earth's magnetic field. The charged particles take strange paths, creating huge currents. This further interacts back and forth with the magnetic field. When radio waves pass through these regions, some power is refracted back toward the Earth. This is what gives us a radio “path” to and from DX stations.

Further, the ionosphere is not uniform. The bottom undulates like waves on a pond. This means that your signal could be refracted in such a way as to fade in and out, or, more likely, the non-uniform ionosphere refracts the signal multiple ways, creating multiple paths that converge at the listening antenna, sometimes constructively (the multiple signals are in phase and thus add to each other) and sometimes destructively (the signals are out of phase and thus cancel each other).

If you watch your S-meter while listening to a DX station, you may see that the signal strength goes up and down. Normally this doesn't affect the audio quality, because the radio's automatic gain control keeps what you hear at a constant level. In many cases, the signal is strong for the entire exchange with the DX station; however, if the signal is weak to begin with, the signal strength can vary such that it descends below your receiver's noise floor at times, causing dropouts.

Also, sometimes a strong signal at the start of a contact will be affected by the sun's movement over

time. Under certain conditions, the signal will start dropping out and then rapidly coming back, sometimes causing every other word to drop out. This is a sure sign the band is closing and it's time to wrap up the contact and look for other stations with better signals.

Numerous factors affect the signal-carrying capacity of the ionosphere; these nether regions of the atmosphere are the subject of continuing research. Sometimes a signal that's fading at your location is strong at a location several hundred feet away at the same instant. It is possible to have receiving antennas at several locations and electronically look for the best signal, a technique known as *diversity reception*.

Normally, signals refracted by the ionosphere are circularly polarized, but this can be "squashed" as they reach Earth, giving way to another possible diversity mode: *polarization diversity*. You see this when a horizontal antenna and a vertical antenna fade out differently from each other. If your rig has the capability to receive two signals at once, or if you have another receiver handy, you can connect a horizontal antenna to one and a vertical to the other. As the signal fades on one antenna, it might strengthen in the other. It's worth a try!

DX and Great Circles

Q Walt Grosch, KZ9F, asks: This has perplexed me for a long time. I live in Wisconsin and just worked a station in the Central African Republic. According to QRZ and my Heathkit rotor control, I have to aim my beam antenna 75 degrees east of north. Why do I have to beam northeast for a station that is southeast of me?

A All of us are used to looking at flat world maps, but in reality, Earth is a sphere (technically an oblate spheroid). The shortest distance between any two points on Earth lies on a "great circle" wrapped around the globe that includes those two points. Figure 1A demonstrates the shortest distance between Wisconsin and the Central African Republic on a globe; Figure 1B zooms in on Wisconsin and shows that, in order to hit the Central African Republic, your signal should leave your location traveling about 15 degrees north of east, or 75 degrees east of north.

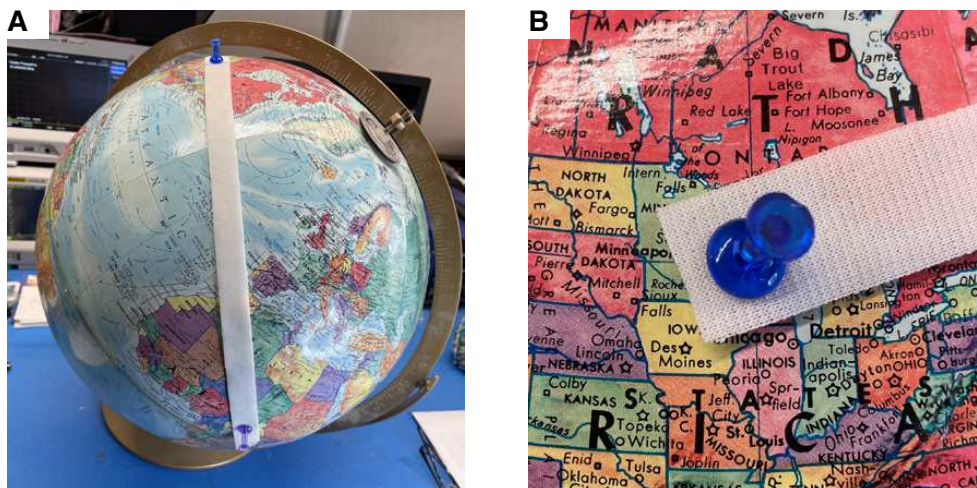


Figure 1 — The white tape (A) shows the shortest route between Wisconsin and the Central African Republic on a globe. The route is part of a great circle. Zooming in on Wisconsin (B), the great circle route to the Central African Republic takes off toward the northeast. This is the direction you should point your beam antenna. [Dave Casler, KEØOG, photos]

Tom Epperly, NS6T, operates a free website (<https://ns6t.net>) that will draw an azimuthal projection map centered on your location that you can download and print. It shows the great circle direction from you to any location on Earth. I've used one for years and highly recommend it.

Note that the radio signal leaving Wisconsin and traveling to the Central African Republic may not follow a perfectly straight line, as the ionosphere is not perfectly smooth. Despite this, a great circle is still the best estimate of where to point your beam.

Send your questions to askdave@arrrl.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.

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Understanding the FCC Exposure Rules for Handheld Radios

By extrapolating from the SAR exposure limits of commercial radios, hams can adjust their operations to keep RF exposure in line with regulations.

Gregory Lapin, PhD, PE, N9GL

Much effort has gone into helping amateurs determine safe exposure distances for HF radios. Along with myriad tools and information, an easy-to-use calculator is available on the ARRL website (www.arrl.org/rf-exposure-calculator). However, determining RF exposure from handheld radios presents a different challenge that is less easily addressed.

Under FCC regulations, any exposure from a source between 100 kHz and 6 GHz that is less than 20 centimeters — about 8 inches — from any part of the body must comply with localized specific absorption rate (SAR) limits (see Figure 1). SAR is the truest measure of RF exposure, corresponding to the rate of energy absorption in human tissue. Other methods of determining exposure are estimates and are usually expressed as incident RF power density or, for lower frequencies, as incident electric and magnetic field strengths. Although determining human internal exposure from incident fields is less accurate, it is a more practical prediction method, as field strength is relatively easy to measure and more easily modeled. SAR, by contrast, is extremely difficult to measure or model.



Figure 1 — Most amateur radio operators hold their handheld transceivers about 2 – 4 inches in front of their mouths for best transmission clarity; however, per FCC regulations, any RF exposure from a source between 100 kHz and 6 GHz that is less than approximately 8 inches from any part of the body must comply with localized SAR limits.

How Is SAR Tested?

The most common method for measuring SAR involves a probe making measurements in every 1 gram of tissue (a cube that is approximately 1 centimeter on each side). Of course, inserting probes into human beings is not practical, so SAR measurements are typically made in “phantoms” made of materials that mimic the electromagnetic properties of tissue. Computer modeling of SAR is possible but highly complex, as the model must account for the electromagnetic properties and spatial distribution of all types of tissue found in the body. Manufacturers whose products require FCC certification spend a lot of money testing SAR, and given the expense and complexity, this testing is not feasible for the radio amateur.

In the US, cell phones and commercial handheld radios are tested for SAR, but amateur radio transmitters, with the exception of certain commercially manufactured external power amplifiers, are not included in these requirements. Testing is intended to confirm that the transmitter conforms with FCC regulations for power output, spurious emissions, and human exposure; however, amateur radio operators have the right to use modified equipment, which would annul any certification. For instance, when you buy an amateur handheld radio, you can easily change the antenna, which is likely to change the parameters of exposure. As a result, the FCC determined that transmitters intended for radio amateurs do not need certification, but they are still required to comply with all FCC regulations, including RF exposure to the licensed operators and the people around them.

So, if amateur handheld radios aren’t being tested for SAR, how is an amateur supposed to conform with the exposure regulations? Ric Tell, K5UJU, had the idea to compare commercial handheld radios, for which SAR testing is required, with similar amateur radio handhelds. This is a reasonable approximation — manufacturers are unlikely to design entirely new radios for amateurs but rather make small modifications to their designs for use in the commercial space and in the amateur radio spectrum. In a study of the FCC certification database, Ric characterized commercial radios

for their SAR exposure levels at or near the amateur 2-meter (144 – 148 MHz), 1.25-meter (222 – 225 MHz), 70-centimeter (420 – 450 MHz), and 33-centimeter (902 – 928 MHz) bands. Tell outlined his findings in his July/August 2021 *QEX* article, “Amateur Portable Radios (Handheld Transceivers): Exposure Considerations Based on SAR.”

Duty Cycle

Human RF exposure is assessed as a time-averaged value. The FCC limits for amateurs are based on the time average of the instantaneous exposures over a 6-minute period. Thus, if a radio’s instantaneous exposure is double the FCC limit but transmission occurs for less than 3 minutes over any 6-minute period, the time-averaged exposure complies with the FCC limits.

SAR measurements of handheld radios for FCC certification are typically based on a 50% transmit cycle, with the expectation that a person using a handheld radio generally talks for half the time and listens for half the time. However, if the amount of time talking is decreased appropriately, virtually any transmitter can be used in compliance with FCC exposure regulations.

FCC exposure regulations give licensed radio amateurs a lot of control over their own exposure. Even if a given handheld radio exceeds the SAR limits extrapolated from commercial radios, the knowledgeable amateur operator can tailor the times that transmissions take place so that the 6-minute time-averaged SAR is less than the FCC limit.

Determining Handheld RF Exposure

You can make reasonable estimates of SAR exposure by extrapolating from tested commercial handheld radios to the exposure of untested amateur handheld radios. The test results for many commercial handhelds are summarized in Tell’s *QEX* article. If you know the SAR exposure from a commercial handheld radio that is similar to your amateur handheld, then that value can be used. For instance, if the FCC database contains exposure results for a commercial radio made by a given corporation, there is a good chance that the results would be proportional for that corporation’s amateur handheld operated at a nearby frequency.

If the results for a comparable commercial radio aren’t known, the safest calculation is based on the worst case in the database. In Figure 2 of Tell, SAR results from several radios are plotted as normalized values, with units of W/kg/W (see Figure 2). SAR is measured in W/kg and the normalization is for 1 W of transmitted power at a 50% duty cycle. These values can then be extrapolated to the wattage produced by a particular

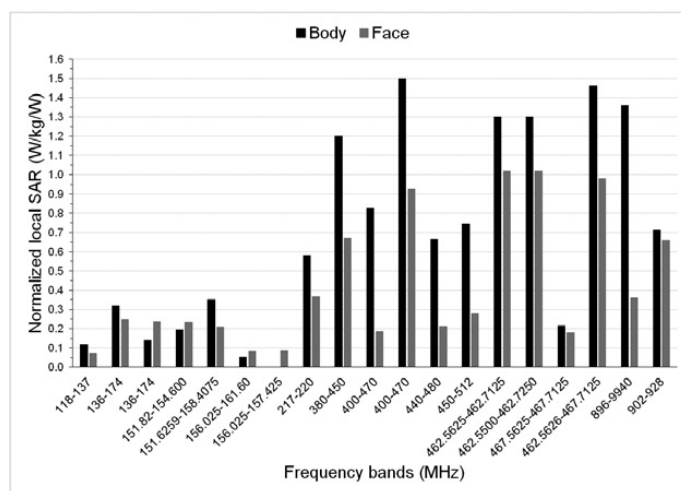


Figure 2 — This graph, from Figure 2 in Ric Tell’s, K5UJU, July/August 2021 *QEX* article, “Amateur Portable Radios (Handheld Transceivers): Exposure Considerations Based on SAR,” depicts the local 1-gram averaged SAR produced by commercial handheld radios in the FCC’s equipment authorization database that operate near or within amateur radio bands. The SAR estimates assume a 50% duty cycle at 1 W.

radio. Table 1 summarizes the reference values that can be used for each band.

The most common value to use, which may be conservative but ensures that you do not exceed FCC limits, is the high SAR. If you have a radio from a manufacturer that does not have entries in the FCC database, you can use the normalized high SAR values of 0.35 W/kg/W on 2 meters; 0.59 W/kg/W on 1.25 meters; 1.50 W/kg/W on 70 centimeters, and 1.35 W/kg/W on 33 centimeters. If, for example, your radio transmits 10 W on these bands, your extrapolated SAR exposure would be 3.5 W/kg on 2 meters; 5.9 W/kg on 1.25 meters; 15.0 W/kg on 70 centimeters, and 13.5 W/kg on 33 centimeters. Because the FCC local SAR exposure limit for a licensed amateur radio operator is 8 W/kg, operating with a 50% duty cycle would conform to that limit on 2 meters and 1.25 meters, but it would exceed the exposure limit on 70 centimeters and 33 centimeters.

Controlling Your Exposure

There are three general actions that you can take to ensure that you’re keeping exposure levels below the FCC limit:

- 1. Lower your power.** Most handheld radios can be programmed to transmit different power levels. Some give a choice of two power levels (Hi and Lo) or three levels (Hi, Med, and Lo). The power outputs associated with those levels vary by manufacturer and radio model, but using the handheld radio at lower power levels is one way to operate within the exposure limits.

Table 1 — SAR Reference Values

Amateur Band	Number of Reference Radios	Low SAR (W/kg/W)	High SAR (W/kg/W)	Mean SAR (W/kg/W)	Median SAR (W/kg/W)
2 m	6	0.05	0.35	0.19	0.17
1.25 m	1	0.59	0.59	0.59	0.59
70 cm	9	0.21	1.50	1.02	1.20
33 cm	2	0.71	1.35	1.03	1.03

2. Move away from the transmitter. You can also use your handheld radio farther away from you. One way is to place the radio more than 20 centimeters, or 8 inches, from any part of your body, holding it farther away or placing it on a nearby table; you can operate it from even farther away with a remote speaker-mic. Another way of distancing yourself from the source of exposure is to replace the handheld's antenna with a transmission line to a stand-alone antenna more than 20 centimeters away. You can still hold the radio in your hand, but your exposure will be from the antenna, which is now farther away. In both cases, you can calculate exposures using incident fields, such as what is done by the ARRL Exposure Calculator.

3. Limit your talking time. You can limit your exposure by reducing the duty cycle of your transmission. The SAR values listed in the FCC database are based on a 50% duty cycle, or 3 minutes of talking over a 6-minute period. Your talking time does not have to be consecutive — it is the sum of all the time that you talk during any 6-minute period.

To calculate the maximum amount of time that you can talk over 6 minutes, start with the tested SAR limit that you are using — either from Table 1 or from the values reported to the FCC from a similar radio — multiplied by the power you will be transmitting and multiplied by 2 to account for the 50% duty cycle used to obtain that tested SAR value. Divide that value into the local SAR limit (8 W/kg) and multiply that fraction by 6 to give you the maximum number of minutes that you can transmit in a 6-minute period.

$$M = \frac{8}{S \times P \times 2} \times 6$$

where

M = Maximum transmit time (minutes)

S = Tested SAR (W/kg/W)

P = Power (W)

Table 2 — Maximum Talk Time per 6-Minute Period

Band	5 W	10 W	15 W	20 W
2 m	Unlimited	Unlimited	4.6 minutes	3.4 minutes
1.25 m	Unlimited	4.0 minutes	2.7 minutes	2.0 minutes
70 cm	3.2 minutes	1.6 minutes	1.1 minutes	0.8 minutes
33 cm	3.6 minutes	1.8 minutes	1.2 minutes	0.9 minutes

Using a 10 W radio as an example, you could talk on 2 meters for the entire 6 minutes without exceeding the exposure limit; on 1.25 meters, you could talk 68% of the time, or for 4 minutes out of every 6 minutes; on 70 centimeters, you could talk no more than 27% of the time, or 1.6 minutes out of every 6 minutes, and on 33 centimeters, you could talk no more than 30% of the time, or 1.8 minutes out of every 6 minutes. Time limits for 5, 10, 15, and 20 W for each of these bands are shown in Table 2.

With the recent availability of low-cost amateur handheld radios with increased power output levels, the question of excessive exposure has been raised. But by using the existing SAR test results for similar commercial radios, a reasonable estimate can be made about the resulting exposure from these radios. Even for radios that exceed FCC SAR limits, modifications to operating procedures can keep your exposure levels within acceptable limits.

I would like to thank Phil Dolbow, WG5D, for initiating investigation into this topic; Kevin Graf, of the FCC Office of Engineering and Technology, for reviewing this article, and the members of the ARRL RF Safety Committee for discussing this topic and reviewing this article.

Gregory Lapin, N9GL, has been a radio amateur for 56 years, earning his license as a Boy Scout. He received his PhD in electrical engineering, specializing in biomedical imaging techniques, from Northwestern University. Greg studied drug delivery methods for brain tumors before becoming involved with RF exposure effects. He is a Life Senior Member of IEEE, serves on the IEEE Committee on Man and Radiation, and co-chairs the subcommittee that develops the C95.1 EMF safety standard for the IEEE International Committee on Electromagnetic Safety. Greg has been the Chairman of the ARRL RF Safety Committee since 1998 and represents ARRL on the FCC Technological Advisory Council. He is currently the editor of *The ARRL Handbook*. His other radio interests include propagation effects, software defined radio, and hiking through parks to operate POTA® and SOTA. Greg can be reached at n9gl@comcast.net.

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County Hunting and the New USA Counties Award

Achieving the top-tier award has challenged hams for decades.

Ron Wilcox, KF7ZN, and Kerry Long, W4SIG

While Ron Wilcox, KF7ZN, was tuning across the 20-meter band in 1986, he heard a ham operator with a large pileup. At first, Ron thought it might be a DX contact, but he soon discovered that it was a mobile station putting a county on the air for a group of county hunters. Soon after, Ron became a member of the Mobile Amateur Radio Awards Club (MARAC), one of America's oldest ham radio special interest groups.

Award History

Interest in collecting contacts with US counties began shortly after World War II — long before mobile operation became commonplace. In the 1950s, Clif Evans, K6BX, formed the County Hunters Club (CHC), in which members contacted as many different counties as possible (this was a significant challenge back then due to sparse mobile activity, so most contacts were with base stations). In 1961, Clif joined CQ magazine and, building on this interest, created the CQ Magazine United States of America Counties Award (USA-CA).

Because of the difficulty of contacting all 3,077 counties, the award was given to operators who contacted 500, and incremental gold stickers were given for every additional 500 contacted. There were only 26 applicants for the initial USA-CA 500, so the first awards were labeled "1A" to "1Z." As interest grew, the labeling system switched to only numbers, with the first USA-CA 1,000 given to John Laney, K4BAI, in 1962. It wasn't until November 19, 1965, that Cliff Corne, Jr., K9EAB (SK), received the first USA-CA for contacting every county in the US (known among county hunters as the "whole ball of wax"). What makes this event even more remarkable is that Cliff had polio and accomplished this milestone while confined to an iron lung. In 1971, Kevin Gill, ZL1KG, received USA-CA #52 and became the first international ham to receive the award.

Interest in the award and mobile activity continued to mount, and in 1969, a group of avid county hunters met in person to discuss organizing a county-hunting club. The following year, a convention was held in Mountain Home, Arkansas, and MARAC was formed. Bill Nash, W0OWY (SK), published a handbook and a logbook

with the outline of each state's counties to be colored in once they were contacted.

Although the original USA-CA continued under the sponsorship of CQ magazine, MARAC created (and continues to offer) many additional county-hunting awards for those chasing and giving out counties, including those who contact all the counties multiple times — special recognition is given for using various modes and bands, and for operating as teams.

A New Award

Those who've been active on the HF bands chasing DX for years, or more recently, participating in Parks on the Air® (POTA®), and are looking for a new goal should consider chasing counties; it offers opportuni-



A sample USA-CA certificate.



Don Flynn's, K3IMC, mobile station on the county line of Hinsdale, Colorado. Don is one of many mobile operators frequently putting counties on the air for hunters.

ties for awards, for which active hams may already have qualifying contacts. Achieving the top-tier county-hunting goal — making contacts with all US counties — has challenged amateurs for decades. Because many counties have only a few (if any) licensed operators, this feat is really only possible with HF mobile and portable activity. In fact, almost 60 years after the original all-counties award was created, only about 1,200 hams worldwide have finished the task.

In early 2025, MARAC formed a committee to investigate how it could expand and extend the long tradition of sponsoring county-hunting participation and awards. After hearing from the committee and general membership, MARAC leadership decided to create its own award for making contacts with all US counties; at the 2024 MARAC National Convention, the Board of Directors added a new US counties award to recognize the achievements of hams who contact America's counties for the first time.

Like other MARAC county-hunting awards, the MARAC first-time award does not require confirmation of contacts. The MARAC Board of Directors noted that rising postage costs and other factors have discouraged participation in awards that require an operator to obtain QSL cards or other written confirmations, and none of the other county-hunting awards sponsored by MARAC require that contacts be confirmed in writing or through electronic programs. MARAC now offers the USA-CA starting at the 500-county level and at increments of additional 500 counties, all the way up to the ultimate achievement of working all 3,077. Special endorsements are available for individual bands and modes. Ham operators who are active on the HF

bands and have participated in state QSO parties or POTA undoubtedly have many counties already logged. Also, some logging programs have a way to create a log of contacted counties.

Opportunities for Mobile Operators

Counties are activated by mobile operators across the US, usually on one of the calling frequencies (such as 14.336 or 14.0565) listed on MARAC's website. There's also a dedicated spotting web page (<https://ch.w6rk.com>) for county activations. An increasing number of POTA activators spot their activation on this site to further increase POTA participation by attracting county hunters. Other POTA activators run additional counties between their park locations to get more contacts, and many MARAC awards allow credit for these additional "activations." Two websites that offer more information are www.countyhunter.com and www.countyhunterweb.org (which has a forum for discussion, as well as listings for planned county-hunting mobile trips). Currently, 18 hams have activated all US counties while mobile.

More Information

Complete details and requirements for the MARAC USA-CA, as well as a complete list of all other awards that MARAC offers, are available at www.marac.org. MARAC members receive the club's monthly newsletter, get special rates for award certificates, and can access *Logger II*, software specifically designed to track MARAC awards. In addition to logging contacts, *Logger II* has tools for spotting county activations, keeping track of progress toward each award, receiving audio and email alerts, and importing ADIF files from other logging programs.

Join in on the fun, get the certificate to hang on your wall, and be active on the air!

All photos provided by the authors.

Ron Wilcox, KF7ZN, is MARAC's Election Coordinator, and he's served on the USA-CA committee. He earned his license in 1984. Ron had a career with Mountain Bell and is currently an RN Case Manager with Intermountain Health/Select Health in Utah. He's a member and officer of organizations such as the Utah DX Association, MARAC, and HamSCI. Ron puts on presentations for clubs and conventions, and he's written for several magazines. Ron is active as a Volunteer Examiner and ARES Assistant Emergency Coordinator. He can be reached at rglogan73@gmail.com.

Kerry Long, W4SIG, is the MARAC Secretary and editor of the club's newsletter, *The County Line Roadrunner*. He has been a county hunter for 44 years, he's contacted all the counties five times, and he's operated mobile HF in more than 2,200 US counties on CW and SSB. Kerry can be reached at kerrylong@comcast.net.

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

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Practical 630-Meter Operation for the Average Radio Amateur

An experienced antenna builder demonstrates that it doesn't take a massive radiator or powerful transceiver to get on this underutilized ham radio band.

Paul Dobosz, K8PD

Ever since the 630-meter band was opened to US amateur use in March 2017, obstacles to transmitting and receiving have kept many hams from operating on this medium-wave band.

With the 475 kHz wavelength approaching half a mile, a simple end-fed half-wave or conventional dipole for this band would be more than 1,000 feet long, and shorter antennas, while possible, need extensive loading and a sizable tuning network that is well beyond what the typical HF tuner can handle. As for transceivers, the units most amateurs have can't transmit on 630 meters, and this lower power level is insufficient for normal operation, particularly when using a compact antenna with efficiency in the low single digits.

With these challenges in mind, I decided to use my previous experience developing compact vertical transmitting antennas for the AM broadcast band to see if those same design principles could be stretched to work on the 630-meter band.

A Series Resonant Antenna

A compact antenna could open 630 meters to urban and suburban amateurs. Electrically short antennas are not terribly efficient, but the 5 W effective isotropic radiated power (EIRP) limit for 630-meter operation makes an antenna with low efficiency a realistic choice.

To operate legally, it is necessary to calculate the station's EIRP, which is highly dependent on the antenna. You'll need to know the transmitter's power output, transmission line loss in dB, and antenna system gain in dBi, or antenna efficiency percentage, to make that calculation. My experiments showed that a 22-foot ground-mounted vertical with inductive center loading and capacitive top loading, with a modest ground radial system of 32 radials 25 feet in length, would be a reasonable compromise between size and performance (see Figure 1). Modeling showed that this antenna had a gain of -15 dBi, equaling about 3% efficiency. The 15 – 20 W output from my modified transceiver resulted in an EIRP of about 0.5 W, well within the legal limit. For more information on how to



Figure 1 — Paul's 22-foot ground-mounted vertical antenna with combined inductive center loading and capacitive top loading.

calculate your station's EIRP, see section 3.3 of *The ARRL Handbook*.

Designing a short series resonant antenna is not without significant challenges. Due to relatively low radiation resistance, the feed-point impedance falls well below the 37.5Ω of a quarter-wave vertical radiator. Electrically short antennas also have limited bandwidth, and efficiency is negatively impacted by the quality of the ground system and loading coil resistances, which are high compared to the low radiation resistance. The antenna's small size also

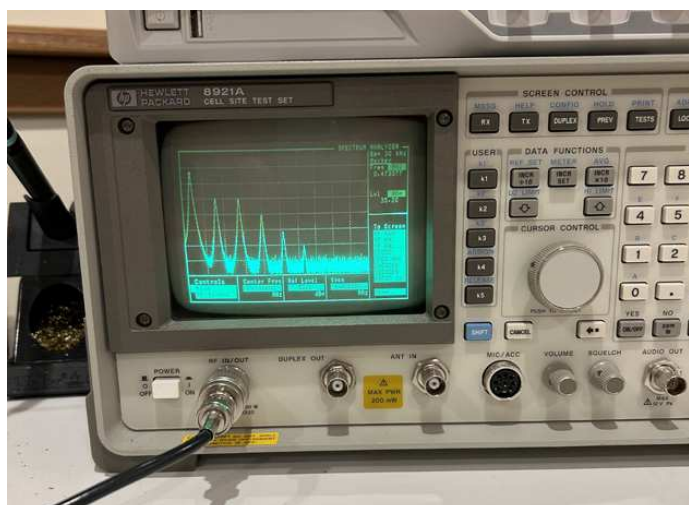


Figure 2 — Spectrum analysis of Paul's modified Icom IC-7300 HF transceiver. Without a low-pass filter, the transmission included harmonics falling both inside and outside of the amateur bands.

impacts receiving efficiency, but its narrow bandwidth combined with a low-pass filter improves the signal-to-noise ratio, allowing for decent reception.

While these shortcomings might be dealbreakers on other bands, the 5 W EIRP limit and 7 kHz-wide band make them manageable. With the addition of an efficient broadband impedance matching transformer, an electrically short but resonant antenna can be fed directly with 50 Ω coax and present a reasonably low SWR to the transmitter without a tuner.

Transceiver Options

Many popular HF transceivers have receive capability down to about 100 kHz and can be easily modified to transmit outside of the amateur bands; however, they aren't designed to operate there, and the transmitter's output signal won't come close to meeting the FCC rule that any spurious emissions must be at least 43 dB below the power of the fundamental frequency.

One solution is to use a transverter. The only one currently available for 630 meters is the Mini-Kits EME223-630M Kit from Australia (<https://minikits.com.au/eme223-630m>). The Mini-Kits transverter performs well, but it's a complex kit best suited to more advanced builders, and its output power (5 W) isn't ideal for a compact antenna.

My hope was to use the Icom IC-7300 HF transceiver I already owned without major modifications. While I used the IC-7300 for my experiments, it is likely that popular HF transceivers from other manufacturers would work in a similar manner. Because the 7300's receiver has coverage below 500 kHz and can transmit there with MARS modification, I decided to try it for both transmit and receive directly on the 630-meter

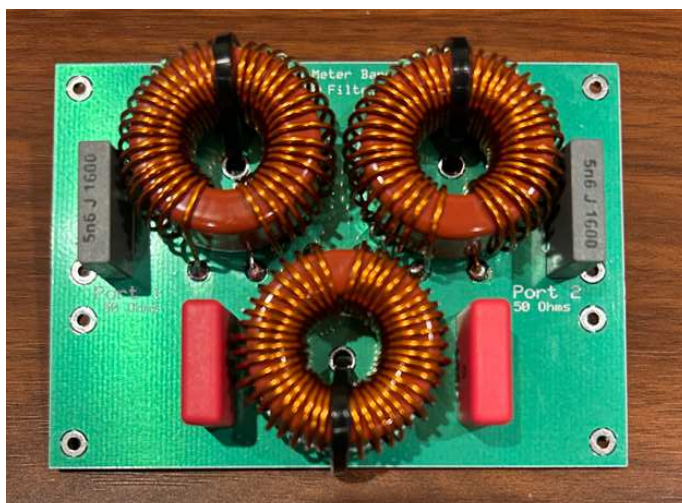


Figure 3 — Paul's assembled external 7th-order low-pass filter.

band. The transmitter produced 10 to 20 W of RF output, but it included harmonics falling both inside and outside of the amateur bands, including the 160- and 75-meter bands and several places in the AM broadcast band (see Figure 2).

The resulting signal's ugly spectrum was not surprising, given the transceiver was operating well below the bottom of its design limits and without an internal low-pass filter following the final power amplifier. I experimented with filtering and found that adding an external 7th-order low-pass filter between the transceiver and the antenna dropped the unwanted harmonics into compliance with FCC requirements for spectral purity (see Figure 3). Above the second harmonic, the filter eliminated all spurious emissions. Component values for the filter were carefully chosen to present minimal SWR to a 50 Ω transceiver and antenna with negligible insertion loss and provide the FCC-required attenuation of harmonics (see Figure 4). An additional benefit of the filter was an added 40 dB of AM broadcast band receiver overload protection, as the attenuator, which normally switches on by default for overload protection below 1,800 kHz, needs to be turned off for 630-meter operation.

Putting It All Together

Daytime ground-wave contacts are possible on 630 meters, but most of the action happens just after dark and just before sunrise, taking advantage of nighttime skywave propagation. While most contacts — especially those made with compact antennas — will be with stations in North and Central America, stations with large antennas capable of reaching the full 5 W EIRP can contact stations in Europe, Japan, and Australia.

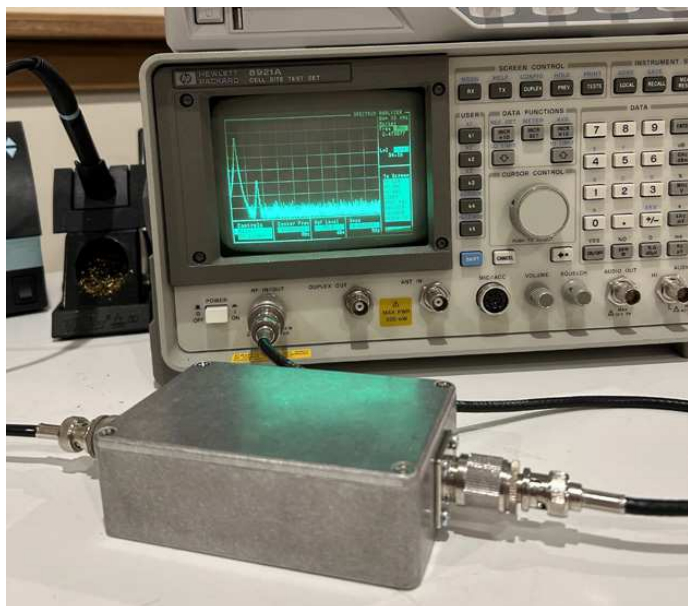


Figure 4 — Spectrum analysis of Paul's modified transceiver with the external low-pass filter installed. Note the attenuation of spurious emissions above the second harmonic.

Operation on this band is almost exclusively CW or digital (primarily FST4 and WSPR). The entire band is only 7 kHz wide; there simply isn't enough room for wider bandwidth modes.

I conducted a real-world test of my compact 22-foot vertical antenna, low-pass filter, and MARS-enabled IC-7300 transceiver on a summer evening. During a 2-hour operating session from my location in western Michigan, I completed 12 FST4 contacts, including contacts as far as New Mexico to the west, New York to the east, and Grand Cayman 1,650 miles to the south. There were no active stations on 630 meters that evening that I was unable to contact. Reception was also reported by stations that automatically monitor 630 meters and post their results on PSK Reporter.

Operation Is Within Reach

My experience shows that it doesn't take a huge antenna or homebuilt transmitter, amplifier, or trans-

UTC Registration

Note that, because the 630-meter amateur radio allocation is shared with electrical utilities that use 472 – 479 kHz or adjacent frequencies for power-line monitoring and control, registration with the Utilities Technology Council (UTC) is required before transmitting on the band. This is done by filling out a short form on the UTC website (<https://utc.org/plc-database-amateur-notification-process>). If the UTC does not respond within 30 days, the amateur station may begin transmitting on the band.



Visit <https://youtu.be/43TP3NHfXxU> to watch W1AW Station Manager Joe Garcia, NJ1Q, and ARRL Lab Digital RF Engineer John McAuliffe, W1DRF, walk through W1AW's experimental 630-meter station.

verter to enjoy operating on this underused amateur radio band — you can do it using much of what you already own. There isn't much activity on the 630-meter band currently, but I'm hopeful that will change. A commercial manufacturer has taken my experimental designs and now manufactures and sells the antenna, filter, and matching transformer (<https://theradiosource.com/products/antenna-630pd.htm>).

You don't need a powerful station to have a lot of fun on this band. Nobody on the band runs more than 5 W EIRP, so you're competing on a relatively level playing field. Operation on 630 meters is within reach.

See QST in Depth for More!

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

- ✓ A schematic for the external 7th-order low-pass filter K8PD used in his build

All photos provided by the author.

Paul Dobosz, K8PD, was first licensed as a Novice in 1963 before earning his Amateur Extra license in 1978. He retired after a 37-year career as a member of General Motors' Engineering staff, and as a design engineer and advanced engineering manager for Delphi/Delco, working on antenna design and development, receiver design, electromagnetic compatibility engineering, and telematics design. Paul was inducted into Delphi's Innovation Hall of Fame in recognition of numerous design patents, intellectual property contributions, and awards received. He can be reached at k8dpd paul@gmail.com.

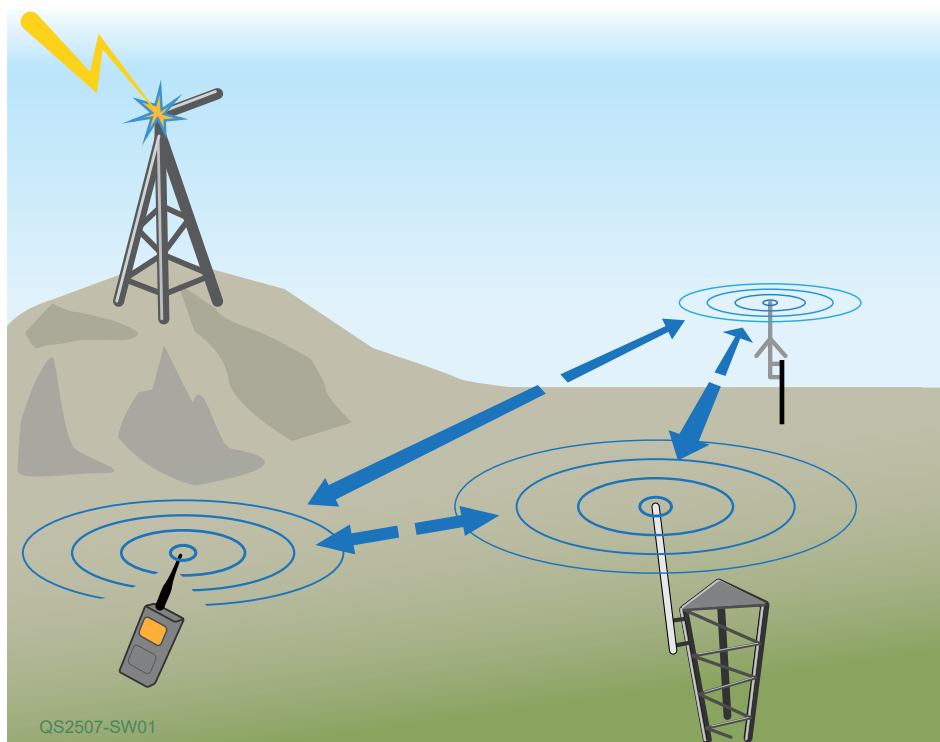
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A Structured Simplex Exercise

Any ham group can replicate this easy, effective drill to prepare themselves for when repeaters fail.



A depiction of simplex communication in the event of a broken repeater.

Mike Walters, W8ZY

One of the most important ways to prepare for an emergency situation is to consider what will happen when infrastructure fails. Many people think about finding sources of water, using Winlink to send emails, or creating alternate heat sources during winter. For hams, one aspect of infrastructure that is often overlooked is the local repeater. Some repeaters have backup power, or they are resilient enough to withstand storms and other natural events. But, there is always a chance for even the most well-equipped repeater to fail; in such instances, hams look to simplex as a reliable method of radio communication. In this article, I describe a simple simplex drill that any group can practice to refine their skills.

Simplex Drill Setup

To begin preparing for this drill, follow and understand these points:

- Assume your local repeater is not working, and ensure that everyone in your group has the repeater frequency programmed into their handhelds.
- Use the output frequency of the repeater as your simplex frequency. Anyone who is listening for the repeater should hear the simplex traffic.
- Do not use a continuous tone-coded squelch system (CTCSS) tone unless it is necessary — in this instance, simplex should be as easy as possible.
- Establish the fact that you are using simplex so that others know you are not on the repeater.
- Simplex capability will vary with frequency and local terrain type.

Next, identify the radio types that may be involved in the exercise. This sets appropriate expectations on

Table 1 — Log of Stations and Signal Reports

Call Sign	Signal Report
N1ABC	Good
N2BBC	Good
K1ASD	Fair
W2CVB	Poor
W3HGF	No Contact

Table 2 — Aggregate Chart of Stations and Signal Reports

	EOC	N1ABC	N2BBC	K1ASD	W2CVB	W3HGF
N1ABC	Good	Good	Good	Fair	Good	No Contact
K1BBS	Good	Good	Fair	Poor	Poor	Good
K1ASD	Fair	No Contact	Good	Fair	Fair	No Contact
W2CVB	Poor	Poor	Poor	Fair	Poor	Poor

simplex capabilities and allows for realistic planning. Such radio types are as follows:

- Handheld only; some operators may have a battery-powered handheld with an attached antenna. It will typically be limited to 4 or 5 W, and its performance is basic.
- Mobile radio; some operators may use a mobile radio and a mobile antenna. Performance will vary based on location.
- Fixed base; this is the station with a mounted antenna that is set up at a designated location. It may be an emergency operations center (EOC), a shelter, an office, or an operator's home shack.

Putting Setup into Action

The exercise starts with a simple question: Who can I talk to? In order to test simplex capability in a given area, find out whether each participant can communicate with the EOC, which is the fixed base. It is expected that depending on where in the area each operator is located and what radios they are using, not everyone will be able to talk to the EOC. For this reason, relay stations will be essential.

Set a start date and time for the drill. At that time, the EOC will announce the beginning of the drill on simplex, and that all further communications will be on simplex. Remember that all participants will be using the output frequency for the repeater, so anyone listening to the repeater should hear this activity. The EOC will continue with a roll call for every station they expect to hear from. If they are using an open net, they may call for check-ins via call sign suffix. Doing so allows net control to manage check-ins in a more orderly fashion. Some stations may hear the EOC, but the EOC might not be able to hear them; this is when a relay becomes necessary. If a station hears a weaker station calling, they can report that to the EOC and possibly relay for the weaker station. Another issue to consider is that some stations may not be able to hear the EOC, but they might hear a relay station.

With an established way to hold a net for the exercise, how can you document it and plan for future events using simplex? The first rule is that every participating station should keep a log of every other station they can hear. Each log should have operator call signs and corresponding signal reports. Signal reports should be on an agreed-upon scale for consistency, such as "good, fair, poor, and no contact" (see Table 1).

When the exercise is over, all operators will need to send their logs to a specified person, who will aggregate the data and load it into one chart (see Table 2).

Modify to Suit Your Needs

As previously discussed, signal reports will vary due to a number of conditions. Many of the stations, especially those with handhelds, may face challenges with respect to local conditions during this drill. After the drill has been held, a call roster of stations may be generated to make the next drill easier. Designated relay stations may be assigned to those with wider coverage. Stations that are located on hills may be able to connect the EOC with other major stations, such as the Red Cross or state agencies, as needed. The fact that you will be using a frequency other than what might be saved on your radio means you need to be able to change the frequency or disable the offset function on a repeater. In short, learn to use the functions on your radio in case you need to make last-minute changes.

A simplex drill is nothing new to many local emergency teams. Adapt the exercise to fit the demands of your group. A structured exercise like this can help ensure that your team is ready for deployment.

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

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Future-Proofing ARES

A Focus on Training

Extending our training beyond communications can make us even more valuable.

Scott Yonally, N8SY

The Amateur Radio Emergency Service® (ARES®) has a rich history of being the last-mile effort to get messages through, as the tagline says, “When All Else Fails.” But that tagline means something different in every ARES group in the country. ARES doesn’t operate the same in California as it does in Ohio. Why? California deals a lot with forest fires that last for days or even weeks at a time. Ohio gets many fast-moving tornadoes lasting just a few minutes. Both of these situations create a lot of damage, but communications are needed for a much longer time in California than they would be in Ohio, so local ARES groups have adapted to local needs in ways that just won’t work in other areas of the country.

For this reason, ARES has long been a program that doesn’t set standards in operation, but rather sets standards in training. No matter where you go, every emergency situation is now utilizing National Incident Management System (NIMS) training, and our ARES volunteers are no exception. This training gives volunteers the basic knowledge of how things function under a command system (who does what and why).

As we envision how ARES can stay relevant as communications systems become even more hardened and satellite internet connections become more prevalent in the EmComm world, we face the reality that ham operators will become less important. Yes, we will still have a communications function in the more rural parts of the country for a while, but as the years progress, advancements in technology will fill the gaps in communications needs even more.

The Value of CERT

Not all is lost. The Community Emergency Response Team (CERT) program has been getting a lot of traction with many of the emergency management agencies (EMAs) around the country. One of the biggest reasons for this is that our local EMA Directors have been the driving force behind CERT. Their office provides training — and lots of it. Not only in communications, but first aid, Stop the Bleed, CPR, and so on.

CERT volunteers are being trained to handle a variety of emergency situations and are getting a well-rounded education that makes them very attractive no matter what the situation is. There have been numerous incidents where CERT teams have volunteered, from tornadoes, to assisting in lost child or lost senior citizen situations. Longer-range communication is the one item that is lacking for them. This is where many of these CERT programs have been begging our ARES volunteers to become a part of CERT, and this just might be the time to do that.

Adaptability and Resilience

By embracing this new opportunity to engage with CERT programs, ARES members can broaden their skill sets and enhance their value within their communities. Integrating this broad range of training in areas beyond communications can only lead to strengthening our preparedness, and will ensure that we remain a vital resource in the rapidly evolving emergency management landscape. Having our ARES groups become more adaptable, capable, and ready to meet any challenge that might arise while serving alongside other groups with a shared commitment to public safety and resilience will make us more valuable.



Richland County, Ohio, CERT volunteers during a LEPC/EMA full-scale exercise in 2024. Rebecca Owens (second from left) was EMA Director at the time.

Celebrate Ham Radio Impact: Nominate for 2026 ARRL Awards

Amateur radio is filled with talented, dedicated hams who perform outstanding acts of service for their club, their community, or the hobby as a whole. Whether they are instructing fellow hams, volunteering their skills, exploring technical ideas and techniques, or spreading the good word about the service, excellence abounds in amateur radio. Seeing other operators excel can inspire us all.

ARRL seeks your help in honoring the outstanding work done by hams through the ARRL service awards. There are a host of different awards that are divided into four categories: Education Awards, Public Relations Awards, Distinguished Service Awards, and Technical Awards.

Consider nominating the extraordinary hams in your circle for one of the ARRL awards. Head to www.arrl.org/arrl-award-nominations to find more details about each award, plus instructions for making nominations.

Education Awards

Hiram Percy Maxim Memorial Award

Named for the Founding President of ARRL, this award goes to a licensed radio amateur under age 21 who has made exemplary contributions to amateur radio and the local community. Nominees must be current ARRL members. **Nomination deadline: March 31, 2026.**

ARRL Herb S. Brier Award for Instructors and Teachers

Honoring Herb S. Brier, W9AD (SK), ARRL sponsors this award in conjunction with the Lake County Indiana Amateur Radio Club to recognize the very best in amateur radio instruction and recruitment. The award goes to a licensed radio amateur and ARRL member who is an ARRL-registered volunteer instructor or ARRL-registered professional classroom teacher. **Nomination deadline: March 15, 2026.**

Public Relations Awards

ARRL Philip J. McGan Memorial Silver Antenna Award

Honoring Phil McGan, WA2MBQ (SK), this award recognizes a radio amateur and ARRL member who

has demonstrated leadership in successfully promoting amateur radio to the public. **Nomination deadline: March 31, 2026.**

ARRL Bill Leonard Award

Honoring Bill Leonard, W2SKE (SK), three annual awards are given to professional journalists or journalistic teams whose outstanding coverage highlights the enjoyment, importance, and public service contribution of the Amateur Radio Service. The award is given in three media categories: audio, visual, and print. **Nomination deadline: March 31, 2026.**

Distinguished Service Awards

Knight Distinguished Service Award

Honoring Joe T. Knight, W5PDY (SK), the award recognizes exceptional contributions by a Section Manager to the health and vitality of ARRL. **Nomination deadline: March 31, 2026** (for consideration during the July ARRL Board meeting).

George Hart Distinguished Service Award

Honoring George Hart, W1NJM (SK), the award recognizes an ARRL member's lifetime of activities within the ARRL Field Organization, including the National Traffic System and the Amateur Radio Emergency Service®. **Nomination deadline: November 1, 2026.**

Technical Awards

ARRL Microwave Development Award

This award recognizes a radio amateur or group of radio amateurs who contribute to the development of the amateur radio microwave bands. **Nomination deadline: March 31, 2026.**

ARRL Technical Service Award

This award recognizes a radio amateur or group of radio amateurs who provide amateur radio technical assistance or training to others. **Nomination deadline: March 31, 2026.**

ARRL Technical Innovation Award

This award recognizes a radio amateur or group of radio amateurs who develop and apply new technical ideas or techniques in amateur radio. **Nomination deadline: March 31, 2026.**

Happenings

FCC 60-Meter Amateur Updates

On December 9, 2025, the FCC released a long-awaited Report and Order (www.fcc.gov/document/fcc-adopts-final-rules-implementing-wrc-15) adopting a new amateur radio spectrum allocation in the 60-meter band; it was approved for worldwide use on a secondary basis in the World Radiocommunication Conference 2015 Final Acts (www.arrl.org/news/it-s-a-wrap-wrc-15-concludes-in-geneva). The FCC also agreed with a petition from ARRL to continue to allow amateur operations on four existing 60-meter channels outside the international allocation, with a full 100 W. The new rules will go into effect 30 days after publication in the *Federal Register*, which is when amateurs may begin using the allocation.

Specifically, the FCC allocated 5351.5 – 5366.5 kHz (60 meters) to the Amateur Radio Service on a secondary basis, with a permitted power of 9.15 W effective radiated power (ERP). The FCC also authorized amateurs to continue using four existing channels outside of the 5351.5 – 5366.5 kHz band, centered on 5332, 5348, 5373, and 5405 kHz on a secondary basis and with a permitted power of 100 W ERP. There are no antenna restrictions, but antenna gain must be used to calculate ERP.

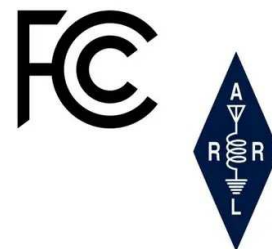
The 60-meter allocation is available to amateurs holding a General-class or above license. The maximum permissible signal bandwidth is 2.8 kHz.

Amateurs are cautioned that this allocation is strictly on a secondary basis, and they must avoid interfering

with non-amateur stations using this spectrum. This obligation includes the responsibility to monitor for such stations using appropriate receiver bandwidths. The FCC emphasized that “allowing amateur operations in this band while fully protecting incumbent primary Federal operations is our priority, and even intermittent interference in this band could jeopardize important Federal operations.”

The FCC left open ARRL’s 2017 Petition for Rule-making (www.arrl.org/news/fcc-invites-comments-on-arrrl-petition-to-allocate-new-5-mhz-band) to implement this WRC allocation (RM-11785), stating that “we expect the Commission may address any necessary power adjustments for the new 15 [kHz] international allocation in that proceeding.” ARRL will be observing operations in the new band to evaluate the effect of the 9.15 W limit and has already been monitoring the regulations and experiences of amateurs in other countries.

In the same Report and Order, the FCC updated 420 – 450 MHz coordination and contact information for geographic areas where the peak envelope power of amateur stations operating is generally limited to 50 W. There was no substantive change to the areas covered by the power limitation.



2025 ARRL Board of Directors Election Results

ARRL announces the results of the 2025 ARRL Division elections.

In the ARRL Pacific Division, current Director John Litz, NZ6Q (1,270 votes), of Stockton, California, was declared the winner, defeating Bob Vallio, W6RGG (960 votes).

In the Southeastern Division, current Director Mickey Baker, N4MB (1,596 votes), of West Palm Beach, Florida, was declared the winner, defeating Tom Schaefer, NY4I (928 votes); Jim Kvochick, K8JK (774 votes), and Northern Florida Section Manager Scott Roberts, KK4ECR (529 votes).

In the Southwestern Division, current Director Richard Norton, N6AA (1,392 votes), of Topanga, California, was declared the winner, defeating Arizona Section Manager Rick Paquette, W7RAP (1,388 votes). John Kitchens, NS6X (1,623 votes), of Somis, California, who is the Santa Barbara Section Manager, was declared the winner, defeating David Ginsberg, N3BKV (1,162 votes), for the position of Vice Director.

In August, the following incumbents and candidate were declared elected without opposition:

- In the Pacific Division, current Vice Director Carol Milazzo, KP4MD.
- In the Rocky Mountain Division, current Director Jeff Ryan, KØRM, and Mel Parkes, NM7P, who

- ran uncontested for the position of Vice Director.
- In the Southeastern Division, current Vice Director Andrew Milluzzi, KK4LWR.
 - In the West Gulf Division, Director John Robert Stratton, N5AUS, and Vice Director Lee Cooper, W5LHC — both already serving in these positions.

Winners have assumed their roles for terms beginning January 1, 2026.

Members voted online or could request paper ballots. The election was conducted by third-party Election Services Co., of Melville, New York — the same company that has conducted ARRL elections since 2022.

ARRL is governed by its Board of Directors. Elections are held for five of the 15 ARRL Divisions each year, for terms of 3 years.

ARRL to Host 2026 HamSCI Workshop at Central Connecticut State University

ARRL will host the 9th Annual Ham Radio Science Citizen Investigation (HamSCI) Workshop on March 14 – 15, 2026, at Central Connecticut State University (CCSU) in New Britain, Connecticut. Activities will also occur at ARRL Headquarters in nearby Newington. Organizers for the HamSCI community are working hard to put together a memorable event that will bring together amateur radio operators, citizen scientists, students, and professional researchers.

This year's theme, "Discovering Science Through Amateur Radio," highlights the vibrant intersection of amateur radio and scientific discovery. The 2026 workshop will showcase achievements across the community, including the latest advances in ionospheric research, Personal Space Weather Station development, meteor-scatter propagation studies, and the expanding use of technology and techniques for real-time radio propagation sensing.

Participants can expect more than 50 oral and poster presentations, invited tutorials, and a Saturday-evening banquet featuring a keynote address from a prominent member of the community. Attendees will also enjoy a visit to ARRL's national headquarters, with tours

of the ARRL Lab and the W1HQ Radio Laboratory, and opportunities to get on the air from W1AW, the Hiram Percy Maxim Memorial Station. Most attendees will participate in person, with a virtual option to be announced.



The workshop welcomes contributions and participation from all sectors of the HamSCI community, including:

- Amateur radio operators and citizen scientists
- Professional researchers
- Academics and educators
- Students at all levels

Presentation topics may explore:

- Ionospheric and propagation effects of geomagnetic storms, solar flares, eclipses, and meteor showers
- Personal Space Weather Station updates
- Radio propagation modeling
- Novel analytical techniques



Some of the HamSCI community gathered at the March 2025 workshop, which was hosted at the New Jersey Institute of Technology. [Bob Inderbitzen, NQ1R, photo]

- Applications of HamSCI research to amateur radio operations
- General-interest topics in arts, literature, and history with a science or amateur radio connection

A variety of registration options are available as of press time, including full-weekend and single-day packages (<https://pci.jotform.com/form/253365111559154>). The full weekend (Saturday and Sunday programs, plus both dinners) is \$200.

The abstract submission window is also open. Submissions (up to 350 words) for both oral presentations (20-minute slots) and poster sessions are invited through January 20, 2026. The Workshop Science Committee will notify accepted presenters by mid-February. Go to the workshop web page for details (www.hamsci.org/hamsci2026).

Bradley International Airport in Windsor Locks, Connecticut, is the closest airport to CCSU, which is located at 1615 Stanley Street, New Britain, Connecticut. The conference will be held in the Student Center (see the virtual campus map at www.ccsu.edu/campusmap). There are many options for lodging at area hotels. Additional travel and accommodation details will be announced in early 2026.

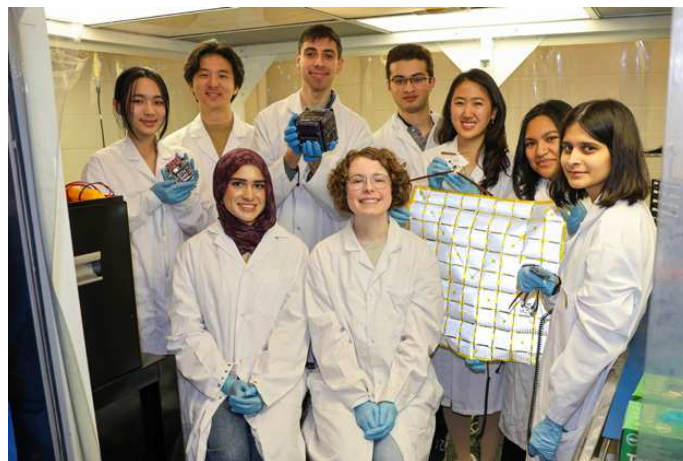
The organizing committee includes representatives from The University of Scranton, the New Jersey Institute of Technology, and ARRL. Financial support includes grants from the US National Science Foundation and Amateur Radio Digital Communications (ARDC).

For more information on the workshop, registration, and abstract submission, visit the HamSCI 2026 Workshop web page at www.hamsci.org/hamsci2026.

Space Sailors Sought Download Help from Ham Radio Operators

A group of students at Cornell University sought participation from radio amateurs equipped with satellite stations to help listen for signals from a retroreflective laser sail. The sail was attached to a 1U CubeSat that was launched early on December 2, 2025, from the International Space Station. After that, it separated and became its own free-flying spacecraft equipped with four tiny “ChipSat” flight computers that transmitted telemetry data back to Earth.

This was the first flight of their ChipSats, and it was that data that the students sought help to detect, according to PhD candidate Joshua Umansky-Castro, KD2WTQ. The light sail’s ChipSats transmitted data using the LoRa® digital protocol on 437.400 MHz. The sail, stowed within the CubeSat, successfully deployed on December 3, and several dozen telemetry signals from its ChipSat flight computers were received and decoded. This was the first time that orbit-to-ground ChipSat data had been fully decoded, which Umansky-Castro called “a huge milestone for the technology.” The data was collected on the TinyGS Project web page at <https://tinygs.com/satellite/CornellLightSail>.



The Cornell students who worked on the light sail project. [Cornell University photo]

It is hoped that the ChipSat and light sail will become the trailblazer for future missions around the solar system, and one day to our closest stellar neighbor, Alpha Centauri.

Images Beamed from Space Celebrate 25 Years of Ham Radio on the ISS

Amateur Radio on the International Space Station (ARISS; www.ariss.org) marked two major milestones in November 2025 with a special slow-scan television (SSTV) event aboard the International Space Station (ISS). Beginning November 12 and continuing through November 20, the station transmitted a series of 12 commemorative SSTV images, pausing only for a scheduled educational contact.

The “SSTV Spacetacular” highlighted both the recent World Scouting movement’s Jamboree on the Air (www.scouting.org/international/jota-joti/jota) and ARISS’s celebration of 25 years of the ISS.

ARISS first went on the air on November 13, 2000, when the ISS Expedition 1 crew made the inaugural ham radio contact using an Ericsson VHF radio. That same year, the first scheduled school contact linked



This SSTV image transmitted from the ISS and celebrating JOTA was captured by Zhanh, BI6PUW, from the People's Republic of China, on November 12, 2025. Pictured is NASA Astronaut Loral O'Hara, KI5TOM.

ISS Commander Bill Shepherd, KD5GSL, with students at Luther Burbank School in Burbank, Illinois. Since then, ARISS has connected an estimated 200,000 students, educators, and enthusiasts each year with astronauts living and working aboard the orbiting laboratory.

Scouts, educators, students, and amateur radio operators worldwide were invited to receive and decode the transmitted images. Participants were able to upload their received pictures to the ARISS SSTV gallery (www.ariss-usa.org/ARISS_SSTV) to earn a commemorative electronic award certificate.

In ARISS's other recent SSTV campaign — held in early October 2025 to celebrate World Space Week — nearly 9,000 images were submitted by more than 3,600 participants on all continents, including three from Antarctica.

For the latest SSTV schedules, frequencies, and event details, follow ARISS on Facebook (www.facebook.com/ARISSIntl), X (www.x.com/ariss_intl) and Instagram (www.instagram.com/ariss_intl).

Section Manager Nomination Notice

To all ARRL members in Illinois, Indiana, Maine, Northern Florida, Oregon, Santa Clara Valley, Vermont, and Wisconsin. You are hereby solicited for nominating petitions pursuant to an election for Section Manager (SM). Incumbents are listed on page 16 of this issue.

To be valid, a petition must contain the signatures of five or more full ARRL members residing in the Sections concerned. It is advisable to have a few more than five signatures on each petition. A sample nomination form is available on the ARRL website at www.arrl.org/section-terms-nomination-information.

Nominating petitions may be made by facsimile or electronic transmission of images, provided that upon request by the Emergency Communications and Field Services Director, the original documents are received by the director within 7 days of the request. It is acceptable to submit signatures that have been sent via email or mail under the following guidelines: The petition copies must be made from the original form supplied by ARRL or downloaded from the ARRL website. The form must be exactly the same on both sides (i.e., autobiographical information should appear exactly the same on all copies). All forms/copies must be submitted together.

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

We suggest the following format:

(Place and Date)

Emergency Communications and Field Services Director, ARRL
225 Main St.

Newington, CT 06111

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

(Signature _____ Call Sign _____ City _____ ZIP _____)

Any candidate for the office of Section Manager must be a resident of the Section, an amateur radio licensee of Technician class or higher, and a full member of ARRL for a continuous term of at least 2 years immediately preceding receipt of a nominating petition. Petitions must be received at Headquarters by 4:00 PM Eastern Time on March 6, 2026. If more than one member is nominated in a single Section, ballots will be mailed from Headquarters no later than April 1, 2026, to full members of record as of March 6, 2026, which is the closing date for nominations. Returns will be counted May 19, 2026. Section Managers elected as a result of the above procedure will take office July 1, 2026.

If only one valid petition is received from a Section, that nominee shall be declared elected without opposition for a 2-year term beginning July 1, 2026. If no petitions are received from a Section by the specified closing date, such Section will be resolicited in the July issue of *QST*. A Section Manager elected through the resolicitation will serve a term of 18 months. A Section Manager vacancy occurring between elections is filled through appointment by the Emergency Communications and Field Services Director. — *Josh Johnston, KE5MHV, Emergency Communications and Field Services Director*

Public Service

ARRL MOU/MOA Stakeholders Update

Many amateur radio public service and emergency communications activities are conducted within the context of ARRL's formal agreements, called *memorandums of understanding* (MOUs) and *memorandums of agreement* (MOAs), with emergency management groups, government organizations, non-governmental organizations, nonprofits, and public service agencies. This month, we'll look at a few happenings and training opportunities among ARRL's MOU and MOA stakeholders. For more information on ARRL's formal partnerships, visit <https://arrrl.org/served-agencies-and-partners>.

The Salvation Army

The Salvation Army, organized in four territories across the US, provides services to disaster victims and is active in impacted communities during the recovery process. The organization has myriad communication needs that are often filled by ARRL volunteers. The Salvation Army Team Emergency Radio Network, which has been operating for 30 years, is an international HF net that provides necessary communication to and from disaster sites around the world. ARRL and the Salvation Army revised their MOU in 2018.

The Salvation Army recently introduced a new suite of Emergency Disaster Services training courses designed specifically to support its partners, such as ARES®. To access these course modules, visit <https://learn.salvationarmyusa.org/EDS/faith-and-community-based-organizations>.

American Red Cross

Over the past year, ARRL officials and QST editors and contributors have prioritized safety as a major issue (for a recent example, see the Public Service column in the October 2025 issue of QST, "Safety Stand-Down: Look Up and Live," by Sierra Harrop, W5DX). The American Red Cross, a long-time official ARRL partner, helps radio amateurs maintain a safe operating environment by providing must-have first aid, CPR, and automated external defibrillator online coursework. It equips our ARES participants and other volunteers with the ability to recognize and care for a variety of first aid, respiratory, and cardiac emergencies involving adults.

The National Weather Service's SKYWARN Program

The severe weather across the US in 2024 can be characterized as near-historic, resulting in the second-highest number of tornadoes in a single calendar year since record-keeping began in 1950, according to the National Oceanic and Atmospheric Administration's Storm Prediction Center, part of the National Weather Service.

Amateur radio operators who are drawn to public service should consider joining the SKYWARN® Storm Spotter Program. Volunteers include police and fire personnel, dispatchers, EMS workers, public utility workers, trained amateur radio operators, and other concerned private citizens. Individuals affiliated with ARES are especially encouraged to become spotters. For more information on the program, visit <https://weather.gov/skywarn>.

FEMA's CERT Program — GMRS and FRS Radios

The must-read editorial "Future Proofing ARES®," featured in the October 2025 issue of QST, is a forward-facing call for reevaluation of ARES and its role in emergency communications. One aspect of the discussion is the potential value added to our responses by broadening our perspective beyond the traditional model of amateur HF SSB and VHF FM voice communications for disaster response and emergency management.

The Federal Emergency Management Agency (FEMA) and ARRL have an MOA — similar to an MOU, but MOAs are legally binding and provide a more formal and structured approach to collaboration between two parties — and amateur radio operators support FEMA's Community Emergency Response Team (CERT) program. CERT trains volunteers in basic disaster response skills, including fire safety, light search and rescue, team organization, and disaster medical operations.

A strong communications network is a priority for a neighborhood CERT in disaster scenarios, such as hurricanes, floods, or tornadoes. When neighbors get together for training and planning, communication is a vital part of preparation. Family Radio Service



Robert Lees, W3ZQN, past MCAR RACES Radio Officer and past MCAR Emergency Coordinator, manning the Lower Providence Township Municipal EOC in Montgomery County with his personal go-kit. [Photo courtesy of Robert Griffiths, NE3I]

(FRS) radios, which are easy to use to communicate with neighbors, are an excellent tool that adds value during emergency scenarios, and CERT members with extended-coverage General Mobile Radio Service (GMRS) radios could communicate with local police and fire departments, the area emergency operations center (EOC), and amateur radio operators.

FRS walkie-talkies are low-powered, easy-to-use radios that operate on UHF frequencies between 462.5625 and 462.7250 MHz, and no license or test is required to operate them, making them ideal for family use. They are, however, limited to line-of-sight communications. Fortunately, FRS radios share their first 22 preset channels with GMRS radios, which means they can cross-talk. GMRS radios are also used for short-distance, two-way voice communications using handheld radios, but GMRS licensees can take advantage of higher power output, mobile radios, and repeater systems to boost communications farther than FRS radios alone would allow.

Supplementing CERTs with the addition of GMRS and FRS radios is growing in popularity, and radio amateurs with access to these radios who can readily interface with neighborhood CERTs represent value added. The Gainesville Amateur Radio Society, an ARRL Special Service Club, published an excellent brochure on the differences between GMRS and FRS radios and services, suitable for reproduction and handing out to neighbors in a CERT or neighborhood watch program: <https://gars.club/GMRS%20FRS%20Emergency%20Communications2.pdf>.

Montgomery County ARES Assists FEMA Drill in Pennsylvania

To illustrate how amateur radio operators can work in partnership with ARRL's MOU and MOA stakeholders, Robert Griffiths, NE3I, Montgomery County ARES/RACES (MCAR) Public Information Officer and ARRL Eastern Pennsylvania Public Information Coordinator, offered the following overview of MCAR's recent collaboration with FEMA and the Pennsylvania Emergency Management Agency (PEMA).

Radio Amateur Civil Emergency Service (RACES) and MCAR recently supported the Limerick Generating Station (LGS) Drill on November 18th. In these biannual drills, FEMA and PEMA evaluate Montgomery County's public safety response in the event of an incident at the LGS, a nuclear power plant located in Limerick Township, Pennsylvania, approximately 30 miles northwest of Philadelphia.

For this drill, MCAR deployed 35 radio amateurs to 20 sites, including the county's alternate EOC, 17 municipal EOCs within the 10-mile Environmental Protection Zone (EPZ), Jefferson Abington Hospital, a PEMA Amateur Radio Liaison Station, and the Peter Becker Community, a senior living community.

The drill's required use of the alternate EOC, a distant location from the EPZ set at a lower elevation that is not ideal for radio, proved a challenge for MCAR. In preparation, MCAR leadership pre-tested access to local repeaters to access distant hillside stations. To further facilitate communications, MCAR also used the newly established Peter Becker Community Amateur Radio Club station, K3PBC, as a provisional relay station.

These preparations proved prudent — 50 minutes into the drill, MCAR's centrally located primary AA3E repeater sustained strong interference reaching levels of 20 dB over S-9. As a result, the MCAR net control station at the EOC had to direct all stations to switch to the more distant Pottstown Area Amateur Radio Club's repeater. The Peter Becker Club's relay station assisted with this move, confirming its ability to access the Pottstown repeater and communicate directly via FM simplex with some of the municipal EOCs.

Of the 35 radio amateurs participating in the drill, 17 were on emergency power. MCAR operators exchanged 335 digital text messages over the air using *fldigi* mode MT63 2KL. The LGS Drill constituted MCAR's ARRL Simulated Emergency Test for 2025.

Contest Corral

February 2026

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

Start - Finish		Date-Time	Date-Time	Bands	Contest Name	Mode	Exchange	Sponsor's Website
Date-Time	Date-Time							
1	0000	1	0400	3.5-14	North American SSB Sprint Contest	Ph	Other's call, your call, serial, name, SPC	ssbsprint.com/rules
3	0100	3	0300	3.5-28	ARS Spartan Sprint	CW	RST, SPC, pwr	ars-qrp.com
4	2000	4	2100	3.5	UKEICC 80m Contest	Ph	6-char grid square	www.ukaiccc.com
5	0000	6	0300	7	Walk for the Bacon QRP Contest	CW	Max 13 WPM; RST, SPC, name, mbr or pwr	qrpcontest.com/pigwalk40
7	0000	8	2059	3.5-28	LABRE-RS Digi Contest	Dig	4-char grid square	labre-rs.org.br
7	0000	8	2359	1.8-28,VHF/UHF	Vermont QSO Party	All (see rules for FT8 guidance)	RS(T), VT county or SPC	www.ranv.org/vtqso.html
7	0001	8	2359	28	10-10 International Winter Contest, SSB	Ph	Name, mbr or "0," SPC	www.ten-ten.org
7	1200	8	1200	3.5-28,144	F9AA Cup, CW	CW	RST, serial	www.site.unc.asso.fr
7	1200	8	1200	1.8-28	European Union DX Contest	CW Ph	RS(T), EU union region or ITU zone	www.eudx-contest.com
7	1200	8	2359	3.5-28	Mexico RTTY International Contest	Dig	RST, XE state or serial	rtty.fmrn.mx
7	1400	7	2359	1.8-28	Minnesota QSO Party	CW Phone (FM/SSB/AM)	Name, MN county or SPC	www.w0aa.org/mnqp-rules
7	1400	8	2359	1.8-28	FYBO Winter QRP Sprint	CW Ph Dig	RS(T), SPC, name, pwr, temperature	azscqrptions.org
7	1600	8	2359	1.8-28	British Columbia QSO Party	CW Ph	RS(T), BC district or SPC	www.orcadxccc.org
8	0000	8	0359	3.5-14	North American Sprint, CW	CW	Other's call, your call, serial, name, SPC	ncjweb.com/Sprint-Rules.pdf
9	0100	9	0300	1.8-28	4 States QRP Group Second Sunday Sprint	CW Ph	RS(T), SPC, mbr or pwr	www.4sqrp.com
9	1300	13	2359	All, no WARC	ARRL School Club Roundup	CW Ph Dig	RS(T), class (I/C/S), SPC	www.arrl.org/school-club-roundup
10	1900	10	2029	3.5,7	DARC FT4 Contest	Dig	RST, 4-char grid square	www.darc.de
11	0130	11	0330	3.5-14	NAQCC CW Sprint	CW	RST, SPC, mbr or pwr	naqcc.info/sprint_rules.html
13	0000	14	2359	All, no WARC	YLRL YL-OM Contest	CW Ph Dig	Serial, RS(T), SPC	ylrl.org
14	0000	14	2359	1.8-7	PODXS 070 Club Valentine Sprint	Dig	Name, OM or YL, SPC	www.podxs070.com
14	0000	15	2359	3.5-28	CQ WW RTTY WPX Contest	Dig	RST, serial	www.cqwpwxrtty.com
14	1100	14	1300	7,14	Asia-Pacific Spring Sprint, CW	CW	RST, serial	jsfc.org/apsprint/aprule.txt
14	1200	15	1159	1.8-28	Russian PSK WW Contest	Dig	RST, 2-letter oblast or serial	www.rdrclub.ru
14	1200	15	1200	1.8	KCJ Topband Contest	CW	RST, JA prefecture/district code or CQ zone	www.kcj-cw.com
14	1200	15	1200	1.8-28	Dutch PACC Contest	CW Ph	RS(T), PA province or serial	pacc.veron.nl
14	1200	15	2359	1.8-28,50	SKCC Weekend Sprintathon	CW	RST, SPC, name, mbr or "none"	www.skccgroup.com
14	1500	15	1500	1.8-28	OMISS QSO Party	Ph	RS, SPC, mbr (if any)	www.omiss.net
14	2000	14	2300	1.8	RSGB 1.8 MHz Contest	Ph	RST, serial, UK district code (if UK)	www.rsgbcc.org
15	1300	15	1700	3.5,7	Balkan HF Contest	CW Ph	RS(T), serial	www.bfra.bg
15	2300	16	0100	1.8-28	Run for the Bacon QRP Contest	CW	RST, SPC, mbr or pwr	qrpcontest.com/pigrun
19	0000	20	0300	14	Walk for the Bacon QRP Contest	CW	Max 13 WPM; RST, SPC, name, mbr or pwr	qrpcontest.com/pigwalk20
21	0000	22	2359	1.8-28	ARRL International DX Contest, CW	CW	RST, SP or pwr	www.arrl.org/arri-dx
21	0600	22	1800	3.5-28	REF Contest, SSB	Ph	RS, French department or serial	concours.r-e-f.org
21	1500	22	0159	1.8-28,50	South Carolina QSO Party	CW Ph Dig	RS(T), SC county or SPC	scqso.com
21	1900	21	2059	1.8-28	Feld Hell Sprint	Dig	See rules	sites.google.com/site/feldhellclub
22	0000	22	2359	3.5-28	World Wide Argentina DX Contest	CW Ph	RS(T), 4-char grid square	worldwideargentina.com.ar
22	1400	22	1700	3.5-28	High Speed Club CW Contest	CW	RST, mbr or "NM"	www.highspeedclub.org
23	2000	23	2200	3.5-28	RSGB FT4 Contest	Dig	Signal report	www.rsgbcc.org
25	0000	25	0200	1.8-28,50	SKCC Sprint	CW	RST, SPC, name, mbr or "none"	www.skccgroup.com
25	2000	25	2100	3.5	UKEICC 80m Contest	CW	6-char grid square	www.ukaiccc.com
27	2200	1	2200	1.8	CQ 160-Meter Contest, SSB	Ph	RS, SP or CQ zone	www.cq160.com
28	1300	1	1300	3.5-28	UBA DX Contest, CW	CW	RST, serial, ON section (if ON)	www.uba.be
28	1800	1	0559	3.5-28	North American QSO Party, RTTY	Dig	Name, SPC+DC	www.ncjweb.com/NAQP-Rules.pdf
28	1800	1	0559	3.5-28	NA Collegiate Championship, RTTY	Dig	Name, SPC+DC	www.w9smc.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.

2025 ARRL 10 GHz and Up Contest Results

The 2025 ARRL 10 GHz and Up Contest weekends took place August 16 – 18 and September 20 – 22.

The 2025 ARRL 10 GHz and Up Contest remained at 156 entries, the same as 2024, but the proportions changed, with five more logs in the 10 GHz and Up category. That's an increase of 17 logs in the 10 GHz and Up category since 2023. Entries were distributed across all regions, with more than 20 entries each again this year in the W1, W2, and W6 call areas, followed by more than 10 entries each in the W0, W3, W5, W8, W9, and VE areas — a much wider distribution than last year.

Top 10 entrants in the 10 GHz category were widely distributed from both coasts, the Midwest, and eastern Canada. This year's winner, Peter Prabucki, VA3ELE, who lives in the Toronto area, was last year's 10 GHz and Up winner. Peter's 59,063 score won by a wide margin over second-place WB0LJC.

In the 10 GHz and Up category, last year's winner, Hugh Duff, VA3TO, took top honors in a narrow victory with 325 contacts and just under 500 points more than second-place scorer Pete Walter, K9PW, whose 350 contacts took the top QSO count for the contest. In third place, less than 1,000 points behind, was Tony Emanuele, K8ZR, with 291 contacts.

QSO totals were up significantly — it took more than 120 QSOs to make the top ten QSOs list in the 10 GHz category, and more than 210 QSOs to make the top ten QSOs list in the 10 GHz and Up category. Activity continues to grow across all the bands in this event. Unique call sign leaders were closely aligned for the top ten scores lists. Again in 2025, K2DH, K2UA, K8ZR, and N2MG broke the 100 unique call sign barrier, with each operator logging 100 – 107 unique call signs. K1FMS and K1UU logged a 24-kilometer optical contact for the best 300+ GHz DX.

Entries by Year

2025		2013	
10 GHz	91	10 GHz	73
10 GHz and Up	65	10 GHz and Up	27
2024		2012	
10 GHz	96	10 GHz	78
10 GHz and Up	60	10 GHz and Up	37
2023		2011	
10 GHz	93	10 GHz	87
10 GHz and Up	48	10 GHz and Up	29
2022		2010	
10 GHz	98	10 GHz	88
10 GHz and Up	56	10 GHz and Up	31
2021		2009	
10 GHz	91	10 GHz	77
10 GHz and Up	45	10 GHz and Up	31
Checklog	1	2008	
2020		10 GHz	77
10 GHz	76	10 GHz and Up	27
10 GHz and Up	46	2007	
2019		10 GHz	77
10 GHz	110	10 GHz and Up	38
10 GHz and Up	34	2006	
2018		10 GHz	76
10 GHz	98	10 GHz and Up	39
10 GHz and Up	45	2005	
2017		10 GHz	95
10 GHz	85	10 GHz and Up	36
10 GHz and Up	42	2004	
2016		10 GHz	94
10 GHz	89	10 GHz and Up	42
10 GHz and Up	42	2003	
2015		10 GHz	105
10 GHz	85	10 GHz and Up	37
10 GHz and Up	37	2002	
2014		10 GHz	106
10 GHz	86	10 GHz and Up	32
10 GHz and Up	26		

Logs Received by Call Area

Call Area	Entries
W0	12
W1	26
W2	20
W3	10
W4	4
W5	12
W6	20
W7	5
W8	16
W9	12
VE	19
XE	1
Total	157

Top Ten Scores, QSO Totals, and Uniques

10 GHz Only				10 GHz and Up			
Call	Score	QSOs	Unique Calls	Call	Score	QSOs	Unique Calls
VA3ELE	59,063	255	45	VA3TO	74,871	325	73
WB0LJC	52,670	178	28	K9PW	74,394	350	77
WA9TT	40,606	161	32	K8ZR	73,555	291	103
W8BYA	37,261	81	41	K1RZ	70,702	203	90
K9JK	37,074	154	46	W6QIW	65,699	240	53
VE2UG	29,439	103	40	K2DH	63,869	262	107
VE3EG	29,285	126	44	VE3KH	63,443	252	81
K6NKC	29,154	126	45	K2UA	63,439	261	106
N0UK	28,930	130	16	N2MG	58,736	248	100
N2WK	28,039	123	43	K6ML	57,080	203	49

Top Ten Unique Call Sign Leaders

10 GHz Only		10 GHz and Up	
Call	Unique Calls	Call	Unique Calls
W6IFE	50	K2DH	107
K9JK	46	K2UA	106
VA3ELE	45	K8ZR	103
K6NKC	45	N2MG	100
VE3EG	44	K1RZ	90
N6VHF	43	K3WHC	84
N2WK	43	AF1T	83
N5BF	42	W1MKY	81
W8BYA	41	VE3KH	81
VE2UG	40	W2FU	80

Call Area Leaders

10 GHz Only				10 GHz and Up			
Call	Score	Call	Score	Call	Score	Call	Score
Area 0				Area 6			
WB0LJC	52,670	K6NKC	29,154	No Entries		W6QIW	65,699
N0UK	28,930	W6IFE	27,195			K6ML	57,080
K0HAC	25,332	N7DA	20,976	Area 1		KB6BA	27,592
N0KP	24,896	N5BF	19,905	AF1T	54,224	N9JIM	23,812
WA2VOI	17,462	N6VHF	15,939	W1MKY	53,234	W6BY	16,586
W0GHZ	10,039	AF5T	11,626	W1GHZ	34,540	N6MX	4,903
K0AWU	6,083	N9RIN	10,292	K1FMS	31,761		
WQ0P	5,814	W6YLZ	10,061	K1OR	25,057	Area 7	
K0SHF	5,690	N6LL	9,341	KC0IYT	24,739	N6RMJ	31,904
WF0T	2,532	N6MI	4,769	W1FKF	15,781	K6VHF	26,287
				AA1I	14,933	Area 8	
Area 1				WA1MBA	12,468	K8ZR	73,555
WG3K	19,873	NJ6D	20,200	KA1NKD	12,278	KB8U	34,713
KB1VC	13,520	K16R	963			WB8TGY	23,243
KC1V	11,378	NJ7A	369	Area 2		WA8VPD	18,816
W1AUV	7,693	Area 8		K2DH	63,869	NN9X	10,697
W1AIM	6,751	K9JK	37,074	K2UA	63,439	K9TMS	9,251
KB1QV	3,664	K2YAZ	15,865	N2MG	58,736	KD9GGZ	8,746
N1CMD	3,471	WA3PZQ	8,096	W2FU	53,476	K8DP	8,553
WZ1V	3,030	W8RU	7,296	K2TER	48,085	K8CLP	7,210
N1ROZ	2,127	K8YSE	4,926	KB8VAO	39,426	Area 9	
WB2VVV	984	KB8YHF	4,126	KE2AIZ	34,026	K9PW	74,394
		VE3ADQ	2,382	WA2TMC	30,589	W9SZ	28,280
Area 2				NR2C	16,289	AA9IL	9,414
N2WK	28,039	Area 9		Area 3			
N2ZN	17,922	WA9TT	40,606	K1RZ	70,702	VE	
N3RG	14,203	W8BYA	37,261	K3WHC	50,788	VA3TO	74,871
WW2Y	9,044	W0ZQ	18,075	NG3W	23,557	VE3KH	63,443
WB2RVX	8,146	K0KFC	16,356	W3SZ	14,166	VE3SMA	43,234
W9KXI	5,094	W0AUS	5,192	Area 4		VE3MSC	20,345
W3TI	4,749	W9XT	4,442	N9ZL	11,809	VE3HPC	11,558
N2YTF	3,550	KA9VVQ	4,332	Area 5		VE3SST	8,217
N2OA	1,564	W9FZ	4,332	W5LUA	21,009	VE4MA	6,473
W2BVH	1,225	AJ9L	2,780	KM5PO	20,285	VA3ECO	2,645
Area 3				KI5EMN	20,119		
WA3DRC	6,701	VE		AA5AM	14,517		
WA3GFZ	6,425	VA3ELE	59,063	AA5C	10,127		
N3OC	4,591	VE2UG	29,439	WA5WCP	9,944		
WX3K	1,787	VE3EG	29,285				
W3HMS	940	VE2ZAZ	10,633				
KC3FQF	163	VE3RSA	8,948				
Area 4							
W3IP	5,364	VA3HES	3,176				
N3MK	2,967	VE4DDZ	2,347				
NV4B	206	VE4SA	2,072				
		VA7SC	372				
		VE7HR	182				
Area 5							
W5VY	15,369	Mexico					
WB5ZDP	14,595	XE2TT	711				
N6CA	3,686						
AD5JK	3,293						
K5MNZ	3,288						
W5ZCA	940						

Best DX by Band in Kilometers

Call	Best DX	Call	Best DX
10 GHz			
KB6BA	863	78 GHz	
K6VHF	863	K2DH	86
NJ6D	863	K2UA	86
N0UK	848	K8ZR	86
W8BYA	848	WA1MBA	86
WQ0P	828	VA3TO	71
W5VY	828	KB8VAO	49
K6ML	764	WB8TGY	49
WA5WCP	744	K8DP	49
AF1T	711	K1OR	44
W1MKY	711	N2MG	5
W1GHZ	711	AA1I	5
K3WHC	711	122 GHz	
K1RZ	711	AF1T	9
VE3KH	711	W1MKY	9
		WB8TGY	7
24 GHz			
W1GHZ	247	K2DH	5
K1RZ	247	K2UA	5
W1FKF	247	N2MG	5
K6ML	246	VE4MA	5
W5LUA	242	VA3ECO	5
KI5EMN	242	300+ GHz	
KM5PO	242	K1FMS	24
K2DH	209	K1UU	24
K2UA	209	AF1T	9
N2MG	209	W1MKY	9
K8ZR	209	K1OR	5
KK1W	209	AA1I	5
		KC0IYT	5
47 GHz			
K6ML	174		
W6QIW	174		
W6BY	171		
KB6BA	166		
K6VHF	163		
VE3KH	116		
K2DH	105		
K2UA	105		
N2MG	105		
K8ZR	105		
W1EX	105		
WA1MBA	105		

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 ARRL 10 GHz and Up Contests will be held August 15 – 17 and September 19 – 21, 2026.



Mike Gilmer, N2MG; Dave Hallidy, K2DH, and Tony Emanuele, K8ZR, work a station in the Toronto area on 10 GHz from FN23 at sunset on Sunday, September 21, the second weekend of the contest. [Rus Healy, K2UA, photo]

2025 ARRL 222 MHz and Up Distance Contest Results

The most recent ARRL 222 MHz and Up Distance Contest was held August 2 – 3, 2025.

The 222 MHz and Up Distance Contest is a distance-scored event, with points earned for the distance in kilometers between the center of the six Maidenhead grid square locators for each station. In 2025, 108 entries were received for the ARRL 222 MHz and Up Distance Contest, with 2,987 total contacts reported. We continue to see a decrease in activity, and we invite ideas that will expand interest to increase participation. If you did participate, please send in your logs — they are our primary gauge for measuring interest and activity, so please submit an entry/log regardless of the number of contacts made. You might even be pleasantly surprised by how well you did in the contest.

The “Contacts Reported per Band” table again shows that most of the activity was focused on the bands from 222 MHz through 10 GHz, with 222 and 432 MHz being the most popular bands this year. Contacts were also reported on 24 and 123 GHz.

Best DX contacts in 2025 included a 1,603-kilometer contact on 222 MHz between Brad Fuller, WQ5S, in Texas grid square EM13ci, and Jeff Wheeler, W7JW, in Michigan grid EN82fj. On 432 MHz, Phil Humphries, N8LRG, in Ohio grid square EN80vi, completed a

1,377-kilometer contact with Rick Wentworth, W5EME, in Louisiana grid EM32ai. Phil also worked Rick over a 222 MHz path — again a long haul! On 902 MHz, Marshall Pochay, WD9EXD, in Illinois grid EM57rn, shared 615-kilometer greatest distance honors with Pat Patterson, W5VY/R, in Arkansas grid EM35nd. Marshall also had the longest contact on 1.2 GHz at 761 kilometers with Christopher Arthur, NV4B/R, in grid EM54vs. With a four-band winning-distance effort on 2.3, 3.4, 5.7, and 10 GHz, David Petke, K1RZ, in FM19jh in Maryland, shared best DX with Jeff Klein, K1TEO, in Connecticut grid FN31jh. Check out a full report of the best DX contacts by band in the “Best DX Contacts by Band” table.

Planning checklist for 2026: Get on the air, call CQ, make schedules with distant friends, and submit your log! Post your plans to social media — share your ongoing event status and accomplishments — and supply your end-of-event summaries. Be sure to send in your photos and stories through the ARRL contest soapbox as well.

Contacts Reported per Band

Band	Contacts
222 MHz	1,062
432 MHz	1,212
902 MHz	193
1.2 GHz	335
2.3 GHz	56
3.4 GHz	33
5.7 GHz	40
10 GHz	45
24 GHz	7
47 GHz	0
75 GHz	0
123 GHz	4
134 GHz	0
Total	2,987

Affiliated Club Competition

Club	Score	Entries
Packrats	363,126	12
North East Weak Signal Group	272,412	14
Society of Midwest Contesters	101,968	7
North Texas Microwave Society	90,037	3
Northern Lights Radio Society	19,945	4
Pacific Northwest VHF Society	14,100	9

Entries by Year

Year	Number of Entries
2025	108
2024	128
2023	145
2022	118
2021	141
2020	171
2019	157
2018	147
2017	199

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.

Regional Winners

Regions are defined in the contest rules (www.arrl.org/222-mhz-and-up-distance-contest). Category key: R — Unlimited Rover; S — Single Operator, Fixed, and M — Multioperator, Fixed.

Region	Category	Call	Score
1	R	KA7RRA/R	1,381
	S	N7EPD	4,362
2	S	W7IMC	9,927
3	R	KC8YEK/R	1,343
	S	K6MI	10,646
4	S	NJ7A	169
	S	WR5O	372
5	M	KC5MVZ	401
	No entries		
6	S	KF0M	4,706
7	R	W5VY/R	65,810
	S	WQ5S	14,322
9	R	KG9OV/R	11,672
	S	K2DRH	46,738
10	M	WD9EXD	72,094
	S	K0AWU	17,401
11	R	NG3W/R	10,137
	S	N8LRG	55,982
12	R	AG4V/R	55,719
	S	N4QWZ	29,672
13	R	NV4B/R	39,990
	S	W4ZST	8,572
14	S	K1RZ	112,231
15	R	AA2SD/R	6,425
	S	W3SZ	37,524
16	R	W1RGA/R	29,211
	S	K1TEO	124,760
16	M	W1FM	798

Best DX Contacts by Band

222 MHz	
W7JW	1,603 kilometers
WQ5S	1,603 kilometers
432 MHz	
N8LRG	1,377 kilometers
902 MHz	
WD9EXD	615 kilometers
W5VY/R	615 kilometers
1.2 GHz	
WD9EXD	761 kilometers
2.3 GHz	
K1RZ	407 kilometers
K1TEO	407 kilometers
3.4 GHz	
K1RZ	407 kilometers
K1TEO	407 kilometers
5.7 GHz	
K1RZ	407 kilometers
K1TEO	407 kilometers
10 GHz	
K1RZ	407 kilometers
K1TEO	407 kilometers
24 GHz	
AA5AM	43 kilometers
123 GHz	
K6MI	1 kilometer
WB6HYD	1 kilometer

Top Ten Scores

Rover	
W5VY/R	65,810
AG4V/R	55,719
NV4B/R	39,990
W1RGA/R	29,211
KG9OV/R	11,672
NG3W/R	10,137
N5ZY/R	7,167
AA2SD/R	6,425
KJ1K/R	4,876
KA7RRA/R	1,381
Single Operator	
K1TEO	124,760
K1RZ	112,231
AF1T	63,686
N8LRG	55,982
K2DRH	46,738
N2JMH	45,200
K1WHS	45,144
W3SZ	37,524
WZ1V	36,087
N4QWZ	29,672
Multioperator	
WD9EXD	72,094
W1FM	798
KC5MVZ	401

The next ARRL 222 MHz and Up Distance Contest will be held August 1 – 2, 2026.



Marcus Sutliff, N5ZY/R, operated his well-equipped Rover vehicle, activating Oklahoma grids, during the 2025 ARRL 222 MHz and Up Distance Contest. Read more about his exploits at <https://n5zy.org/2025-august-arrrl-222-and-up>. [Marcus Sutliff, N5ZY, photo]

Club Station

Hosting Collaborative STEM-Related Workshops for Youth

In 2024, the West Bend Community Library in West Bend, Wisconsin, received an Amateur Radio Digital Communications (ARDC) grant, and they partnered with the Ozaukee Radio Club, W9CQO, STEM Committee to host two workshops that focused on building the Elenco FM-88K radio kit. These workshops took place at the library on Friday, October 18, and Saturday, October 19, 2024.

Ozaukee Radio Club initiated this project months earlier, following an initial meeting with West Bend Library Youth Services Librarian Terika Koch. Together, we selected the Elenco FM-88K kit as the project for attendees to build. Grant funds covered the cost of the radio kits and the tools needed for assembly, such as soldering irons, wire cutters, pliers, practice circuit boards, silicone table mats, soldering iron stands, and screwdrivers. Our goal was to provide at least one tool set per table and a soldering-iron station for each participant.

In total, 17 children attended the workshops. Ozaukee Radio Club participants included Pat Volkmann, W9JI; Gary Sutcliffe, W9XT; Bill Greaves, K9GN; Bill Schnell, AC9JV; Scott Galaska, KD9YEW; Gary Bargholz, N9UUR, and Jeananne Bargholz, N9VSV.

Workshop Details, Successes, and Challenges

The library promoted the event in the STEM section of its website and created a detailed sign-up poster, which was displayed inside the library and featured in the club newsletter.

We faced questions about whether 12- and 13-year-olds could learn to solder safely, and if the radios would even work. As it turned out, all the children successfully learned to solder! Their enthusiasm was evident — they were genuinely excited by the prospect of building a radio. The expressions on their faces when the radios powered on for the first time were truly memorable, taking us back to our own early experiences building working circuits.

We maintained a ratio of one Ozaukee Radio Club volunteer to every two children. This level of supervision proved crucial for guiding the young participants through the assembly process; fewer volunteers would have made it significantly more challenging.

The Elenco FM-88K kit proved to be a good choice, with one significant exception: The solder included in the kits had corrosive flux, which destroyed the soldering-iron tips in about 15 minutes. This caused



Each Ozaukee Radio Club volunteer was paired with two youth attendees during the workshops.

issues on the first day, but we adapted for the second workshop by repairing the soldering-iron tips and substituting the solder with a standard rosin flux.

This project offered several benefits to the Ozaukee Radio Club: It provided an opportunity to engage with young people interested in technology, and it showcased our organization as one that possesses technical expertise and our willingness to share that knowledge within the community.

Tips for Organizing a Youth-Related STEM Project

If your club is interested in organizing a similar STEM project, here are some tips based on the insights we gained:

- **Find a collaborator.** When we started looking for STEM projects to sponsor, we learned that the West Bend Library had an active STEM program and was very receptive to collaboration with our club.
- **Select a project.** Choose a project suitable for your target group, and make sure that it's achievable within a reasonable time frame.
- **Develop a project plan.** Even for kit-assembly projects, significant planning is required. This is especially important for first-time builders. We determined the necessary tools, supplies, costs, and procurement sources prior to the event, and held a practice session to familiarize ourselves with the kit we chose and to identify potential issues.
- **Recruit volunteers.** We determined early on that much assistance would be needed for this work-

shop. While we had enough volunteers to assign one adult to every two children, having a few more volunteers would have been beneficial for addressing unexpected problems.

- **Gather participant feedback.** We learned alongside the children and sought out their input on what worked well and what could be improved. Feedback collected by the library at the end of each session was overwhelmingly positive.
- **Celebrate success.** We shared an article about the radio-assembly project in the Ozaukee Radio Club newsletter and on our website.

Acknowledgments

The Ozaukee Radio Club extends its sincere thanks to West Bend Library Youth Services Librarian Terika Koch for her invaluable support in making this project a reality. Terika wrote and submitted the ARDC application that secured the project's funding. A special thank you also goes to all the Ozaukee Radio Club members who volunteered their time — your efforts made many children happy, helped them acquire new skills, and exemplified the true spirit of amateur radio. Finally, thank you to the many parents who were there, supporting their children's interest in this radio project.

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.

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 manuscript materials 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.

Ham Media Playlist

SaveltForParts

Folks often say that hams were the first makers and hackers. I firmly believe there is some truth in that statement. Gabe Emerson, KL1FI, takes that saying to a whole new level. Gabe runs a YouTube channel called SaveltForParts (www.youtube.com/@saveitforparts), and if you've ever wondered if some of that surplus equipment that your significant other may refer to as "junk" is good for anything, you're in for a treat with Gabe's channel!

Gabe was introduced to radio at a young age. While he was living in southeast Alaska in an off-grid location, radios were an important part of daily life. CB radios were used to talk with neighbors, and VHF marine radios were used to communicate with commercial fishermen. He got his hands on second-hand copies of ham radio magazines, and he occasionally acquired second-hand radio parts to play with. Gabe never had a mentor to help him find his way into amateur radio, instead discovering it through a love of tinkering and finding an opportunity during college to pursue licensing.

Gabe got his amateur license when he was a college student, and he was active on and off throughout the years. Gabe's interest in radio is typical of many people getting licensed at a young age today. He is less interested in HF operations and related activities, instead finding enjoyment through hacking and repurposing hardware to extend its usability.

Gabe used his Technician license only sporadically through the years, usually as part of a bigger project he was tinkering with. In 2020, he bought his first software defined radio and started experimenting with various projects, including weather satellite reception. Discovering that there was a love for that sort of content on YouTube, Gabe decided to make content along those lines.

Satellite Reception

Gabe's most popular videos revolve around satellite reception. Gabe finds that people are fascinated with the ability to get free, live weather images and data. That often serves as a springboard for his viewers to learn about and experiment with receiving other satellite signals using simple equipment. A great example of this sort of content is Gabe's video titled "Downloading



Gabe, KL1FI, shows the various parts of the antenna he is assembling from spare parts.

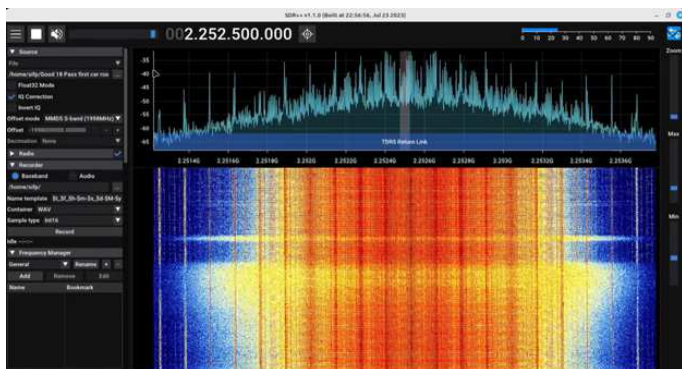
Images From US Military Satellites" (<https://tinyurl.com/parts-military>).

In this video, Gabe sticks to his theme of using parts he has sitting around — hence the channel name, SaveltForParts. He puts together an antenna system mostly using parts he has salvaged from other equipment. He spends time educating his viewers about satellite orbits and methods to track them. Gabe isn't one to overly edit his content to make it look like everything always works, instead showing when things are "a total and complete failure." After several attempts, Gabe finally receives data from military satellites. He illustrates the fun and excitement of tackling a project and enjoying the process of troubleshooting issues until he finds success.

After days of repeated attempts to download data from military satellites, Gabe finally receives a solid signal and successfully obtains images. Gabe then discusses how he determined that some passes are encrypted



Gabe, KL1FI, prepares his homebrew satellite antenna for use.



After days of attempts, Gabe, KL1FI, finally receives a strong signal from a military satellite.

and others are not. He also explains his theory that the satellites do not transmit when on a descending pass, but do on an ascending pass. Watching Gabe work through the issues he encountered was refreshing and enjoyable.

EME Communications

In another enjoyable video, titled “Can I Hear The Moon With A Coffee Can?” (<https://tinyurl.com/parts-moon>), Gabe explains what Earth-moon-Earth (EME) communications are and how they initially became of interest to amateur radio operators. He explains that he will be listening to the moon, but due to not having the appropriate equipment, he will not be transmitting.

Gabe then steps viewers through the process of the different equipment he will need and how he had difficulty finding complete information. Explaining that he knows almost nothing about EME communications, he found that most amateur radio websites that attempt to explain EME make too many assumptions about readers’ level of knowledge and are not beginner-friendly.

Gabe has to hack some hardware to put an antenna together. In this case, he makes use of a coffee can. After the first night of attempting to eavesdrop on EME communications, Gabe moves away from the coffee can and tries different tactics and equipment.

On the second night, Gabe finds his first indication that he might have received an EME signal — an extremely faint signal. Testing to confirm that the signal appears to be coming from the moon by moving the dish away from the moon and back, Gabe confirms that it appears to be EME of some sort. Gabe then explains that while the signals appear to be coming from the moon,



Gabe’s, KL1FI, view as he attempts to eavesdrop on amateur radio EME communications.

there is indeed a steep learning curve when it comes to finding success. It is nice to find a YouTuber who, even when things aren’t going as planned, is not afraid to openly share the challenges he encounters. This enables viewers to learn from his struggles.

Meshtastic

Another video that caught my attention is titled “I Hid A Meshtastic Node Somewhere In Alaska” (<https://tinyurl.com/parts-alaska>). Gabe explains the equipment he will use, what he expects might prove to be a problem, and how he manages to hack a station together. He then demonstrates other node options and possibilities, using various common solar panels and Meshtastic nodes. Gabe places the node in southeast Alaska, letting viewers know that if they find the node, they are welcome to have it. He tests that the node is working and leaves it. Gabe also notes that the node should be accessible to passengers on passing cruise ships. It will be interesting to see how many people manage to connect to the node.

SaveltForParts is a unique YouTube channel, mixing hardware hacking, radio, and other bits and pieces of Gabe’s varied interests. If you’re looking for a different kind of YouTube rabbit hole to fall down, this may be the one for you.



Gabe, KL1FI, places his Meshtastic device on the rocks in Alaska.

How's DX?



A Nod to NEMARC; Rare Island DXpeditions; Pilot Stations

The Northeast Maryland Amateur Radio Club (NEMARC) is made up of contesting enthusiasts who often combine their individual scores for a collective club total. The group fosters camaraderie by sharing their experiences virtually and tracking real-time scores to encourage friendly competition and support. To participate in certain ARRL-sponsored contests that require club affiliation, NEMARC formed a subgroup called the Northeast Maryland Amateur Radio Contest Society (NEMARCS), which is recognized by ARRL and has its own call sign, NE3MD. NEMARCS membership is free; the only requirement is that members must make at least 100 contacts in one contest per year. A club coordinator keeps an active roster and manages ARRL submissions.

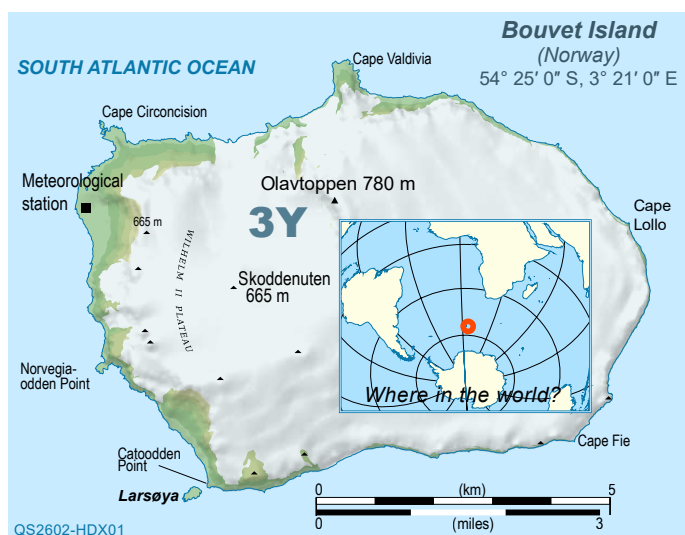
Bouvet Island DXCC History

Bouvet Island (3Y/B) was not originally included in the 1947 postwar DX Century Club (DXCC) list, but it was added in March 1963. Contacts made with Bouvet Island after November 15, 1945, could then be credited to DXCC. The island qualifies as a geographically separate entity according to current DXCC rules. It also

counts for Africa in the Worked All Continents program, and it can be activated for Islands on the Air (IOTA; reference number AN-002).

There have been only 10 DXCC-eligible activations from Bouvet Island. The first was by Gus Browning as LH4C in November 1962. The first Norwegian DXpedition to Bouvet occurred in February 1977, and it was managed by Audun Hjelle, 3Y1VC, and John Snuggerud, 3Y3CC. Subsequent notable activations include that of Thore Winsnes, 3Y5DQ, in 1978 – 1979; another by Hjelle in early 1979, and 3Y5X in 1989 – 1990, the first multi-operator DXpedition to the island, resulting in nearly 47,010 contacts. Other significant operations were conducted by Kare, who operated as 3Y2GV in 1997; Dr. Chuck Brady (SK), who operated as 3Y0C in 2000 – 2001, and Petrus, ZS6GCM, who operated as 3Y0E in 2007 – 2008. The last operation from Bouvet was 3Y0J in early February 2023, which made 18,455 contacts in just more than a week of low-power operating.

Several other Bouvet activations were planned but didn't occur, such as 3Y0G and 3Y0H. More recently, attempts by the 3Y0Z team in 2018 and the Rebel DX Group in 2019 were aborted due to severe weather and mechanical issues.



A simplified map of Bouvet Island. Bouvet is the world's most remote island, located about 2,520 kilometers (1,570 miles) south-southwest of South Africa. The 3Y0K team expects to begin operations from Cape Fie, on the southeast side of Bouvet, just after February 7. North American stations may want to keep an ear out for them via the long path.

February 2026 3Y0K DXpedition

Three team members from the February 2023 3Y0J team are leading the next DXpedition to the island, this time using the call sign 3Y0K. The team leader is Ken Opskar, LA7GIA, and the co-leaders are Adrian Ciuperca, KO8SCA, and Cezar Trifu, VE3LYC.

The international team will depart from Cape Town, South Africa, on February 1, 2026, to travel via an Icelandic icebreaker (courtesy of Icetugs) to the remote, ice-covered Bouvet Island. Bouvet is an uninhabited Norwegian territory in the South Atlantic Ocean, currently ranked #10 on the Club Log's DXCC Most Wanted List. The voyage should take about 7 days. They have arranged to be on and around the island for up to 21 days. As of press time, 17 operators are scheduled to participate. They will be flown via helicopter to and from the island.

Two young hams are also part of the team: 21-year-old ARRL Education and Learning Support Specialist Max Freedman, N4ML, and Alex Schengber, DL2ALY, a 26-year-old aviation engineer currently stationed at Neumayer III, DPØGVN, in Antarctica. Both are experienced operators active in various amateur radio activities. The Northern California DX Foundation has provided significant financial support for their participation. Once on the island, they and other support personnel will set up two camps, with living quarters, stations, and antennas. They plan to be active on 1.8 – 28 MHz CW, SSB, FT8, RTTY, and the QO-100 satellite. They'll have up to 12 operating stations.

Thanks to the support of Icom, the team will be able to stay in communications with the European and North American pilot stations via satellite radios. The pilot stations for this DXpedition are Lead Pilot James, KB2FMH; Antonio, I8KHC, for southern Europe; Champ, E21EIC, for Asia; Morten, LA3MHA, for Scandi-

DXpedition Pilots

What They Do

While not part of the operational team, DXpedition pilots play an important role in assuring the success of a DXpedition. In the words of Lee, ZL2AL (SK):

A DXpedition pilot is a “screen door” between the DXpedition team and the thousands of ham DXers out there [who] want to work the DXpedition. The pilot becomes the regional collection point for complaints and accolades for the DXpedition. If the pilot [doesn't] exist, then DXers can and sometimes [do] turn ugly. That's a fact. The job of the pilot is to be a “sounding board” and a channel for information to and from the DXpedition team.

Having pilots in different regions or continents allows local operators to communicate about how well they are — or aren't — hearing the DX station. The lead pilots can then pass the information to the DX operators, who may adjust their focus to where they're being best received at a given time, depending on propagation. Pilots can also pass much-appreciated messages of thanks to the DX operators, who often hear only critical comments. In other words, pilots are filters, acting as the go-betweens for the DX community.

What They Don't Do

Pilots will not arrange schedules with any operator, do log checks (that is for the QSL manager after the DXpedition is over), relay individual messages to team members (unless specifically requested by a team member), or — most importantly — engage in negative communications from those wishing only to criticize the operation.

navia; and Joe, JJ3PRT, for Japan and the Pacific. See the sidebar, “DXpedition Pilots,” for more information about their role.

This one will count for DXCC, the CQ Worked All Zones Award, the DX Marathon, IOTA, Parks on the Air®, and the World Wide Flora and Fauna Awards. For the latest and most up-to-date information on the 3YØK DXpedition, watch their website at www.3y0k.com and check your favorite DX outlet news.

CEØX — San Félix and San Ambrosio

There are three Chilean DXCC territories located in the South Pacific: Easter Island (aka Isla de Pascua), CEØY; the Juan Fernández Islands, CEØZ, and the San Félix and San Ambrosio Islands, CEØX. The latter islands are part of a group also known as the *Desventuradas*, or the Unfortunate Islands.

CEØX is the number-one most wanted on the inactive list, as it has not been on the air since March 2002. This entity has topped the inactive list for almost 24 years. On Club Log, it is currently ranked number three on the DXCC Most Wanted List.

January – February 2026 3GØXQ DXpedition

In May 2024, Felipe Gutiérrez, XQ7IR (formerly CE5WQO), announced the 3GØXQ San Ambrosio Island DX Project, which would be a DXpedition to this rare and sought-after entity. In November 2025, he announced more details about the upcoming activation, including confirmed dates (January 12, 2026 – February 15, 2026). Permits and authorizations will be finalized and sent to ARRL for DXCC validation. Renner, PY7RP, will lead the remote team operating a 24/7 remote station focused on CW and FT8. Cezar, VE3LYC, joined as Senior Advisor. Operations will cover 160 – 6 meters on SSB, CW, and FT8. The necessary equipment will be acquired and shipped to Robinson Crusoe Island, the departure point for San Ambrosio. Tim, MØURX, was named QSL Manager, and various QSL systems will be available. For more information, keep an eye on his website at www.sanambrosio-project.com and your favorite DX publication.

Wrap-Up

That's it for this month, with special thanks to LA7GIA, W3JX, and XQ7IR. Don't forget to send your DX news, IOTA activations, and even “holiday-style” operations to bernie@dailydx.com. Until next month, see you in the pileups! — *Bernie, W3UR*

The World Above 50 MHz

A Veterans Day Geomagnetic Storm; Pacific 6-Meter Openings

Three massive coronal mass ejections (CMEs) approached Earth as Veterans Day dawned in North America. The first two CMEs struck together late on November 11, 2025, causing a G4-class (severe) geomagnetic storm. Visible aurora spread to almost every state that evening, and it was even seen in El Salvador at 13 degrees latitude! The HF bands died while magic appeared on the VHF bands. Dan, K7SMA (DN13), noted “strange-looking” signals on 6-meter FT8 at around 0100 UTC on November 12. He said, “I turned up the audio and heard auroral buzz!” He went to SSB and logged VE5SWL (DN79) and VE3EXT (EN58). Note that FT8 does not decode on aurora; SSB, CW, and Q65A are more effective modes.

Hawaii – Japan 6-Meter Madness

While I was vacationing with family in Kauai, Hawaii, I monitored 6 meters from our hotel room with a 10 W MFJ-9406 radio and a quarter-wave whip. At the same time, Dan noticed aurora, and 6 meters opened from Hawaii to Japan! JS6RGQ (PL24) was +16 dB, and he gave me a –12. Signals faded before breaking wide open at 0400 UTC. JA1DGE went into the log, followed by more than 50 JA-region stations. My receive screen

was a solid red pileup of callers. John, WH6EY (BL02), called it “6-meter madness.” The opening ended at around 0500 UTC, with JA6RJK (PM53), DS1JFY (PM45), and BA5CW (PM00) making it into the log. I saw JG1TSG and JA7JPZ calling KL7HBK at 0434 UTC. John, KL7HBK (BP40), reported working 12 JA stations, a few WØ stations, and some VE stations; his best DX was VK4MA. There was F2 from Hawaii to North America the next morning. Dan, K7SMA, said, “A whole bunch of Hawaiian [stations] rolled in at around 2030 UTC. I worked KH6U and WH6EY.” Dan, NA6MG (DM04), said, “I spent most of the time just watching, as I’d already worked nearly everyone that was rolling in at least once this year. Activity was high from stateside. However, I worked three new Hawaiian call signs.”

I was at a medical conference at the time, but a text from KCØY alerted me to the opening. I went back to the hotel room and on the air, which allowed me to work Joseph, N6KK; Bob, K6QXY, and Trey, N5KO, all in California. I moved my station to another room for a clear view to North America and put a dozen W7-region stations in my log. They were mostly concentrated in Oregon and Washington, with a few in Idaho. The band died out for me at 2058 UTC, and W7IMC (DN13) was the last North American station I copied. WH6EY made 40 contacts with stations in North America. That evening, Dave, WO2X, connected to his 100 W remote station (with a six-element Yagi) on the east coast of Kauai, and he worked many stations in Japan.

Openings to Australia and New Zealand

There was more 6-meter magic on November 14. Brad, WQ5S (EM13), said it was “the best opening (to Australia) since 1989.” Larry Lambert, NØLL (EM09), added:

My log looks like this: 0036Z K6GOH (DM15), 0042Z VK2EMA heard, VK2NSS (QF45) –13 worked, VK2OKR (QF23) –15, VK3HR (QF33) –5, VK2DAS (QF46), and at 0138 UTC, VK2JDS –18. For a long time, ZL7DX was in.

Scott, AA5AM (EM13), noted on Slack that the opening started at about 2230 UTC on November 13 and ended at 0350 UTC the next day (for a total



Hawaii-based operator John Martin, WH6EY, displays the *shaka* gesture after making 40 6-meter contacts with North America on Veterans Day 2025. [John Martin, WH6EY, photo]

of 5½ hours). Scott decoded 47 different stations in Australia and 11 in New Zealand, in addition to ZL7DX, 3D2AG, and three FK8-region stations. Jim, K5ND (EM12), worked 16 new VK-region stations, including nine new grids. Mike, K4PI, logged 14 VK stations and copied JG1TSG via a skew path. Greg Cerny, WQØP (EM19), logged ZL7DX and eight VK stations. Jerry, K5JC (EM00), worked VK5PO, VK4ADC, and VK4HJ. Jerry runs 90 W with an IC-7300 to a four-element Yagi elevated 15 feet. Dan, NA6MG, had 664 FT8 decodes from Australia and New Zealand, as well as 98 from Japan. He logged 23 new Australian stations. Steve, NN4X, sent a PSK map of Bob, ZL1RS, showing flags from coast to coast in North America.

From Kauai, I logged LU2GPB (GG03) at 0130 UTC. Australia boomed in shortly after. I could see the VK stations working North America, and VK4CZ and others were sending reports to WU1ITU! I put a dozen new VK stations in the log. VK5PO was +35 dB. These signals faded at 0400 UTC. After analyzing this opening, I believe it was stronger-than-normal transequatorial propagation from Australia to the northern Pacific, followed by possible sporadic-E linking to North America.

On the Bands

50 MHz. An unexpected F2 opening took place on November 2 from North America. Mike Downing, KCØY (EM17), picked up P43A and V26OC for new countries. Jim, AAØMZ (EM29), logged V26OC. John, KFØM (EM17), and WQØP worked VP2MAA and PJ2MAN. Randy, NØLD (EM15), also worked P43A.

On November 3, Dave, N4QS (EM56), worked 7Q5BM (KH67) at 1510 UTC via FT8. Rich, K1HTV (FM18), also logged 7Q5BM. Juan, TG9AJR, worked 9U1RU “with a great signal and very few takers.” On November 6, N4QS, K1HTV, and K5JC logged C5R, and N4QS picked up 9L8MD at around 1550 UTC. N4QS’s band activity map showed K5HPT (EM32) working stations in Spain. CEØYHF made an appearance from Easter Island and worked Dan, K1TO, and others. Dan, K7SMA, logged TI2AA at 1935 UTC. In Kansas, PY2XB (GG66) was strong at 1940 UTC.

N4QS worked ZL3AIC and ZL3OY, and K1HTV logged ZL1RS during a short opening on November 7. Rich

noted, “Earlier in the day, starting at around 1830 UTC, the 6-meter band was open to HC, PY, 8R, OA, CE, CX, and XE. That opening lasted almost 3 hours, ending at around 1845 UTC.” In Kansas, WQØP logged FK8CP at 1840 UTC. Northern South America was in strong for KFØM (EM17) and me, NØJK, at around 1915 UTC. Pete, K5CPR, worked 8R1TM and P43A. Dan, K1TO (EL88), worked YE9BJM via long path.

On November 8, Mike, W3IP (FM19), worked V51DM and C5R at around 1513 UTC. The next day, NØLL worked ZL1RS and five VK3 stations. He noted weak E_s to southern California, confirming a sporadic-E link. 9U1RU reported a strong opening to Japan on November 13. On November 27, KCØY copied TI3GB and TI2FAF working W5 and WØ stations at 1600 UTC. On November 29, Mike had E_s to W4 and F2 to Ecuador. KØGU (DN70) spotted the 3GØYR DXpedition to Easter Island at 1850 UTC.

222 MHz. John Lock, KFØM (EM17), reported tropospheric propagation on November 15. He worked K9YK (EN60), who was running 90 W to a Par Electronics Omniangle antenna. WQ5S (EM13) also worked K9YK on Q65.

Here and There

Mike, KMØT, earned Fred Fish Memorial Award #62. His last grid was DN01, courtesy of Petr, AG6EE, and Ian, W6TCP. Deep Space Exploration Society (DSES) President Paul Sobon, NOØT, noted that they are reviving a 60-foot dish antenna in Colorado for scientific exploration and amateur Earth-moon-Earth. For more information, visit www.dses.science.

Here’s an FT8 tip from Rick, K5GZR:

Put your six-character grid in the **MY GRID** field of **WSJT-X FILE > SETTINGS > GENERAL**. Then, **WSJT-X** will send the full six characters to PSK Reporter. PSK Reporter will put your flag on that six-character location instead of putting it in the middle of the four-character grid. That keeps [it] from putting your flag in the middle of the grid, which could be somewhere in the ocean.

Steve Sacco, NN4X, found an interesting video about sporadic E at www.youtube.com/watch?v=g-z6J_8FZjA.



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 2025

Glenn M. Davies, KO4NTA	10
Michael A. Krahnenbuhl, K0ARA	25
Gary C. Tartanian, K3WK	25

July 2025

Thomas Duong, KR4DOT	10
William H. Rupert, KI5JWV	10
Mark A. Jessing, N4OJE	15
Daniel L. Schaible, KD8UZS	15

August 2025

James M. Joyce, VE3LTN	10
Gary D. Mentro, Sr., N3OS	10

Todd E. Foster, W2TEF	15
Margaret L. Bowen, KY4WH	20
Richard McCleaf, K3EYJ	20
Denis O'Brien, N2JJF	40

September 2025

Richard F. Bobrowicz, K2RFB	10
J. Andrew Hall, N5ASE	10
Simpson A. Huston, N8UZF	15
Thomas F. Corcoran, VE3NY	20
Scott R. Rosenfeld, N7JI	25
David R. Koberstein, N9DK	30

October 2025

Douglas M. Dukes, W5DMD	10
Thomas F. Corcoran, VE3NY	25

November 2025

Thomas D. Tarman, AF5TT	10
J. Andrew Hall, N5ASE	15
Ronald G. Call, KE7CR	20
Michael R. Lunebach, WG9P	35

Congratulations to all of the recipients.

February 2026 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.

February 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 K6KPH on Saturday, February 21, at 2 PM PST (2200 UTC on February 21) on 3581.5, 7047.5, 14047.5, 18077.5, and 21067.5 kHz. Unless indicated otherwise, sending speeds are from 10 to 35 WPM.

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

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

Include \$10 (check or money order) if this is a submission for your initial Code Proficiency certificate; \$7.50 if you are applying for an endorsement (available for speeds up to 40 WPM). Your 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.arrrl.org/qualifying-run-schedule.

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



W1AW Qualifying Run Schedule – February 2026 (All times are in Eastern Standard Time.)

Monday	Tuesday	Wednesday	Thursday	Friday
		2/4 4 PM – 2100Z 10 – 35 WPM	2/5 10 PM – 0300Z (2/6 – UTC) 10 – 40 WPM	2/6 9 AM – 1400Z 10 – 35 WPM
2/9 4 PM – 2100Z 10 – 35 WPM	2/10 7 PM – 0000Z (2/11 – UTC) 10 – 40 WPM		2/12 9 AM – 1400Z 35 – 10 WPM	
Presidents' Day	2/17 10 PM – 0300Z (2/18 – UTC) 35 – 10 WPM		2/19 9 AM – 1400Z 10 – 35 WPM	2/20 4 PM – 2100Z 10 – 40 WPM
2/23 7 PM – 0000Z (2/24 – UTC) 10 – 35 WPM	2/24 10 PM – 0300Z (2/25 – UTC) 10 – 40 WPM		2/26 4 PM – 2100Z 35 – 10 WPM	

Field Organization Reports — November 2025

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.

400 N9VC	190 ND8W	145 NW3X N1ILZ	128 W8IM	110 AD3J KM4WHO	95 K9BJA	86 WB4ZDU	74 W3ZR	73 K6RAU KF7GC N3RPB	71 W2ZXN	70 WA5EWN
371 W0PZD	185 WM5N	144 K5OB	126 KC9FXE W4CMH	93 KB3YRU KO4OL	85 KE8DON					
320 W7EES	181 KC8YVF	143 KC8T	125 WB9WKO	92 W02H N1IQI W1RVY	84 KC3FAU W4TTO WJ3P KD2PQP W2QS					
299 KD2LPM	180 KV2J	140 AC0KQ AG9G	123 KD2QAR	109 KB1NAL	90 KT4WX WX2DX WB8RGE					
246 W7PAT	175 WA3QLW	136 WK4WC W2PAX	120 K3JL	108 W5WMC	83 AA3N W2ARP					
240 W9FE	171 NI2W	136 KO4KUS	105 KN4WX WA4VGZ KD0HHN	104 W4KX W3STN	80 KG5AOP KB4OLY KR4ST					
238 W9EEU	170 K1YBO	135 KB5PGY W3YVQ	117 W1LEM	100 K28Q WB8RJW	79 W9PXE					
232 W9RY	165 W4DNA	132 WM2C	116 KC1HHO	89 WV5Q	77 K3EAM					
216 W8ROY	154 N3STP	130 AE5MI K9LGU	115 KB8PGW W1TCD	88 W5XX	76 K1CJV KB0DTI K8RDN					
215 W9GRG	150 KR4PI N4CNX K2VTT	111 N0JAR	96 NT1N	87 WW3S	75 W5RFY KA9ROY WB3FTQ					
201 WA9SWW	149 KN4QJ KA9IKK									
200 KT2D KD2NMG	148 W8USA									

Section Traffic Manager Reports

The following Section Traffic Managers reported: AR, AZ, CO, CT, DE, EMA, ENY, EPA, GA, IA, IL, IN, KS, KY, MDC, ME, MI, MO, MS, NC, ND, NFL, NLI, NM, NNY, OR, RI, SD, SFL, SJV, SNJ, STX, TN, WCF, WI, WMA, WNY, WPA, WWA, WY.

Section Emergency Coordinator Reports

The following Sections submitted ARES Activity Reports for October: AR, CT, EMA, ENY, EPA, GA, IN, ME, MO, NC, NFL, NLI, NNJ, NNY, NTX, NV, OH, OK, SNJ, STX, SV, TN, VA, VI, VT, WCF, WI, WMA, WTX, WY.

Brass Pounders League

The BPL is open to all amateurs in the US, Canada, and US possessions who report to their SMs a total of 500 or more points or a sum of 100 or more origination and delivery points for any calendar month. Messages must be handled on amateur radio frequencies within 48 hours of receipt in standard ARRL radiogram format. Call signs of qualifiers and their monthly BPL total points follow.
KY2D 1,921, NX9K 1,659, WB9WKO 838, WA3QLW 716, KB9GO 639, KW1U 621, N9CK 555.

Strays

2026 SVHFS Conference Call for Papers

The Southeastern VHF Society is seeking papers and presentations on both the technical and operational aspects of VHF, UHF, and microwave weak signal amateur radio for its 2026 Conference. The deadline for submission is March 2, 2026. Some suggested areas of interest are transmitters, receivers, transverters, beacons, RF power amplifiers, RF low noise preamplifiers, antennas, construction projects, test equipment and station accessories, station design and construction, contesting, roving, DXpeditions, EME, propagation, digital modes, Digital Signal Processing (DSP), Software Defined Radio (SDR), amateur satellites, and amateur television.

In general papers and presentations on non-weak signal related topics such as FM repeaters and packet will not be accepted, but exceptions may be made if the topic is related to weak signal. For example, a paper or presentation on the use of FM simplex in contests or on the use of APRS to track rovers during contests would be considered.

All submissions for publication in the proceedings should be emailed to SVHFS@downeastmicrowave.com in Microsoft Word (.doc) format. No Power Points will be accepted for use in the proceedings.

Submissions for presentation at the conference should be in Microsoft PowerPoint (.ppt) format and can be delivered at the conference on a USB memory stick.

Formatting information can be found at <https://svhfs.org>.

While papers will not be copy-edited, SVHFS does attempt to make all papers somewhat uniform.

Please indicate when you submit your paper or presentation if you plan to attend the conference and present your paper in person or if you are submitting solely for publication. Papers and presentations are being handled by Don Woodward, KD4APP, and should be sent to SVHFS@downeastmicrowave.com. Don can be contacted at dbwoodw@w-ent.com if you have any questions.

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

ARRL SOUTHWESTERN DIVISION CONVENTION

February 26 – 28, Yuma, Arizona

D F H Q R S T V

8 AM – 6 PM. Spr: Yuma Amateur Radio Hamfest Organization. Yuma Co. Fairgrounds, 2520 E. 32nd St. TI: 146.84 (88.5 Hz), 146.55. Adm: \$5 Advance, \$15 door. www.yumahamfest.com

Colorado (Brighton) — Feb. 15 D F H R V

9 AM – 1 PM. Spr: Rocky Mountain Ham Radio. Adams Co. Riverdale Regional Park & Fairgrounds, 9755 Henderson Rd. TI: RMHAM DMR System Rocky Mtn Wide Tlk Grp 700. Adm: \$6. www.rmham.org

Florida (Brooksville) — Feb. 21 D F H Q R T V

8 AM – 3 PM. Spr: Hernando Co. ARA. Sand Hill Scout Camp, 11210 Cortez Blvd. TI: 146.715 (123.0 Hz). Adm: \$6. www.hcara.org

ARRL SOUTHEASTERN DIVISION CONVENTION

February 13 – 15, Orlando, Florida

D F H Q R S T V

Fri. and Sat. 9 AM – 5 PM, Sun. 9 AM – 1 PM. Spr: Orlando ARC. Central Florida Fairgrounds and Expo Park, 4603 W. Colonial Dr. TI: 146.76 (103.5 Hz). Adm: \$25 Advance, \$30 door. www.hamcation.com

Florida (Sebring) — Feb. 21 F H R T

8 AM – 1 PM. Spr: Highlands Co. ARC. Lake Josephine Baptist Church, 111 Lake Josephine Dr. TI: 147.045 (100 Hz). Adm: \$5. www.highlandsamateurradio.com

12TH ANNUAL TECHCON

February 28, Tampa, Florida

R S

9 AM – 5 PM. Spr: ARRL West Central Florida Section. Hillsborough Co. Public Safety Operations Complex, 9450 E. Columbus Dr. TI: 146.790 (146.2 Hz). Adm: Free. www.arrlwcfc.org/wcf-special-events/wcftechconference

Georgia (Dalton) — Feb. 14 D F H R S T V

8 AM. Spr: Dalton ARC. North Georgia Fair, 500 Legion Dr. TI: 145.23 (141.3 Hz). Adm: \$5. www.qrz.com/db/w4drc

Hawaii (Honolulu) — Mar. 7 D F H R S V

9 AM – noon. Spr: Emergency ARC of Hawai'i. National Guard Association Center, 891 Valkenburgh St. TI: 146.52 (simplex). Adm: Free. www.linktr.ee/earc_hi

Indiana (La Porte) — Feb. 28 D F H R V

7 AM – 1 PM. Spr: La Porte Co. ARC. La Porte Co. Fairgrounds, 2581 IN-2. TI: 146.61 (131.8 Hz). Adm: \$8. www.lpcarc.org

Iowa (Perry) — Feb. 28 D H R S V

8 AM – noon. Spr: Hiawatha ARC. National Guard Armory, 2930 Willis Ave. TI: 145.19 (114.8 Hz). Adm: \$10. www.harciowa.org

Massachusetts (Marlborough) — Feb. 14 F H R V

9 AM – noon. Spr: Algonquin ARC. 1LT Charles W. Whitcomb School, 25 Union St. TI: 446.675 (88.5 Hz). Adm: \$5. www.n1em.org

Michigan (Northville) — Feb. 21 D F H R V

8 AM – noon. Spr: Livonia ARC. Ward Church Knox Hall, 40000 Six Mile Rd. TI: 145.35 (100 Hz). Adm: \$5. www.livoniaarc.com/larc-annual-swap-and-shop

Michigan (Traverse City) — Feb. 8 H V

8 AM – noon. Spr: Cherryland ARC. VFW Cherryland Post 2780, 3400 Veterans Dr. TI: 146.86 (114.8 Hz). Adm: \$5. www.cherrylandarc.com

Minnesota (St. Cloud) — Feb. 28 D F H R V

9 AM – 1 PM. Spr: St. Cloud ARC. Army National Guard Armory, 1710 Veterans Dr. TI: 146.940 (100 Hz). Adm: \$10. www.w0sv.club

North Carolina (Concord) — Mar. 6 – 7 D F H Q R S V

Fri. 3 PM – 7 PM, Sat. 8:30 AM – 4 PM. Spr: Mecklenburg ARS. Cabarrus Arena & Event Center Gold Hall, 4751 Hwy. 49 N. TI: 146.655. Adm: \$12 Advance, \$14 door if using cash, \$15 if using a credit card. www.charlottehamfest.org

Oklahoma (Sayre) — Mar. 7 D F H R S V

8 AM – 4 PM. Spr: West Central Oklahoma ARC. Beckham Co. Activity Building, 310 E. Main St. TI: 146.76 (88.5 Hz). Adm: \$5. www.sites.google.com/view/wcoarc

Oregon (Rickreall) — Feb. 21 D F H R V

9 AM – 3 PM. Spr: Salem Repeater Association. Polk Co. Fairgrounds, 520 S. Pacific Hwy. W. Adm: \$10. www.w7sra.com/flyer2026.pdf

Pennsylvania (South Park Township) — Feb. 22 D H Q R V

8 AM – 3 PM. Spr: Wireless Association of South Hills ARC. South Park Home Economics Building, 3735 Buffalo Dr. TI: 146.955 and 443.650 (131.8 Hz). Adm: \$5. www.n3sh.org

Texas (Irving) — Mar. 7 D F H R V

8 AM – 2 PM. Spr: Irving ARC. Betcha Bingo Hall, 2420 W. Irving Blvd. TI: 146.720 (110.9 Hz). Adm: \$5. www.irvingarc.org

Texas (Orange) — Feb. 27 – 28 D F H R S T V

Fri. 1 PM – 6:30 PM, Sat. 7:30 AM – 2 PM. Spr: Orange ARC, Jefferson Co. ARC. Orange Co. Convention & Expo Center, 11475 FM 1442. TI: 147.18 (103.5 Hz). Adm: \$10 per person for 2 days. www.qsl.net/w5nd/index_files/HAMFEST%20INFO/hamfest%20info.htm

ARRL TEXAS STATE CONVENTION

February 20 – 21, 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: 146.94 (167.9 Hz). Adm: \$10 Advance, \$15 door. www.houstonhamfest.org

Utah (Sandy) — Feb. 28 H S T

9 AM – 5 PM. Spr: Utah Digital Communications Conference, Utah VHF Society. Conference Center at Miller Campus, 9750 S. 300 W. TI: 146.62. Adm: \$18 Advance, \$20 door. <https://utah-dcc.square.site>

ARRL VERMONT STATE CONVENTION

February 28, Colchester, Vermont

D F H Q S V

8 AM – 1 PM. *Spr*: Radio Amateurs of Northern Vermont.
Hampton Inn Convention Center, 42 Lower Mountain View Dr.
Tl: 145.15 (100.0 Hz). *Adm*: \$8 Advance, \$14 door.
www.ham-con.org

Washington (Puyallup) — Mar 7 D F H Q R V

9 AM – 3 PM. *Spr*: Mike and Key ARC. Washington State Fair
Event Center Pavillion Building, 110 9th Ave. SW. *Tl*: 146.82
(103.5 Hz). *Adm*: \$15. www.mikeandkey.org/index.php

West Virginia (Charleston) — Mar. 7 D F H R S V

9 AM – 1 PM. *Spr*: Charleston Area Hamfest & Computer Show,
Inc. Beni Kadem Temple, 100 Quarrier St. *Tl*: 145.35 (91.5 Hz).
Adm: \$10. Email: rdn8xea@gmail.com

To All Event Sponsors

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

Events that are sanctioned by ARRL receive special benefits, including an announcement in these listings and online. Sanctioned conventions are also listed in *The ARRL Letter*. In addition, events receive donated ARRL prize certificates. 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 **March 1** to be listed in the **May** 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@arrrl.org.

Strays

Turkey Hosts TC88YL, Its First Amateur Radio Event for Women

Turkey's first amateur radio event for women, TC88YL, was held August 16 – 17, 2025, at the TC2E contest station.

Six women operators, including one international guest from Switzerland, attended: Merzuke Gediktas, TA7YLY; Zehra Sen, TA2ZEH; Gizem Ucar, TA2RAG; Ezgi Keklik, TA3YL; Emine Cavusoglu, TA3EMN, and Eva Thiemann, HB9FPM.

Over 2 days, the operators achieved more than 2,200 contacts, reaching more than 80 different DX Century Club entities. While most contacts were made in SSB and CW modes, some digital contacts also took place. In addition, successful operations were carried out via the QO-100 satellite. A unique program granting a certificate to every amateur operator who made contact with TC88YL encouraged attention from the international ham radio community.

The technical setup included an Ultrabeam antenna, an Icom IC-9100 transceiver, and an Icom IC-2KL linear amplifier. For some participants, TC88YL was their very first on-air experience, so an experienced operator helped guide them through the process and overcome any challenges.

In addition to the radio operations, the event also included a presentation on the establishment of TC2E, highlighting the journey and legacy of the contest station, restaurant dinners to strengthen the bonds between the group, as well as active promotion via social media to raise broader awareness about young women in amateur radio. In the future, the goal is to build a stronger community for young women in Turkey via national and international amateur radio events like TC88YL.



TC88YL attendees, from left, Eva Thiemann, HB9FPM; Emine Cavusoglu, TA3EMN; Merzuke Gediktas, TA7YLY; Zehra Sen, TA2ZEH; Gizem Ucar, TA2RAG, and Ezgi Keklik, TA3YL. [Furkan Ozen, TA7H, photo]

Special Event Stations

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

Feb. 14, 1700Z – 2300Z, AB5ER, Romance, AR. North Central Arkansas Amateur Radio Service. **Valentine's Day Special Event**. 14.260. Certificate. Roger Gray, North Central Arkansas Amateur Radio Service, P.O. Box 166, Searcy, AR 72145-0166. www.ncaars.org

Feb. 14 – Feb. 16, 1600Z – 2300Z, W0JH, Stillwater, MN. Stillwater (MN) Amateur Radio Association (SARA). **Ice Station W0JH — Frozen Minnesota Lake Portable**. 3.860 7.260 14.260 21.360. Certificate. Shel Mann, 1618 Pine St. W., Stillwater, MN 55082. www.radioham.org

Feb. 14 – Feb. 22, 0000Z – 2359Z, W7P, Flagstaff, AZ. Northern Arizona DX Association. **6th Annual Pluto Discovery Anniversary S.E.** 7.266 14.266 21.366 28.366. Certificate & QSL. W7P — Pluto Special Event, 6315 Townsend Winona Rd., Flagstaff, AZ 86004. www.nadxa.com

Feb. 21, 1300Z – 2100Z, K3S, Odenton, MD. Nuclear Ship *Savannah* Amateur Radio Club. **War Shipping Administration Created 1942**. 7, 14, 21, 28. QSL. Ullis Fleming, 980 Patuxent Rd., Odenton, MD 21113. www.qrz.com/db/k3s

Feb. 23 – Apr. 21, 0000Z – 2359Z, WA5DTK, Montgomery, TX. Republic of Texas SES History Operators Club. **Republic of Texas SES**. 7.030 7.230 14.040 14.260. QSL. Barry Brewer, 10519 Bilsing Ct., Montgomery, TX 77356.

Feb. 25, 1500Z – 2359Z, W7ASL, Mesa, AZ. Sunlife Amateur Radio Club. **Annual Snowbird Field Day**. 14.329 21.329 28.329 50.329. QSL. Tom Goforth, 4324 E. Dragoon Cir., Mesa, AZ 85206. www.sunlifearc.org

Feb. 28, 0000Z – 2359Z, N4R, Sparta, TN. KR4EE. **2026 Rare Disease Day Special Event**. 14.070 14.080 21.074 28.074. QSL. Jill Dybka, 7737 Sparta Hwy., Sparta, TN 38583. KR4EE@arrl.net

Feb. 28, 1400Z – 2200Z, W0EBB, Leavenworth, KS. Kickapoo QRP Amateur Radio Club. **Freeze Your Keys — 22nd Winter Operating Event**. CW: 7.035 14.058; SSB: 7.240 14.325. QSL. Gary Auchard, 34058 167th St., Leavenworth, KS 66048. *Please send a SASE with your QSL card. Other bands will be used also if open.* w0mna74@gmail.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 **May QST** would have to be received by **March 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.

This Month in

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

Coming up in the January/February 2026 issue of *QEX*:

- Andrew J. Anderson, VK3CV/WQ1S, presents a breakthrough in top band technology, showing how the 241 – 250 GHz transverter makes the 1 mm band accessible.
- David J. Ahlgren, K1BUK, continues his exploration of complex impedance matching with an in-depth analysis of the stepped line transformer.

■ Jonathan Dorminy, KN4LGM, advances radio communications by highlighting methods to achieve higher data rates within the THz frequency gap.

■ John Wiseman, CT9/WT3J, details the development of an AI-based voice synthesizer, highlighting innovative applications of artificial intelligence.

■ Eric P. Nichols, KL7AJ, revisits foundational concepts in radio technology, offering valuable insights into essential topics for enthusiasts and professionals alike.

Would you like to write for *QEX*? We pay \$50 per published page for full articles and *QEX* Technical Notes. Get more information and an Author Guide at www.arrl.org/qex-author-guide.

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 November 2025 activity report of the VM Program.

◆ Two Technician operators in Texas, and one each in California, Arkansas, and Florida, were issued advisories concerning 20-meter FT8 operation, a band on which Technicians have no privileges.

◆ Operators in North Carolina and Tennessee were issued advisories regarding improperly wide signals on 3.927 MHz. Section 97.307(a) of the Commission's rules states, "No amateur station transmission shall occupy more bandwidth than necessary for the information rate and emission type being transmitted, in accordance with good amateur practice."

◆ Operators in Washington, Oregon, and California were issued advisories regarding SSB operation on 7.299 MHz, too close to the band edge.

◆ An operator in Florida was issued an advisory for operation with an expired license.

◆ An operator in Maine was issued an advisory concerning his disregard for a directive from a local repeater owner to stop using the repeater. The FCC not only expects, but requires, repeater owners to maintain control of their repeaters, and will enforce such "stay off" letters.

◆ The FCC requested assistance in a public safety case near McAllen, Texas, and an unlicensed operation case in California. Information was provided to the FCC in both, but no action was taken due to the FCC closure.

The totals for October 2025 monitoring were 1,511 hours on HF frequencies, and 1,579 hours on VHF frequencies and above, for a total of 3,090 hours.

— Thanks to Volunteer Monitor Program Administrator
Riley Hollingsworth, K4ZDH

Congratulations

November 2025

QST Cover Plaque Award Winner

Carl Luetzel Schwab
K9LA

In his article, "Current and Upcoming HF Propagation in Solar Cycle 25," Carl fills readers in on the current propagation trends for Solar Cycle 25, how long those trends are projected to continue, and what operations could look like once the solar maximum comes to an end.

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!

Current and Upcoming HF Propagation in Solar Cycle 25



Analyzing rise times, sunspots, and more to help us understand what operations might look like after solar maximum.

Carl Luetzel Schwab, K9LA

Solar Cycle 25 has been at its maximum over the last several years, and many hams are enjoying propagation on the higher HF bands (15, 12, and 10 meters). These bands have not only been great for making domestic contacts, but they've been good for DX contacts, too. But the solar maximum of Cycle 25 won't last forever.

Data Evaluation

When you average the *rise times* (the time it takes a cycle to rise from its minimum to its maximum) of the previous 24 solar cycles, you find that they take about 4 years to reach their maximum. The rise times vary; larger cycles tend to be somewhat shorter, and smaller

cycles tend to be somewhat longer. Because the length of a solar cycle averages around 11 years, that means the average decline of a cycle is around 7 years.

In terms of the latest *smoothed sunspot number* (the official measurement of a solar cycle) for January 2025, Cycle 25 is just about 5 years (61 months, to be exact) past its solar minimum (which was in December 2019) — about 1 year more than the average rise time. This is shown in Figure 1, which also includes a comparison of Cycle 25 to a small cycle (Cycle 24), an average cycle (Cycle 23), a moderately big cycle (Cycle 21), and the largest cycle in recorded history (Cycle 19).

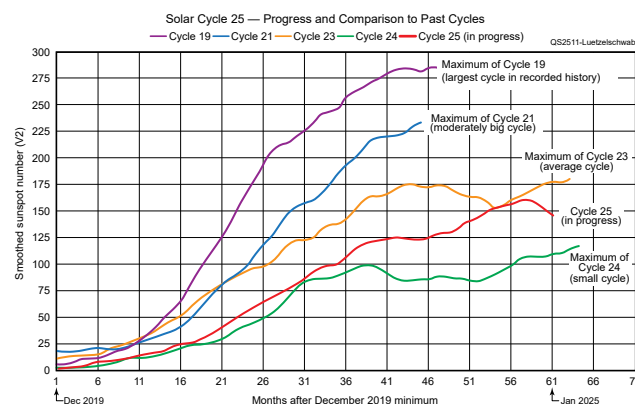


Figure 1 — This is the latest Cycle 25 monthly mean data for July 2025, resulting in the latest smoothed data for January 2025 (smoothed data is 6 months behind the monthly mean data).

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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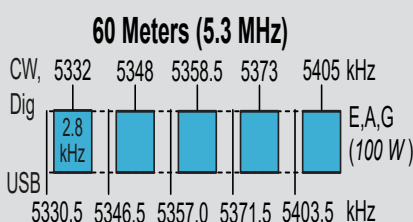
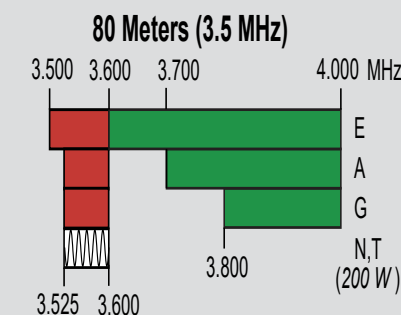
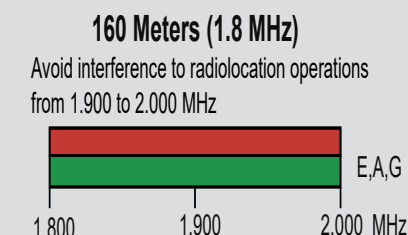
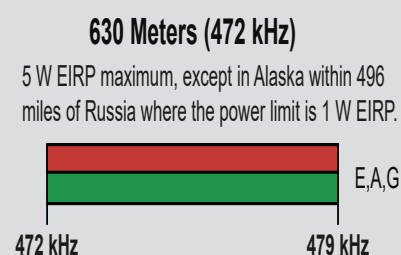
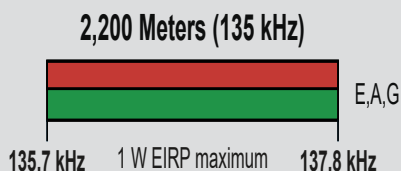
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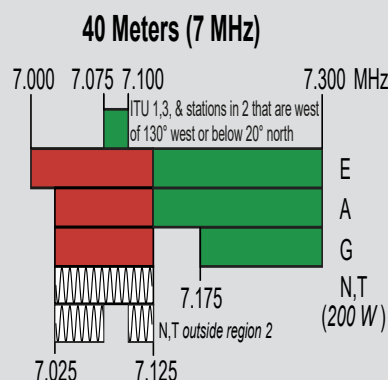
Exams: 860-594-0300 email: vec@arrl.org

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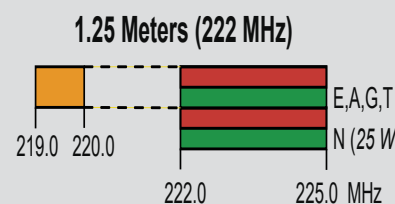
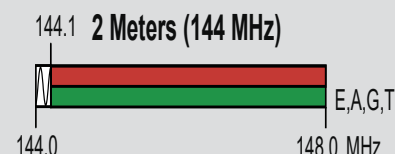
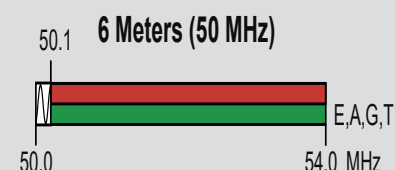
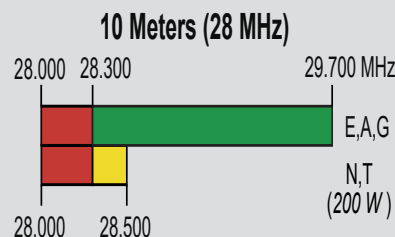
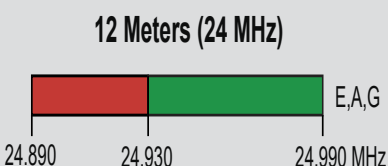
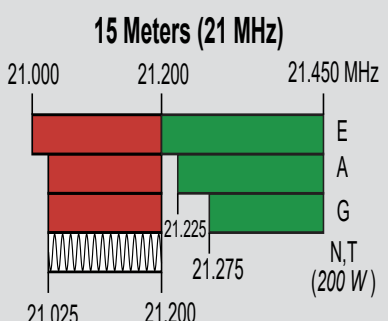
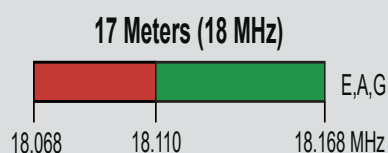
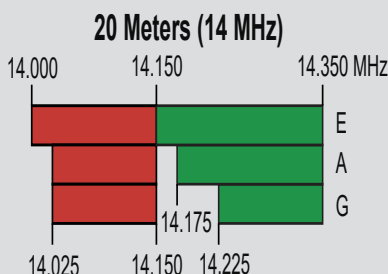
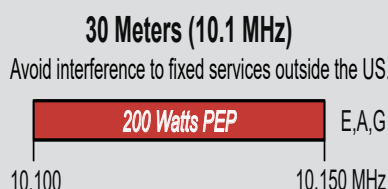
Amateurs wishing to operate on either 2,200 or 630 meters must first register with the Utilities Technology Council online at <https://utc.org/plc-database-amateur-notification-process/>. You need only register once for each band.



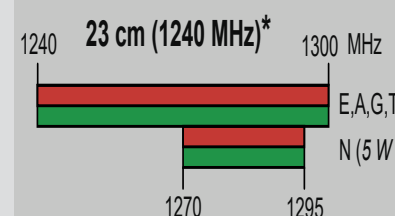
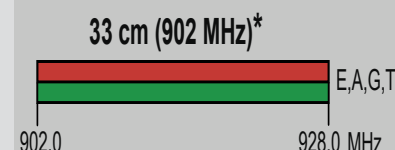
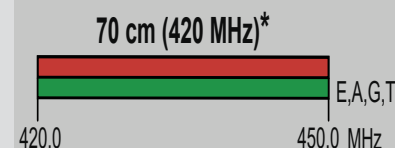
General, Advanced, and Extra licensees may operate on a secondary basis with a maximum ERP of 100 W (relative to a half-wave dipole antenna).



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



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



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

A Look Back



devoted entirely to Amateur Radio

March 1976 \$1.00



How many consumer electronic devices are near this antenna?
A potential RFI problem?

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A Cure for Intermod Alley

Adjacent-channel intermodulation products find themselves "banned in Boston" — thanks to compensated coaxial notch filters.

By George Downs,* W1CT

I have been driving through an area known as "intermod alley" for several months now, and it seems just like any other location. What makes this possible is a 30-dB notch filter that nulls out the signal from the Telco (Telephone Company) transmitter on Bear Hill. The notch alone will not do the job; it must be combined with an antiresonant circuit to emphasize the amateur frequencies.

For those not in the know, the Bell System operates a relay transmitter for the mobile telephone service near the junction of routes 128 and 20, near Boston, Massachusetts. The transmitter operates on several channels between 152.4 and 152.9 MHz. When these signals are present, and particularly when the nearby 146.04/64 repeater is active, many amateur mobile units within a mile or more are swamped by the intermodulation products.

When I established the Weston c.d.

*85 Fairview Rd., Weston, MA 02193.

Fig. 1 — An open-ended stub across a transmission line reflects an effective short circuit across the line at the rejection frequency.

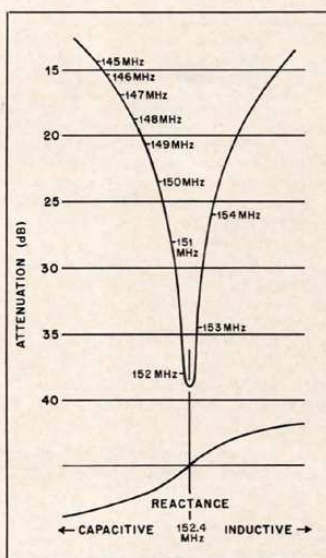
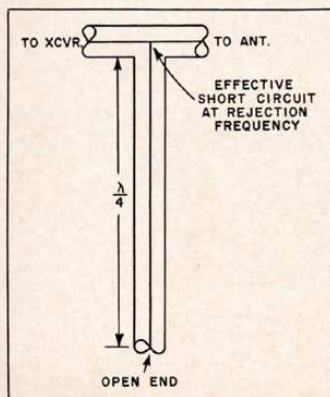


Fig. 2 — Attenuation curve of a typical 1/4-wavelength stub, top, and a reactance vs. frequency curve, bottom.

station this year at the new police headquarters, conditions on two meters were intolerable. The station is three miles from Bear Hill and has a 5/8-wavelength ground-plane antenna 60 feet up. Both a-m and fm signals were beset with telephone conversations, squeals, and assorted noises; something had to be done.

Dick Hughes, W1GTJ, suggested a solution and provided a prototype trap. It worked very well, indeed — but would it also work in mobile units? The prototype was transferred to the VW, and I found that I could drive right up and shake hands with the Bear Hill problem and have the intermod barely break the squelch. Thus encouraged, I made up four "production" units of the W1CT

Intermod Notch Filter, all assembled in my cellar using imprecise equipment.

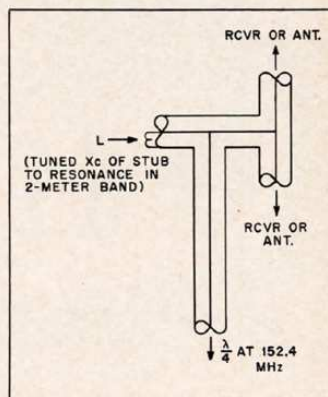
How it Works

Let us insert a T-fitting in the transmission line, and attach a quarter-wavelength open-ended stub section tuned to 152.4 MHz, illustrated in Fig. 1. Such a stub will reflect a short circuit across the line and will attenuate the Telco signal approximately 30 dB. You will also see, in Fig. 2, that the signals in the two-meter band are attenuated to an unacceptable degree.

Fig. 2 shows something else that is very important. The apparent short circuit at the T-fitting has the characteristic of a series-resonant circuit. That is to say at frequencies below resonance, capacitive reactance is seen at the T, as shown by the reactance vs. frequency curve at the bottom of Fig. 2.

The idea is this: Since we have a few ohms of capacitive reactance at 148 MHz, we can add an equal amount of inductive reactance at the T-fitting to construct an antiresonant circuit tuned

Fig. 3 — An antiresonant circuit is formed by placing an inductance across the stub near its junction with the transmission line.



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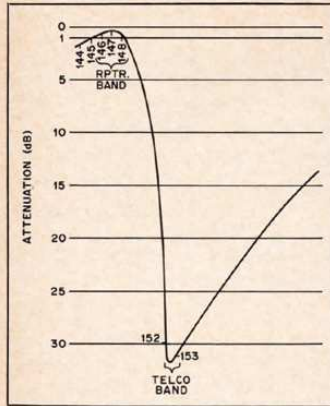


Fig. 4 — Typical response curve obtained from compensated notch filters.

to the amateur band. Fig. 3 shows how the arrangement can be altered, and Fig. 4 shows a typical response curve obtained from actual filters.

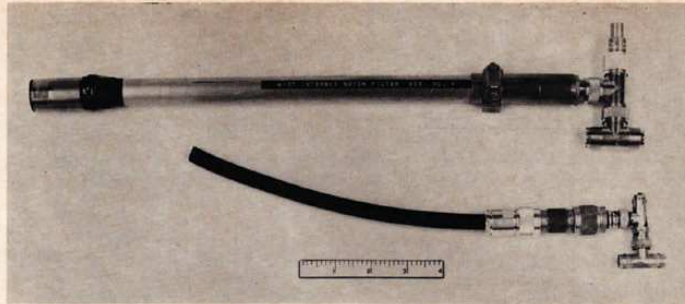
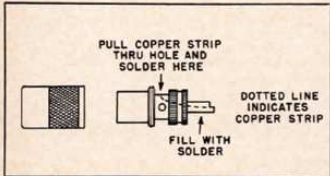
Practical Construction Considerations

The ideal impedance for a coaxial stub is approximately 77 ohms. This is not critical, but does indicate that it is slightly better to use 70-ohm cable, rather than 50. The best type to use, if you can get it, is the aluminum-jacketed Foamflex or equivalent. You will need about 20 inches of it. For connectors I used the uhf type because they have lower inductance than BNC and are usually less expensive.

The photograph will give you a good idea of how things fit together. The following steps will guide you in the assembly:

- 1) Put a uhf female connector on the end of the stub. I made the assembly by using a single-hole mount uhf fitting, a copper spacer, a slotted piece of 3/4-inch copper pipe, and a hose clamp.
- 2) Prepare the shunt inductor. Cut a 3/32-inch wide strip of copper (0.005-inch thick) about 1-1/2 inches long. Solder this strip into the center pin of a PL-239 plug. Fill the entire center pin of the plug with solder. The free end of the strip extends up into the body of the

Fig. 5 — The shunt inductor is assembled by soldering a loop of copper strap in a PL-259 plug.



The shorter assembly is the prototype by W1GTJ, using flexible cable and BNC fittings. The longer one is a "production" model made from aluminum-jacketed line. A plastic pill bottle is taped over the open end of the stub for protection.

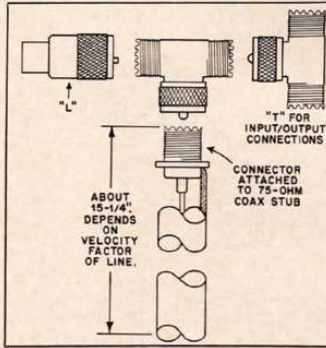


Fig. 6 — An exploded view of the entire assembly. "L" is the plug shown in Fig. 5.

plug. Fish out this free end through the nearest hole in the plug body and solder to the outside (see Fig. 5).

- 3) Obtain two T-fittings and assemble as shown in Fig. 6.

- 4) Adjustment: The setup is shown in Fig. 7. You must have enough amplitude range in the generator output, and in the meter, to measure voltage levels 30-dB apart. Stub adjustment is made by trimming pieces off the end of the line. I used a tubing cutter, a razor blade to cut the insulation, and a jeweler's saw to part the inner conductor. A 1/8-inch change moves the frequency 1 to 1-1/2 MHz. Because of the shape of the response curve, try to get the amplitude at 146 and 148 MHz equal —

this will put a peak at 147.2. Also try to get the maximum rejection at the low end of the Telco band, 152.4 MHz. This means that the delta — or difference — frequency between peak and null will be 5 to 5.2 MHz. As you trim the line, the peak and null will both increase in frequency. However, as they do so, they will get farther apart.

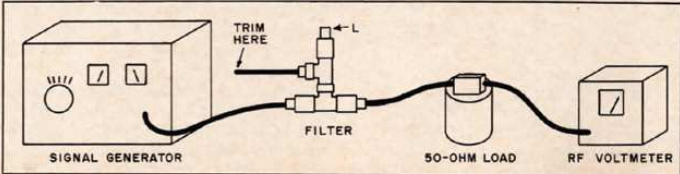
There is interaction between the length of the line and the amount of inductance. A change in either one will change both the peak and null frequencies. Therefore it is important to watch the spread between them as you go through successive trimmings. I found that it was difficult to make the inductance low enough, but it was easy to increase by melting the solder and pulling a little more strip out of the center conductor of the plug.

The Price We Pay

The penalty is called "insertion loss." The units I made covered 146 to 148 MHz with a loss of no more than a dB at the band edges and considerably less in between. This may bother you a bit on the periphery of a repeater area. A compromise might be to leave the filter in while driving in a problem area and take it out when on trips. It is worth the price to me to have the intermod problem solved near Bear Hill.*

*[Editor's note: A follow-up article using the notch-filter principle to decrease 6-meter interference from Channel 2 TV stations will be presented in a subsequent issue of QST.]

Fig. 7 — Test equipment setup for adjusting the stub and inductor for proper response.



New Tricks for Old Club Program Nights

Same old programs year after year? Think your club has done it all? Insights are offered herewith to prove you wrong.

A little bit of brain storming mixed with many ideas found in club bulletins received has produced a bag of new tricks for "program nights." Activities and materials for twenty-five areas have been considered. A few of these areas will be reported on from time to time. This issue will cover "Old Timers' Night," "Homebrew Night" and "Novice Night."

"Old Timers' Night" is an annual event for many clubs and is a favorite of their members. All known old timers (including non-members) in the area are sent special invitations. *200 Meters and Down*, *50 Years of ARRL* or other handbooks on antique gear could be used as door prizes. Ideas members can work on for this program are:

- 1) Meet at a state or radio museum displaying old equipment.
- 2) Have members bring antique equipment and give an explanation of it. (The Des Moines Radio Amateur Association, IA, lined up a 5-meter receiver used in the mid-thirties for their display.)

Early devices can be displayed at Old Timers' Night.



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- 3) Read items from an old club bulletin or old files and pass around an old club scrapbook.
- 4) Display old tubes and hold a contest with a prize for the person who can name the most.
- 5) Have an old timer speak on spark gap and other early devices or what amateur radio was like when he first started operating.
- 6) Pass around an early *QST* or other publication.
- 7) Award certificates to any of the following — oldest member in age, longest licensed, earliest club member, earliest president, member with the oldest confirmed QSO/WAC/WAS/DXCC.

Suitable "blank" certificates are available from Hq. to award as prizes.

"Homebrew Night" usually includes a contest with various categories of competition. Some descriptive words that can be combined to make a half-dozen categories include: Novelty, ingenuity, originality, usefulness, economy, use of surplus parts, use of readily available parts, operating convenience, neatness, workmanship, sophistication of function, and simplest. Clubs often pit holders of the same class of license against each other. Penn Wireless Association (PA) even awards the best mistake, best unfinished project and best "pipedream." Circuit diagrams and documentation or proof of operation may be required. Utah Amateur Radio Club allows their members to enter antennas and towers, that is, pictures and diagrams of them. Award certificates which can be filled out appropriately are obtainable from Hq.

A tour can be planned to those area stores carrying surplus parts. Possible club construction projects might be displayed and voted on as to which one to take up for the year. An area expert on homebrewing could give a talk. Bibliographies listing surplus stores or past *QST* articles on equipment built from surplus parts can be requested from Hq.

"Novice Night" is often held by clubs that have a licensing class comprised of many non-club members in order to stir these peoples' interest in joining the club. Other guests could include Novice friends of old timers and non-ham friends of Novices. Door prizes (such as a year's membership dues for the club) are given to the oldest and youngest Novices. Construction projects that the Novices have built can be displayed. A Novice corner can be set up for the exchange of crystals, making skeds, and so on. An award can be given to the best student in the class. Or for a different twist, have the Novices plan the program to present their fields of interest, such as Novice nets, DX in the Novice bands, the Novice Roundup or Worked-All-States.

Materials that can be used for the meeting, all obtainable from Hq., are: Novice Roundup sample logs, the Technical Department bibliography on the "Novice Gallon," Quiz 10 covering Novice license questions and the following booklet and pamphlets of use to Novices — *Operating an Amateur Radio Station*, "Your Novice Accent," and TAS-1 "Curing Signal and Operating Difficulties." — WA1STO

QST

Celebrating Our Legacy

101 Years of History

I was first licensed in 1978 while in high school. In 2000, I upgraded to Amateur Extra and got a vanity call sign with my initials — W9SG. Twenty-three years later, I received an email from Pete Varounis, NL7XM, a well-known amateur radio archivist, asking if I had any interest in a variety of vintage W9SG documents that he had. This led to the discovery that my call had previously belonged to George Lane Eldred.

Lane was born in 1908 and grew up in Illinois. He received his first ham license in 1923, when he was 14 years old. He graduated from the University of Illinois with a degree in banking and finance, and after serving in the war, he returned home to raise a family and pursue his career. He was active on the bands throughout his life, and his last logged contact was on December 1, 1994, before he died in 1995.

Among the documents I acquired from Pete were Lane's handwritten logbooks from 1923 to 1995. Recently, I was looking through my logbook from my early amateur years as WD9ION when an entry caught my eye — on November 14, 1979, I had a 40-meter CW contact with W9SG! Because I had Lane's logbooks, I went to find his log from the same time period — it was a match!

Lane's start in 1923, and my startling discovery in 2024 of our chance QSO 45 years ago, spanned 101 years of history!

Steve Geske, W9SG
Algonquin, Illinois

Remembering the Tennessee Teenage Net

Between 1968 and 1970, I participated in the Tennessee Teenage

Net (TTN). Founded by Mike Arnold, W8NWA (SK), TTN met each afternoon (after members were out of high school) on the 40-meter band. Traffic was relayed to the Tennessee Single Sideband (TSSB) Net on 80 meters. Participants were from Tennessee, but there were also frequent check-ins from Kentucky, Illinois, and other surrounding states. Net managers of the TSSB Net were very supportive and allowed several experienced TTN members to call the TSSB Net.

While TTN offered public service opportunities and promoted understanding of traffic and net protocols, the contacts before and after the formal net were equally as important. In addition to ragchewing, these contacts allowed technical support to be passed from more experienced hams to newly licensed hams and fostered many informal shack gatherings. We competed in contests together, met at hamfests, and gathered to watch Apollo moon landings. Unlike at a ham club at school or as part of a Boy Scout troop, we did not have direct adult supervision — our activities were self-created.

TTN flourished because of the support of existing traffic nets, local ham clubs, and individual hams who mentored us. Its history offers



Members of TTN. [Photo courtesy of Gerald Reed, WA4CRU]

an example of how a short-term phenomenon for young hams can have a long-term impact.

Gerald Reed, WA4CRU
Brentwood, Tennessee

A Father's Passion for Homebrew

I'm not a ham, but my father, S. Milton Thomsen, W9NDR, was. He was fascinated with crafting his own gear. When he was a teenager in the 1920s, the workshop in his parents' basement was home to his amateur chemistry lab and electronics experiments, where he used any resistor, capacitor, coil, or vacuum tube he could get his hands on. Buying a ready-made transmitter would have cheated him out of the fun of designing and building his own. His 10 W transmitter used a 100-foot antenna wire, strung from the house to a tree.

His idea that all kinds of radio projects were easier to build and work on if they used chassis made of ¼-inch hardware cloth, rather than stamped steel, appeared on the cover of the August 1953 issue of QST!

He was a chemistry professor at Dana College in Blair, Nebraska (where he became a ham), and later a research chemist at RCA Laboratories in Princeton, New Jersey. When he joined RCA in 1944, his new call sign was W2CGN. I recall hearing him chant "W2CGN, calling CQ. That's W2CGN: 'W2 Can't Get Nobody.'"

Michael Thomsen
Mesa, Arizona

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

Classic Radio

Building a VFO Amplifier for a Tube-Type Transmitter

Most of the less expensive tube-type transmitters from the 1950s and 1960s used quartz crystals to determine operating frequencies. Heathkit offered an external variable frequency oscillator (VFO) — the VF-1 — for their transmitters, such as the AT-1, DX-20, DX-35, etc.

A modern amateur can build a VFO using current technologies that can easily outperform those old VFOs and be a fraction of the size. A couple of years ago, I converted a VF-1 to an all-solid-state operation.

The problem, however, is that one of those old transmitters requires a lot of signal voltage on the grid of its oscillator tube. I measured the signal across a 40-meter crystal in my Heathkit DX-20 and saw 70 V_{p-p} on the oscilloscope!

The output level of my converted VF-1 is adjustable and can be set anywhere between 0 and 5 V_{p-p}. The VF-1 oscillates on the 160-meter band (for transmitter output on 160, 80, or 40 meters) or on 40 meters (for transmitter output on 40, 20, 15, or 10 meters). Frequency multiplication takes place in the target transmitter.

This article describes a self-contained amplifier/power supply that requires only a 3 V_{p-p} signal from a VFO or another signal source to make more than 50 V_{p-p} available to drive the transmitter. All the circuitry is housed in a 6 × 3 × 3-inch Hammond 1411M aluminum utility box.



The completed unit.

form a cascode amplifier. This arrangement avoids the input appearing to be largely capacitive due to the Miller effect (the phenomenon in an inverting amplifier where the capacitance between the input and output is amplified, making the effective input capacitance much larger). There's just enough gate bias (about +1.25 V dc) that a 3 V_{p-p} input signal from the VFO will drive the MOSFET well into conduction.

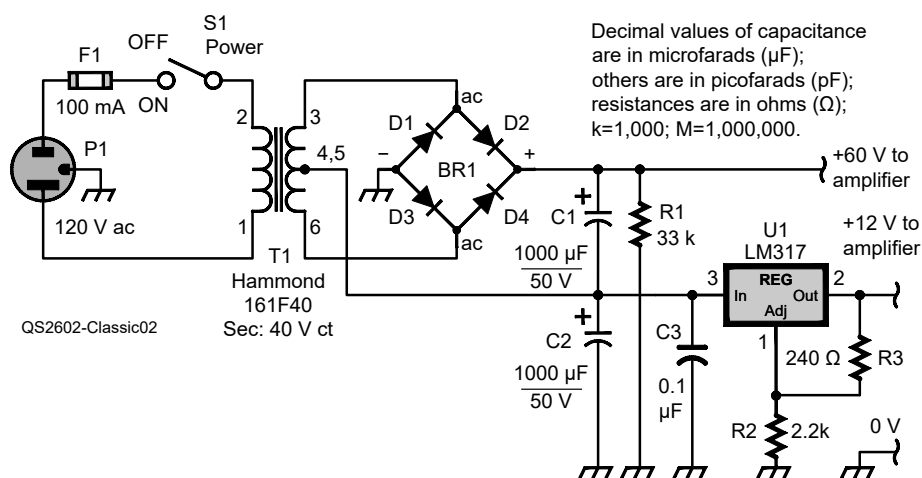
The two variable inductors, labeled L1 (50 – 150 μH) and L2 (5 – 15 μH), were recycled from my original

Circuit Details

The power supply provides unregulated (but adequately filtered) +60 V dc to the amplifier.

U1, an LM317T voltage regulator, provides +12 V dc to power the VFO and to bias the amplifier. U2 (a 78L08 three-terminal voltage regulator) and a resistive-divider chain, R4, and R5 determine the base- and gate-bias voltages.

Q1 (a 2N7000 MOSFET) and Q2 (a 2N3440 bipolar NPN transistor)



Power supply schematic.

VF-1. Both are contained in a single metal can stamped with Heathkit part number 40-56. In the 160-meter range, both are connected in series; in the 40-meter range, the top inductor is shorted out by switch S2. If you don't have this Heathkit part, you can wind suitable inductors on ferrite toroidal cores or on adjustable cores, which can be bought online.

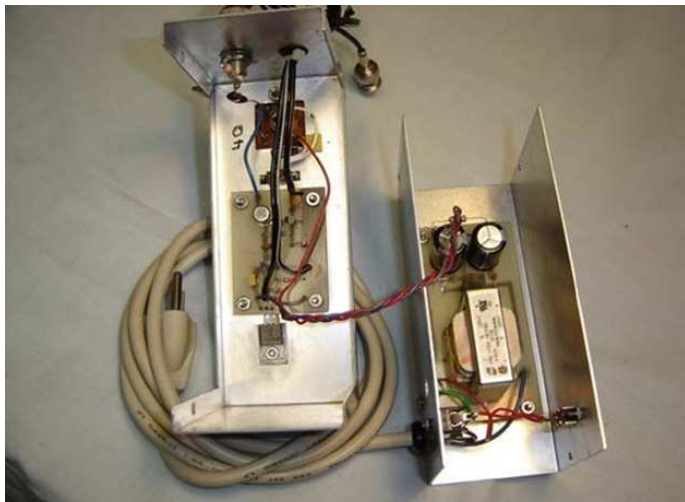
I used a 24-inch piece of RG-174/U coaxial cable (about 60 pF of capacitance from the center conductor to the shield) between the amplifier and P4, which plugs into the DX-20 crystal socket. At the crystal socket, there is about 40 pF of capacitance to ground, for a total of 100 pF. This capacitance, in series with C7 (the 100 pF coupling capacitor), presents 50 pF to ground at the collector of Q1.

This capacitance and the inductance resonate at the required frequency and provide the load for the cascode pair. There will be about 100 V_{p-p} at the collector of Q1 and 50 V_{p-p} at the DX-20 crystal socket. I repurposed an old FT-243 crystal holder for use as plug P4.

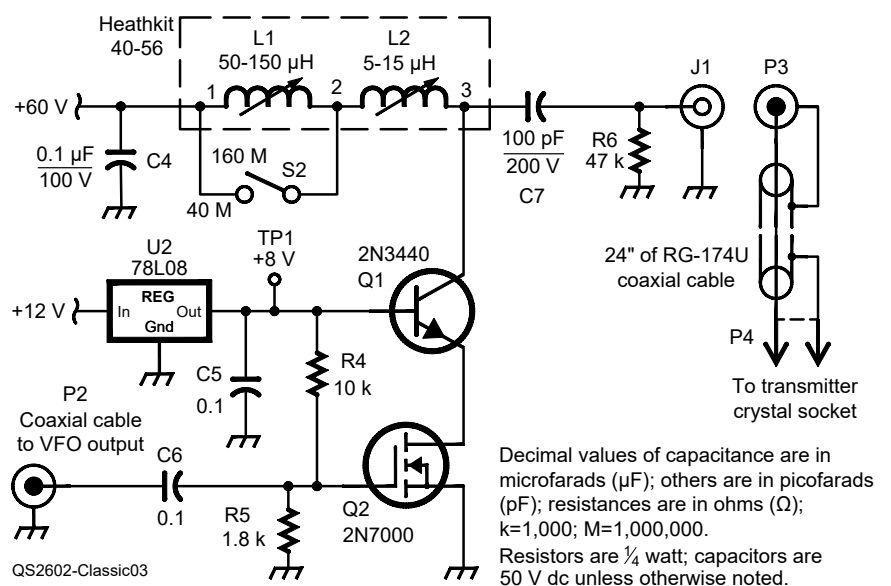
Construction

The ac line cord, strain relief, fuse holder, and power switch are at one end of the bottom case half. The power transformer, bridge rectifier, filter capacitors, and bleeder resistor are on a circuit board, which is mounted to the bottom of the case half.

The remaining components are on a second circuit board. This board, S2, and the 40-56 metal can are



Inside view of the case halves.



Amplifier schematic.

mounted on the top case half. Be sure to insulate and heat-sink the LM317T voltage regulator.

I made the circuit boards using a Sharpie pen on copper-clad board, and there's nothing critical about the layout. Unless otherwise noted, all the resistors are rated at ¼ W, and all the capacitors are rated at 50 V dc.

After double-checking your wiring and before applying a drive signal, confirm that the dc voltages are correct. There should be +60 V and +12 V from the power supply, +8 V at TP1, +7.4 V at the emitter of Q1, and +1.25 V at the gate of Q2.

Connect the amplifier output to your oscilloscope input so that the P4 end of the coax receives an additional 40 pF of capacitance. Connect P2 to your VFO output. You should see tens of volts (p-p) of signal on the oscilloscope. Peak the coils, adjust L2 on 40 meters, and adjust L1 on 160 meters. When you're finished, you may see as much as 50 V_{p-p} on 160 and 40 meters.

Setting Up with the Target Transmitter

Adjust the output level of your VFO so that the target transmitter sees an adequate drive level from the VFO amplifier. You should be able to adjust your transmitter for the required grid current on every band of operation.

All photos provided by the author.

100, 50, and 25 Years Ago

February 1926

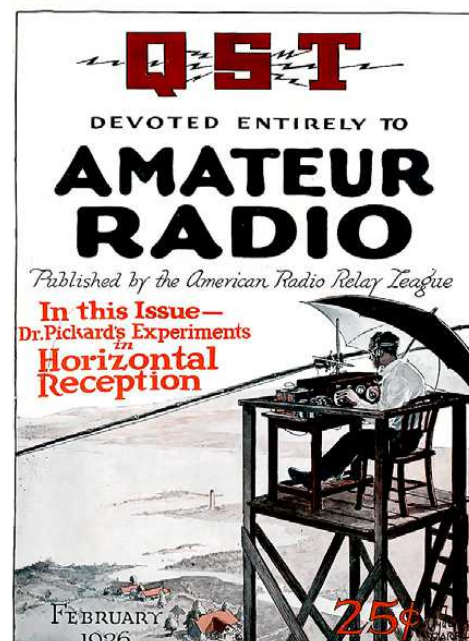
- The cover, by Clyde Darr, 8ZZ, depicts a ham with his radio and an umbrella in a wooden watchtower overlooking a town on the sea, a visual representation of Dr. Greenleaf W. Pickard's Seabrook Beach analyzer station.
- In "Battery Substitutes," Robert S. Kruse, 10A, tests several different alternatives to batteries, focusing on economy, convenience, and superior performance as the three key factors in making one worth substituting for a dry B battery.
- "Receiving Conditions in England" provides a transcript of W. M. Bakewell's, g6UZ, speech at the third National A.R.R.L. Convention about the state of radio in England at the time.
- The last "Calls Heard" article runs in this issue, as the editors state that, with the proliferation of international communication and QSL cards, it has "ceased to serve a useful purpose."
- Chauncy Hoover, 9AMU, walks readers through his construction of a method for "Filtering The Synchronous Rectifier."
- In "Calibrating Your Wavemeter From a Quartz Crystal," Assistant Technical Editor John M. Clayton, 1DQ, writes a guide on calibrating a new coil from the quartz standard.

February 1976

- The cover shows an LED display of the numbers 1976, relating to a project in "Learning to Work with Integrated Circuits, Part 2."
- "Operation Vietnamese Refugee" by George Hart, W1NJM, details efforts by a group of amateur radio users to coordinate communications across several different refugee camps for those fleeing the dissolution of South Vietnam.
- Howard M. Berlin, K3NEZ, explains the science behind electricity and what you should do to keep safe in "Danger Lurks!"
- "To the Moon and Back" by William A. Tynan, W3KMY, recaps tests done using a 150-foot parabolic dish at the Stanford Research Institute to contact a total of 64 different 70-cm stations on 432 MHz.
- In "UHF Antenna Ratiometry," Richard T. Knadle, Jr., K2RIW, writes that ratiometry, the simultaneous comparison of signal strengths observed with a reference antenna and the antenna under test, will help solve the issue of inconsistent results in checking antenna gain.
- "Telecom '75" includes a paper presented by George Jacobs, W3ASK, and Richard L. Baldwin, W1RU, at the World Telecommunication Forum in Geneva in October 1975. The authors present a history of the Amateur Radio Service, its contributions to society, and hopes and concerns for the future.

February 2001

- The cover shows the FO0AAA crew on a DXpedition to Clipperton Island in the Pacific Ocean.
- In "It Seems To Us..." David Sumner, K1ZZ, extols the benefits of ARRL membership beyond QST, including their legislative efforts and the work of the ARRL Lab.
- In "Tales of Sails," Donald Stark, N3HOW, and Peter Sturdivant, N1PS, describe the ham involvement in OpSail 2000, a tour of ships and sailboats across seven East Coast port cities.
- "So People Still Do That?" by William J. Newman, K0NSA, and Mary Joseph, N0TRK, details local outreach efforts by the Ak-Sar-Ben Amateur Radio Club from Omaha, Nebraska. The club set up a display at the local movie theater as a tie-in with the release of *Frequency*.
- "Radio Camp 2000 — Texas Style" by Barry A. Goldblatt, WA5KXX, details a program put together by some Texas hams, teachers, a local radio club, area corporations, and community volunteers called Tech Camp 2000 that taught middle school students RF technology.
- Al Alvareztorres, AA1DO, provides step-by-step instructions for "An HF Mobile Installation." He installed a Yaesu FT-900 into a 1994 Subaru Wagon.



Silent Keys

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

▼K1CWO •N1DJU W1IZT K1LJF ▼KA1TR ▼W1TY •WA1WQM •W2ALP K2EVJ WA2GFN ▼K2HRM ▼KB2KIR ▼WB2KLA ▼•N2MAZ K2MGM KC2QGH •N2UFL •AA2XA ♦K3NGN •WA3YRA KQ4CEN ▼•W4DDE K4ESE KF4EVD ▼N4GGP ▼N4GMU K4HCM N4JJY ▼•K4JZA ▼W4MHA ▼W4OLJ ♦K4SE ▼K04SGZ KC4TFQ KF4UKC W4VRM N4WCQ ▼K4WJV ♦WB4YHI •KC4YWY ▼WB4ZOH ▼♦•K15A ▼W5BLC	Williams, Neal, Greenville, ME Mott, Ruth M., Topsfield, MA Stoico, Robert F., Marco Island, FL Frazier, Lawrence J., Freeport, ME McAuliffe, Robert P., Attleboro, MA Mintz, Richard B., Macedon, NY Wilson, Kathryn M., Shelburne, VT Wood, Robert F., Williamsville, NY Valmore, Edward W., Pittsford, NY Beck, Peter L., Metuchen, NJ Mercer, Malcolm C., Fairfax, VA Toriello, Joseph J., Norwich, NY Rotundo, Samuel A., Utica, NY Ettington, Ray, Rochester, NY Roswell, Edwin L., Lincroft, NJ Hurney, Joanne S., Fair Lawn, NJ Lapierre, Lloyd J., Montgomery, NY Canty, James D., Stafford, NY Deem, David A., Linwood, NJ Hunsinger, Jan S., Pottstown, PA Cashion, Tim W., Washington, NC Elsea, David D., Winchester, VA Singletary, Neill M., Lake Waccamaw, NC McDaniel, Carl B., Loganville, GA Young, David J., Frederick, MD Sutherland, David L., DeLand, FL Brisendine, Paul E., Mobile, AL Floyd, Thomas L., Springdale, AR Bowdoin, Pete A., Enterprise, AL Arthur, Michael H., North Chesterfield, VA Wyrick, Virgil L., Sweetwater, TN May, Robert M., Jonesborough, TN Phillips, Roy P., Cookeville, TN Womack, Marion R., Nashville, TN Williams, Danny J., Russellville, KY Myers, Robert R., Cleveland, TN Stanback, Rick, Nonesuch, KY Turner, Dale W., Taylors, SC Anderson, Joe C., Knoxville, TN Jenkins, Janet K., Newport News, VA Coghill, Kenneth R., Ashburn, VA Moore, Dwaine R., Dallas, TX Wetterau, Lin C., Dallas, TX	N5DO ▼W5DXR ▼♦WA5GHR ▼KZ5HT •WA5JQQ ▼KG5MWG W5M2M N5NET K5OCQ ▼N5PHT AG5PS KE5QNP W5SR ▼W5THA ▼•KD5WFD ▼♦•W5YUO W5ZZV KE6EBN •KA6ENC •N6YMJ ▼W7BXD ▼N7EF •KE7FEL KD7GNV ▼•KG7HZO ▼AJ7N ▼N7OFW N7ZA ▼•N8AEJ WD8AXZ ▼WB8BUT KA8IPA ▼KB8LGV ▼WB8N •KA8QHD •KE8RM N8RWF •KB8THD ▼K08U KB8VHL •KD8VOV ▼•KD8WRN ▼WD9CTH	Cockrum, David L., Victoria, TX Swanger, Floyd R., Friant, CA Walker, Bill, Freeport, TX Thompson, Elkin H., Diamond City, AR Clark, Jerry M., Fairfield, TX Pope, Rick J., Fayetteville, AR Heustess, J. Ellis, Albuquerque, NM Johnson, James E., Tiawah, OK Middleton, Ronnie J., Brownfield, TX Stone, Gary R., Louisburg, KS Busse, Michael, Ocala, FL Crawford, James T., Mena, AR Nail, George R., Albuquerque, NM Arcy, Thomas H., Creston, OH Quatro, Robert A., Oklahoma City, OK Williams, Walter G., Wichita Falls, TX Wiygul, Dorsey L., Nettleton, MS Harris, Jared E., Bellingham, VA Keniston, Harold D., Visalia, CA Langford, James C., Jefferson, GA Lilly, John K., Klamath Falls, OR Anderson, Donald M., Kent, WA Kanvick, Glenn R., Billings, MT Robison, Ray A., Logan, UT Fitzsimmons, David R., Shoshone, ID Sudbury, Richard A., Marysville, WA Nicholson, David R., Vancouver, WA Wade, Bruce H., Spokane, WA Brant, Charles A., Maybee, MI Harbus, Walter A., Clinton Township, MI Lahmann, William J., Venice, FL Capozzio, Carol, Pall Mall, TN Lenhardt, Howard, Niles, MI Wayne, Thomas L., Wickliffe, OH Wharton, Jean E., Clarksburg, WV Fletcher, Robert E., Proctorville, OH Leibengood, Bill, Trenton, MI Skoglund, Denis W., Houghton, MI Sihtala, Ronald Stu, Green Bay, WI Graber, Jeremy J., Uniontown, OH Scott, Martin A., Petoskey, MI Robertson, Charles E., Chillicothe, OH Van Caster, Jack J., Spokane Valley, WA	WA9FWT WB9HKE W9JRW KB9PUQ AG9W ♦W0BEI ▼N0BKB ▼K0CWO ▼•KC0DZ ▼AE0G ▼NT0G ▼KV0H WA0MAG WB0NCB ▼K0PLX ▼•K0REQ KB0SCB ▼•AE0TH VA3RSB VE6PWT ZL1AQ DL7HC	Doncheck, Phillip J., Sheboygan, WI Strauss, Richard W., Milwaukee, WI Krueger, Ronald Paul, Chippewa Falls, WI O'Brien, John P., Decatur, IL Kinnaman, Emerson G., Charleston, IL Schmidtke, Herman D., Faribault, MN Vandewater, Larry J., Greenfield, IA Voute, Berend J., Princeton, MN Lukefahr, Harry R., Sainte Genevieve, MO Trumble, Larry W., Beatrice, NE Vernia, Ronald E., Boone, IA Tomasiewicz, Louis S., Council Bluffs, IA Daw, Harry A., Troy, MO King, R. Michael, Grand Junction, CO Merrihew, Richard W., Dubuque, IA Peterson, Wendell C., Punta Gorda, FL Smith, Kim K., Burlington, IA Phillips, Howard A., Colorado Springs, CO Bryan, Ron, Lyn, Ontario, Canada Gould, Robert, Calgary, Alberta, Canada Rouse, Gordon, Hamilton, New Zealand May, Alexander, Hamburg, Germany
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- ♦ARRL Life Member
- ▼Veteran
- Former call sign

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

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

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FTX-1 Optima | HF/50/144/430MHz All Mode SDR Xcvr

- Detachable Field head For QRP SOTA/POTA Adventures • Attach Field Head to SPA-1 For 100 Watts (Base Operations) • SPA-1 Includes Internal HF Antenna Tuner • SSB, CW, AM, FM and C4FM Digital



FTX-1 Field | HF/50/144/430MHz All Mode SDR Xcvr

- Compact QRP SOTA/POTA Xcvr (8.4"W, 3.5"H, 2.2"D) • 6W (5W for QRP) • Includes 6400mAh High Capacity Li-ion Battery • SSB, CW, AM, FM and C4FM Digital • 10W of Power w/External Power Supply • Upgradable to 100W with Purchase of SPA-1



FT-70DR C4FM/FM 144/430MHz Xcvr

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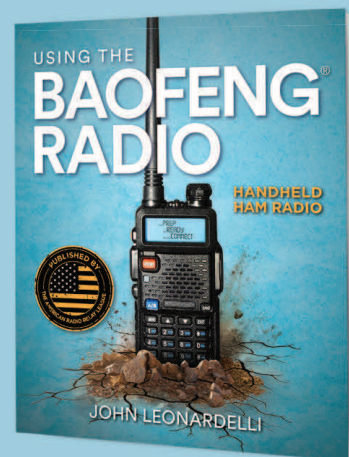


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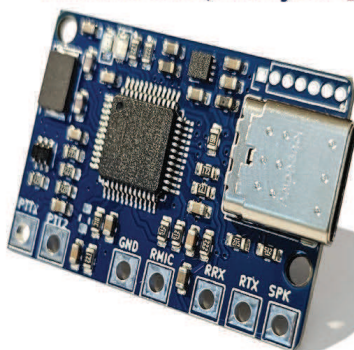
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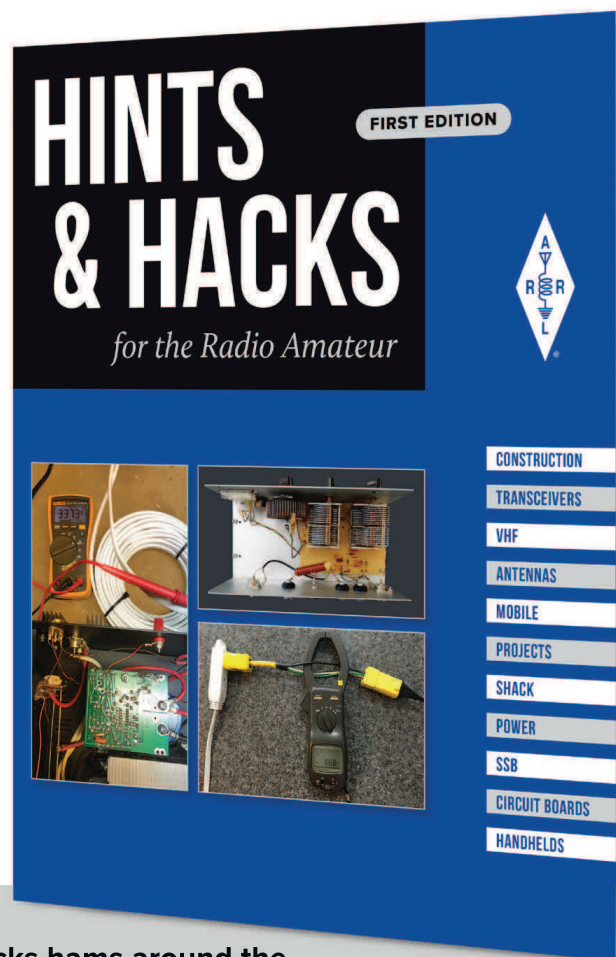
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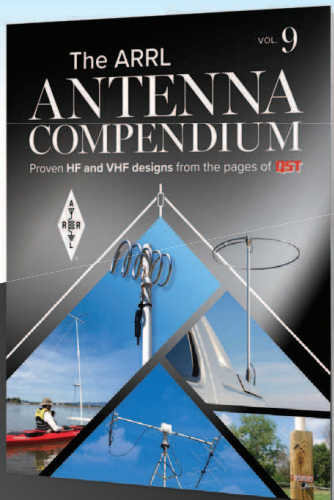
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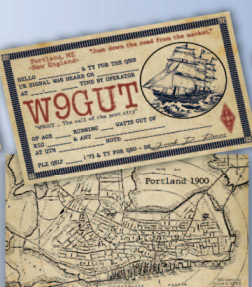
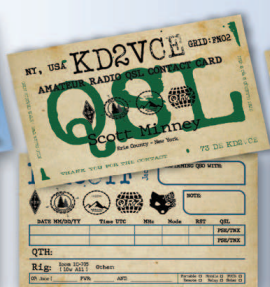
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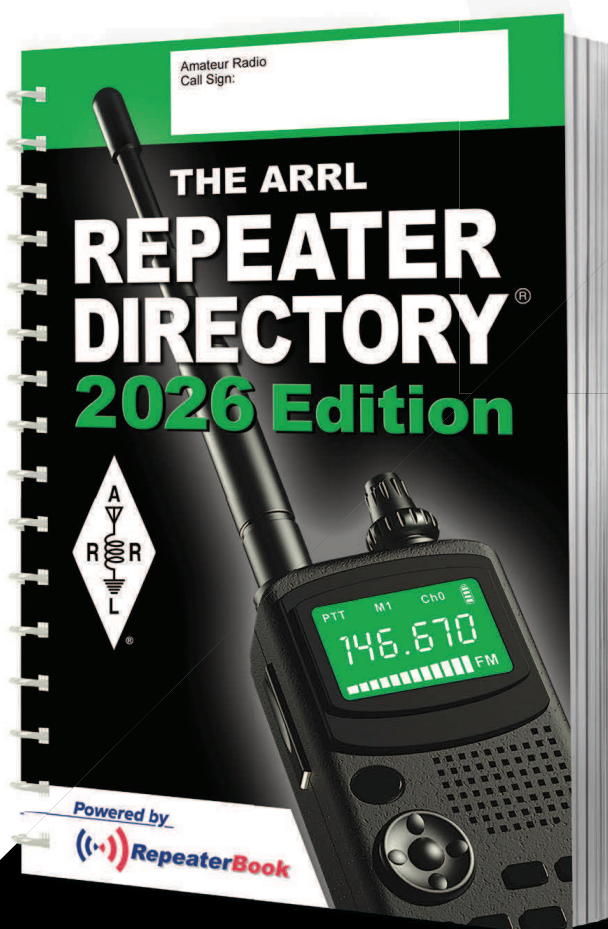
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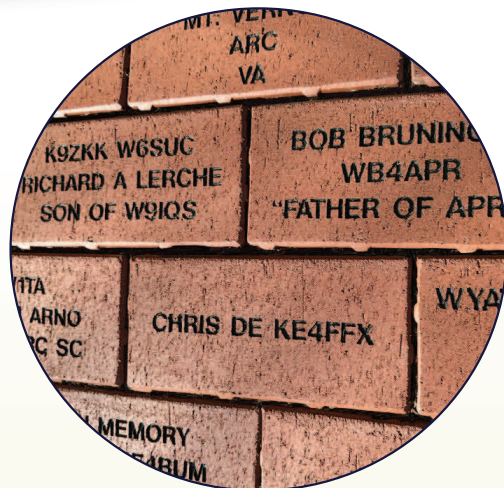
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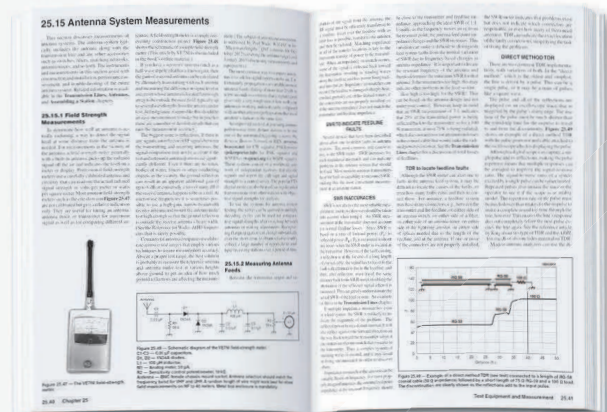
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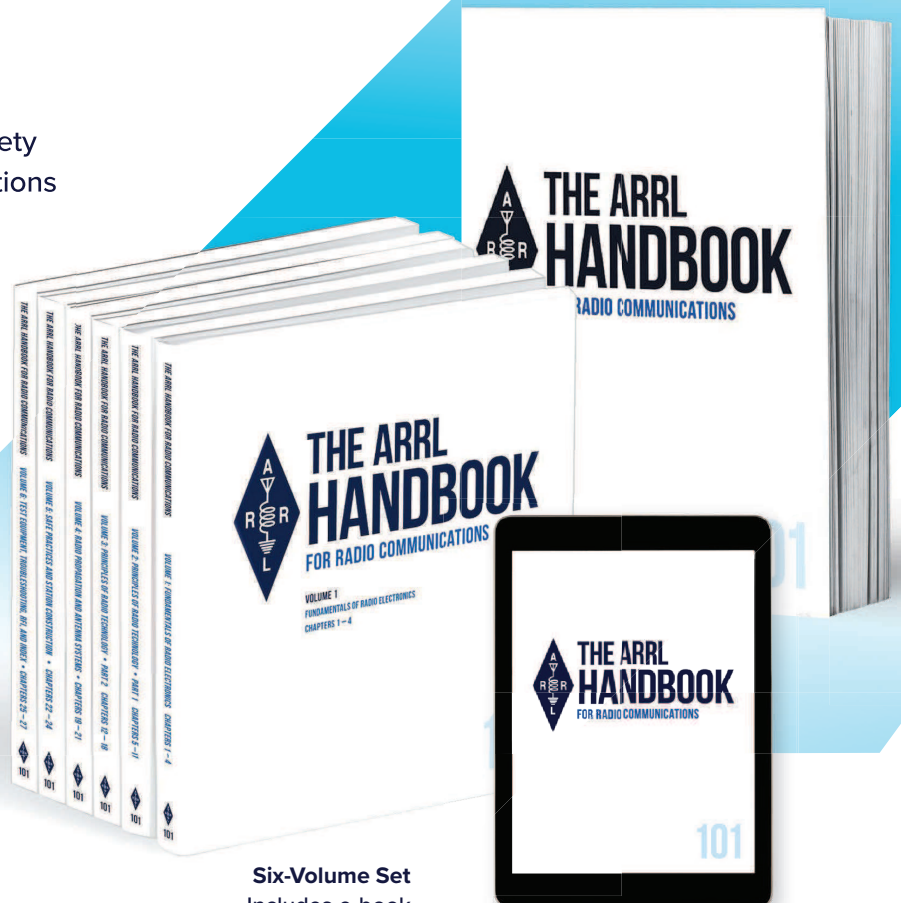


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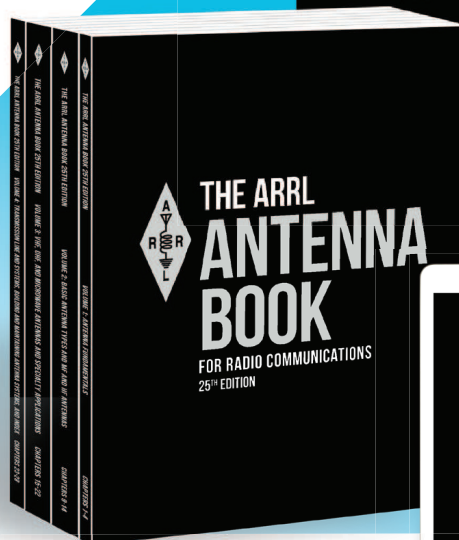
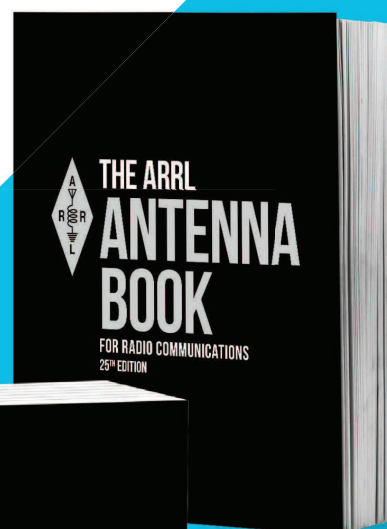
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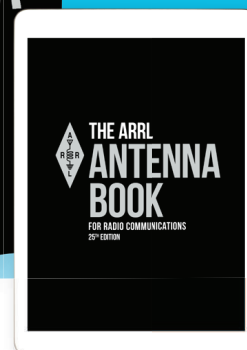
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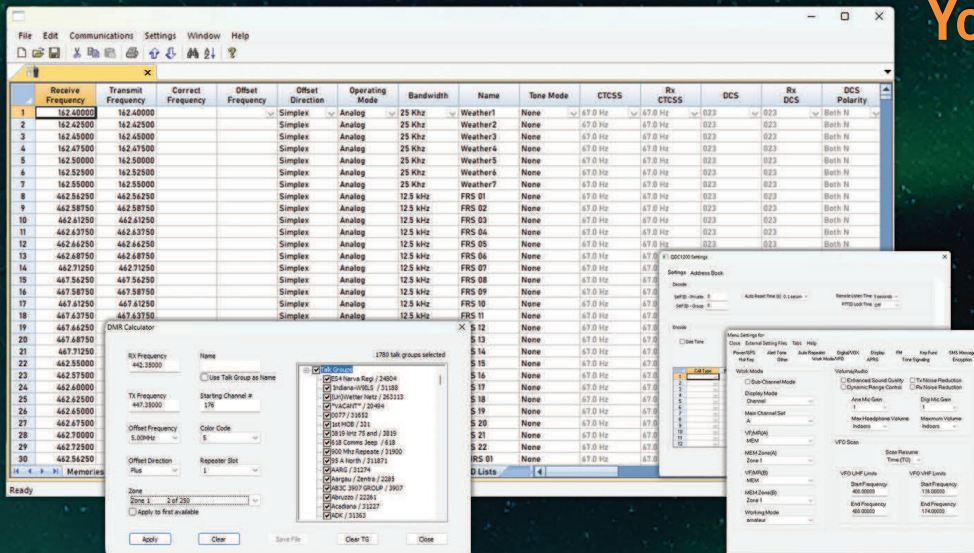


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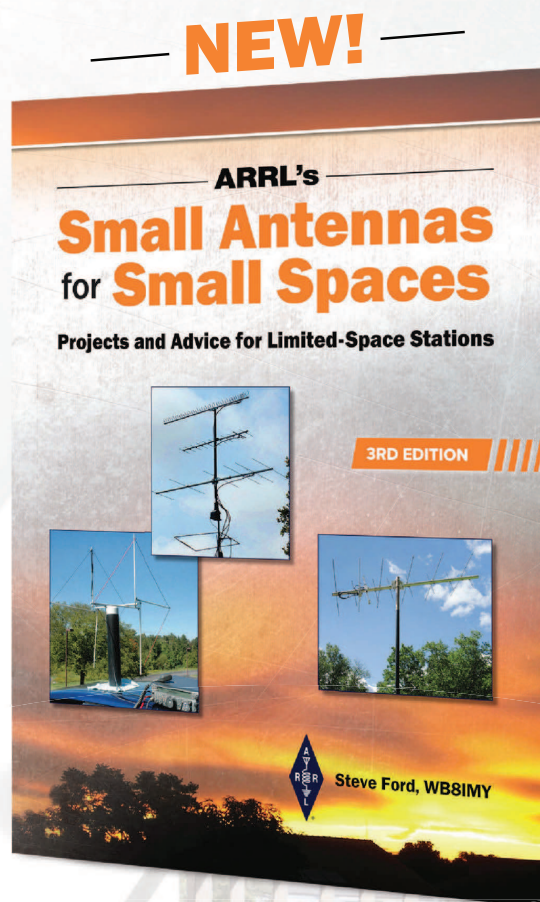
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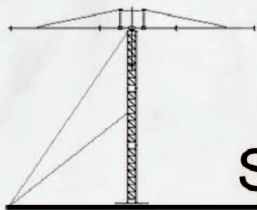
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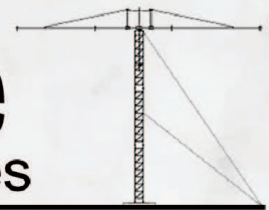
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ARES volunteers provide communications for:

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- Disaster relief organizations
- Public service events
- Emergencies or disasters
- Training exercises

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- Communication technology
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- Disaster preparedness



ARRL's volunteer amateur radio operators help their communities in good times and bad through community events, disaster response, and various programs.

Get Involved in ARES

- Ask local hams about involvement
- Contact your Section Manager or Section Emergency Coordinator, www.arrl.org/sections
- Join local radio clubs, www.arrl.org/clubs
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- Attend SKYWARN® training, weather.gov/SKYWARN
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- Reach out to ARRL for assistance, email ares@arrl.org

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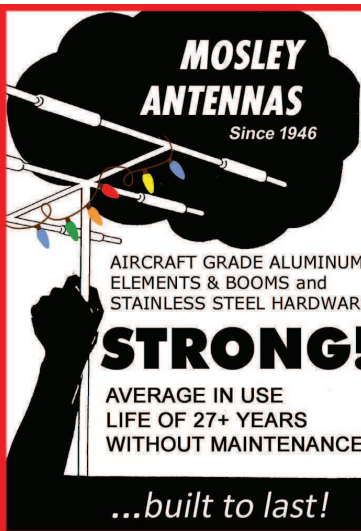
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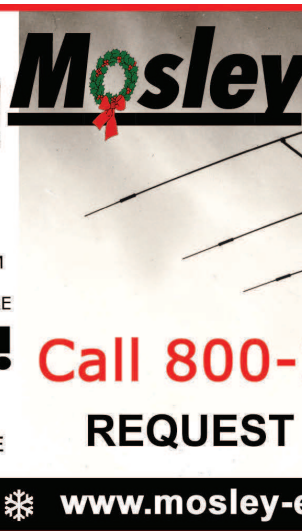
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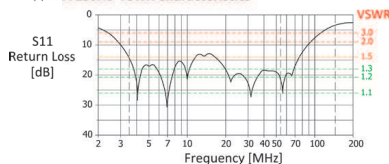
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3 COMET GP-6 DUAL-BAND 146/446MHZ BASE REPEATER ANTENNA

Wavelength: 146MHz 5/8 wave x 2 • 446MHz 5/8 wave x 5 • Gain-146 MHz: 6.5dBi / 446 MHz: 9dBi • Max Pwr: 200W • Length: 10'2" • Weight: 3lbs. 8ozs. • Conn: Gold-plated SO-239 • Construction: Fiberglass, 2 Sections

4 COMET GP-9 / GP-9N DUAL-BAND 146/446MHZ BASE REPEATER ANTENNA

Wavelength: 146MHz 5/8 wave x 3 • 446MHz 5/8 wave x 8 • Gain-146 MHz: 8.5dBi / 446 MHz: 11.9dBi • Max Pwr: 200W • Length: 16' 9" • Weight: 5lbs. 11ozs. • Conn: GP-9 Gold-plated SO-239 • GP-9N Gold-plated N-type female • Construction: Fiberglass, 3 Sections

5 COMET CX-333 TRI-BAND 146/220/446MHZ BASE REPEATER ANTENNA

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

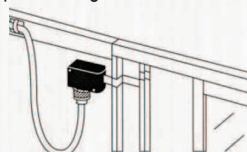
6 COMET GP-15 TRI-BAND 52/146/446MHZ BASE REPEATER ANTENNA

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

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