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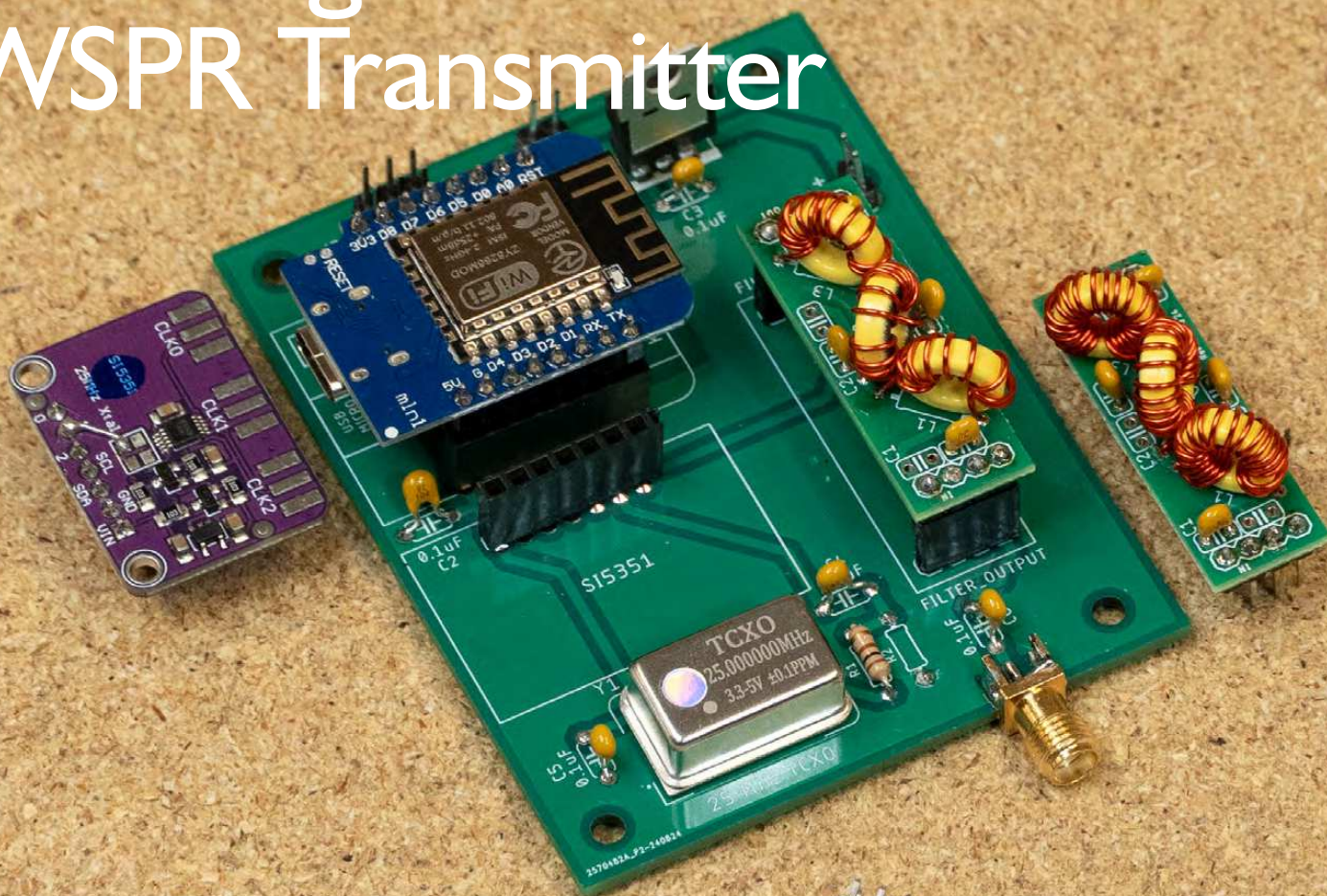
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Our Cover

When the Montgomery Amateur Radio Club (MARC), KV3B, in Rockville, Maryland, was looking for a low-cost, fun, and easy-to-build, yet useful club build project, club member Bob Fontana, AK3Y, designed "A Wi-Fi-Reconfigurable Multiband WSPR Transmitter" that fit the bill. All classes of licensee can use this transmitter, making it a great way for Technicians to use their HF privileges. Twenty-five hams built this project with MARC — try it with your club!

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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

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Second Century

What Is ARRL?

How well do you know ARRL and its structure? Decades before I became CEO, I was a member. I've always supported ARRL because, in large part, I always believed it had my back. I still very much believe that today. As a member, I never took the time to understand the organization of ARRL and its inner workings. ARRL was simply always there for me, and other than those special times I spent seeing or working with my Section Manager, I never knew about the Board, the President, or much of anything. That was pretty much true right up until I went to apply for the CEO position.

Let me ask you: Who is the President of ARRL? Who was his predecessor? And before that? Who was your Director in 1990? How about your Section Manager? Maybe you pulled it out for 1990, but how about 1960 or 1930? The point I am driving at is that people, many people, come and go over the history of an organization as old as ours. What's still the same? ARRL. It is still here. It is still pursuing its mission to promote and protect our hobby. The beauty and genius of ARRL's structure and its ability to endure for more than a century is that it ensures members can find, select, and elect capable people as the years go by to oversee the operations, finances, and Field Services of ARRL.

How about this one: Who *owns* ARRL? The answer may surprise you, and will certainly differ from opinion pieces posted to social media. The answer is: No one. ARRL is not a ham radio club. ARRL does not have shareholders. The members of the association do not own ARRL. It is a registered 501(c)(3) nonprofit organization for the public good. It is not a governmental body you are required to pay taxes to. It is a corporation that must abide by local, state, and federal laws where applicable in pursuit of its mission. Some people do not seem to like this, but that's the way it is.

So what does the Board do? The ARRL Board, which includes 30 member-elected Directors and Vice Directors and seven Board-elected Officers, is responsible for the oversight of the organization. The Board must ensure that ARRL is working to meet the needs of amateur radio broadly but also to provide certain programs and services that directly benefit members. The Board is also responsible for carefully overseeing the legal and financial obligations of the organization to keep it in good standing with the appropriate authorities and to ensure that ARRL is financially viable.

What the Board is not? It is not a representative democracy. We're not even sure how a page was

created on the ARRL website, or what caused an editorial column some years ago, to refer to it as one. Again, this is one of those topics where proponents wrap themselves in the argument that ARRL is some kind of governmental body run by the members, and get wound up if they're not supported in this misbelief. ARRL is not a governmental body based on democracy. It is an organization, a corporation, overseen by a corporate board, where the members find, select, and elect members to a 15-person Board of Directors who are responsible — as a single unit — to oversee ARRL. The Board, not individual Directors, is responsible for ARRL.

What about Section Managers, who are also member-elected? They do not, as some people believe, report to their Division Director. There are even Section Managers who have been told this, and know this, but refuse to accept it. Section Managers report to the Director of Emergency Communications & Field Services (ECFS) — a member of the Headquarters staff. They are part of the Field Services program, which is overseen by a Board standing committee called EC-FSC. The Section Managers work with members in their Section to fulfill certain volunteer positions that support areas such as emergency communications, technical support, Affiliated Clubs, traffic handling, and governmental affairs, to name a few. Section Managers are not Board members. They do not make decisions on behalf of ARRL regarding operations or finances. They focus on promoting and protecting amateur radio within their Section by carrying the field initiatives established by ARRL Headquarters into practice at the local level.

Let's finish on one of my favorite topics: transparency. This term has been weaponized to hurt ARRL's reputation, and yet it is a double-edged sword. For those who would speak out against ARRL, there are both members and staff who would like to see ARRL

(Continues on page 28)

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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				
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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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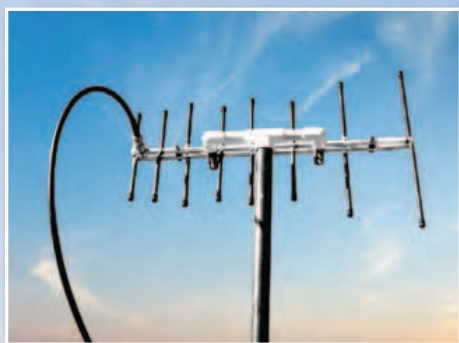
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Club Spotlight

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K4YTZ

York County Amateur Radio Society

Founded: 1948	ARRL Affiliation Date: Nov. 22, 1948
Voting Licensed Amateur Members: 128	Meetings: Monthly
Members: 151	Website: www.ycars.org
Section: South Carolina	Focus: Community engagement

York County Amateur Radio Society (YCARS) is the oldest continuously operating club in South Carolina. But being a premier club doesn't happen overnight; its officers knew that if the club wanted to remain a resource for the community, it needed to undergo a significant transformation. In 2016, YCARS turned a deteriorating facility, a lack of engagement and recruitment, and outdated technological infrastructure into the vibrant club it is today. Now, some of YCARS's biggest commitments are to real-world service, community involvement, youth engagement, and inclusivity.

Community Engagement

YCARS created a Youth Engagement Team and, with help from a grant it received from Amateur Radio Digital Communications (ARDC), developed a program called Project Target to help reach its public service goals. Project Target was developed to help the club direct resources where they matter most. This formal proposal to the ARDC foundation identified three areas where YCARS can make a real impact: community engagement,

remote station operations, and youth engagement and STEM education.

Youth engagement is such an important piece of the puzzle that makes up YCARS that the club also created a team just for the purpose of enhancing Project Target goals. YCARS Trustee John Gendron, NJ4Z, says the purpose of the Youth Engagement Team is to "collaborate with middle school science teachers on hands-on STEM projects, support Radio Merit Badge training for local [Scouting America] troops, and help coordinate ARISS contact events with selected schools." Members of this team invest in youth and themselves by working to inspire the next generation of hams and ensuring the future of the hobby.

While the club has had much success with garnering youth interest in the hobby, they've found sustaining that initial interest to be a challenge. To achieve long-term success, kids have to progress beyond the classroom. They've found it to be most effective to have a "committed adult champion" at school or at home to continue engagement for interested kids.

While much of the club's focus is on new, young hams, they haven't forgotten about the current reality of the hobby's demographic — that it's mostly made up of older hams. That's where the remote station operations portion of Project Target comes into play — YCARS designed a remote HF operating solution allowing members to operate from anywhere that has secure internet access. This allows older hams who may not be able to get to the clubhouse or operate a traditional home station to use the club's receivers, antenna controllers, and RF infrastructure.

Broadening Their Reach

While YCARS is immersed in the local community, the club still manages to include and engage hams around the world by hosting monthly hybrid meetings. Many clubs began doing so in 2020 to meet social distancing regulations associated with COVID-19, but YCARS was ahead of the curve — homebound members and those unable to drive at night were the driving force in 2019. This accommodation has broadened the club's engagement to reach international hams (some in the United Kingdom and New Zealand have even become YCARS members). John said that having members outside the local area "is highly valuable for leadership, as it can inform solutions to challenges, anticipate trends, and enhance the range of offerings available to members."

The Makings of Success

YCARS is an adventurous organization that isn't afraid to take risks or learn from failures. You can read more about its transformation in the September 2022 "Club Station" column.

Guide to Member Benefits



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On the Air – for new and beginner-to-intermediate-level radio amateurs

QEX – A Forum for Communications Experimenters

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The American Radio Relay League, Inc.

ARRL The National Association for Amateur Radio® in the United States: supports the awareness and growth of Amateur Radio worldwide; advocates for meaningful access to radio spectrum; strives for every member to get involved, get active, and get on the air; encourages radio experimentation and, through its members, advances radio technology and education; and organizes and trains volunteers to serve their communities by providing public service and emergency communications (*ARRL's Vision Statement, adopted in January 2016*).

ARRL is an incorporated, noncommercial association without capital stock chartered under the laws of the State of Connecticut, and is an exempt organization under Section 501(c)(3) of the Internal Revenue Code of 1986. Its affairs are governed by a Board of Directors, whose voting members are elected every 3 years by the general membership. The officers are elected or appointed by the Directors.

ARRL is noncommercial, and no one with a pervasive and continuing conflict of interest is eligible for membership on its Board.

"Of, by, and for the radio amateur," ARRL numbers within its ranks the vast majority of active amateurs in the nation and has a proud history of achievement as the standard-bearer in amateur affairs.

A *bona fide* interest in Amateur Radio is the only essential qualification of membership; an amateur radio license is not a prerequisite, although full voting membership is granted only to licensed amateurs in the US.

Membership inquiries and general correspondence should be addressed to the administrative headquarters: ARRL, 225 Main St., Newington, Connecticut 06111-1400 USA.

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Up Front

A 2-Meter Ham Radio

ARRL Advertising Sales Manager Steve Bossert, K2GOG, spotted this bona fide 2-meter ham radio for sale at the 2025 Saratoga County Hamfest in Ballston Spa, New York. This Haug Inc. transceiver is reading at a whopping 100 mega-whatevers on the multimeter. If any attendees of the Saratoga County Hamfest have more information on this device and who built it, please reach out to Up Front and let us know!



[Steve Bossert, K2GOG, photo]

A Handy Device

Peter Nowinski, W3LIX, was soldering a wire to a battery and needed something to hold the wire in place. Looking around the room, he spotted this mysterious item that he'd won at an auction for about \$5. He's not sure what it is, but he's been told that it's a device that hams do not want. Peter disagrees — it's the perfect tool for holding unruly wires in place.



[Peter Nowinski, W3LIX, photo]

Field Day with the Parkersburg Amateur Radio Klub

Conard, WV8JCR (left); John, N8CDD (middle), and Earl, KB8HRG (right), could barely hold their excitement as the Parkersburg Amateur Radio Klub (PARK) set up for ARRL Field Day 2025. They hoped their club would come in at number one, or even number two. All three agreed — whether signals were clean or in the toilet, PARK's Field Day team had all their ends covered.



[Larry Dale, KF8NW, photo]

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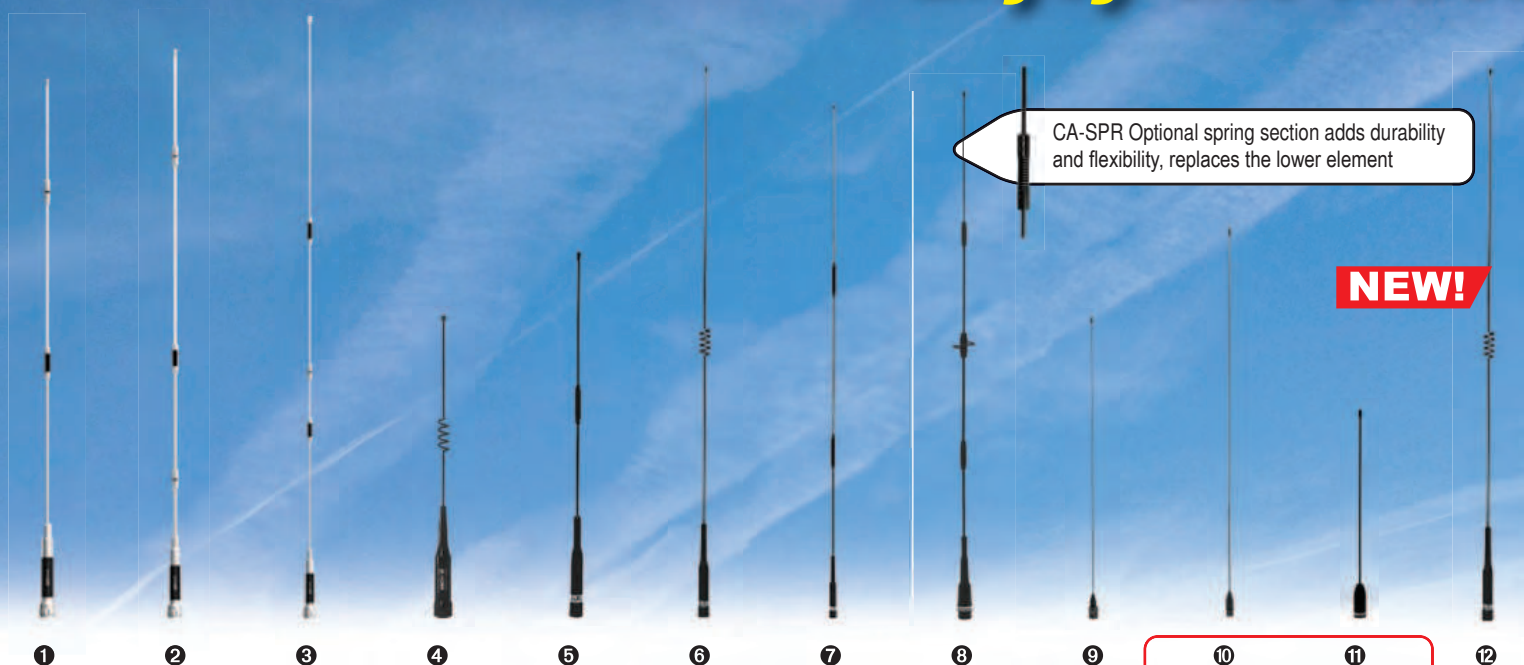
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Correspondence

Letters from Our Members

CW Operating

Letters printed in previous issues — by James Harvey, W7YV, “The Mode that Can Endure All Things” (October 2025), and Edward Baznik, WB8CFO, “CW Offers a Little Something Extra” (January 2026) — express very positive aspects of the CW mode. While I would like to see a requirement for CW returned to amateur radio licenses, realistically I feel the backlash would be overwhelming. However, a more formal VEC-coordinated endorsement approach may be more acceptable. This would differ from the current certificate program by having CW testing be offered as part of VE sessions. The test would feature computer-generated five-character code groups containing letters, numbers, and limited punctuation at speeds of 5, 10, 13, 15, and 20 WPM. Each speed would continue for 5 minutes.

CW is not a dying art; all you need to do is monitor the Field Day events and other contests in the CW portion of the bands to see the high participation rate.

Anthony Sarracino, AB1XK
Andover, Massachusetts

Digital Modes

In the January 2026 issue of *QST*, in “100, 50, and 25 Years Ago,” there was mention of the January 2001 article by Steve Ford, WB8IMY, titled “The HF Digital ‘Tower of Babel,’” which mentioned what the future might bring in digital modes. I have enjoyed digital, mostly PSK and Olivia, for the US Coast Guard Aux-

iliary MT-63 for many years. Over the last couple of years there have been new melodic sounds coming from my radio and new and somewhat familiar-looking traces on my waterfall. I have given up chasing these new ones and gone back to my old “vacuum tube modes” of PSK and Olivia compared to today’s more powerful modes. The marriage between radio and computer hobbyists and the power of some of the newer modes are incredible.

Bill Hopwood, KB1QXJ
Elkins, New Hampshire

Encouraging Club Volunteers

Any “social” club depends on volunteers — a dependency that applies to every amateur radio club I was a member of during my 45 years of being involved in amateur radio. Volunteer enthusiasm can wane; however, these guidelines for members and officers can help foster a positive club environment for volunteers:

- Maintain a cordial demeanor during business meetings.
- Respect the treasurer, who may not have a financial background.
- Assist others with their tasks.
- Develop a task calendar to ensure timely handling of necessary filings.
- Value all volunteers, as they are essential for the club’s survival.
- Consider running for a board position if not currently involved.
- Address issues face-to-face, rather than through email or social media.

- Keep board matters within the board unless necessary.
- Give constructive criticism, and keep it private, not public.

In summary, strong leadership supported by the membership is vital for clubs.

Dan Sherwood, W6DAS
Palmdale, California
Life Member

CW Contest Interference

There are a great many hams who live for the thrill of the contest, but that doesn’t place contesting above the rest of us hams who are just trying to connect by having a nice CW exchange. It seems as though when the contest begins, the rest of us need to get out of the way. I wish we could make the lower 25 kHz a contest-free zone.

Mike Lunebach, WG9P
Crystal Lake, Illinois

630-Meter Operation

“Practical 630-Meter Operation for the Average Radio Amateur” by Paul Dobosz, K8PD, in the February 2026 issue of *QST*, and the corresponding video by W1AW Station Manager Joe Carcia, NJ1Q, and ARRL Lab Digital RF Engineer John McAuliffe, W1DRF, were quite instructive. Thank you for all that you do at ARRL.

Bill Overstreet, K4AJ
Roanoke, Virginia
Life Member

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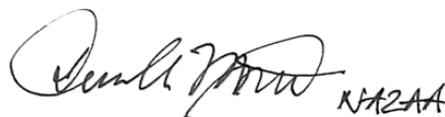
Second Century

(Continued from page 9)

respond or retaliate. That's not who we are. And yet, there are members who would love to see us speak publicly about bad behavior by this or that Director, or false statements made to a blog or social media group by this or that person — who many times isn't even an ARRL member! We're not doing it. It takes us right back to that fundamental question we always ask, not only at ARRL but in our ARRL Foundation meetings as well: *How does this benefit amateur radio?* And ask yourself this question: How does *their* behavior benefit amateur radio or ARRL?

ARRL will endure for many more years. It is an organization we should all be very proud of. And it is an organization that offers so many opportunities to join in,

fit in, share, and relish this hobby — this community — that is so important to all of us. Be ARRL-active! Take the time to know who your Director, Vice Director, and Section Manager are. And thank them for volunteering. Be a connector! Encourage people to not only join ARRL, but to become active in their local club and in ARRL field positions they might be well suited to fulfill. I hope to see you at Dayton Hamvention!



David A. Minster, NA2AA
Chief Executive Officer

W1AW Schedule

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

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

♦ Morse code transmissions: Frequencies are 1.8025, 3.5815, 7.0475, 14.0475, 18.0775, 21.0675, 28.0675, 50.350, and 147.555 MHz.

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

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

Code bulletins are sent at 18 WPM.

♦ 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 2026, Headquarters and W1AW are closed on New Year's Day (January 1), Presidents Day (February 16), Memorial Day (May 25), Independence Day (July 3), Labor Day (September 7), Veterans Day (November 11), Thanksgiving and the following day (November 26 and 27), and Christmas (December 25).

For more information, visit us at www.arrl.org/w1aw

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Remote Transceiver Antenna Switch

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Mike Bryce, WB8VGE

Many hams have several (sometimes quite a few) HF transceivers and, if you're like me, additional general-coverage receivers. Putting them on the air and deciding which antenna to feed which radio can be complicated, and I constantly found myself reaching behind the radios to swap coaxial cables from one to another.

This project allows you to select up to five different transceivers or receivers to a single antenna with the push of a button — like a remote antenna switch for equipment. It will switch the antenna for five transceivers or receivers. Each antenna port is grounded when not in use, and there are two control relays to provide increased isolation. Using two printed circuit boards (PCBs), it's simple to build (see Figure 1).

How It Works

The schematic of the console is shown in Figures 2 and 3. Basically, Figure 2 is a simple linear power supply. A 12 to 15 V ac or dc wall wart, or your station's 13.8 V power supply, feeds bridge diode D3 and filter capacitor C5 that rectifies incoming ac (or it will direct the correct dc polarity to C5 if you use a dc supply). There is a resettable fuse to protect the input to D3.

An LD1085 low-dropout adjustable regulator supplies the power to the rest of the circuits and relays. Resistors R13 and R14 set the output voltage. With the values shown, the voltage common collector is just under 12 V.

Power MOSFET Q3 is a series regulator. It's a P-channel field-effect transistor, so R11 pulls the gate low, turning on the device. Current flows to the relays

when one of the pushbuttons is selected. Current flow is monitored by R9/R10 and R7/R8. Because the surface-mount device (SMD) resistors are rated at $\frac{1}{4}$ W, I used two resistors in parallel to handle the current. A voltage drop is produced across resistors R9/R10 and R7/R8. This turns on Q2, and it supplies voltage to the anode of diode D1, effectively keeping light-emitting diode (LED) D2 dark. At the same time, Q1 saturates and provides the ground for the relay's LEDs.

If there is a short circuit between the console and the relay switch box, Q3 will limit the current to about 125 mA. If there is an open-wire or a relay failure, then Q2 is turned off, and LED D2 will illuminate because D1 is no longer holding it off. Transistor Q1 will shut off, and the relay's LEDs will stay dark.

So, having a short circuit anywhere between the console and the switch box will be limited to 125 mA. On the flip side, an open wire will keep the relay-select LED dark. LED D2 will indicate there's an open-wire or relay failure on whatever port caused the fault.

Selecting a Port

Looking at Figure 3, there are five pushbutton switches — one for each port. They are electrically (not mechanically) interconnected, so you can only select one port at a time (it is impossible to select two or more ports). It's important to note that you should never switch antennas while transmitting.

From the current limiter Q3, the **+RELAY_IN** line daisy-chains through the five switches.

The lowest switched port has the highest priority. If you have port five selected, then pressing port four will give it priority over port five; port three has priority over port four and five, and if you select port five, and then select port one, port five will turn off, giving port one priority. If you deselect all the switches, then **INPUT GND LED** will illuminate.

The Relay Switch Board

Figure 4 shows the schematic of the relay switch. The RF path for each port is activated or disabled using two Omron G2R-1-E-DC12 relays. The relays, rated for 380 V ac with contact current rated at 16 A, will handle 1 kW when connected to an antenna with a 50 Ω impedance. Perform a *sweep test* (a foundational check of your antenna system) with your antenna analyzer to be



Figure 1 — The completed remote switch console.

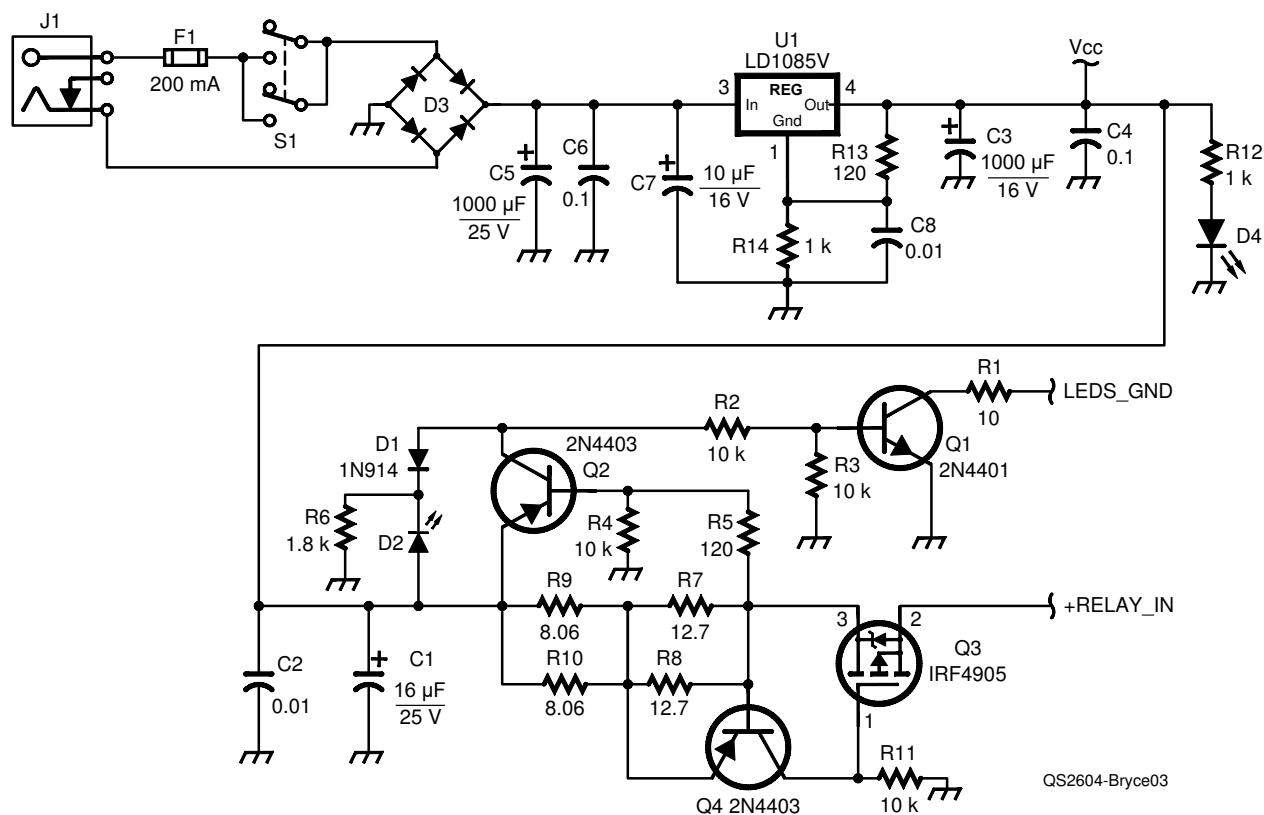


Figure 2 — Schematic of the console power supply.

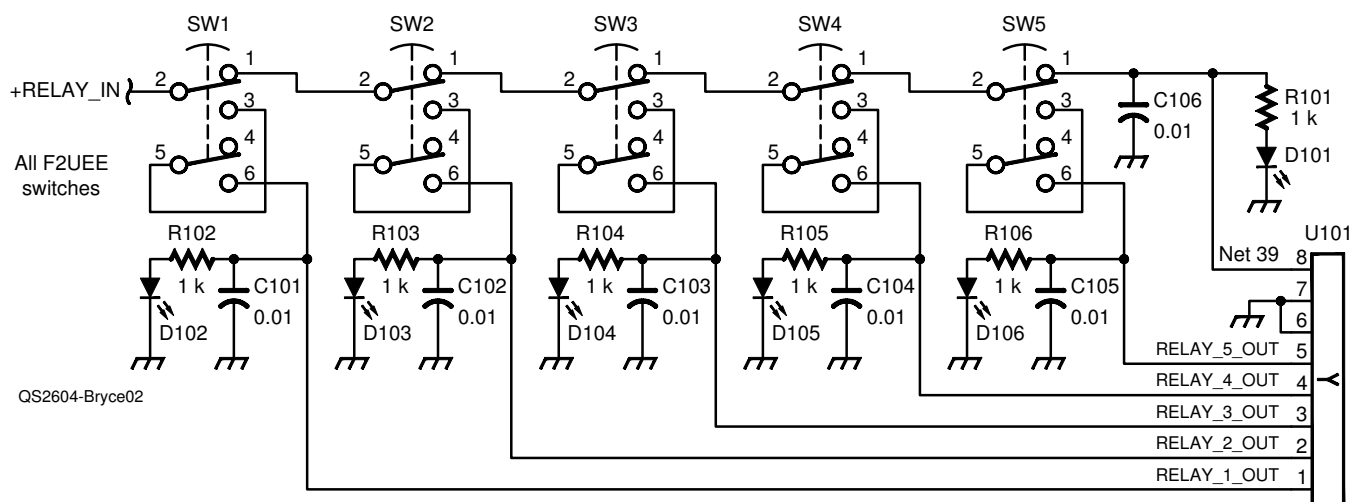


Figure 3 — Schematic of the console pushbutton switches.

sure it's 50 Ω before running power through this switch. A mismatched antenna could cause excessive current draw and possibly exceed the relay ratings.

The relay contacts are in series. When off, the inputs are at ground, effectively grounding the output to the transceivers and antenna. Decoupling capacitors C101 to C106 are used on the relay board and C1 to C5 on the console circuits.

There are five LEDs on the relay board that mirror the LEDs on the console, because I grew tired of troubleshooting which radio went to which port. Now, I can see on the relay box which port is selected — it's a real time saver.

The console and relay board are connected via CAT5 cable with RJ-45 plugs on both ends. Decoupling capacitors are also on both ends. The RJ-45 cable

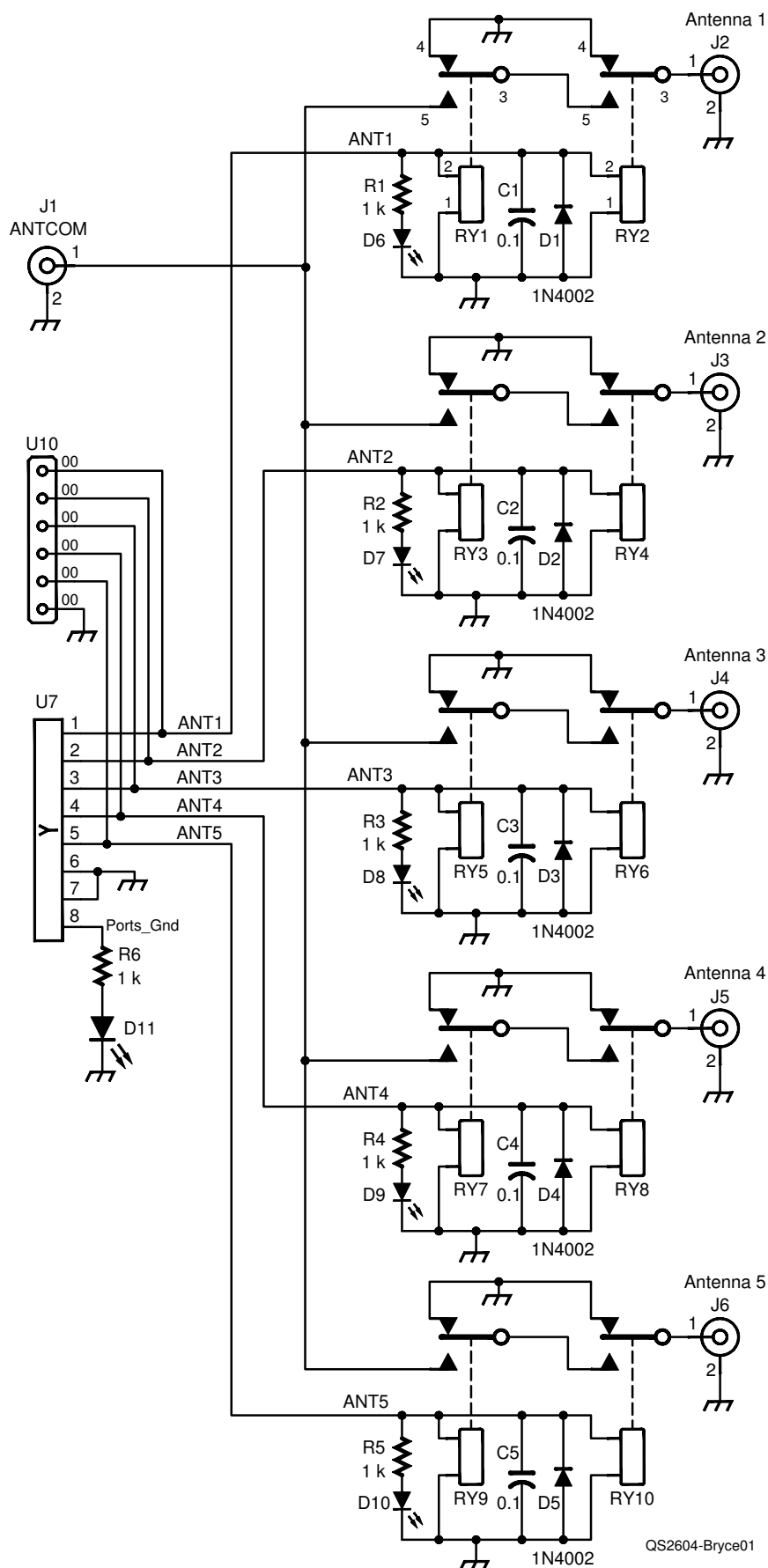


Figure 4 — Schematic of the remote antenna switch.

makes it simple to move or relocate the relay box or console.

Building Your Own

It would be possible to build this circuit on perf board, but having a PCB makes assembly much quicker. The relay board would be difficult to use with point-to-point wiring. You can find the Gerber files on QST in Depth (www.qst-in-depth.com).

I decided to go with a mix of through-hole and SMD parts. The SMD parts use the 1206 footprint (0.12 × 0.06 inches), and they are large enough to almost pick up with your fingertips. The electrolytic capacitors, as well as the transistors, are through-hole parts. See Tables 1 and 2 for comprehensive parts lists.

Mount the SMD parts first. Then, follow up with the transistors and electrolytic capacitors. Mount the switches last. The same applies to the relay board — install the SMD parts first, then the through-hole parts. The relays go on last. To create an enclosure, I bent a sheet of aluminum to hold the relay and console PCBs, but you can use any metal project box you prefer.

You can use whatever RF connectors you'd like for the ports; I used SO-239 connectors. Use 16-gauge buss wire to connect the RF connectors to the PCB (see Figure 5).

Final Thoughts

There are no adjustments to be made, and if you've assembled the PCBs correctly (see Figure 6), the switch should fire right up.

This switch will of course work with transceivers, receivers, and antennas. You can mix between receivers and transceivers. If you're using the switch for transceivers, always turn off any unused transceivers. If you use this switch for antennas, too, I strongly suggest you weatherproof the RJ-45 connectors on the outdoor relay box.

Table 1 — Console Parts List

Reference	Description	Jameco Electronics Part Number
S1 & SW1 – SW5	F2UEE-JVP	2336239
Reference	Description	Mouser Electronics Part Number
J1	2.5 mm PCB power jack	806-KLDX-0202-BP-LT
Fuse	Resettable fuse	576-60R020XPR
Q1	Transistor	833-2n4401-AP
Q2, Q4	Transistor	512-2N4403TA
Q3	Power MOSFET	942-IRF4905STRLPBF
U1	LD1085V	511-LD1085D2M
U101	RJ45-8pth PCB jack	571-5520426-4
D2, D4	LEDs	859-ltl-533-11
D3	Bridge rectifier	583-DB102
C1, C7	10 μ F @ 25 V	667-ECA-1EM100I
C2, C4, C8	0.01 cap SMD	81-GRT3195C2A103JA2D
C3	10 μ F @ 16 V	667-ECE-A1CKA100I
C5	1000 μ F @ 25 V	80-ESK108M025AH4EA
C101 – C106	0.01 cap SMD	81-GRT3195C2A103JA2D
C6	0.1 cap SMD	791-1206B104K101CT
R1, R2 – R4, R11	10 k SMD resistor	603-RC1206JR-1010KL
R5	100 Ω	660-RK73B2BTTDD101J
R7, R8	12.7 Ω SMD resistor	603-rc1206fr-0712rl
R9, R10	8.06 Ω SMD resistor	71-crcw12068r06fkea
R13	120 Ω	708-RMCF1206JR-1010KL
R12, R14	1 k SMD resistor	303-1206S4J0102TDE

Table 2 — Relay Board Parts List

Reference	Description	Mouser Electronics Part Number
R102 – R106	1 k SMD resistor	303-1206S4J0102TDE
Cap	Switch cap	612-taggr
RY1 – RY10	Relays 16 A	G2R-1-E-DC12
U1	PCB terminal block	179-TB0010-500-06GR
U7	RJ45-8pth PCB jack	571-5520426-4
C1 – C5	0.1 cap SMD	791-1206B104K101CT
R1 – R6	1 k SMD resistor	303-1206S4J0102TDE
D1 – D5	1N4002 diode	637-1N4002
D6 – D11	LEDs	859-ltl-533-11
J2 – J6	SO-239	601-25-7350

See QST in Depth for More!

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

- ✓ Gerber files

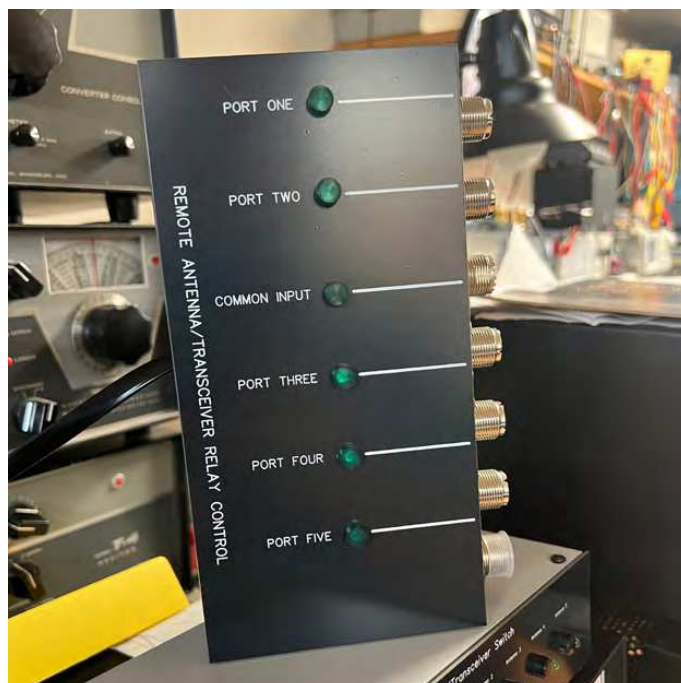


Figure 5 — Remote switch console ports.



Figure 6 — Relay switch board mounted into its homebrew chassis.

All photos provided by the author.

Mike Bryce, WB8VGE, was licensed in 1975 and currently holds an Amateur Extra-class license. He retired after nearly 50 years at Republic Steel. You can find him running QRP on the low end of 40 meters on any given night, and when the bands fold, Mike is up to his elbows working on a broken radio. His spare time is divided between keeping the water levels topped off in his solar power station batteries and working in his greenhouse. Mike has authored numerous ham radio and solar power articles over the years, as well as the ARRL book *Emergency Power for Radio Communications*. He can be reached at prosolar@sssnet.com.

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Revisiting the S-Meter Scale

A comprehensive explanation of what these readings represent.

José Luis Giordano, PhD, CE4TW

The received signal strength indicator, or *S-meter*, is an instrument that displays the relative strength of a radio frequency signal received by an amateur radio receiver. Because it represents the signal strength at the receiver's input connector, its value depends on the entire signal path, including power transmitted at the distant transmitting station, antennas and transmission cables used at the transmit and receive sites, signal loss because of propagation conditions, and the receiver input at the receiving station.

Composing and Interpreting the Scale

The S-meter scale consists of two parts. The first part (on the left side of the meter) has nine divisions or *S-units* (S1, S2, etc.) used for the lower intensities. These units are associated with the nine S (or strength) intensity levels of the RST code, making signal reporting quantitative.

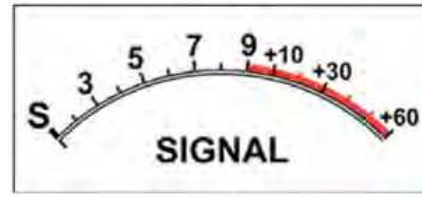
Calibration of S-units for the first part of the scale follows the International Amateur Radio Union (IARU) recommendation found in version nine of the *HF Manager's Handbook: IARU Region 1* (pp. 38 – 39), which is summarized as follows: There is a difference of 6 dB between two consecutive S-units, and the S9 reading corresponds to a power gain of –73 dBm for signals up to 30 MHz (MF/HF) and –93 dBm for signals above 30 MHz (VHF/UHF).

It should be noted that by expressing the gain in decibel-milliwatts, the standard is indicating that the average reference power is 1 mW, or

$$P_{REF} = 1 \text{ mW} = 0.001 \text{ W} = 10^{-3} \text{ W}.$$

The second part of the scale (on the right side of the meter) reads higher RF intensities and is made up of six divisions explicitly separated by 10 dB each: S9 +10 dB, S9 +20 dB, etc., all the way up to S9 +60 dB.

Both scales are logarithmic and represent power and voltage. One advantage of expressing the scale in decibels is that it works for both quantities. The only difference between the two parts of the scale is that between two consecutive divisions of the first part there are 6 dB (which is equivalent to a factor of 4 in power), and between two consecutive divisions of the second part there are 10 dB (which corresponds to a factor of 10 in power).



An illustration of the S-meter scale.

Gain, Power, and Voltage

The mathematical expressions that relate the S-meter scale divisions of gain, average power, and root mean square (RMS) voltage are obtained below. The average power gain (P) reaching the receiver, expressed in decibels (G), and relative to the reference power (P_{REF}), makes up Equation 1:

$$G = 10 \times \log_{10} \left(\frac{P}{10^{-3} \text{ W}} \right). \quad \text{Eq. 1}$$

In this context, the gains (G) are negative because they correspond to attenuation, with $P < 1 \text{ mW}$. The relationship between G and P can be inverted to determine the average power from G , which brings us to Equation 2:

$$P = 10^{(\frac{G}{10} - 3)} \text{ W}. \quad \text{Eq. 2}$$

Therefore, in following the recommendation of IARU Region 1,

$$\begin{aligned} G_{(S9-MF/HF)} &\equiv -73 \text{ dBm}, \\ G_{(S9-VHF/UHF)} &\equiv -93 \text{ dBm}, \end{aligned}$$

the S9 reading corresponds with the following average power values:

$$\begin{aligned} P_{(S9-MF/HF)} &= 10^{(\frac{-73}{10} - 3)} \text{ W} = 10^{-10.3} \text{ W} \approx 50 \text{ pW} \\ P_{(S9-VHF/UHF)} &= 10^{(\frac{-93}{10} - 3)} \text{ W} = 10^{-12.3} \text{ W} \approx 0.5 \text{ pW}. \end{aligned}$$

Then, to determine the RMS voltages associated with these powers, it is necessary to use the antenna system impedance, which is considered perfectly matched to the transmitter impedance (50 Ω). Therefore,

$$Z = 50 \Omega. \quad \text{Eq. 3}$$

Under sinusoidal conditions (ac/RF), and with a resistive load, the relationship between the average power P and the RMS voltage V_{RMS} is given by Equation 4:

$$P = \frac{V_{RMS}^2}{Z}. \quad \text{Eq. 4}$$

So, reversing this relationship gives

$$V_{RMS} = \sqrt{PZ},$$

which, with Eq. 2 and Eq. 3, becomes Equation 5:

$$V_{RMS} = \sqrt{10^{(\frac{G}{10}-3)} W \times 50 \Omega}. \quad \text{Eq. 5}$$

Consequently, S9 will correspond with the following RMS voltage values:

$$V_{RMS(S9-MF/HF)} = \sqrt{50 \text{ pW} \times 50 \Omega} = 50 \mu\text{V}$$

$$V_{RMS(S9-VHF/UHF)} = \sqrt{0.5 \text{ pW} \times 50 \Omega} = 5 \mu\text{V}.$$

Thus, a signal of up to 30 MHz with a reading of S9 corresponds to an average power of 50 pW and an RMS voltage of 50 μV . If the signal frequency is greater than 30 MHz, then S9 corresponds to 0.5 pW and 5 μV .

To determine the power and voltage values corresponding to the other S-meter divisions, simply add or subtract 6 dB at the bottom, and add or subtract 10 dB at the top. Once the gain (G) is obtained, you can calculate the corresponding values of P and V_{RMS} by applying Eqs. 2 and 5, or consider the factors 4 for power and 2 for voltage every 6 dB in the first part of the scale, or the factors 100 for power and 10 for voltage every 20 dB in the second part of the scale. Table 1 shows the results of Eqs. 2 and 5, including the values corresponding to two divisions below and above S9. A similar table can also be found in the 101st edition of *The ARRL Handbook* on page 12.2 (Table 12.1), and includes the decibel-milliwatt and microvolt (RMS) values for all S-meter indications.

The reason for choosing 6 and 10 dB is purely practical — to have round numbers and to mentally calculate by multiplying or dividing by two, four, or 10. In particular, 6 dB between the S-units of the first part of the scale corresponds to a factor of 4 in power and a factor of 2 in voltage, and for higher intensity signals, the choice of 10 dB corresponds to a factor of 10 in power (10^1), 20 dB corresponds to a factor of 100 (10^2) in power and 10 in voltage, 30 dB corresponds to a factor of 1,000 (10^3) in power, and so on.

Starting from the picowatts and microvolts of S9, it is very easy to construct the complete table for all divisions, knowing the P and V_{RMS} factors between each one. Indeed, considering Eq. 4, the relationship between two average powers (P_1 and P_2), and their corresponding effective voltages (V_1 and V_2), is

$$\frac{P_2}{P_1} = \left(\frac{V_2}{V_1} \right)^2.$$

Therefore, applying logarithms to both terms shows that the gain (G) can be expressed with the ratio P_2/P_1 of average powers with a factor of 10, while with

Table 1 — Values of G , P , and V_{RMS} up to Two Divisions Around S9

	S-Units	G (dBm)	P (pW)	V_{RMS} (μV)
MF/HF	S9 +20 dB	−53	5012	500.6
MF/HF	S9 +10 dB	−63	501.2	158.3
MF/HF	S9	−73	50.12	50.06
MF/HF	S8	−79	12.59	25.09
MF/HF	S7	−85	3.162	12.57
VHF/UHF	S9 +20 dB	−73	50.12	50.06
VHF/UHF	S9 +10 dB	−83	5.012	15.83
VHF/UHF	S9	−93	0.5012	5.006
VHF/UHF	S8	−99	0.1259	2.509
VHF/UHF	S7	−105	0.03162	1.257

the voltage ratio V_2/V_1 , the factor of 10 changes to 20, that is,

$$G = 10 \times \log_{10} \left(\frac{P_2}{P_1} \right) = 20 \times \log_{10} \left(\frac{V_2}{V_1} \right).$$

Observing that

$$10 \times \log_{10} 4 = 20 \times \log_{10} 2 \approx 6,$$

$$10 \times \log_{10} 10 \approx 20 \times \log_{10} 3.16 \approx 10,$$

$$10 \times \log_{10} 100 = 20 \times \log_{10} 10 \approx 20,$$

it can be seen that a 6 dB jump in the first part of the scale corresponds to a factor of 4 in power and 2 in voltage, while in the second part of the scale, a 10 dB jump corresponds to a factor of 10 in power and 3.16 ($\approx \sqrt{10}$) in voltage, and a 20 dB jump corresponds to a factor of 100 in power and 10 in voltage.

In Summary

Based on the recommended calibration of the S-meter scale, this article shows how to determine the nominal voltage and power values of the received signal for each S-unit. In practice, the voltage and power values of the signal may differ more from those calculated in divisions farther from the calibration points used by the manufacturer.

A version of this article was originally published in Spanish in the May 2023 issue of Radioaficionados, the magazine of the Unión de Radioaficionados Españoles.

José Luis Giordano, PhD, CE4TW, is a physicist who has worked at the Balseiro Institute and Bariloche Atomic Centre in Argentina, the University of Zaragoza in Spain, and the University of Talca in Chile. His area of work was applied magnetism and superconductivity. Now retired from academic life, José Luis lives in Chile, and he obtained his amateur radio license in 2021. He is a member of ARRL, Radio Club Argentino, and Unión de Radioaficionados Españoles. He also is the author of four books, several papers on physics, and articles in *QST* and other ham radio magazines. José Luis is especially interested in DX, HF, and broadband transformers. He can be reached at jlgiordano@hotmail.com.

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



A Wi-Fi-Reconfigurable Multiband WSPR Transmitter

Get your club's Technicians into HF operating with this entry-level project.

Bob Fontana, AK3Y

Our local VHF/UHF repeater club, the Montgomery Amateur Radio Club (MARC), KV3B, in Rockville, Maryland, was looking for group build ideas. The goal was to come up with a project that was both fun to use and fun to assemble.

Many of our recently joined club members were new to amateur radio and had only Technician-class privileges, so we wanted the design to give them a taste of HF signal propagation — particularly because we are still within one of the best solar cycles in many years. A low-cost entry point was also desirable.

Building a Weak Signal Propagation Reporter (WSPR) transmitter seemed like an ideal choice. All licensees, regardless of class, could use the device (digital privileges on 10 meters are allowed for both Novices and Technicians), and the unit can be made for less than \$25 with simple construction techniques.

Overall, 25 hams participated in this project, and we found it to be a great way to bring club members together for a common goal. Several were introduced



The completed WSPR transmitter, pictured with a 30-meter filter.

to HF propagation for the very first time, whetting their appetites for higher-level licenses!

Designing for Accessibility

When designing the unit, I tried to make it as modular and easy to build as possible. I used readily available, inexpensive submodules, like a pre-loaded ESP8266

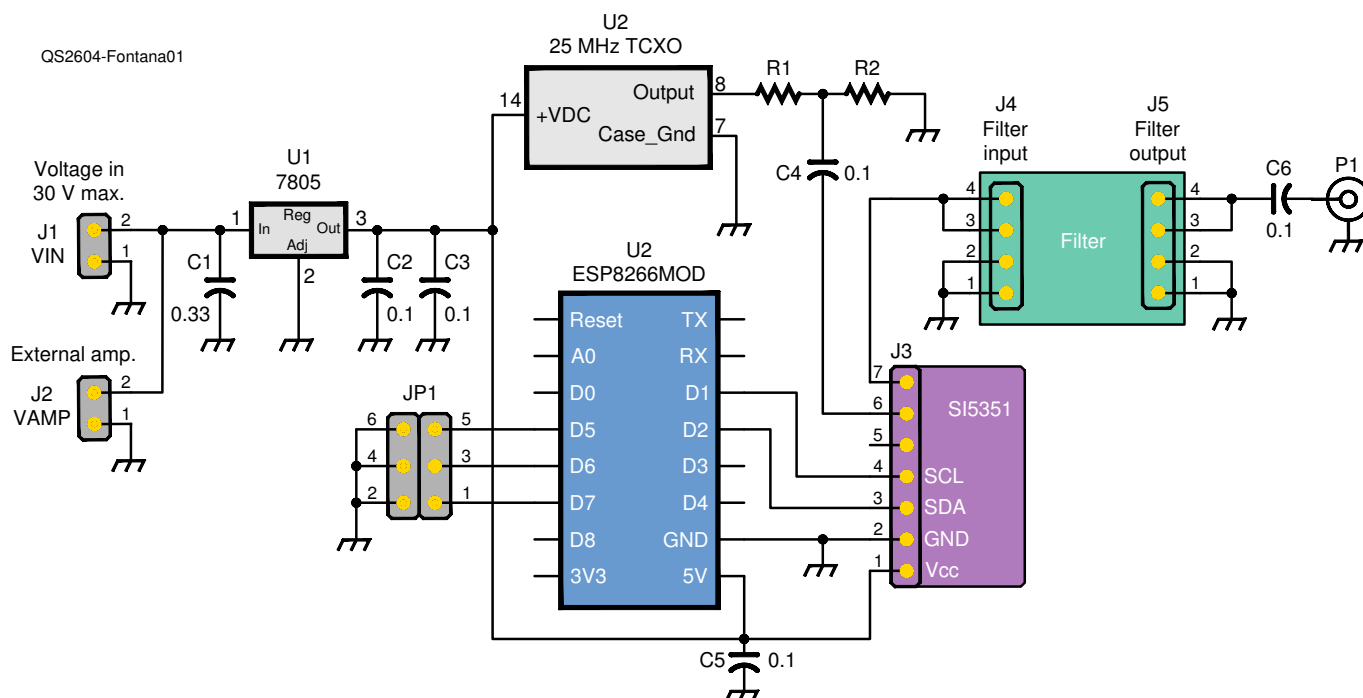


Figure 1 — WSPR transmitter schematic.

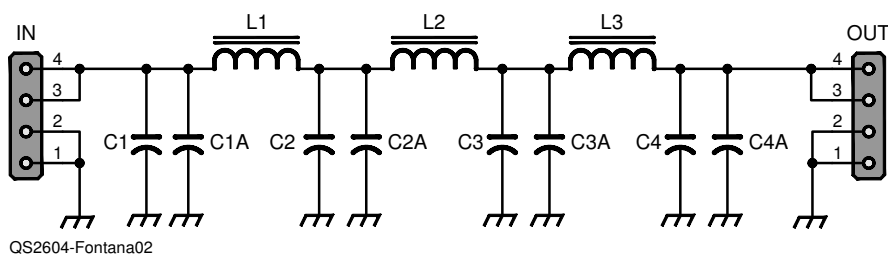


Figure 2 — Plug-in LPF schematic.

Wi-Fi microcontroller that could be configured to run WSPR and Si5351 synthesizer breakout boards. I also wanted a multiband unit without the complexity of switching, so I chose a plug-in filter design for harmonic suppression and used a jumper for band selection.

The assembled unit is shown in the lead photo. The schematic for the transmitter is shown in Figure 1, the schematic for the plug-in low-pass filter (LPF) is provided in Figure 2, and the parts list is shown in Table 1. I designed the printed circuit boards (PCBs) for this project in *Autodesk Fusion 360* and fabricated them with JLCPCB (www.jlcpcb.com). The PCB silkscreen for the transmitter is illustrated in Figure 3, the silkscreen for the plug-in filter is in Figure 4, and the complete Gerber files can be found at www.arrl.org/qst-in-depth.

After building a prototype for the project, I ran across the first problem: the Si5351 synthesizer boards use an inexpensive 25 MHz crystal for reference, which does not have short-term stability for generating narrowband WSPR tones at frequencies of higher than about 12 MHz. Others who have used this board have noted this as well, and it is obvious when watching the waterfall display of the transmitted waveform. The unit needed to be capable of at least 28 MHz in order for our Technician-class licensees to operate on the 10-meter band, so I needed to improve upon this stability.

Fortunately, the Si5351 can be driven by an external oscillator. This requires the onboard 25 MHz crystal to be removed and the Si5351 to be connected to the external reference oscillator, typically through a resistive divider network to limit the input signal to the synthesizer. I describe how I did this in the accompanying article at www.arrl.org/qst-in-depth. To achieve the needed frequency stability, I used

a separate temperature-controlled crystal oscillator. This added around \$8 to the overall project cost, but it handily solved the issue.

The WSPR unit can operate on any frequency from 2200 (136 kHz) to 10 meters (28 MHz) with the existing components. To guarantee that the harmonic content from the unit satis-

fies FCC spectral purity constraints, the output from the synthesizer (which is nominally a square wave) is followed by a seven-pole Chebyshev LPF. To eliminate the requirement for elaborate band switching to a series of LPFs, the design incorporates a plug-in LPF designed specifically for your desired frequency. You can change the frequency by setting a jumper on the board and plugging in the appropriate LPF.

How It Works

You must upload a software application called *WSPR_WiFi.ino* into the ESP microcontroller using the Arduino IDE tools on your computer. When the unit is turned on for the first time, it appears as a wireless access point on your computer or mobile device's Wi-Fi screen and transmits a service set identifier (SSID) named **WSPRSETUP**. When you select it, it presents a dialog box, allowing you to enter your Wi-Fi network parameters (SSID and password), call sign, grid square, and power level (see Figure 5).

The unit synchronizes to the newly selected wireless access point once you fill in all of the necessary parameters. It then sends an inquiry data packet to an internet-based time server (e.g., <https://time.gov>). In turn, the time server sends back the current time within ± 100 milliseconds as the number of seconds past January 1, 1900. The microcontroller takes this information, determines when the next even 2-minute time

Table 1 — WSPR Transmitter Parts List

Qty.	Designator	Description	Source
1	C1	0.33 μ F/35 V tantalum capacitor	Mouser 581-TAP334M035SCS
5	C2, C3, C4, C5, C6	0.1 μ F/50 V ceramic capacitor	Mouser 594-K104K15X7RF5TH5
2	J1, J2	Two-position (0.1-inch spacing) header	AliExpress
1	J3	Seven-position (0.1-inch spacing) header	AliExpress
2	J4, J5	Four-position (0.1-inch spacing) header	AliExpress
3	JP1	2 $\times$ 3 (0.1-inch spacing) double header pin header jumper blocks	AliExpress
1	P1	SMA female end-launched PCB connector	N/A
2	R1, R2	See www.arrl.org/qst-in-depth	N/A
1	U1	5 V regulator L805CV	Mouser 511-L7805CV
1	U2	25 MHz TCXO ± 0.1 parts per million	AliExpress
1	U3	D1 mini NodeMCU ESP8266 ESP-12	AliExpress

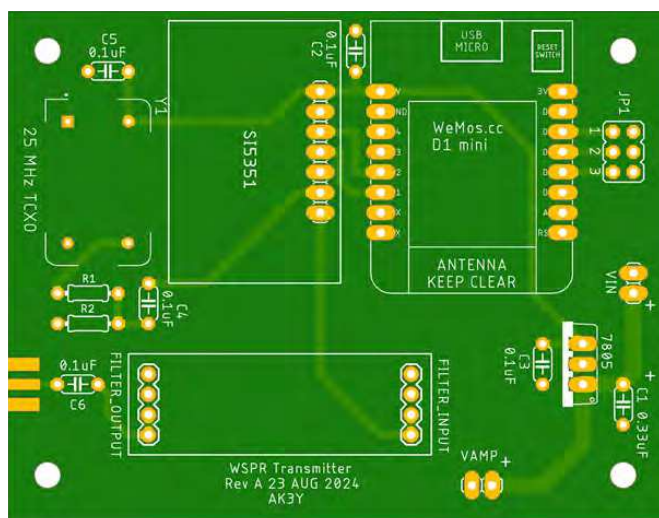


Figure 3 — Silkscreen for the WSPR transmitter PCB.

slot will occur, and sets up the Si5351 to start generating the 4-ary FSK (four distinct frequency tones used for encoding symbols) WSPR signal from that point. The unit then waits a complete 2-minute cycle, and the process repeats, essentially transmitting for 2 minutes every other cycle. How often the WSPR transmitter will transmit is adjustable in the application configuration files.

If you want to change any of the transmission parameters (e.g., if I want to operate in France as F/AK3Y or as a portable station, AK3Y/5, etc.) or move to another Wi-Fi network, double-press the **RESET** button on the microcontroller to put the unit back into wireless access point mode, and add the new parameters. This process is often referred to as *Wi-Fi on demand*. The new parameters are stored in the microcontroller's non-volatile flash memory (emulating a conventional EEPROM).

The complete details of the circuit design, the Gerber files for the PCBs (WSPR transmitter and plug-in filter modules), and the software can be found at www.arrl.org/qst-in-depth.

Club Project Notes

When designing this as a club project, I considered the very wide range of members' experience levels. Most had no problems with soldering through-hole compo-

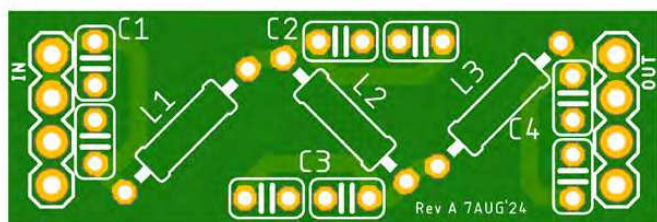


Figure 4 — Silkscreen for the plug-in LPF.

nents; several had programming experience and easily tackled uploading code to the unit. However, a few had slight difficulties with either soldering or using programming tools. To tackle this diversity in skills, I proceeded as follows:

Modify the Si5351

I modified each Si5351 breakout board to remove the 25 MHz crystal and add the necessary jumper. This would have been difficult for those with no experience with surface-mount device part removal. A few tackled this on their own without any problems, but I thought it best to supply this modified board to minimize potential problems. A steady hand and some magnification are all that are required.

Include 10- and 30-Meter Filter Parts

I kitted each of the units with all of the components and PCBs needed to make the project. These included all of the mini PCBs, toroids, capacitors, and even hook-up wire for making two plug-in filters: one for 10 meters and a second for 30 meters. Because of the steep skirts on the seven-pole LPFs, the 10-meter filter was also fine for 17, 15, 12, and 10 meters, while the 30-meter filter was good for both 40 and 30 meters. This gave participants a smorgasbord of bands to try out with minimal construction effort, and the 10-meter filter satisfied the desire to get our Technicians on the air.

Program in Advance

As I designed the software using Wi-Fi on demand, there was no need for any custom information to be added to the source code prior to programming the microcontroller. This made it possible to program the ESP8266 modules in advance and provide these programmed units to members who did not want to get involved with the microcode. Interestingly, most members wanted to learn more about coding, so they did this step themselves.



Figure 5 — Wireless access point data entry dialog box.

WSJT-X SuperCW Mode

WSJT-X release candidate 4.1 adds 150 WPM CW functionality.

Frans Thomas Eyt, KA1FTE

The developers of *WSJT-X* have announced release candidate *WSJT-X* 4.1.0-rc1. The candidate release for *WSJT-X* 4.1 is a major revision offering many new features and capabilities, the most important being the addition of an entirely new mode: “SuperCW.”

Introducing SuperCW

The addition of SuperCW to *WSJT-X* exemplifies technical innovation at its finest. Years of development and testing have resulted in a CW mode that is virtually indistinguishable from CW sent manually.

Taking advantage of the framework already in place for FT8 and FT4 exchanges, SuperCW follows the same exchange protocol, with station 1 calling CQ with their call sign and grid square, a responding station 2 answering with a call sign and grid square, then the

exchange of signal reports, and finally the traditional “73” and a “dit dit” to complete the contact. The true advantage of SuperCW over other modes is the speed at which this exchange can occur — because CW can be sent much faster than FT8, contacts happen in a fraction of the time.

Also, unlike other digital modes, SuperCW mode is not required on both sides of the exchange; someone using the client application can contact any station using CW. However, when the application is used on both sides of the exchange, speeds that were never before thought possible are achievable in even the worst of propagation conditions.

Features

Here is an overview of the many advanced features of the new SuperCW mode (see Figure 1).

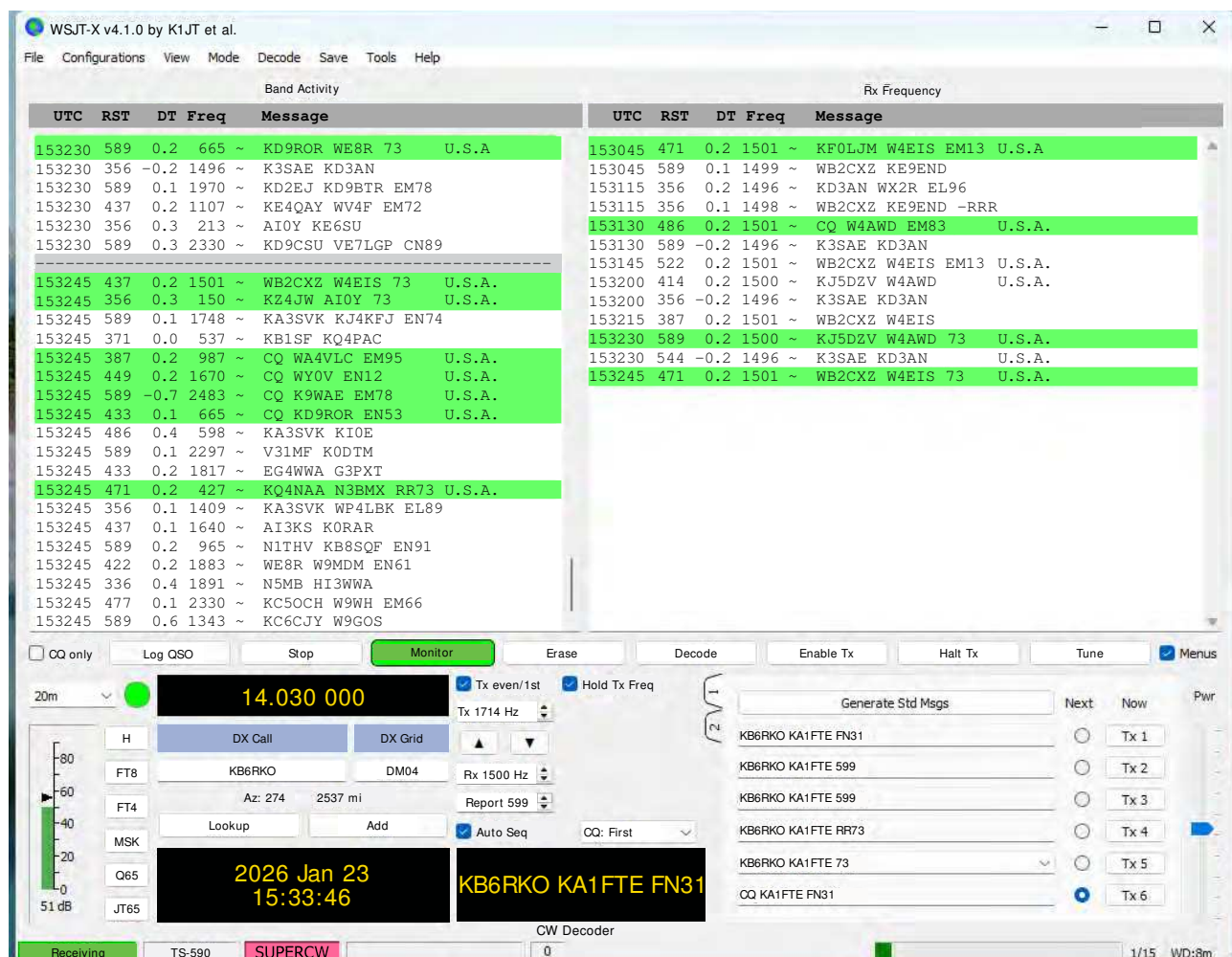


Figure 1 — *WSJT-X* rc 4.1 main window.

Frequency Selection: The *WSJT-X* pull-down menu now includes SuperCW, with the frequencies for the CW portions of the band saved in the menu. For example, when selecting 20 meters, SuperCW mode, the CAT control will tune your receiver to 14.035 MHz, covering 14.030 MHz to 14.070 MHz. The waterfall can be adjusted to show that span of the spectrum, and green and red markers that FT8 operators are familiar with will operate similarly, allowing you to select receive and transmit frequencies. Audio filtering will follow the received frequency marker to isolate that station from the rest of the stations in the waterfall.

Decode Screen: The new CW decode screen will respond to and decode the signal in the waterfall below the green marker. On-board artificial intelligence will filter the received audio to eliminate noise and fill in missing characters, similar to autocorrect on a mobile phone. If a signal is noisy and characters are lost, the auto-complete feature will make the best suggestion. With access to the worldwide database of amateur operator licenses, by process of elimination it can auto-complete a call sign if a character is missed.

Automatic Speed Adjustment: SuperCW mode will send a short FSK tone burst at the beginning of each CQ call to allow others using SuperCW mode to know that they are communicating with a *WSJT-X* client. If so, speed is automatically adjusted for the highest rate possible to complete the exchange in the fastest amount of time. Speeds of up to 150 WPM are achievable, though path conditions will regulate just how fast. Using the relative signal-to-noise ratio (SNR) calculations already built into *WSJT-X* to calculate FT8 signal reports, the SNR-WPM chart in Table 1 shows how SuperCW mode speeds will be adjusted based on received SNR figures. If the far-end station is not using *WSJT-X*, then the application will automatically adjust send speed to match.

Automatic Signal Reports: Because *WSJT-X* can already calculate SNR, Readability, Signal, and Tone (RST) signal reports can be derived from the CW audio and the relative band noise levels of the station being received. No more 5NNs — now, you'll be able to send a true "356" or "212" and know that it's been determined by the most advanced algorithms available.

"Fist" Selection: To acknowledge those who may frown upon the automation of CW, with the help of an artificial intelligence large language model, hours of live CW from around the world were recorded to create a

**Table 1 — SuperCW Mode WPM
Based on Received Signal Strength**

Signal Strength	Received Power (dBm; $Z_c = 50 \Omega$)	WPM
S1	-121	5
S2	-115	7
S3	-109	10
S4	-103	30
S5	-97	50
S6	-91	75
S7	-85	110
S8	-79	130
S9	-73	150
S9 +10	-63	150
S9 +20	-53	150
S9 +30	-43	150
S9 +40	-33	150
S9 +50	-23	150
S9 +60	-13	150

regionalized database storing "fists." This database will allow users to emulate the sound of a particular "fist" with a simple pull-down menu selection. For example, if you would like to sound like a CW operator in Italy using a paddle, you can select Italy->Paddle, and anyone listening would be unable to tell the difference between SuperCW and an actual operator in Italy. All countries are represented in the database, and selections for the sending device emulator include straight key, paddle, and bug.

SuperFox Integration: SuperCW can be used with SuperFox for those running DXpeditions. SuperFox-SuperCW mode will allow CW to be transmitted from the fox station to nine separate hounds at once, allowing the DXpedition to answer that many stations simultaneously. Because transmit speeds must be synchronized during the transmission of nine signals at once, the DXpedition needs to determine what fixed speed to set at the start of their event, and hunting stations will need to match that speed.

CW Spotting: Finally, when operating in SuperCW mode, *WSJT-X* will post the stations it receives to the Reverse Beacon Network and PSKReporter.

The new release candidate will be available to download on April 1, 2026.

Frans Thomas Eyt, KA1FTE, has been active in weak-signal digital experimentation on HF and VHF for more than 4 decades. His interests include time-synchronized decoding techniques, low-SNR communications, and the practical integration of legacy operating modes into modern software-defined frameworks. He participates in several informal digital-mode development groups.

The Launch of the Clean Signal Initiative



The work toward clean HF transmit signals starts now.

George Spatta, W1GKS
ARRL Laboratory Manager

This month marks the official launch of ARRL's Clean Signal Initiative (CSI) and its integration with *QST* Product Review. For decades, HF receiver performance has steadily improved, while transmitter cleanliness has not kept pace. The result has been a long period of CW key clicks, SSB splatter, and excessive composite noise on the HF bands.

The CSI program, conceived by Mike Ritz, W7VO, and Ward Silver, N0AX, was developed by ARRL Lab staff, respected RF experts, and engineers from several manufacturers. All worked to agree on a set of transmitter performance benchmarks that we hope will encourage HF radio manufacturers to improve their designs, thereby closing the performance gap. By introducing clear standards for transmitter signal purity and focused efforts to better educate operators, ARRL is working toward ensuring that modern amateur transmissions occupy no more bandwidth than necessary, improving the experience for everyone on the air. For more information on the origins of CSI and the formation of its Working Group, see "The ARRL Clean Signal Initiative" by Ritz in the June 2023 issue, and "ARRL's

Clean Signal Initiative Adopts Metrics for Transmitter Performance" by the CSI Working Group in the May 2024 issue.

Overview

The ARRL Lab is central to the CSI program; it will be the *only* lab that can certify a device as being CSI compliant. Devices will need to meet three benchmarks. CSI *badges*, or emblems displayed next to the pertinent test results in each relevant review's Table 1 (see Figure 1), will indicate which devices have met CSI criteria. The overall rating is as follows: gold for meeting all three benchmarks, silver for meeting any two, or bronze for meeting one. Badges (see Figure 2) will appear near the title of the review. If a transmitter does not comply with any of the three CSI benchmarks, no reference to CSI will be made in the review, though the maximum acceptable levels (masks) will still be visible in the relevant graphs. The exception is if a device fails a benchmark by a small enough margin. For example, if there is a difference of 1 dB on one band, it will technically not achieve CSI compliance, but we will point this out in the review's "Lab Notes" sidebar. A device that is that close to earning a badge will still be considered a good performer deserving of a mention. Manufacturers of CSI-certified devices may use the associated graphics on their website, promotional materials, and packaging of the compliant device.

Starting with this issue of *QST*, you will notice some changes and additions to what the Lab reports in Product Review. These changes are discussed in the following sections and summarized in the sidebar, "QST Product Review Changes."

Spurious signal and harmonic suppression: ≥ 50 dB HF band, > 66 dB 50 MHz band	
HF: typically, > 70 dB; worst case, 18 MHz, -52 dB; 50 MHz: > 66 dB	
Complies with FCC emissions standards.	
Transmit IMD products: Not specified.	
Order: 3rd 5th 7th 9th	
CSI Limit: $\leq -36/-42$ $\leq -42/-48$ $\leq -48/-54$ $\leq -54/-60$	
1.8 MHz $-57/-63$ $-67/-73$ $< -79/-85$ $< -79/-85$	
3.5 MHz $-58/-64$ $-67/-73$ $< -79/-85$ $< -79/-85$	
5.3 MHz $-55/-61$ $-65/-71$ $< -79/-85$ $-71/-77$	
7 MHz $-55/-61$ $-70/-76$ $< -79/-85$ $-77/-83$	
10 MHz $-58/-64$ $-65/-71$ $-73/-79$ $-75/-81$	
14 MHz $-51/-57$ $-63/-69$ $-65/-71$ $-72/-78$	
18 MHz $-48/-54$ $-54/-60$ $-63/-69$ $-65/-71$	
21 MHz $-54/-60$ $-60/-66$ $< -79/-85$ $-71/-77$	
24 MHz $-53/-59$ $-65/-71$ $-71/-77$ $< -79/-85$	
28 MHz $-51/-57$ $-59/-65$ $-71/-77$ $-74/-80$	
50 MHz $-55/-61$ $-60/-66$ $-70/-76$ $< -79/-85$	
@ 100 W PEP, DPD on:	
14 MHz $-47/-53$ $-62/-68$ $-67/-73$ $-72/-78$	
6 – 48 WPM; iambic mode A&B.	
See Figures A and B.	
Transmit-receive turnaround time (PTT release to S-9 signal, AGC fast, SSB: 37 ms.	
S-9 signal, AGC fast, CW (full break-in): 45 ms	
Receive-transmit turnaround time: Not specified.	
SSB, 67 ms; FM, 12 ms (29 MHz), 11 ms (52 MHz).	
Amplifier key line closure to RF output time: Not specified.	
CW: close, 7 ms; open, 9.2 ms (full break-in); 500 ms (semi-break-in)	
SSB: close, 65 ms; open, 6.7 ms	
Transmit composite noise: Not specified.	
Spacing: 10 kHz 20 kHz 100 kHz	
(dBc/Hz) (dBc/Hz) (dBc/Hz)	
CSI Limit: ≤ -136 ≤ -139 ≤ -142	
14 MHz, 200 W -120 -124 -141	
51 MHz, 200 W -116 -119 -137	
14 MHz, 30 W -117 -121 -135	

Figure 1 — An example of a *QST* Product Review's Table 1 showing CSI badges. These are not actual results; they are for demonstration purposes only.



Figure 2 — Overall rating designations for a CSI-compliant transmitter meeting three, two, or one of the benchmarks.

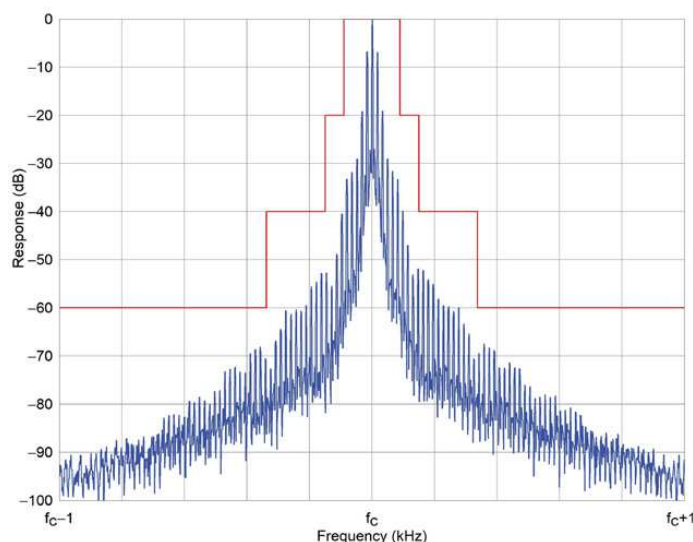


Figure 3 — Spectral plot of a CSI-compliant CW signal. All components of the signal (blue trace) do not exceed the mask (red trace).

CSI Eligibility

For a radio to be considered for any CSI badge, there are two prerequisite provisions. First, the unit must comply with FCC rules for spurious emissions on every band on which it can transmit. Second, the amplifier key-line times (both key down and key up) must prevent the radio from *hot switching* an external power amplifier. Hot switching is when the transmit or receive state of the amplifier changes while RF is still being transmitted. When this happens, the amplified signal occupies a significantly larger bandwidth than it should, causing interference to other users of the band.

The Benchmarks

As determined by the CSI Working Group, three key technical specifications serve as the foundation of CSI's transmitter performance benchmarks: CW bandwidth, two-tone transmit intermodulation distortion (IMD), and composite noise. These metrics were chosen and the benchmarks were formed based on practical on-air observations and rigorous laboratory analysis of modern HF transceivers.

For a radio to be CSI compliant for CW bandwidth and two-tone transmit IMD, it must achieve compliance on every band on which it can transmit. Composite noise must achieve compliance on 20 meters at full power and 30 W (if applicable), as well as 6 meters (if applicable) at full power. Compliance on 20 meters at 30 W describes the typical level required to drive a power amplifier.

Until now, the Lab has graphed certain measurement results on the same band every month to allow for easy product comparisons. Starting with this issue, we

QST Product Review Changes

Starting with this issue of QST, the ARRL Lab will make the following changes to reported data in QST Product Review:

- A newly added Figure A: a transmit two-tone IMD graph of the worst-performing band referenced to dBc.
- In the transmit “Two-Tone Intermodulation Distortion (IMD)” section of the “Key Measurements Summary,” the unit of measurement will be changed to dBc.
- A Figure C CW bandwidth graph will be of the worst-performing band.
- The “Transmit Keying Sidebands” section of the “Key Measurements Summary” will show the maximum and minimum values for the power of keying sidebands in each of the three CSI mask bandwidths for the worst-performing band.
- A “Transmit Composite Noise” section will replace the “Transmit Phase Noise” section in the “Key Measurements Summary.” It will show the maximum and minimum values for the composite noise power in the two CSI mask bands for the transmitter at full power on 20 meters.
- Figure D will display composite noise, and phase noise and amplitude noise graphs will be available at www.arrl.org/qst-in-depth.
- The “Audio Output” section of the “Key Measurements Summary” will be removed. Audio level comparisons are subjective, so we feel this is no longer needed. We will continue to verify the manufacturer's specifications in Table 1.
- When testing a direct-sampling software-defined radio, where there is no observed blocking, an ADC overload level will be reported in its place.

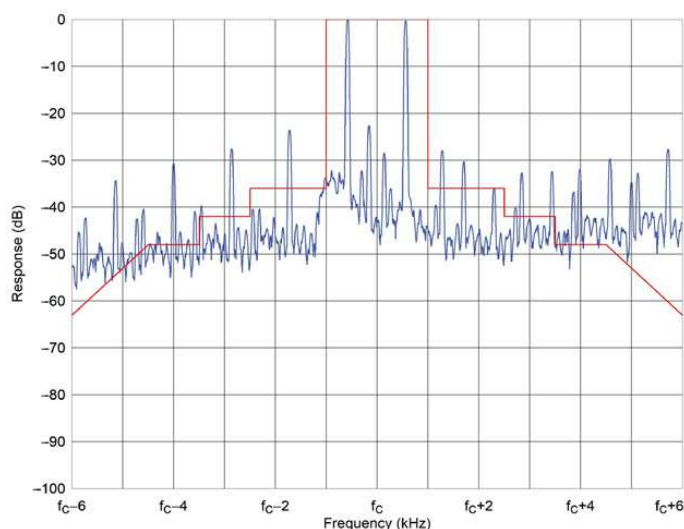


Figure 4 — Spectral plot of a non-CSI-compliant transmit IMD signal. Many components of the signal up to the 11th-order product (blue trace) exceed the mask (red trace).

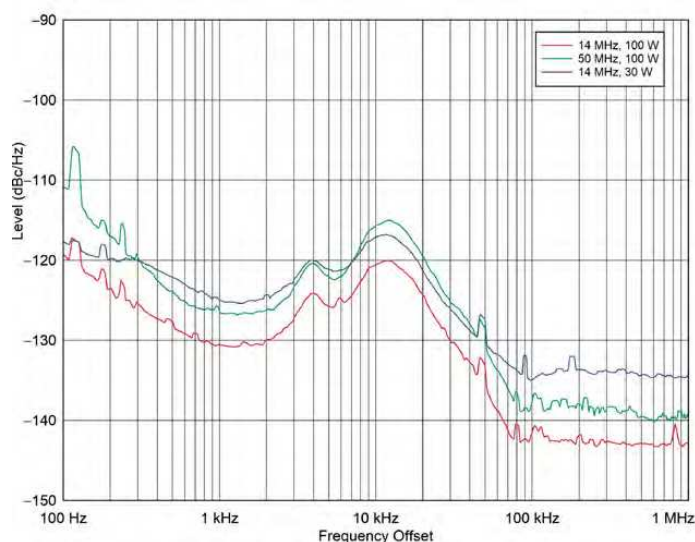


Figure 5 — Example results using data from Table 1 in this article, showing a non-CSI-compliant composite noise graph. All results are higher than the acceptable CSI levels listed in Table 1. These results are for demonstration purposes only.

Table 1 — Example Transmit Composite Noise Results

	10 kHz	20 kHz	100 kHz
Spacing:	(dBc/Hz)	(dBc/Hz)	(dBc/Hz)
CSI Level:	≤ -136	≤ -139	≤ -142
14 MHz, 100 W	-120	-124	-141
51 MHz, 100 W	-116	-119	-137
14 MHz, 30 W	-117	-121	-135

will instead publish a graph of the data from the band displaying the worst-case CW bandwidth and transmit IMD measurements. We will still report data for applicable bands in numerical form in the review's Table 1. We will also provide graphs of the data for all bands at www.arrl.org/qst-in-depth.

CW Bandwidth

Figure 3 is an example of a CSI-compliant CW bandwidth graph displaying the transmitter output (blue trace) ± 1 kHz from the carrier. The red trace represents the mask for any signal relative to the carrier for CSI compliance. A CSI-compliant CW signal must fall entirely beneath the masks at all frequency offsets and at full output power, while keyed at 40 WPM and with QSK enabled at every available rise-time setting. These thresholds (-20 dBc at 180 Hz, -40 dBc at 300 Hz, and -60 dBc at 675 Hz) ensure that key clicks are significantly attenuated and do not interfere with nearby spectrum, even during contests or crowded band conditions.

Two-Tone Transmit IMD

The IMD mask in the newly added two-tone transmit IMD graph (see Figure 4) limits third-, fifth-, and seventh-order distortion products to -36 dBc, -42 dBc, and -48 dBc, respectively. Higher-order products must exhibit a 6 dB slope, with no product down to the 11th order being worse than that by more than 4 dB. Transmitters that produce IMD products below these limits

will generate SSB signals that are much narrower and cleaner than what many transceivers have produced over the past decades. Some recent designs implementing varieties of predistortion have been effective at reducing transmitted IMD.

Composite Noise

Composite noise, comprising phase and amplitude noise components, is the third benchmark adopted by CSI. Composite noise will be measured and graphed on 20 meters at both full power and 30 W, as well as on 6 meters at full power (if applicable). To be CSI compliant, the measured values at specific spacings from the carrier must be less than -136 dBc/Hz at 10 kHz, -139 dBc/Hz at 20 kHz, and -142 dBc/Hz at 100 kHz. Table 1 in this article and Figure 5 show an example of a transmitter that does not achieve CSI compliance; all results are higher than the acceptable CSI limits. Due to the X-axis log scaling of the composite noise graph, a mask trace between 10 and 100 kHz will not be easy to see. So, we will be reporting the actual composite noise numerical data in the review's Table 1 in addition to graphing out to 1 MHz from the carrier. For anyone who wishes to see only the phase noise component for historical comparison, we will provide graphs at www.arrl.org/qst-in-depth displaying the phase, amplitude, and composite noise data for both bands.

Currently Available Products

Starting with this issue, every HF transceiver tested in QST Product Review will be evaluated for CSI compliance. There are many products on the market that we have already tested, so under certain conditions and at their expense, manufacturers may provide us with a previously reviewed device for CSI compliance testing. Manufacturers will need to contact the Lab to initiate this process, as we will not be looking at past reviews for devices that may be candidates for CSI compliance. We will re-test only for the CSI benchmarks and link any badges/rating to the original review. The Lab's priority will be testing new transceivers, so we will accommodate requests on a first-come, first-served basis and fit them into our schedule as time allows.

Looking Ahead

The standards that the CSI Working Group has developed, coupled with ARRL's testing and badge program, provide guidelines and incentive for transceiver manufacturers to design their equipment to transmit cleaner signals. The ARRL Lab remains committed to providing support to manufacturers and operators to help create a cleaner, more enjoyable HF spectrum. See future issues of QST for more technical articles and videos from the Lab in support of the Clean Signal Initiative.



Product Review

Icom IC-7760 MF/HF and 6-Meter Transceiver

Reviewed by Mark Wilson, K1RO
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Icom's high-end IC-7760 offers excellent performance and a wide range of features in an innovative package. The RF deck is a large black box bristling with connectors. It's connected to a separate control head through an Ethernet cable. The control head is just about the same height and width as the IC-7610, and the IC-7760 is similar to that radio in look and feel. The IC-7760 covers 160 through 6 meters with two independent, high-performance receivers and a 200 W transmitter rated for continuous duty. The transmitter features digital pre-distortion (DPD) technology for an exceptionally clean SSB signal, even at full power.

Operating modes include USB/LSB, AM, FM, CW, PSK, and RTTY. FT8/FT4 and other data modes are supported via the integrated USB port. Receive coverage is continuous from 30 kHz to 60 MHz. The 60-meter channels can be programmed into memories.

Documentation and Firmware

Icom includes a printed *Basic Manual* with the radio. This 100-page document includes everything you need to set up the IC-7760 and use it on the air on a variety of bands and modes. A 124-page *Advanced Manual* and other documents are available online (see <https://icomamerica.com/support/manual/?keyword=ic-7760>).

There have been several firmware updates since the IC-7760's introduction, with firmware files and a PDF document detailing the changes available online. Version 1.13 was released during the review period. It took just a few minutes to download the file and instructions, transfer the new firmware to an SD card, and follow the instructions on the radio's **FIRMWARE UPDATE** screen to perform the update. I backed up my current radio settings to the SD card before performing the update.

Initial Setup

In addition to the RF deck and controller, the IC-7760 package includes a desktop stand for the controller head, a 3-meter Ethernet cable, an ac power cable for the RF deck, and connectors for the CW key and acces-



sory jacks. The RF deck includes an ac power supply, while the control head has its own small 15 V dc power supply.

The RF deck weighs about 35 pounds, and the control head is about 5 pounds. Once everything is connected, you don't need to touch the RF deck, so I placed it on a small stand underneath my operating table and connected it to the control head using the supplied cable. If needed, you can use a longer Ethernet cable or connect the RF deck and control head through a home network.

I have Wi-Fi extenders with Ethernet ports in my basement station and in my second-floor office. Both communicate with a router and fiber internet interface on the first floor. I plugged the IC-7760's controller into the extender in my office and connected the RF deck into the one in the basement. The transceiver's networking menus and the instruction manual show a lot of different options and settings for different situations. I just used the default settings and enabled **THE ROUTE INCLUDES WIRELESS LAN**. I was able to make contacts and monitor a needed DXpedition while working in my office.

Bottom Line

The IC-7760 direct-sampling transceiver is a fully featured, high-performing HF and 6-meter radio. Its innovative two-piece packaging offers flexibility for local or remote station configuration, and its DPD technology creates exceptionally clean SSB signals.



Figure 1 — The IC-7760 controller rear panel.

The IC-7760 was designed with remote operation in mind. It can be operated over the internet using up to five controllers (RC-7760 controllers are available separately). The IC-7760 can also be operated with Icom's *RS-BA1* remote-control software or other remote-control software. There's a lot of information about this available for download from Icom's website. See the *Advanced Manual*, the *IC-7760 Technical Report*, and the *IC-7760 LAN & Remote Connection Update*.

Control Head

The control head's front panel includes a high-resolution touchscreen and all of the controls for operating the radio. A smaller "sub screen" supplements the main screen. I thought that the control head stand could be improved with some way to adjust the tilt for a better viewing angle on the screen and front-panel controls.

A microphone and headphones connect to the front panel. The rear panel (shown in Figure 1) has connectors for external speakers for each receiver, as well as audio line in/out jacks.

You can connect a paddle for the internal CW keyer or an external keying device here or to the RF deck. The **SEND** jack can be used to control a power amplifier or other external device. The **EXT-KEYPAD** jack is for an external keypad to control transmit message memories.

A USB-B port is available for connecting a PC. After

installing a USB driver from Icom's website, look in your PC's **DEVICE MANAGER** screen under **PORTS (COM & LPT)** for **IC-7760 SERIAL PORT A (CI-V)** and **IC-7760 SERIAL PORT B** to find COM port numbers to use with your software. I had an older version of Icom's USB driver on my computer for my IC-7300. This driver worked with the IC-7760, but the COM port labels didn't display properly. Updating the driver to the latest version took just a few minutes.

The controller also has two USB-A ports that can be used for connecting a keyboard, mouse, USB flash drive, or Icom's optional RC-28 remote encoder. If you have more than two USB devices, you can use a USB hub.

The **EXT DISPLAY** jack is a DVI-D connector for using an external monitor to show the contents of the IC-7760's main display. I tried it with a 20-inch widescreen computer monitor with good results. Many of today's monitors use HDMI and/or DisplayPort interfaces instead of DVI-D, but adapter cables are readily available.

RF Deck

The RF deck's rear panel (see Figure 2) includes four SO-239 antenna jacks. You can select antennas manually using the **ANT** button on the touchscreen, or use the **ANTENNA** screen to save selections for each band.



Figure 2 — The IC-7760 RF deck rear panel.



Figure 3 — The IC-7760 controller is about the same height and width as the IC-7610.

You can temporarily override automatic selections by touching the **ANT** button on the display. Temporary selections are indicated by a yellow star.

There's an **RX-ANT IN** BNC jack for use with a separate receive antenna, and that can be paired with **RX-ANT OUT** for a band-pass filter or preamplifier in the receive path. A long press of the **ANT** button on the display switches between listening with the main antenna or receive antenna.

The transverter (**X-VERTER**) jack is menu-enabled to provide a low-level transmitter output and receiver input. **REF IN** is for connecting an external 10 MHz reference signal. The **TUNER** connector below the **REF IN** jack is for an external automatic antenna tuner such as Icom's AH-730. (If you enable the external tuner in the menus, power output is limited to 100 W on **ANT1** to avoid damaging the external tuner.) The **REMOTE** jack is for providing CI-V frequency information to an external device such as Icom's IC-PW2 amplifier.

The RJ-45 connector labeled **CONTROLLER** is for the control head cable. The other, labeled **LAN**, is for connection to the control head through a local area network or for remote control using Icom's *RS-BA1* software or the radio remote head.

The **KEY** jack is for connecting a straight key, external CW keyer, or other keying device. I connected my computer keying output to this jack and connected a paddle for the internal memory keyer to the **ELEC-KEY** jack on the controller and used both options interchangeably.

Automatic level control (**ALC**) and transmit/receive switching (**SEND**) are for connecting a non-Icom amplifier. For the **SEND** jack, you can choose to use reed-relay (16 V 500 mA maximum) or solid-state switching (250 V 200 mA maximum). Both options offer silent

amplifier switching. The **TX DELAY** menu introduces a delay of 10 to 30 milliseconds between the time the amplifier control switches and RF output appears at the IC-7760 antenna jack. This delay allows time for amplifier relay contacts to engage before the radio starts to transmit.

The eight-pin DIN **ACC1** jack provides connections for digital mode

operation as an alternative to using the USB connection. This jack includes an FSK RTTY keying input, PTT control, fixed-level audio input and output for sound card digital modes, and other functions. The seven-pin DIN **ACC2** jack is primarily for interconnecting an Icom PW1 or PW2 linear amplifier.

The USB-B port could be used to output in-phase/quadrature (IQ) data for use with the free HSDR software-defined radio application running on a PC (see www.hdsdr.de). Icom's website offers a comprehensive PDF document for setting up and using HSDR with the IC-7760.

Controls and Display

The control head shown in Figure 3 looks similar to other Icom transceivers from the current generation. I have an IC-7300, and even though the IC-7760 does much, much more, I was able to navigate its front panel and menus right away. The transceiver has a long list of features and settings, but Icom has done a great job of organizing and labeling the menus so that it's usually not difficult to find what you're looking for.

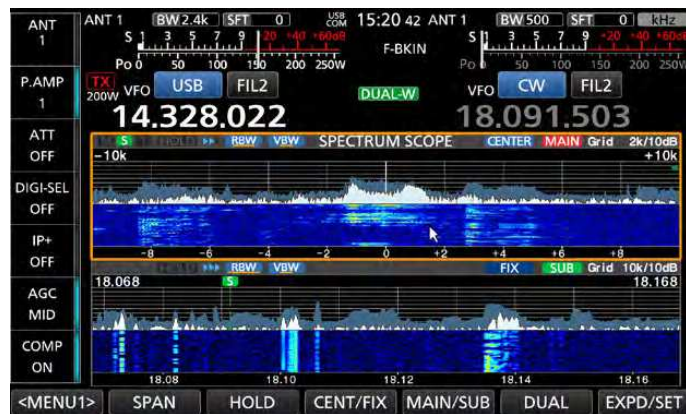
Main Display

The high-resolution touchscreen display is beautiful. Although it's densely packed with information and on-screen buttons, I found it highly readable. Brightness, frequency display font, and screen-saver options are adjustable.

On-screen buttons along the left side offer quick access to often-used features such as antenna selection and preamp/attenuator settings. Press the **MULTI** knob to pop up a menu for settings such as transmitter power, CW keyer speed, or mic gain. Press the hardware **FUNCTION** button below the display to pop up a screen for the notch filter, VOX, noise reduction, and other



4A



4B

Figure 4 (A and B) — The IC-7760 controller main screen. At (A), the main band is set to 17-meter SSB while the sub band is idling on 20-meter SSB. This view shows the beautiful simulated analog meters and a large band scope with good detail. At (B), the transceiver is in dual-watch mode, listening on 20-meter SSB and 17-meter CW simultaneously. The top band scope is for the main (left) receiver and is set to center mode looking at 10 kHz above and below operating frequency. The lower band scope, for the sub band, is in fixed mode and shows the entire 17-meter band. The main band controls the transmitter, but the main and sub bands can be swapped instantly using the **CHANGE** button on the front panel.

features. Button functions are tailored to the operating mode.

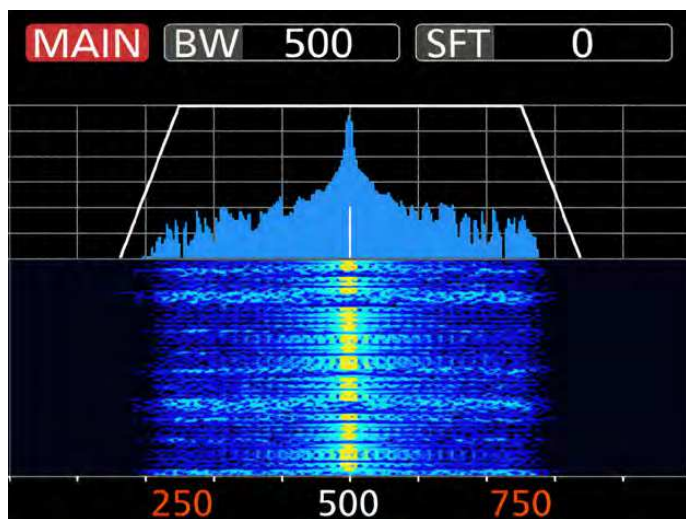
The main display splits the top section of the screen between the two receivers, called the main and sub bands. You can see key information at a glance. Icom does a great job with the simulated analog meters, but you can also choose a horizontal (“edgewise”) meter presentation or a bar graph. The meter presentation changes automatically to edgewise or bar graph when other features require screen space. Another selection shows all of the metering parameters simultaneously.

Band Scope

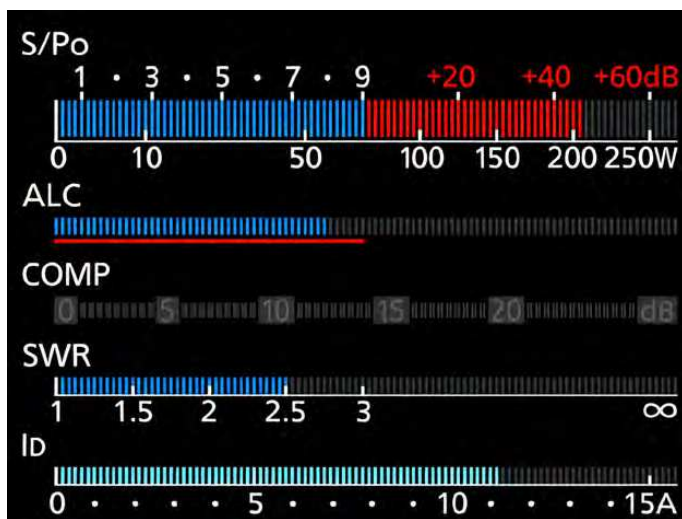
The IC-7760’s band scope offers several options (see Figure 4). You can view the spectrum scope alone,

a combination spectrum scope/waterfall, or a larger (expanded) spectrum scope/waterfall. A compact version of the band scope displays when other windows are active. You can touch the screen or use a mouse to select signals in the band scope, and the transceiver will tune there. I found using the mouse to be much more precise. Note that the mouse works only within the band scope and not other areas of the screen.

The **FIXED** display mode allows you to set up four fixed frequency ranges for each band and select among them using the **SPAN** control. The **CENTER** mode keeps the cursor in the center and moves the display within a span of ± 2.5 to ± 500 kHz of the center frequency. In the **CENTER** mode, waterfall signals smear as the display moves, but that can be minimized by using a



5A



5B

Figure 5 (A and B) — The sub screen **FILTER EFFECT** setting makes it easy to tune signals to the center of the filter passband (A). The multifunction meter setting (B) is useful for monitoring several transmitter parameters at a glance.

faster sweep speed. Enabling the **SCROLL** mode for either **FIXED** or **CENTER** mode automatically adjusts the frequency range up or down as you tune. Different color markers show the main and sub band frequencies and the transmit frequency. That's handy when trying to find a clear transmit frequency during split operation.

Touching the **MAIN/SUB** button switches the band scope between the main and sub receivers. Touching **DUAL** displays a separate, smaller band scope for each receiver. You can display the two band scopes horizontally or side by side.

I often used the band scope in **FIXED** mode with **SCROLL** enabled to focus on the band segment of interest or to look for any activity on a quiet band. With lots of signals on the air, I tended to use **CENTER** mode with **SCROLL** set to a narrow frequency range for more detail.

From the **MENU** screen you can enable an audio scope that displays two views of the waveform of received and transmitted signals. One scope display is similar to a spectrum analyzer, and the other is similar to an oscilloscope.

Sub Screen

A small touchscreen to the right of the main display has several useful functions. Push the **SUB DISP** button below the screen to scroll through the choices. Most of the time I used the sub screen to display a virtual band switch. Touch a band button to change bands, and touch again to cycle through three band-stacking memories. Press **F-INP** to enter a frequency directly, or press **GENE** to enter general-coverage receiver mode. The **MPAD** button next to the **SUB DISP** button is a quick-access memo pad that stores five or 10 frequencies, along with modes and filter settings.

The sub screen **FILTER EFFECT** selection displays a close-in view of the selected receive filter(s) in relation to signals in the passband (see Figure 5). You can visually tune a signal to the center of the passband or see the effects of IF and notch filter settings or passband tuning (PBT) adjustments. The third sub screen choice is another meter similar to the one on the main screen.

Receiver

The IC-7760 has two independent receivers with identical features and performance. ARRL Lab test results are shown in Table 1. Like Icom's other recent transceivers, the IC-7760 is based on a direct-digital sampling architecture. The analog-to-digital conversion (ADC) happens at signal frequency. To help prevent overloading the ADC, the IC-7760 uses 15 sharp band-

pass filters in the front end to reject out-of-band interference.

The radio also offers a digital preselector (**DIGI-SEL**) as an additional tool to prevent ADC overflow from out-of-band signals. With **DIGI-SEL** on and the preamp off, the preselector is placed in front of the band-pass filters for best interference rejection. With the preamp on, the preselector is placed after the preamp and band-pass filters for best sensitivity.

The two receivers can operate on the same band, or on different bands and modes. Using the dual-watch (**DUAL-W**) feature, you can listen to both receivers at the same time. You can only transmit on the main band except during split-frequency operation. Pressing the **CHANGE** button toggles frequency, mode, and other settings between the main and sub bands. Push the **SPLIT** button and the transceiver transmits on the sub-receiver frequency. A long press of that button equalizes the settings of the two receivers.

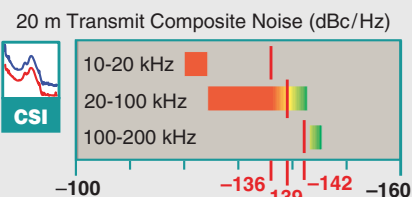
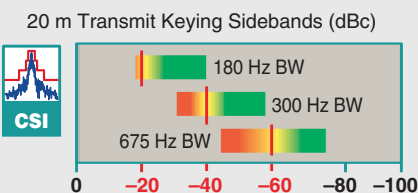
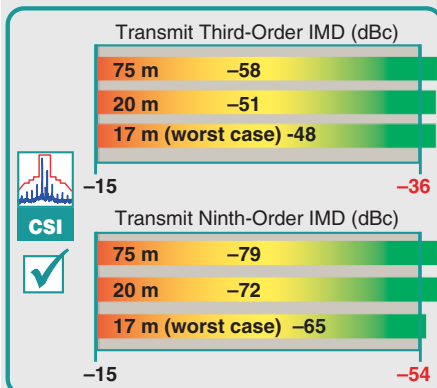
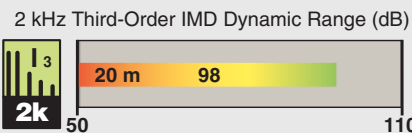
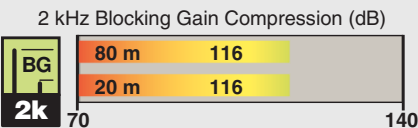
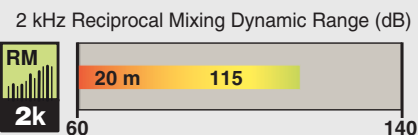
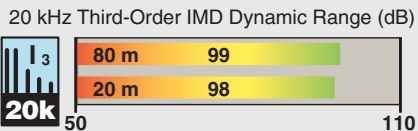
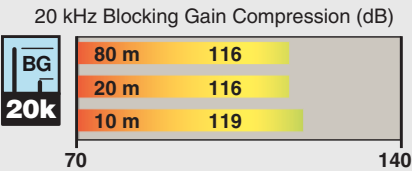
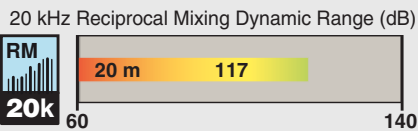
The IC-7760 has a single tuning knob that can be switched between receivers by touching the frequency area of the screen. If you prefer a separate tuning knob for each receiver, Icom's optional RC-28 encoder connects to the front panel through a USB cable and can be used to tune either receiver. I missed having a separate tuning knob for the second receiver during the review and would consider an RC-28 to take full advantage of the IC-7760's dual-watch and split-frequency capabilities.

The control head has separate top-facing speakers for the main and sub receivers. From the menus, you can choose to listen to one receiver in each speaker or headphone side, or mix audio from the main and sub receivers together in both speakers or both ears. You can also set up the external speaker jacks to listen to audio from the main and sub receivers separately or mixed. The internal speakers are so close together that I didn't hear much difference in the settings, but it was really obvious when listening via headphones. I thought that the internal speakers sounded fine, with plenty of clear audio.

Each receiver has its own volume control, and you can temporarily mute either one by pressing the knob. Menu-adjustable high-pass and low-pass filters tailor receive audio characteristics for each mode. In addition, there are bass and treble settings for each voice mode.

You can set up three bandwidth filters for each mode (SSB, SSB data, CW, PSK, RTTY, and AM). Switch among the filters by touching the **FIL** button on the screen. A long press of that button brings up a configu-

Icom IC-7760 Key Measurements Summary



KEY: QS2604-PR183
CSI threshold values in red.
Receiver measurements with preamp off.
Transmitter measurements at 200 W RF output.
Bars off graph indicate values over or under scale.

Table 1 — Icom IC-7760 HF Transceiver S/N 12001267, Main CPU Firmware 1.01

Manufacturer's Specifications

Frequency coverage: Receive, 0.03 – 60 MHz; transmit, 1.800 – 54.000 MHz (amateur bands only).

Power requirements: Receive, 150 VA max; transmit, 800 VA max.

Modes of operation: CW, RTTY, AM, USB/LSB, FM, and PSK.

Receiver

SSB/CW sensitivity (2.4 kHz BW, 10 dB S/N):

135/475 kHz band, +3 dBμV (1.41 μV) typ.

1.8 – 29.999 MHz, –16 dBμV (0.16 μV) typ.

50 MHz band, –18 dBμV (0.13 μV) typ.

P1 on for HF bands, P2 on for 50 MHz band.

AM sensitivity (6 kHz BW at 10 dB S/N):

0.5 – 1.79999 MHz: +16 dBμV (6.3 μV) typ.

1.8 – 29.9999 MHz: +6 dBμV (2.0 μV) typ.

50 MHz band: 0 dBμV (1.0 μV) typ.

P1 on for HF bands, P2 on for 50 MHz band.

FM sensitivity (15 kHz BW at 12 dB SINAD):

28.00 – 29.7000 MHz: –6 dBμV (0.5 μV) typ.

50 MHz band: –10 dBμV (0.32 μV) typ.

P1 on for HF bands, P2 on for 50 MHz band.

Reciprocal mixing dynamic range:

Not specified.

Blocking gain compression

dynamic range: Not specified.

Two-tone intermodulation distortion (IMD) testing (500 Hz bandwidth, IP+ on):

Band/Preamp	Spacing (kHz)	Measured IMD Level (dBm)	Measured Input Level (dBm)	IMD DR (dB)
3.5 MHz/off	20	–129	–30	99
14 MHz/off	20	–128	–31	98
14 MHz/1	20	–137	–39	98
14 MHz/2	20	–141	–42	98
14 MHz/off	5	–128	–31	98
14 MHz/off	2	–128	–31	98
50 MHz/off	20	–127	–29	98
50 MHz/1	20	–137	–40	99
50 MHz/2	20	–141	–38	103

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.

Measured in the ARRL Lab

Receive and transmit as specified.

At 115 V ac: RF deck: Receive, 57 VA (46 W); transmit, 543 VA (440 W) at 200 W RF output; controller: 16 VA (9 W). As specified.

Receiver Dynamic Testing

Noise floor (MDS), 500 Hz bandwidth (dBm/μV):

Preamp	Off	1	2
0.137 MHz	–120/0.22	–126/0.11	–128/0.09
0.475 MHz	–127/0.09	–136/0.04	–139/0.02
3.5 MHz	–129/0.08	–138/0.03	–142/0.02
14 MHz	–128/0.09	–137/0.03	–141/0.02
50 MHz	–127/0.10	–137/0.03	–141/0.02

10 dB (S+N)/N, 1 kHz tone, 30% modulation, 6 kHz BW (dBm/μV):

Preamp	Off	1	2
1.02 MHz	–102/1.75	–111/0.65	–114/0.46
3.88 MHz	–104/1.44	–113/0.48	–117/0.32
50.4 MHz	–102/1.70	–112/0.55	–115/0.38

12 dB SINAD, 3 kHz deviation, 15 kHz BW (dBm/μV):

Preamp	Off	1	2
29 MHz	–108/0.88	–117/0.30	–122/0.18
52 MHz	–108/0.91	–118/0.29	–122/0.18

Preamp off (dB):

Offset	20 kHz	5 kHz	2 kHz
3.5 MHz	116 ¹	114	114
14 MHz	117 ¹	116	115
50 MHz	118 ¹	114	111

500 Hz BW:

	20 kHz Offset Preamp Off/1/2 (dB)	5/2 kHz Offset Preamp Off (dB)
3.5 MHz	116/114/110	116/116
14 MHz	116/114/111	116/116
50 MHz	119/117/113	119/119

Preamp Off (dBm) 1 (dBm) 2 (dBm)

14 MHz	+85	+85	+85
50 MHz	+71	+73	+73

15 kHz BW: 29 MHz, P1 on: 83 dB²; 52 MHz, P2 on: 91 dB¹.

20 kHz Offset (dB) 10 MHz Offset (dB)

29 MHz, P1 on	90	>118
52 MHz, P2 on	90	118

Waterfall: Preamp

	Off	P1 (dBm)	P2 (dBm)
14 MHz	–144	–154	–158
50 MHz	–144	–148	–150

ration screen for adjusting IF bandwidth and skirt shape (sharp/soft) filters. The three FM filter bandwidths are fixed.

In addition to the bandwidth filters, twin passband tuning (**TWIN PBT**) is a great help in reducing or eliminating interference from nearby stations. Rotate the inner or outer knob to cut the upper and/or lower edge of

the passband. A graphic pops up on screen to show filter shift values, and you can also observe the effect on signals in the passband using the **FILTER EFFECT** option on the sub screen. The manual notch filter offers wide, mid, and narrow settings, and it is effective in attenuating interfering signals. I found the automatic notch filter to be effective at reducing

S-meter sensitivity: Not specified.	S-9 signal: <i>Preamp</i> 14 MHz 50 MHz	<i>Off</i> -72/54.3 -71/59.5	<i>P1</i> (dBm/μV) -78/28.5 -79/23.7	<i>P2</i> (dBm/μV) -79/24.5 -81/19.7	
Notch filter: ANF attenuation > 30 dB (1 kHz single tone).	Up to 55 dB attenuation, 15 ms attack time.				
DSP noise reduction: Not specified.	Up to 12 dB.				
Squelch sensitivity: Not specified.	At threshold, P1 on: FM, 29 MHz, -119 dBm/0.25 μV; 52 MHz, -118 dBm/0.27 μV; SSB, 14 MHz, -102 dBm/1.78 μV.				
Receive bandwidth:	Range at -6 dB points (bandwidth), filter type SHARP:				
CW (BW = 500 Hz): > 500 Hz/-6 dB, <700 Hz/-60 dB	CW (500 Hz BW): -263 Hz to +262 Hz (525 Hz)				
SSB (BW = 2.4 kHz): > 2.4 kHz/-6 dB, < 3.6 kHz/-60 dB	SSB (2400 Hz BW): 240 to 2750 Hz (2510 Hz)				
AM (BW = 6 kHz): > 6.0 kHz/-6 dB, <15 kHz/-60 dB	AM (6 kHz BW): 119 to 3097 Hz (5956 Hz)				
Receive processing delay time: Not specified.	3.6 ms.				
Audio output: > 2.0 W (8Ω, ≤ 10% THD).	As specified. THD 0.35% at 1 V _{RMS} .				
Transmitter	Transmitter Dynamic Testing				
Power output: SSB/CW/FM/RTTY/PSK: 1 – 200 W; AM 0.25 – 50 W.	As specified.				
Spurious signal and harmonic suppression: ≥50 dB HF band, > 66 dB 50 MHz band.	HF: typically, > 70 dB; worst case, 1.8 MHz, -52 dB; 50 MHz: > 66 dB. Complies with FCC emissions standards.				
Transmit IMD products: Not specified.	@ 200 W PEP, DPD on (dBc/dB PEP):				
	<i>Order:</i>	<i>3rd</i>	<i>5th</i>	<i>7th</i>	<i>9th</i>
	<i>CSI Limit:</i>	≤ -36/-42	≤ -42/-48	≤ -48/-54	≤ -54/-60
	1.8 MHz	-57/-63	-67/-73	< -79/-85	< -79/-85
	3.5 MHz	-58/-64	-67/-73	< -79/-85	< -79/-85
	5.3 MHz	-55/-61	-65/-71	< -79/-85	-71/-77
	7 MHz	-55/-61	-70/-76	< -79/-85	-77/-83
	10 MHz	-58/-64	-65/-71	-73/-79	-75/-81
	14 MHz	-51/-57	-63/-69	-65/-71	-72/-78
	18 MHz ³	-48/-54	-54/-60	-63/-69	-65/-71
	21 MHz	-54/-60	-60/-66	< -79/-85	-71/-77
	24 MHz	-53/-59	-65/-71	-71/-77	< -79/-85
	28 MHz	-51/-57	-59/-65	-71/-77	-74/-80
	50 MHz	-55/-61	-60/-66	-70/-76	< -79/-85
	@ 100 W PEP, DPD on:				
	14 MHz	-47/-53	-62/-68	-67/-73	-72/-78
	See Figure A.				
CW keyer speed range: Not specified.	6 – 48 WPM; iambic mode A&B.				
CW keying characteristics: Not specified.	See Figures B and C.				
Transmit-receive turnaround time (PTT release to 50% audio output): Not specified.	S-9 signal, AGC fast, SSB: 37 ms. S-9 signal, AGC fast, CW (full break-in): 45 ms.				
Receive-transmit turnaround time: Not specified.	SSB, 67 ms; FM, 12 ms (29 MHz), 11 ms (52 MHz).				
Amplifier key line closure to RF output time: Not specified.	CW: close, 7 ms; open, 9.2 ms (full break-in); 500 ms (semi-break-in) SSB: close, 65 ms; open, 6.7 ms				
Transmit composite noise: Not specified.	Spacing:	<i>10 kHz</i> (dBc/Hz)	<i>20 kHz</i> (dBc/Hz)	<i>100 kHz</i> (dBc/Hz)	
	CSI Limit:	≤ -136	≤ -139	≤ -142	
	14 MHz, 200 W	-120	-124	-141	
	51 MHz, 200 W	-116	-119	-137	
	14 MHz, 30 W	-117	-121	-135	
	See Figure D.				
Size (height, width, depth, including protrusions): RF deck, 6.7 × 16.7 × 18.4 inches; controller, 4.6 × 13.7 × 5.2 inches.					
Weight: RF deck, 34.8 pounds; controller, 5.1 pounds.					

¹ "OVF" indicator was displayed, and test was stopped at the value shown.

² Noise limited at the value shown.

³ Worst-case band. See Figure D.

annoying carriers. The audio peak filter (APF) peaks CW signals and brings them out of the noise. Filter level, passband width, and peak frequency are all adjustable.

The IC-7760 offers adjustable noise reduction, noise blanker, and notch filter features. I don't experience much power-line or other man-made noise where I live, so I didn't use the noise blanker much. I thought that the noise reduction worked well at lower settings, with little or no evident digital artifacts.

Transmitter and Antenna Tuner

The IC-7760's transmitter performance is shown in Table 1 and associated figures. Output power is adjustable in 1 W steps from less than 2 W to the full 200 W. From the **TX POWER LIMIT** menu, you can set the maximum power output separately for each band, with separate settings for the SSB data modes. This is helpful for use with amplifiers with drive requirements that vary by band, or to stay within the legal power limits on 60 meters. The RF deck has four internal fans that

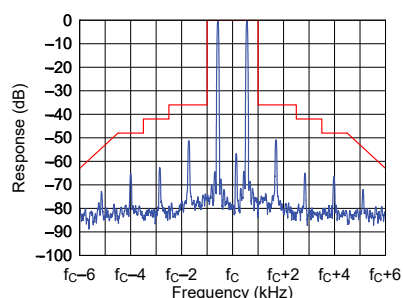


Figure A — The spectral display of the Icom IC-7760 transmitter output during two-tone third-order IMD testing on the 18 MHz band (worst case) at full power. DPD is enabled. This plot shows the transmitter output (blue trace) ± 6 kHz from the carrier. The red trace represents the maximum acceptable level for ARRL CSI compliance. The reference level is 0 dBc, and the vertical scale is 10 dB per division.

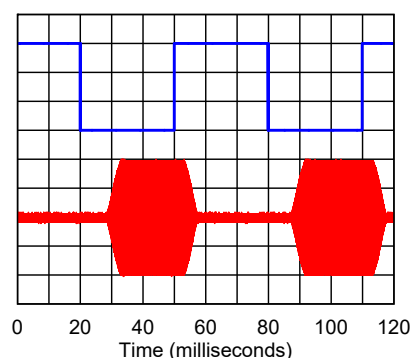


Figure B — CW keying waveform for the Icom IC-7760 showing the first two dits using external keying. Equivalent keying speed is 40 WPM. The upper trace is the key closure; the lower trace is the RF envelope. Horizontal divisions are 10 ms. The transmitter was being operated at 200 W output on the 14 MHz band using QSK set to the default 4 ms. The first-dit rise time is 3.0 ms; the fall time is 2.9 ms. The second-dit rise time is 3.1 ms; the fall time is 2.9 ms. The first-dit on delay is 10.5 ms; the off delay is 5.4 ms. The second-dit on delay is 9.3 ms; the off delay is 5.8 ms.

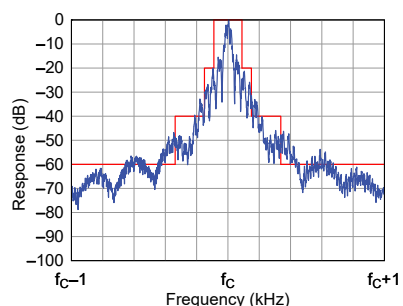


Figure C — The spectral display of the Icom IC-7760 transmitter during keying sideband testing. Equivalent keying speed is 40 WPM using external keying and the default rise time setting. The transmitter was being operated at 200 W PEP output on the 14 MHz band, and this plot shows the transmitter output (blue trace) ± 1 kHz from the carrier. The red trace represents the maximum acceptable level for ARRL CSI compliance. The reference level is 0 dBc, and the vertical scale is in dB.

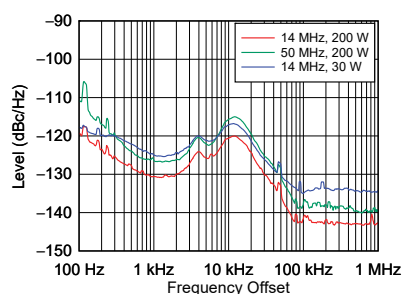


Figure D — The spectral display of the Icom IC-7760 transmitter output during composite noise testing. Power output is 200 W on the 14 MHz band, 30 W on the 14 MHz band, and 200 W on the 50 MHz band. The carrier, off the left edge of the plot, is not shown. This plot shows composite noise 100 Hz to 1 MHz from the carrier. The reference level is -90 dBc/Hz, and the vertical scale is 10 dB per division.

only ran during prolonged operation at full power. The fans are quiet, and with the RF deck located away from my operating position, I barely noticed the sound.

Note that the CW rise time is adjustable, with a default of 4 milliseconds. Other menu choices are 2, 6, and 8 milliseconds. I changed to 8 milliseconds for the cleanest CW waveform and keying sidebands.

The internal antenna tuner is rated for loads from 16.7 to 150 Ω (3:1 SWR). Initial tuning for a given frequency and antenna combination is quick. The tuner remembers settings, so operation is nearly instantaneous after the initial tune. I used the tuner on 40 meters, where my inverted V is cut for the low end of the band, and on 17

meters, where my multiband beam presents an SWR of about 2:1.

Voice Operation

As detailed in the Lab Notes, the IC-7760 incorporates DPD technology to reduce intermodulation distortion (IMD) products on transmitted SSB and AM signals. To use DPD, simply touch the **DPD** button on the **FUNCTION** menu. It's adjusted at the factory for proper operation when you're using the IC-7760 by itself, but you can check and readjust settings if needed from a menu.

Icom's IC-PW2 amplifier also incorporates DPD technology that integrates seamlessly with the IC-7760, but the manual doesn't discuss using the DPD feature with amplifiers other than the IC-PW2. To use the IC-7760 DPD with IC-PW2, connect a suitable cable between the ALC jacks on the IC-7760 and PW2, and follow the adjustment procedure described in the *Advanced Manual*. Adjustments are performed for each band at 500 W and 1000 W.

Transmit audio is adjustable with bass and treble settings in the menus. There are separate tone control settings for SSB, AM, and FM. SSB transmit bandwidth menu choices are **WIDE** (100 – 2,900 Hz), **MID** (300 – 2,700 Hz), and **NAR** (500 – 2,500 Hz), with adjustable high and low cutoff frequencies.

AM transmit power is adjustable from 0.25 to 50 W. As with the other modes, you can pre-set three AM receive filters with a maximum bandwidth of 10 kHz. The notch filter and twin passband tuning filters are effective in AM, and the AGC menu offers a wide range of adjustments for that mode. An

interesting feature is **AUTO TUNE**, which automatically dials in a station if you tune close to the signal and press the button.

The IC-7760 is ready for 10- or 6-meter FM operation. For repeater operation, split-frequency offsets can be set in a menu. CTCSS tone encoding and decoding are available for repeater access, and you can use the tone scan feature to find the tone frequency in use. It's always fun to try 10-meter FM when the band is open.

Voice message memories are available in SSB, AM, and FM modes, with messages stored on an SD card. You can record up to eight messages for transmission, with a maximum recording time of 180 seconds per

Lab Notes

Beginning with this review, we are making a few changes to data reported in Table 1, the Key Measurements Summary, and the figures — all in line with the start of the Clean Signal Initiative (CSI) program. See “The Launch of the Clean Signal Initiative” for a discussion of the changes in detail, as well as a description of the CSI program.

The Icom IC-7760 was a pleasure to test here in the Lab. The same conveniences that apply to operating the unit in the shack (built-in power supply, remote control head) all made it enjoyable to test as well. It performed well with our test suite, and the results in Table 1 show across-the-board improvements on the performance of the excellent IC-7610. Both sensitivity and large signal handling were outstanding, with the radio maintaining its composure even when presented with very large test signals. Our tests are designed to push a receiver to extremes, even overload, and the only indication of the IC-7760 reaching the onset of overload was a front-panel indicator; audio quality was not impacted. Based on our test results, the transceiver should be a great contest radio.

From an RF perspective, the big news for the IC-7760 is the inclusion of Icom’s digital DPD, which greatly reduces transmitter intermodulation products for voice modes like SSB and AM. Speech consists of multiple audio frequencies transmitted simultaneously, and these frequencies can mix together during transmission, generating additional undesired signals (called “intermodulation products”) due to non-linearities in the transmitter’s circuitry. Radio designers go to great lengths to make the transmitter’s IMD products as small as possible with careful circuit design, especially of the power amplifier. Icom’s DPD system takes this a step further; at the factory, the transmitter’s distortion characteristics are modeled and applied “in reverse” by the IC-7760’s DSP during transmission, thus dramatically reducing these

IMD products. A quick glance at the transmitter IMD values in Table 1 confirms the significant improvement over a typical transceiver without this feature. The reduction in IMD products generally reduces a transmitter’s total transmission bandwidth, making the IC-7760 a better neighbor on the air. In addition, expect clearer transmitted audio and less fatigue for the op on the other end of your signal. By the way, transmit IMD products are not generated for single-frequency modes like CW, so DPD does not offer any improvement for CW operating.

Though not new, the IC-7760 also includes the latest version of “IP+,” Icom’s implementation of dithering for receiver IMD improvement, and it works quite well. Table 1 indicates superior receiver IMD response with IP+ enabled. Depending on the band, enabling IP+ can reduce sensitivity by a couple of dB, though in most cases the presence of band noise will make this reduction in sensitivity a moot point.

— Rick Ciervo, W1CIE, ARRL Senior Laboratory Engineer



Visit the ARRL Learning Center at https://learn.arrl.org/courses/125968/video_presentations/396237 to watch a members-only video of the Lab’s test results.



Figure 6 — The RTTY decoder screen expanded version shows decoded text in green, transmitted text in red, and transmit/receive transitions in blue. I programmed the transmit memories with a CQ message and my exchange for the Makrothen RTTY Contest, and used a USB keyboard to enter the other station’s call sign and other variable information. Buffered text to be transmitted would be shown in the lower portion. The tuning indicator on the right offered a fast response and made it easy to tune in stations. You can switch to a smaller decode window that allows room for a compact version of the band scope.

memory. You can name the memories and transmit using buttons on the **VOICE TX** screen. If you have a keyboard connected, you can play the memories using function keys. Voice memory level is adjustable so you can set it to match your microphone.

CW Operation

The IC-7760 supports full break-in (QSK) or adjustable delay, semi-break-in operation. The transmit-receive switching is silent. The built-in keyer can be adjusted from 6 to 48 words per minute. Eight message memories store 70 characters each and can include incremental serial numbers for contests. The keyer **EDIT** menu brings up an on-screen keyboard to edit memory content. You can send the memory content from the **KEYER SEND** screen or use function keys on an external USB keyboard.

Digital Modes

The IC-7760 has a lot to offer for digital mode operators. The simplest setup is using the transceiver's USB port and USB driver to connect with the radio's internal sound card for digital modes such as FT8, PSK, AFSK RTTY, or SSTV. You can also enable FSK RTTY keying using the **USB SEND/KEYING** menu. It took just a few minutes to set up *WSJT-X* software for the IC-7760, select **USB-D** mode, set the audio levels, and begin making contacts.

You can also connect a computer to the IC-7760 radio through the **ACC 1** connector on the rear panel or the **LINE IN**, **LINE OUT**, and **SEND** jacks. Connections for audio in and out, transmit-receive switching, and FSK RTTY keying are available.

The IC-7760 has an internal decoder for RTTY and PSK31 or PSK63 that works in concert with transmit memories and/or an external USB keyboard. This feature is great for DXing, making a few contest contacts, or casual conversations. Figure 6 shows the RTTY decode window with tuning indicator at the right. You can choose a screen with six decode lines and a compact spectrum scope above, or an expanded decode window with 11 lines.

You can use a USB keyboard to program eight message memories for RTTY or PSK, which are sent by pressing the corresponding function key on the keyboard or an on-screen button. You can use the keyboard and/or memories to compose your next transmission, and then press F12 to toggle transmit on and off. Whatever received and transmitted text appears on the screen can be saved to a log file on the SD card. The log is not formatted and requires transcription to a logging program for submission to Logbook of The World® or a contest sponsor.

On the Air

I enjoyed using the IC-7760 for several months. It was a pleasure to explore the radio's capabilities on all bands

from 160 through 6 meters using SSB, CW, RTTY, and FT8/FT4. Despite the radio's vast feature set, I quickly got comfortable with the user interface. In addition to casual operating, I used it in several contests, including the CQ World Wide CW and SSB events. The extensive filtering and band scope options, along with dual-watch capability, made it easier to pick out weak signals on crowded bands. Transmit audio received high marks after tailoring the transmit tone and speech processor settings for my voice and microphone. Additional testing results are available online at *QST* in Depth (www.arrl.org/qst-in-depth).

Final Thoughts

The IC-7760 is a full-featured transceiver with a wide range of features and excellent receive and transmit performance. Its DPD technology is a big step toward cleaner SSB signals, allowing stations to operate more closely without causing interference to nearby frequencies. The innovative packaging makes the most of available desk space and allows a number of remote and local station configuration options. Although the transceiver has myriad settings and adjustments, the controls and menus are well thought out and easy to access. Default settings are generally good, so you can start using the radio right away while perusing the manual for more details.

Manufacturer: Icom America, 12421 Willows Rd. NE, Kirkland, WA 98034, www.icomamerica.com/amateur. Price: \$7,000.

See *QST* in Depth for More!

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

- ✓ Additional testing results
- ✓ A link to a video of ARRL Lab Digital RF Engineer John McAuliffe, W1DRF, discussing the Icom IC-7760's networking capabilities.

QRPworks SideKar Decoder Edition

Reviewed by Charles "Chip" Veres, KM4SJN
km4sjn@arrl.net

The QRPworks SideKar for the Elecraft KX2/KX3 and K3/K3S radios was reviewed in the November 2017 issue of *QST*. The SideKar Decoder Edition is compatible with more radios, including the CAT interface to the Icom IC-705 via Bluetooth.

In the May 2024 issue of *QST*, I reviewed the *MRP40* CW software. *MRP40* is a program for Windows that sends and receives Morse code. The SideKar Decoder Edition does the same thing, but in hardware. No computer is necessary to use it. It is small, rugged, light, and suitable for portable operation.

Sensitivity and Bandwidth

The SideKar audio input is peaked at 700 Hz. At that frequency, any signal above 10 mV at the headphones will decode, and 100 mV will give a more realistic headphone level. I highly recommend the headphone splitter so you can hear what you are doing. It is a \$4.50 accessory, or you can make your own. The audio frequency response extends from 545 to 965 Hz at the -6 dB points, giving a total bandwidth of 420 Hz. That is fine for general CW work. These measurements were taken with a Polarad 336.3019.32 signal generator and a Signal Electric hand key from the 1920s.

Receiving W1AW

The SideKar was able to receive W1AW code practice at every speed they sent. Oddly, it seemed to be more comfortable at higher speeds. Thirty-five WPM was no challenge for it. At lower speeds, W1AW uses the Farnsworth method of sending letters quickly with extra space between them. Sure enough, the SideKar puts a word space between every letter. Every decoder I have tried (except human ears) has this questionable feature.

Getting in Tune

The SideKar does not have a tuning indicator. On my Icom IC-7100, I did two things to deal with this situation. I set the CW high-pass filter to 500 Hz and the CW low-pass filter to 1 kHz. Also, I set the combined sidetone and CW offset control to 700 Hz. I have an antenna switch that dumps the transmitter into a dummy load in case I want to hear the sidetone without creating interference.

The Keyboard

The keyboard supplied by QRPworks is a 2.4 GHz wireless keyboard from Tecknet. The (tiny) dongle to plug into the SideKar has its own place in the battery compartment. There is also a small, black on/off switch. This keyboard runs on two AAA batteries. The SideKar and keyboard are shown in the lead photo. There is a smaller keyboard available for backpacking operations.

Setting the Date and Time

The first thing I wanted to do after connecting the keyboard was to set the date and time. Alt-D on the keyboard is supposed to do that. Instead, it brought up a screen that says **ENTER SN:** and stuck there. I sent another email to Shel, KF0UR, at QRPworks. He promptly replied and told me to enter a specific code and the serial number of the SideKar. That got it working, and I was able to set the date and time.



A Real Test

I used the SideKar to log a few contacts in the IARU DX contest. On 10 meters, there was no problem. On 15 meters, again there was no problem. But on 20 meters, the band was so busy that the bottom 50 kHz had three stations on every kHz, all calling CQ. Not only was this too much for the decoder in the SideKar, but it's also too much for any decoder.

Under normal conditions (not in a contest), the SideKar does fine both transmitting and receiving. Like all automated CW equipment, it does best receiving signals generated by other computers. But in a bench test, it got above 90% of my hand-sent CW, and my fist is nothing to brag about. Again, an interfering station within 400 Hz of the one you intend to receive will stop the parade. You must cut it out with your rig's notch filter. The SideKar can't discriminate by pitch and speed like your ear can.

Useful Downloads

At least five useful files are available at www.qrpworks.com: the user manual for the SideKar itself, a message management utility (see Figure 7), an ADIF export utility, and the PDF manuals for the message utility and the ADIF utility. The utilities work with both Windows and MacOS. The message utility allows you to create and store several whole groups of messages and swap them at will with the 20 messages stored in the SideKar.

The SideKar has a micro-USB to communicate with the outside world. I thought, "No problem, I've got a couple of those cables laying around." So, I started the

Bottom Line

This QRPworks SideKar accessory is a good portable CW decoder for SOTA or POTA activation, and it is compatible with many radios.

ADIF export utility on my computer and tried to download my log. No action. With investigation I found out that some micro-USB cables are only for charging and lack the data conductors. I got a real USB cable and solved the problem. On Windows 10, the export utility puts the ADIF file in your **DOCUMENTS** folder.

Additional Details

The SideKar is a compact CW companion featuring a full-featured internal keyer that works with any paddle and uses the **KEY OUT** port to the rig's paddle input, or you can send CW directly from a keyboard. Its built-in logger can store up to 1,000 QSOs in the field and includes a time-saving feature that lets you insert a call sign into a canned message from the paddle or keyboard, automatically capturing it in the log — an especially useful feature for POTA, SOTA, and Field Day operations. In addition, the LCD display remains readable in full sunlight while offering an adjustable backlight for night use. The SideKar Decoder Edition can also be used as a training tool for learning to copy and send CW.

Conclusion

As I found out with my Icom IC-7100, the SideKar will work with any radio capable of sending CW, but connecting it to some rigs brings extra features — specifically, the Elecraft KX2/KX3, the Yaesu

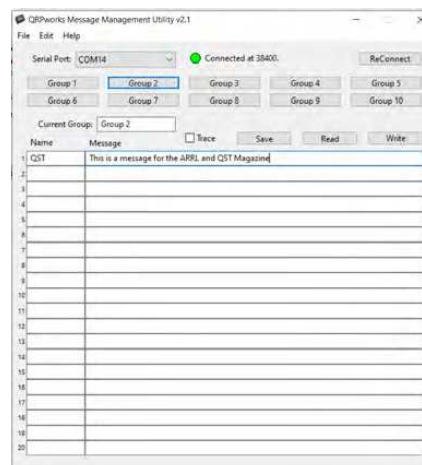


Figure 7 — The QRPworks SideKar screenshot of the message management utility at work.

FT-817/818/857/897, the QRP Labs QCX family, and the Icom IC-705. The Icom requires a Bluetooth adapter that is \$50 from QRPworks. If you make the digital rig connection, you can record macros to change frequency, band, and mode from the keyboard. Also, if the rig has a built-in CW or PSK decoder, you can see its output on the SideKar screen.

Manufacturer: QRPworks, 2505 Kinderhook Ln., Colorado Springs, CO 80919, www.qrpworks.com. Price: starts at \$349 with different packages available.

Ask Dave

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

Velocity Factor, Slow Code, and Signal Reports

Coax Velocity Factor

Q David Hobbs, WA6LOL, asks: Velocity factor in coaxial cable is the speed at which signals travel through the cable, and I’ve read on forums that you can mix coax with different velocity factors in a feed-line run without problems. How can this be? It seems like it would be like having people going different speeds in the same lane on the freeway — it wouldn’t work for long.

A Due to many factors, radio waves travel through coaxial cables more slowly than they travel in a vacuum. The ratio of a radio wave’s speed in coax to its speed in a vacuum is called the *velocity factor*.

If you string together a transmission line of several types of 50 Ω cable, the signal transits each cable in succession, and due to differing velocity factors, the signal will go faster in some sections than in others. This is okay, because the signal is affected by only one cable at a time. It would only be a problem if the signal were to be fed to two different cables simultaneously — if the two cable lengths were the same but the velocity factors were different, the signals at the output ends would be out of phase.

So, if you need to create a longer transmission line, you can string different types of cable in series without having to worry about phasing issues. Note that I’m assuming that all the cables involved are 50 Ω; if there are cables with differing characteristic impedances in your feed line, you will encounter reflections and standing wave ratio issues.

Finding Slow CW

Q George Sucich, KE8SNS, asks: After getting my General license in 1960, I’m now getting active again at age 77. I am copying CW (my main interest) at 7 – 10 WPM. I work on it every day, but it’s harder at my age. I am told the high end of the HF bands has slow-CW hams, but I haven’t found them yet. Are there clubs for people like me?

A Yes, there are frequencies where slow coders congregate, and yes, there are organizations that can help you.

The best way by far to improve your code speed is to get on the air. There’s an organization called the Straight Key Century Club (SKCC; <https://skccgroup.com>) that costs nothing to join. The club has a number of resources to support new CW operators — for example, SKCC uses 7114 kHz as an “Elmer” frequency, a “safe haven” for CW newcomers where mentors are encouraged to monitor the frequency and work beginners. The club also runs a 24-hour “Slow Speed Saunter” on the first day of every month, an informal event intended for operators at a slower CW pace; 12 WPM or less is encouraged (see https://skccgroup.com/operating_activities/slowspeed for details).

You can also look into the Long Island CW Club (<https://longislandcwclub.org>). This group assigns mentors to those looking to learn CW and improve their speed, and they work with you individually to help you play to your strengths as a CW operator. The club also hosts online CW classes for different experience levels. Note that, unlike SKCC, the Long Island CW Club has membership dues.

ARRL also offers resources for learning and practicing Morse code, including CW training CDs, archived mp3 files of W1AW code practice runs, and more (see <https://arrl.org/learning-morse-code>). For live, on-the-air code practice, W1AW puts out daily slow-code transmissions at 5, 7.5, 10, 13, and 15 WPM; for times and frequencies, see the W1AW operating schedule on page 28 of every issue of QST, or online at <https://arrl.org/w1aw-operating-schedule>.

Giving Signal Reports

Q Ron Burski, KJ7PAQ, asks: On my Icom IC-7300, I can change the S-meter reading for a received signal by using (or not using) one of the pre-amps or by adjusting the RF gain control. With that said, what

meaning is there in giving a signal strength report based on an S-meter reading?

A I've often glanced at my Icom IC-7300's S-meter when giving readability, signal strength, and tone (RST) reports. But comparing the RST reporting system to S-meter readings is like comparing apples to oranges — the original RST system long predates radios with S-meters.

The RST system, shown in Figure 1, is largely subjective and was designed at a time when CW was the primary operating mode. Readability refers to how well you can “read” the CW being sent, with a report of 5 meaning “perfect” readability. These days, hams often report a readability of 5; however, that rating is not always accurate. You may, for example, hear something like, “UR SIGS 599 PLS REPEAT QTH.” Obviously, the receiving ham did not have “perfect” readability if they're asking the transmitting ham to repeat something.

As for tone, reporting this factor dates back to the spark era, before vacuum tubes created nice, continuous waves at a single frequency for CW. These days, unless you're using some horrible equipment discovered in an old barn, the tone quality is probably a 9 — it's rare to hear an R below 5 and a T below 9. The only real variable is signal strength, which is subjective. An S9 means “extremely strong signals.” Does that mean pegging the S-meter, or just a louder signal than everyone else?

Various methods to provide a less subjective signal report go back almost to the beginning of radio. The way that modern superheterodyne receivers perform the measurement is to measure the voltage of the automatic gain control (AGC), a process by which a receiver automatically turns down its front-end gain to adjust for strong signals; the change in AGC voltage is fed to the S-meter to provide relative signal strength. Efforts to standardize this method settled on a signal of 50 μ V at the input to the receiver as equal to S9, and every voltage reduction, by half, equal to one S-unit. Now that amateur radios are standardized on 50 Ω inputs, the 50 μ V works out to -73 dBm, and one S-unit is equal to -6 dB of power, equivalent to cutting the input voltage in half.

Signal Strength

- 1--Faint signals, barely perceptible.
- 2--Very weak signals.
- 3--Weak signals.
- 4--Fair signals.
- 5--Fairly good signals.
- 6--Good signals.
- 7--Moderately strong signals.
- 8--Strong signals.
- 9--Extremely strong signals.

Figure 1 — The current definitions for the signal strength portion of RST reports from the ARRL website. See <https://arrl.org/quick-reference-operating-aids> for additional resources.

That said, this method measures the power at the input to your station's main receiver, which is the input to the RF amplifier — it tells you nothing about your antenna. If your antenna has gain, the S-meter shows a larger signal, even though the other station is still using the same amount of power. Also, if you insert a pre-amp or an attenuator in front of the RF amp, that will throw the S-meter off. On superheterodyne radios, turning down the RF gain is done by changing the AGC voltage, which immediately throws off the S-meter, and digital radios, such as your Icom IC-7300, do AGC entirely differently. In other words, an S9 on one radio is likely not the same as an S9 on another.

Given this variability, we get back to the subjective nature of RST. I usually restrict myself to 55, 57, and 59 for SSB. If it helps, print out Figure 1 and keep it at your operating desk. Give subjective reports; if fading makes the signal strength vary considerably, say so. Don't worry about the S-meter except as a very general guide.

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

Microwavelengths

Microwave VSWR and Return Loss

Hams are often preoccupied with voltage standing wave ratio (VSWR), a measure of the RF power reflected back down the transmission line due to an impedance mismatch between the radio, transmission line, and antenna. This is important at HF, where many hams use non-resonant wire antennas on multiple bands. This compromise usually requires an antenna tuner to match the antenna for low VSWR and to protect the radio or amplifier from damage due to high VSWR.

At microwave frequencies, professional engineers prefer to measure return loss (RL) rather than VSWR, which is essentially a different measurement for the same concept. Return loss is the ratio of forward (transmitted) power to power reflected from an antenna or other load — it measures the loss in dB for the reflected signal, so a high RL indicates less reflected power and a better VSWR. An RL of 20 dB (VSWR = 1.22), or only 1% power reflected, is usually considered adequate. At higher microwave frequencies, an RL of 15 dB (VSWR = 1.43; 3% reflection) or even 10 dB (VSWR = 1.92; 10% reflection) may be acceptable. There are several reasons for this tolerance:

- Many commercial microwave designs are broadband, creating some variation over frequency — hams operate in narrow frequency ranges.
- Tuning is difficult at the higher microwave frequencies — an antenna tuner would have too much loss.
- Measuring small amounts of reflected power at microwave frequencies is difficult.



Figure 1 — Coaxial directional couplers for 10 GHz. Arrows indicate the coupling direction, and the coupling factor is marked near the top connector.

Measuring Return Loss

The straightforward way to measure RL is with a directional coupler, a component that separates a sample of only the power traveling in one direction. The 10 GHz directional couplers shown in Figure 1 are marked with a directional arrow. A sample of the power traveling in that direction is available at the top connector; the coupler can be reversed to sample the other direction. The amount of coupled power is called the “coupling factor” — the three couplers on the left are marked with coupling factors of 10, –20, and –30 dB, the amount of coupled power relative to the energy passing through. One W passing through a coupler with a coupling factor of 30 dB yields 1 mW at the port on top.

To properly measure RL, we need to measure RF power. A good power meter is ideal, but even a simple one, such as the Analog Devices AD8317 described in the April 2023 “Microwavelengths” column, will suffice for approximate results.

The actual measurement is made at low power, with a 10 dB attenuator in between the directional coupler and the transverter or signal source. With the directional coupler oriented to sample reflected power, an RF short circuit is placed on the output, which causes 100% of the power to be reflected and measured at the coupled port, reduced by the coupling factor. Then the short is replaced by the antenna or load and coupled power measured; the difference in dB is the return loss. These coupled power levels can be quite low when making measurements at modest power levels, perhaps 0 dBm — a 20 dB return loss with a 30 dB coupler reduces the coupled power to –50 dBm, difficult to measure with most power meters. A 10 dB or even 6 dB coupler would provide more convenient levels when measuring with modest power.

The separation of the two directions by a directional coupler is not perfect, limiting accuracy. Directivity is a measure of the separation between forward and reverse directions. A directivity of 20 dB implies that the separation is only 20 dB down, so the RL with no reflections would be only 20 dB. The coaxial directional couplers in Figure 1 are only specified for directivity of 15 or 20 dB (depending on the version) over the design band. I’ve tested a few, and the best was 23 dB at 10.368 GHz. These couplers are designed for moni-

toring output power or reflected power for high VSWR due to failures, not for precise measurements.

When measuring an actual antenna, the reflected power combines with some of the unwanted forward power that is not completely separated by the directional coupler. Depending on the relative phase, the total can be either higher or lower, adding uncertainty to the result. With a directivity of 20 dB, accurate measurements of low VSWR are limited by this error. Marki Microwave has an online calculator for calculating return loss errors for directional couplers (<https://markimicrowave.com/technical-resources/tools/return-loss-error-calculator-for-directional-couplers-and-bridges>). Figure 2 shows the possible error range when measuring a VSWR of 1.25 with a directivity of 20 dB — the actual return loss could be anywhere from 13.5 dB (VSWR = 1.5) to 40 dB (VSWR ~1.0). Anything in this range is good enough, but attempting to tune something using a directional coupler with directivity of 20 dB or less would be futile. Anything measuring a return loss of 15 dB or better is good enough to use; anything much worse probably has a problem worth investigating.

VNAs

A more accurate measurement of VSWR or RL at microwave frequencies requires a calibrated vector network analyzer (VNA). The VNA compensates for the errors in its internal directional couplers with computer correction based on a calibration procedure, involving an RF short, RF open, and accurate termination.

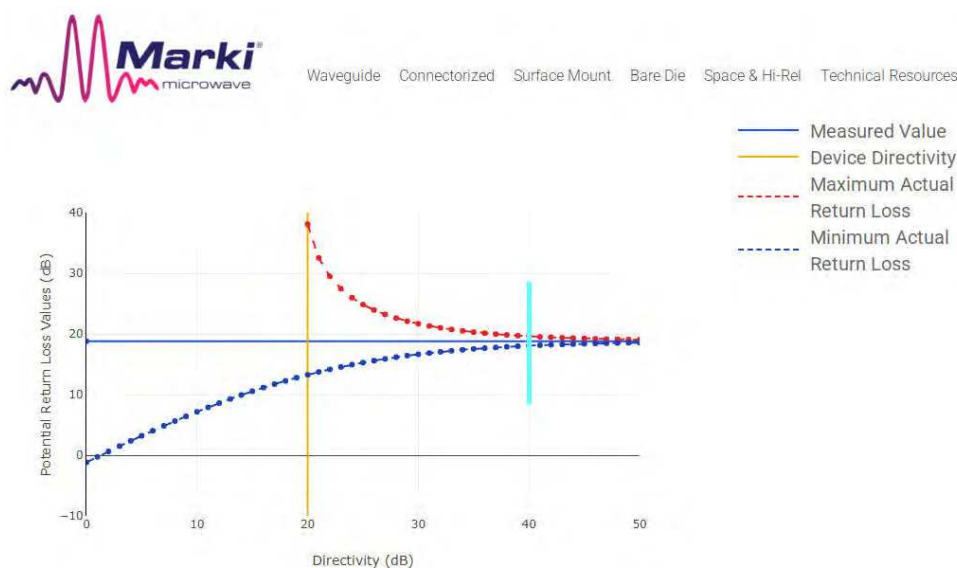


Figure 2 — This plot from the Marki Microwave calculator shows the degree of error due to the directivity of the directional coupler when measuring RL = 19 dB (VSWR = 1.25) for coupler directivity of 20 dB (yellow bar) and 40 dB (light blue bar). Directivity of 20 dB leaves significant uncertainty, while 40 dB directivity produces accuracy within 1 dB.

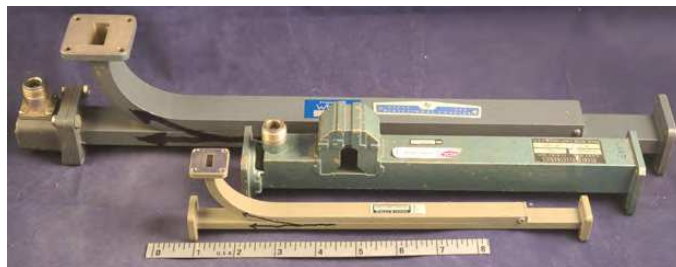


Figure 3 — Waveguide broadwall directional couplers, including two WR-90 models for 10 GHz (top and middle) and a WR-42 for 24 GHz (bottom). The arrows indicate coupling direction, which is opposite from coaxial couplers.

For frequencies up to 6 GHz, the handheld LiteVNA (https://randl.com/index.php?main_page=product_info&cPath=15_8620&products_id=75669) is an affordable solution, with additional capabilities beyond measuring VSWR or RL, at a price lower than many antenna analyzers. The performance is more than adequate for most amateur needs and is competitive with professional instruments.

Waveguide

At 10 GHz, most electronics use coaxial connectors, but most antennas are waveguide — using hollow metallic structures to guide and radiate RF energy — even if they have coax connectors. At 10 GHz and above, VNAs are rare, but waveguide directional couplers are available. The broadwall waveguide couplers shown in Figure 3 are excellent options. The Hewlett-Packard HP752 series, from an era when HP made excellent waveguide hardware, has directivity better than 40 dB and provides great results. While

HP no longer produces these, they are relatively easy to get secondhand — I recently acquired one for 10 GHz at a hamfest and am pleased at being able to make stable and reliable measurements.

Most microwave antenna designs are based on waveguide and will work well without tuning if dimensions are reasonably close. Measurement of RL is not essential, but it offers some assurance. That said, whether you can measure accurately or not, don't obsess with perfection — embrace good enough, and get on the air.

All images provided by the author.

The Tulsa ARES Winlink Net

The weekly net trains hams for real-world emergencies.

Jeff Scoville, AE5ME

Almost every voice exercise encounters an issue when the fidelity of a message is corrupted (especially when messages go through multiple stations) or a voice net gets overwhelmed with a large amount of traffic. Winlink, a network of amateur radio and authorized government stations that provide worldwide radio email using radio pathways when the internet is not present, provides an opportunity to address both issues. With Winlink, messages retain content perfectly (even when forwarded by multiple stations), and upwards of 300 messages per hour can be supported. (Voice nets are typically limited to 12 – 15 messages per hour, depending upon the complexity and length of the message.) The first full-time VHF and HF Winlink gateways in Oklahoma were created in 2013 to facilitate the use of digital technologies to complement years of work in voice communications on VHF, UHF, and HF.

The Start of Winlink

A fair number of early adopters tried Winlink because it was the new kid on the block. As the newness wore off, many of the early adopters would forget how they set up their station and operated the software. A common comment was that we needed some type of formal process to keep hams in practice and engaged.

Our first approach was yearly exercises coinciding with the annual ARES® Simulated Emergency Test (SET). The first few exercises were a learning experience, as many of the early adopters had limited experience with sending and receiving messages and were not familiar with important foundational portions of Winlink, such as Incident Command System (ICS) and National Traffic System (NTS) forms. We created over-the-air help

desks on VHF/UHF to provide support to operators who were struggling for various reasons (hardware, software, etc.).

We eventually increased the number of exercises to two or three per year, which increased the retention of skills in the operator pool, plus increased the number of operators who graduated to become subject-matter experts that could further mentor new operators. Even with the increased number of exercises, 30 – 50% of operators still struggled with equipment setup and software operation at some time during the exercise. Usually 5 – 15% of operators were unable to get on the air and missed a given exercise.

Using an after-exercise action list for “lessons learned,” we determined that two or three exercises per year were still not sufficient to keep operator skills at the level that would be required for a real emergency. Our goal was 95% or higher operator proficiency that would *not* require the intervention of a subject-matter expert to operate through a typical event. We realized we needed to move to a weekly Winlink net with mini-exercises that would keep operator skills fresh.

The Tulsa ARES Weekly Winlink Net

Each Tulsa ARES Winlink Net lasts a week, which gives all participants plenty of time to perform the exercise at a convenient time and place. We target an assignment that can be completed in 30 minutes or less. Typical assignments include use of ICS forms, NTS message forms, the location reporting features of Winlink, and medical forms. Assignments have also included making catalog requests from the extensive library available on Winlink, retrieving information from websites, and sending text messages to non-hams. Our first net was for the week of February 22, 2024. As of the writing of this article, the net has been in operation for more than 2 calendar years.

How to Conduct a Net Based on Messages/Mail

Voice and CW nets generally follow the same formula and occur in real time. Net controls are the focus of communication and act as the gatekeeper for hams participating in the net. Most participants are able to copy each other, so the communication is primarily from one to many, even when net control hands things off to the net participants.

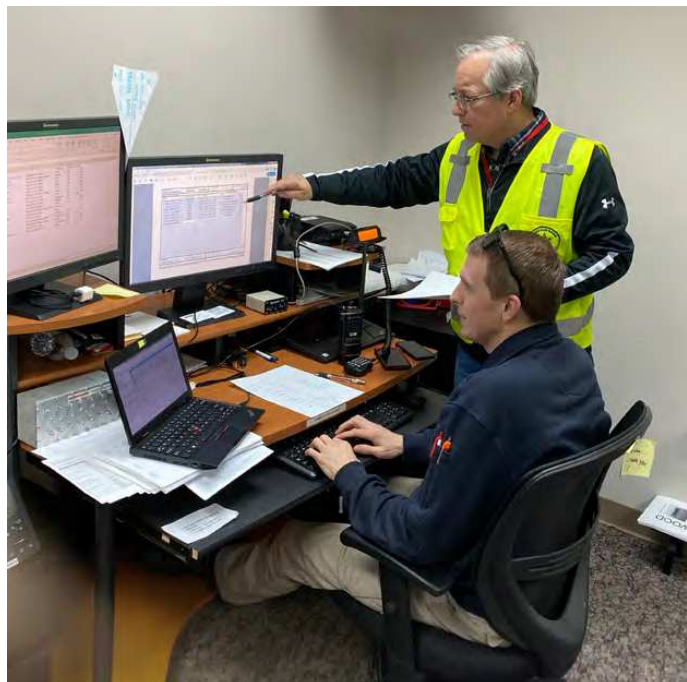


Winlink ARES display at Green Country Hamfest. [Paul Teel, WB5ANX, photo]

So how does a message/mail net compare to a voice net? It is a completely different method of communication. Instead of real-time communications with the speed of a push-to-talk (PTT) button, there are longer pauses as participants and net control compose detailed messages to/from each other. In the case of Winlink, messages can be either one to many or one to one. Net controls have to adapt to the fact that not everyone may have seen a message between net control and another net participant. When in doubt, make sure to include snippets or full private messages to the group to keep everyone on the same page.

Voice nets focus on keeping things short and to the point, as long-winded voice transmissions will make success much more difficult. We all know that verbal communication loses fidelity as it gets passed through several hands before making it to the final destination. Detailed communications such as NTS messages typically require extensive use of the phonetic alphabet and repetition to ensure that the recipient gets an accurate message.

In contrast, message/mail nets are intended for long messages along with detailed information (such as extensive lists). Participants can read and re-read a message until they fully comprehend it. Winlink even supports small graphic file attachments, such as drawings and pictures. Messages/mail can be forwarded easily with 100% fidelity.



James Plumlee, KI5DAZ, and Paul Teel, WB5ANX, using Winlink during the 2020 Winter Field Day SET. [Paul Teel, WB5ANX, photo]

The bottom line is that message/mail nets are another tool in emergency communication and are intended to complement, not replace, voice communications.

The Results

We have conducted three of our large exercises since starting the Tulsa ARES Winlink Net. We have achieved 100% operator proficiency in all of the exercises, which exceeded our goal of 95%. Operator feedback has reflected higher confidence during the exercises and a recognition that the exercises were composed of individual skills taught during the weekly nets. Engagement has increased to a level at which the subject-matter experts are suggesting particular topics for a weekly net.

Retention has also increased, with the loss of no operators in the past year. Previously, 20 – 30% of operators would lose interest over a calendar year and not participate in the exercises.

Lessons Learned from the Tulsa ARES Winlink Nets

- Pick exercises that teach skills needed in an actual emergency. Choose forms and functionalities in Winlink that would be used in real-world emergencies. For example, the Winlink Check-In and Check-Out forms are invaluable for keeping track of who is on the air. The ICS forms suite is used by most served agencies, and they will appreciate the ham volunteers using them.
- Teach the limitations of Winlink (such as file attachments that are too large), so operators don't unwittingly get tripped up by them.
- Introduce the net with the appropriate information about the group (name, etc.), as well as the start and finish times and dates for the net itself. It should be clear to everyone how much time they have to respond.
- Provide clear instructions for the weekly exercise. It is best to go through what you are requesting the net participants to perform and make sure your instructions can be followed by someone who may not have as much knowledge about Winlink. When in doubt, give your instructions to a Winlink novice.
- Always offer participants the opportunity to provide feedback and suggestions. Some of the best exercises have come from the participants.
- Provide a summary email thanking those who participated in the net.
- You will have nets that don't go as expected. Don't get frustrated. Use those moments as opportunities for improvement.

We have also expanded to participants in other states and countries. A typical weekly net has participants from five different states and at least two countries (the US and the Philippines). This has led to the realization that we now have resources that could act as net control and resources outside of the Tulsa County area. Disasters are local in nature, but resources do not have to be local due to the coverage of HF and Winlink gateways throughout the world.

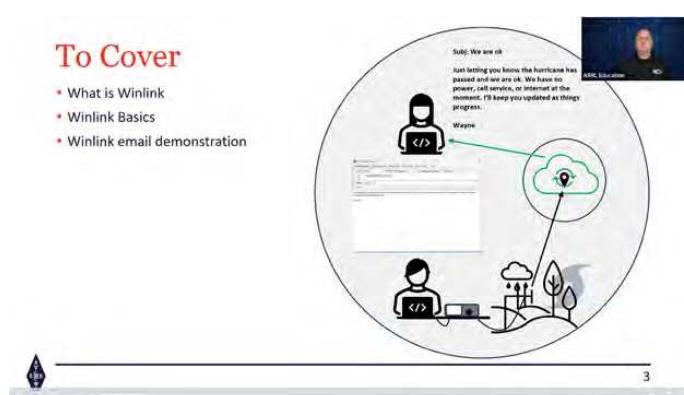
Subject-matter-expert interest has also resulted in an increase in the number of gateways in Oklahoma from the original two in 2013 to 11 in 2026.

Plans for the Future

Due to the positive results, we will continue to run the Tulsa ARES Winlink Net. We just finished covering all of the ICS forms that would be included in an Incident Action Plan. We have plans to conduct more activities peer to peer/completely off the grid to demonstrate capabilities in the event that Winlink gateways are not available. We continue to publicize the net on the weekly ARES voice net and Facebook, which results in one to two new operators per year. With an average attendance of 20 operators per week, we have increased our confidence in being able to use Winlink effectively during an actual emergency.

Invitation to Join Us

If you'd like to join the Tulsa ARES Weekly Net, send a Winlink message to ae5me@winlink.org. If you do not have a Winlink station or account, send an email to ae5me@yahoo.com. I do online assistance via *Zoom* and can help you get on the air with Winlink.



For more information about using Winlink, check out the November 2025 episode of "On the Air Live" with ARRL Education Specialist Wayne Greene, KB4DSF, at <https://learn.arrl.org/webinars/87521>.

Jeff Scoville, AE5ME, has been an amateur radio operator for 29 years. He had an interest in shortwave radio, weather spotting, scanners, and computers throughout his teenage years. Jeff has a BS in mechanical engineering from the University of Tulsa and an MS in aerospace engineering from Georgia Tech. He has held multiple engineering and management roles in his career, mainly in the power plant and petrochemical shell and tube heat exchanger industry. Jeff has been involved with Winlink for 25 years, both as an operator as well as an HF and VHF gateway system administrator. He can be reached via email at ae5me@yahoo.com and via Winlink at ae5me@winlink.org.

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A DXpedition to the Faroe Islands

A chance contact sparked an unforgettable trip to the North Atlantic for a technical challenge and a cultural experience.

Jim Millner, WB2REM

Having visited more than 70 countries over the years, some of which I activated, I was eager to discover a new and fascinating place to operate a radio. Unexpectedly, one such opportunity emerged while operating on 20 meters when I reconnected with Amir Bazak, 4X6TT, who was operating portable from the Faroese Amateur Radio Union (Føroyskir Radioamatørar; FRA), OY6FRA, in the Faroe Islands. He kindly introduced me to the club's president, Ólavur Frederiksen, OY1OF, and it sparked the idea of a DXpedition to this extraordinary beacon in the North Atlantic (www.faroeis.com).

The OY prefix does not appear at the top of the DXCC Most Wanted List (it's approximately #200 overall and #136 for North America), but its relative rarity ensures healthy pileups during activations. The islands' inclusion in Islands on the Air (EU-018), along with opportunities for operating Summits on the Air and Parks on the Air®, adds further incentive for operators to log an OY contact.

Discovering the Faroes

The Faroe Islands are a self-governing archipelago within Denmark in the North Atlantic between Iceland and Norway. This rugged chain of 18 islands is home to approximately 55,000 residents and lies about 4 degrees south of the Arctic Circle. The climate of the Faroe Islands is influenced by the Gulf Stream's current interactions with polar fronts, resulting in unpre-

dictable weather patterns that lead to frequent rain and windy conditions.

Vágar Island (where the airport is) is linked to Streymoy Island through a subsea tunnel, where the capital, Tórshavn, is located, along with OY6FRA. Tórshavn is about a 45-minute drive from the airport. The Faroe Islands are connected by a remarkable network of tunnels, including the world's only undersea roundabout.

OY Operations

Operating in the Faroes is straightforward for many amateurs, thanks to the European Conference of Postal and Telecommunications Administrations (CEPT) reciprocal licensing agreements (www.arrrl.org/cept). US hams holding General-, Advanced-, or Amateur Extra-class licenses can legally operate with an "OY/" prefix before their call (e.g., OY/W1ABC).

Our team included Carol Sugars, K5TFL; Regin Nicolajsen, OY1R; Bruce Baskett, K3BAB; Krish Kanakapathi, W4VKU; Bill Mims, W2WCM; Mike Kelly, W9MK; Ólavur Frederiksen, OY1OF; John Froehler, K4LT, and me. We initially gathered in Iceland so that we could explore for 3 days before our 2-hour flight to the Faroe Islands.

In the Faroe Islands, we were joined by two FRA officers. This multinational group used a variety of call signs, including OY6FRA, OY/W9MK, and OY/K4LT, with each location offering a unique operating perspective in breathtaking settings.

The FRA's club station serves as a hub for local and visiting operators. We were honored to be welcomed by FRA President Ólavur Frederiksen, OY1OF, and Vice President Regin Nicolajsen, OY1R. Their hospitality was exemplary, as they granted us full access to their well-equipped station featuring multiple operating positions and an extensive antenna field.

The station's primary antenna is a nine-element Opti-Beam. Additional antennas include inverted-V and -L dipoles, verticals, and a delta loop. For VHF/UHF work, the club has two five-element Yagis, one for 6 meters and another for 4 meters (70 MHz). This comprehensive setup allowed us to cover bands from 160 through 4 meters. Considering the unpredictable propagation



OY6FRA antennas and shack. [Photo courtesy of Ólavur Frederiksen, OY1OF]



The Faroe Islands are located between Norway and Iceland.

(and to facilitate better communication with distant stations) we brought an SPE Expert 1.3K-FA amplifier with us from the US. Perched on a rocky coastline, OY6FRA offers a commanding view of Tórshavn, the surrounding islands, and local maritime traffic.

Our team operated from the club station and two remote locations: central Tórshavn (OY/W9MK) and the village of Leynar (OY/K4LT). Our gear included two Icom IC-7300s, a Yaesu FT-710, wire antennas, and vertical antennas using Wolf River Coils.

Operating in the Faroes presented unique challenges. The combination of steep terrain and limited flat areas, as well as rapid weather changes, made antenna deployment difficult. On our first full day operating as OY/K4LT, we experienced 70 mph winds, driving rain, and cold temperatures. Nevertheless, the elevated terrain, saltwater horizons, and low noise floor made for excellent HF conditions, particularly on 20 meters.

That said, summer daylight posed issues for low-band operation. With daylight lasting until 1 AM and twilight persisting until 4 AM, we found operating on 160 and



Regin Nicolajsen, OY1R (on the left), and Ólavur Frederiksen, OY1OF (on the right), at the OY6FRA operating position. [Photo courtesy of Ólavur Frederiksen, OY1OF]

80 meters to be difficult. Propagation was further impacted by a solar flare in the first few days. Despite setbacks, we logged more than 15,000 contacts. The FRA operates a beacon station, OY6BEC, which is active on several bands (www.qrz.com/db/oy6bec). The beacons help to determine propagation to the islands.

Why the Faroes Matter

We were continually struck by the natural beauty of the islands — towering waterfalls, mountain passes, and ocean vistas. Wildlife sightings included puffins, Faroese horses, and countless sheep. Tórshavn and the surrounding villages preserve vibrant cultural traditions, such as the centuries-old chain dance and the distinctive Faroese dress, worn only on special occasions.

Despite their modest size and population, the Faroe Islands excel in the realm of amateur radio. Their distinctive location and scenic beauty, coupled with a passionate amateur radio community and inherent advantages, make them an exceptional destination for hams seeking a technical challenge and a cultural experience. Whether you're a DXer eager to activate the OY prefix, a portable operator facing the elements, or a local enthusiast linking the islands' remote villages, the Faroes provide a radio adventure unparalleled by any other.

If you're planning a trip to the Faroe Islands, contact Ólavur Frederiksen, OY1OF, via his QRZ page for information on guest operating opportunities at OY6FRA.

Acknowledgments

I wish to express my gratitude to Gene Hinkle, K5PA, and Kenneth Steiner, K1GUY, for their support in the publication of this article.

Jim Millner, WB2REM, has been a licensed ham radio operator for more than 60 years. He is a passionate DXer, a global traveler, and a licensed psychologist. He received QST's Cover Plaque Award for his April 2020 article, "HD8M DXpedition to the Galapagos Islands." In the April 2023 issue of CQ magazine, Jim authored the article, "An Interview with ChatGPT on the Future of Ham Radio." He can be reached at wb2rem@verizon.net.

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



Roving for WAS Chasers

KA6U revamped his EME station for those seeking rare states on VHF and UHF.

Peter Van Horne, KA6U

Working all 50 states on 222 MHz and above is a challenge. Many operators consider achieving the ARRL Worked All States (WAS) Award on 222, 432, and 1296 MHz to be among their greatest achievements. Some states do not have full-time operators on these bands. Great distances and propagation challenges require Earth-moon-Earth (EME) operation to complete contacts with stations in all 50 states.

On December 13, 2019, I made my first-ever EME contact with Dmitry Kozlov, UA3PTW, on 2 meters, and I was hooked. Later, on April 28, 2023, Dmitry and I were happy to complete a 432 MHz contact while I was in Wyoming so that he could earn WAS on that band.

In 2020, I joined Marshall Williams', K5QE (SK), operating team at their contest station in Texas. Marshall told me stories about several of the first-class expeditions he made to help Fred Fish Memorial Award and WAS chasers. One piece of advice he offered to me was, "Work 'em all!"

Marshall and I share an interest in doing difficult things. He told me that the hardest accomplishment in VHF/UHF operation is to complete WAS on all bands: 50, 144, 222, 432, and 1296 MHz. Until 2023, Al Ward, W5LUA, was the only operator to do this.

Upgrading the Rover

I decided to re-work my 2-meter EME roving station into one for 222, 432, and 1296 MHz. I built the station into my 2012 Ford Explorer (with the back seat removed) and upgraded it to deliver at least 500 W to the antennas on 432 and 1296 MHz, and to run 800 W on 222 MHz. I also designed it to enable continuous operation on 1296 MHz, with simultaneous operations on either 432 or 222 MHz. My goal was to be able to work any average-sized station on these bands, even at the moon's apogee.

One challenge of assembling such a station was deciding where to put everything. The back of the rover is organized for fast setup and teardown of the EME stations. On the right side, the folding dish hangs from the roof. The two generators (2.2 kW each) needed to enable simultaneous operation are visible. The rotator for the 2.4-meter dish is at the back. Four 1-meter tent stakes are also visible at the back; they are used to prevent the antennas from blowing away in the wind.

In the back and on the left are all the power cords, cables, and the rotator control (see Figure 1). The cables are color coded and keyed to prevent connection to the wrong places. Also on the left is the antenna tripod for the 222 and 432 MHz Yagis. The Yagis ride on a roof rack when fully assembled. They snap onto the cross-boom — no tools required.

The operating location is in the passenger seat of the car (see Figure 2). I use two Icom IC-705 radios: one for 1296 MHz using a 144 MHz transverter, and one for either 222 or 432 MHz. I run two chat windows when my internet connection is good.

The RF deck (replacing the back seat; see Figure 3) includes a 1 kW 222 MHz Harris power amplifier (PA). The 600 W 432 MHz PA is a Tajfun 1000, and the 600 W 1296 MHz PA is from James Klitzing, W6PQL.

The way I organized my rover allows me to set up the 23-centimeter station in only 15 minutes. The 222 and 432 MHz tripod and antennas require 25 minutes to set up, and packing everything up takes 30 minutes. In contrast, my first 2-meter roving station took 2 hours to set up!

I have made four roving trips in the past 18 months, which amounted to more than 30,000 miles of travel and operation in 45 states. One of the highlights of those trips was helping Marshall achieve WAS on 50, 144, 222, 432, and 1296 MHz.



Figure 1 — Various pieces of equipment for the roving station, as viewed from the vehicle's open trunk.

Spring 2023 EME Roving Trip

My fourth roving trip started in Florida on April 24, 2023. I used Google Earth Pro to plan my stops. The high-resolution satellite photos enabled me to see small details, like power poles and even gates on interesting roads. Google Street View allows rovers to reliably select sites while considering possible interference sources, such as trees.

After setting out from Florida, I stopped in Texas to participate in the DUBUS EME contest at the K5QE contest station before heading north to North Dakota, west to Washington, and south to New Mexico. I proceeded around the bottom of the Rocky Mountains, and then back to North Dakota, east to Rhode Island, and south again to Florida, with many stops along the way. I moved fast so that I could cover all of the rare western states while the moon was still high over Europe.

I completed the trip on May 15. Three operators completed 432 MHz WAS, and 10 additional operators completed 1296 MHz WAS. Including other operators who completed WAS during my previous trips, when all of the certificates are issued, the WAS counts on these bands will be the following (as of the writing of this article):

- 222 MHz: 17 (formerly 10)
- 432 MHz: 33 (formerly 24)
- 1296 MHz: 30 (formerly 3)

During this most-recent trip, I operated in 25 states, made more than 500 EME contacts, drove 9,000 miles, contributed to 13 WAS completions, and slept — at most — 5 hours a day.



Figure 2 — A view of the author's operating location when in the rover.



Figure 3 — The station's power amplifiers, which replace the back seat of the vehicle.

The Takeaway

The enjoyment of roving includes the people you meet, the places you visit, and the people you help. Many operators told me they had chased 1296 MHz WAS for 20, 30, and even 41 years. Jeff Wheeler, W7JW; Dave Kerl, N9HF, and Linda Straubel, N9LHS, were able to complete 1296 MHz WAS less than 9 months after making their first 1296 MHz contacts (all used 3-meter surplus dishes).

To further help other hams, Ian Parker, W6TCP; Frank Potts, NC1I; Jay Baack, N1AV; Marshall, and I donated a 432 MHz EME station (the same as my roving station) to an operator in Hawaii so 432 MHz EME is available there at any time.

All photos provided by the author.

Peter Van Horne, KA6U, earned his Novice-class license in 1967 at age 11. In 1969, he upgraded to Advanced class and became WB8FHC. He upgraded to Amateur Extra class in 1970 as KA8U. In 1977, Peter moved to California with the call sign KA6U. After that, he moved to the Tampa, Florida, area in 2020. Peter can be reached at petervanh143@gmail.com.

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

VOTE

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



Interoperability Skills Every ARES Operator Should Understand

Bob Famiglio, K3RF

During disasters, public safety and federal agencies, non-governmental organizations, and critical-infrastructure entities all operate communications systems within a national interoperability framework. At the center of that framework is the *National Interoperability Field Operations Guide (NIFOG)*.

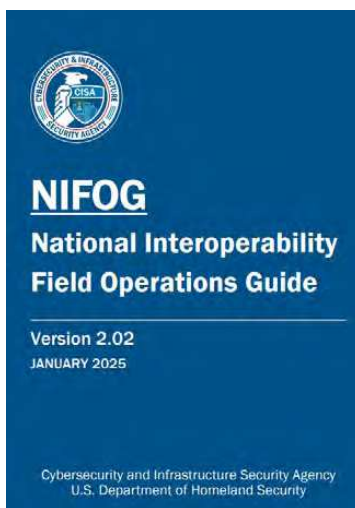
The *NIFOG* is published for responders, communications technicians, and radio operators, and it catalogs nationwide interoperability channels across HF, VHF, UHF, 700/800 MHz, federal bands, and other shared resources, outlining standardized procedures, naming conventions, channel priorities, and operational practices used in multi-agency incidents.

It's paramount that Amateur Radio Emergency Service® (ARES®) operators are familiar with the *NIFOG* during multi-agency responses, particularly wide-area disasters. Understanding the guide helps hams see how agencies communicate, how interoperability is achieved, and where amateur radio fits into the national plan.

Why the *NIFOG* Matters

ARES volunteers are prohibited from transmitting on the *NIFOG* channels, and they can only program them into equipment as receive-only, unless specifically authorized, in writing, by the appropriate authority having jurisdiction. Even so, knowing the structure of the interoperability plans allows trained amateur radio operators to integrate more effectively with served agencies when assistance is requested and additional equipment is offered to trained volunteers to use alongside ham equipment.

In any disaster, amateur radio is only one tool in a much larger communications toolbox. If multiple agencies are involved, responders turn to the interoper-



The *NIFOG* outlines the framework for national interoperability.

ability channels defined in the *NIFOG* to find common frequencies to use. This knowledge can transform an ARES volunteer from "someone with a radio" to "a communicator who better understands the operational environment."

Our role is to supplement public safety and other emergency response groups (when requested) and support information flow. Knowledge of the *NIFOG* helps volunteers understand when amateur radio is likely to be used, what gaps it can fill, and how to coordinate effectively with agency communications units.

ARES volunteers who understand the *NIFOG* procedures can integrate more smoothly into an incident command system (ICS) structure. They can assist with logging, message relay, and documentation in ways that align with agency expectations. They can also communicate more effectively with a communications leader and technician personnel, which are defined ICS roles that rely heavily on the *NIFOG* standards.

ARES groups that incorporate *NIFOG* awareness into their training produce operators who are better prepared, more confident, and more valuable to served agencies. Even a basic understanding of the national interoperability plan elevates an operator's ability to contribute meaningfully during a disaster.

More Guide Information

ARRL's contact information and basic amateur radio frequency listings are also found in the *NIFOG*. Free copies of the latest (January 2025) guide are available for download from www.cisa.gov, among other public safety, federal agency, non-governmental organization, and critical-infrastructure entity websites. Printed and bound copies are also widely available. Put a copy with your go-kit!

Happenings

New 60-Meter Frequencies Available as of February 13, 2026

The new 60-meter frequencies approved by the FCC in December 2025 have become available to amateurs as of February 13, 2026, along with new power restrictions on those frequencies. Different rules apply to different segments of the band. The changes result from the FCC's action to approve a worldwide 60-meter amateur allocation made by the 2015 World Radiocommunication Conference (www.tinyurl.com/mt8p8jpa).

As of February 13, amateur radio operators with General-class licenses or higher may operate on a secondary basis anywhere between 5351.5 and 5366.5 kHz, subject to a maximum bandwidth of 2.8 kHz and a maximum transmit power of 9.15 W effective radiated power (ERP). For the purpose of computing ERP, the transmitter peak envelope power is multiplied by the antenna gain relative to a half-wave dipole antenna. A half-wave dipole is presumed to have a gain of 1 (0 dBd). Amateurs using other antennas must maintain records of either the antenna manufacturer's data on the antenna gain or calculations of the antenna gain.

Here's the confusing part: The existing 60-meter channels centered on 5332, 5348, 5373, and 5405 kHz remain as secondary amateur allocations with a maximum power of 100 W ERP. However, the old channel at 5358.5 kHz is eliminated, as it is now part of the new 5351.5 – 5366.5 kHz subband and subject to the lower power limit.

For all 60-meter transmissions, emission bandwidth is limited to 2.8 kHz or less, and amateurs must not cause harmful interference to — and must accept interference from — stations authorized by the US (the National Telecommunications and Information Administration and the FCC) and other nations in the fixed service, as well as all other nations in the mobile service (except aeronautical mobile). Data or RTTY emissions in particular must be limited in transmission length so as not to cause harmful interference. Digital mode operators must be familiar with offsets in order to stay within the authorized frequencies.



NCVEC QPC Removes Three Questions from Use



The National Conference of Volunteer Examiner Coordinators (NCVEC) Question Pool Committee (QPC) has removed two questions from the General-class question pool and one question from the Amateur Extra-class pool.

Due to recently published FCC rule changes affecting the 60-meter band (see the lead story), General-class questions G1A04 and G1C09 are no longer valid and must be removed from use on examinations. Amateur Extra-class question E4D05 must also be removed because it contains more than one correct answer. All affected questions should be removed from examinations as soon as possible.

Updated General-class question pool files, including the errata and new information, have been posted to the NCVEC General-class question pool web page at www.ncvec.org/index.php/2023-2027-general-question-pool-release. The current Element 3 General-class question pool became effective on July 1, 2023, and it is valid through June 30, 2027.

Updated question pool files have also been posted to the NCVEC Amateur Extra-class question pool web page at www.ncvec.org/index.php/2024-2028-extra-class-question-pool-release. The current Element 4 Amateur Extra-class question pool became effective on July 1, 2024, and it is valid through June 30, 2028.



The ARRL Volunteer Examiner Coordinator advises the amateur radio community, and particularly Volunteer Examiners, to regularly check the NCVEC website

at www.ncvec.org for updates to the question pools, which may include errata and withdrawn questions.

ARRL Director Receives Search-and-Rescue Award



ARRL Northwest Division Director Mark Tharp, KB7HDX, at the 2026 ARRL Board Meeting held in Windsor, Connecticut, in January.

ARRL Northwest Division Director Mark Tharp, KB7HDX, has received the Hall of Honor Award for 35 years of service to the Yakima County Search and Rescue group.

Tharp called the award "unexpected and very much appreciated," adding, "You don't do volunteer work to get awards, you do it because it's needed and makes a difference."

Tharp was first licensed in 1989 and now holds an Amateur Extra-class license. He became a ham

after spending time with a ham friend and exploring the mountains of the northwestern US. "The Yakima County Search and Rescue group continues to grow and help volunteers train and keep [more than] 100 sports-related locations safe," said Tharp. He remembered one particular rescue that involved a young boy and his cat.

The boy had been missing for several hours, and it was getting dark and cloudy. "We were tired but didn't quit. I sat down on a hillside and using an infrared camera...we were able to find him and his cat... cold, but okay," said Tharp.

Tharp is retired now, but as the ARRL Northwest Division Director, he represents members in Alaska, Montana, Idaho, Washington, and Oregon. He is an ARRL Life Member, a member of the ARRL Diamond Club, and a member of the ARRL Maxim Society.



The Hall of Honor Award given to ARRL Northwest Division Director Mark Tharp, KB7HDX, by the Yakima County Search and Rescue group.

John Cadwallader Kanode, N4MM, Silent Key

John Cadwallader Kanode, N4MM (SK), of Boyce, Virginia, passed away on January 13, 2026. He was 88 years old. First licensed in 1952, Kanode served on the ARRL Board of Directors for 21 years as Roanoke Division Vice Director, Director, and Honorary Vice President. He was a member of the ARRL Maxim Society (President Class) and an ARRL Life Member, and he was named ARRL Honorary Vice President in 2003.

A remembrance from his hometown radio club, the Shenandoah Valley Amateur Radio Club, of which he was a founding member, noted that Kanode made hundreds of thousands of contacts in his lifetime, earning nearly every top award available to amateur radio operators from every nation in the world. He attained DX Century Club (DXCC) Honor Roll and the DXCC Challenge Award, and he was inducted into the

CQ DX Hall of Fame in 2000. In 2025, he earned the DXCC Trident Award.

In 1984, Kanode received the ARRL Roanoke Division Special Service Award. He also served as manager of the W4/K4/N4 ARRL QSL Bureau, and as a Volunteer



John Cadwallader Kanode, N4MM (SK).

Examiner (VE), he had 223 VE sessions to his credit. He was a member of the Quarter Century Wireless Association, the Radio Amateur Satellite Corporation, the International DX Association, and the International Radio Club of America. He also belonged to the North Shenandoah DX Association, the National Capitol DX Association, and the Potomac Valley Radio Club.

Kanode served in the US Air Force, and he worked for several years with Sandia Corporation in New Mexico, retiring from IBM in 1993.

Special thanks to Elizabeth Cottrell, W4EHC, and the Shenandoah Valley Amateur Radio Club for information included in this memorial.

Bob Jones, VE7RWJ, Silent Key

Robert W. "Bob" Jones, VE7RWJ, a former top official of the International Telecommunication Union (ITU) and Canadian telecommunications regulator, passed away on January 7, 2026, at age 82. His early fascination with amateur radio led to a career in telecommunications and engineering, according to his obituary.



Jones was Director General of the Canadian Radio-communications and Broadcasting Regulatory Branch from the 1970s through the mid-1990s. He led the Canadian delegation to various ITU conferences between 1977 and 1994 when he was elected Director of the ITU Radiocommunication Bureau (ITU-R). He served in that leadership post from 1995 to 2003. Jones continued his involvement with ITU as a member of the Radio Regulations Board from 2007 to 2010, and he received an ITU Silver Medal at the end of his term.

Jones was an active amateur, first licensed in 1959 as VE3CTM. International Amateur Radio Union (IARU) Secretary Joel Harrison, W5ZN, noted that he "was very helpful to amateur radio" during his time as ITU-R Director, adding that when he retired, Jones "became one of the IARU Technical Experts and worked with us for several years on World Radiocommunication Conference matters."

Section Manager Nomination Notice

To all ARRL members in Connecticut, Idaho, Minnesota, North Dakota, Ohio, Oklahoma, Puerto Rico, Southern Florida, Virgin Islands, and Western New York. 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 June 5, 2026. If more than one member is nominated in a single Section, ballots will be mailed from Headquarters no later than July 1, 2026, to full members of record as of June 5, 2026, which is the closing date for nominations. Returns will be counted August 18, 2026. Section Managers elected as a result of the above procedure will take office October 1, 2026.

If only one valid petition is received from a Section, that nominee shall be declared elected without opposition for a 21-month term beginning October 1, 2026. If no petitions are received from a Section by the specified closing date, such Section will be resolicited in the January issue of *QST*. A Section Manager elected through the resolicitation will serve a term of 12 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

Because no nomination petitions were received for the Eastern Pennsylvania and the Pacific Section Manager election by the nomination deadline of December 5, 2025, nominations are hereby resolicited. See above for details.

2026 ARRL Straight Key Night Results

“SKN only happens once a year and it helps remind me of the good old days...” — Karl Schwab, KO8S

Bart Jahnke, W9JJ

Radiosport & Regulatory Information Manager

ARRL Straight Key Night (SKN) is an event Morse code (CW) operators eagerly await every year. To kickstart 2026, 126 participants took part in the event, reporting a total of 784 contacts. Several participants this year noted that they used this opportunity to operate with vintage equipment to honor the past.

Eric Castro, VE3DN, spent his spare time between Christmas and the New Year carefully building a new QRP Labs QMX radio covering 20 – 80 meters, giving the radio its first contact on SKN with a Schurr Mini Straight Key. Tuning to 7055.5 MHz, he connected with Jim, AF3Z, in Mount Joy, Pennsylvania, and had a “truly joyful QSO — friendly, unhurried, and perfectly suited to Straight Key Night.”

Hank Preciado, HP1IBF, participated in SKN for the 23rd year in a row, using a US military J-45 straight key (a J-37 mounted in a metal band that attaches to the leg) for most of his contacts.

Karl Schwab, KO8S, who is celebrating his 90th birthday this year, enjoyed the opportunity to relive his Novice days, using the same Speed-X straight key he used back then.

Gregory Smith, W2GLS, used this year’s SKN event to live a childhood dream. He started as a radio amateur in 1955 as a seventh grader in Mendham, New Jersey. With only a 35-cent weekly allowance, he couldn’t afford a commercial rig, but as an inventive kid, he started collecting discarded radios on clean-up day and stripping and sorting the parts, managing to construct a regenerative receiver and a 6V6 tube transmitter. However, his dream a number of years later was to own a Hammarlund receiver and a Johnson Ranger. So, on SKN 2026, he lived that dream by setting up both of those pieces of equipment for the event.

Best Fist and Most Interesting QSO

Each year, SKN participants cast their votes for “Best Fist” and “Most Interesting QSO.” This year’s vote for “Best Fist” is a three-way tie between David Evans, VA7DXX; Mark Stile, W1AAF, and Steve Carman, W4IT. “Most Interesting QSO” is a five-way tie between Austin Seraphin, KA3TTT; Steve Carman, W4IT; Kenny

Craig, WA0IYY; Jeff Lynch, WA1VQY, and Hank Ball, WV7U. The next ARRL Straight Key Night will be held on January 1, 2027.

Participating Stations

AA1ZX, AA4TB, AA7IR, AB3AP, AB8FJ, AC7JW, AC8JU, AE3A, AE4ZR, AE7AX, AE7CG, AI6SL, AJ6T, AL7JK, K0CX, K0DLB, K0DTJ, K1HIS, K1SP, K3BVQ, K3MD, K3TW, K4CBW, K5BG, K5MBA, K5NZ, K5RIX, K5SOH, K6DF, K6GPB, K6KQV, K8BZ, K9PFA, K9YA, KA4WJB, KB8YGA, KB9W, KC2LM, KC6MIE, KD0SVI, KD2BD, KD8RV, KE0TT, KE2KEH, KF8KS, KG4KGY, KG7BF, KN4SA, KN5L, KO8S, KQ9J, KW0B, KW6G, N0ENO, N3HCN, N5BF, N5GUS, N6ZO, N7QR, N8GU, N9BOR, N9RU, NE3I, NF8M, NI0R, NN7A, NV5P, NY0O, VA3RKM, VE3CBK, VE3DN, VE3FIT, VE7NI, VO1NA, W0BTS, W0EJO, W0ESE, W0FUN, W0OJW, W0UI, W1FP, W1IK, W1PD, W1PID, W1TS, W1WEF, W2GLS, W2IY, W2NTN, W2NYU, W3DF, W4CMG, W4RF, W4YE, W7AIT, W7HF, W7JRB, W7VHW, W8MAF, W8MND, W8DPK, W8VE, W8WTS, W8WZ, W9ABD, WA0FBH, WA1CFX, WA2CHV, WA7LNC, WA9ZBW, WB0B, WB0IXV, WB4ABY, WB6VRN, WB7AEA, WB7EHX, WB8FCO, WB8RFB, WB9HFK, WD8RIF, WG3W, WK0X, WN8HCV, and WQ3T.

DX stations included HP1IBF and ON7DQ.



Woody Linwood, W0UI, used his grandfather’s 1930s-era Signal Electric R-62 brass hand key for most of his contacts during the 2026 ARRL Straight Key Night. His grandfather was killed in action during World War II, and Woody inherited his key when he was first licensed in 1966. [Woody Linwood, W0UI, photo]

2025 ARRL September VHF Contest Results

Check out the results of the event, held September 13 – 15, 2025.



Russell Beech, VE3OIL/R, in FN04, who won the Classic Rover category in the 2025 ARRL September VHF Contest for the third year in a row. [Michael Kennedy, VA3TEC, photo]

The total number of entries in 2025 was 559, a significant decrease from 646 in 2024 and 706 in 2023. Conditions this year were difficult, as is typical for September on the VHF bands.

One note is that log-checking revealed 3,092 call signs in the submitted logs, highlighting that participation is much higher than the number of submitted logs suggests. Everyone is encouraged to submit their logs, regardless of how many contacts you logged.

Among the entry categories, Single Operator, Low Power saw the most entries this year, but there was a 31% decrease in the mixed category from last year. Entries in the high-power categories stayed mostly the same as in recent years. Numbers of entrants for the three-band categories continued the downward trend from the past 2 years; however, the very small Portable categories saw some growth from last year. See the full results article at <https://contests.arrl.org> for further information.

Year over year, there has been a decline in rover entries; however, there was a slight increase this year. The top 10 rover scores in general were well above last year, when the 10th position scored just under 2,000 points.

The next September VHF Contest will be held September 12 – 14, 2026.

Logs Received by Year

Year	Number of Logs
2017	473
2018	569
2019	691
2020	833
2021	745
2022	672
2023	706
2024	646
2025	559

Entries by Category

Category	Number of Entries
Classic Rover	27
Limited Rover	20
Unlimited Rover	7
Single Operator, High Power	124
Single Operator, Low Power	136
Single Operator, Analog Only, High Power	22
Single Operator, Analog Only, Low Power	42
Single Operator, Portable	14
Single Operator, Portable, Analog Only	16
Single Operator, Three-Band	80
Single Operator, Analog Only, Three-Band	22
Single Operator, FM Only	18
Limited Multioperator	13
Unlimited Multioperator	15
Checklog	3
Total	559

Contacts by Band

Band	CW/SSB/FM	Digital	Total
50 MHz	3,154	12,631	15,785
144 MHz	5,336	7,199	12,535
222 MHz	2,371	914	3,285
432 MHz	3,452	1,919	5,371
902 MHz	788	45	833
1.2 GHz	1,131	127	1,258
2.3 GHz	301	21	322
3.4 GHz	134	0	134
5.7 GHz	143	5	148
10 GHz	160	2	162
24 GHz	42	0	42
47 GHz	6	0	6
123 GHz	19	0	19
Light	18	0	18
Total	17,055	22,863	39,918
% of Total	42.73%	57.27%	

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.

Top Ten

Classic Rover		Single Operator, Portable	
VE3OIL/R	93,470	K5ND	4,998
K2QO/R	40,362	W4RXR	4,218
N5ZY/R	29,562	AF5T	2,128
KC9NJZ/R	24,960	K7MDL	1,840
VE3WJ/R	22,113	AF6SA	1,320
KG9OV/R	20,935	VA2VT	456
K9TMS/R	19,008	N0SUW	432
N9REP/R	16,380	KN6OKY	416
W8ISS/R	14,674	N0JK	135
W2EV/R	14,157	KB1RJS	64
Limited Rover		Single Operator, Portable, Analog Only	
N7GP/R	26,390	K6MI	10,494
KM4OZH/R	16,820	W7JET	1,702
KE4WMF/R	8,568	KC8YEK	1,210
AA2SD/R	7,605	K7ATN	924
N0LNO/R	5,764	NR7Y	882
KC3FQF/R	5,650	KF7NP	741
WA1PQY/R	3,948	N2MAK	688
NL7CO/R	2,886	KE6GLA	615
N6GP/R	2,376	WN1C	600
KA7RRA/R	1,330	WB2AMU	432
Unlimited Rover		Single Operator, Three-Band	
KG6CIH/R	36,240	N3AAA	29,832
N0LD/R	32,882	KO9A	24,824
N2SLN/R	10,175	W5TRL	16,632
KJ1K/R	3,410	W3FAY	10,974
WB2VVQ/R	3,333	K1HC	9,128
KK4BZ/R	2,912	KD2CDV	7,579
W8BRY/R	1,680	W1DYJ	5,750
Single Operator, High Power		NA2NY	5,355
K1TEO	354,432	WA4LDU	3,870
K1RZ	150,046	K3UA	3,731
K1KG	59,052	Single Operator, Analog Only, Three-Band	
W3IP	46,374	N7QOZ	2,898
K3SK	44,890	W1SRH	518
N3MK	37,855	WB9HFK	420
K9KLD	28,000	KV4ZY	324
WB2RVX	21,375	WG1Z	294
WA2FZW	16,686	N0LFK	133
VA3IKE	16,100	AG7QH	132
Single Operator, Low Power		W6KSR	128
N2WK	86,194	KC1WVQ	117
NR2C	67,750	AE1D	98
W1SJ	52,871	Single Operator, FM Only	
K2DRH	49,612	VE3RWJ	1,212
N2SCJ	28,938	W1NIV	546
KA2ENE	28,618	AF6GM	511
N2OA	18,410	K6RJF	440
N3IDR	17,355	N1TEN	432
WA2VNV	16,206	KN6FKQ	125
VE2ZAZ	13,875	KM6LKT	105
Single Operator, Analog Only, High Power		KQ4VYQ	66
W2FU	122,010	K6ZKA	45
WZ1V	43,935	AF1R	36
VE3ZV	28,391	Limited Multioperator	
W2KV	18,247	AA4ZZ	155,092
WA1T	9,010	N2NT	118,720
KR1ST	7,938	K5N	54,060
K5LLL	4,998	KE8FD	47,263
N6RO	4,988	WA3EKL	18,722
K1TR	4,653	W4AD	4,216
KC3BVL	3,375	W1FM	2,970
Single Operator, Analog Only, Low Power		WO1S	1,508
AF1T	114,400	K2AA	1,122
WB2JAY	26,544	KJ5BIN	189
VE3KH	19,082	Unlimited Multioperator	
WB2VVV	7,335	W2SZ	290,250
AC1J	6,422	W2EA	105,028
N6KN	4,676	KD2LGX	81,015
KG9AP	4,545	N8GA	73,048
K2GMY	3,834	N3NGE	48,246
K1PNQ	2,139	WE1P	43,279
N1CMD	1,980	W4NH	32,512
		WD9EXD	29,750
		KV1J	24,653
		W1XM	16,576

Division Winners

Classic Rover			Single Operator, Portable		
Atlantic	K2QO/R	40,362	Atlantic	W3MEO	20
Central	KC9NJZ/R	24,960	Dakota	N0SUW	432
Dakota	W0ZF/R	1,200	Delta	W4RXR	4,218
Delta	AG4V/R	4,563	Midwest	N0JK	135
Midwest	KO0Z/R	799	New England	KB1RJS	64
New England	K1UU/R	7,335	Northwestern	K7MDL	1,840
Southwestern	KD6EFQ/R	1,710	Pacific	AF6SA	1,320
West Gulf	N5ZY/R	29,562	Southwestern	AF5T	2,128
Canada	VE3OIL/R	93,470	West Gulf	K5ND	4,998
Limited Rover			Canada	VA2VT	456
Atlantic	AA2SD/R	7,605	Single Operator, Analog Only, Portable		
Dakota	W0RRC/R	160	Atlantic	N2MAK	688
Midwest	N0LNO/R	5,764	Central	WN1C	600
New England	WA1PQY/R	3,948	Delta	N3AWS	12
Northwestern	KA7RRA/R	1,330	Hudson	WB2AMU	432
Roanoke	KM4OZH/R	16,820	New England	AJ1S	35
Southwestern	N7GP/R	26,390	Northwestern	K7ATN	924
West Gulf	NL7CO/R	2,886	Pacific	K6MI	10,494
Canada	VE3RKS/R	105	Roanoke	W4AQ	84
Unlimited Rover			Southwestern	W7JET	1,702
Atlantic	N2SLN/R	10,175	Single Operator, Three-Band		
New England	KG6CIH/R	36,240	Atlantic	N3AAA	29,832
Roanoke	KK4BZ/R	2,912	Central	KO9A	24,824
West Gulf	N0LD/R	32,882	Dakota	K8OS	216
Single Operator, High Power			Delta	N9TF	616
Atlantic	K1RZ	150,046	Great Lakes	KA8CNI	1,870
Central	K9KLD	28,000	Hudson	NA2NY	5,355
Dakota	K0AWU	5,247	Midwest	N0RC	55
Delta	N4QWZ	14,155	New England	K1HC	9,128
Great Lakes	N8LRG	15,036	Northwestern	AL1VE	944
Hudson	WA2FZW	16,686	Pacific	KH2TJ	1,475
Midwest	K0TPP	3,864	Roanoke	WA4LDU	3,870
New England	K1TEO	354,432	Southeastern	NS4T	3,239
Northwestern	N7EPD	6,784	Southwestern	KC7V	540
Pacific	K6RE	7,332	West Gulf	W5TRL	16,632
Roanoke	W3IP	46,374	Canada	VE3PJ	1,972
Rocky Mountain	K7ULS	957	Single Operator, Analog Only, Three-Band		
Southeastern	WA4GPM	10,512	Atlantic	KC3UKC	84
Southwestern	W6KK	455	Central	WB9HFK	420
West Gulf	AA5AM	14,091	Great Lakes	WB8WUA	1
Canada	VA3IKE	16,100	Hudson	N2RI	9
Single Operator, Low Power			Midwest	N0LFK	133
Atlantic	N2WK	86,194	New England	W1SRH	518
Central	K2DRH	49,612	Northwestern	N7QOZ	2,898
Dakota	K0VG	588	Pacific	K6GHA	12
Delta	AJ6T	3,216	Roanoke	KV4ZY	324
Great Lakes	K8NWN	9,380	Southwestern	W6KSR	128
Hudson	WA2VNV	16,206	Single Operator, FM Only		
Midwest	N0LL	2,067	Delta	K4NRT	15
New England	W1SJ	52,871	Hudson	KE2CCG	21
Northwestern	W7IMC	4,520	Midwest	KF0SCA	1
Pacific	K6USY	4,200	New England	W1NIV	546
Roanoke	K4FJW	2,415	Pacific	K6ZKA	45
Rocky Mountain	WJ7L	494	Southeastern	KQ4VYQ	66
Southeastern	KY4G	4,452	Southwestern	AF6GM	511
Southwestern	N7IR	4,560	Canada	VE3RWJ	1,212
West Gulf	WB5TUF	3,196	Limited Multioperator		
Canada	VE2ZAZ	13,875	Atlantic	WA3EKL	18,722
Single Operator, Analog Only, High Power			Great Lakes	KE8FD	47,263
Atlantic	W2FU	122,010	Hudson	N2NT	118,720
Great Lakes	K2YAZ	54	New England	W1FM	2,970
Hudson	W2KV	18,247	Roanoke	AA4ZZ	155,092
New England	WZ1V	43,935	Southwestern	WO1S	1,508
Northwestern	KJ7BJS	2,940	West Gulf	K5N	54,060
Pacific	N6RO	4,988	Unlimited Multioperator		
Southeastern	WB4WXE	1,269	Atlantic	W2EA	105,028
West Gulf	K5LLL	4,998	Central	WD9EXD	29,750
Canada	VE3ZV	28,391	Dakota	W0AUS	99
Single Operator, Analog Only, Low Power			Great Lakes	N8GA	73,048
Atlantic	KD3HN	980	Hudson	WE1P	43,279
Central	KG9AP	4,545	New England	W2SZ	290,250
Great Lakes	K8BB	740	Northwestern	WD0RKS	1,078
Hudson	WB2JAY	26,544	Southeastern	W4NH	32,512
Midwest	AF4JF	192	Southwestern	W6TRW	290
New England	AF1T	114,400	West Gulf	KC5MVZ	570
Northwestern	N6ZE	1,805			
Pacific	K2GMY	3,834			
Roanoke	KN4FTT	35			
Southeastern	KI4MZC	4			
Southwestern	N6KN	4,676			
West Gulf	WB5ZDP	165			
Canada	VE3KH	19,082			

Regional Leaders

LM = Limited Multioperator; R = Classic Rover; RL = Limited Rover; RU = Unlimited Rover; SO-ALG-3B = Single Operator, Analog Only, Three-Band; SO-ALG-HP = Single Operator, Analog Only, High Power; SO-ALG-LP = Single Operator, Analog Only, Low Power; SO3B = Single Operator, Three-Band; SOFM = Single Operator, FM Only; SOHP = Single Operator, High Power; SOLP = Single Operator, Low Power; SOP = Single Operator, Portable; SOP-ALG = Single Operator, Portable, Analog Only; UM = Unlimited Multioperator

West Coast Region

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

KD6EFQ/R	1,710	R	K6USY	4,200	SOLP	AF6SA	1,320	SOP	N7QOZ	2,898	SO-ALG-3B
N7GP/R	26,390	RL	WZ8T	4,186	SOLP	KN6OKY	416	SOP	AG7QH	132	SO-ALG-3B
N6GP/R	2,376	RL	AB9BH	1,482	SOLP	K7MWD	60	SOP	W6KSR	128	SO-ALG-3B
KA7RRR/R	1,330	RL	N6RO	4,988	SO-ALG-HP	K6MI	10,494	SOP-ALG	KK7A	36	SO-ALG-3B
KM6Z/R	639	RL	KJ7BJS	2,940	SO-ALG-HP	W7JET	1,702	SOP-ALG	K6GHA	12	SO-ALG-3B
K6LMN/R	266	RL	K7YO	1,710	SO-ALG-HP	KC8YEK	1,210	SOP-ALG	AF6GM	511	SOFM
K6RE	7,332	SOHP	N6KN	4,676	SO-ALG-LP	K7ATN	924	SOP-ALG	K6RJF	440	SOFM
N7EPD	6,784	SOHP	K2GMY	3,834	SO-ALG-LP	NR7Y	882	SOP-ALG	N1TEN	432	SOFM
K7CW	2,697	SOHP	N6ZE	1,805	SO-ALG-LP	KH2TJ	1,475	SO3B	KN6FKQ	125	SOFM
KW6S	2,511	SOHP	KE7UQL	1,375	SO-ALG-LP	AL1VE	944	SO3B	KM6LKT	105	SOFM
VE6BMX	1,316	SOHP	N7RK	1,113	SO-ALG-LP	WA7PVE	672	SO3B	WO1S	1,508	LM
N7IR	4,560	SOLP	AF5T	2,128	SOP	KC7V	540	SO3B	WD0RKS	1,078	UM
W7IMC	4,520	SOLP	K7MDL	1,840	SOP	KI6X	165	SO3B	W6TRW	290	UM

Midwest Region

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

N5ZY/R	29,562	R	W5LO	5,104	SOHP	AF5CC	60	SO-ALG-LP	KF0SCA	1	SOFM
W5OC/R	8,586	R	N5RZ	4,346	SOHP	N5LUL	1	SO-ALG-LP	K5N	54,060	LM
W0ZF/R	1,200	R	W5PR	4,089	SOHP	K5ND	4,998	SOP	KC5MVZ	570	UM
K00Z/R	799	R	WB5TUF	3,196	SOLP	N0SUW	432	SOP	W0AUS	99	UM
K0BBC/R	720	R	N0LL	2,067	SOLP	N0JK	135	SOP			
N0LNO/R	5,764	RL	KM5RG	1,242	SOLP	W5TRL	16,632	SO3B			
NL7CO/R	2,886	RL	AE0MO	962	SOLP	K5DHY	1,395	SO3B			
W0RRR/R	160	RL	N0MMA	792	SOLP	W0HGJ	736	SO3B			
N0LD/R	32,882	RU	K5LLL	4,998	SO-ALG-HP	K8OS	216	SO3B			
AA5AM	14,091	SOHP	AF4JF	192	SO-ALG-LP	WB0LJC	108	SO3B			
K0AWU	5,247	SOHP	WB5ZDP	165	SO-ALG-LP	N0LFK	133	SO-ALG-3B			

Central Region

(Central and Great Lakes Divisions; Ontario East, Ontario North, Ontario South, and Greater Toronto Area Sections)

VE3OIL/R	93,470	R	VE3WY	9,694	SOHP	K8BB	740	SO-ALG-LP	WB9HFK	420	SO-ALG-3B
KC9NJZ/R	24,960	R	K2DRH	49,612	SOLP	N9GH	20	SO-ALG-LP	N9OBB	80	SO-ALG-3B
VE3WJ/R	22,113	R	VE3SMA	13,860	SOLP	KB9VKQ	15	SO-ALG-LP	WB8WUA	1	SO-ALG-3B
KG9OV/R	20,935	R	K8NWN	9,380	SOLP	WN1C	600	SOP-ALG	VE3RWJ	1,212	SOFM
K9TMS/R	19,008	R	KE8R	3,198	SOLP	KC9LZQ	6	SOP-ALG	KE8FD	47,263	LM
VE3RKS/R	105	RL	N9YK	2,379	SOLP	KO9A	24,824	SO3B	N8GA	73,048	UM
K9KLD	28,000	SOHP	VE3ZV	28,391	SO-ALG-HP	K0PG	3,066	SO3B	WD9EXD	29,750	UM
VA3IKE	16,100	SOHP	K2YAZ	54	SO-ALG-HP	VE3PJ	1,972	SO3B			
N8LRG	15,036	SOHP	VE3KH	19,082	SO-ALG-LP	KA8CNI	1,870	SO3B			
AC9S	10,125	SOHP	KG9AP	4,545	SO-ALG-LP	NJ9R	1,376	SO3B			

Southeast Region

(Delta, Roanoke, and Southeastern Divisions)

AG4V/R	4,563	R	AJ6T	3,216	SOLP	W4AQ	84	SOP-ALG	K3TW	8	SOFM
KM4OZH/R	16,820	RL	K4JMX	2,613	SOLP	N3AWS	12	SOP-ALG	AA4ZZ	155,092	LM
KE4WMF/R	8,568	RL	K4FJW	2,415	SOLP	WA4LDU	3,870	SO3B	W4AD	4,216	LM
KK4BZ/R	2,912	RU	N1WR	1,924	SOLP	NS4T	3,239	SO3B	KQ4LEO	135	LM
W8BRY/R	1,680	RU	WB4WXE	1,269	SO-ALG-HP	W2UA	1,416	SO3B	W4NH	32,512	UM
W3IP	46,374	SOHP	W4AMP	330	SO-ALG-HP	N4NM	875	SO3B			
K3SK	44,890	SOHP	KN4FTT	35	SO-ALG-LP	KC4GCK	780	SO3B			
N3MK	37,855	SOHP	WA4WZQ	20	SO-ALG-LP	KV4ZY	324	SO-ALG-3B			
K1HTV	14,552	SOHP	KI4MZC	4	SO-ALG-LP	WB5RMG	66	SO-ALG-3B			
KT1R	14,325	SOHP	K4MI	1	SO-ALG-LP	KQ4VYQ	66	SOFM			
KY4G	4,452	SOLP	W4RXR	4,218	SOP	K4NRT	15	SOFM			

Northeast Region

(New England, Hudson, and Atlantic Divisions; Maritime and Quebec Sections)

K2QO/R	40,362	R	WB2RVX	21,375	SOHP	VA2VT	456	SOP	W1NIV	546	SOFM
W2EV/R	14,157	R	WA2FZW	16,686	SOHP	KB1RJS	64	SOP	AF1R	36	SOFM
W3ICC/R	13,932	R	N2WK	86,194	SOLP	W3MEO	20	SOP	KE2CCG	21	SOFM
K1UU/R	7,335	R	NR2C	67,750	SOLP	N2MAK	688	SOP-ALG	K1STK	12	SOFM
KE5NJ/R	3,630	R	W1SJ	52,871	SOLP	WB2AMU	432	SOP-ALG	N2NT	118,720	LM
AA2SD/R	7,605	RL	N2SCJ	28,938	SOLP	AJ1S	35	SOP-ALG	WA3EKL	18,722	LM
KC3FQF/R	5,650	RL	KA2ENE	28,618	SOLP	KQ2RP	18	SOP-ALG	W1FM	2,970	LM
WA1PQY/R	3,948	RL	W2FU	122,010	SO-ALG-HP	N3AAA	29,832	SO3B	K2AA	1,122	LM
WA1VUG/R	966	RL	WZ1V	43,935	SO-ALG-HP	W3FAY	10,974	SO3B	KJ5BIN	189	LM
W2BMT/R	220	RL	W2KV	18,247	SO-ALG-HP	K1HC	9,128	SO3B	W2SZ	290,250	UM
KG6CIH/R	36,240	RU	WA1T	9,010	SO-ALG-HP	KD2CDV	7,579	SO3B	W2EA	105,028	UM
N2SLN/R	10,175	RU	KR1ST	7,938	SO-ALG-HP	W1DYJ	5,750	SO3B	KD2LGX	81,015	UM
KJ1K/R	3,410	RU	AF1T	114,400	SO-ALG-LP	W1SRH	518	SO-ALG-3B	N3NGE	48,246	UM
WB2VVQ/R	3,333	RU	WB2JAY	26,544	SO-ALG-LP	WG1Z	294	SO-ALG-3B	WE1P	43,279	UM
K1TEO	354,432	SOHP	WB2VVV	7,335	SO-ALG-LP	KC1WVQ	117	SO-ALG-3B			
K1RZ	150,046	SOHP	AC1J	6,422	SO-ALG-LP	AE1D	98	SO-ALG-3B			
K1KG	59,052	SOHP	K1PNQ	2,139	SO-ALG-LP	KC3UKC	84	SO-ALG-3B			

April 2026 Frequency Measuring Test

Bart Jahnke, W9JJ

Radiosport & Regulatory Information Manager

The April Frequency Measuring Test (FMT) will have two transmitting stations: Connie Marshall, K5CM, in Oklahoma, and Michael Suhar, W8RKO, in Ohio. Transmissions will be made on 40 and 80 meters, in that order. This should give stations throughout North America an opportunity to receive and measure a strong signal.

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

Measurement Software

The free software tools are quite advanced. If you're already using the *WSJT-X* suite of FT8 or WSPR, you can use its frequency calibration mode as a sophisticated frequency measurement tool. Joe Taylor, K1JT, explains how to use *WSJT-X* for frequency measurement in "Accurate Frequency Measurements with your WSPR Setup" at https://wsjt.sourceforge.io/FMT_User.pdf.

FMT Schedule and Format

The FMT "runs" will start with a call up by K5CM at 0230 UTC on April 17 (Thursday evening in North America). The call-up frequency may not be the same exact frequency as during the key-down period (it may shift as much as 10 Hz). Although the call up is scheduled to start at a specific time, both stations will try to

start earlier to establish a clear frequency. Every effort will be made to start key down at the published time in Table 1. The key-down period will be 1 minute.

Measure the transmitted frequency, and report your results at <https://fmt.arri.org>. Please include your notes and observations, including equipment and any special techniques used. Results must be submitted by 0200 UTC on April 20, at which time they'll be published on the website. Stations submitting measurements within 1 Hz for all transmissions from W8RKO and K5CM will be listed in the "Green Box" of the results, as shown in Figure 1.

Table 1 — Frequency Measuring Test Schedule

Start: April 17 at 02:29 UTC

(Thursday evening in North America)

Results: Submit measurements online until April 20 at 02:00 UTC (Sunday evening in North America)

40 Meters: K5CM

near 7064 kHz

02:30 Call up

02:34 Key down

02:35 End 40-meter run

80 Meters: K5CM

near 3598 kHz

03:00 Call up

03:04 Key down

03:05 End 80-meter run

40 Meters: W8RKO

near 7065 kHz

02:45 Call up

02:49 Key down

02:50 End 40-meter run

80 Meters: W8RKO

near 3599 kHz

03:15 Call up

03:19 Key down

03:20 End 80-meter run

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



Figure 1 — Stations submitting measurements within 1 Hz for all transmissions from W8RKO and K5CM will be listed in the "Green Box" of the results.

Contest Corral

April 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				Bands	Contest Name	Mode	Exchange	Sponsor's Website
Date-Time	Date-Time							
2	0000	3	0300	7	Walk for the Bacon QRP Contest	CW	Max 13 WPM; RST, SPC, name, mbr or pwr	qrptest.com/pigwalk40
4	0000	5	2359	1.8-28	YBDXPI SSB Contest	Ph	RS, serial	contest.ybdxpi.net
4	1200	5	1200	3.5-28	EA RTTY Contest	Dig	RSQ, province or serial	concursos.ure.es
4	1400	5	0200	1.8-28,50,144	Louisiana QSO Party	CW Ph Dig	RS(T), LA parish or SPC	laqp.louisianacontestclub.org
4	1400	5	0200	1.8-28,50,144	Mississippi QSO Party	CW Ph Dig	RS(T), MS county or SPC or 4-char grid	www.arrlmiss.org
4	1500	5	1500	1.8-28	SP DX Contest	CW Ph	RS(T), SP province or serial	spdxcontest.pzk.org.pl
11	0000	11	0600	1.8-28	QRP ARCI Spring QSO Party	CW	RS, SPC, mbr or pwr	qrparci.org
11	0700	12	1300	1.8-28	JIDX CW Contest	CW	RST, JA prefecture or CQ zone	www.jidx.org
11	1200	12	1100	3.5-28	DIG QSO Party, CW	CW	RST, mbr (if member)	dig-contest.de/rules
11	1200	12	1159	1.8-28,sat	Yuri Gagarin International DX Contest	CW Ph	RST, ITU zone	gccontest.ru
11	1200	12	1159	1.8-28	OK/OM DX Contest, SSB	Ph	RS, OK/OM county code or serial	okomdx.crk.cz
11	1200	12	1200	1.8-28	RSGB FT4 International Activity Day	Dig	Signal report	www.rsgbcc.org
11	1200	12	1800	3.5-28	IG-RY World Wide RTTY Contest	Dig	RST, 4-dig yr first licensed	www.ig-ry.de
11	1200	12	2359	1.8-28,50	SKCC Weekend Sprintathon	CW	RST, SPC, name, mbr or "NONE"	www.skccgroup.com
11	1400	12	0200	1.8-28,50,144	New Mexico QSO Party	CW Ph Dig	RS(T), NM county or SPC	www.newmexicoqsoparty.org
11	1400	12	2000	1.8-28,VHF/UHF	Missouri QSO Party	CW Ph Dig	RS(T), MO county or SPC or "DX"	www.w0ma.org
11	1800	12	1800	1.8-28,50,144	North Dakota QSO Party	CW Ph Dig	RS(T), ND county or SPC	ndarrlsection.com
11	1800	12	2359	1.8-28,50	Georgia QSO Party	CW Ph	RST, GA county or SPC or "DX"	gaqsoparty.com
13	0000	13	0200	1.8-28	4 States QRP Group Second Sunday Sprint	CW Ph	RS(T), SPC, mbr or pwr	www.4sqr.com
13	2300	14	0600	144	144 MHz Spring Sprint	CW Ph Dig	4-char grid	sites.google.com/site/springvhfupsprints
15	0030	15	0230	3.5-14	NAQCC CW Sprint	CW	RST, SPC, mbr or pwr	naqcc.info
16	0000	17	0300	14	Walk for the Bacon QRP Contest	CW	Max 13 WPM; RST, SPC, name, mbr or pwr	qrptest.com/pigwalk20
17	1200	20	2359	1.8-28,50	Florida State Parks on the Air	CW Ph Dig	Signal report, SPC (if hunter)	fspota.org/rules
17	2100	18	2059	3.5-28	World Wide Holyland Contest	CW Ph	RS(T), 4X area or serial	tools.iarc.org/wwhc
18	0000	19	2359	No WARC	Texas State Parks on the Air	CW Ph Dig	RS(T), TX park nbr or SPC or "DX" or grid	www.tspota.org
18	0500	18	0859	3.5,7	ES Open HF Championship	CW Ph	RS(T), serial	erau.ee
18	0600	19	0559	3.5-28	Worked All Provinces of China DX Contest	Ph	RS(T), BY province or serial	www.mulandxc.com
18	0700	18	1900	1.8-28	Dutch PACCDigi Contest	Dig	Signal report, PA province or serial	www.veron.nl
18	0800	18	1800	3.5-28	QRP to the Field	CW Ph	RST, SPC, name/station code (see rules)	www.zianet.com
18	0900	19	2359	3.5-28	CQMM DX Contest	CW	RST, continent abbr, "M" (member), "Q" (QRP), "Y" (YL), "C" (multiop/club)	www.cqmmcx.com
18	1200	19	1200	1.8-28	World Time Zone Challenge	CW Ph	RS(T), TZ offset code	wtzc-contest.com
18	1200	19	2359	No WARC	Georgia State Parks on the Air	CW Ph Dig	RS(T), park nbr or SPC or grid	gaparks.org
18	1600	19	0400	3.5-28	Michigan QSO Party	CW Ph	RST, MI county or SPC	miqp.org
18	1700	19	1200	3.5-28	EA-QRP CW Contest	CW	RST, category, "M" (if mbr)	www.eaqrp.com
18	1800	19	1800	1.8-28,50,144	Ontario QSO Party	CW Ph	RS(T), ON county or SPC	www.va3cco.com
19	0700	19	1900	3.5,7	International Vintage Contest HF	CW Ph	RS(T), 6-char grid	vintagecontest.webnode.it
19	1200	19	2200	3.5-28,50,144	Quebec QSO Party	CW Ph	RS(T), QC zone or SPC	quebecqsoparty.org
19	1800	19	2359	3.5-28	ARRL Rookie Roundup, SSB	Ph	Name, 2-dig yr first licensed, state/province/XE area/DX	www.arrl.org/rookie-roundup
19	2300	20	0100	1.8-28	Run for the Bacon QRP Contest	CW	RST, SPC, mbr or pwr	qrptest.com/pigrun
21	2300	22	0600	222	222 MHz Spring Sprint	CW Ph Dig	4-char grid	sites.google.com/site/springvhfupsprints
22	0000	22	0200	1.8-28,50	SKCC Sprint	CW	RST, SPC, name, mbr or "NONE"	www.skccgroup.com
25	0800	26	1159	3.5,7,28	Tipalayo DX Contest	Ph	RS, serial	tipalayo.orlopolman.id
25	1200	26	1200	3.5-28	SP DX RTTY Contest	Dig	RST, SP 2-letter province or serial	pkrv.org
25	1200	26	1200	3.5-28	UK/EI DX Contest, CW	CW	RST, serial, district code (if UK/EI)	www.ukeicc.com
25	1300	26	1259	1.8-28	Helvetia Contest	CW Ph Dig	RS(T), HB 2-letter canton or serial	uska.ch
25	1400	27	0200	1.8-28,VHF/UHF	Nebraska QSO Party	CW Ph Dig	NE county or SPC or grid square	nebraskaqsoparty.com
25	1600	26	2159	7,14,21,28	Florida QSO Party	CW Ph	RS(T), FL county or SPC	floridaqsoparty.org
26	1700	26	2059	3.5-28	BARTG Sprint 75	Dig	Serial	bartg.org.uk
27	1900	27	2100	3.5-28	RSGB FT4 Contest	Dig	Signal report	www.rsgbcc.org
29	2300	30	0600	432	432 MHz Spring Sprint	Dig	4-char grid	sites.google.com/site/springvhfupsprints

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.

Public Service

CERT and Neighborhood Watch: Opportunities for ARES®

At the neighborhood level, radio amateurs — particularly members of the Amateur Radio Emergency Service® (ARES®) — have long participated in FEMA's Community Emergency Response Team (CERT) program, which educates and trains neighborhood volunteers on disaster preparedness and basic skills for dealing with the hazards that may occur in their area. Volunteers are trained in basic disaster response, including fire safety, search and rescue, team organization, and disaster medical operations. The CERT program offers a consistent, nationwide approach to volunteer training and organization that professional responders can rely on during disaster situations, allowing them to focus on more complex tasks.

An example of a neighborhood CERT is where homeowners or apartment dwellers get together in a community center or a neighbor's living room to form a team, then study and learn basic fire safety, simple search and rescue, basic first aid, CPR, and Stop the Bleed. The latter is a program — developed by the US Department of Defense and taught through organizations like the American College of Surgeons and the American Red Cross (with whom ARRL has a Memorandum of Understanding) — that trains volunteers to control life-threatening bleeding using simple techniques like direct pressure, wound packing, and tourniquet application until professional help arrives, empowering anyone to become a lifesaver in emergencies (see <https://stopthebleed.org> to find a course or to order Stop the Bleed kits).

Neighborhood Watch

Neighborhood Watch is one of the oldest and most recognized crime prevention programs in the US, bringing citizens together with local law enforcement to deter crime and make communities safer. If you look around your own neighborhood, there is a decent chance that there is a sign in the area that designates a “crime watch neighborhood.”

Sponsored by the National Sheriffs' Association (NSA), Neighborhood Watch was originally developed in response to requests from sheriffs and police chiefs who wanted to form a crime prevention program that

would involve citizens and address an increasing number of burglaries across the country.

Working alongside law enforcement, neighbors organize themselves as the eyes and ears of their community, showing their presence to deter crime. The driving goal of the program is to reduce opportunities for crime to occur; it doesn't rely on altering or changing the criminal's behavior or motivation, according to the NSA (for more information, see <https://nnw.org/about-neighborhood-watch>).

As with local CERT programs, amateur radio operators could be a valuable resource in Neighborhood Watch communities. There is often an uptick in crime in the aftermath of major disasters when cellular networks are taken down. This gap in communications can be



A “Crime Watch Neighborhood” sign at the entrance of the Three Rivers Estates community, Ichetucknee River, Florida. [Rick Palm, K1CE, photo]

filled by trained neighbors using Family Radio Service and General Mobile Radio Service radios, and radio amateurs using VHF FM handheld, mobile, and stationary radios into repeaters can assist in notifying law enforcement through pre-established protocols.

Tips for Hams in Neighborhood Watch

Amateur radio can play a significant role in the Neighborhood Watch program, as it has in the CERT program. That said, there are a number of important tips to remember when participating in your local Neighborhood Watch.

When organizing volunteers in your community, it is important to work with your local police or sheriff's office. These agencies are critical to a watch group's credibility and are the source of necessary information and training. Hold regular meetings to help residents get to know each other and to decide on program strategies and activities. Consider linking with an existing organization, such as a CERT or other citizens' association, that may be able to provide supplementary support.

Canvass door-to-door and/or attend HOA meetings to recruit members. Even neighbors who don't get out much can participate — seniors who are mostly homebodies and individuals who seldom leave their homes can simply look out their windows and report any unusual activities they see. You can also sponsor a crime prevention meeting and exhibit at your community center, hand out information sheets, and introduce members of your local CERT and Neighborhood Watch groups. Teach parents to educate their children on how to spot and cope with potential crime while walking to and from school or playing in the area.

It's also worth looking into the nature of crime in your area. Check police reports, conduct surveys, and learn residents' perceptions about local crime. Often, residents' opinions are not supported by facts, and accurate information can reduce the fear of crime.

Addressing your neighborhood's physical conditions — low lighting, for example, or the presence of aban-

Weapon Safety and Personal Responsibility

Over the years, questions have been raised about radio amateurs carrying weapons during ARES operations, including former Neighborhood Watch activities. Here is the statement of former ARRL Chief Executive Officer David Sumner, K1ZZ, released in the ARES newsletter on March 31, 2014, which supersedes any prior communication on the subject.

"Anyone seeking permission to carry weapons during an ARES deployment is to be advised that the ARRL cannot give such permission. Neither does the ARRL prohibit legal weapons, but the ARRL accepts no responsibility or liability for injury or damages to anyone as the result of possession of a weapon by an ARES volunteer. The responsibility or liability for injury or damages to anyone as a result of an individual's possession of a weapon remains with the individual. ARES volunteers must obey all federal, state, and local laws while on deployment. When supporting a served agency, ARES volunteers must also adhere to the policies of the served agency. The ARRL does not expect volunteers to participate in a dangerous activity or to place themselves in what they perceive to be a dangerous or unsafe environment. Volunteers should avoid or cease participating in any ARRL activity or deployment under circumstances which make them uncomfortable."

doned cars or overgrown vacant lots — may also help to deter crime. Sponsor cleanups, encourage residents to beautify the area, and ask neighbors to turn on outdoor lights at night. Work with small businesses to repair run-down storefronts and clean up litter from streets; personally, I walk my dogs twice a day and pick up any trash along the way.

And, most importantly, emphasize that Neighborhood Watch groups are not vigilantes and should not assume the role of the police. Never, ever approach the perpetrators of a crime in progress. Your job is to report, not to act like a law enforcement officer. Also, never brandish a weapon at a suspected criminal — refer to the ARRL statement on carrying firearms during ARES operations (see the sidebar, "Weapon Safety and Personal Responsibility").

Club Station

Launching a Club for Emergency Communications

During natural disasters, Westminster Village, a retirement community in Spanish Fort, Alabama, shelters a large elderly population, as well as resolute employees who are expected to come and stay. There are on-site services if residents need additional help — a health clinic, rehab therapies, private-duty home care, etc. Westminster Village is owned by Acts Retirement-Life Communities of Pennsylvania. Prior to a hurricane landfall, Acts stages team members from other Acts communities to support the disaster response and recovery functions of Westminster Village.

Establishing the Club

During Hurricane Sally in 2020, it was discovered that three residents were licensed amateur radio operators. We met and became committed to getting involved so a post-hurricane communications situation could be better next time. The process of founding the Amateur Radio Club of Westminster Village (ARCWV), AB4WV, began, and I was elected club president.

As president of ARCWV, I explored our county Emergency Management Agency (EMA) protocols, joined the county Amateur Radio Emergency Service® (ARES®) group, and got certified as an ARES operator. Westminster Village became known to the local ham

community as a wonderful place for hams to retire, and by June 2022, there were four ham residents and two prospective ham residents. We met and developed a proposal for the executive director of Westminster Village to establish a radio room on site with the purpose that “in the event of a local, regional, or national disaster we would be available to assist in reaching communications outside of the area to seek help or secure vital information for Acts to determine a plan forward.”

After receiving the commitment of the executive director, we established a constitution and bylaws. ARCWV had an identified purpose: provide all residents and employees of Westminster Village, Acts Retirement-Life Communities an opportunity to familiarize themselves with the use of amateur radio and to share related information between its members.

Club Accomplishments

As of June 2025, our club has accomplished vital priorities and objectives:

Secured relations with our local EMA. We publicized ARCWV to Baldwin County EMA, so Westminster Village could be remembered during future disaster events.

Provided emergency communications. We had a historic snowstorm of 9.5 inches, and AB4WV was activated with the county EMA. We monitored trucker traffic on CB channels to relay road conditions and icing on bridges and overpasses to the EMA.

Established a club emergency net. After receiving a club call sign from the FCC, we started a weekly simplex net for the hams in our area. This net began with one net control operator, and now it rotates between eight members who run it.

Became a public charity. We successfully obtained 501(c)(3) status so we could begin writing grants and receiving donations.

Secured a radio room and equipment. Space on the third floor of the main building was donated for use



Leann Abernathy, KQ4WQA, a graduate of ARCWV's Technician course, performing the weekly simplex net.

as a radio room. We also received donations of radio equipment, computers, and furnishings.

Received support from fundraising and Westminster Village. We received cash donations from founding members to pay the fees related to club licensure, liability insurance, and training videos. Westminster Village not only gave us free space and utilities, but they paid for antennas and their installation and provided an electronic lock for the radio room, four file cabinets, a refrigerator, a microwave, access to rooms for meetings/educational programs, and access to their culinary department.

Launched a Technician course. ARCWV received a training grant from ARRL, with which we developed a 10-hour Technician course for adults and youth. The course is free to residents and employees and \$25 for those interested outside our community. Results from this course yielded an increase in our membership from five to 14.

Became an ARRL Volunteer Examiner site. In 2024, we offered three testing sessions and added eight new Technicians and one new General to the community. In 2025, we offered five test sessions, resulting in 12 new Technicians and five hams who upgraded to General or Amateur Extra.

Mentored new hams. Learning to operate a handheld transceiver and checking in to weekly emergency nets is an important lesson for new hams. Once they are proficient, we teach them how to use the equipment in our radio room. Using a one-on-one instruction model, we start with what the new operator is most interested in learning. We also keep binders at each of our stations with standard operating procedures unique to that station.

Established hurricane readiness. We created a process for recruiting and training residents to assist operators during hurricane season by developing training and scheduling simulated emergency practice drills in conjunction with ARRL Field Day. This allows hams to help meet the challenges of assuring communication among residents and their families during a disaster, especially when telephone, cellular, and internet communications fail.

Devised systems for emergency communications. In order to assist with emergency communications in multiple counties along the Gulf Coast, we installed a

Winlink gateway. ARCWV intends to use Winlink for health and welfare messaging to reach the families of Westminster Village residents. We've also developed our own radiogram and used it to educate residents about how the process would work. Susan Dube, a fellow resident, described her experience with the radiogram process: "I thought our time was well spent with a physical presence that led to interest and questions; the safety vests attracted attention, and we helped everyone to better understand what amateur radio can do in a disaster."

Provided youth outreach. We forged relationships with the STEM teacher at the local elementary school and the staff in the public library youth room. We've also held our first Radio Technology Summer Camp for youth. We hope to have an ongoing opportunity to conduct demonstrations at the school.

Looking to the Future

ARCWV has gained significant support from Westminster Village, so our expenses remain low. We'll continue to expand operator training and licensure in our county and surrounding Gulf Coast cities and recruit students for ham camps during the summer. These actions will ensure that ARCWV continues to meet our obligations for emergency communications and will remain sustainable well into the future.

ARRL Special Service Clubs

ARRL offers the Special Service Club (SSC) program for clubs that demonstrate that they're working to improve the amateur radio community by completing special projects, holding license classes, and working with local groups on events, among other activities. Visit www.arrl.org/ssc-application

for more information about this program. Below is a list of new and renewing SSCs as of January 13, 2026.



Renewing SSCs

Stanwood Camano ARC, W7PIG
Holmesburg ARC, WM3PEN

Stanwood, WA
Philadelphia, PA

Sign Up for ARRL Club News

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

Ham Media Playlist

Ham Radio Workbench

All hams have a workbench of some sort, whether it occupies an entire wall of the shack or just a corner of a desk. In other words, we all have a spot where we get ham radio things done. The fun part of the workbench is deciding what projects we want to work on. From building a QRP radio from a kit to programming a handheld for a digital voice mode, there is something for everyone. The question is, where do hams go to spark their interest? Well, to the workbench, of course — the Ham Radio Workbench.

The Ham Radio Workbench I am talking about is not the one in your shack, but rather one you can find online. Hosted by George Zafiropoulos, KJ6VU, and a collection of other hams, Ham Radio Workbench has been producing amazing shows since 2016. In addition to George, the team now includes Vince, VE6LK; Mark, N6MTS; Mike, VA3MW; Thomas, K4SWL; Paul, WD9GCO, and Rod, VA3ON.

While primarily an audio production, Ham Radio Workbench has a modest YouTube presence as well. The vast majority of content is produced solely for audio listeners, but from time to time, they have a special topic that finds its way to www.youtube.com/@HamRadioWorkbench.

The Birth of an Amateur Radio Podcast

George was introduced to amateur radio in junior high school. The vice principal of the school saw him reading *The ARRL Handbook* in the school library and instructed George to go to his office. Generally speaking, trips to the principal's office never ended well, but this visit turned out to have a significant impact. The vice principal, Gene Midyett, K6VSB, offered to teach a Novice licensing course at the

school, for which eight students signed up. About half of those students earned their Novice tickets. To keep the kids interested, Gene regularly gave the group of young hams old equipment, copies of *QST*, and radio parts. Gene turned out to be George's first mentor.

As a teenager, George worked at Henry Radio in Los Angeles, where he found several hams who readily adopted the role of mentor. Frank Cuevas, W6AOA, and Cy Kahn, W6PXH, took George under their wings and helped mold him into the ham he is today. In George's words, "Working at Henry Radio was really like being a kid in a candy store!"

Ham Radio Workbench was born when, as a teenager, George was invited to talk about building repeater systems on a podcast hosted by Jeremy, KF7IJZ. George found that experience to be quite fun, and he explored how podcasting worked. After the podcast, he and Jeremy became good friends and together decided to launch a podcast that focused on hands-on ham radio.

With more than 250 episodes, the podcast has a wealth of great content. The episodes are curated and categorized in a manner that allows for easy browsing based on topics. By navigating to the podcast website, www.hamradioworkbench.com, users can look through episodes chronologically or by clicking on category links on the side of the page.

The Ham Radio Workbench YouTube Channel

The Ham Radio Workbench YouTube channel also has great content. One episode, titled "HRWB 243 A Fresh Approach to Go-Kit design" (<https://tinyurl.com/hrwb-gokit>), features Vince d'Eon, VE6LK, who shares his design methodology for putting together a go-kit. This episode made it to YouTube, in addition to living on the podcast platforms, because it lends itself well to visual presentation. One thing to note: The podcast format tends to be much longer than the standard YouTube video, so this episode is more than 3 hours long.

Watching the video, viewers have the opportunity to see the various pieces of the kit and listen as the hosts discuss why each piece is important, as well as discuss alternatives that viewers may want to consider.



The Ham Radio Workbench crew kicking off an episode.



What's your Purpose?

A Ham Radio Workbench episode discussing how to rethink their go-kit.

A Stand-Out Podcast

A podcast episode that resonated with me is the second episode that was produced. Dating back to July 19, 2016, the episode is titled simply “Hand Tools” (<https://tinyurl.com/hrwb-tools>). Hams often ask about what tools they should buy as they are setting up their workbench at home or in a school classroom. This episode discusses not only what the different tools are and what they do, but also why sometimes it is okay to go with a less expensive version, and why sometimes it is important to get a high-quality tool. It's nice to have a guide to follow, especially for people new to tinkering on a workbench.

Ham Radio Workbench posts “show notes” for episodes. This is a website where they provide critical information, such as product names and links, to learn more. This is critical in the podcast arena because a lot of the listeners are driving while listening, so a spot to go back to and reference is helpful.



Ham Radio Workbench “Hand Tools” episode, which helps listeners decide how to equip their workbench.

Ham Radio Workbench stands out, in part, due to the many ways there are to interact with the hosts and other viewers. They have a Discord server for those who prefer to communicate in mostly text, and they have a DMR talkgroup (BrandMeister 31075).

If you're looking for great content that you can easily consume while on the road or sitting at your desk, Ham Radio Workbench fits the bill. George and his crew do a great job of keeping the episodes coming, ensuring there is always something fresh and new. Head over to www.hamradioworkbench.com today. Not only can you listen to episodes on your computer, but you will also find links to subscribe on your podcast platform of choice.

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.

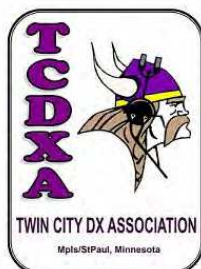
General interest submissions should be in the range of 1,200 – 1,800 words with 3 – 5 high-resolution images. Technical article submissions may be longer and include more images as the subject matter requires (for example, if there are step-by-step instructions for a build project). Please submit images 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.

How's DX?

Highlighting TCDXA; February DX News Follow-Up; Assorted DXpeditions

The following section on the Twin City DX Association (TCDXA) is provided by TCDXA Secretary/Treasurer Mark Johns, KØJM.



As the name implies, TCDXA is in the Twin Cities of Minneapolis and St. Paul, Minnesota. The ARRL Affiliated Club was founded in 1970. Its members enjoy DXing and DX contesting, ranging from hams just getting started in the hobby to old-timers who have held a passion for DXing for decades. There are currently more than 130 members, and around 35 of them are present at each monthly in-person or Zoom meeting. Meetings always begin with a social hour, and programs feature presentations about upcoming or recent DXpeditions, propagation, antenna ideas or new rigs, and contest strategies. Members are also proud of *The Gray Line Report* newsletter, which is published quarterly.

TCDXA's primary mission is to support DXing and DXpeditions with financial donations. Annual member donations and other contributions are the main source of these "Dollars for DX." The club has provided grants to more than 125 DXpeditions, beginning with VKØIR in 1997, and most recently, E44OM. Priority is given to those in the top 100 of Club Log's DX Century Club (DXCC) Most Wanted List. Around \$5,000 is disbursed annually — quite a large amount for such a small club. TCDXA is a 501(c)(3) nonprofit organization incorporated in the state of Minnesota, and it has a long-standing agreement with the Minnesota Vikings National Football League team to use a Viking wearing headphones as its logo. More information about TCDXA is available at www.tcdxa.org.

February 2026 Column Updates

Each "How's DX?" column is written weeks in advance of publication, so mentioned events may change after it goes to press. The February 2026 issue featured stories about the 3YØK DXpedition to Bouvet Island and the CEØX DXpedition to the San Félix and San Ambrosio Islands. In an early January 2026 press release, Felipe A. Gutiérrez, XQ7IR, leader of the San

Ambrosio Project, 3GØXQ, announced the postponement of CEØX. Authorities may process his application to coincide with the local fishing season, which will take place from September 2026 to March 2027. He assured the DX community of his ongoing commitment to activating this rare DXCC entity and confirmed that all equipment remains secure on Juan Fernández Island. Gutiérrez also stated that sponsors and donors would be individually contacted regarding their support following the schedule change.

The 3YØK Bouvet Island DXpedition team also announced in late January 2026 that their DXpedition would be delayed by about 2 weeks due to necessary vessel maintenance. The team emphasized that safety remained their top priority and reassured us that the overall plan, developed over the past 3 years, remains unchanged. They will provide further updates as their schedule evolves. Hopefully, by the time you read this, they will have completed their activation of the number 10 most-wanted DXCC entity.

FO/M — Marquesas Islands

A six-operator team, including members from the Oklahoma DX Association, New Mexico, and France, will operate as TX9W from Atuona, Hiva Oa (Islands on the Air; IOTA reference OC-027), of the Marquesas Islands from April 19 to April 30, 2026. They



plan to be active on all bands from 160 to 6 meters using CW, FT8, FT4, SSB, and RTTY. They will use six complete stations, with a variety of transceivers, amplifiers, and antennas. They'll also upload logs daily to Club Log (streamed live if the internet allows) and later send them to Logbook of The World® (LoTW®). Targeted transmit frequencies for each mode are specified as follows, and they may use US General-class allocations:

- CW: 7007, 10107, 14007, 18077, 21007, 24903, and 28007 KHz
- SSB: 14170, 18130, 21270, 24945, and 28485 KHz

- FT8: 1835, 3563, 5357, 7056, 10144, 14091, 18091, 21091, 24920, 28091, and 50313 KHz
- FT4: 7051, 10144, 14091, 18091, 21091, 24920, and 28091 KHz
- RTTY: 7051, 10135, 14088, 18091, 21088, 24910, and 28088 KHz

On Club Log's DXCC Most Wanted List, the Marquesas Islands are ranked 63 globally and 43 in Europe. The TX9W team prefers QSL requests via Club Log's OQRS, and K5WE is the QSL manager. Those who donate \$10 or more qualify for free direct OQRS after the DXpedition. Direct QSLs require a self-addressed envelope and sufficient postage (no international reply coupons), and bureau requests must go through OQRS — do not send bureau cards directly. They will upload the full log to LoTW for free after returning. Direct cards via OQRS cost \$5; bureau cards requested through OQRS are free, but costly for the team. For more information, visit their website at www.k5we.com/tx9w.

The team expresses appreciation to Jari, OH6BG, for featuring TX9W in the VOACAP DX Charts and for developing a dedicated propagation prediction page to assist their upcoming DXpedition (www.voacap.com/dx/tx9w)

FO/A — Austral Islands



A Dutch/German DXpedition team is planning a March 13 – 25, 2026, activation at Tama Resort, Raivavae Island (IOTA OC-114), which is part of the Austral Islands. The TX5EU operating team includes Gerben, PG5M; Ron, PA3EWP; Rainer, DL2AMD; Evert, PA2KW; Ernö, DK2AMM, and Guenter, DL2AWG, who will serve as group leader. They will be active on 80 – 10-meter CW, SSB, RTTY, and FT8 on the following frequencies:

- CW: 3.523, 7.002, 10.102, 14.023, 18.085, 21.023, 24.905, and 28.023 MHz
- SSB: 3.770, 7.092, 14.210, 18.130, 21.275, 24.955, and 28.465 MHz
- RTTY: 7.043, 10.143, 14.094, 18.106, 21.094, 24.925, and 28.094 MHz

- FT8: 3.570, 7.056, 10.133, 14.090, 18.095, 21.090, 24.911, and 28.095 MHz

For further details, please visit their website at <https://tx5eu-2026.topdx.de>.

5W — Samoa

Jacek, SP5EAQ, will conduct a solo operation as 5W0AF near Apia, Samoa, from March 22 to April 11. He will utilize SSB exclusively and employ a Yaesu FT-710 transceiver, an amplifier, a multiband vertical antenna, and a delta loop configured for 80 meters (with limited activity anticipated on 80 meters). He plans to participate in the CQ World Wide WPX SSB Contest; he will select the specific contest band later. All logistics have been finalized. QSL confirmations will be available via LoTW, the bureau (free of charge), and directly through OQRS.

A2 and 9J — Botswana and Zambia

Bernie, ZS4TX, will operate as A21TX from Kasane, Botswana, on March 26 – 27, 2026. He will focus on transequatorial propagation (TEP) and satellite activities before joining the Ribbetjies Earth-moon-Earth (EME) Team in Zambia for an EME DXpedition as 9J2EME on March 28 – April 1, 2026. The Zambia team consists of Bernie; John, ZS6JON; Paul, ZS6NK, and Lins, PA3CMC. They will operate from grid locator KH22 on 6 meters, 2 meters, 70 centimeters, and 23 centimeters via Q65, JT65, and CW, with additional satellite operations (including a QO-100 satellite rover station and RS-44 monitoring) and TEP activities. QSL cards and LoTW confirmations will be available, and the team will utilize HB9Q and N0UK loggers.

Santa Maria DXers and Contesters Convention

The 2026 Santa Maria DXers and Contesters Convention is scheduled for April 10 – 12, 2026. For more information, visit www.socalcontestclub.org/SantaMaria2026.

Wrap-Up

That is all for this month, with special thanks to K0JM, K5WE, LA7GIA, N6TJ, SP5EAQ, W0VTT, XQ7IR, and *The Daily DX* for helping to make this month's column possible. If you have any DX or IOTA news, photos, or club newsletters, please send them to bernie@dailydx.com. Until next month, see you in the pileups! — Bernie, W3UR

The World Above 50 MHz

The Phenomenon of 6-Meter TEP

After 20 years of HF operating from Long Island, New York, I looked at the 6-meter band as a new challenge. I bought a used Swan 250 6-meter transceiver just prior to the September 1990 ARRL VHF contest, and I hooked it into an old TV antenna mounted on a pole in my backyard. I proceeded to work two dozen northeast US stations via line of sight.

The morning prior to the June 1991 VHF contest is when I really discovered the magic of 6 meters, working stations via skip into North Carolina and Florida. I then made another two dozen contacts via this sporadic-E skip during the contest. There were more sporadic-E openings that summer, and that fall, I experienced 6-meter F2-layer activity when I worked Central American countries on SSB and CW. I experienced more F2 in January 1992 when I made contacts with those in western Europe and the US West Coast, and I even worked aurora in May!

These events led me to learn all I could about 6 meters, other VHF bands, and the different propagation modes. In time, I would give talks at local radio clubs and write the book *Six Meters: A Guide to the Magic Band* in 1994 for Worldradio. It is with this background that I take on the challenge of writing “The World Above 50 MHz,” to help all hams who enter this unique spectrum of the hobby. Please send any reports of interest for this column to **ken.neubeck@gmail.com**. For every month that I write this column, I will also give VHF propagation outlook tables (see Tables 1 and 2) detailing conditions that North American operators can expect.

General TEP Traits

Of the three 6-meter propagation modes, transequatorial propagation (TEP) is the most likely to occur in April and into May for paths between North and South America, or between Europe and southern Africa for

Table 1 — April 2026 VHF 6-Meter Propagation (North America)

Propagation Mode	Rate of Occurrence
Sporadic E	Spotty at best — two to four occurrences
Aurora	If major geomagnetic event occurs
Transequatorial	Occasional for certain US locations

Table 2 — April 2026 VHF 2-Meter Propagation (North America)

Propagation Mode	Rate of Occurrence
Tropospheric	Spotty for certain US locations (east, Central Valley, Gulf area, and West Coast)

paths over the geomagnetic equator. TEP can occur during moderate-to-high solar activity and around the spring and autumn equinoxes. This is an F-layer propagation, in which the F-layer area centered over the geomagnetic equator is sufficiently ionized to transport radio waves. It acts like a duct on 6 meters; signal paths from parts of South America enter this duct and exit into the southern US, as well as in parts of Europe and into South Africa. This is one of the primary 6-meter propagation modes for stations in South Africa, as the area has a low yearly incidence of sporadic-E propagation.

This mode occurs generally in the late afternoon, and there can be some noticeable distortion on SSB signals. I’ve worked Damon, KJ4E, in central Florida a lot on 6 meters. In 2025, he experienced TEP beginning on April 11, and he worked LU7VFF in Argentina on SSB at around 5:55 PM local time. He worked more stations in Argentina via TEP during the first week of May. A simple example of this TEP path is shown in Figure 1.

TEP with Sporadic E

The F-layer TEP duct between Argentina and southern Florida covers 4,500 miles. However, it is possible for stations farther north to work into Argentina when there is a sporadic-E link connecting northern US stations to southern states (such as Florida) at the same time as the TEP event.

I have experienced this a few times during May. One such event happened on May 12, 2014 (see Figure 2,

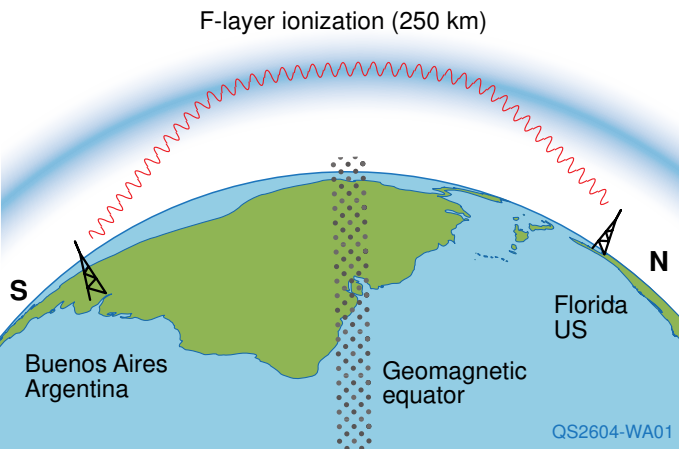


Figure 1 — The TEP path in the ionized F layer over the geomagnetic equator. This allows 6-meter signal paths between Argentina and the southern US.

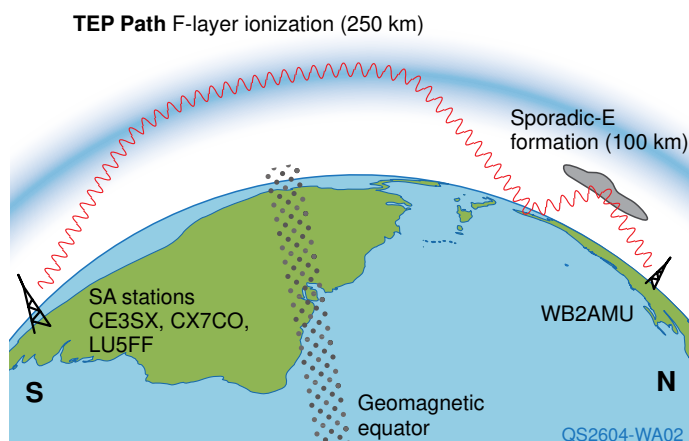


Figure 2 — The TEP/sporadic-E combination that occasionally allows stations in the northern US to connect to a TEP event with a sporadic-E link.

which shows the basic TEP duct plus the sporadic-E link). In this opening, I worked three different stations in three different countries over the course of 30 minutes (see Figure 3). It is interesting to note that the width of the sporadic-E formation (located in the US) is projected toward this area in South America. While solar flux values for 2014 were not high for F2 propagation, there was sufficient F-layer activity over the geomagnetic equator for TEP paths.

Other parts of the US, such as the Midwest or the West, can get into South America via the TEP and sporadic-E combination, with the basic TEP path landing in southern states (such as Texas) at around 25 – 35 degrees north latitude.

Throughout Solar Cycle 25, many 6-meter TEP or TEP/sporadic-E contacts have been conducted via 50.313 MHz FT8, particularly when the signals are weak. Contacts compiled on a DX cluster show that Tim, WW1L, in Maine and Ron, WZ1V, in Connecticut worked Javi, LU5FF, in April 2025 via combined TEP and sporadic E on FT8. Signal strength ranged from –7 to –21 dB, which is below CW and SSB levels.

There may be confusion as to whether the contacts were a result of TEP or a north-south F2 path, which can occur during months of high solar activity. The primary clue is that north-south F2 paths may take place during late morning and early afternoon, whereas TEP tends to occur only in late afternoon. For example, I observed north-south paths the day after the major October 11 aurora openings, when I worked stations in Argentina as early as noon.

The sunspots have been appearing erratically as of late, but April and May should be good months for monitoring TEP. There is also a fall season for TEP



Figure 3 — The stations in South America that I worked from Long Island, New York (grid FN30), during late afternoon on May 12, 2014, via the combined TEP/sporadic-E link.

activity, so late September into October 2026 will present potential opportunities as well.

January 2026 Aurora Event

An Earth-directed X1.9 coronal mass ejection happened on January 18, 2026. It impacted Earth's magnetic field late on January 19, inducing significant VHF aurora propagation. Europe and North America were affected in the evenings on January 19 and 20; many stations in the northeast US, such as Michael, N2VJ; Doug, K1DG; Victor, VA2WA, and myself, worked stations via distorted 6-meter CW. Activity reached up to 220 MHz on January 19, with David, K1WHS, in Maine working as far west as Joseph, K9MRI, in Indiana and Jonathan, W0ZQ, in Minnesota.

When aurora activity faded on January 20, a terrific event occurred at 0000 UTC the next day, when there was major F2-layer activity on 6 meters, and stations in the US and Canada worked those in the Caribbean on CW, SSB, and FT8 for more than 4 hours. I and others worked Puerto Rico, Trinidad and Tobago, Curaçao, and a very loud Charlie, TI5CDA, in Costa Rica. Damon, KJ4E, in central Florida, worked 19 stations in 13 different countries. The KP5/NP3VI Desecheo Island DXpedition team worked 500 North American stations via FT8 for a new DX country on 6 meters!

Convention and Hamfest Calendar

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

Abbreviations

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

Alabama (Headland) — Apr. 25 **F T V**

8:30 AM. *Spr*: Wiregrass ARC. Headland Town Square, 100 Park St. *TI*: 145.43 (186.2 Hz). *Adm*: Free. Email: clwoodall2@gmail.com

Arizona (Phoenix) — Apr. 4 **D Q R S T V**

7 AM – 11 AM. *Spr*: Arizona Red Cross Communications Club, Arizona ARC. Alhambra High School parking lot, 3839 W. Camelback Rd. *TI*: 147.28 (162.2 Hz). *Adm*: \$5. www.k7arc.org

Arizona (Sierra Vista) — May 2 **D F Q R T V**

7 AM – 11 AM. *Spr*: Cochise ARA. CARA club property, 2756 S. Moson Rd. *TI*: 146.76 (162.2 Hz). *Adm*: Free. Email: tomyarbrough@icloud.com

Arizona (Tucson) — Apr. 11 **D F H Q R T**

6 AM – 11 AM. *Spr*: Radio Society of Tucson. Calvary Tucson Church, 8711 E. Speedway Blvd. *TI*: 147.16 (141.3 Hz). *Adm*: Free. www.k7rst.club

Arkansas (Paris) — Apr. 4 **F H R V**

8 AM – 2 PM. *Spr*: Mt. Magazine ARC. Union Bank Community Center, 11 E. Main St. *TI*: 147.09 (151.4 Hz). *Adm*: \$5. Email: techno1953@gmail.com

Colorado (Longmont) — Apr. 4 **F H R V**

9 AM – 1 PM. *Spr*: Longmont ARC. Boulder Co. Fairgrounds Exhibit Center, 9595 Nelson Rd. *TI*: 147.27 (100 Hz) and 448.80 (88.5 Hz), linked repeaters. *Adm*: \$7. www.w0eno.org/2026larcfest

Connecticut (Thompson) — Apr. 26 **D F H**

8 AM – noon. *Spr*: Eastern Connecticut ARA. Raceway Restaurant, 205 E. Thompson Rd. *TI*: 147.225 (156.7 Hz). *Adm*: \$7. www.ecara.net

Connecticut (Waterford) — Apr. 18 **F H R T**

8:30 AM – 2 PM. *Spr*: Southeastern Connecticut ARS. St. Paul's Church Hall, 170 Rope Ferry Rd. *TI*: 146.73 (156.7 Hz). *Adm*: \$5; students with ID, free. www.secars.org

EASTERN VHF/UHF/MICROWAVE CONFERENCE

April 24 – 26, Windsor, Connecticut

D F H Q R S T

Fri. 2 PM – Sun. noon. *Spr*: North East Weak Signal Group. Hilton Garden Inn, 555 Corporate Dr. *Adm*: \$40 Advance, \$50 door. www.newsvhf.com

Florida (Dade City) — May 9 **F H R T V**

7 AM – noon. *Spr*: East Pasco ARS. American Legion Post #15, 37745 Church Ave. *TI*: 146.88 (146.2 Hz). *Adm*: \$5. www.eparsonline.org/2024

Florida (Tampa) — Apr. 25 **F H Q R T V**

7 AM – noon. *Spr*: Tampa ARC. 7801 N. 22nd St. *TI*: 147.105 (146.2 Hz). *Adm*: \$5. www.hamclub.org

Idaho (Coeur d'Alene) — Apr. 25 **D F H S T V**

8 AM – 1 PM. *Spr*: Kootenai ARS. CDA Hockey Academy, 3513 W. Seltice Way. *TI*: 146.98 (127.3 Hz). *Adm*: \$5. www.k7id.org

Illinois (Sandwich) — May 3 **D F H R T**

8 AM – 1 PM. *Spr*: Kishwaukee ARC. Sandwich Fairgrounds, 1401 Suydam Rd. *TI*: 146.73 (100.0 Hz). *Adm*: \$8 Advance, \$10 door. www.karc-club.org

Illinois (Sullivan) — Apr. 25 **D F H R T**

7 AM – noon. *Spr*: Moultrie Amateur Radio Klub. Sullivan American Legion, 8 E. Strain St. *TI*: 146.655 (162.2 Hz). *Adm*: \$5. www.qsl.net/mark

RV RADIO NETWORK RALLY

May 9 – 13, Florence, Indiana

S

7 AM – noon. *Spr*: RV Radio Network. Follow the River RV Resort, 12273 Markland Town Rd. *TI*: 147.52. *Adm*: \$60 and \$5 park visitor fee. www.rvradionetwork.com

Maryland (Maugansville) — May 2 **D F H Q R S T V**

7 AM – 12:30 PM. *Spr*: Antietam Radio Association. Maugansville Church, 17904 Binkley Ave. *TI*: 147.09 (100 Hz). *Adm*: \$7. www.antietamradio.org

Maryland (Odenton) — Apr. 26 **D F H R T**

8 AM – noon. *Spr*: Maryland Mobileers ARC. Odenton Volunteer Fire Company, 1425 Annapolis Rd. (Rte. 175). *TI*: 146.805 (107.2 Hz). *Adm*: \$5. <https://sites.google.com/view/marylandmobileers/hamfest?authuser=0>

Michigan (Burnips) — Apr. 11 **F H**

8 AM – noon. *Spr*: Allegan Co. ARC. Salem Township Hall, 3003 142nd Ave. *TI*: 147.24 (94.8 Hz). *Adm*: \$5. www.ac8rc.org

Michigan (Cadillac) — May 2 **D F T V**

8 AM – 1 PM. *Spr*: Southern Michigan ARS. Calhoun Co. Fairground, 720 Fair St. *TI*: 146.66 (94.8 Hz). *Adm*: \$5. www.w8df.com

Michigan (Centreville) — Apr. 18 **D F H R V**

8 AM – noon. *Spr*: St. Joseph Co. Michigan ARC. St. Joseph Co. Fairgrounds, 316 E. Charlotte St. *TI*: 145.31 (123 Hz). *Adm*: \$5. Email: fuseboxr@hotmail.com

Michigan (Marshall) — May 2 **D F H Q R V**

8 AM – noon. *Spr*: Wexauke ARC. Mackinaw Trail Middle School, 8401 Mackinaw Trail. *TI*: 146.98. *Adm*: \$5. www.wexaukeearc.org

Minnesota (Brainerd) — Apr. 18 **D F H Q R**

9 AM – 1 PM. *Spr*: Brainerd Area ARC. Brainerd National Guard Armory, 1115 Wright St. *TI*: 147.225. *Adm*: \$5. www.brainerdham.org

Minnesota (East Grand Forks) — Apr. 25 **F R S V**

8 AM – 1 PM. *Spr*: Forx ARC. Heritage Village, 219 20th St. NE. *TI*: 146.94 (123 Hz). *Adm*: \$10. www.wa0jxt.org

Missouri (Perryville) — Apr. 11 **D F H R S T V**

8 AM – noon. *Spr*: River Hills ARC. Elks Lodge 2701, 921 N. Perryville Blvd. *TI*: 147.315 (100.0 Hz). *Adm*: \$5. www.facebook.com/w0rhx

Missouri (Raytown) — Apr. 25 D F H Q R S V

7 AM – 3 PM. *Spr:* Raytown ARC. Raytown High School, 6019 Blue Ridge Blvd. *Tl:* 145.17. *Adm:* \$5. www.k0qg.com/hambash

Nebraska (Bellevue) — Apr. 11 D F H R S

8 AM – 1 PM. *Spr:* Bellevue ARC. Reed Community Center, 1200 Lord Blvd. *Tl:* 147.39 (131.8 Hz). *Adm:* \$5. www.bellevuearc.org

New Hampshire (Hampton) — Apr. 11 F H R T V

8 AM – 1 PM. *Spr:* Port City ARC. St. James Masonic Lodge, 77 Tide Mill Rd. *Tl:* 145.15 (127.3 Hz). *Adm:* \$5. www.w1wqm.org

New Jersey (Surf City) — May 9 D F H R T V

7 AM – 1 PM. *Spr:* Old Barney ARC. Surf City Fire Department, 713 Long Beach Blvd. *Tl:* 146.835 (127.3 Hz). *Adm:* \$5. Email: ihosid@aol.com

New York (Mountainville) — May 3 D F H R T V

8 AM. *Spr:* Orange Co. ARC. Black Rock Fish & Game Club, 5 Pleasant Hill Rd. *Tl:* 147.105 (114.8 Hz). *Adm:* \$6. www.ocarcny.org

New York (Norwich) — Apr. 11 F H R S T V

7 AM – noon. *Spr:* Chenango Valley ARA. St. Bartholomew's Parish Center, 81 E. Main St. *Tl:* 146.685 (110.9 Hz). *Adm:* \$6. www.cvara.net/hamfest

New York (Palmyra) — Apr. 18 D F H R T

8 AM – 1 PM. *Spr:* Drumlins ARC. Palmyra VFW Post 6778, 4306 NY-31. *Tl:* 146.745 (71.9 Hz). *Adm:* \$5. www.drumlinsarc.us/hamfest-info

New York (Queensbury) — Apr. 11 D F H V

10 AM – 2 PM. *Spr:* Warren Co. Radio Club. Aviation Mall, 578 Aviation Rd. *Tl:* 146.73 (100 Hz). *Adm:* Free. Email: kd2yfy@gmail.com

North Carolina (Goldsboro) — May 2 H R T V

8 AM – 2 PM. *Spr:* Wayne Co. ARA. First PH Church, 1100 The First Church Rd. *Tl:* 146.85 (88.5 Hz). *Adm:* Donation. www.k4cyp.com

North Carolina (Winston-Salem) — Apr. 25 D F H V

7:30 AM – 11:30 AM. *Spr:* Forsyth ARC. Robinhood Baptist Church, 5422 Robinhood Rd. *Tl:* 145.47. *Adm:* \$5. www.w4nc.com

Ohio (Athens) — Apr. 26 D F H R V

8 AM – noon. *Spr:* Athens Co. ARA. Athens Community Center, 701 E. State St. *Tl:* 145.15. *Adm:* \$5. www.ac-ara.org

Ohio (Cuyahoga Falls) — Apr. 11 D F H Q R V

8 AM – 1 PM. *Spr:* Cuyahoga Falls ARC. Emidio & Sons Expo Center, 48 E. Bath Rd. *Tl:* 147.27 and 444.85 (110.9 Hz). *Adm:* \$9 Advance, \$10 door. www.cfarc-hamfest.org

Ohio (Dover) — Apr. 25 D F H R V

8 AM. *Spr:* Tusco ARC. Tuscarawas Co. Fairgrounds, 259 S. Tuscarawas Ave. *Tl:* 147.73. *Adm:* \$5. www.w8zx.net/hamfest

Ohio (Toledo) — May 2 D F H R V

10 AM – 2 PM. *Spr:* Lucas Co. ARES. Merchants Landing, 6182 Summit St. *Tl:* 444.925 (103.5 Hz). *Adm:* \$5. www.lucasares.org

ARRL EASTERN PENNSYLVANIA SECTION CONVENTION

May 3, Bristol, Pennsylvania

D F H R S T V

7 AM – noon. *Spr:* Warminster ARC. Bucks Co. Community College-Lower Bucks Campus, 1304 Veterans Hwy. (Rte. 413). *Tl:* 147.09 (131.8 Hz). *Adm:* \$8. www.wp.k3dn.org/hamfest

Pennsylvania (Elizabeth) — Apr. 19 D F H R T V

8 AM – noon. *Spr:* Two Rivers ARC. Lincoln Borough VFD No. 184 Social Hall, 4312 Liberty Way. *Tl:* 147.12 (131.8 Hz). *Adm:* \$5. www.trarc.org

Pennsylvania (Glen Rock) — Apr. 25 D F H Q R T V

8 AM – noon. *Spr:* Penn-Mar Radio Club, Hilltop Transmitting Association. Glenview Alliance Church, 10037 Susquehanna Trail S. *Tl:* 147.33 (123.0 Hz). *Adm:* \$10; under 16, free. www.yorkhamfest.org

South Carolina (Batesburg-Leesville) — Apr. 11 F T

8 AM – noon. *Spr:* The Ridge ARC. Shealy's BBQ parking lot, 340 E. Columbia Ave. *Tl:* 147.255 (123 Hz). *Adm:* Free. www.w4rrc.org/events/tailgate

Virginia (Madison) — Apr. 11 F H Q R T

8 AM – 11:30 AM. *Spr:* Greene Co. Virginia ARC. Madison Co. High School, 68 Mountaineer Ln. *Tl:* 145.47 (151.4 Hz). *Adm:* \$10. Email: jim.dickman@aol.com

Washington (Union Gap) — Apr. 11 F H R T

9 AM – 2 PM. *Spr:* N7YRC Group. Yakima Office of Emergency Management, 2403 S. 18th St. *Tl:* 444.750 (131.8 Hz). *Adm:* Free. Email: kc7vqr@arri.net

Wisconsin (Cedarburg) — Apr. 25 D F H R

8 AM – noon. *Spr:* Ozaukee Radio Club. Ascension Columbia St. Mary's Expo Center (Milwaukee Curling Club), W67N890 Washington Ave. *Tl:* 146.97 (127.3 Hz). *Adm:* \$7. www.ozaukeeradioclub.org

Wisconsin (Stoughton) — Apr. 18 D F H R S

8 AM – noon. *Spr:* Madison Area Repeater Association. Mandt Community Center, 400 Mandt Pkwy. *Tl:* 147.15 (123 Hz). *Adm:* \$8 Advance, \$10 door. www.w9hsy.org

Wisconsin (Superior) — May 2 D F H Q R V

9 AM – 1 PM. *Spr:* Arrowhead Radio Amateurs Club. Head of the Lakes Fairgrounds, 4700 Tower Ave. *Tl:* 146.940 (103.5 Hz). *Adm:* \$10. www.thearac.org

To All Event Sponsors

Before making a final decision on a date for your event, you are encouraged to check the Hamfest and Convention Database (www.arri.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.arri.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 **May 1** to be listed in the **July** 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@arri.org.

Special Event Stations

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

Apr. 11 – Apr. 12, 1400Z – 2200Z, W4AC, Nokomis, FL. Tamiami Amateur Radio Club. **Shark's Tooth Festival**. 14.034 14.260 28.034 28.460. QSL. Tamiami ARC, P.O. Box 976, Nokomis, FL 34274. www.tamiamiarc.org

Apr. 11 – Apr. 12, 1500Z – 0100Z, KC5OLO, Abilene, TX. Key City Amateur Radio Club. **Atlas Missile Silo**. 14.250 21.300 28.400. QSL. Key City Amateur Radio Club, P.O. Box 2722, Abilene, TX 79604. <https://keycityarc.org>

Apr. 14 – Apr. 19, 0817Z – 0817Z, W4S, Lakeland, FL. Lakeland Amateur Radio Club. **Sun & Fun Aerospace Exposition**. 7.40 14.40 18.93 28.40. QSL. Lakeland Amateur Radio Club, P.O. Box 90853, Lakeland, FL 33804. *Please send a self-addressed stamped envelope for QSL card.* info@lakelandarc.com

Apr. 16, 0900Z – 1600Z, W9W, New Castle, IN. Henry County (Indiana) Amateur Radio Club. **Wilbur Wright 159th Birthday Event**. 14.340. QSL. Dave Peters, 3517 Hampton Ct., New Castle, IN 47362. W9OB@yahoo.com or <https://w9ob.org>

Apr. 16 – Apr. 21, 0600Z – 0600Z, N5L, Gonzales, LA. Ascension Amateur Radio. **Louisiana Purchase Special Event**. 14.300. Certificate. K5ARC, P.O. Box 1617, Gonzales, LA 70707. www.k5arc.org

Apr. 17 – Apr. 20, 1200Z – 2359Z, W4AC, Nokomis, FL. Tamiami Amateur Radio Club. **Florida State Parks on the Air Contest**. 14.337. Certificate. Tamiami ARC, P.O. Box 976, Nokomis, FL 34274. www.fspota.org

Apr. 18, 1200Z – 1600Z, KG4NXO, Ocala, FL. Marion County Florida Emergency Radio Team (MERT). **MERT-22**. 443.875 reflector 30C KG4NXO; 3.950 7.235 14.275 (±20) SSB. Certificate by email request. KG4NXO, 7199 SW 95th Ct., Ocala, FL 34481. MERT-22@KG4NXO.com

Apr. 23 – Apr. 27, 0500Z – 0500Z, K4H, Camden, SC. Kershaw County Amateur Radio Club, KC4RC. **Battle of Hobkirk's Hill Commemoration**. 3.825 7.225 14.325 21.325. Certificate upon request. info@kc4rc.com

Apr. 24 – Apr. 26, 1900Z – 1900Z, WØZSW & WØEQO, Minneapolis, MN. Handiham Radio Club & Handiham Radio Club of Minnesota. **Handiham Program 59th Anniversary QSO Party**. 7.200 14.250 21.350 28.350. QSL. Handiham Program, 3915 Golden Valley Rd., Mail Route 78446, Minneapolis, MN 55422. www.handiham.net

Apr. 25, 1300Z – 2000Z, W2GSB, Babylon, NY. Great South Bay Amateur Radio Club. **Marconi Day**. 7.275 14.245 21.325 28.500. Certificate. GSBARC Marconi Day, 200 E. Sunrise Hwy., Lindenhurst, NY 11757. www.gsbarc.org

Apr. 25, 1300Z – 2100Z, K3S, Baltimore, MD. Nuclear Ship Savannah Amateur Radio Club. **International Marconi Day Official Station**. 7000. QSL. Ullis Fleming, 980 Patuxent Rd., Odenton, MD 21113. *Check spotting networks on all bands for frequency.* www.qrz.com/db/K3S

Apr. 30 – May 1, 1600Z – 0000Z, KA6OES, Eureka, CA. Humboldt County Sheriff's Office of Emergency Services. **BEACON Exercise**. 3.9920 7.1920 14.2205. Certificate. Greg Waters, ATT: OES, 826 4th St., Eureka, CA 95501. www.beaconexercise.org

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

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

Submissions must be received by ARRL HQ no later than the 1st of the second month preceding the publication date; a special event listing for **July QST** would have to be received by **May 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.



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.

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
Maiyun Zhang, AK6DS	10
J. Andrew Hall, N5ASE	15
Buren Earl Wells, Jr., KZ4W	15
Ronald G. Call, KE7CR	20
Louis K. Yadevia, WA3EBS	25
Michael R. Lunebach, WG9P	35

December 2025

James E. Ligman, K4OHW	10
Michael G. McCarty, KB9HV	10
William G. Homsany, KG6COH	20
Craig H. Moody, K1CHM	20

Michael A. Krahenbuhl, K0ARA	30
Thomas P. Dean, K7TPD	35
Michael A. Krahenbuhl, K0ARA	35

January 2026

John M. Fenton, KB0KSA	10
Karl L. Skogen, AA0BQ	10
James B. Wilkinson, KQ4RXX	10
Stephen Bonville, KN6NMV	15
Stephen M. Riley, WA9CWE	15
Thomas F. Corcoran, VE3NY	30

Congratulations to all of the recipients.

April 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.

April Qualifying Runs will be transmitted by W1AW in Newington, Connecticut, at the times shown on 1.8025, 3.5815, 7.0475, 14.0475, 18.0775, 21.0675, 28.0675, 50.350, and 147.555 MHz. The West Coast Qualifying Runs will be transmitted by K9JM on Wednesday, April 29, at 9 PM PDT (0400 UTC on April 30) on 3581.5 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.arrl.org/qualifying-run-schedule.

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



W1AW Qualifying Run Schedule – April 2026 (All times are in Eastern Daylight Time.)

Monday	Tuesday	Wednesday	Thursday	Friday
		4/8 4 PM – 2000Z 10 – 35 WPM	4/9 10 PM – 0200Z (4/10 – UTC) 10 – 40 WPM	4/10 7 PM – 2300Z 35 – 10 WPM
	4/14 10 PM – 0200Z (4/15 – UTC) 10 – 35 WPM		4/16 7 PM – 2300Z 10 – 40 WPM	4/17 9 AM – 1300Z 35 – 10 WPM
4/20 4 PM – 2000Z 10 – 40 WPM	4/21 9 AM – 1300Z 10 – 35 WPM	4/22 10 PM – 0200Z (4/23 – UTC) 35 – 10 WPM		
4/27 10 PM – 0200Z (4/28 – UTC) 10 – 40 WPM	4/28 4 PM – 2000Z 35 – 10 WPM	4/29 7 PM – 2300Z 10 – 35 WPM		

Field Organization Reports — January 2026

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.

640 AD8CM	180 K5OB KT5SR KV2J N9VC	135 AG9G KE5YTA KE4RS W3YVQ	110 N9CK KM4WHO WV5Q WB8TQZ W1RVY	99 N4NOA KC1HHO 97 N0JAR	88 KB2YAA KD2KUB 87 W2ZXN W4TTO	75 KG5AOP NK4AA K9WIC AA3N	74 N2RTF 73 KF7GC	70 W5XX KD2TDG WB3FTQ
320 W8ROY	175 KB5PGY WA3QLW	130 KD0HHN KJ5DJC KY2D WD4SDH	107 AI9F	95 KM2I KT4WX	86 WB8RGE N3RPB K2PHD	The following stations qualified for PSHR during these previous months, but have not been recognized yet: (Dec. 2025) AD8CM 600, AC8NP 195, N2LC 180, KE4RS, KC8PBU 155, N8SY 135, K8MDA 129, NA7G, KD8UUB 120, KE8ANW 105, KB8GUN, N8MRS, WB8SIQ, W8MAL 100, WB8YYS 99, N7UWX 94, KL7RF, N8OD, K3RC, K8KRA, W8GSR 90, KA8BJA 80, KC8WH 76. (Nov. 2025) AD8SM 575, AC8NP 215, N2LC 155, KD8UUB, KC8PBU 150, KE4RS 145, N8SY 140, WB8YYS 125, NA7G 120, K8MDA 106, W8MAL, WB8GUN, KC8WH, WB8SIQ, N8MRS 100, N7UWX 94, KL7RF, K3RC, N8OD, K8KRA, W8GSR, 90, KA8BJA 80. (Oct. 2025) AD8CM 780, AC8NP 270, KE8ANW 200, N8SY 165, K8MDA 144, KE4RS 140, WB8SDH 135, N8MRS, W8GSR 130, KD8UUB 125, KL7RF, WB8YYS 120, KC8WH 116, WB8SIQ 115, KB8GUN 110, K3RC, N8OD, K8KRA 90, KA8BJA 80. (Sept. 2025) AD8CM 545, KE8ANW 400, AC8NP 231, W8MAL 180, N2LC 160, KC8PBU 156, N8SY 140, KE4RS 130, K8MDA 121, WB8YYS 117, KD8UUB 110, WD8SDH, KB8GUN, N8MRS, KC8WH 100, WB8SIQ 99, N8OD, K8KRA, W8GSR, KL7RF 90, KA8BJA 80. Section Traffic Manager Reports The following Section Traffic Managers reported: AR, AZ, CO, CT, EMA, ENY, EPA, GA, IA, IL, IN, KY, MDC, ME, MI, MS, NC, ND, NFL, NLI, NM, NNJ, NNY, NTX, OH, OR, RI, SFL, SJV, SNJ, STX, TN, WCF, WI, WMA, WNY, WPA, WY. Section Emergency Coordinator Reports The following Sections submitted ARES Activity Reports for December 2025: AL, AR, CT, ENY, EPA, EWA, GA, IA, ID, IL, IN, LAX, MDC, MI, MN, NC, NFL, NH, NLI, NM, NNY, NV, OH, OR, ORG, STX, 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 2,689, NX9K 958, WA3QLW 736, KB9GO 704, W8MAL 672, WB9WKO 667, KW1U 612, AG9G 546, AD8CM 505. The following station qualified for BPL during these previous months, but has not been recognized in this column yet: (Dec. 2025) AD8CM 553. (Nov. 2025) AD8CM 523.		
335 N9VC	173 W9RY	106 N2DW K8MDA	105 W02H	94 WB4ZDU WB2VUF	85 WW3S			
246 W5WMC	170 W9FE N4CNX	125 KA9IKK WB4YYS WD8USA	103 WJ3P	92 K1YBO	83 N2TSO			
241 W0PZD	165 W4DNA	102 KO4KUS	91 W8IM KE8DON	82 W2QS	81 KC8WH			
240 KT2D	160 WA9SWW	100 KB9GO KC9UC KR4ST	90 KB9GO KC9UC KR4ST	80 KB4OLY KO4OL KC3SJ	79 W8GSR WB2JNQ W2ARP			
237 W9EEU	157 N8SY	116 KM4WXX	100 KB9GO KC9UC KR4ST	80 KB4OLY KO4OL KC3SJ	79 W8GSR WB2JNQ W2ARP			
210 KD2NMG	155 KN4QJ	115 KC9FXE K9LGU W8MAL NI2W	100 KB9GO KC9UC KR4ST	80 KB4OLY KO4OL KC3SJ	79 W8GSR WB2JNQ W2ARP			
205 W4CMH AC8NP	150 AE5MI KR4PI	112 KY2MMM	100 KB9GO KC9UC KR4ST	80 KB4OLY KO4OL KC3SJ	79 W8GSR WB2JNQ W2ARP			
200 KB3YRU	149 N3GE	112 W5RFY N3STP	100 KB9GO KC9UC KR4ST	80 KB4OLY KO4OL KC3SJ	79 W8GSR WB2JNQ W2ARP			
195 AC0KQ ND8W	147 WA5EWN	112 W5RFY N3STP	100 KB9GO KC9UC KR4ST	80 KB4OLY KO4OL KC3SJ	79 W8GSR WB2JNQ W2ARP			
190 NW3W	145 KF5OMH	112 W5RFY N3STP	100 KB9GO KC9UC KR4ST	80 KB4OLY KO4OL KC3SJ	79 W8GSR WB2JNQ W2ARP			
188 KC8PBU	140 W2PAX WK4WC	112 W5RFY N3STP	100 KB9GO KC9UC KR4ST	80 KB4OLY KO4OL KC3SJ	79 W8GSR WB2JNQ W2ARP			

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 March/April 2026 issue of **QEX**:

■ Carlo Francescangeli, KJ4EGU, modernizes the 90° corner reflector by tilting the dipole to generate low-axial-ratio circular polarization with simple mechanical RHCP/LHCP switching. Built from inexpensive materials, the antenna proves the performance advantages of precise polarization control for UHF operation.

■ José Luis Giordano, CE4TW, presents a three-part tutorial connecting RF coil theory to practical amateur radio applications, covering key concepts such as magnetic cores, permeability, saturation, resonance, Q, and skin effect, with real-world examples.

■ Dale Ostergaard, N3HXZ, demonstrates a method for estimating relative antenna gain using time-averaged WSPR SNR data from alternating transmissions between test and reference antennas. Results comparing an inverted L and vertical antenna on 40 and 20 meters closely track expected patterns while illustrating the influence of local terrain.

■ Eric Nichols, KL7AJ, introduces nodal analysis as a practical tool for solving multi-source circuits, using relatable examples to show how equal-potential nodes can simplify complex problems, emphasizing efficient problem-solving techniques, and the value of verifying results through multiple approaches.

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.

Congratulations

January 2026
QST Cover Plaque Award Winner

Irwin Math
WA2NDM

In his article, "An Introduction to THz (Optical) Communications," Irwin introduces readers to communications via optical signals, offering instructions on how to build a transmitter and receiver capable of sending audio signals via laser.

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

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An Introduction to THz (Optical) Communications

Send audio over a light beam with simple hardware.



The completed transmitter and receiver, built with perforated breadboard material and wooden boards.

Irwin Math, WA2NDM

As amateur radio operators, we are certainly all familiar with the HF spectrum, VHF, UHF, and even microwaves. But there are other frequencies not commonly used for routine communications (except by a few experimenters) that can be explored. Communication via optical signals was recently demonstrated by NASA's Psyche spacecraft, which sent signals over 140 million miles to Earth. These signals are truly electromagnetic in nature, but they lie in the terahertz (THz) region, well beyond microwaves. Hopefully, building this transmitter and receiver assembly (see the lead photo) for THz communications will motivate those who like to consider unusual ideas to experiment with this mode.

Once frequencies rise into the 1000 MHz or more (gigahertz) region, wavelengths drop to millimeters and nanometers, which is why they're described as microwaves. With even higher frequencies, electromagnetic waves become visible colors that can be seen by the human eye. These wavelengths have a frequency of hundreds of THz. Visible light begins at a wavelength

of around 700 nanometers (red, or around 426 THz) and ends at a wavelength of around 400 nanometers (blue, or around 743 THz). While this is quite high, it's still electromagnetic in nature. Although it doesn't end there, we'll keep this THz investigation in this range by using visible light as our choice.

Getting Started

One of the easiest and most inexpensive ways for someone to get started operating on THz wavelengths is to locate a suitable transmission source that can be modulated. The two most common visual THz sources are light-emitting diodes (LEDs) and laser diodes. LEDs require an optical system to concentrate their diverging output, while laser diodes are easier



Figure 1 — The laser diode.

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 January 2026 activity report of the VM Program.

- ◆ An operator in Wisconsin was issued an Advisory Notice concerning a beacon on a 60-meter frequency not authorized to US operators.
- ◆ A Technician operator in California was issued an Advisory Notice for 20-meter FT8 operation, a band on which Technicians have no privileges.
- ◆ An operator in Washington was issued an Advisory Notice for repeatedly transmitting "free DV digital software" on 40 meters and refusing to vacate the frequency when requested.
- ◆ An operator in New York was issued an Advisory Notice for interference with the Jamaica Emergency Net on 20 meters.
- ◆ An operator in New York was issued an Advisory Notice for deliberate interference with amateur operators on 20 meters and for using CB equipment on amateur frequencies.

- ◆ An operator in Chesterfield, Virginia, received a commendation for providing assistance to new licensees (one 11 years old), and donating radio equipment and installation and operation assistance to get the new licensees on 10 meters.
- ◆ There was one FCC meeting, and the FCC accepted HF cases in North Carolina, Kentucky, Georgia, and Missouri for enforcement sanctions.
- ◆ A new automated FT8 monitoring system was implemented in January and is undergoing testing. It will randomly monitor FT8 and FT4 frequencies to ensure that the operators hold the proper license class for the band they are using.

The totals for December 2025 monitoring were 1,370 hours on HF frequencies, 1,097 hours on VHF frequencies and above, and 42 other monitoring hours, for a total of 2,509 hours.

In 2025, Volunteer Monitors reported 17,642 hours of monitoring on HF frequencies, and 23,436 hours on VHF frequencies and above, for a total of 41,078 hours for the year.

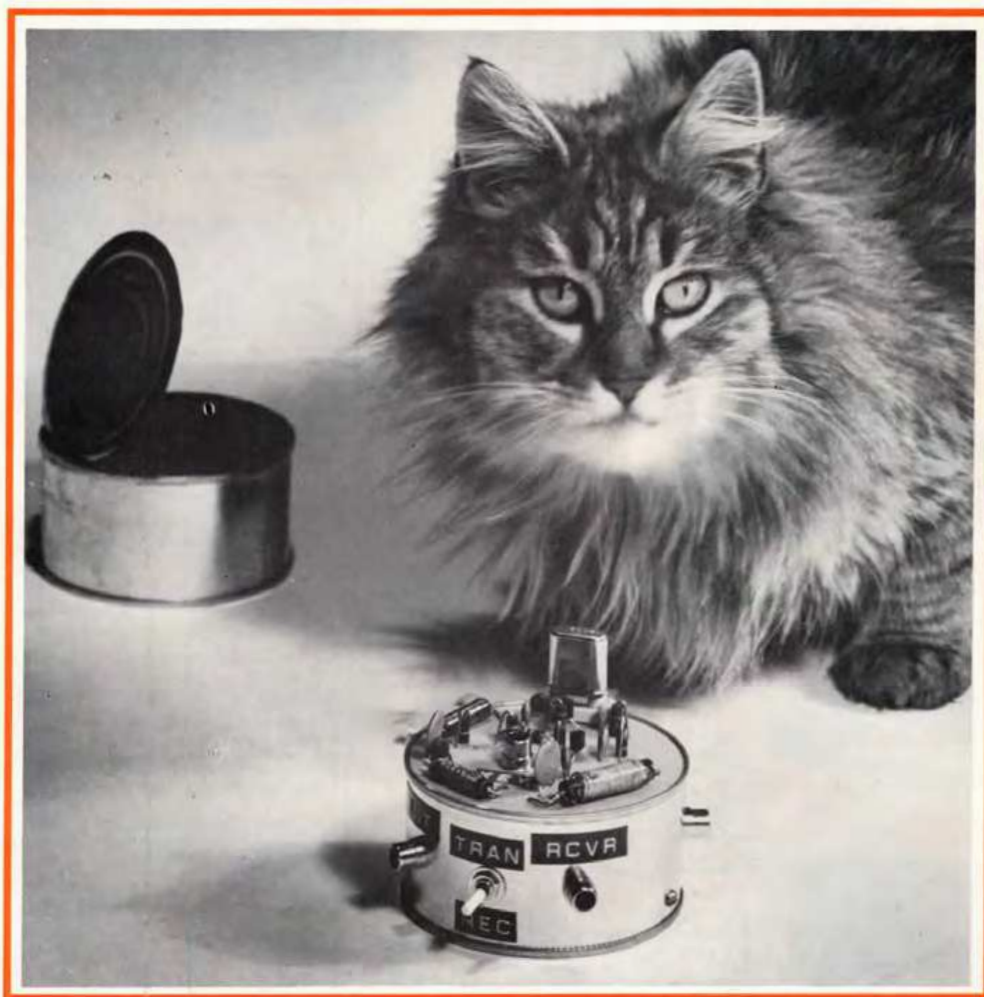
— Thanks to Volunteer Monitor Program Administrator
Riley Hollingsworth, K4ZDH

A Look Back

QST

devoted entirely to Amateur Radio

May 1976 \$1.00



A Boondoggle in the Boondocks

Page 11



Washington Mailbox

Q. What is meant by a "third-party agreement?"

A. A third-party agreement is simply an agreement between the administrations of two countries which authorizes licensed amateurs of those countries who are control operators to handle messages on behalf of other people. The other persons, whether licensed or unlicensed, are known as "third parties," whereas the control operators are the "first and second parties." (97.3w)

Q. What are the international regulations on third-party traffic?

A. International regulations expressly forbid amateur stations being used for transmitting international communications on behalf of third parties unless a specific agreement exists between the countries involved. In addition, whenever amateur stations of different countries are in contact the transmissions shall be in plain language and limited to remarks of a technical nature or personal character that by virtue of their unimportance do not justify the use of public telecommunications services.

Q. Who decides if a third-party message can be sent from a U.S. amateur station?

A. It is determined by the station licensee, and in all cases a control operator, either the station licensee or one designated by him, must be present to continuously monitor the transmission. (97.79d)

Q. What type of third-party traffic is prohibited in the U.S.?

A. U.S. amateurs enjoy considerable freedom when handling third-party messages; however, there are certain restrictions which must be followed. Of

course, U.S. amateurs can not conduct third-party traffic with countries with which we have no formal agreement. Furthermore, no third-party traffic involving material compensation to anyone involved is allowed; and, except in emergencies, third-party traffic involving business communications on behalf of any party is prohibited. (97.114)

It should be mentioned here that phone-patching is a type of third-party traffic and must conform to the above rules. Although not specifically mentioned in the rules, domestic phone-patching solely to avoid toll charges gives rise to questions as to whether amateurs should have these privileges.

Q. What countries does the U.S. have third-party agreements with?

A. The U.S. has third-party agreements with Argentina, Bolivia, Brazil, Canada, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Guyana, Haiti, Honduras, Israel, Jordan, Liberia, Mexico, Nicaragua, Panama, Paraguay, Peru, Trinidad and Tobago, Uruguay, and Venezuela.

Q. Why do international regulations prohibit third-party traffic at all, unless the individual countries enter into a formal agreement?

A. It's often a matter of vested interests. It is not the purpose of amateur radio to take revenue away from normal communication outlets such as the phone company and common carrier services. In many countries these services are operated, as well as regulated, by the government, and they are very protective of these means for producing needed revenue — to the extent that if

you are monitored while handling a third-party message with an amateur in a country with which we have no third-party agreement, you, or the other amateur, could be charged the price of an equivalent phone call. Or even lose your license.

Q. How does one go about creating a third-party agreement between the U.S. and another country where there is no present agreement in force?

A. It is *not* simply a case of writing the FCC and asking that one be put into effect. The FCC can not enter into third-party agreements as it is only a domestic regulatory agency. Such agreements are diplomatic matters that are handled by the Department of State. However, the U.S. stands ready to enter into third-party agreements with any foreign administration.

Q. How can I, as an individual amateur, help create a third-party agreement where no current one exists?

A. It is necessary to create the desire for such an agreement in the other country — to demonstrate that the usefulness of amateur radio as a tool to create and cement international friendships and as an absolute necessity in times of disaster far outweigh any possible conflict with established interests. The Sister Cities program is one way to do this because it introduces amateur radio to people in a position to influence the powers-that-be. Or you could ask friends in other countries to write their government representatives citing the many values of amateur radio, especially in the light of the recent Guatemalan tragedy. You *can* help.

[Note: Send your FCC questions to Hal Steinman, K1FHN, ARRL, Newington, CT 06111. Questions appearing in this column are typical of those frequently asked of the FCC and other agencies. Answers, prepared at ARRL, have been approved by FCC staff. Interpretations contained herein concur with those of the Amateur and Citizens Division of the FCC. Numbers in parentheses refer to specific sections of the FCC rules.]

QST

Strays

FASTEST HAMSHACK AFLOAT?

WB2VYU/MMR2 claims his "100% Mahogany Hamshack" powered by twin diesels of 3100 h.p. each for unusual station status. Presently assigned as commander on the PTF-17 which operates on the Great Lakes, Tim Sammons operates his SB102 into a 28' fiberglass whip. While on board, he has had opportunity to make numerous hf and uhf antenna and propagation experiments. Tim also operated Field Day '75 aboard.



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Celebrating Our Legacy

Research of W9SG History Presents a Full-Circle Discovery

Certain discoveries in life can unexpectedly bring you full circle to the starting point of unknown history, including amateur radio history. This is one of those stories.

I was first licensed as WD9ION in 1978 while in high school. I bought a used Yaesu FT-101B and had a lot of fun working all 50 states and chasing DX, mostly on CW. Within a year, I upgraded to General and had a blast operating during the bounty of Solar Cycle 21. I upgraded to Amateur Extra in 2000, and I was hoping to get a vanity call sign with my initials. W9SG would be available in April of that year, and I submitted my application on the first day of eligibility and was granted the vanity call!

In 2023, I received an email from Pete Varounis, NL7XM, who is well-known to many hams as an amateur radio archivist and prolific collector of vintage documents. Pete had a variety of vintage W9SG documents and asked if I was interested in them. At first, I turned down his offer, as I didn't know the previous holder.

Some months later, after reviewing a larger cache of W9SG documents collected by Pete, I got curious and decided to acquire them. Among the items I received were old QSL cards; original station photographs from 1923; ARRL membership certificates from the 1920s, 1930s, and 1940s, and a radio club newsletter from 1934 featuring W9SG on the cover. From these documents, I saw that my call had previously belonged to George "Lane" Eldred, and it appeared that he held W9SG for a very long time.



Lane's 9AWQ/W9SG logbooks from 1923 to 1994.

With a little searching, I found information online about investigating old call signs (<https://w0is.com/oldcallsigns/oldcalls.html>). Peter also maintains a vast callbook library and is readily available to other hams for performing call sign research. After some legwork, I was able to build a call sign timeline: Lane was licensed as 9AWQ from 1923 – 1926, W9IJA from 1932 – 1933, and W9SG from late 1932 – 1995.

Ultimately, I determined that Lane and I are the only two hams to have held W9SG, starting with him in 1932.

W9SG, from the Beginning

I scoured the internet to learn more about Lane. He was born in 1908 and grew up in Carrollton, Illinois. He received his first amateur radio license in 1923 when he was 14 years old, and he was issued the call sign 9AWQ. After high school, Lane attended Phillips Exeter Academy. Then, in 1931, he graduated from the University of Illinois Champaign-Urbana with a degree

in banking and finance. By 1934, he was president of the Egyptian Radio Club, W9AIU, in southern Illinois, a club still in operation today with the same call sign. In my search through ARRL's archives (www.arrrl.org/arrrl-periodicals-archive-search), I discovered that W9AIU nominated him for ARRL Central Division Director in 1934, but he didn't win.

After moving to Chicago, Lane married the daughter of his colleague, Clarence W. Kern, W9KB (SK), on February 15, 1941. Soon after, he served in the Navy during World War II, including as a communications officer on Admiral Alan Kirk's flagship, the USS *Augusta*, during the D-Day invasion at Normandy, known as Operation Neptune.

After the war, Lane moved to Hinsdale, Illinois, where he raised a family while pursuing a career as a commodities broker. He was active on the bands throughout his life, and his last logged contact was on December 1, 1994; he died in 1995 at the age of 87.

DATE	TIME	CALLED/WORKED	REPORT	RECD	TIME OF	OTHER DATA	QSL
			SENT	RECD	RECD		
10/6	10:10	Started portable operation from Oglethorpe Hall, Urbana, IL					
10/6	09:10	VP2MFX	51	56	20:59	Monticent, IL	X
10/10	09:26	N4A2S	539	579	21:45	Brockville, FL	Ben
10/11	20:21	N6BJQ	419	579	20:07	San Diego, CA	Eron
10/15	03:06	W4EDM	559	579	7:07	Hen Lake, MN	Larry
10/32	03:32	N5ALV	559	559	7:07	Hatfield, Miss.	lost Charlie
10/26	22:11	KA9DF2	599	589	7:09	Menomonee Falls, Wis.	Joe
10/28	18:48	W002J	559	579	14:04	Lead, SD	Ed
10/31	19:13	KB9HR	579	579	7:08	Indianapolis, IN	Tena
10/31	23:00	K7RDC	589	579	21:05	Sun City, AZ	Bill
10/31	23:13	W4YLX	589	589	21:19	Clearwater, Fla.	Bill
10/31	07:06	W4ADA	559	559	21:05	San Juan, Puerto Rico	Tito
10/31	06:00	W4JFE/7	589	579	14:08	Portland, Ore.	Frank
10/31	05:28	W856PN	569	569	7:07	Blue Mound, TX	Ross
10/31	23:56	A83D	579	579	14:35	Newark, Newcastle Co., DE	Bill
10/31	15:32	KA1EP	559	579	21:03	At	
10/31	04:13	K4TGP	579	589	7:05	Sacramento, KY	Bob
10/31	22:29	W9SG	579	579	7:07	Hinsdale, IL	Lane
10/31	22:33	W4YTA	569	569	14:05	Gastonia, NC	Ules

DATE	TIME	CALLED/WORKED	REPORT	RECD	TIME OF	OTHER DATA	QSL
			SENT	RECD	RECD		
NOVEMBER							
08	16:15	9ACU	57	57	7045	Frank Proulx	F 50
	16:35	0BCJ	57	59	7045	Clank	
09	16:15	0EUT	56	56	7037	Bob 19ST Owen	F 49
12	16:45	6ALZ/2JE					O 42
	16:30	8STX	57	58	7027	Bill	
	16:45	2HYF	56	57	7027	Bill	
13	16:30	8TIX	58	58	7027	John 19 not 20	O 42
14	15:45	6ALZ/2JE/14YE					O 42
	16:20	W424K50	58	59	7027	Gene	
	16:32	WB9ION/9	57	58	7027	STEVE	

Steve Geske's logbook (on the left) from when he held the call WD9ION, and Lane Eldred's, W9SG (SK), logbook (on the right) show matching CW contacts for November 14, 1979.

Using the collection of W9SG artifacts I obtained from Pete, I've assembled a presentation binder of vintage documents and photographs, as well as various findings from the internet about Lane.

Subsequently, Pete gave me a treasure trove of Lane's handwritten logbooks from 1923 to 1995 — more than 30 in total. In addition to logging all his contacts over the years, he wrote many notes on the backs of his logbook pages, such as journal entries of personal events in his life or changes to his equipment.

An Unforgettable Discovery

More recently, I methodically began a visual scan down every page of my own logs from my days as WD9ION, reviewing all the call sign entries, when one caught my eye — on November 14, 1979, it showed I had a 40-meter CW contact with W9SG! I recorded in my log that his name was Lane, and his QTH was Hinsdale, Illinois. Because I now had all of Lane's logbooks, I immediately searched his log from the same time period — it was a match!

Lane's log entry had a small error — he recorded my call as "WB9ION/9," instead of "WD9ION/9" — but the operator's name was correct. I wanted to be sure that

the contact was in fact with me, so I checked the 1979 *Radio Amateur Callbook* and verified that the "B" call sign belonged to an operator with a different first name. Also, on that date in November 1979, I would have been signing /9, as he recorded, because in the fall of 1979, I operated portable from my dorm room at the University of Illinois Champaign-Urbana, with just a wire hung out of the window. Next, Lane always recorded local time (Central) in his logs, and my log was UTC, which is 6 hours ahead, so the times matched. Lastly, the frequency was 7027 kHz in both logs. It was indeed the same contact!

According to my log, our CW contact lasted for 12 minutes. I had no idea in 1979 that I would someday hold that special call sign myself.

Lane's start in 1923 as 9AWQ, and my discovery in 2024 of our chance contact 45 years earlier spanned 101 years of history! Over the course of my exploration, I developed an extensive knowledge and a sincere respect for a man I never knew, but with whom I feel a definite connection. The whole journey was engaging, challenging, and full of interesting discoveries!

Steve Geske, W9SG
Algonquin, Illinois

All photos provided by the author.



Original photos of Lane Eldred, W9SG (SK), operating his station in 1939.

Classic Radio

ARRL's Heathkit Exhibit

ARRL is fortunate to have many original Heathkit receivers and transceivers. In 2023, the ARRL Historical Committee and Headquarters staff decided to display the equipment they had in the ARRL Headquarters lobby as an exhibit (see Figure 1).

Heathkit produced a wide variety of amateur radio equipment between the 1950s and 1970s that were sold as kits. During those years, Heathkit equipment was incredibly popular, and, in addition to amateur radio equipment, Heathkit produced kits for test equipment, audio equipment, and other electronic devices. No one knows the exact number of kits that Heathkit sold worldwide, but ARRL Historical Committee member and Heathkit expert Chuck Penson, WA7ZZE, estimates they sold more than 30 million.

Heathkit was started by Edward Heath, who bought the Bates Aeroplane Company in 1911 and renamed it the Heath Aerial Vehicle Company, which sold aircraft in kit form. After Heath's death in 1931, Howard Anthony purchased the bankrupt company for \$300 in 1935, in hopes of selling aircraft accessories.

After World War II, Anthony bought large quantities of war surplus parts and equipment to resell them, but decided to sell an oscilloscope instead. Anthony quickly realized that the most expensive part of manufacturing any piece of electronic equipment was the cost of assembling it, so he offered the oscilloscope in kit form. While often quite complex, Heathkit radios were easy to build because they created clearly illustrated and detailed manuals with kit-building instructions.

Their first Heathkit product was the O-1 oscilloscope in 1947, which sold for \$39.95. It was soon followed by a vacuum-tube voltmeter (VTVM), and, by 1959, Heathkit sold more than 500,000 VTVMs. The company's first radio product was the AR-1 general-coverage receiver in 1949, and the AT-1 Novice transmitter arrived in 1953.

After Howard Anthony's death in 1954, the company was sold to Daystrom and absorbed into Schlumberger Limited in 1962. Business boomed until Schlumberger sold Heathkit to Zenith Corporation in 1979. In 2011,



Figure 1 — The Heathkit exhibit at ARRL Headquarters in 2023.



Figure 2 — Heathkit AR-1.

Heathkit returned to offering kits, but ultimately filed for bankruptcy in 2013.

The company still exists, and you can find a few Heathkits for sale on their website (<https://shop.heathkit.com>). Today, many Heathkit radios are collectors' items and are still on the air. Here are just a few of the radios that were part of the Heathkit exhibit at ARRL Headquarters.

AR-1 HF Receiver (1949 – 1951)

The AR-1 (see Figure 2) was Heath's first Heathkit general-coverage receiver. A prototype for the final production model was in the ARRL exhibit (there is no serial number, and it has an unfinished chassis). It covered 550 kHz to 20 MHz, and was a superheterodyne receiver with a single 455 kHz IF stage and six vacuum tubes. There was no beat frequency oscillator, bandspread control, headphone jack, or speaker. There was an optional input jack for a phonograph. It sold for \$23.50, and a cabinet was \$4.50 extra.

AT-1 Transceiver (1953 – 1957)

The AT-1 transceiver (see Figure 3) was Heathkit's



Figure 3 — Heathkit AT-1.



Figure 4 — Heathkit SB-100.

first amateur radio transceiver kit. The transceiver in the ARRL exhibit was one of the first to be produced. It operated on only CW and was rated at 25 – 30 W on 80, 40, 20, 15, 11, and 10 meters. The frequency was crystal controlled, but, with a small modification, an optional variable frequency oscillator (VFO) could be used. It was designed for Novice operators who had limited HF CW privileges in the 1950s and 1960s. It used three vacuum tubes, a 5U4 rectifier, a 6AG7 oscillator-multiplier, and a 6L6 amplifier-doubler. It cost \$29.50.

SB-100 Transceiver (1965 – 1966)

Based on the Collins KWM series, the SB-100 (see Figure 4) was the first of a series of the enormously popular SB-line transceivers. The SB-100 in the ARRL exhibit is a prototype or pre-production model. The final version covered 80 – 10 meters on LSB, USB, and CW. Power output for this HF transceiver was a nominal 100 W, and it was a dual-conversion superheterodyne. A custom-designed highly stable VFO called a linear master oscillator came pre-assembled. The SB-100 sold for \$360, and the solid-state HP-23 power supply sold separately for \$39.95.

Acknowledgments

A special thanks to Chuck Penson, WA7ZZE, author of *Heathkit: A Guide to the Amateur Radio Products*, for his Heathkit expertise and contributions to this article.

The Heathkit radios pictured here are just a few at ARRL Headquarters. Others, such as the SB-303, SB-401, HW-16, HW-30, and SSB Single Bander, can still be seen in the ARRL Lab museum display. In addition to ARRL's Heathkit collection, more classic radios by other manufacturers such as Collins, Johnson, and Hammarlund can currently be viewed in the ARRL lobby.

100, 50, and 25 Years Ago

April 1926

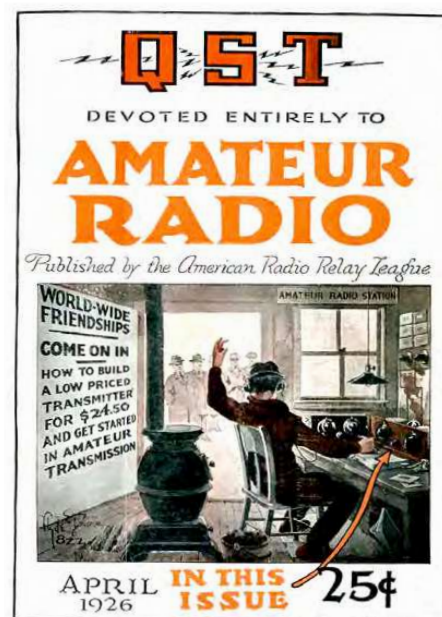
- The cover, by Clyde Darr, 8ZZ, features a ham at his station inviting others to come in, with a sign reading "World-Wide Friendships."
- In an editorial, Kenneth B. Warner, 1BHW, quotes from the May 1917 issue of QST about the unique and enduring "A.R.R.L. Spirit."
- John M. Clayton, 1DQ, writes the first part of a guide for "Breaking Into Amateur Transmission," focusing on setting up a transmitter using a UX-210 7 1/2 W tube.
- "Isolantite — A Unique Material" by Austin C. Lescarbours and Robert S. Kruse, 1OA, describes the process of making things using Isolantite, an insulating material.
- In "The Modesto Radio Club's Housewarming," R. L. Brown, Jr., outlines how the club sold hot dogs at the county fair to raise money to construct their own clubhouse.
- The A.R.R.L. Board of Directors had its annual meeting February 26 – 27, 1926, during which it re-elected Hiram Percy Maxim, 1AW, as president, raised membership dues to \$2.50 per year, renamed the Traffic Department to the Communications Department, and made some structural changes to the League, as noted in "The Board Meets."

April 1976

- The cover features an amplifier that runs 1 kW using transistors.
- In "It Seems to Us...Another Look at CB," Richard L. Baldwin, W1RU, talks about how amateur radio can capitalize on a recent increase in the popularity of CB radio to attract new hams.
- H. O. Granberg, WB2BHX/OH2ZE/7, provides instructions on building a 1.8 to 30 MHz linear solid-state amplifier with push-pull power blocks of the 50 and 300 W class in "One KW – Solid-State Style."
- "How To Use Zener Diodes" by Doug DeMaw, W1CER, explains how the often used but seldom understood semiconductor works.
- In the fourth part of "Learning to Work with Integrated Circuits," Jerry Hall, K1PLP, and Charles Watts, WA6GVC/1, describe how integrated circuits work inside a frequency counter.
- Dana W. Atchley, Jr., W1CF; Harold E. Stinehelfer, and Joseph F. White outline "360°-Steerable Vertical Phased Arrays," a design that incorporates microwave power-splitting and phasing techniques.
- "The Guatemalan Earthquakes—February 1976" by Don Waters details efforts by the amateur radio community to help after a 7.5-Richter earthquake hit Guatemala.
- A Stray in memory of Hidetsugu Yagi highlights his contributions to antenna design, as likely the first person to use parasitic elements in directive arrays.

April 2001

- The cover features Dave Patton, NT1N, using the FoxFinder, a device designed specifically for close-range foxhunting.
- In "It Seems To Us...Forty Meters: What's Happening?" David Sumner, K1ZZ, discusses how ARRL and the IARU are preparing for the upcoming 2003 World Radiocommunication Conference.
- Frank N. Musso, WA5QHV, writes about "Laser Generated Antennas" under development at Teragram Labs.
- In "Bridge the Digital Divide—Basically," Al Williams, WD5GNN, explains how Basic Stamp processors work.
- Joe Everhart, N2CX, outlines "The NJQRP Squirt," a reduced-size 80-meter antenna designed for small building lots and portable use.
- "Winds Aloft: When Radio Free Europe Flew Balloons" by David L. Hollyer, W4SG, describes an early 1950s project by Free Europe Press, with technical advice from Radio Free Europe, to use balloons to distribute leaflets with news across the Iron Curtain.
- In "TV on 10," Steve Ford, WB8IMY, walks through how to send images over a slow scan television signal on 10 meters.



Silent Keys

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

•N1DKF N1GC ♦WA1GTP ♦K1NIT KB1NOG ♦K1OCU ♦K1RBC •KA1YHI ♦W2AG •KD2JSW ♦♦N2MTG	Gookin , Sylvester J., Cranston, RI Colborne , Gary E., Stony Point, NC McCurdy , Richard S., Ivoryton, CT Crowley , Bill, Farmingdale, ME Dyer , Harriet "Belle" B., Colrain, MA Nordhausen , Juergen H., Acton, MA Comer , Richard B., Effingham, NH Jones , Thomas L., Mason, NH Troy , Michael F., Carmel, NY Vibbert , Stephen R., Falkville, AL Rautenstrauch , John P., Poughkeepsie, NY Montague , William C., Oxford, NJ Bliven , Francis "Fran" B., Baldwinsville, NY Buda , David L., Landing, NJ Primavera , Gerry, Rockaway, NJ Trittle , Gene E., Ellijay, GA Sheer , Martin J., Poughkeepsie, NY Kaczmarek , Edward F., Sayreville, NJ Zappile , Richard D., Mount Ephraim, NJ Galbraith , Robert R., Washington Township, NJ Southard , David L., Moravia, NY Shaver , Anthony L., Greencastle, PA Jaeger , Richard "Dick" D., Brookfield, WI Mundis , Gregory R., York, PA Zinicola , Matthew A., New Ipswich, NH Van Iderstine , 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I., Plantation, FL Kitchens , Robert O., Winter Haven, FL Roberts , Lawrence D., Pleasant Garden, NC	♦♦KE4TMN ♦WV4TN ♦KI4VGO ♦KY4W •KE4ZQO ♦KA5ABF ♦WJ5D ♦W5DRM ♦N5EL KD5EXM ♦K5GHY ♦WA5HWO W5IRF W5JEA ♦KB5JHU •WA5M ♦N5MCK ♦KC5NXX WE5O ♦W5OKL W5OW K5ROX K5SAC ♦KB5UKS K15VLH ♦♦W5XU ♦N6BV ♦W6CEF WH6JOE KG6KIU ♦W6LG ♦♦N6QDO ♦WA6SPY AD6VI ♦AE6ZF KL7DR N7EP WL7II ♦WA7JRF N7JU ♦W7MKB ♦KF7MKG K7TGU KI7VAF ♦K7ZED ♦K8ACE WD8AJJ •KE8CBI ♦♦K8DUX ♦KC8GM ♦W8ILD N8IW N8LEF ♦K8UC ♦N8YV ♦WV8ZH ♦KC8ZLZ ♦WD9BDO K9EDI N9FIM W9FXT KB9INI KC9LHB ♦N9LJY W9OGC	Mobus , Paul J., Raleigh, NC Houser , Wayne D., Maryville, TN Johnson , Ernie L., Clearfield, KY Weiss , Frank C., Raleigh, NC Rose , Willie L., Morehead, KY Miller , Paul L., Lake Charles, LA Holcomb , Danny L., Guntown, MS Cox , Percy T., Conroe, TX Bumpus , Floyd D., Belton, TX Wilson , Marie T., Glencoe, OK Brown , Richard M., Austin, TX Graham , Charles A., Daphne, AL Brinkmeyer , Thomas A., Brenham, TX Armstrong , Jesse E., Friona, TX Cooper , Robert L., Denison, TX Belcher , Brian E., Fairview, TX Pavlik , George J., Houston, TX Gardea , Jose L., Midland, TX Langston , Ronald W., Seneca, SC Shroff , Richie L., Tulsa, OK Carlson , Beverly A., Las Cruces, NM Horton , David L., Grand Prairie, TX Helms , Norman H., Nederland, TX Moore , Gary K., Lee's Summit, MO Ledbetter , Kim H., Paris, TX Assaf , David, Covington, LA Straw , Richard D., San Francisco, CA Rogers , Joseph M., Salem, MO Rosenbaum , Joseph J., Mountain View, HI Bingham , William "Bill" B., Ammon, ID Heath , James "Jim" S., Rocklin, CA Marchant , James W., Blacksburg, VA Troutman , Earl L., Hemet, CA Early , Stephen M., Ogden, UT Church , Daniel F., Santa Rosa, CA O'Barr , Danny R., Wasilla, AK Palmer , Earl E., SeaTac, WA Johnson , Terry E., Buffalo, OK Overton , Robert "Bob" A., Thermopolis, WY Hollar , John S., Myrtle Beach, SC Kamlowsky , Frank J., Sun City, AZ Zwer , Patricia A., Vancouver, WA Lee , Robin, University Place, WA Lundberg , David W., Surprise, 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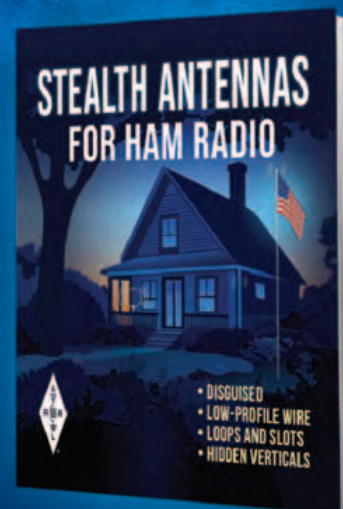


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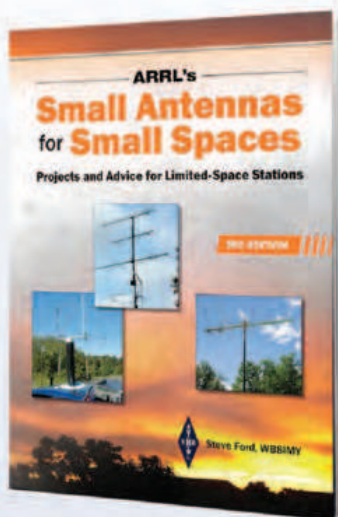
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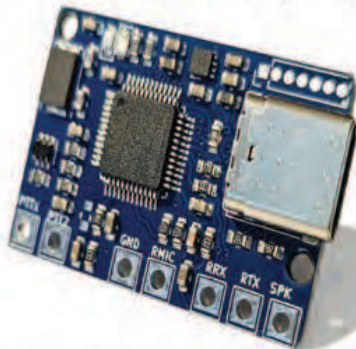


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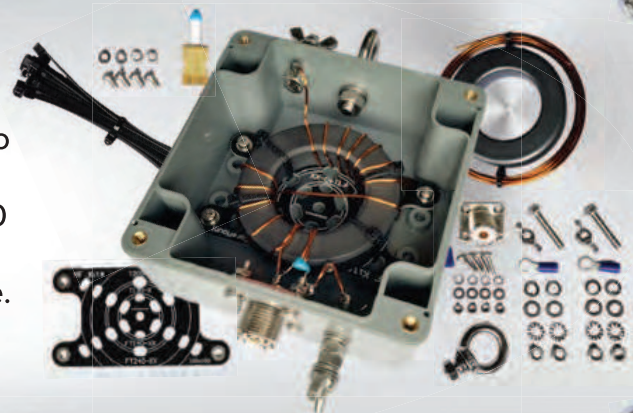
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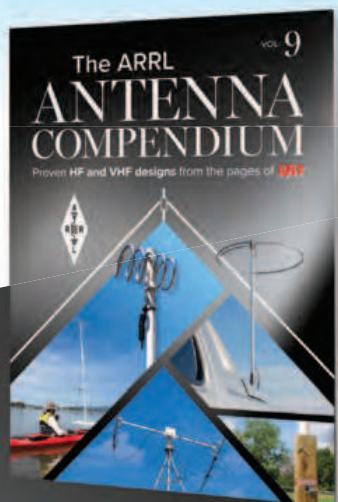
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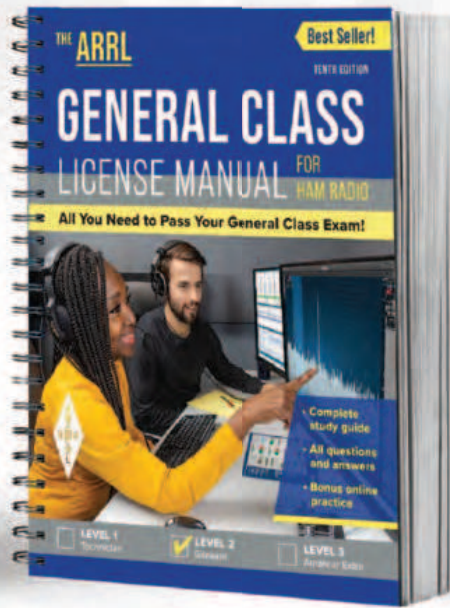
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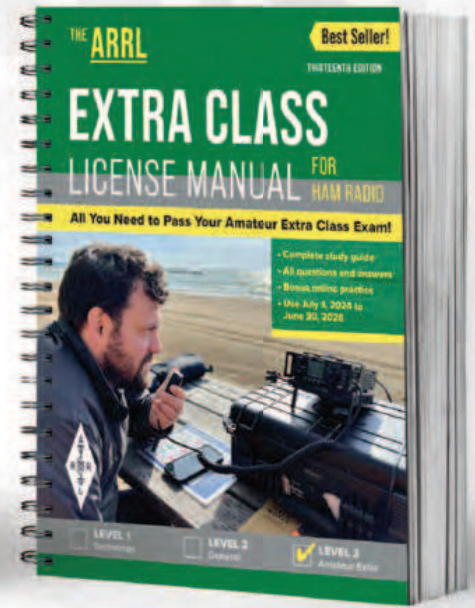
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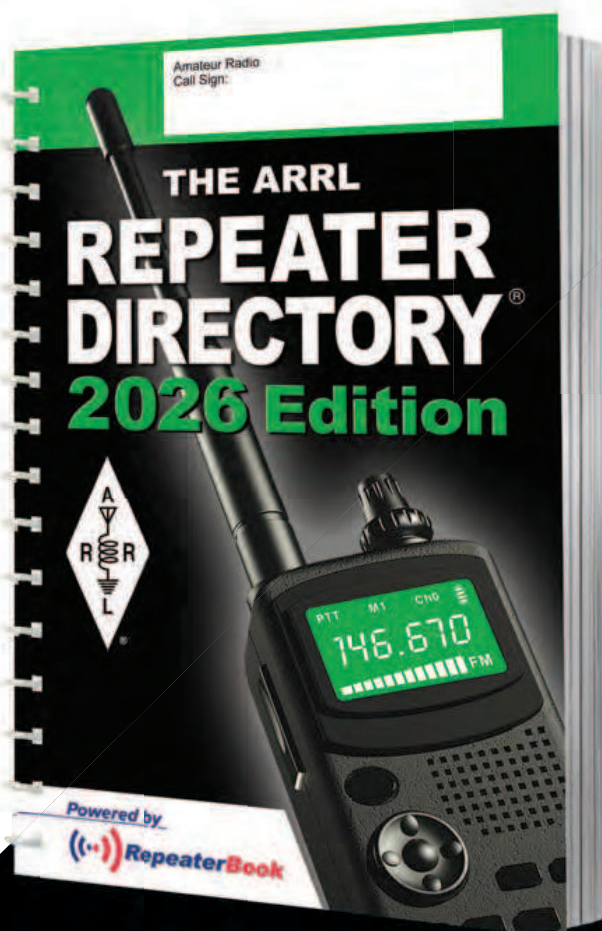
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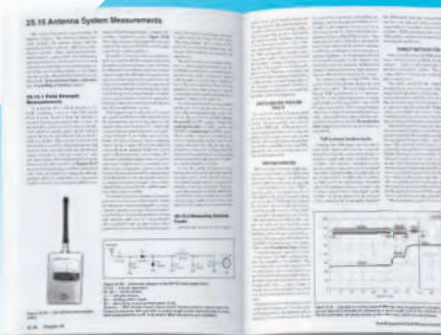
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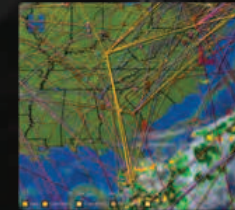
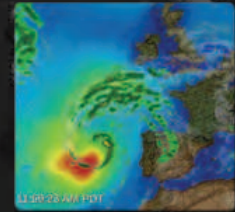
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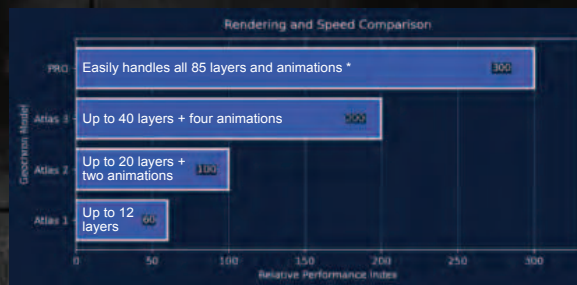


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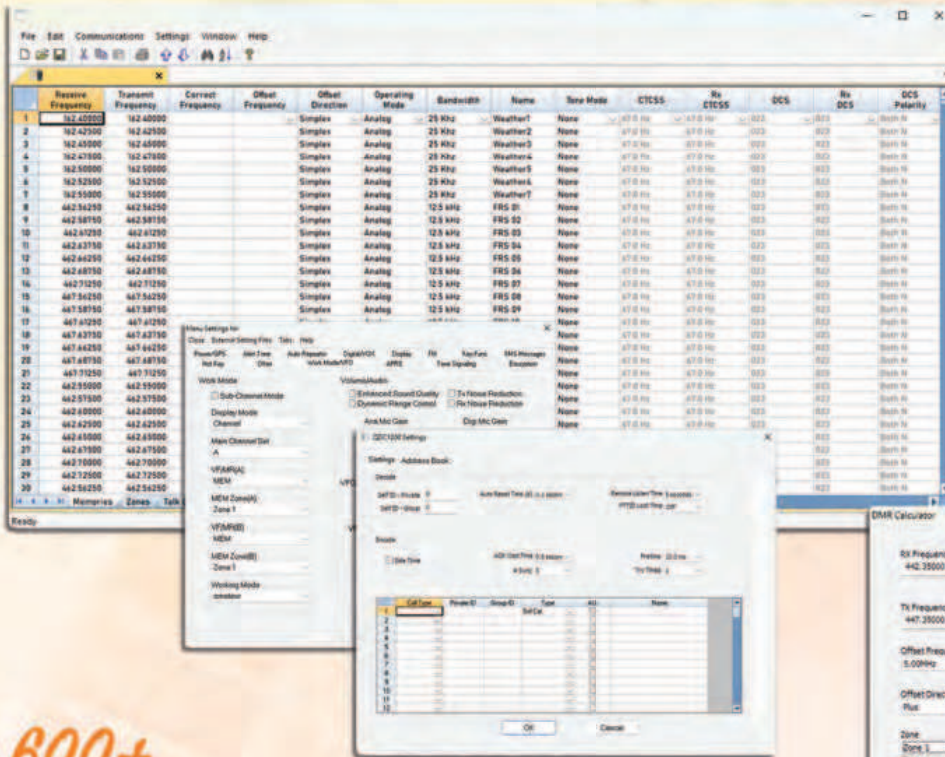
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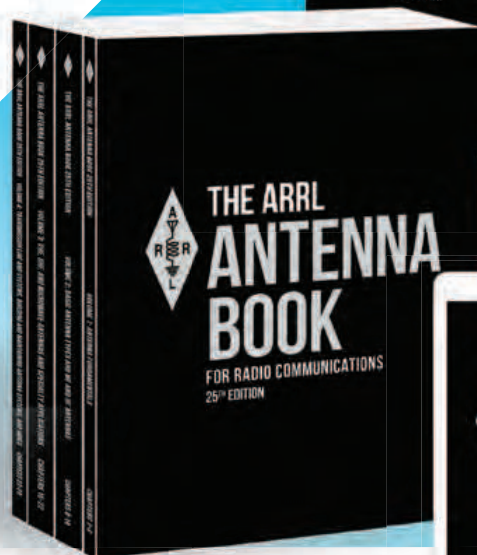
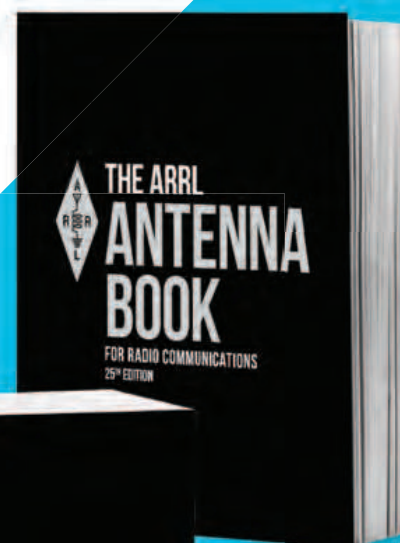
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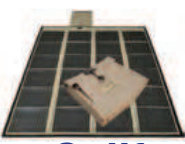
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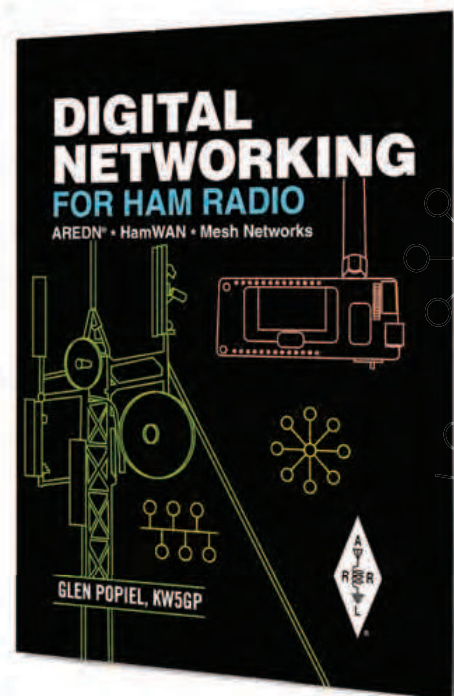
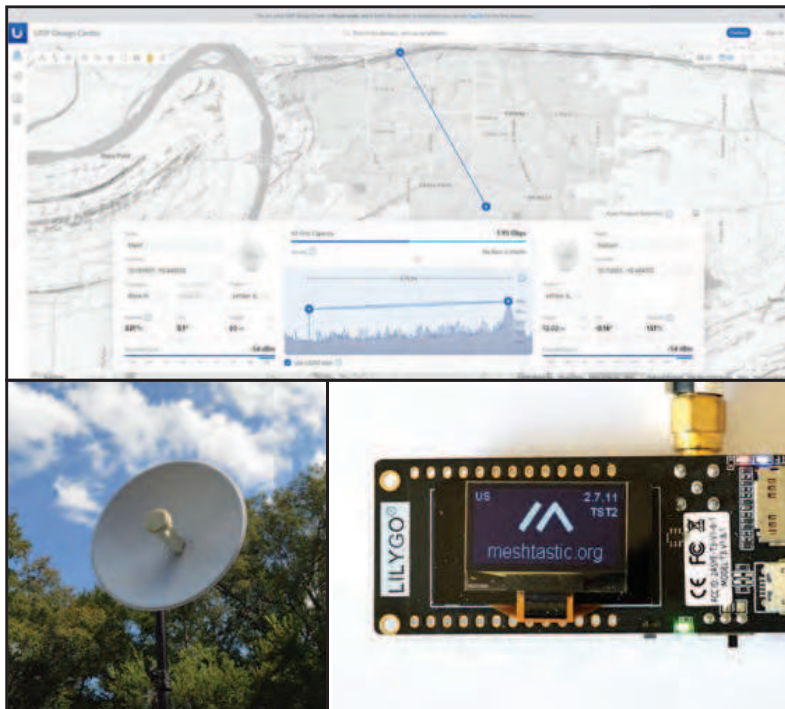
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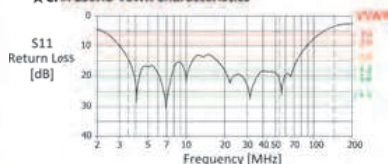
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2 **COMET GP-3 DUAL-BAND 146/446MHZ BASE REPEATER ANTENNA**

Wavelength: 146MHz 6/8 wave • 446MHz 5/8 wave x 3 • Gain-146 MHz: 4.5dBi / 446 MHz: 7.2dBi • Max Pwr: 200W • Length: 5'11" • Weight: 2lbs. 9ozs. • Conn: Gold-plated SO-239 • Construction: Single-piece fiberglass

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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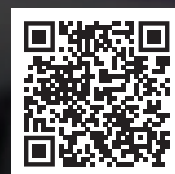
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