A 70-Centimeter Kitchen Array, p. 79

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COMMUNICATIONS & TECHNOLOGY

AUGUST 2023

On the Cover: Harry Hauesser, WA0CNS, of Ballwin, Missouri, operates multiple VHF+ bands in the June ARRL VHF Contest from High Ridge, Missouri (EM48) with a specialized software defined radio and Raspberry Pi. Details on page 32 and in the VHF+ column on page 82

STRAIGHT ELEMENT YAGIS

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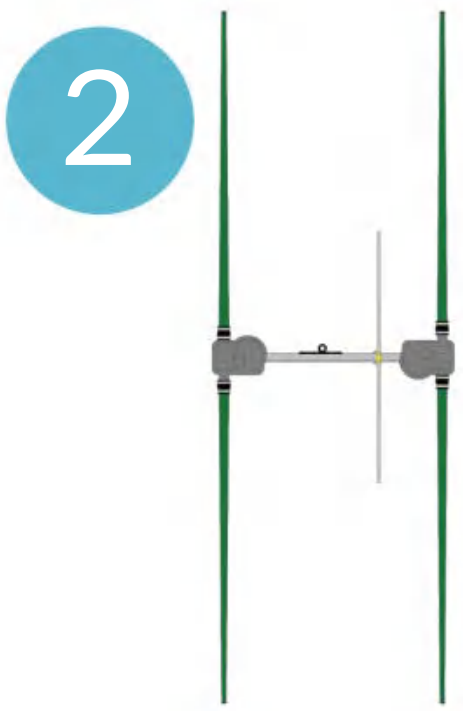

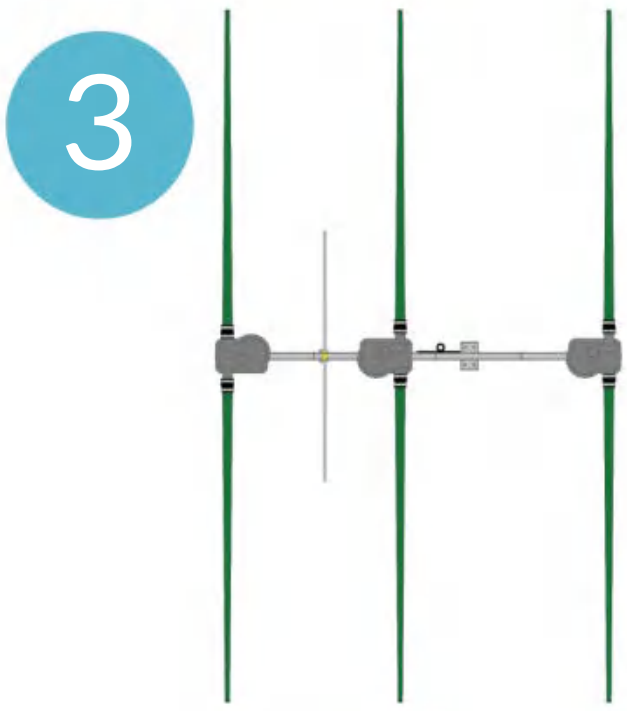

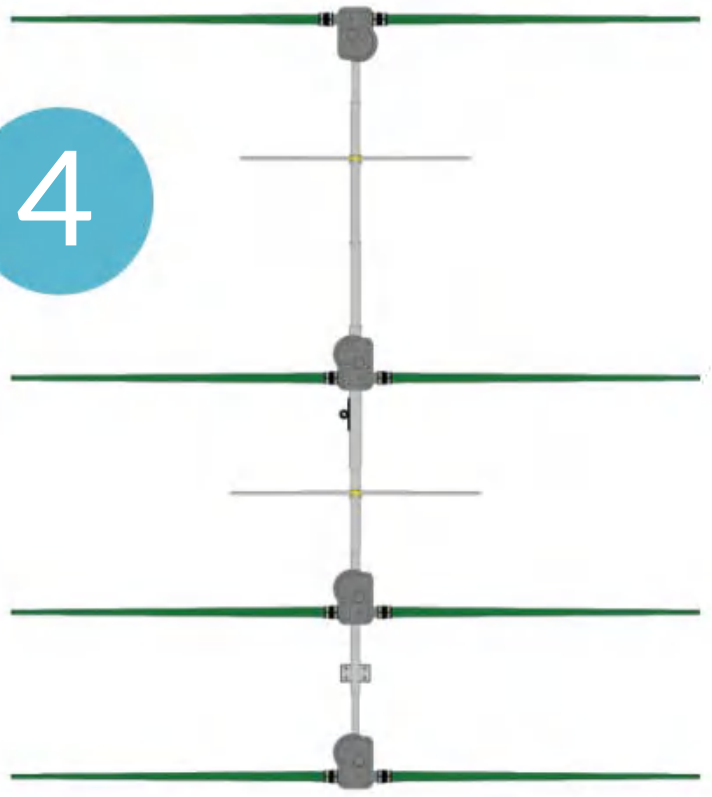

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announcements

AUGUST

CARLINVILLE, ILLINOIS — The MACOUPIN, OKAW VALLEY, MONTGOMERY AND SANGAMON RADIO CLUBS will hold their West Central Illinois Hamfest from 7:00 a.m. to 12:00 p.m. on Saturday August 5 at the Macoupin County Fairgrounds, 21249 Illinois Route 4. Contact: James Pitchford, N9LQF. Website: <http://wcilhamfest.com>. Email: <n9lqf@arrl.net>. Phone: (217) 670-5777. Talk-in 444.250 / 103.5 K9MCE Repeater System. VE testing.

CENTRAL CITY, IOWA — The CEDAR VALLEY AMATEUR RADIO CLUB will hold its Cedar Valley ARC Hamfest from 8:00 a.m. to 5:00 p.m. on Saturday August 5 at the Linn County Fair Grounds, 201 Central City Rd. Contact: David Cripe, NMØS. Website: <wØgq.org/hamfest>. Email: <nmØs@nmØs.com>. Phone: (319) 651-5879. Talk-in 146.735/192.8. VE testing.

ELKHART, INDIANA — The NORTHERN INDIANA K9DEW REPEATER NETWORK will hold the Elkhart East Hamfest from 9:00 a.m. to 2:00 p.m. on Saturday August 5 at the Northern Indiana Event Center, 21565 Executive Parkway. Contact: Dewey Thrash, K9DEW. Website: <http://elkharteasthamfest.com>. Email: <elkharthamfest@gmail.com>. Phone: (574) 370-2436. Talk-in 147.330+ PL 131.8. VE testing.

GROVE CITY, OHIO — The ALADDIN SHRINE AUDIO UNIT will hold the 2023 Columbus Hamfest from 8:00 a.m. to 1:00 p.m. on Saturday August 5 at the Aladdin Shrine Center, 1801 Gateway Circle. Contact: Art Wilson, N8ART. Website: <https://aladdinshrine.org/hamfest/>. Email: <W8FEZAUDIO@AOL.COM>. Phone: (614) 256-5829. Talk-in 146.760 PL 123.0.

LA CROSSE, WISCONSIN — The RIVERLAND AMATEUR RADIO CLUB will hold the Riverland Amateur Radio Club Swapfest from 8:00 a.m. to 1:00 p.m. on Saturday August 5 at the Bethany Church La Crosse, 3936 County Road B. Contact: Scott Cross, KB3MKD. Website: <http://rarc.qth.com>. Email: <kb3mkd@arrl.net>. Phone: (319) 432-1070. Talk-in 146.970 / 131.8. VE testing.

RAPID RIVER, MICHIGAN — The DELTA COUNTY AMATEUR RADIO SOCIETY will hold the U.P. Hamfest 2023 from 9:00 a.m. to 1:00 p.m. on Saturday August 5 at the American Legion Post 301, 10584 N. Main. Contact: Maureen Potvin, KD8SDE. Website: <https://k8pl.org/>. Email: <kd8sde@gmail.com>. Phone: (906) 553-9439. Talk-in 147.150 (+600 / 100PL).

SINKING SPRINGS, PENNSYLVANIA — The READING RADIO CLUB, INC. will hold the Reading Radio Club Hamfest time TBA on Saturday August 5 at the Heritage Park, 992 Clematis St. Contact: Harry Hoffman, W3VBY. Website: <http://www.qsl.net/w3bn/>. Email: <harryhoffmanjr@juno.com>. Phone: (610) 678-8976. Talk-in 146.91/.31 (tone 131.8).

TRUMANSBURG, NEW YORK — The TOMPKINS COUNTY AMATEUR RADIO ASSOCIATION will hold the Ithaca Hamfest from 7:00 a.m. to noon on Saturday August 5 at the Trumansburg Fairgrounds, 2150 Trumansburg Road/NYS Route 96. Contact: Joe Zawislak, W2IFB. Website: <https://tcara-ny.org>. Email: <jbz2@cornell.edu>. Phone: (607) 793-4349. Talk-in 146.970, 146.370 Tone 103.5.

VINTON, VIRGINIA — The ROANOKE VALLEY AMATEUR RADIO CLUB will hold the Roanoke Hamfest from 8:00 a.m. to 1:00 p.m. on Saturday August 5 at William Byrd Middle School, 2910 E Washington Ave. Contact: Darrell Little, KI4LLA. Website: <https://roanokehamfest.info/>. Email: <darrell@ki4lla.us>. Phone: (540) 885-2262. Talk-in 146.985 107.2. VE testing.

BERRYVILLE, VIRGINIA — The SHENANDOAH VALLEY AMATEUR RADIO CLUB, INC will hold the 72nd Annual Berryville Hamfest from 8:00 a.m. onward on Sunday August 6 at Clark County Ruritan Fairgrounds, 890 W. Main. Contact: Larry Miller, KB6VAA. Website: <http://www.hamfesters.org>. Email: <kb6vaa@gmail.com>. Phone: (540) 325-8644. Talk-in 146.820 pl 146.2. VE testing.

PEOTONE, ILLINOIS — The HAMFESTERS RADIO CLUB will hold its Hamfesters 88th Annual Hamfest from 8:00 a.m. onward on Sunday August 6 at Will County Fairgrounds, 710 S. West St. Contact: Jim Riley, W9JPR. Website: <https://berryvillehamfest.com/>. Email: <w9jpr2016@gmail.com>. Phone: (708) 301-1863. Talk-in 146.52 MHz.

ABUQUERQUE, NEW MEXICO — The ROCKY MOUNTAIN HAM RADIO CLUB will hold the ARRL Rocky Mountain Division Convention times TBA from Friday August 11 to Sunday August 13 at the St. Pius X High School, 5301 Saint Josephs Dr. NW. Contact: Brian Mileshosky, N5ZGT. Website: <https://www.divisionconvention.org/>. Email: <bpmiles@gmail.com>. Phone: (505) 463-9468.

NEW WESTMINSTER, BRITISH COLUMBIA, CANADA — The ORCA DX AND CONTEST CLUB will hold the Pacific Northwest DX Convention times TBA from Friday August 11 to Sunday August 13 at the Inn at the Quay, 900 Quayside Dr. Contact: Dave Johnson, VE7VR. Website: <https://pacificnwdxconvention.com/>. Email: <djohnson@davetek.com>. Phone: (604) 603-2254.

CHIPPEWA FALLS, WISCONSIN — The CHIPPEWA VALLEY AMATEUR RADIO CLUB will hold the CVARC 2023 Hamfest from 9:00 a.m. to noon on Saturday August 12 at the Northern Wisconsin State Fairgrounds, 225 Edward St. Exhibit Hall A. Contact: Wayne Johnson, W9CVA. Website: <https://w9cva.org/hamfest>. Email: <hamfest@w9cva.org>. Phone: (715) 600-1332. Talk-in 147.375/975 PL 110.9 W9CVA/R. VE testing.

FAYETTEVILLE, NORTH CAROLINA — The CAPE FEAR AMATEUR RADIO SOCIETY will hold the 24th Annual Cape Fear Amateur Radio Society Swapfest from 8:00 a.m. to noon on Saturday August 12 at the Cumberland County Shrine Club, 7040 Ramsey Street. Contact: David Cowart, KI4W. Website: <http://cfarsnc.org/>. Email: <davidki4w@gmail.com>. Phone: (910) 624-1394. Talk-in 146.910 100 Hz. VE testing.

GRAND JUNCTION, COLORADO — The WESTERN COLORADO AMATEUR RADIO CLUB will hold the WCARC Hamfest and Swapmeet from 9:00 am onward on Saturday August 12 at the First Christian Church, 1326 North 1st Street. Contact: Chip Ferron, NØWKR. Website: <http://www.wØrrz.org>. Email: <chip.ferron@gmail.com>. Phone: (970) 261-2508. Talk-in 146.94 - 107.2.

HUNTINGTON, WEST VIRGINIA — The TRI-STATE AMATEUR RADIO ASSOCIATION, INC will hold the Tri-State Amateur Radio Association, Inc. 60th Annual Hamfest time TBA on Saturday August 12 at the New Baptist Church, 610 28th St. Contact: Teresa Killen, KD8QIH. Website:

(Continued on page 30)

ham radio news

FCC Considering Proposal for New Commercial Use of HF Bands

As traditional users of the shortwave spectrum move their operations to satellites and the internet, a group of businesses in the financial sector is seeking to use HF for high-speed, high-power data transmissions. The ARRL reports that the "Shortwave Modernization Coalition" has petitioned the FCC for use of multiple frequencies between 2 and 25 MHz with power authorizations up to 20 kilowatts. While *Newsline* reports that the FCC says that the proposed uses would not impact spectrum used exclusively by amateur radio, maritime or aeronautical services, the ARRL points out that some requested frequencies are immediately adjacent to amateur bands, which could be affected by high-power digital signals. Comments were due by July 31, with reply comments open until August 15. The full petition may be found at <https://tinyurl.com/dh5dbctb>.

Bill to Pre-Empt HOA Antenna Restrictions Reintroduced in Congress

A Republican Congressman from Ohio and a Democrat from Connecticut have jointly introduced a bill to force homeowners' associations (HOAs) to allow amateur radio antennas in the developments that they control. HR 4006 would remove private land use restrictions that prevent amateur radio operators from installing and using "reasonable antennas" on property that they own or control. This month's Learning Curve column is devoted to the bill and recommendations for encouraging your congressional representative to support it. The full text of the bill may be found at <https://tinyurl.com/vtvputst>.

Attendance Up at Europe's Biggest Hamfest

The annual "HAM RADIO" show in Friedrichshafen, Germany, drew a crowd of over 11,000 attendees this year, up 10% from 2022, according to *Newsline*. The show, Europe's largest, had close to 400 exhibitors, according to the *ARRL Letter*, including 149 commercial exhibitors and international associations (including ARRL), as well as 243 flea market vendors, an increase of 15% from last year. The show's theme this year was "We're all about STEM!" (science, technology, engineering, and math), and included many youth-focused activities.

JY1's Ham Station Donated to RSGB

Jordan's Queen Noor has donated the ham station equipment of her late husband, King Hussein, JY1, to the Radio Society of Great Britain. The king was very active on the ham bands and always introduced himself simply as "Hussein" to ham contacts. The *ARRL Letter* reports that RSGB is preparing a permanent exhibition of the JY1 station at its National Radio Centre at Bletchley Park.

Milestones: W5NYV Honored as a Woman of Influence in Engineering

Open Research Institute (ORI) co-founder and CEO Michelle Thompson, W5NYV, is among this year's "Women of Influence in Engineering," a list assembled each year by the *San Diego Business Journal.* The *ARRL Letter* reports that Thompson, a third-generation ham, has been licensed for more than 25 years. Through amateur radio, she told the *Letter*, "I was drawn to the vocation of helping people navigate difficult rules and regulations that impeded their learning and success."

Thompson is heavily involved in amateur satellite service regulatory reform and is a member of the FCC's Technological Advisory Council. She is also chair of the San Diego section of the Institute of Electrical and Electronics Engineers (IEEE) and founder of the institute's Information Theory Society.

Milestones: Bouvet Puts NF7E at the Top of the Honor Roll … and in the Newspaper

When Bob Wertz, NF7E, of Flagstaff, Arizona, received his confirmation for working the 3Y0J DXpedition to Bouvet earlier this year, it was his 340th confirmed DX entity, putting him at the Top of the Honor Roll for DXCC, and that put him in the local newspaper! The *Flagstaff Business News* ran an excellent article on Bob, DXing, and ham radio in general. He was hoping that the article would draw prospective hams to the Flagstaff Hamfest (also mentioned in the article) on July 15.

It's good to keep in mind that local newspapers and internet news outlets are always interested in stories about accomplishments by area residents and can often be good ways to promote amateur radio. The article can be found at <https://issuu.com/flagbiznews/docs/fbn0723hr> on page 14.

ARDC Grant Provides New Antennas and Satellite Capability for Museum Ham Station

A grant from ARDC, the Amateur Radio Digital Communications foundation, has allowed the radio club of the Vintage Radio and Communications Museum of Connecticut in Windsor to upgrade its antennas and add satellite capability to its demonstration station, W1VCM. According to the *ARRL Letter*, the new equipment includes a high-gain antenna system with computer-controlled tracking and a satellite-capable transceiver. While the museum focuses on vintage radio gear, officials feel a modern ham station complements the collections and helps to reinforce the history that has led to our current communications capabilities.

A New "OTA" – Scout Camps On The Air

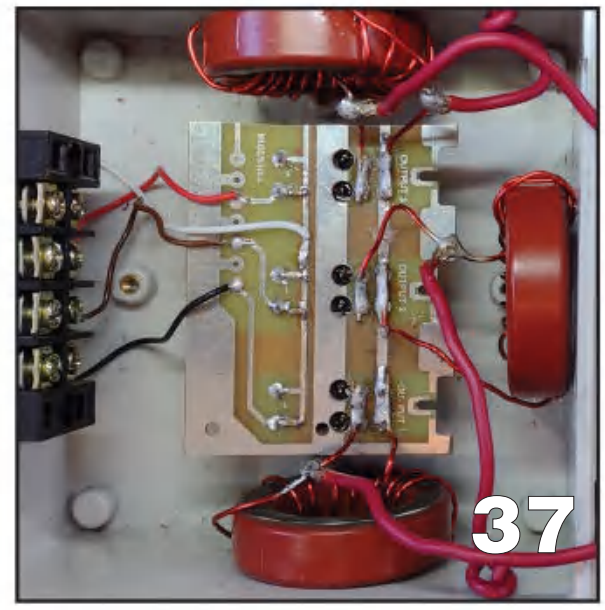
There's a new "OTA" program joining islands, summits, parks, and lighthouses on the air … Scout Camps On The Air, or SCOTA. According to *Newsline*, the goal is to promote amateur radio operations from scout camps, non-camp Scout-operated stations and everyone else who works them. The program is the brainchild of Matt Murphy, KR8E. It is still in the formative stages. Interested hams are invited to follow progress or contribute to it by following the group on Twitter <@SCOTA_k2bsa> or on Instagram at <scota_k2bsa>.

contents

AUGUST 2023 • VOLUME 79 NUMBER 8

On the Cover:

Getting high (in frequency) … Harry Hauesser, WA0CNS, of Ballwin, Missouri, operates the ARRL June VHF Contest from EM48 in Missouri. Details on page 32 and in the VHF+ column on page 82. (Cover photo by Ron Ochu, KOØZ)



features

FOCUS ON Getting new members is the lifeblood of any organization. From the local Rotary club to the National High School Honor Society, getting in new folks is the only way to continue existing. Ham radio is no exception, and we at *CQ* celebrate each new ham that successfully tests into our worldwide club. Youth is found all over this issue, from collegiate foxhunts (p. 10) to the creative hijinks of the W8EDU club during Field Day (p. 8). We also take a look at what young hams in our community are up to at our hamfests, such as in our News Bytes section (p. 7). So this issue is really focused on hope – hope that the future of ham radio is as bright as solar cycle 25 seems to be thus far. We at *CQ* hope more and more young hams join the airwaves soon!

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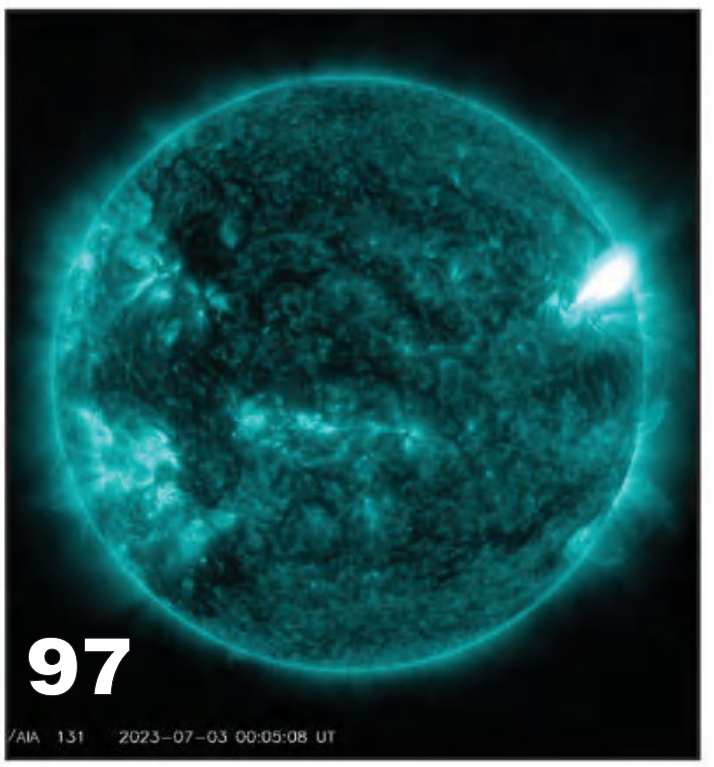
miscellaneous



zero bias: a cq editorial

BY RICH MOSESON,* W2VU

"Thank You for Your Service"

I'm writing this just after the 4th of July, when it's even more common than usual to hear people say "thank you for your service" to just about anybody in a uniform. This is great, of course, as long as it's sincere and not just a cliché, but that's a topic for another day and perhaps another forum. For this forum, though, it brings to mind the fact that there are more ways to serve one's country and community than with a gun (or a firehose). We hams illustrate that fact every day, and we are always happy to highlight examples of that service here in *CQ*.

There are more ways to serve one's country and community than with a gun (or a firehose). We hams illustrate that fact every day.

The most common form of amateur radio community service that comes to mind is providing public service and emergency communications, something we have done since the earliest days of radio and continue to do today, often under very trying circumstances. We continue to be there "when all else fails" … and it still does.

But another equally-valuable service that we perform is the use of amateur radio to promote careers and provide practical experience in STEM fields – science, technology, engineering and math. A key element of this service is that, while attracting more young people to the ranks of amateur radio is certainly a desirable side-effect, it is not necessarily the primary goal of these activities. Rather, the primary goal is to increase the ranks of scientists, technologists, engineers and mathematicians, careers that are vital to our shared futures.

This month's issue illustrates several of these activities in its focus on youth and amateur radio, starting with our News Bytes column on the next page, which highlights the youth activities at the Dayton Hamvention®. That's followed by a report from the Case Western Reserve University Amateur Radio Club (p. 8) on how it used its Field Day station to teach antenna building to new and prospective hams, and to provide them with what was frequently their first opportunity to get on the air on HF. Next, we have a report from India (p. 10) on how a technical university there partnered with the local ham radio club to put on a foxhunt (hidden transmitter hunt) as part of its annual "Technobash" technical symposium. One hundred sixty students signed up (more than for any other activity) to learn about antenna design, signal measurements and more, in addition to hunting for hidden transmitters. We also introduce the 2023 Amateur Radio Newsline Young Ham of the Year – W0AAE – who became interested in amateur radio at age 12 after visiting a museum ham station, and now has become a leader in the Youth on the Air Americas program as well as the Remote Ham Radio Youth Network. See his story on page 14.

Last month, we reported on the annual HamSCI workshop, held on the campus of the University of Scranton, that brings together scientists, students and ham radio citizen scientists to jointly explore the forces that determine how far we can communicate at any given time. Ham radio is unique in that it a) is fun and b) provides real-world practical experience in applying concepts and formulas that are otherwise just words and numbers in a textbook.

The bottom line here is that amateur radio can help stimulate interest in STEM careers and even help scientists learn more about our ionosphere and the role of cosmic forces on wireless communication, which has become an essential part of the global economy and our everyday lives. Hams who help in these efforts, whether by conducting or participating in programs like these or simply introducing the public to radio science through public demonstrations, are providing a service to our communities and our nation (even multiple nations) that, in the long run, coupled with emergency and public service communication, is important in its own way to our secure futures. So if no one has said this to you before, *thank you for your service!*

Join the CQ Family?

We are looking for help in a couple of different roles within the CQ family. WPX Award Manager Steve Bolia, N8BJQ, is looking for a volunteer to administer the WPX Honor Roll program. You'd need to be an active participant in the WPX program, preferably already an Honor Roll member, and have a good understanding of the ebb and flow of special prefixes issued by various governments on a temporary basis.

Also, "Listening Post" editor Gerry Dexter is back with us in this issue after a several-month absence due to illness. Gerry is going to be winding down his column over the next couple of months to focus more on his health. If you are one of our readers who enjoys listening as much as talking (or maybe even more!) and have the time and interest to gather information and write a monthly column on the monitoring side of the radio hobby, we'd love to hear from you. We're also interested in your thoughts on whether our reporting on what to listen to should remain focused on shortwave broadcasting or extend to aspects that may be a little less technically challenging but still provide interesting perspectives from around the world, including online and satellite sources. We'd like to hear your thoughts on these topics even if you are not in a position to consider taking on our monitoring column.

We hope you're enjoying your summer and getting a chance to make the most of the approaching peak of solar cycle 25, clearly the best cycle in a very long time. And once again, thank you for your service!

73,
Rich, W2VU

*Email: <w2vu@cq-amateur-radio.com>

news bytes:

Young Hams in the Spotlight at Hamvention

Once again, the Dayton Hamvention® Youth Forum highlighted the accomplishments of young radio amateurs. This year, there were six presenters (see Photo A) describing their involvement in various ham radio activities and events. The forum coordinator, as always, was Carole Perry, WB2MGP, who also presented the 11th annual "Young Ham Lends a Hand" award to 16-year-old

(Continued on page)

Photo A: The young hams who made presentations at the 2023 Dayton Hamvention Youth Forum. From left: Lyle Strachan, KEØZNV; Javan Miller, W8UA; Collin Holdsworth, KØNNK; Forum Moderator Carole Perry, WB2MGP; Landon Baumgartner, KE8TJU; Katie Campbell, KE8LQR, and Grace Papay, KE8RJU. (Photos courtesy WB2MGP)

Field Day frequently provides newer hams with their first opportunity to operate HF. At W8EDU, the radio club of Case Western Reserve University, the focus is always on doing something new each year. Oh, and did we mention the Pink Pig?

The 2023 Field Day Experience for a University Amateur Radio Club

BY MATT CANEL,* KE8NZR and DAVID KAZDAN, AD8Y

The Case Amateur Radio Club, W8EDU, of Case Western Reserve University in Ohio held its annual ARRL Field Day exercise at the university farm's Pink Pig meeting house. The Pink Pig was indeed the farm's pig barn back in the day; it's now a pleasant if rustic gathering place with a large lawn and some quite high trees. Porky's sty has been transformed into hams' radio hangout, as it were.

Planning meetings began in January and then in earnest in April; we reviewed last year's debriefing notes, checked on last minute purchases, and assigned tasks. W8EDU does not target "winning" the contest, but we very much do have the goal at Field Day and at all of our events to have high engagement, happy attendees, good food, and fun operating. Sometimes, it is more important to bake bread on-site and then break that bread together than it is to have all transmitters running full duty cycle.

CARC members have decided to do *something* new each year for Field Day. We lost some club years to COVID-19 so for this event, much of the novelty was teaching newcomers how to "do" Field Day and amateur radio. We planned new antennas and a new power system. We sketched five antennas cabled to two transmitters and a VHF/UHF station. The club had six large pulled-from-service batteries donated to us from the Cleveland Clinic's engineering department. We deployed those as our main station power supply system. Their 12.6 volts at scary amperage ran an Icom IC-7300 and the club's go-box Yaesu FT-991a (Photo A). The tuners and bias-tees and the controlling laptops were all set up on that battery bank, rounding out our class 2A emergency power station. Our

Photo A. W8EDU Go Box with Yaesu FT-991a operating on one of the DXE-135 dipoles.

* *E-mail: <mjc243@case.edu>*

VHF/UHF station was powered by its own supply, the product of an undergraduate senior engineering project battery system. It used a 100 amp-hour (Ah) $LiFePO_4$ battery and a West Mountain Radio Epic PWRGate controller for similar off-grid, simulated emergency power.

Our undergraduate club officers were all out of town for summer work, so staff included alumni, the faculty advisor, community radio amateurs, university faculty who were interested in helping out, and other visitors and well-wishers. The youth working group ranged in age from 6 to 16. Everyone did something!

Our HF antenna farm comprised two DXE-135 dipoles, one of which we strung in a location we have been using for years facing east-west, and the other in a new location we chose perpendicular to the first dipole facing north-south. The theory behind this was that it would greatly reduce cross talk (a major issue at past Field Days) and indeed it did when we performed testing. We also hoped to have an east-west antenna and a switchable north-south one. Our biggest antenna endeavor, however, was a 160-meter full-wave loop (Photo B). We strung 558 feet of wire into the trees to form a nearly equilateral triangle. This loop proved challenging as there were several obstacles to loft it through and past. The loop traversed buildings, shorter trees and bushes between the main supporting greenery, and even vehicles and fencing which made some of the runs quite challenging to lay out. Once the wire was lofted, we were able to even it out and have the feed point almost 70 feet in the air, although the lowest point of the antenna sagged to 12 feet above ground.

VHF/UHF antennas, supported by two 8-foot masts, were a 6-meter Ringo Ranger a Comet GP-1 dual-band 2-meter/70-centimeter antenna. Our Ringo Ranger was damaged during deployment but a good sanding and careful reattachment of the broken part made the antenna functional and allowed for good operation. Field Day sometimes calls for field repairs; we'll get the antenna properly fixed soon while the problem is still fresh in memory. It's part of our debriefing document, begun as soon as the operating period was over and before cleanup of the Pink Pig began.

How'd we do? Pick the metric by which you wish to have that question answered. We certainly did not make a competitive score. About forty people, licensed or not, learned what a communications emergency constitutes and how amateur radio might help. They learned power systems and HF radio operations; they learned traffic handling by 'phone and by digital, and they learned knot tying and line handling. Some learned a bit of cooking and baking. Some learned a bit of music and acoustics. We learned that despite 6-meter openings, there weren't contacts to be had there, and 160 meters was the same but noisier. CW is fast, SSB is faster to learn although certainly not trivial. We all acquired new knowledge and skills in amateur radio, electrical and mechanical engineering, and human factors engineering plus project management. We demonstrated to ourselves and to our community that we could help provide both rapid and formal communications in an emergency.

So, we won! Thanks to all of the amateur radio operators and their friends out there for making Field Day a success *for all of us.* Bread recipes on request.

73 and GL di-dit

Photo B. The W8EDU crew lofting the 160-meter loop, directed by KB3VSC (in green shirt).

Amateur radio activities continue to offer great value for students, especially in the STEM fields of science, technology, engineering and mathematics. At a recent "Technobash" at an engineering school in India, a ham radio foxhunt was the most popular activity among the students. VU2OOM has details.

Indian Ham Club Supports College Fox Hunt – A Great Success!

BY MANGESH PATIL,* VU2OOM

The G.S. Moze College of Engineering, Balewadi, Pune, India, in association with Pune Hams VU2RCP (the Amateur Radio Club of Pune) successfully held its Fox Hunt event this past March (Photo A) as part of the school's annual national level technical symposium, Technobash 2023. There were several events under Technobash 2023, including Roborace, blind coding, and more, but most of the entries from students were received for the foxhunt event (Photo B).

Over 160 students from across the college participated in the event, making it a great success. Preparation for Fox Hunt started with a Yagi-Uda antenna workshop a week before the event (Photo C). Commodore Ashish Saxena, VU2ANM, provided instruction about the Yagi antenna in theory as well as a practical demo on the subject. Students were excited to see the practical demo using the field strength meter (Photo D). They then conducted various measurements like vertical and horizontal polarization, directivity, gain, SWR, front-to-back ratio, etc., using the field strength

Over 160 students from across the college participated in the event, making it a great success.

*Email: <vu2oom@yahoo.com>

Photo A: Pune Hams, VU2RCP, the amateur radio club of Pune, India, worked with the G.S. Moze College of Engineering's "Technobash 2023" to put on a very popular fox hunt. (Photos courtesy of the author)

meter and an MFJ antenna analyzer. After that, the students assembled ten Yagi antennas in the college workshop.

Students also learned about the hands-on activity of radio direction finding from Kunal Gautam, VU3YEJ, in preparation for the fox hunt, which created a lot of excitement (Photo E). Vilas Rabde, VU2VPR, shared some interesting facts and stories which excited the students even more. The fox for Fox Hunt was made by student SWL Vishnu under the guidance of VU3YEJ, your author, using a Raspberry Pi 3 microcomputer. For the hunt itself, there were 12 handhelds provided by participating hams.

Photo B: Students at the college created this tapestry to commemorate the transmitter-hunting activity.

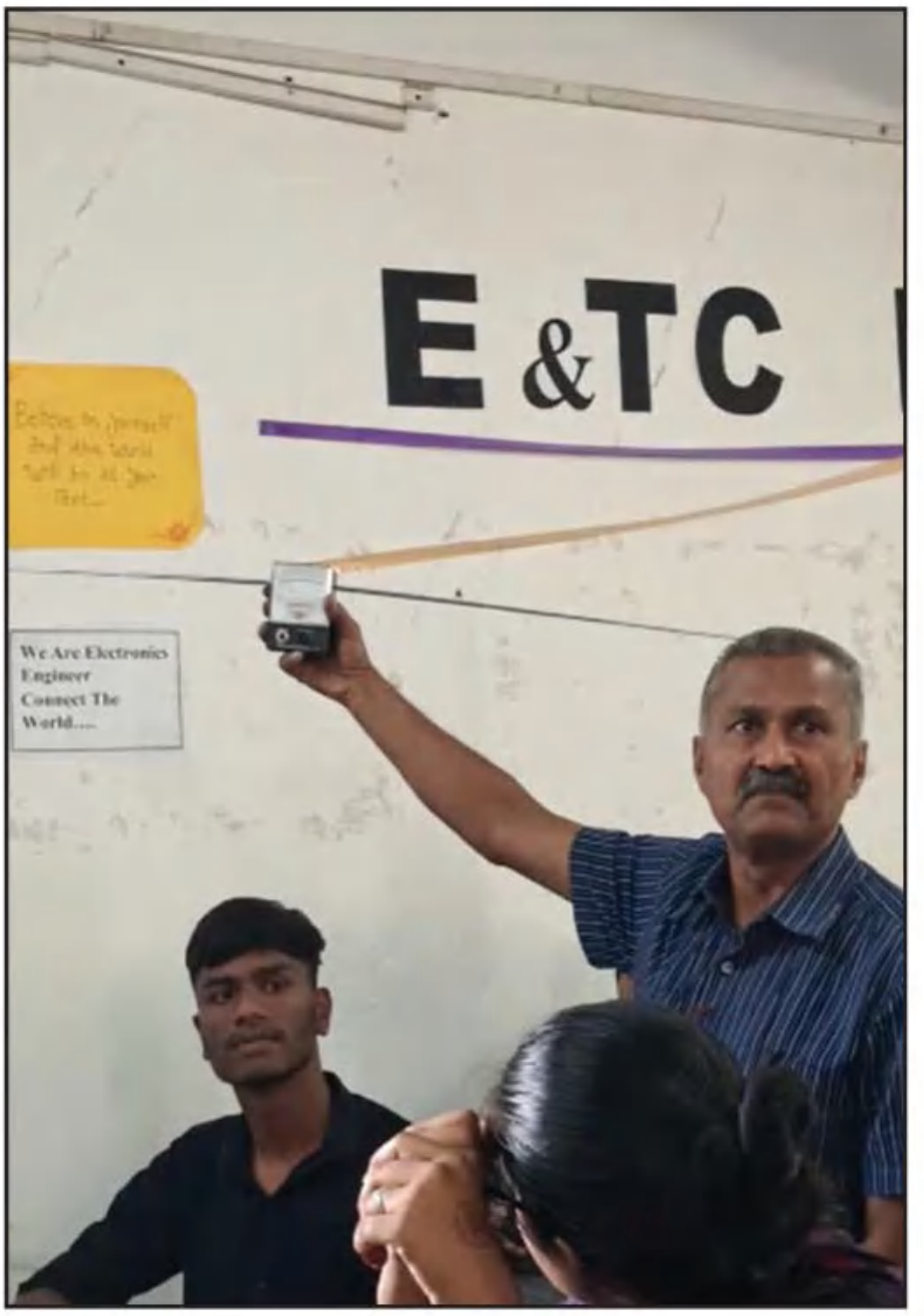


Photo D: VU2ANM demonstrated changes in signal strength with a field strength meter

Photo C: Commodore Ashish Saxena, VU2ANM, works with students during an antenna workshop prior to the foxhunt. The students built ten Yagis for the event.

Photo E: Kunal Gautam, VU3YEJ, instructs students in the art of hidden-transmitter hunting before the event got under way.

Photo F: More than 160 students signed up to take part in the foxhunt

Photo G: One of the teams gets ready to start chasing foxes!

With the knowledge gained by students, the fox hunt event was conducted on the 3rd and 4th of March (Photo F). As accommodating 160+ students was a tough task, groups of two students each were formed. Due to the limited number of radios and antennas, there were nine rounds conducted, each having a maximum of 7 to 10 groups (Photo G). On the first day, a total of six rounds were concluded. On the second day, three rounds were conducted.

Winners of each round were invited again for a final round, and first and second prize winners were decided based on the final 10th round. The final round was quite interesting, as there were two foxes hidden at random places by the VU2RCP group. The first fox was found in 5 minutes and 51 seconds by Mr. Harsh and Mr. Atharv. The second fox was found in 21 minutes by Mr. Anand and Mr. Bhavik. The VU2RCP group congratulated the prize winners and coordinator for their hard work.

For additional details, you can visit <https://tinyurl.com/yc6bnwse>.

Each year, Amateur Radio Newsline selects an outstanding young amateur – generally from a group of highly-qualified nominees – to represent young people in our hobby as Newsline Young Ham of the Year. This year's honoree is WØAAE.

Kees Van Oosbree, WØAAE, Named 2023 Amateur Radio Newsline Young Ham of the Year

BY STAFF

Nineteen-year-old Kees Van Oosbree, WØAAE, of Maple Grove, Minnesota, has been selected as the 2023 Bill Pasternak, WA6ITF, Memorial Amateur Radio Newsline Young Ham of the Year. Kees was honored for his leadership in helping other young amateurs through the Youth on the Air (YOTA)-Americas program and the Remote Ham Radio Youth Network.

A visit to a museum with an amateur radio station at age 12 sparked his interest in becoming a ham, Van Oosbree told *Newsline*. Studying on his own, he quickly earned his Technician and General Class licenses, then joined the Minnesota Wireless Association and developed his interest in contesting.

"HF was my life," Kees said. "Contesting is pretty much my main thing in amateur radio although I do branch out and do other things."

2023 Amateur Radio Newsline Young Ham of the Year Kees Van Oosbree, WØAAE. (Photo courtesy Amateur Radio Newsline)

A visit to a museum with an amateur radio station at age 12 sparked his interest in becoming a ham...

"HF was my life," Kees said. "Contesting is pretty much my main thing in amateur radio although I do branch out and do other things."

Among those "other things" is the YOTA-Americas program, in which he has taken on a variety of leadership roles including the training of youth operators, serving as QSL manager for W8Y contacts made with YOTA campers and sharing his interest in remote operating.

He found a remote operating mentor in Ray Higgins, W2RE, owner of Remote Ham Radio, a service which rents time on world-class stations to hams with restricted spaces for their own stations or a desire to use state of the art gear without the investment of purchasing it themselves. Ray was in the process of setting up his RHR Youth Network when Kees joined the group. The Youth Network provides free access and unlimited airtime on a variety of dedicated RHR stations. (See <https://tinyurl.com/3zsuu9nv>)

"He gives us unlimited access to these highly competitive stations that use FlexRadios," Kees explained. "I was able to do very, very well through that (in) DX contesting."

Kees said he was one of five youth who were originally involved in the remote operating program. Now, he said, the ranks of youth remote operators have grown to near 100, and he has been instrumental in recruiting and mentoring new operators.

A 2023 graduate, and class valedictorian, of Heritage Christian Academy in his hometown, Kees will be attending Iowa State University this fall, where he plans to study aerospace engineering.

The YHOTY award will be presented to Kees during a ceremony at the Huntsville Hamfest in Alabama on August 19. Amateur Radio Newsline, *CQ* magazine, and Yaesu USA are primary sponsors of the award, along with Heil Sound, Ltd. and Radiowavz Antenna Company.

(*Full disclosure:* CQ *Editor W2VU is a member of the YHOTY judging committee.*)

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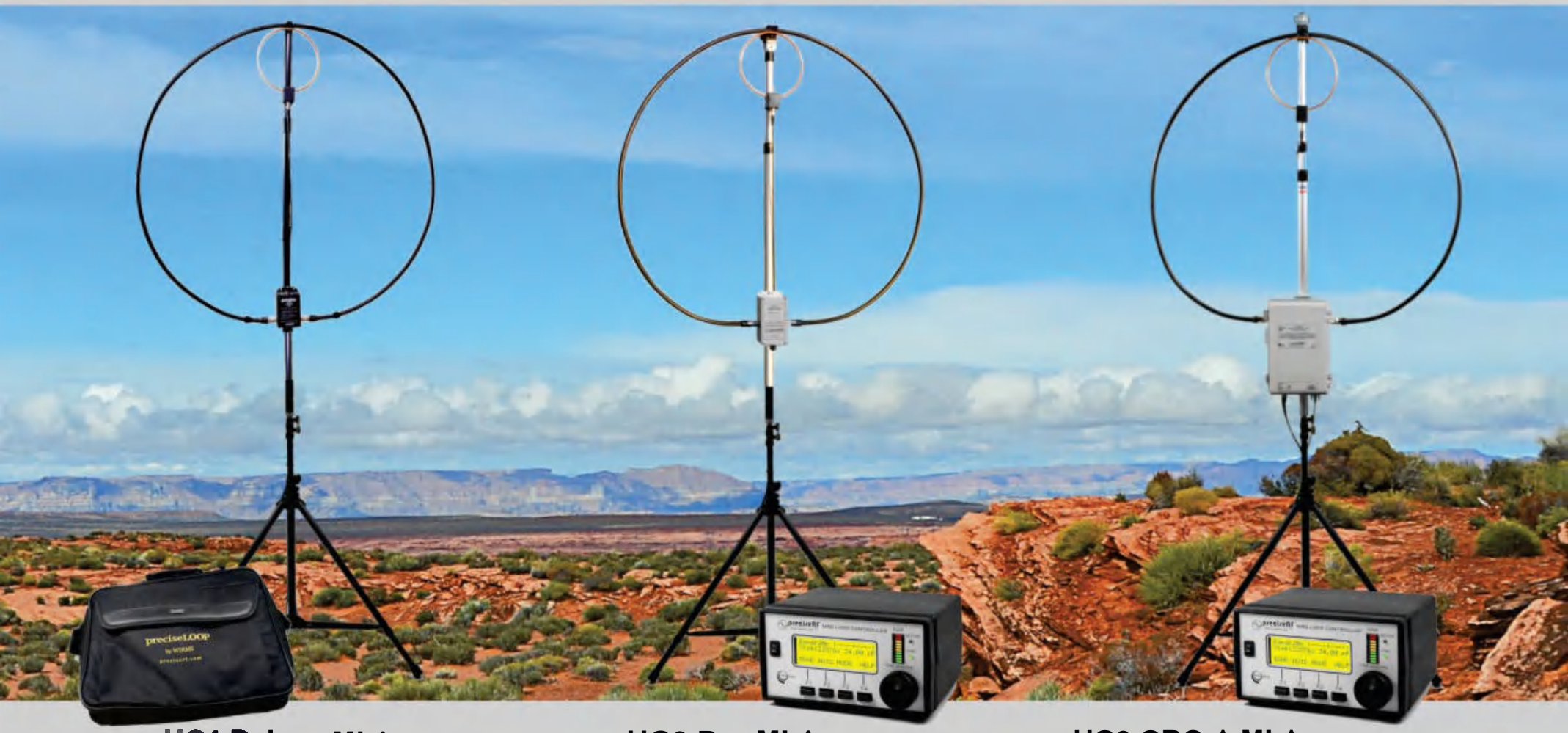

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Results of the 2023 CQ World Wide 160-Meter Contest

Top-Band Contesting During Less-Than-Optimal Conditions, Both On the Air and Off

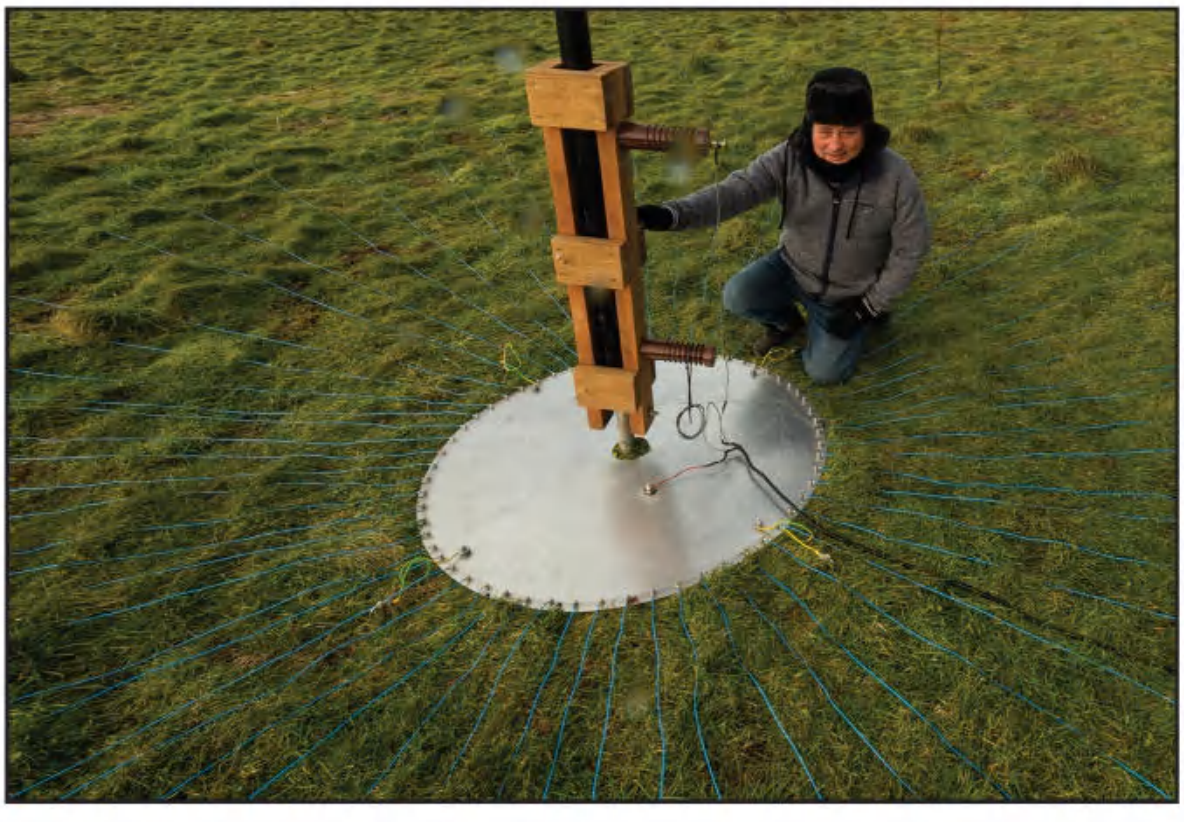
BY ANDY BLANK,* N2NT

Bob Beebe, GU4YOX, as MJ5E just before contest start.

The 2023 CQ 160 CW Contest, along with all other amateur contests, suffered this year from the Ukraine/Russia war. Log participation was way down as well, and this is due partially to the approaching solar maximum in Cycle 25 as well as the war.

Traditionally, we are now charting the log activity from prior years; this will be shown below. Participation was down slightly from 2022, and only nine stations were able to break 1 million points, which was down from 13 stations last year. SSB conditions were depressed again, similar to 2022. The highest score was from I5JVA, with 446K.

* <director@cq160.com>



The MJ5E Topband vertical antenna radial plate with 2400 meters of radials.

Check out the MJ5E van.

Below is a comparison of logs submitted since 2015, with the peak year being in 2021.

CW Results

Conditions had the typical high sunspot signature, with high absorption for long haul propagation. Geography played a big part in the ability to make a good score, and specifically if you were centrally located between high density areas of activity, it was the only way to make a big score. Witness the scores from Wales, Jersey, African Italy and Labrador for examples of this.

The Millionaires Club was quite small again this year, with only the following entries breaking the barrier. All of these were CW scores. Congratulations to the team at IG9/S59A for the highest score in the entire contest.

IG9/S59A 1,664,970
PJ2T.....1,252,320
P40AA.....1,202,571
P33W 1,165,682
VO2AC.....1,126,800
E7DX 1,072,375
MW5B 1,067,664
S50C 1,030,302
MJ5E 1,004,435

Only MJ5E was able to accomplish the Millionaire's Club Single op unassisted! Congratulations to Bob Beebe, GU4YOX on this amazing job (see photo)!

There were also several noteworthy winners from 2022, although not necessarily in the same category. Congratulations to the following stations as repeat "contenders."

NA8V	K1LT	ND8DX
CR3W	KD4D	4L2M
KH7A	N0NI	ED8W
JH4UYB	K1LZ	OK1LRD
ZM4T	NA7TB	S54ZZ
K7NJ	VE3MGY	HG8DX

In the highly competitive multi-op category, aside from the team at IG9/S59A who ran away with the high score, there were three very close results.

VO2AC 1,126,800
E7DX 1,072,375
S50C..... 1,030,302

Special shout-out to VO2AC and VE3KG, who annually make the trek to a lighthouse on the coast of Labrador. They fought the elements in a Field Day-style operation, to make the highest score from North America. We decided to award them a trophy this year as well for their outstanding effort!

The most interesting story is the operation of Bob Beebe, GU4YOX, from MJ5E, mentioned earlier in the article. Bob managed the number 1 single-op unassisted score in the world. Here are some comments directly from Bob.

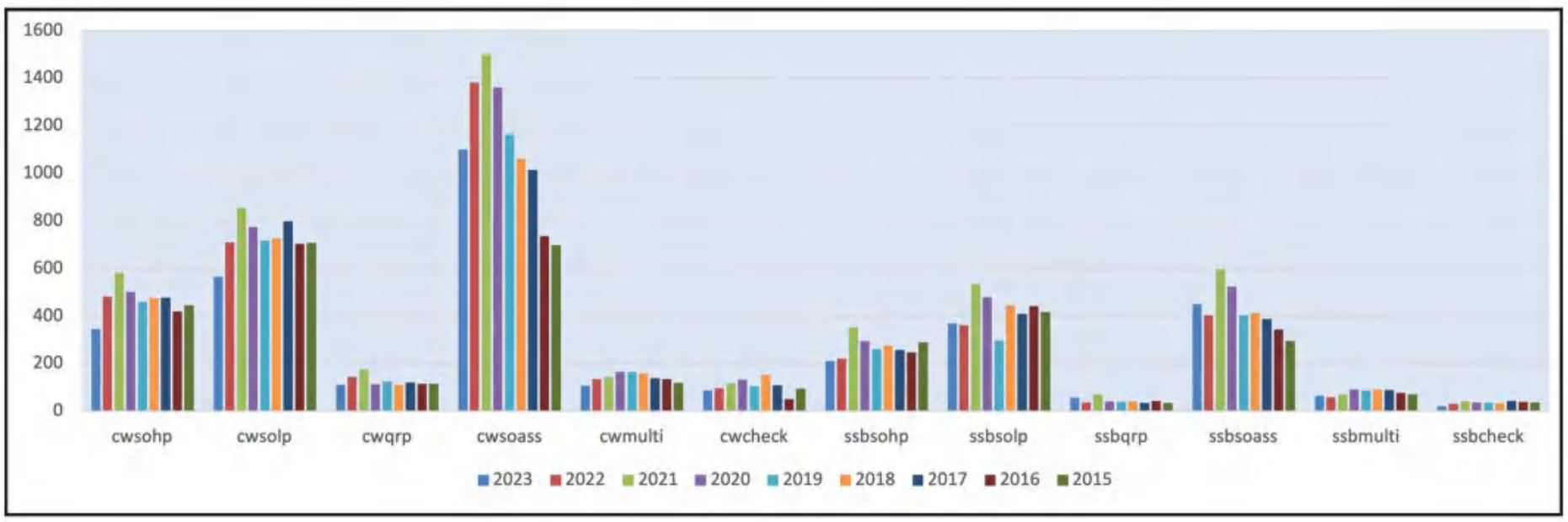
"The only British winner of CQWW 160 CW HP was Ron Stone, GW3YDX in 1989 and 1985, which was 34 years ago. That's a long time. Previously, GM3IGW/A in 1965 and G3GRL in 1964 (200 Qs). This is the first ever win for the Channel Islands. Ron became SK in 2023 and my win is dedicated to the memory of Ron."

There was a feature article in the May/June issue of the *National Contest Journal* about Bob's operation. Here is an excerpt to put it into perspective:

"I thought I would try a Field-Day style operation to try to improve my 160 con-

Year	CWSOHP	CWSOLP	CWQRP	CWSOASS	CWMULTI	CWCHECK
2023	346	566	112	1101	107	88
2022	482	711	146	1381	135	98
2021	583	854	175	1502	146	118
2020	501	775	113	1362	166	134
2019	459	719	125	1166	166	105
2018	475	727	112	1064	160	153
2017	478	798	122	1014	139	110
2016	420	705	115	737	135	51
2015	446	709	116	698	119	96

Year	SSBSOHP	SSBSOLP	SSBQRP	SSBSOASS	SSBMULTI	SSBCHECK
2023	212	369	58	450	65	21
2022	221	362	38	404	59	32
2021	352	537	71	596	71	42
2020	295	480	42	524	92	38
2019	261	298	39	403	87	35
2018	276	446	41	413	91	36
2017	258	409	36	387	90	44
2016	247	441	44	343	77	39
2015	290	418	35	295	72	37



2023 CQWW 160M CONTEST TOP SCORES

CW

Single-Op USA

K3ZM	788,240
AA1K	598,561
K1KI	530,725
NA8V	526,693
WF2W	490,968
N2MF	419,440
N4XD	398,454
KD4D	331,065
W5ZN	326,230
K1ZM	21,360
W3BGN	309,570

Single-Op VE

VE3JM	823,914
VE3DZ	738,108
VE3AT	668,322
VE3MGY	378,314
VY2WW	261,699
VA3AR	178,434
VE6BBP	172,250
VE3KP	141,657
VE3XL	134,792
VE3MM	103,820

Single-Op Zone 3

W8KA	125,510
K6NA	94,572
WJ9B	91,000
KH7X	88,725
N7IR	80,535
KC7V	72,256
W6AYC	60,480
K7RAT	54,208
N7GP	53,600
VA7MM	53,346

Single-Op Zone 4

VE3JM	823,914
VE3DZ	738,108
VE3AT	668,322
NA8V	526,693
VE3MGY	378,314
W5ZN	326,230
W9RE	227,682
W8CAR	186,235
VA3AR	178,434
W1NN	177,567

Single-Op QRP

DK7HA	179,862
OL1A	174,704
OL4W	135,405
E77Y	121,900
OL5Y	120,981
N0NI	113,091
OK1FKD	103,286
EA3O	102,856
S51Z	96,726
N9SE	82,080

Single-Op DX

MJ5E	1,004,435
CR3W	974,792
9K2NO	609,783
4L9M	552,244
OM5R	496,506
OM7K	484,677
GM4Z	458,810
EU4E	440,742
IV3SKB	439,236
KP2M	437,144
PA4VHF	392,124

Single-Op Zone 14

MJ5E	1,004,435
GM4Z	458,810
PA4VHF	392,124
SM2U	380,562
TM6M	342,606
DL0MCM	258,932
PA3EYC	254,610
DK5DQ	211,623
LC9X	196,020
DK8FD	195,432

Single-Op Zone 15

OM5R	496,506
OM7K	484,677
IV3SKB	439,236
IS0JHQ	388,790
9A2AJ	382,120
YT8A	330,008
OM5NL	283,751
YT9W	282,150
Z35F	272,205
OM2XA	267,075

Single-Op Zone 16

EU4E	440,742
UT5ECZ	113,360
RA3XM	94,446
RM2U	88,800
UW5KW	83,153
UT3SO	81,328
RX6LRU	67,980
EW2ES	63,999
UT5UGR	63,600
EW3LN	57,948

Single-Op Russia

RA3XM	94,446
RM2U	88,800
RX6LRU	67,980
RK3DK	53,460
R3OM	50,190
RA3UAG	50,102
RL6C	37,800
R1NW	33,336
R3ZJ	32,604
UA4UAR	19,776

Single-Op Russia Assisted

RW7K	642,912
RX3APM	517,884
RG2A	295,848
UA2FZ	238,720
RM4F	227,766
RV1CC	215,059
R8OM	206,016
R8WX	200,805
R3ZZ	190,968
R5WW	144,720

Single-Op LOW

VE3MGY	378,314
LZ4TX	373,907
TM6M	342,606
KD4D	331,065
YT8A	330,008
K1ZM	321,360
OM5NL	283,751
OM2XA	267,075
OL0A	265,536
DL0MCM	258,932

Single-Op W/VE LOW

VE3MGY	378,314
KD4D	331,065
K1ZM	321,360
W1NN	177,567
KG9X	153,497
VE3XL	134,792
W0UO	126,822
WD8DSB	115,441
VE3MM	103,820
K7SV	103,272

Single-Op W/VE QRP

N0NI	113,091
N9SE	82,080
K4XL	80,250
WB4MSG	47,850
WE9R	42,483
K4TO	41,310
K3TW	22,995
WB2CPU	21,528
WQ6X	21,060
K8ZT	15,337

Multi-Op

IG9/S59A	1,664,970
VO2AC	1,126,800
E7DX	1,072,375
S50C	1,030,302
HB0DX	978,768
SP8R	923,364
OM2Y	874,060
K1LZ	853,492
OL1R	838,605
HG8DX	834,460

Multi-Op W/VE

VO2AC	1,126,800
K1LZ	853,492
N2AA	709,341
K3LR	705,789
K1RX	690,305
K0DI	523,448
W1UE	512,658
N4RV	487,084
N1RR	440,990
VE2OJ	437,285

Single-Op Assisted

PJ2T	1,252,320
P40AA	1,202,571
P33W	1,165,682
MW5B	1,067,664
VE3EJ	974,208
9A5W	903,408
SN7Q	898,092
LY4A	892,254
VA2WA	863,052
LX7I	818,688

Single-Op Assisted W/VE

VE3EJ	974,208
VA2WA	863,052
AB3CX	539,136
N1LN	536,192
K2KW	487,084
AA3B	484,035
VE3VN	454,464
K1LT	438,700
K1AR	413,592
VE9HF	404,808

Single-Op Assisted LP

SN7O	395,600
OK2BFN	254,464
HA8WY	253,875
4Z5PN	242,896
OE6VIE	242,352
SP2R	240,448
G0BNR	239,967
YO3APJ	233,610
PA0O	194,004
SP7CF	193,192

Single-Op Assisted LP W/VE

N3HEE	162,708
WO1N	138,826
WB8JUI	121,286
NS3T	119,440
NJ3K	114,304
KX9RT	110,364
KK0U	99,200
K9MMS	81,213
VE3VY	72,432
WT9Q	62,048

SSB

Single-Op USA

K1LZ	339,797
K3ZM	251,356
ND8DX	172,457
WF2W	136,752
W3BGN	114,036
AF1T	104,044
W1XX	83,223
N1DPM	78,740
K5TR	74,152
W4KW	72,561

Single-Op VE

VE3MGY	169,062
VA3AR	90,720
VY2WW	79,173
VE3HJ	54,880
VE3BR	36,594
VE3CKO	34,486
VA3AC	30,566
VE6BBP	23,104
VE3WG	13,860
VE3KMQ	12,615

Single-Op Zone 3

W8KA	41,760
N7AU	8,704
VA7MM	4,320
AI6LY	3,942
N6AA	3,813
KD7UO	3,686
WA7TV	3,168
VE7DX	3,162
K7STO	2,990
N9BD	2,886

Single-Op Zone 4

ND8DX	172,457
VE3MGY	169,062
VA3AR	90,720
K5TR	74,152
W4KW	72,561
WN8HCV	66,150
KW8N	55,100
VE3HJ	54,880
KD8TNF	43,562
K5RX	42,700

Single-Op QRP

K1ZM	57,120
RD3K	43,134
DL8LR	27,861
WB4MSG	24,381
HA1TI	23,925
DK2LO	23,800
PA2TMS	23,494
ON5RZ	14,950
DL2OE	13,472
9A/IZ3NVR	12,648

Single-Op DX

I5JVA	446,173
S53O	235,554
PA4VHF	183,313
LY5W	167,501
ZF2VE	166,140
YR8D	149,060
OK1LRD	116,466
OK4U	113,805
IK1PMR	110,211
OM7K	107,916

Single-Op Zone 14

PA4VHF	183,313
DK5NJ	73,436
DH1UK	57,150
M0NPK	54,912
DL0NG	44,655
OZ11A	42,592
DG5MLA	38,608
DL4ZA	36,036
M0EBJ	35,508
F6FYA	35,013

Single-Op Zone 15

I5JVA	446,173
S53O	235,554
LY5W	67,501
OK1LRD	116,466
OK4U	113,805
IK1PMR	110,211
OM7K	107,916
YT9W	103,000
SP6LUV	100,744
YT8A	97,382

Single-Op Zone 16

EU4E	84,366
RC5Z	35,680
RW1A	25,262
RD1AH	23,030
UA3BL	13,980
RA9SDT	11,088
UT7NY	9,639
RT1M	8,096
R3DCB	8,046
UR5FEO	7,375

Single-Op Russia

RC5Z	35,680
RW1A	25,262
RD1AH	23,030
UA3BL	13,980
RA9SDT	11,088
RT1M	8,096
R3DCB	8,046
R3LCV	6,696
RZ9WU	6,308
RL5A	5,588

Single-Op LOW

VE3MGY	169,062
OK1LRD	116,466
SP6LUV	100,744
YT8A	97,382
LY4L	84,538
IK7YTT	73,723
WN8HCV	66,150
SP9DTE	62,832
HA8WY	60,120
SQ8MFM	59,508

Single-Op W/VE LOW

VE3MGY	169,062
WN8HCV	66,150
WA2QAU	42,328
N0NI	37,128
KS3D	36,623
VA3AC	30,566
AI6O	28,435
WD8DSB	25,326
N4RA	22,760
N8CWU	22,345

Single-Op W/VE QRP

K1ZM	57,120
WB4MSG	24,381
KD9NYE	1,349
K3TW	1,170
NN1DX	994
W7LG	912
N0LMQ	240
K8ZT	126
KC8ZKI	126
K2EKM	12

Multi-Op

S59A	346,480
HG8DX	341,201
LZ5R	258,020
SP8R	239,020
N2CEI	197,032
HA3DX	193,564
OL1R	191,202
N4RV	167,920
DR5Z	152,580
DP6A	145,851

Multi-Op W/VE

N2CE	197,032
N4RV	167,920
NE3F	78,246
WA3EKL	59,040
N1RR	54,400
K4TG	51,250
W4RN	38,869
AD4XT	33,255
W5SGL	28,980
W8UCO	23,352

Single-Op Assisted

LY4A	332,195
OM3TWM	216,512
HB9CXZ	195,804
SN7D	183,793
DK6WL	181,503
SP9N	179,684
SN9B	175,920
LZ4TX	172,142
LX1ER	149,820
G5K	146,475

Single-Op Assisted W/VE

K4ISV	136,323
WU2X	100,408
N0PB	78,993
N4SS	78,1835
K3MM	77,860
K3JO	75,003
W3LL	73,842
K1EP	73,664
N2FI	69,443
VE3PJ	68,376

Single-Op Assisted LP

UA7K	95,004
S54ZZ	85,376
N4SS	78,183
K1EP	73,664
VE3PJ	68,376
N3AAA	65,094
SP/UR5AS	63,099
OK2BFN	60,808
OK6RP	55,040
LY7K	52,640

Single-Op Assisted LP W/VE

N4SS	78,183
K1EP	73,664
VE3PJ	68,376
N3AAA	65,094
VE3VY	36,290
KC9LA	31,819
WE9R	31,650
KG9X	25,452
WO1N	19,539
AE0DX	17,415

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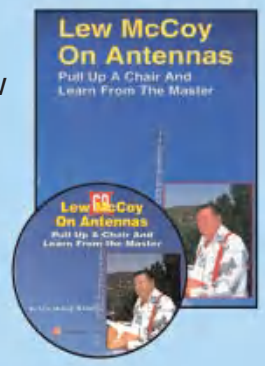

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test performance. I managed to lay 1,000 meters (3,281 feet) of ground radials under the vertical transmit antenna and installed a couple of 200-foot Beverage-on-Ground (BOG) receive antennas. The station was operated from a wooden summer house, which turned out to be particularly cold.

The physical effort in setting up a portable 160-meter station takes its toll, but with the island being small, if I forgot or needed anything, it was a short trip home to pick anything up. I did quite well in the contest, but after some reflection, I decided to make a more ambitious effort. My focus was to put an even greater effort into the 2023 CQ WW 160 CW, and that it would be a Field Day-style contest expedition to Jersey, where I would use MJ5E.

It was a great contest expedition trip, full of apprehension and trepidation before leaving and all the detailed planning that went into it, but it seemed to work for everyone who made a QSO with MJ5E. Since the contest, I have received many QSL requests and letters from ops who said they'd waited decades for GJ to be on 160 competitively, so I am pleased my efforts made helped others."

PLAQUE WINNERS AND DONORS

COMBINED SSB/CW TROPHIES

World Single Operator Combined SSB/CW
Peter Briggs, K3ZM
Donor: Ed Parish, K1EP

World Multioperator Combined SSB/CW
Station HG8DX
(HA8DJ HA8DZ HA8DU HA8FM HA8KW HA8JV)
Donor: Juan Carlos Munoz, TG9AJR

CW TROPHIES

SINGLE OPERATOR

World
Bob Beebe (GU4YOX), MJ5E
Donor: DJ8WL Memorial by Bill Tippett, W4ZV

U.S.A
Peter Briggs, K3ZM
Donor: Milt Jensen, N5IA, Memorial by Arizona Outlaws Contest Club

Canada
Vlad Milutinovic, VE3JM
Donor: Mike Wetzel W9RE

U.S.A. - Zone 3
Frank Fusari, W8KA
Donor: Bruce Butler – W6OSP Memorial

U.S.A. - Zone 4
Greg Chapoton, NA8V
Donor: Steve Schmidt, K4WA

U.S.A. - Zone 5
Jon Zaimes, AA1K
Donor: Tim Duffy, K3LR, and Sandy Raeker, N0QQ

Africa
Ulf Ehrlich (DL5AXX)
Station CR3W
Donor: James "Skip" Riba, WS9V

Asia
Muhammad Al Hashash, 9K2NO
Donor: Missouri DX/Contest Club, K4SX

Europe
Tibor Szabo (OM5WW), OM5R
Donor: Emir-Braco Memic, E77DX

South America
Mathias Kolpe DL4MM, P40AA
Donor: John Rodgers, WE3C

Oceania
AKITO NAGI (JA5DQH), KH7A
Donor: Steve "Sid" Caesar - NH7C

Japan
Masaki Okano, JH4UYB
Donor: Alabama Contest Group

North America
Philip Allardice (KT3Y), KP2M
Donor: N4IN Memorial CQ Magazine

Southern Hemisphere
Holger Hannemann (ZL3IO), ZM4T
Donor: Robert Kile, W7RH

World Assisted
Jeff Maass (K8ND), PJ2T
Donor: Andy Chesnokov, UA3AB

Asia Assisted
Igor Booklan (RA3AUU), P33W
Donor: Jon Zaimes, AA1K

Europe Assisted
Ian Pritchard (G3WVG), MW5B
Donor: Bill Salyers, AJ8B

U.S.A. Assisted
Michael Schwartzman, AB3CX
Donor: Akito Nagi, JA5DQH

U.S.A. Assisted – Zone 3
Riki Kline, K7NJ
Donor: Larry Pace, N7DD

U.S.A. Assisted – Zone 4
Victor A. Kean, Jr., K1LT
Donor: Pete Michaelis, N8TR

U.S.A. Assisted – Zone 5
Dennis Egan, N1LN
Donor: Potomac Valley Radio Club

World Low Power
Brian Campbell, VE3MGY
Donor: Akito Nagi, JA5DQH

U.S.A. Low Power
Mark Bailey, KD4D
Donor: Rich Kennedy, N4ESS

Asia – Low Power
Kunishige Shimokawa, JA6BZI
Donor: Robert Kile, W7RH

Europe Low Power
Todor Diamandiev, LZ4TX
Donor: DL1RK Memorial Petr Ourednik, OK1RP

Canada Low Power
Ric Guidone, VE3XL
Donor: Contest Club Ontario

World QRP
Rudolf Rüffer, DK7HA
Donor: EU1AA Memorial by Ilya Semichastnov, R3XA/4L9M

U.S.A. QRP
Toni Radebaugh, N0NI
Donor: Bob Raymond, WA1Z

Europe QRP
Vlada Sladek, OL1A
Donor: Peter Voelpel, DJ7WW

MULTI-OPERATOR

World
Drago Turin, IG9/S59A
(S59A S57DX S54W S51V S52OT S50O ops)
Donor: Paul Newberry, N4PN Memorial (by N4RJ)

U.S.A.
Krassy Petkov K1LZ
(K1LZ K3JO NA1NA ops)
Donor: W0CD Memorial (by K8GG and W8UVZ)

U.S.A. Zone 3
Station NA7TB
(KY7M AA7A N7NR K9DR ops)
Donor: Tom Whitted, N7GP

Europe
Emir Memic, E7DX
(E76C E77DX E77EA ops)
Donor: Bob Evans, K5WA

ASIA
Izumi Yoichi ,JA3YBK
(JG3KIV, JG3MRT, JG3WDN ops)
Donor: Nodir Tursoon-Zadeh, EY8MM

Canada
Chris Allingham, VO2AC
(VO2AC VE3KG ops)
Donor: John Crovelli, W2GD

SSB TROPHIES

SINGLE OPERATOR

World
Carlo Bavecchi, I5JVA
Donor: Nodir Tursoon-Zadeh, EY8MM

U.S.A.
Krassy Petkov, K1LZ
Donor: Dr. Scott Wright, K0MD

Canada
Brian Campbell, VE3MGY
Donor: Tom Haavisto, VE3CX

U.S.A. - Zone 3
Frank Fusari, W8KA
Donor: Nate Moreschi, N4YDU

U.S.A. - Zone 4
Karl Brandt, ND8DX
Donor: Alabama Contest Group

U.S.A. - Zone 5
Peter Briggs, K3ZM
Donor: CQ 160 Contest Committee

Asia
Mamuka Kordzakhia, 4L2M
Donor: Ron Lowrance, K4SX

Europe
LJUBO PINTAR, S53O
Donor: James "Skip" Riba, WS9V

Africa
Manuel Angel Martin Brito (EA8DO), ED8W
Donor: John Rodgers, WE3C

North America
Gerry Hull, ZF2VE
Donor: CQ magazine – K2EEK Memorial

South America
Sergio Lima de Almeida, PP5JR
Donor: John Rodgers, WE3C

Oceania
Ronald Tremayne
VK3IO
Donor: Steve "Sid" Caesar - NH7C

Here are some comments from the single op leaders to bring the contest into perspective:

Perennial USA winner Peter Briggs, K3ZM has some interesting comments as usual; pay particular attention to the last sentence!

"I was able to work well to the west coast both nights and got two or three KH6's Friday night, then a VK6 at my sunrise Saturday morning. No JA yet. Never heard KL7QOW. At bedtime after the first night, my totals were as follows: 551,667 points 1,031 QSOs 56 Countries 57 States/Provinces. I had worked 320 EUs. Back on the air on Saturday at 2110Z and made 25 contacts the first hour. After that, the hourly total stayed around 30 to 40 for about nine hours. I was hoping to get close to 1,400 QSOs. A trip up the band during Saturday evening yielded a decent stream of EU contacts. I added 120 EUs the second night for a total of about 440, which is a pretty good result. Sunday morning was a grind after EU sunrise but it had a happy ending with two more VK6s and two JAs at my sunrise. Very grateful to the XYL for setting up my new WinKeyer and WinTest software. Maybe it's also time to discard my rotary telephone."

Riki Tucek, OM7RU, using the contest call OM7K to #10 in the world had this interesting experience:

"I spent weeks before the contest constructing a 5-circle RX vertical array (VE6WZ/W1FV concept). The electrical part was optimised and tuned by Bel Ritzko, OM8AW (antenna guru of OMØM). The verticals provided outstanding performance, back and side signals are extremely suppressed. So, I was looking forward to the live test in the contest. It lasted 2.5 hours, then silence from all directions. One improper PTT sequencer setting caused a short, but fatal, peak towards the preamps. Two out of 6 were burned... Fortunately, I still have the K9AY RX array in the air. Conditions looked fine at the beginning, first night with a good opening to NA. There was no opening to the east on Saturday evening. The second night was worse, only a 2-hour NA opening in the morning, weaker than the first night. 69 W/VE in total. Fortunately, I was in the right place at the right time on Sunday evening. A nice eastern opening put 14 JAs in the log!"

Long time Topband contester and DXer Jon Zaimes, AA1K, had the following experiences:

"Murphy struck early this year. Old age caught up with my K3LR parasitic

Southern Hemisphere
Yohanes Budhiono, YB2DX
Donor: John Rodgers, WE3C

World Assisted
Rolandas Jokubauskas, LY4A
Donor: K9HMB Memorial by Ray Sokola, K9RS

Asia Assisted
Husamettin Aksogut, TA3NE
Donor: Chuck Dietz, W5PR

Europe Assisted
Vlado Ludrovsky, OM3TWM
Donor: Curtis Rose, N2ZX

U.S.A. Assisted
Bud Foster, K4ISV
Donor: Pete Michaelis, N8TR

U.S.A. Assisted - Zone 4
Phil Baldwin, N0PB
Donor: Pete Michaelis, N8TR

World Low Power
Brian Campbell, VE3MGY
Donor: Steve Molo, KI4KWR

U.S.A. Low Power
Gregory Poel (W8GP), WN8HCV
Donor: Tim Duffy, K3LR and Sandy Raeker, N0QQ

Europe Low Power
Vaclav Urban, OK1LRD
Donor: Contest Club Ontario

Assisted Europe Low Power
Simon Kopmajer, S54ZZ
Donor: John Rodgers, WE3C

Canada Low Power
Kevin Smith, VA3AC
Donor: Rudy Bakalov, N2WQ

World QRP
Jeff Briggs, K1ZM
Donor: John Rodgers, WE3C

MULTI-OPERATOR

World
Drago Turin, S59A
(S51V S56DX S57DX S57UN S59A ops)
Donor: Rev. Paul Bittner, W0AIH Memorial by WB9Z and NV9L

U.S.A.
Steve Kostro, N2CEI
(K4SME K0DI N2CEI ops)
Donor: Jerry Rosalius, WB9Z, and Val Hotzfeld, NV9L

Europe
Station HG8DX
(HA8DJ HA8DZ HA8DU HA8FM HA8KW ops)
Donor: South Jersey DX Association, N2CW

USA Zone 3
Station K6YA
(KA6MZE AA6XV W4NJK KN6QI ops)
Donor: Paulo, PV8DX

One of the mainstay ops at K3LR on 10 meters, George Gross, N3GJ, takes some time to try his hand on 160.

transmit vertical array after 25 years. Numerous repairs a few days before the contest made it operational but still it wasn't right. The single driven element worked just fine in omni mode. Then on Thursday I discovered a broken wire at the T top of one of the elements on my other transmit array, a broadside/end-fire setup of 4 elements. No time to fix it until Friday morning, so I did a climb to 70 feet, cutting into my pre-contest rest period. After my nap, I walked barefoot into our laundry room an hour before the bell and stepped into puddles of water. The washing machine had sprung a leak inside somewhere. So I spent a half hour mopping up all the water instead of doing final checks of the station."

Number 2 USA Multi Op N2AA (W2GD, et. al.) also chimed in with a tale of Murphy's woe.

"We apologize to our EU friends for being almost deaf the first night. It became obvious within minutes of the start our EU Beverage (two 310-meter-long elements phased) had catastrophically failed. In searching for an alternative RX solution, we discovered the low dipole strung in tree branches 8 feet off the ground (an antenna we rarely use) was capable of hearing most callers, including EU. Signals were way down, but it was something to work with overnight. We logged 231 ten-point contacts, mostly EU, using the dipole. Saturday night, the EU Beverage worked perfectly but the band didn't cooperate. Compounding our reception problems, the Hi-Z Four system was inoperative and unavailable as a back-up or for diversity reception. Despite nearly 20 man hours of diagnostic effort with added guidance from K7TJR spread over multiple site visits, we could not find the reason the system had low signal output."

By the way, N2AA and K3LR had their usual battle, swapping places this year.

N2AA	709,341
K3LR	705,789

The four regular operators of K3LR (Tim plus John Golomb, N2NC; Phillip Koch, K3UA, and George Gross, N3GJ) used just one radio and one op at a time. This is truly a testament to the capabilities of Tim's great station.

Also, in the "I worked the CQ 160 from a famous multi-multi station" category was Mark Bailey, KD4D, operating Low Power from W3LPL. Mark made 331K points, good enough for #4 in the world!

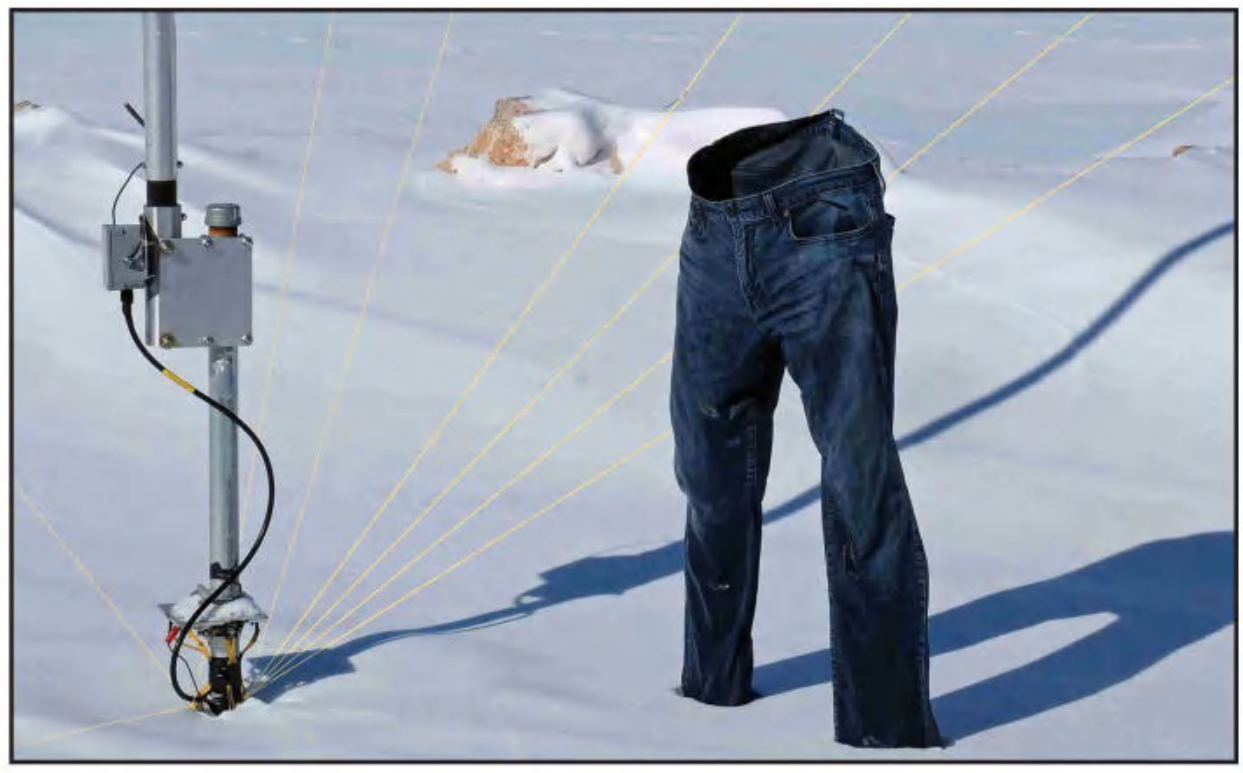
If you have ever thought about operating the CQ 160 contest, but just don't have the room for a good antenna; check out the interesting story of Chris Bowne, AJ1G/M, who made 229 QSOs from his truck! Congratulations Chris!

"Operated strictly as a mobile from Stonington Point, Connecticut, overlooking Block Island Sound, Fisher's Island Sound, and the eastern end of Long Island Sound. This is the fourth 160-meter CW contest I operated in this season as a mobile from this location. It's been lot of fun tilting at windmills with a very small jousting lance! Finally made a QSO with Hawaii, KH6AQ, mahalo nui, we did it this time! My mobile station consists of an Icom 7100 putting 100 watts into a repurposed 1960s-vintage 2-MHz marine radio boat whip, 12.54 feet in length, center loaded with a 30-inch-long small diameter solenoid-wound coil similar to that of a Hamstick, most likely was a Shakespeare Wonder Rod. The antenna is mounted on the left rear corner of a 2012 Tacoma 4x4 pickup. A small adjustable LC network at the base provides matching for use on 160 meters. No external radials were used, only the truck body is used for the counterpoise to keep it a true mobile."

And yet another portable operation was done by Steve Harrison, KØXP, making 281 QSOs from his trailer as well:

"I had forgotten how much fun the CQ WW 160 CW contest is. I had technical issues with both my trailer and the radio/computer setup, so was not able

Here is the very neat shack of SOLP CW entrant Fred Sanborn, KG9X. Fred can be heard in almost every CW event!



With a feed system inspired by K7SS, 'Stu' Hoar, N7ZZ's vertical froze him out of his pants.

to get on until Saturday night. Imagine my surprise when several Europeans popped up during their gray line at 0430, and I was even able to work them with my makeshift, low inverted L, from the SoCal desert! "

Howie Naugle, K1TZQ, returned to the band after a long sabbatical to amass 716 QSOs. He said:

"This was a real blast! My first 160-meter contest since returning in 2020 from 35 years of inactivity. My present location has zoning limitations on towers, and the area lacks trees of useful height to put up an effective 160-meter antenna. A very good friend, John King, WA1ABI(SK), once said to me any antenna is better than no antenna, so I built a helically-wound 25-foot vertical for this band. I had no idea how this compromise antenna would do...I was pleasantly surprised."

The top score from European Italy was the 2-man team of Luca Babolin, IK2PFL, and Stefano Galli, IK2JUB, at IQ2CJ.

"This year we participated as MS, just two full time ops, running a main RTX and an inband. First night closed with 750 QSOs, very promising. But the second day and the following night were very, very slow. Propagation toward far-east was one of the worst, only JA4UYB worked 1h before his sunrise. Nothing else heard at our station. On the other side, good opening to NA both nights, had in log 210 USA, 22 VE; heard N6JV for some time, but we weren't heard in CA. Most QSOs in our log are with DL: 237, Italians: only 66. Overall, a little below the expectations, but we had great fun anyway!"

And interestingly, the #3 Multi Op team in the world at S50C was also a portable operation. But this one is a bit more complicated than the others.

Gil Lappay, 4F2KWT, looks very comfortable at his bedside station!

"Another great Team C effort with UFB live score competition with E7DX and others, hats off! Station built over two weeks (several afternoons) and will be fully dismantled after 3Y and ARRL CW operation. 1xFTDX101d 2xFTDX10, 1xTS590SG + 3na1 QSO generator with QRO and for CW skimmers 2x Perseus, 1x QS1R and Red Pitaya in public domain."

The next time you complain about conditions at your QTH, think about the story of Fred Klein, KS7T who made 129 QSOs from lonely northern Montana:

"What else besides operate a contest can a guy do at 31 below zero (F)? No, I didn't stay up all night, had to get under the warm covers sometimes. Besides, the horrible propagation due to ongoing negative polarity events on the sun caused openings to be short, plenty of QSB and alligators."

And of special note was Ron Fitch, WQ6X, operating QRP from WA6TQT's fine but slightly broken station. Ron managed 154 QSOs.

"This was a last-minute 'find some time to run QRP' exercise. This was my 2nd 160-meter QRP operation from the WA6TQT Super Station in ANZA. I had access to a crippled 3-Square vertical array that was STUCK in the N-E direction. I appreciate everyone's patience with my WEAK signal. I'm beginning to get the hang of this QRP-thaing."

SSB Results

Conditions once again were very similar to 2022, with very depressed propagation for long haul. Anyone who stuck it out deserves accolades, it was tough sledding. The highest score was only 446K from Carlo Bavecchi, I5JVA, just a bit higher than Carlo's 2022 score of 418K. The next high-

2023 CQWW 160M CONTEST CLUB SCORES

(Minimum of 3 three entries required for listing)

SCORE	#ENTRIES	CLUB
25,708,654	244	BAVARIAN CONTEST CLUB
10,757,579	149	POTOMAC VALLEY RADIO CLUB
10,210,457	102	FRANKFORD RADIO CLUB
8,716,933	93	YANKEE CLIPPER CONTEST CLUB
6,151,728	45	CONTEST CLUB ONTARIO
4,669,749	67	RHEIN RUHR DX ASSOCIATION
3,640,759	84	SOCIETY OF MIDWEST CONTESTERS
3,612,573	27	SP DX CLUB
3,561,379	44	ITALIAN CONTEST CLUB
3,497,771	17	CROATIAN CONTEST CLUB
3,233,811	13	BALTIC CONTEST CLUB
3,136,507	20	MAD RIVER RADIO CLUB
2,731,349	10	BELOKRANJEC CONTEST CLUB
2,435,068	10	SLOVENIA CONTEST CLUB
2,245,044	23	KAUNAS UNIVERSITY OF TECHNOLOGY RADIO CLUB
2,142,280	7	MARITIME CONTEST CLUB
2,077,081	4	THREE A'S CONTEST GROUP
1,970,281	19	EA CONTEST CLUB
1,934,011	28	UKRAINIAN CONTEST CLUB
1,777,701	8	LATVIAN CONTEST CLUB
1,762,033	9	CONTEST CLUB SERBIA
1,691,353	31	FLORIDA CONTEST GROUP
1,593,646	26	TENNESSEE CONTEST GROUP
1,565,426	6	HA-DX-CLUB
1,557,927	52	DEUTSCH AMATEUR RADIO CLUB
1,456,419	27	ARIZONA OUTLAWS CONTEST CLUB
1,331,099	30	RUSSIAN CONTEST CLUB
1,290,106	4	RSGB CONTEST CLUB
1,242,653	42	MINNESOTA WIRELESS ASSN
1,057,790	11	CZECH CONTEST CLUB
1,025,329	4	CONTEST GROUP DU QUEBEC
1,015,003	16	NORTH COAST CONTESTERS
1,010,564	16	SOUTH EAST CONTEST CLUB
932,393	10	CONTEST CLUB FINLAND
891,967	15	HUDSON VALLEY CONTESTERS AND DXERS
889,531	6	WORLD WIDE YOUNG CONTESTERS
875,711	18	VERON
869,710	17	KENTUCKY CONTEST GROUP
680,305	5	NIAGARA FRONTIER RADIOSPORT
670,201	4	MILARA CONTEST CLUB
650,600	12	BELARUS CONTEST CLUB
636,142	11	CENTRAL TEXAS DX AND CONTEST CLUB
623,129	3	FAZENDA ACTIVITY CONTEST GROUP
519,866	5	DANISH DX GROUP
508,385	10	GRAND MESA CONTESTERS OF COLORADO
479,236	5	GM DX GROUP
475,630	12	SOUTHERN CALIFORNIA CONTEST CLUB
471,529	7	CTRI CONTEST GROUP
438,143	9	ALABAMA CONTEST GROUP
427,313	4	ALRS ST PETERSBURG
374,043	4	ARKANSAS DX ASSOCIATION
364,714	23	NORTHERN CALIFORNIA CONTEST CLUB
348,810	5	CHILTERN DX CLUB
347,630	12	DFW CONTEST GROUP
334,320	9	SWAMP FOX CONTEST GROUP
281,336	3	DEEP DIXIE CONTEST CLUB
278,570	5	IOWA DX AND CONTEST CLUB
271,418	3	SPANDAU DXERS
267,275	3	CS PETROLUL PLOIESTI
245,788	3	SP-CW-C
234,597	10	NORTHEAST MARYLAND AMATEUR RADIO CONTEST SOCIETY
198,273	5	CAROLINA DX ASSOCIATION
195,247	10	ROCHESTER DX ASSOCIATION
166,409	4	KANSAS CITY CONTEST CLUB
155,708	9	WILLAMETTE VALLEY DX CLUB
152,889	3	HSC
152,042	3	RIIHIMAEN KOLMOSET
151,143	3	LA CONTEST CLUB
149,593	4	TEXAS DX SOCIETY
149,290	3	IVANOVO DX CLUB
141,931	3	CONTEST CLUB BELGIUM
130,940	5	5NNDXCC
111,266	3	ARI PRATO
110,705	5	HUMBER FORTRESS DX ARC
110,288	3	SHAKHAN CONTEST CLUB
107,566	3	SK6AW HISINGENS RADIOKLUBB
106,749	4	BIG SKY CONTESTERS
105,598	4	PORTAGE COUNTY AMATEUR RADIO SERVICE
103,254	6	BRISTOL (TN/VA) ARC
102,132	3	CATALONIA CONTEST CLUB
86,302	5	CENTRAL VIRGINIA CONTEST CLUB
85,178	3	HERMOSILLO CONTEST GROUP
79,798	9	ORCA DX AND CONTEST CLUB
79,456	3	THRACIAN ROSE CLUB
78,950	3	HAMPDEN COUNTY RADIO ASSOCIATION
78,145	3	SK5AA VASTERAS RADIOKLUBB
77,062	7	WESTERN WASHINGTON DX CLUB
70,913	3	CSM CRAIOVA
68,730	3	RADIOKLUB SKOFJA LOKA S59DKR
67,915	3	TURKISH RADIO AMATEUR CLUB
67,820	3	BAY AREA DXERS
55,068	3	INTEREST GROUP RTTY
51,924	4	SHENANDOAH VALLEY WIRELESS
49,007	3	ECHELFORD AMATUER RADIO SOCIETY
43,622	3	PZK OT-01
34,085	3	HILLTOP TRANSMITTING ASSOCIATION
33,121	3	PROVIDENCE RADIO ASSOCIATION
31,849	11	VRHNIKA CONTESTERS
26,265	11	THE VILLAGES AMATEUR RADIO CLUB
25,643	4	RUSSIAN CW CLUB
25,511	3	OKAYAMA DX CLUB
22,671	3	SILVER COMET AMATEUR RADIO SOCIETY
21,012	3	LA4O
20,572	4	FORT WAYNE RADIO CLUB
19,491	6	SPOKANE DX ASSOCIATION
15,002	6	VK CONTEST CLUB
5,849	3	VLADIMIR CONTEST CLUB
5,613	3	RU-QRP
5,112	3	PACIFIC NORTHWEST VHF SOCEITY
3,772	6	ARAUCARIA DX GROUP
2,303	19	7A DX-CONTEST CLUB
1,452	18	ORARI LOKAL BOGOR
1,179	17	YB LAND DX CLUB
490	6	ORARI LOKAL KEDIRI
38	3	CABREUVADX

est score in the entire contest was the multi op at S59A with 344K.

Some interesting comments about activity from Japan were made by Topband experts Akira Asai, JA8RWU, and Sakaaki Ashikawa, JE1SPY:

"This was my third participation in this TopBand phone contest. The first one two years ago was my debut on 160m SSB from JA. Compared to the previous years, much less activity from Japan. Called CQ maybe for an hour in total with no luck even Still worked only ASIA so far on the TopBand phone." – Akira Asai

"It was the 3rd CQ 160m contest since the 160m SSB was lifted in Japan. The Japanese SSB band has a width of only 30 kHz from 1845 to 1875 kHz. JA stations can transmit on 1848 kHz low edge. In Europe and the United States, band plans are not laws and there are no penalties, but in Japan they are legal. So if we do not follow the band plan, we will be sentenced to imprisonment or a fine.

During the CQ 160m contest, in Europe and the United States, the entire 160m band is almost filled with SSB. However, from Japan, only about half of these operating (from) Western countries are in the Japanese SSB band, so it is not possible to call more than half of the stations. Western stations should sometimes watch the Japanese SSB band (1848-1875 kHz)." – Sakaaki Ashikawa

The #1 score in the USA goes to the superstation of K1LZ with Manu Siebert, LU9ESD, at the helm. He had the following to say to his fellow DXers:

"Thank you all for the QSOs and especially for your patience! The first night was a nightmare. If you were one of the many who called me and I couldn't work, I sincerely apologize.

The second night was more interesting, with some very strong signals from EU and a short opening with VK/ZL in the morning. Although I hoped to be able to make a higher score, it is all that could be done with the terrible propagation in this contest.

Thanks to Krassy Petkov, K1LZ, for letting me drive his Formula 1 for my first 160M experience. I am also especially grateful to Jeff Briggs, K1ZM, who constantly greeted me when passing through my frequency and asked me how I was doing. I knew his brother, Peter, K3ZM, would be in the same category, so it is my great honor and pleasure to share a radio contest. And also to my friend Velimir Deric, K3JO, the mastermind of the station."

And here is an interesting perspective from Ron Tremayne, VK3IO, who managed to make 28 QSOs under tough conditions:

"Our Saturday evening was very low noise, so I could hear weak signals, but only five USA stations heard. Sunday morning, no Europeans heard, mostly due to very bad static noise here, but also due to no propagation. Compared to some other years, I would still consider this a good contest, even though I did not hear any pacific, NZ or Asia (JA) activity. Thank you all for participating."

And finally Karl Brandt, ND8DX, the perennial top scorer from Zone 4 had these comments:

"Missing the great runs into Europe of years ago. I was plagued by an existing RFI issue and sadly was greeted with a new RFI problem on the second night, rendering several Beverages almost useless. A BIG TU for those who hung in there and gave multiple repeats."

Obeying the rules

As we pointed out last year, the committee receives many complaints from entrants. We wish to emphasize these violations in the hopes we can keep a level playing field in the future.

- Use of remote receivers outside 100 kilometers (inside 100 KM allowed in Multi Op only)
- Use of excessive power
- Use of QSO finding assistance by Single Op who claim Unassisted
- Excessively wide signals, including key clicks and splatter.
- Operating outside band limits (below 1810 in IARU region 1, and using band edges)
- Unsportsmanlike conduct (such as frequency fights).

In closing, special thanks to all those helping out to make the contest a success, including Larry Tyree, N6TR (log checking); Doug Grant, K1DG (trophies), and Randy Thompson, K5ZD (webmaster). Certificates for everyone are available for printing on our website at <www.CQ160.com>.

If anyone would like a Log Checking Report, send an e-mail to me at <Director @CQ160.com>. Please specify which mode you are asking for and the call sign used. Trophies will be mailed shortly. Thanks to all for participating and see you in 2024!

Remember, all CQ contests have a 5-day deadline for submitting logs. Check out the rules on <www.CQ160.com> for the latest information.

73, Andy Blank, N2NT
Director CQ160 Contest

(Scores on page 103)

Announcing:

75th CQ World Wide DX Contest

SSB: October 28-29, 2023 CW: November 25-26, 2023
Starts 0000 UTC Saturday; Ends 2359 UTC Sunday
Log Deadlines: SSB – 2359 UTC Nov. 3 / CW – 2359 UTC Dec. 1, 2023

Join nearly 40,000 participants from over 200 DX entities and all 40 CQ Zones in the world's largest DX contest.

The CQ World Wide DX Contest (CQ WW) offers 48 hours of non-stop DX-chasing fun with activity taking place from virtually every part of the world! Whether you are competing for awards, looking for a few new band-countries, or simply filling up your logbook, the CQ WW offers something for everyone. Check out the Classic and Rookie Overlay categories for even more chances to enjoy ham radio's premier operating event! Or, perhaps the rapidly growing Youth and Explorer Overlays may be for you! Regardless of your entry class, the bands magically light up in the CQWW with activity levels that are unlike any other radio competition.

Some Contest Basics

Each mode is a separate operating event that runs for 48 hours from 0000 UTC Saturday until 2359 UTC Sunday. SSB is the last full weekend of October. CW is the last full weekend of November.

Working stations is easy. Exchange and log a signal report and your CQ Zone number (e.g., 59 05 on SSB or 599 05 on CW). If you're not sure which zone you're in, visit <http://bit.ly/1BHtmsP> for more information. Generally speaking for USA operators, the US west coast is in Zone 3, the east coast is in Zone 5, and the rest of the lower 48 is in Zone 4. Western Europe is mostly Zone 14 and Japan is in Zone 25. Make sure to accurately copy and log the other station's call and zone.

Contacts are valid only on the 1.8-, 3.5-, 7-, 14-, 21-, and 28-MHz amateur bands (No WARC bands or 60 meters).

Scoring

Your final score is based on QSO points earned for each contact times the number of multipliers worked. Contacts with other continents count three points each. Contacts with the same continent, but different country, count one point (except in North America where they count two points). Same-country contacts earn zero points, but do count for multiplier credit.

Multipliers are the number of DXCC entities and Worked All Europe (WAE) countries, plus IG9/IH9, worked on each band plus the number of CQ zones worked on each band.

Don't worry about calculating your score; the CQWW Contest Committee's contest log checking software will do that for you when you submit a log. Most participants are using readily available contest logging software to help as well (e.g., N1MM+, Win-Test, etc.).

Entry Categories

The competition is divided into Single Operator and Multi-Operator categories. There are also four additional Overlay sub-categories (see below).

Single Operator (all bands or any single band) – only one operator finds, makes and logs all contacts in the following categories:

- High power: Up to 1,500 watts
- Low power: 100 watts or less
- QRP: 5 watts or less

Single Operator Assisted (all bands or any single band) – One operator may use DX spotting or other tools to help find contacts. Note that a CW decoder is considered assistance. The one operator must make and log all contacts in the following power categories:

- High power: Up to 1,500 watts
- Low power: 100 watts or less
- QRP: 5 watts or less

Available Overlays

(Note: You may not enter more than one overlay; a single overlay must be selected.

Classic Category – Allows the use of only one radio (e.g., Single Operator, Two-radio operation is not permitted), no QSO finding assistance, and only counts the first 24 hours of operating time. Off-times are a minimum of 60 minutes during which no QSO is logged. Single Operator Assisted entries are not eligible for this Overlay category.

Rookie Category – Open only to operators who were first licensed as radio amateurs less than three (3) years before the date of the contest.

Youth Category – Available to single operators who are 25 years old or younger at the start of the contest.

Explorer Category – Established to allow amateurs to participate in the CQ WW Contest while experimenting creatively with Internet-linked stations and other new technologies. The goal of this category is to encourage innovation in operating strategies, station design, and technology adaptation. Single- and Multi-operator entries are permitted. See <https://cqww.com/explorer.htm> for more information.

Multi-Operator – more than one person is involved in operating the station.

Single-Transmitter: This category allows one transmitter to work any station. It may only change bands after 10-minutes on a band. Note: A second transmitter may be used to

work multipliers only. This category has some very specific restrictions so please read the full rules carefully.

- High power: Up to 1,500 watts
- Low power: 100 watts or less

Two-Transmitter: Allows the use of two simultaneously transmitted signals on two separate bands. Each station may change bands as many as 8 times per hour.

Unlimited: Allows the use of one transmitted signal on each band.

Awards

Electronic certificates will be made available for everyone who submits an entry, provided that entry is submitted before the log deadline. Plaques are awarded to top finishers in major categories.

Submitting Your Log

Electronic logs should be in the Cabrillo format. Most logging software generates this file automatically. Upload your log on the web at <http://www.cqww.com/logcheck/>. The website also includes a utility to convert an ADIF-formatted log file if needed. Please note that paper logs are no longer accepted. All entries must be sent WITHIN FIVE (5) DAYS after the end of the contest: no later than 2359 UTC November 3, 2023 for SSB and 2359 UTC December 1, 2023 for CW. Resubmitting an entry after the deadline will result in it being considered as a late log.

Only one entry is permitted for each callsign. If you submit a log multiple times, the latest log submission will replace any previous attempts. No further action is required.

Full Rules

The complete rules of the CQ WW DX Contest are available in English and 18 additional languages on the Web at <http://www.cqww.com/rules.htm> as well as the CQ magazine website at <http://www.cq-amateur-radio.com> (Look for link on home page or the CQWW DX Contest main page). In addition, there is a rules FAQ that provides additional answers to commonly asked questions.

You are strongly encouraged to review the rules and the frequently asked questions before the contest, especially for possible minor changes in some rule details from previous years. Any questions may be submitted at any time via the on-line contact form at <http://cqww.com/contact/>. The most important requirement for all competitors, however, is to have fun!

CQ CLASSIC:

CQWW at 75: The First CQ World Wide DX Contest Announcement, August 1948

This fall marks the 75th anniversary of the CQ World Wide DX Contest, long the world's most popular amateur radio contest and, by some reckonings, the largest participation sporting event anywhere.

This year's CQWW contest announcement is elsewhere in this issue. For this month's "CQ Classic," we take a look back exactly 75 years, to the August 1948 issue, and the first CQWW announcement. While the rules back then were much shorter and simpler (remote operations over the internet were not an issue in 1948!), the basic structure of the contest has been remarkably consistent over three-quarters of a century! Here's a look at how it all started out…

Announcing…

CQ's World-Wide DX Contest

A new contest over the weekends of October 29 and November 5—separate weekends for phone and c.w.—awards for individual and group-operated stations—no limit on the number of contacts—zone and country multipliers on each band.

THE EDITORS OF *CQ* announce the forthcoming World-Wide DX Contest to take place on the weekends (U.S.A. time) of October 29, 30, and 31, and November 5, 6, and 7, of this year.

While the activity calendar for the amateurs is earmarked for many events during the year, it is felt by DX men everywhere that there is room for a truly international DX contest. The DX committee, in settling on the final rules, feels that this contest should be different from all others. The rules give the average DXer an opportunity to participate on an even footing with his DX friends, and the rules favor no single country. In addition to the usual country multipliers on each band, the rules allow zone multipliers on each band as well. With this added incentive, the low frequency bands should see plenty of use. This goes for the foreign stations particularly, as it makes it very much worthwhile their time to work 40 and 80 meters in order to pick up extra zone and country multipliers. The DX man has a chance to use his own strategy in mapping out which is of the most value. For example, should he keep gunning for a zone or a country he needs on one band, or

LOG OF W2BXA ZONE 5 COUNTRY U.S.A. DIVISION C W OP. 1

DATE AND TIME (LOCAL OR GMT)	STATION	COUNTRY	SERIAL NUMBER		ZONE AND COUNTRY MULTIPLIERS								PTS
					3.5 mc		7 mc		14 mc		28 mc		
			SENT	RECEIVED	Z	C	Z	C	Z	C	Z	C	
10-29 1002 DST	J9ABC	OKINAWA	58905	58925							1	1	3
1007	VK2DI	AUST.	58905	57930							2	2	3
1045	PY1DH	BRAZIL	57905	56911					1	1			3
1056	G6QB	ENGLAND	57905	56914					2	2			3
1100	G2PL	ENGLAND	57905	57914					2	2			3
1103	WØYXO	U.S.A.	59905	59904					3	3			0
1110	W6SA	U.S.A.	58905	58903					4	3			0
10-30 1202	ON4JW	BELGIUM	57905	56914			1	1					3
1215	W7AMX	U.S.A.	57905	57903			2	2					0
1218	I1MV	ITALY	56905	57915			3	3					3
1230	XF1A	MEXICO	59905	59906			4	4					1
100	XF1A	MEXICO	59905	59906	1	1							1
				TOTALS	1	1	4	4	4	3	2	2	23

COUNTRY MULTIPLIER 1+4+3+2 = 10
ZONE MULTIPLIER 1+4+4+2 = 11
TOTAL MULTIPLIER 10+11 = 21
CONTACT POINTS = 23

TOTAL SCORE 21X23 = 483

CQ WORLD-WIDE DX CONTEST SCHEDULE		
TIME ZONE	STARTING TIME	ENDING TIME
GREENWICH MEAN TIME (GMT)	SATURDAY, OCT. 30, 0200	SUNDAY, NOV. 1, 0200
	SATURDAY, NOV. 6, 0200	SUNDAY, NOV. 8, 0200
U.S.A. EASTERN STANDARD TIME	FRIDAY, OCT. 29, 9:00 P.M.	SUNDAY, OCT. 31, 9:00 P.M.
	FRIDAY, NOV. 5, 9:00 P.M.	SUNDAY, NOV. 7, 9:00 P.M.
U.S.A. PACIFIC STANDARD	FRIDAY, OCT. 29, 6:00 P.M.	SUNDAY, OCT. 31, 6:00 P.M.
	FRIDAY, NOV. 5, 6:00 P.M.	SUNDAY, NOV. 7, 6:00 P.M.

could he offset this delay in trying to work a flock of 3-pointers. There is no limit as to the number of stations you can work in any one country. This factor should help fill in the less active hours.

Contest Period

The first weekend, October 29 to 31, wiil be for phone, while the second weekend, November 5 to 7 will be for c.w. Because the first weekend of the ARRL Sweepstakes contest, which follows the *CQ* DX Contest, is for phone, the dates were chosen to afford a minimum of conflict. The reaction of participants to the short contest period will determine whether the *CQ* contest should be one or two weekends for each class (c.w. and phone) in succeeding years.

Divisions

Please read thoroughly rule number 3 on divisions and sections. It is absolutely necessary that you enter the correct section that is, either the oneoperator section, or

WORLD — WIDE DX CONTEST RULES

1 . Contest Period: 0200 GM T October 30 to 0200 GMT November 1 for phone and 0200 GM T November 6 to 0200 GM T November 8 for c.w. (See time chart for local times and dates.)

2. Bands: The contest activity will be confined to four bands, 3.5, 7,1 4, and 27-28 mc amateur bands.

3. Divisions and Sections: The competition will be divided into two divisions, c-w and phone. Each of these two divisions will be divided into two sections, the one-operator and more-than-one-operator section. Thus, there will be: (1) one-operator c-w section, and (2) more-than-one-operator c-w section; (3) one-operator phone section, and (4) more-thanone-operator phone section. Stations in each section will compete for awards only with others in the same section. C-W stations must work c-w stations, and 'phone stations must work 'phone stations only,- however, stations in the one-operator section, and stations in the more-than-one-operator section of both c-w and phone divisions may contact each other. Stations may enter in more than one section, but logs must be submitted for each section.

4. Equipment: There will be no limit to the number of transmitters and receivers allowed, and competitors may use the maximum transmitter power permitted under the terms of their licenses.

5. Serial numbers: C-W stations will exchange serial numbers consisting of five numerals, the first three being the RST report, and the last two being their own zone number. Stations in Zones 1 through 9 will prefix their zone number with zero (01, 02, 03, etc.). Phone stations will exchange serial numbers consisting of four numerals. The first two being the readability and strength report, and the last two being their own zone number. Phone stations in zones 1 through 9 will prefix their zone number with a zero (01 , 02, 03, etc.).

6. Contacts: Contacts b2tween amateur stations on different continents shall count three points; contacts between amateur stations on the same continent but not in the same country shall count one point; contacts between stations in the same country, for the purpose of obtaining zone and/or country multipliers, shall be permitted but no points will be allowed for these contacts.

7. Multipliers: Two types of multipliers will be used: (1) a multiplier of 1 for each zone contacted on each band, (2) a multiplier of 1 for each country worked on each band.

8. Scoring: The contest score will be the sum of all contact points multiplied by the sum of the zone and country multipliers.

9. Awards: Certificates will be awarded to section winners in each division of:

(1) Each U.S. call area
(2) Each licensing area of Canada and Australia
(3) Al l other countries

Certificates will also be awarded to each operator of each winning station in the more-than-oneoperator section.

10. Zones and Continents: The W.A.Z. boundaries as defined in "CQ-DX " and in *CQ* for January, 1947, and the recognized continental boundaries as used for W.A.C . will determine zone and continent boundaries. The W.A.Z . maps are reasonably accurate, but should any question arise as to the positive location of a station, the official definitions will be final. The latest official country list as published in *CQ* for May 1948, with any revisions announced since then will be used to determine country multipliers. Copies of the country list are also available from the *CQ* Editorial Office upon receipt of a stamped self-addressed envelope.

11 . Eligibility: The contest will be open to all amateurs but *CQ* staff members are not eligible for awards.

12. Disqualifications: Falsification of logs or illegal operation in any manner will be cause for disqualification. The decision of the judges will be final in all cases.

announcements *(from page 2)*

<https://www.qsl.net/w8va/>. Email: <tkillen31@gmail.com>. Phone: (740) 550-3811. Talk-in 146.76/16 Pl 131.8.

HUTCHINSON, KANSAS — The RENO COUTY KANSAS AMATEUR RADIO ASSOCIATION will hold the Reno County Kansas Amateur Radio Association Hamfest from 8:00 a.m. to 2:00 p.m. on Saturday August 12 at the Kansas National Guard Armory, 1111 N. Severance. Contact: Jerome Kahn, ACØRL. Website: <http://rckara.org>. Email: <acØrl@yahoo.com>. Phone: (620) 728-0840. Talk-in 147.120+ 103.5. VE testing.

OWENSVILLE, OHIO — The MILFORD ARC will hold the Cincinnati Hamfest (SM) from 8:00 a.m. to 2:00 p.m. on Saturday August 12 at the Clermont County Fairgrounds, 1000 Locust St. Contact: Ron Brooks, AC8MA. Website: <https://CincinnatiHamfest.org>. Email: <info@cincinnatihamfest.org>. Phone: (513) 706-0630. Talk-in 147.345 MHz (123.0). VE testing.

PORTSMOUTH, VIRGINIA — The TRCI will hold the Tidewater Hamfest and Swap Meet from 9:00 a.m. to 3:00 p.m. on Saturday August 12 at the Ambassador Club of Portsmouth, 364 Peninsula Ave. Contact Carl Clements, W4CAC. Website: <http://VirginiaBeachHamfest.com>. Email: <w4cac@cox.net>. Phone: (757) 235-4813. Talk-in 146.850 PL 100.00.

POST FALLS, IDAHO — The KOOTENAI AMATEUR RADIO SOCIETY (KARS) will hold the KARS Hamfest from 8:00 a.m. to 1:00 p.m. on Saturday August 12 at the Farm Field, 2130 N. Meyer Rd. Contact: James Sibley, WA7NSJ. Website: <http://www.k7id.org>. Email: < jcsibley@me.com>. Phone: (509) 750-9200. Talk-in 146.980 (-), 127.3 Hz.

SHREVEPORT, LOUISIANA — The SHREVEPORT AMATEUR RADIO ASSOCIATION will hold the Shreveport Bossier Hamfest from 7:00 a.m. to 2:00 p.m. on Saturday August 12 at the Louisiana State Fair Agriculture Bldg., 3206 Pershing Ave. Contact: Bob Davis, KB5RD. Website: <http://www.shreveporthamfest.com>. Email: <ke5cpl@gmail.com>. Phone: (318) 230-1242. Talk-in 146.82.

SPECULATOR, NEW YORK — The NORTHERN NEW YORK AMATEUR RADIO DISCUSSION GROUP will hold the Junk in the Trunk/Southern Adirondack Hamfest time TBA on Saturday August 12 at the Speculator Pavilion and Ball Field, 2834 State Route 30. Contact: Paul Palmatier, W2POL. Website: <https://www.adkhamfest.org/>. Email: <kd2ipc@outlook.com>. Phone: (518) 332-2092. Talk-in 147.165.

UNIONTOWN, PENNSYLVANIA — The UNIONTOWN AMATEUR RADIO CLUB will hold the Uniontown Amateur Radio Club 73rd Annual Gabfest from 8:00 am onward on Saturday August 12 at the Uniontown Amateur Radio Club, 433 Old Pittsburgh Road. Contact: Cory Sickles, WA3UVV. Website: <http://w3pie.org>. Email: <wa3uvv@gmail.org>. Phone: (714) 822-8146. Talk-in 147.045 131.8.

ADAMS, MASSACHUSETTS — The NORTHERN BERKSHIRE AMATEUR RADIO CLUB will hold the NoBARC Hamfest from 7:00 a.m. onward on Sunday August 13 at the Bowe Field, 371 Old Columbia St. Contact: Eric Mazur, KA1SUN. Website: <http://www.nobarc.org>. Email: <k1ffk@yahoo.com>. Phone: (413) 743-9975. Talk-in 146.91 PL 162.2. VE testing.

O'FALLON, MISSOURI — The ST CHARLES AMATEUR RADIO CLUB will hold the St Charles Amateur Radio Club Hamfest from 7:00 a.m. to noon on Sunday August 13 at the O'Fallon Elks Club, 1163 Tom Ginnever Ave. Contact: Douglas Wheeler, KØHKK. Website: <https://www.wbØhsi.org/>. Email: <dwhlr51@gmail.com>. Phone: (314) 660-0674. Talk-in 146.67 & 145.33.

PHOENIXVILLE, PENNSYLVANIA — The MID-ATLANTIC AMATEUR RADIO CLUB (MARC) will hold the Valley Forge Hamfest from 8:00 a.m. to noon on Sunday August 13 at the Kimberton Fire Company Fairgrounds, 762 Pike Springs Rd. Contact: Bob Palin, N3JIZ. Website: <http://marc-radio.org/hamfest2.htm>. Email: <hamfest@marc-radio.org>. Phone: (610) 420-1535. Talk-in 145.130- / 147.060+ (PL 131.8). VE testing.

AVOCA, NEW YORK — The KEUKA LAKE AMATEUR RADIO ASSOCIATION will hold the Keuka Lake Amateur Radio Association Hamfest time TBA on Saturday August 19 at the Howard Community Center, 7481 Hopkins Road. Contact: Donna Fiske, KD2CZY. Website: <https://klara.us/>. Email: <fiskefamily@hughes.net>. Phone: (607) 346-6475. Talk-in 146.94 - 100Hz.

BRAINERD, MINNESOTA — The BRAINERD AREA AMATEUR RADIO CLUB will hold the Brainerd Tailgate Hamfest from 9:00 a.m. to 2:00 p.m. on Saturday August 19 at the Crow Wing County Fairgrounds, 2000 13th St. SE. Contact: Lyle Amundson, KØLFV. Website: <https://brainerdham.org/>. Email: <lmamundson@gmail.com>. Phone: (218) 330-5110. Talk-in 147.225 No Tone.

HUNTSVILLE, ALABAMA — The HUNTSVILLE HAMFEST ASSOCIATION will hold the Huntsville Hamfest and ARRL Alabama State Convention from 9:00 a.m. to 4:30 p.m. on Saturday August 19 and 9:00 a.m. to 3:00 p.m. on Sunday August 20 at the Von Braun Center South Hall, 700 Monroe St. SW. Contact: Mark Brown, N4BCD. Website: <https://hamfest.org/>. Email: <mark.n4bcd@yahoo.com>. Phone: (256) 503-8887. Talk-in 146.94 - 100Hz.

(Continued on page 44)

the more-than-one-operator section. It has been felt that many DX stations have used more than one operator and yet claimed single operator scores. In this contest, certificates will be awarded to all operators of each winning station in the more-than-one-operator section. Any violation of the rules which is substantiated to the satisfaction of the committee will be grounds for immediate disqualification.

The multipliers for countries and zones worked is the sum of the total number of zones and countries worked on each band. Notice particularly that the zones and countries worked on each band are added together, and their total is used as a multiplier of the contact points. As an example, if operation happens to be confined to 14 mc, and if 85 countries and 34 zones are worked, the multiplier is 119. If operation is on 14 mc, with 50 countries and 30 zones, 7 mc with 30 countries and 18 zones and 3.5 mc with 9 countries and 5 zones, then the multiplier is 142. It should be emphasized that contacts within your own country do not count for contact points, though these contacts do count toward country and zone multipliers just as though they were with DX stations. This should be clear from the sample log. Note that W2BXA gets both zone and country multipliers for working WØYXO, since this is the first contact in both U.S.A. and Zone 4. W2BXA also receives a zone multiplier for W6SA, as this is his first contact in Zone 3, but he gets no contact points for either contact.

In reading rule number 5 on serial numbers, an example might show up something like this: W2BXA might send a contest serial number such as 56905, or 58905, etc. The report would, of course, vary but the zone number would always be 05: C8YR might send 45923, or 59923, etc. Phone stations would, of course, use the same system, only the number would consist of four numerals. For example, on phone, W6DI might send 5803, indicating readability 5, strength 8, Zone 3.

To help you in keeping a contest log, we have prepared a large quantity of blank log sheets, and they are now obtainable by writing to *CQ* Editorial Office, 342 Madison Avenue, New York 17, N. Y. A stamped self-addressed envelope should be enclosed, or sufficient postage to cover a large manila envelope and any number of logs desired. Clubs desiring logs for a large group should send postage enable the operator to keep duplicate sheets and save the necessity of recopying. If homemade logs are employed, they should be submitted in the form shown. All logs must be postmarked before midnight November 30, 1948. If specifically requested, an acknowledging postcard will be sent upon receipt of the log. Any logs received which are postmarked later than November 30, 1948, positively will not be considered.

Separate receive antennas can be very helpful on the low bands as they can be designed to limit noise pickup. But antenna design programs such as EZNEC are focused on transmit antennas and these limitations must be accounted for in designing receive-only antennas. DK6ED shows us how he compensated for the program's shortcomings in a redesign of his double loop antenna for 160, 80 and 60 meters.

The DK6ED Double Loop (Version 3)

Latest Experiences on Resistive Terminated Loops Require a Redesign

BY DR. ING. CHRIS KUNZE,* DK6ED

Resistive terminated loops are my favorite receive antennas for the low bands. They are broadbanded and need no retuning when changing bands. The have a good front/back ratio, so local noise sources can be notched easily. I designed them using EZNEC, but with most of the antennas there was a major difference between the simulation results and the radiation pattern experienced from the built antenna.

Simulation Limitations

Every design needs a source to drive the antenna. As the NEC code is developed for transmit antennas, it presumes that the antenna is power matched to the source; that means that the impedance of the antenna and the source are equal. With the real antenna, I wanted to minimize the influence of the load, so I used high input impedance preamplifiers. But this idea was misleading, because it contradicts the simulation's limitation of power matching. The resulting radiation pattern can be simulated by a combination of a source and a high resistance representing the input impedance of the preamplifier. The antenna will lose a major part of its directivity. Figure 1 shows a power-matched loop in red and the pattern with a high impedance preamplifier attached in blue. This experience leads to the postulation that resistive loops must also be terminated at their feed point. Both impedances must be the same!

To improve the radiation pattern, double loop systems are helpful. With these antennas, generally two resistive terminated loops are mounted one behind the other. This leads to a smaller pattern but also to lower output. To join the loops, feed lines are needed. The simulation software always offers a feeder subroutine. But a closer look at the program's description shows that they must not be used with resistive terminated loops. The program presumes that voltages and currents on the two lines are out of phase, so any signal picked up along the line will be nulled. With resistive terminated loops, voltages and currents are *in phase* on both wires, so the feeder will pick up signals on the way between the loop and the

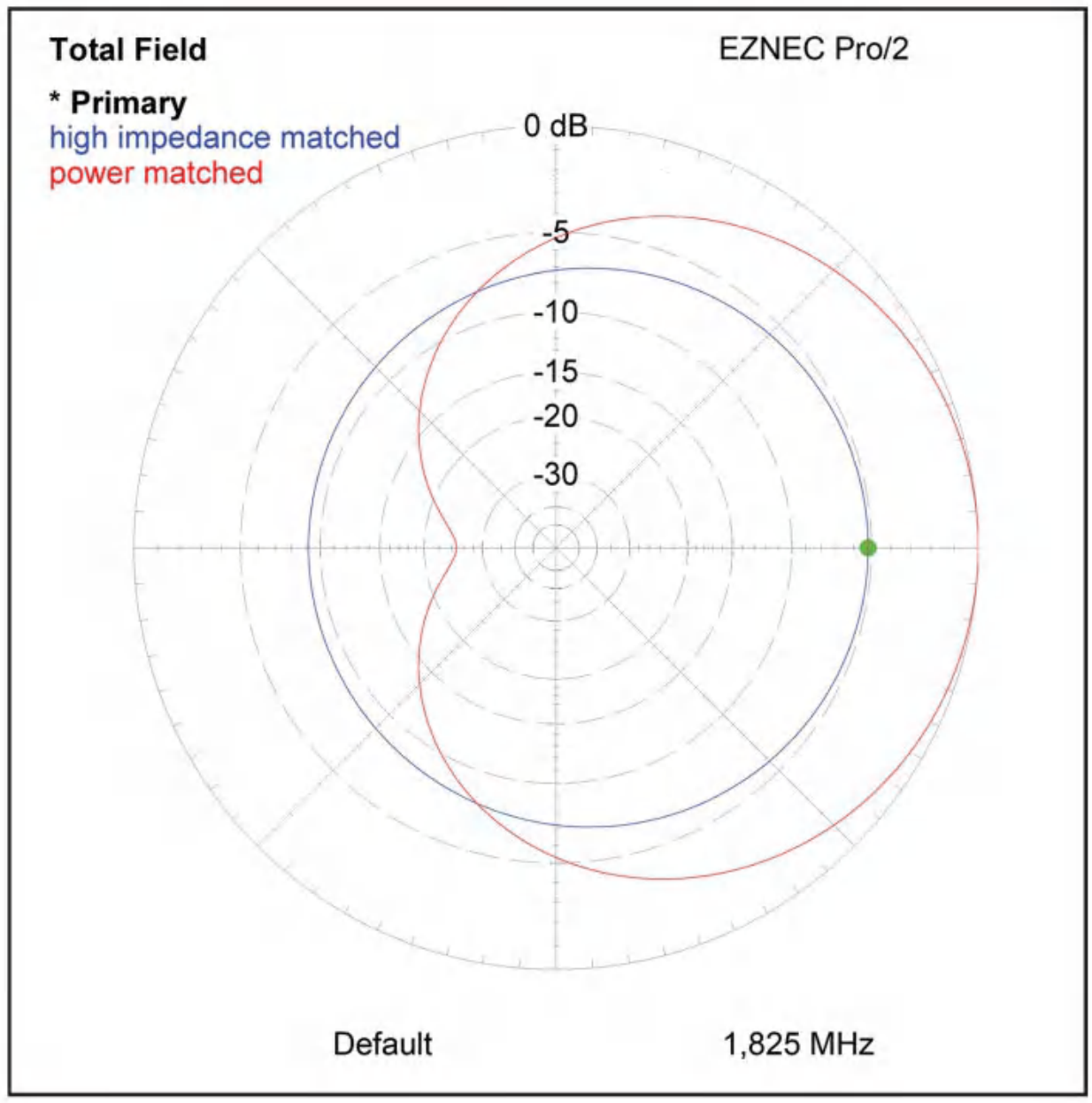


Figure 1: Influence of the output termination on the radiation pattern.

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On the Cover – August 2023

A grand slam for SLAMS? Harry Haeusser, WAØCNS, of the St. Louis Area Microwave Society, or SLAMS, operated the ARRL June VHF Contest from EM48 in High Ridge, Missouri, using a new multi-band microwave station built around the Analog Devices ADALM-PLUTO software defined radio and a Raspberry Pi computer. His fellow club members, Herbert Ullman, AF4JF, and *CQ* Learning Curve editor Ron Ochu, KOØZ, were about 40 miles away in EM49, so they could all work each other for points and multipliers, along with anyone else they could hear on the VHF+ bands.

The ADALM-PLUTO is described as an "active learning module for students, hobbyists and educators" wanting to learn more about UHF and microwave communications. The unit covers 325 MHz to 3.8 GHz, but if you look closely at the photo, you'll see that Harry had it running as high as 24 GHz. That's because he was using a UK Microwave Group Project Langstone transceiver, which mashes up the ADALM-PLUTO with an extended frequency modification and a Raspberry Pi to operate from 70 MHz to 5.7 GHz, with experimental support for 10 GHz and 24 GHz. More info on the Langstone Project in on the UKuG website at <https://wiki.microwavers.org.uk/Langstone_Project>. See this month's VHF+ column on page 82 for more about SLAMS and its activities. (Cover photo by Ron Ochu, KOØZ)

common feed point. Of course, this feedline can be simulated by two wires running close to each other. Even the impedance of the line can be taken from the program. But that picking up of signals on the way destroys the radiation pattern! So feedlines between the loops must not be used, even if they are shielded.

New Design

Generally the radiation pattern of a double loop is significantly smaller than that

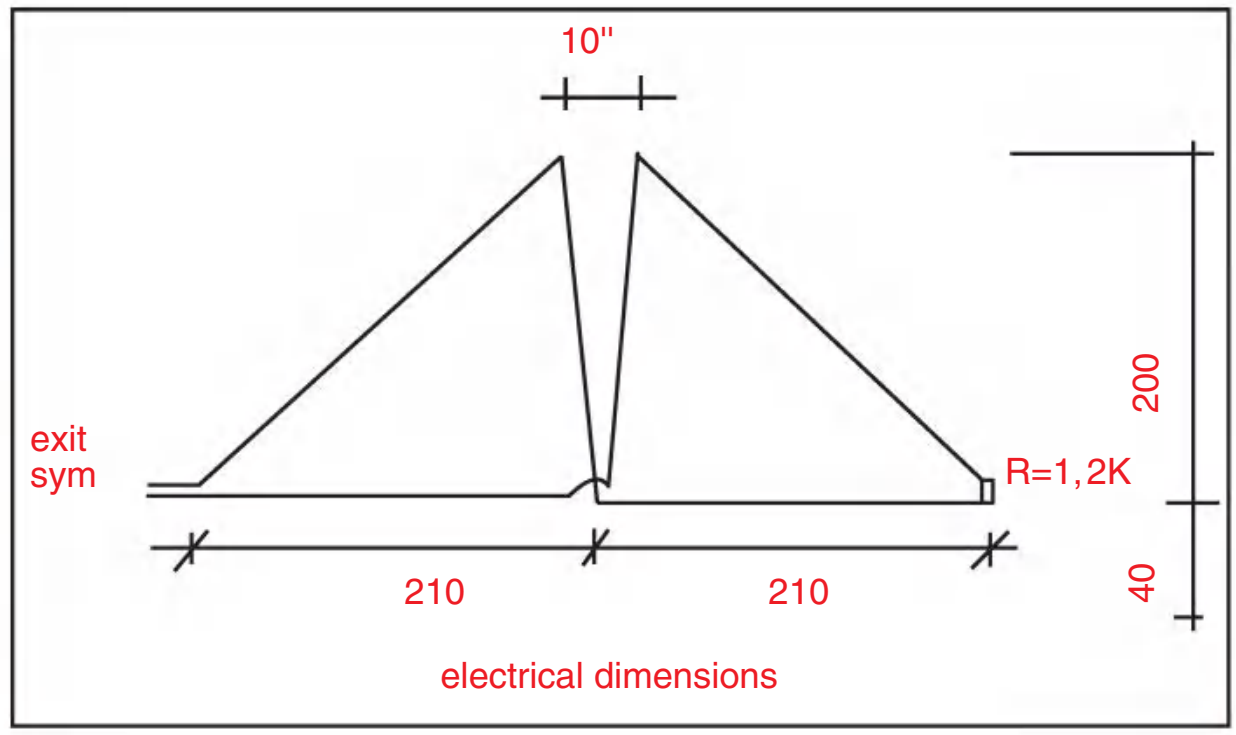


Figure 2: New design of a double loop.

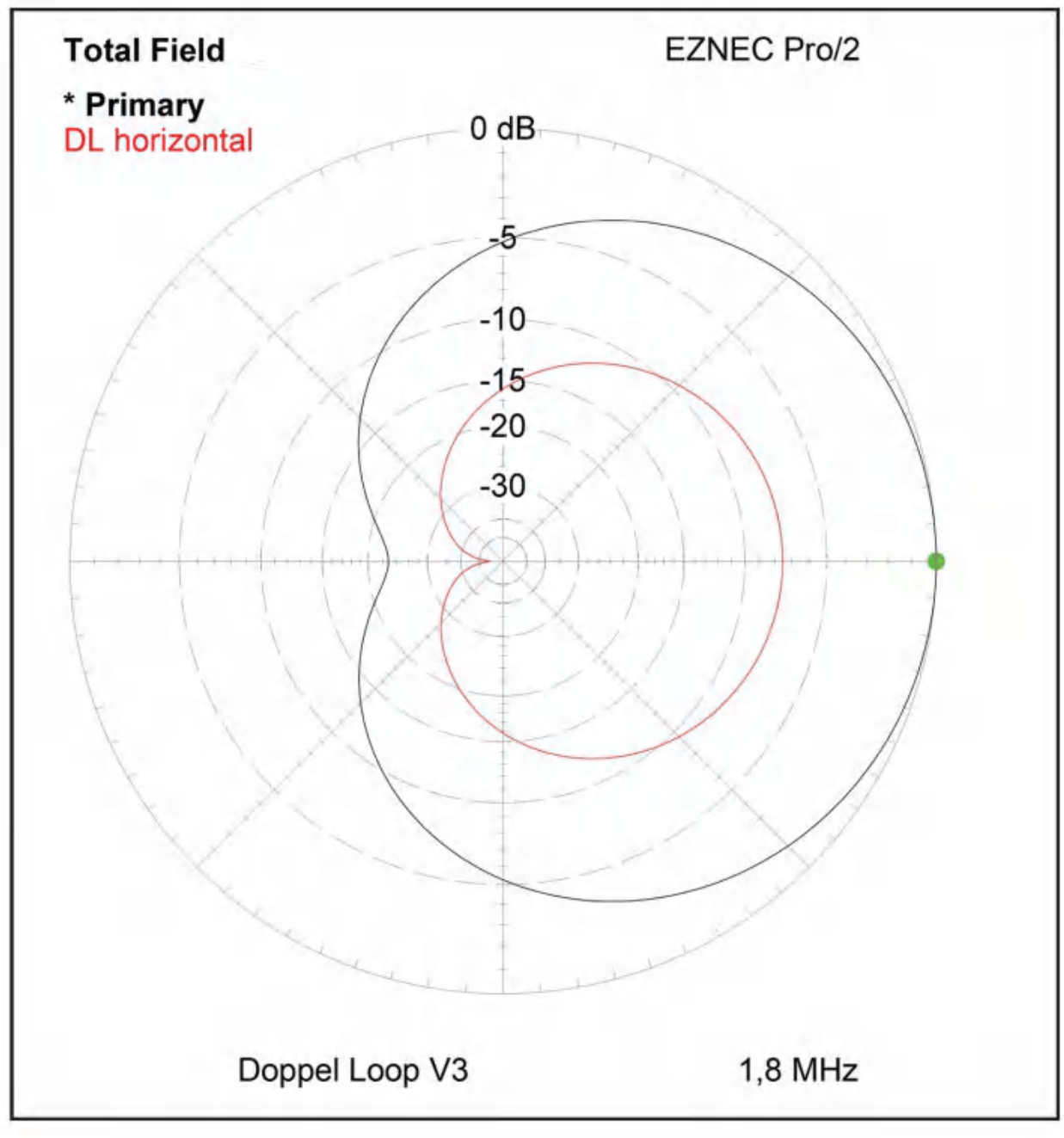


Figure 3: Horizontal pattern of the DK6ED double loop V3.

of a single loop. This is why I designed the new double loop system shown in Figure 2. It still consists of two loops behind each other. No feedline is required, because the loops are close and they are interlaced. This crossover inverts currents, leading to that smaller pattern. By aligning the antenna, I found that a termination resistor of 1200 Ohms gave the best front/back ratio at my location. The resulting horizontal pattern is shown in Figure 3, the vertical one in Figure 4. Compared to the pattern from Figure 1, the opening gets much smaller and the front/back ratio increases. But the output power gets

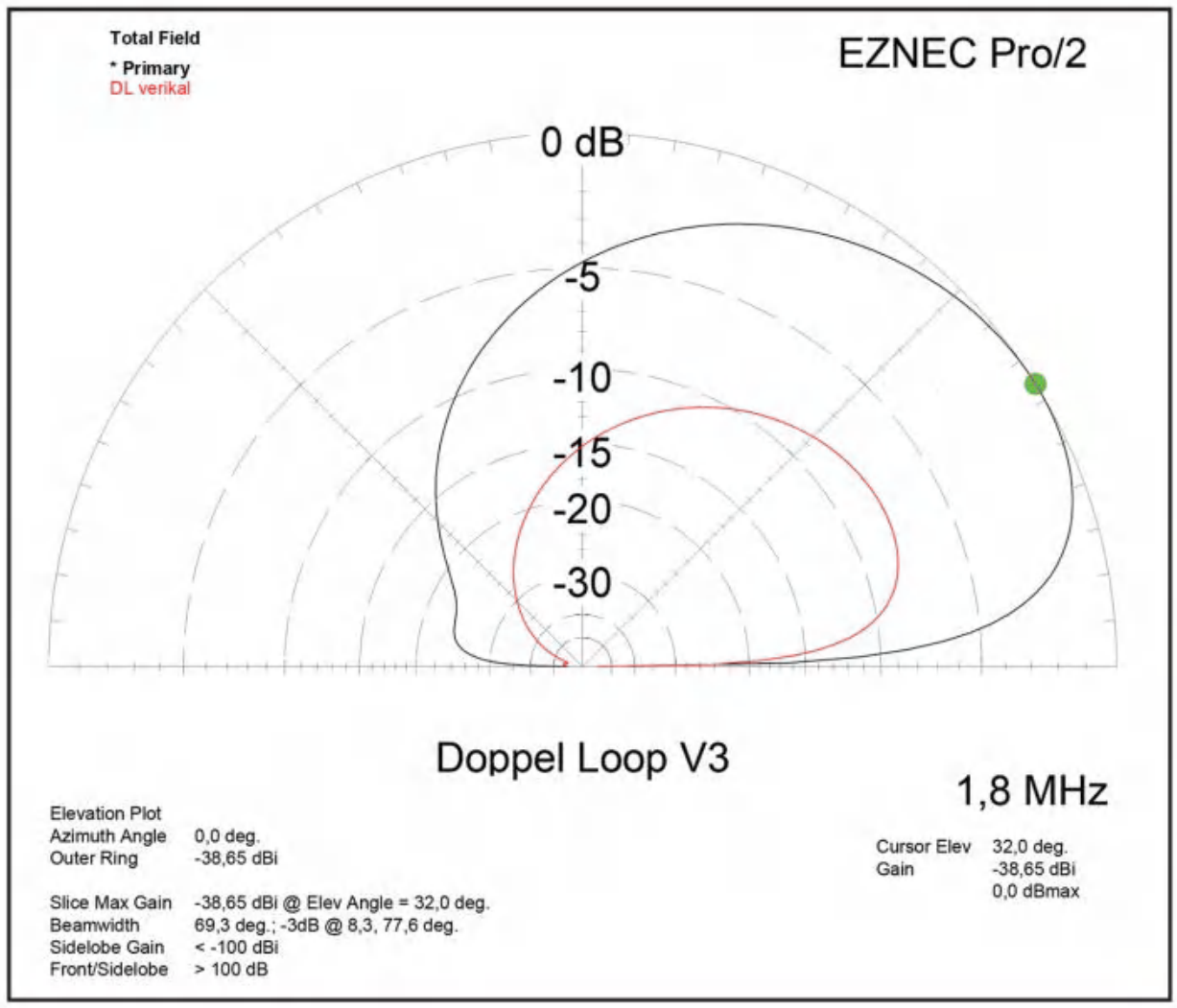


Figure 4: Vertical pattern of the DK6ED double loop V3.

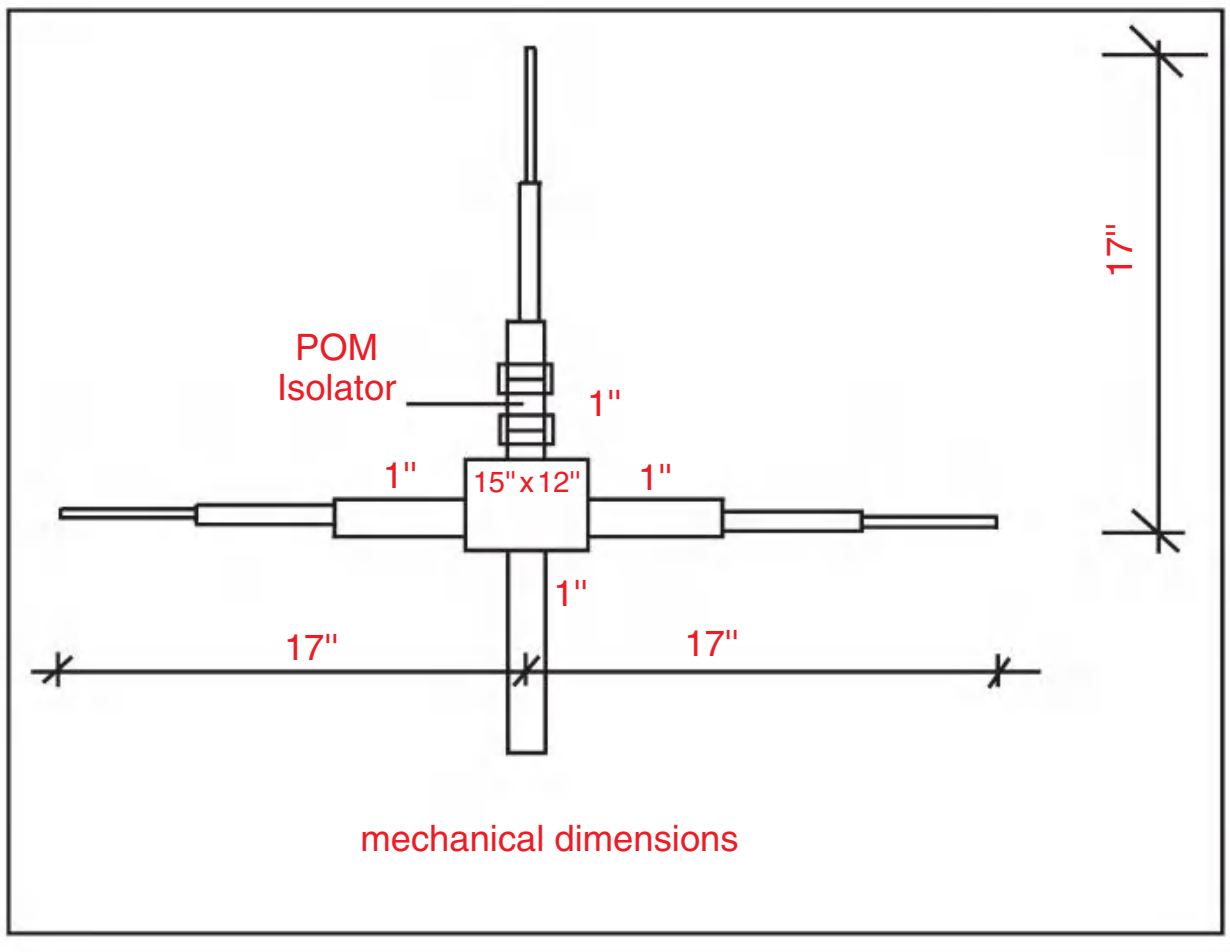


Figure 5: Mechanical dimensions of the double loop.

lower, so a preamplifier becomes a must. Its input impedance must be set to 1200 Ohms.

Building the Antenna

The idea was to rotate the antenna, so its dimensions had to be limited. It can be built from fiberglass reinforced roods, but because of a better sideways stability I decided for aluminum construction. This leads to the mechanical dimensions shown in Figure 5. In order to avoid any influence from the basic construction on the radiation pattern, I decided to separate all arms of the system and the mast electrically. The central point of the system is shown in Photo A. This also includes the mast mounting. Because of the mechanical rigidity, the antenna wire itself is made from AWG 14 stranded steel wire. As the wires cross the center, they must be kept away from the aluminum construction as shown in Photo B. Details of the top point can be taken from Photo C. Here the antenna wire supports the construction and it must be isolated against the aluminum construction. The complete antenna is shown in Photo D.

After the mechanical work is done, it's time to build a small amplifier which only consists of two transistors. The circuit is shown in Figure 6. As from the fundamental requirements the input impedance must be 1200 Ohms. But after a long series of experiments, I found that is extremely difficult to design such a medium impedance broadband preamplifier with an IMD performance required for the shortwave bands. So a step-down transformer (T1) is inserted between the loop and the preamplifier, reducing the antenna's impedance from 1200 to 300 Ohms. I had to accept that it reduces the volt-

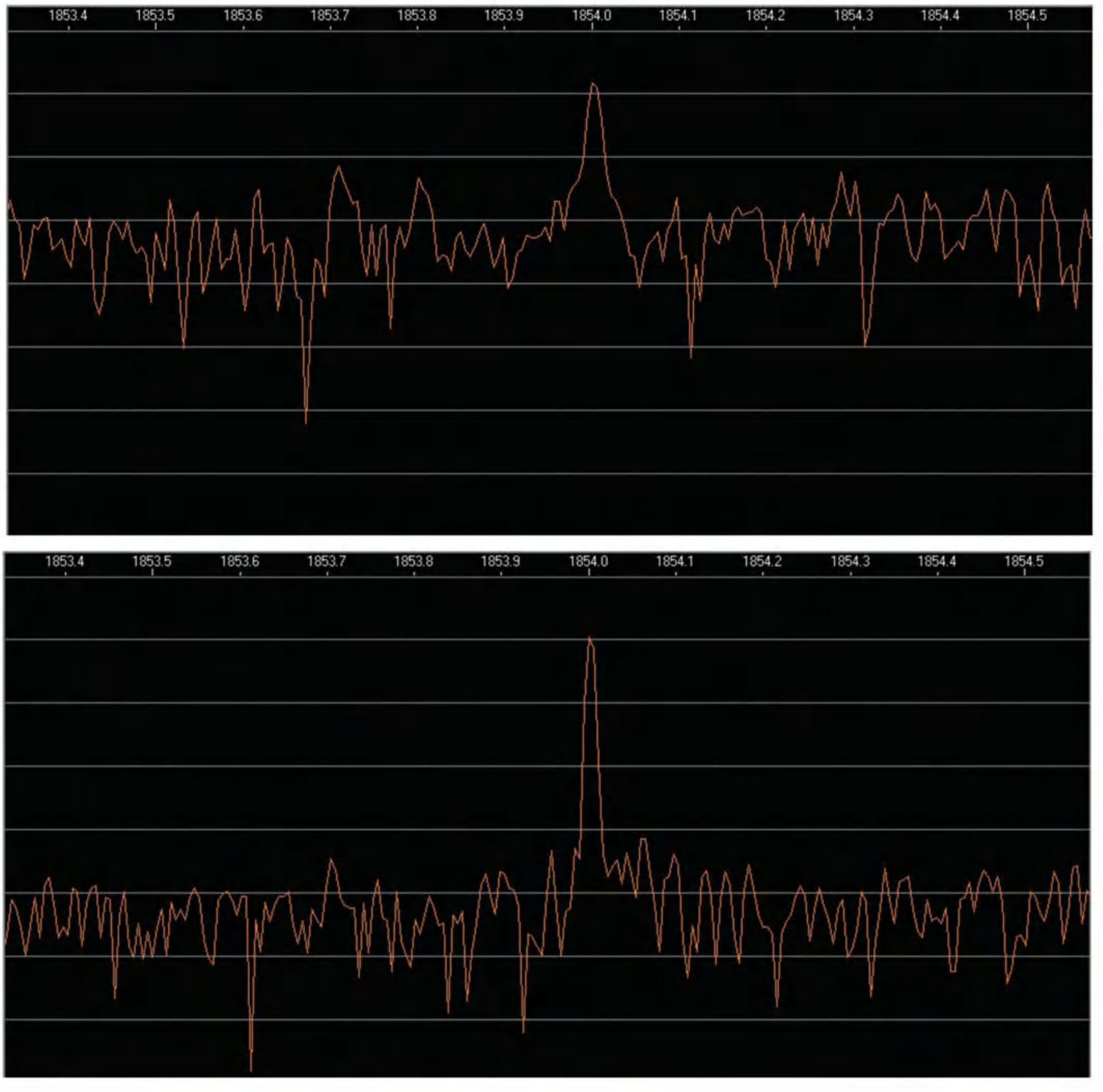


Figure 7: Signal/noise ratio between the transmit (top) and the receive (bottom) antennas

age at the input, leading to a higher noise figure, but all IMD issues were solved. This transformer also works as a voltage balun, matching the balanced loop to an unbalanced preamplifier circuit. For best symmetry, a special technique is used. First, I start with the 5 windings for the output; 5 windings for the input are next and finally followed by the next 5 windings for the output.

The amplifier itself consists of a Darlington stage as we know from MMIC designs. The OIP2 level reaches more than 20 dBm, the OIP3 is greater than 30 dBm. The noise figure reaches 2.5 dB at 10 MHz. The gain of this simple two stage circuit is sufficient for the double loop antenna. Too much gain might overdrive the receiver‘s input, causing more distortion. The output is designed for a longer feedline and three transformers are required. T2 is a voltage balun, T4 a current balun. They prevent the signals picked up from the feedline from reaching the preamplifier and making the antenna lose its directivity.

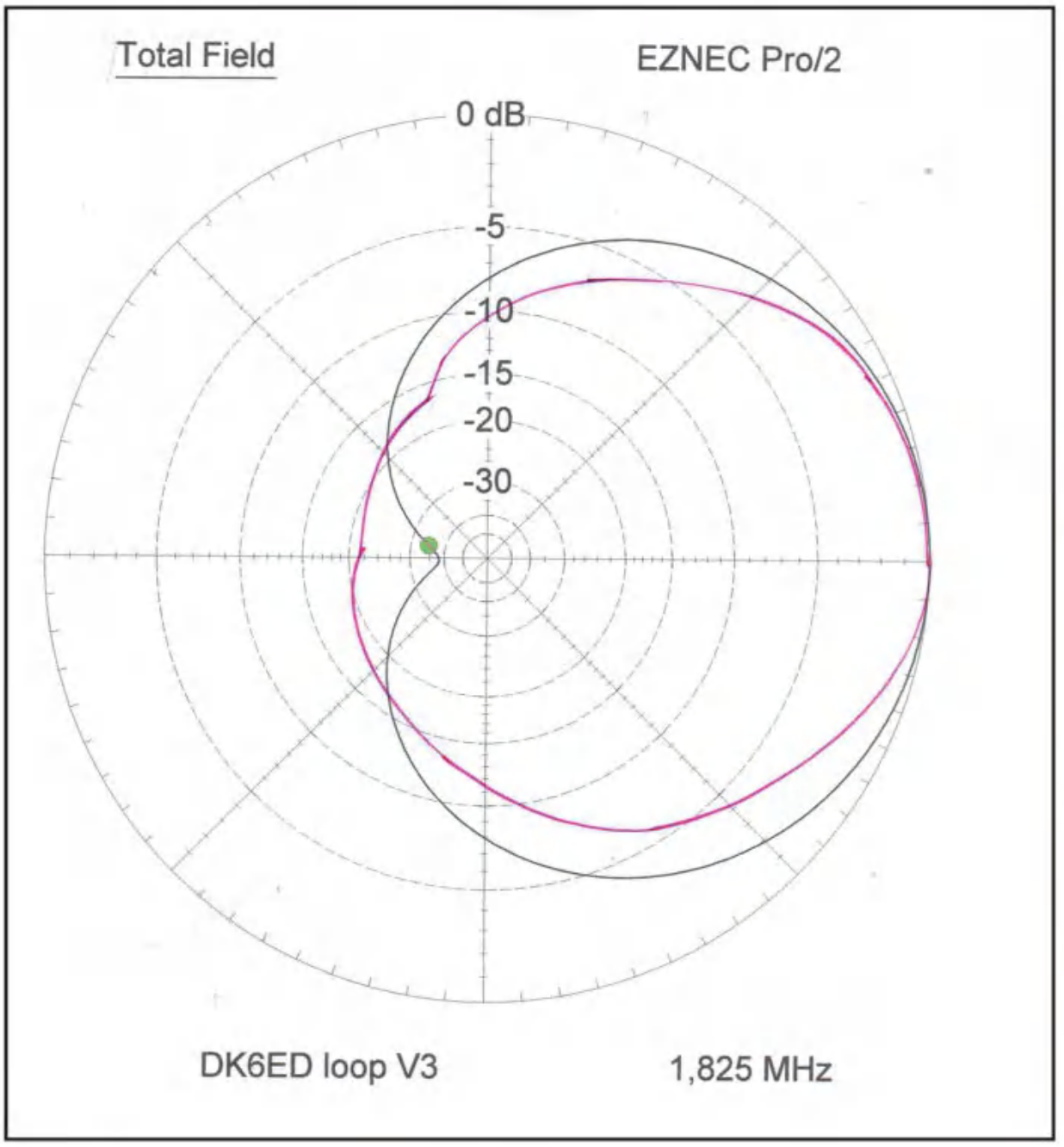


Figure 8: Comparing simulation results and the real antenna

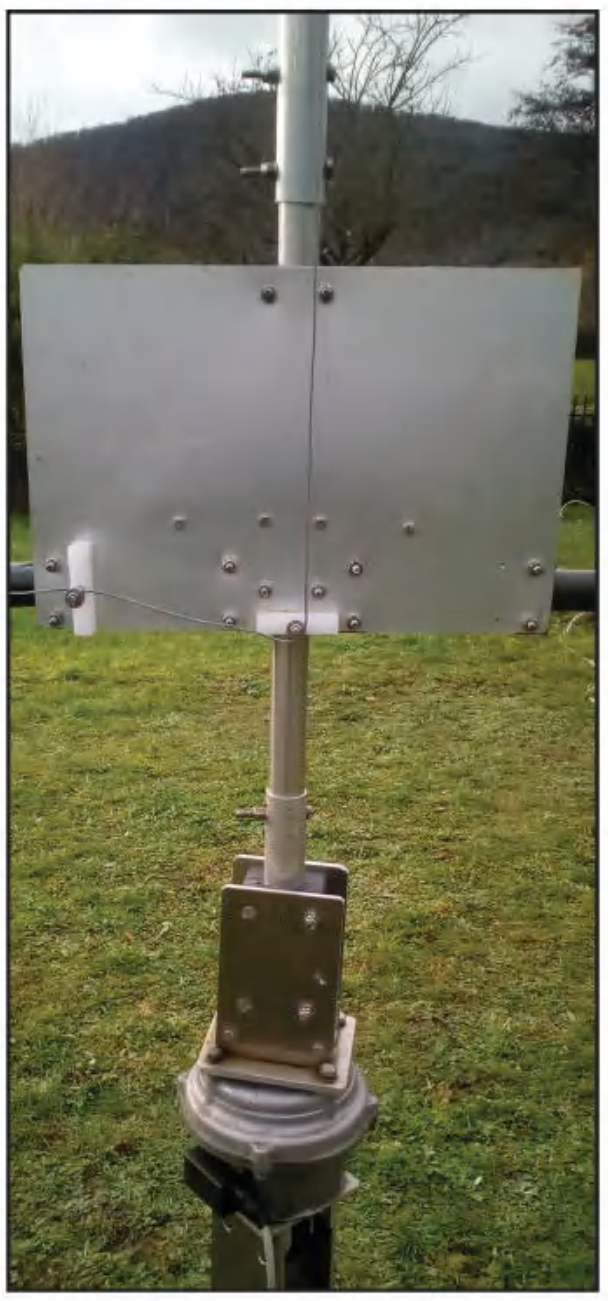


Photo B: Isolating the antenna wire at the central point.

Photo A: Central point of the system.

Photo C: Highest point of the system.

Photo D: The final construction.

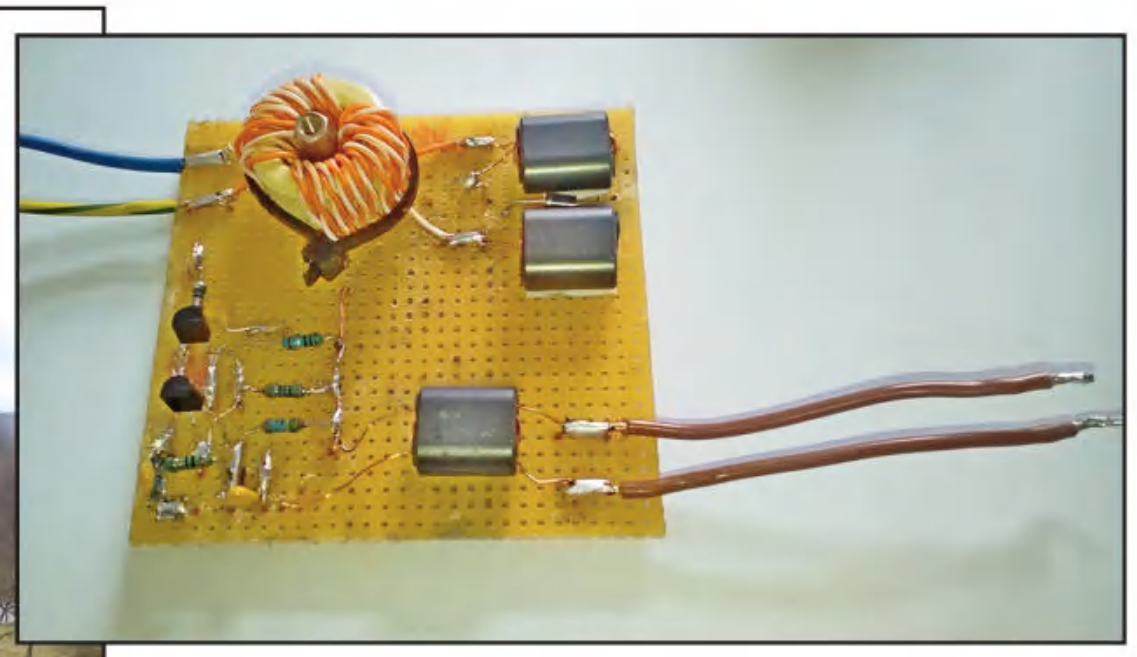


Photo E: Layout of the preamplifier

For shorter feedlines the baluns can be omitted. Transformer T3 is there for feeding the amplifier with DC. It shortens the line for RF and the signal reaches the T2 balun without significant loss. T3 can be omitted when the preamp is fed by a separate line. The preamplifier's construction is so simple that it can be built Manhattan style or on a simple board as shown in Photo E.

For the line between the antenna and the receiver, TV-SAT cable is highly recommended because of its better shielding. At the receiver end, one of the common bias Ts is needed to separate the signal and the DC supply. Here the supply can be turned off when transmitting. No further precautions are needed to protect the preamplifier's input, even when the transmit and receive antennas are close to each other.

Results

Receive antennas are required to improve the signal/noise ratio in a noise-polluted area. Because of its front/back ratio, this antenna can reduce distortions significantly. The 160-meter band is most critical as the antenna is very small. Figure 6 shows the difference between receiving a beacon on the transmit antenna and on the receive antenna at 2.7 kHz bandwidth. The difference is about 20 dB in favor of the double loop. This is also a first proof that the radiation pattern is close to the simulation's result. Details can be taken from Photo E. Simulation and the performance of the real antenna almost match after redesigning the double loop. The opening is a little smaller, and the front/back ratio a little less than simulated. From experience, I can say that the antenna can also be used on 80 and 60 meters. On higher frequencies, the circumference is getting too long relative to the wavelength, so the system loses directivity and must be redesigned.

To make sure, any NEC simulation program is a very helpful means to design antennas, but we have to understand and carefully watch its limitations.

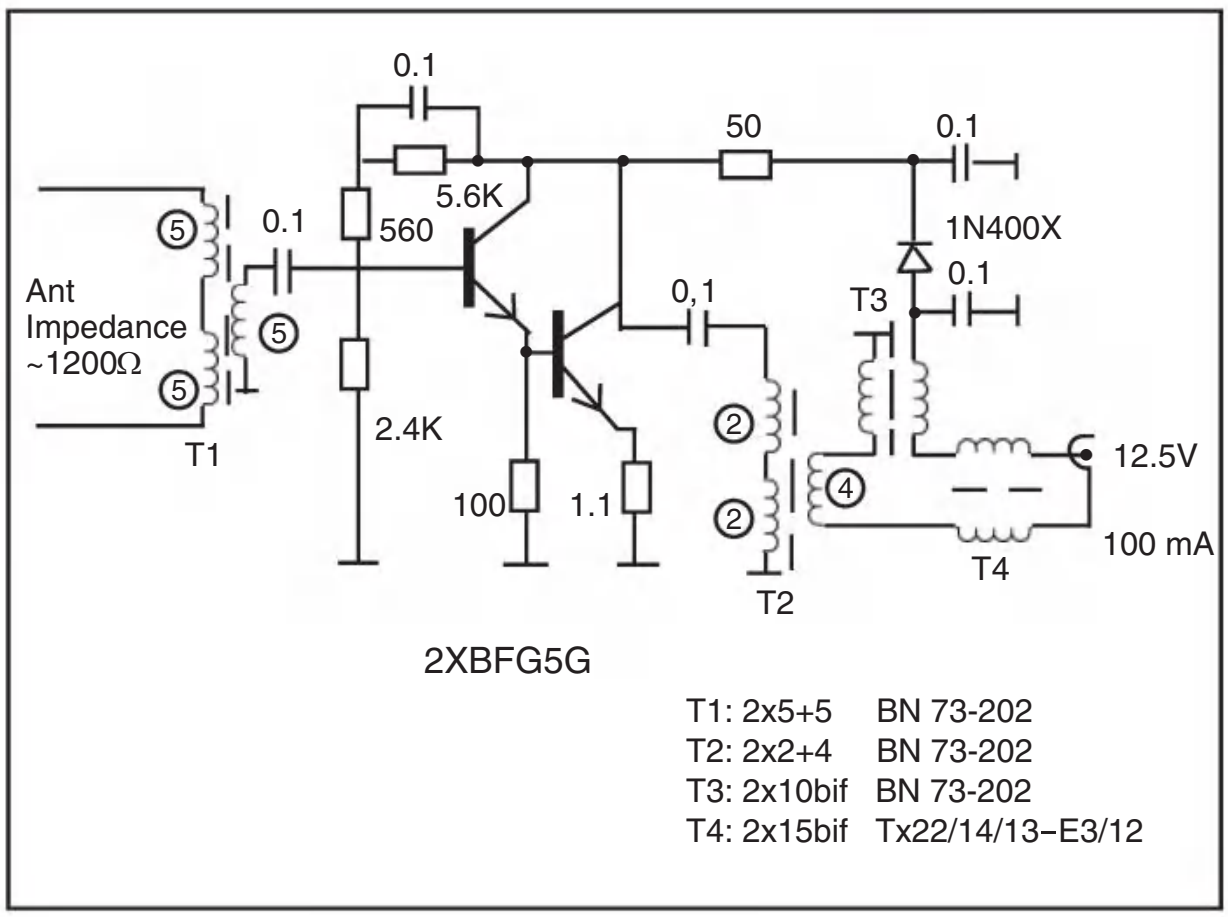


Figure 6: Circuit of the preamplifier.

Having an antenna that's resonant across the entire 80-meter band is a challenge. Commercial antennas with integrated tuning units are expensive, but KA2C offers a compact and low-cost approach to "rolling your own" step-tuned 80-meter dipole or inverted vee.

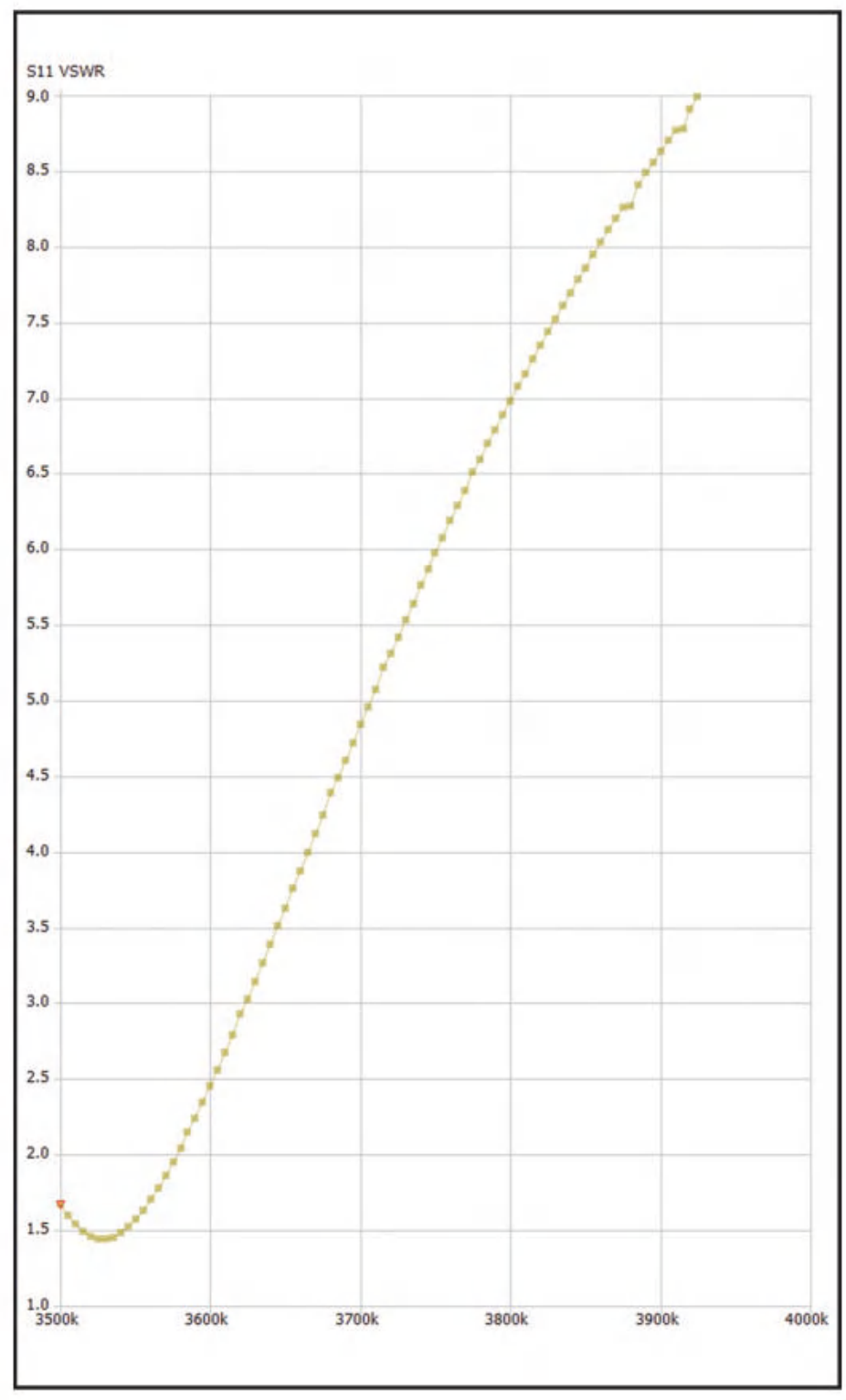
An Inverted Vee for 80 Meters with Integrated Tuning

BY NELSON SOLLENBERGER,* KA2C

Antennas for 80 meters rarely cover the full band with low SWR, including full-size dipoles, inverted vees, and verticals. Many solutions to this problem are used by hams, including desktop manual and automatic antenna tuners, remote antenna tuners, antenna broad-banding techniques such as cage dipoles, manual adjustments such as adding/removing pieces of wire to shift antenna resonance within the band, and other techniques. SWR and antenna efficiency/performance are not tightly coupled and good antenna performance with high SWR is possible, while poor antenna performance with low SWR is also possible. But low SWR (an impedance-matched system) can be important for safe and efficient operation of transmitters and amplifiers. Low SWR also minimizes coax cable transmission loss. For high power operation, a matched impedance system at 50 ohms results in operating voltages of only a few hundred volts while unmatched conditions with high SWR can result in thousands of volts that may cause failures.

High performance HF antenna products sometimes include an integrated antenna tuning function. SteppIR is well known for including antenna tuning in its antennas, including 80 meters, based on adjusting the physical length of elements. OptiBeam offers an 80-meter rotatable dipole as well as 2-and 3-element Yagis with integrated tuning using relays and loading inductors at the center of the antenna elements to cover 80 meters in four band segments, and Array Solutions has provided 80-meter Yagi solutions with similar features. General-purpose remote antenna tuning units are available, but units capable of the full legal power limit cost $1,000 and up and are fairly large in size. But the use of integrated antenna tuning optimized and designed for low-cost full-size simple wire antennas appears uncommon for 80 meters. One exception is a simple 80-meter dipole with relay switched loading coils built into the antenna center unit available from Antennas-Amplifiers with two frequency selections for CW and SSB. Some hams have used relays and loading coils in some arrangements to provide an integrated tuning function.

This article describes a simple and low-cost inverted vee or dipole antenna for 80 meters with integrated tuning cov-



Figures 1-8: SWR plots using a nanoVNA for each of the eight switch positions of the integrated tuner, ranging from the bottom of the 80-meter band (Figure 1) to the top (Figure 8).

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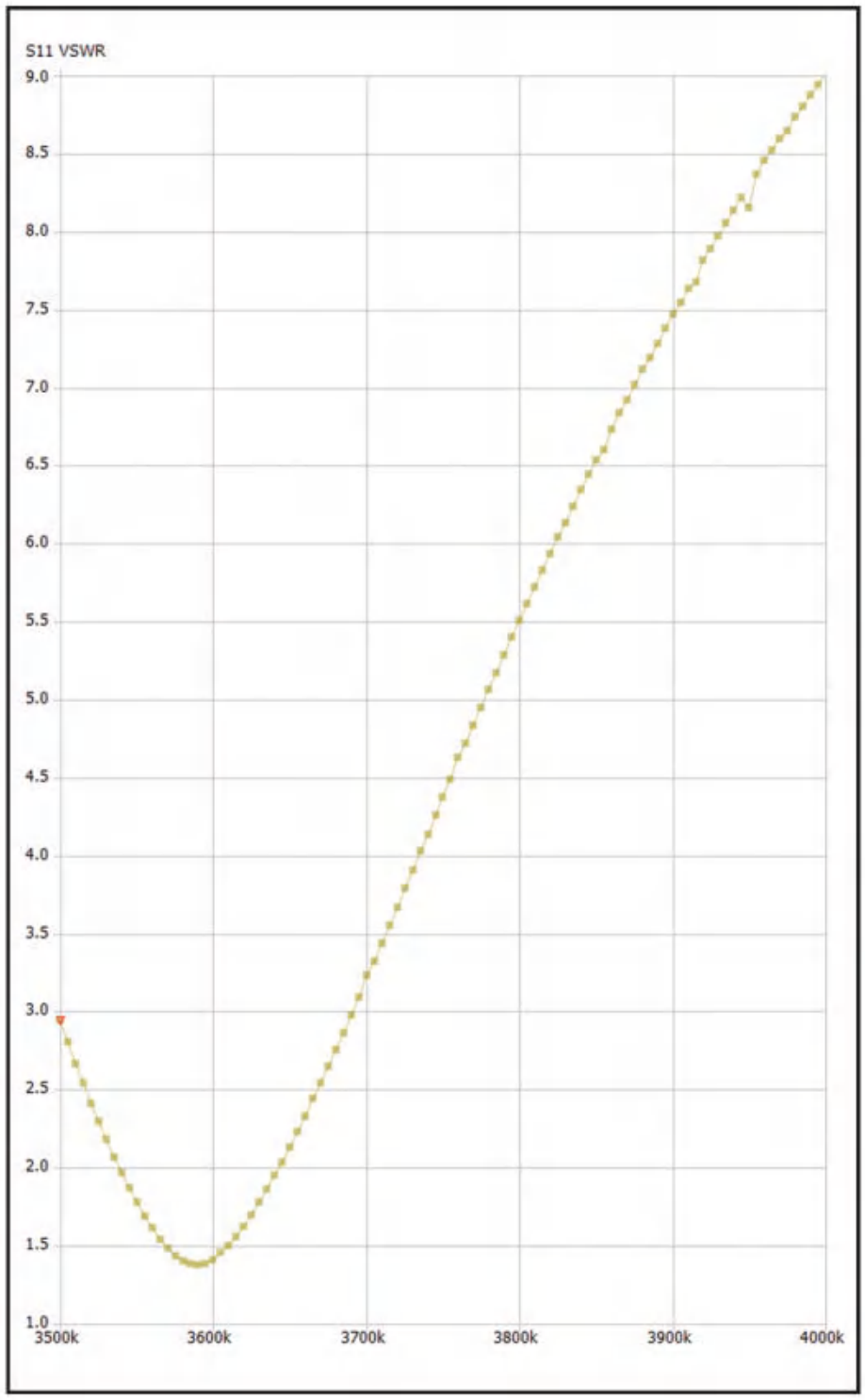

Figure 2.

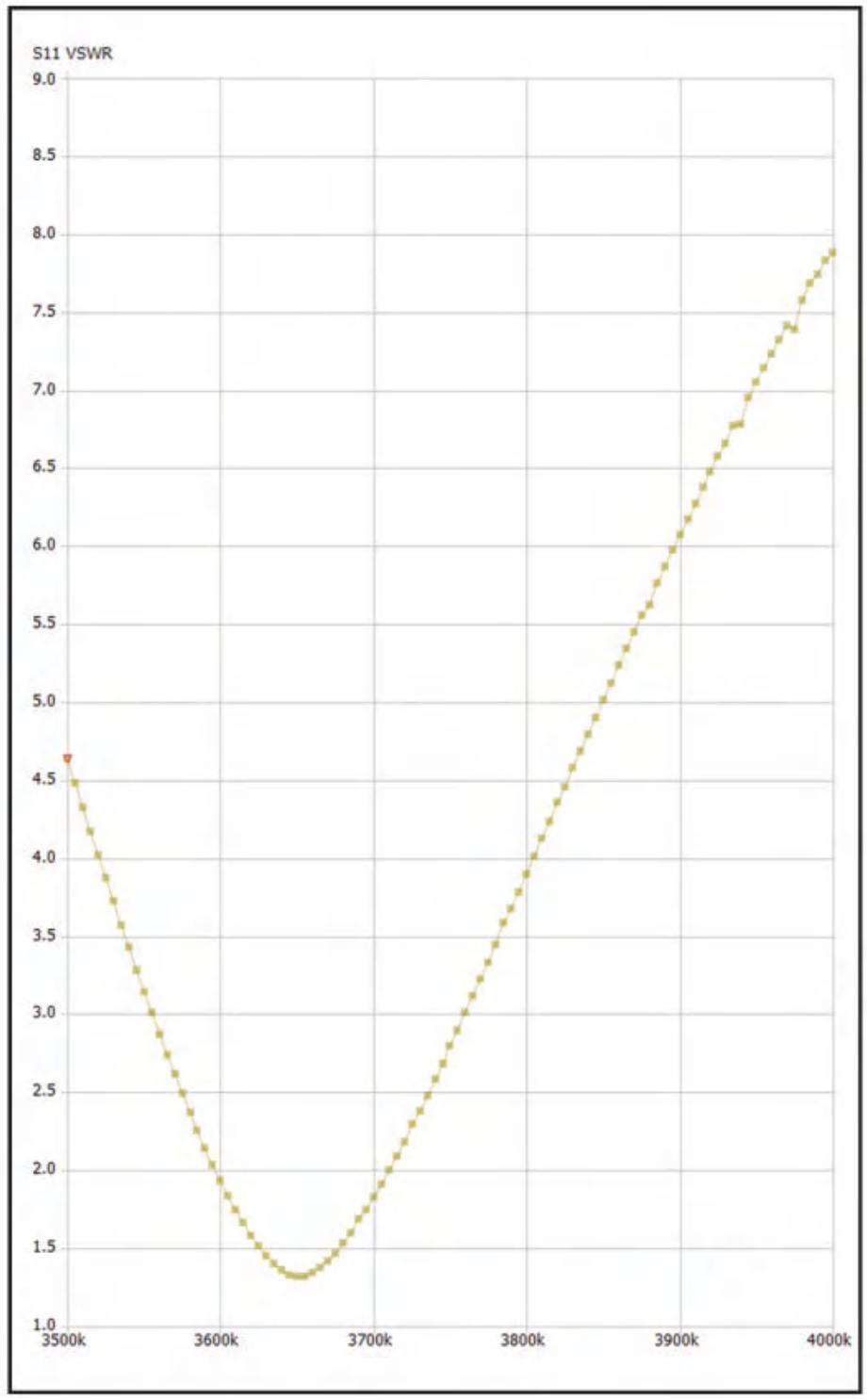

Figure 3.

ering 80 meters in eight frequency steps of about 70 kHz each at the full legal power limit, resulting in excellent matching across the entire band. Figures 1 through 8 show the measured SWRs for the 8 antenna tuning steps. When the best tuning step is selected, nearly all frequencies have an SWR below 1.5:1, with a few points showing an SWR between 1.5:1 and 1.7:1. A simple dipole or inverted vee for 80 meters typically has a 3:1 SWR bandwidth of only 250 to 300 kHz, and a 1.5:1 SWR bandwidth of less than 100 kHz.

This device is simple to build using only a few components. An antenna center box connects to a coaxial feedline going to the radio shack, and it replaces a balun or center insulator. In the center box, the signal goes first to an internal balun which provides an impedance matching function as well as a transition from unbalanced coax to a balanced circuit connecting to the two antenna elements of the inverted vee or dipole. The balun is followed by circuits containing three small low-cost relays to enable/disable three toroid inductors arranged in eight binary steps across the band to provide fine-tuning of the antenna. A printed circuit board from Far Circuits designed for a 1:6 remote antenna switch described in an April 2005 *QST* article by Bill Smith, KO4NR, was modified to mount three relays to appropriately enable/disable the three loading inductors. The largest inductor shifts the antenna resonance from the top of the band to near the middle of the band, and it is placed in series with one antenna element in the center box. The other two inductors, with values of about one-half and one-quarter of the largest inductor, are placed in series with the other element of the antenna. The two antenna wires are cut to resonant just below 4 MHz with no loading inductors enabled. In the radio shack, a control box contains only a 12 VDC power supply and a 3-pole 8-poition rotary switch connected with a 4-wire control cable to the center box of the inverted vee and the three relay coils plus ground. The control cable can be run alongside the coax for the inverted vee and attached with outdoor electrical tape or tie wraps.

By integrating the loading inductors for tuning with the antenna center unit directly on the antenna elements and with an internal balun, several advantages result. A separate antenna tuner or other tuning box is not required. The SWR is low for the complete station including the coax, antenna switches, filters and the rig and/or power amplifier for the entire 80-meter band. Tuning is very simple to control by selecting 1 of 8 sequential center frequencies with a rotary switch. The cost of the components is low to support operation at the full legal power limit of 1500 watts in the USA.

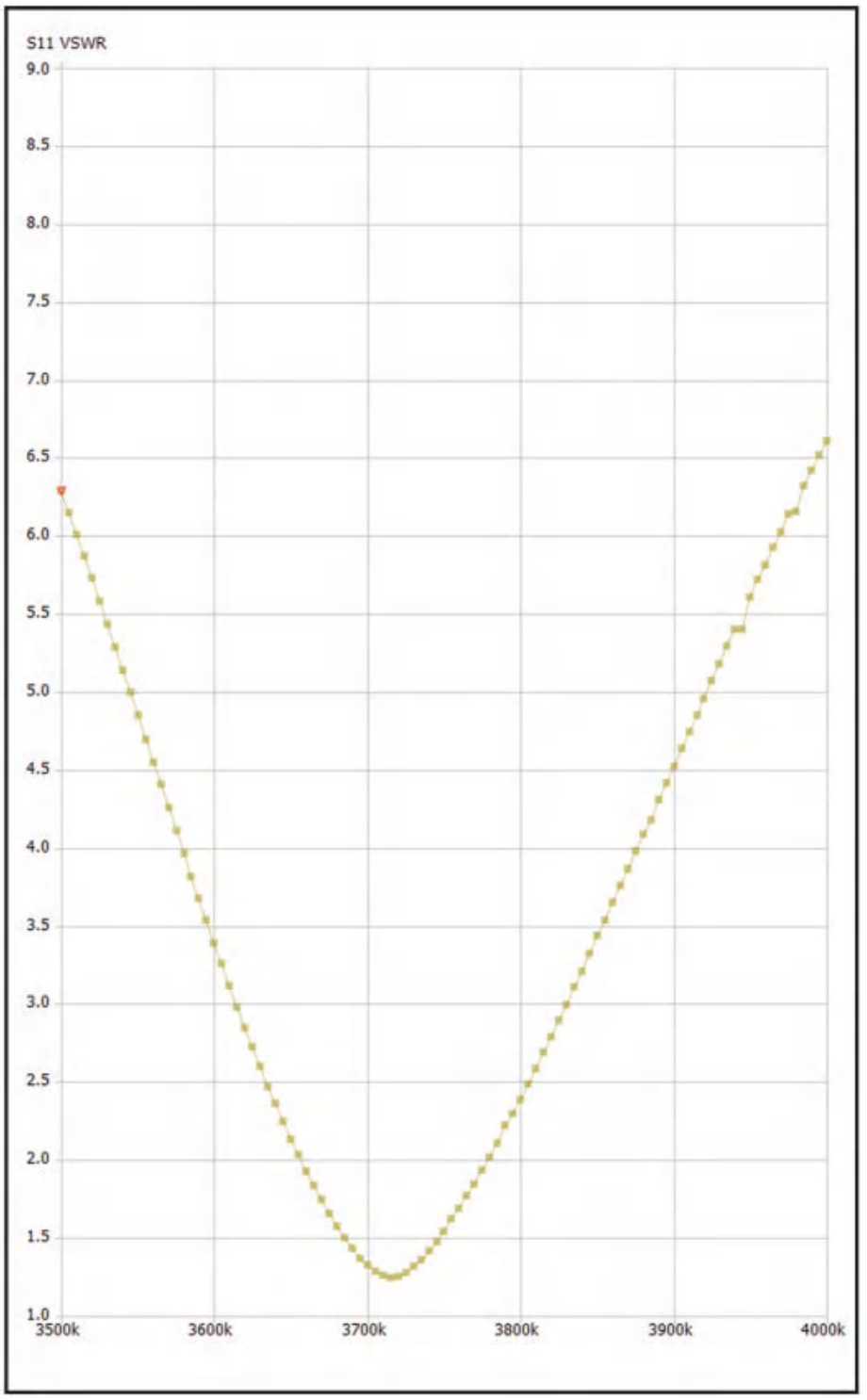

Figure 4.

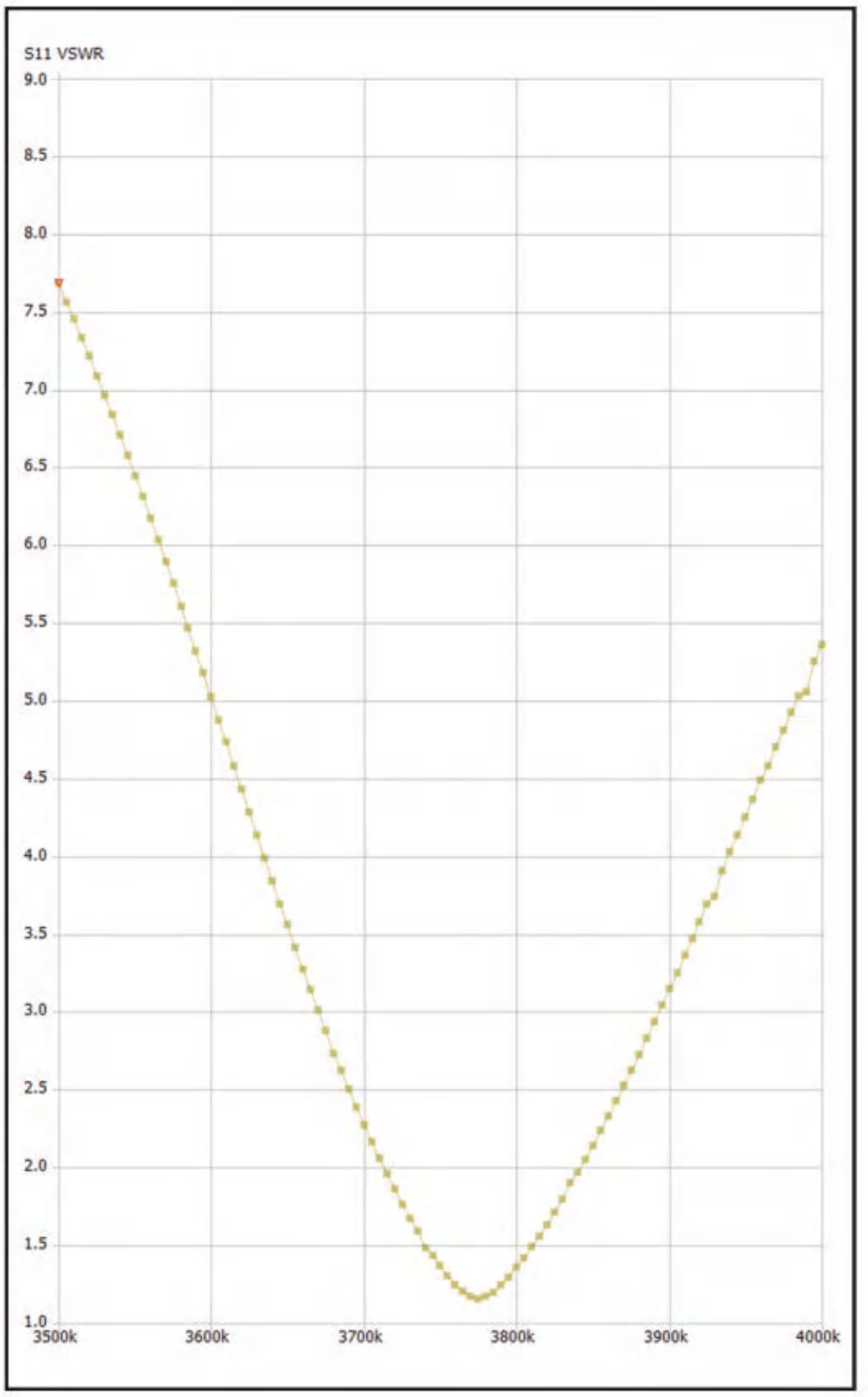

Figure 5.

While this design is for 80 meters, it could be scaled for 160 meters, which has a similar antenna bandwidth issue.

Precise matching of element lengths and of the loading with inductors of the two elements of an inverted vee or dipole is not necessary for the modest loading and frequency shifts required to tune across the 80-meter band for a dipole resonant at the top of the band. This is true because the impedance of a dipole changes slowly for small feed position offsets near the center of a resonant dipole. However, the radiation resistance of a shortened dipole decreases proportional to the square of the frequency, and this is the major side-effect of loading the antenna with inductance to lower the resonant frequency.

An inverted vee with the center at about 37 feet off the ground and the two ends at about 18 feet with elements of about 58 feet were used for the antenna. The modest height above ground and the inverted vee arrangement lower the impedance significantly from 73 ohms of an ideal resonant free space dipole. This resulted in a measured antenna resistance of about 40 ohms at 4.0 MHz (at resonance) going down to only 30 ohms at 3.5 MHz with loading. The SWR results show a minimal SWR very close to 1.0:1 at the top of the band, but rising to about 1.4:1 at the bottom of the band, which is consistent with the impedance results. With a higher antenna or with other arrangements, the antenna impedance may be different. The balun can be easily adjusted with more/fewer turns on the primary or secondary to provide a good match.

Antenna Center Unit and Tuning Inductors

A schematic diagram of the antenna center unit is shown in Figure 9, and Photo A shows its interior. The center unit is built in an outdoor electrical box by Zulkit, just 5.9 x 5.9 x 3.5 inches in size, which is mounted with the lid down in order to protect the circuits from any moisture which may enter the box. A few small 1/16” holes are drilled in the lid for drainage. A balun is placed at the input to the center unit using an FT240-43 toroid core with 8 turns of #14 solid copper enameled wire for an unbalanced primary and 7 turns of wire for the balanced secondary. This provides a 50- to 38-ohm impedance matching function as well as an unbalanced-to-balanced transition. The wires on the balun toroid core are secured with tie wraps at the start and ending turns and in the middle of the windings, and they are spaced to provide high RF voltage isolation with the primary and secondary windings interleaved.

The balun is mounted next to an SO-239 connector and connects to the SO-239 for the coax in the lid of the electrical box. Epoxy can be used to secure the balun but the con-

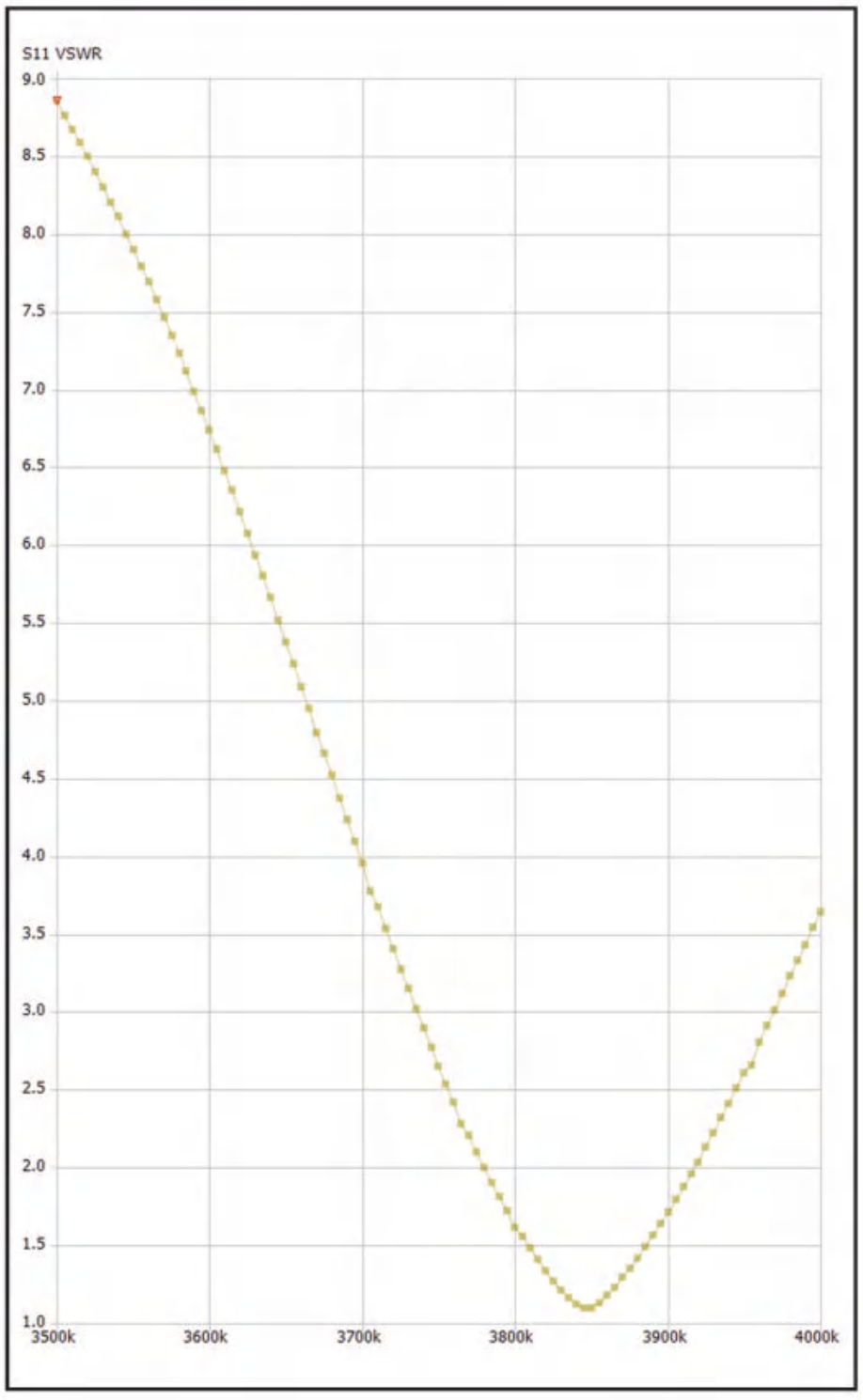

Figure 6.

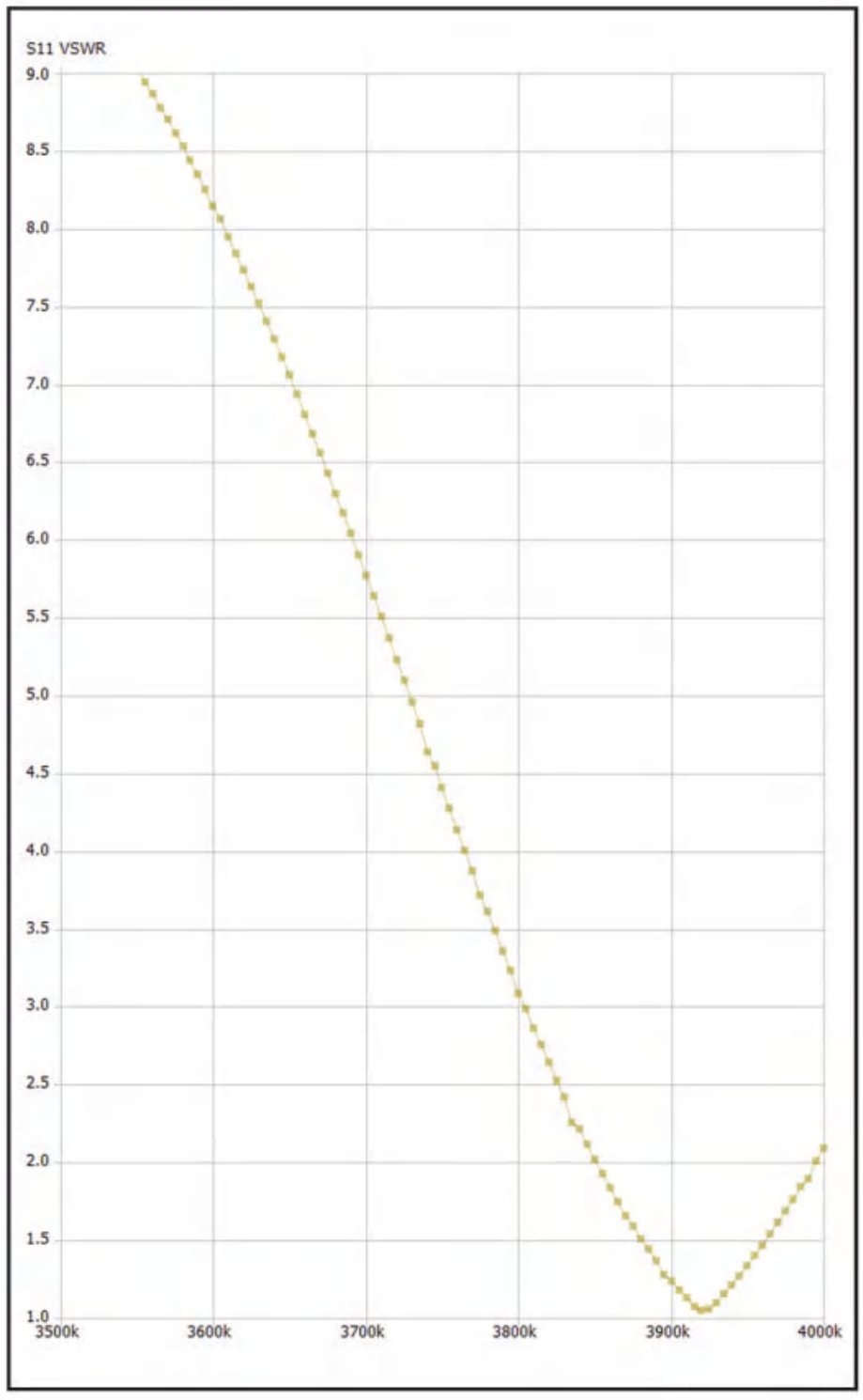

Figure 7.

nections to the SO-239 connector secure the balun fairly well. The balanced secondary of the balun connects to the toroid inductor loading elements in the main part of the electrical box with two #12 stranded copper insulated wires of about 6 inches in length. Those wires fold up into the lid beside the balun when the center box is closed and are guided into safe positions as it is closed to avoid contact with other parts in the box.

The PCB from Far Circuits contains an area for three relays on one side of the center and a similar area on the other side. One side of the PCB plus a small center area is cut off and discarded, leaving the area of the PCB for relays 1 to 3. The signal trace between output 3 and output 2 was cut with a Dremel® tool. The PCB grounds inactive relay outputs using the normally-closed relay connections, but that is not appropriate for this application, so those PCB connections to ground were removed by drilling out those holes with a 7/32-inch drill bit. Photo B shows the prepared PCB.

The three relays are Zettler AZ755s, and are also available from Far Circuits. Small eyelets are provided to place around each pin connecting to the relay contact prior to soldering to provide a good connection for the RC current.

In the first step, the three relays are mounted on the PCB; three small coil bypass surface mount caps, also provided by Far Circuits, are soldered to the PCB; and four hookup wires for the three relay coils plus ground with lengths of about 6 inches each are soldered to the PCB with the other ends unattached. This assembly is then turned upside down and attached to the center of the electrical box with epoxy on the relay tops with the four wires facing away from box lid hinges.

Next, a 4-connection terminal strip is attached with epoxy as shown in Photo A, and the four wires from the three relay coils plus ground are connected to one side of the terminal strip. The control cable connects later to the terminal strip.

The third step is to prepare the three toroid inductors. The inductors are 19, 12 and 8 turns of #14 enameled copper wire wound on T200-2 cores, providing calculated inductances of 4.33, 1.73 and 0.77 µH, not including pigtails, stray inductance and stray capacitance. Those factors increase the achieved circuit inductances, and EZNEC simulations of the antenna with three loading inductors to tune the antenna as desired produces values of 5.3, 2.7 and 1.4 µH.

The inductors are prepared with 6-inch pigtails. About 3/4-inch of enamel is stripped from the end of each pigtail. Also, 3/4-inch sections in the center of four pigtails are stripped to attach the two inputs from the balun and the two outputs to the wires which exit the center box to attach to the antenna elements. See Photo A and the schematic in Figure 9. The

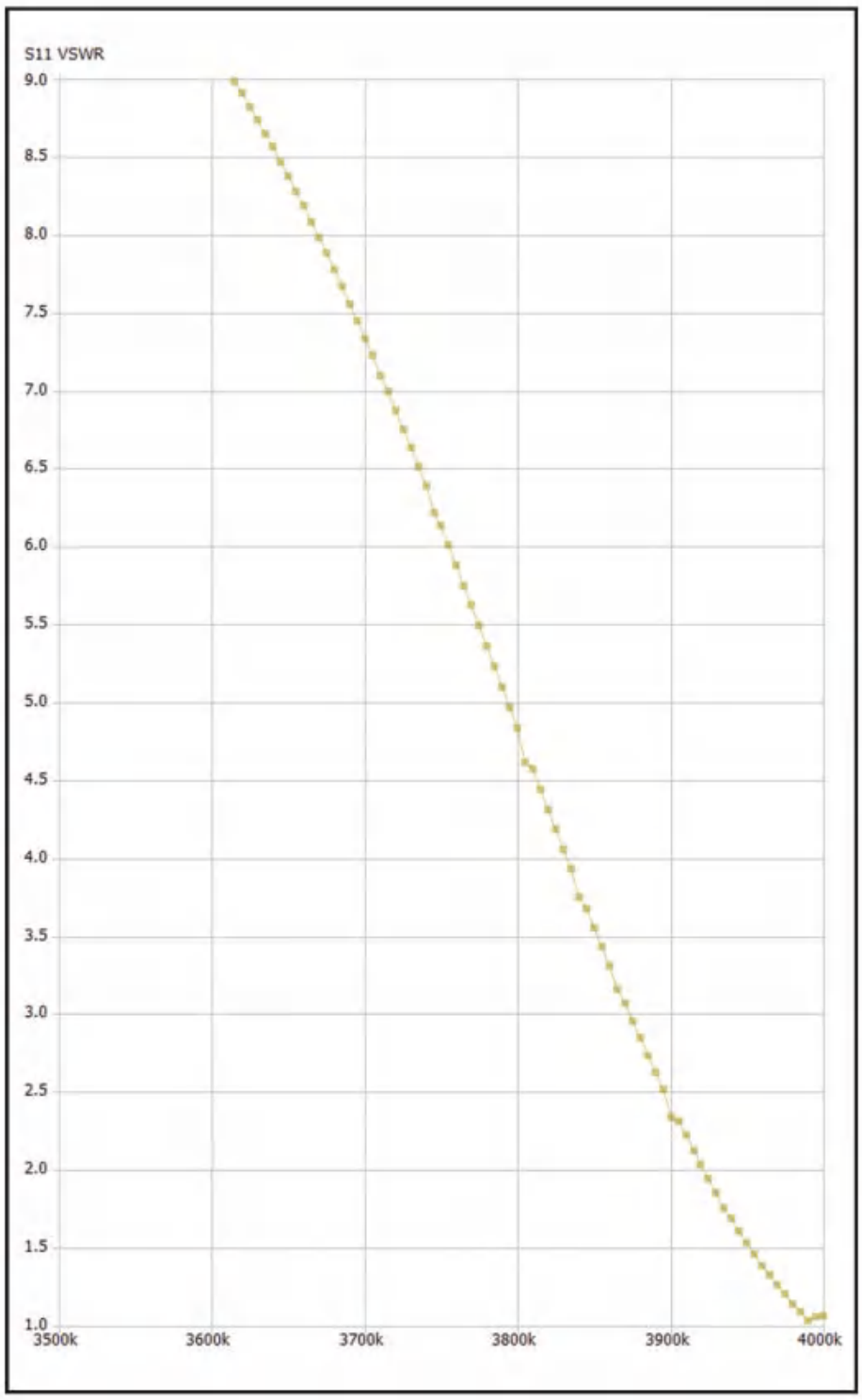

Figure 8.

three inductors are installed against three sides of the box and the pigtails are shaped so that the end sections align with the appropriate two pins for each connection to the relays (each signal connection to a relay uses two pins).

The spacing between the relay pins is modest, and joining the toroid inductor pigtail ends to the traces on the PCB requires some care. It is important to keep the gap as large as possible due to the RF voltages involved during operation. An 80-watt soldering iron with a chisel tip of about 1/2" width was used. First, lightly tin the bare end of each pigtail. Then with the wire shaped to meet the PCB trace, place it on the side away from the gap between the pins using needle nose pliers. With the chisel spanning the two pins and trace on the relay, reflow the solder and press the pigtail against the pins and PCB trace. To prevent heat damage, the 80-watt iron should be used sparingly and for a period just long enough to reflow the solder and allow the pigtail to be pressed into position and held until the solder is cooled and hardened.

Antenna Control Unit

A schematic for the antenna control unit is shown in Figure 10. It is very simple, containing a basic 12 VDC power supply with a fuse, and a 3-pole 8-position rotary switch. The rotary switch is wired to provide binary encoded 12 VDC to

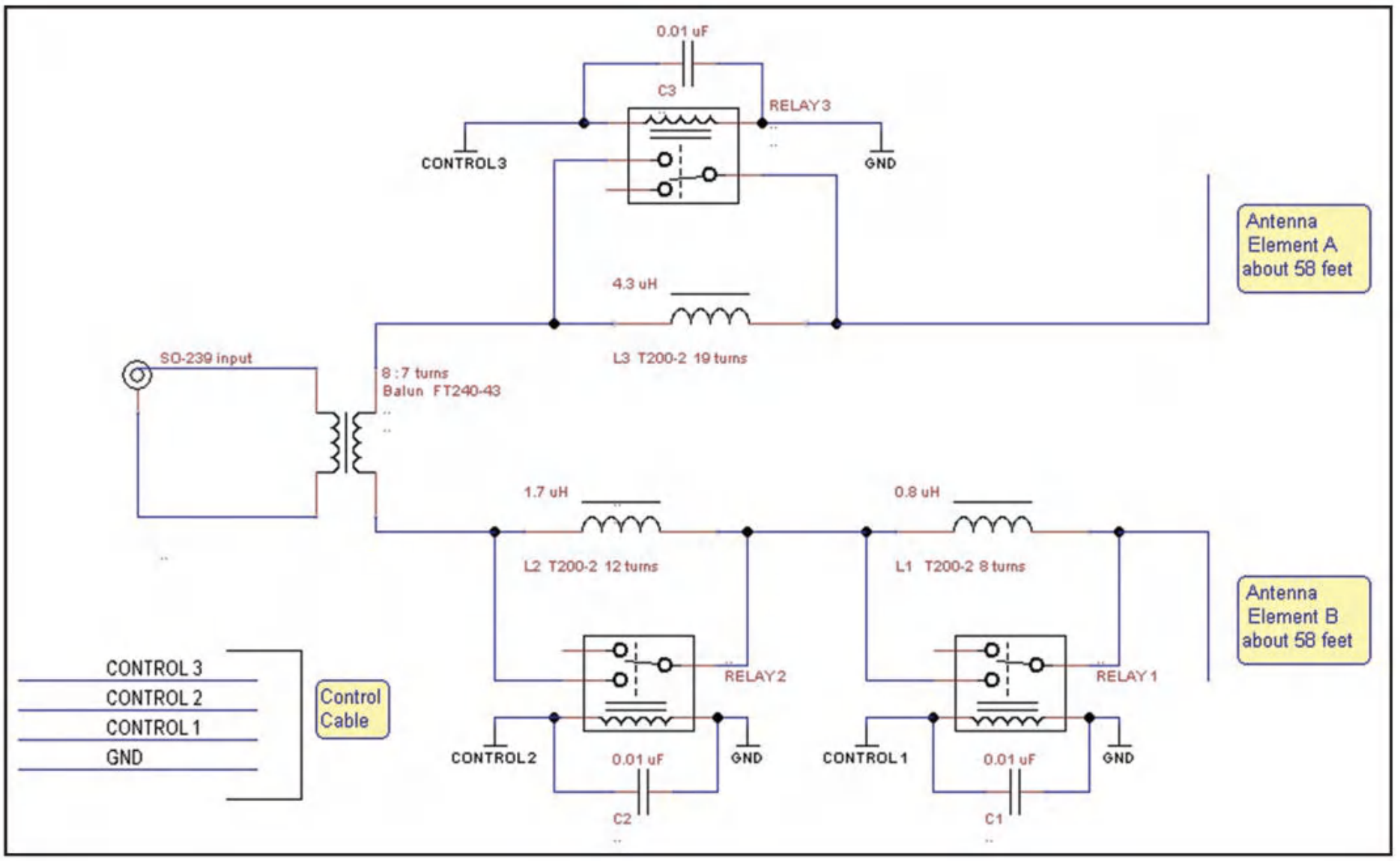

Figure 9. Schematic of the antenna center unit

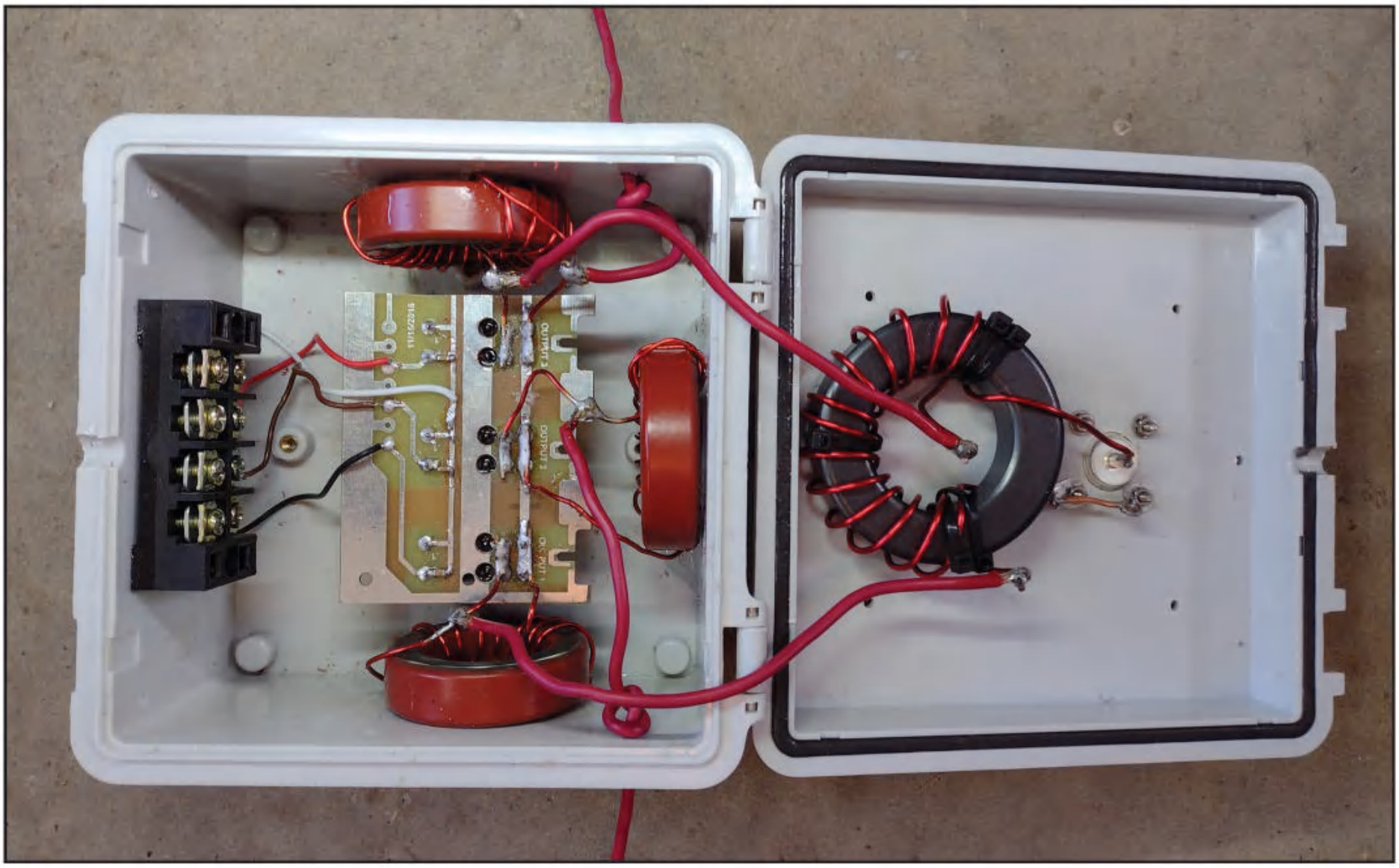

Photo A: Picture of the antenna center unit.

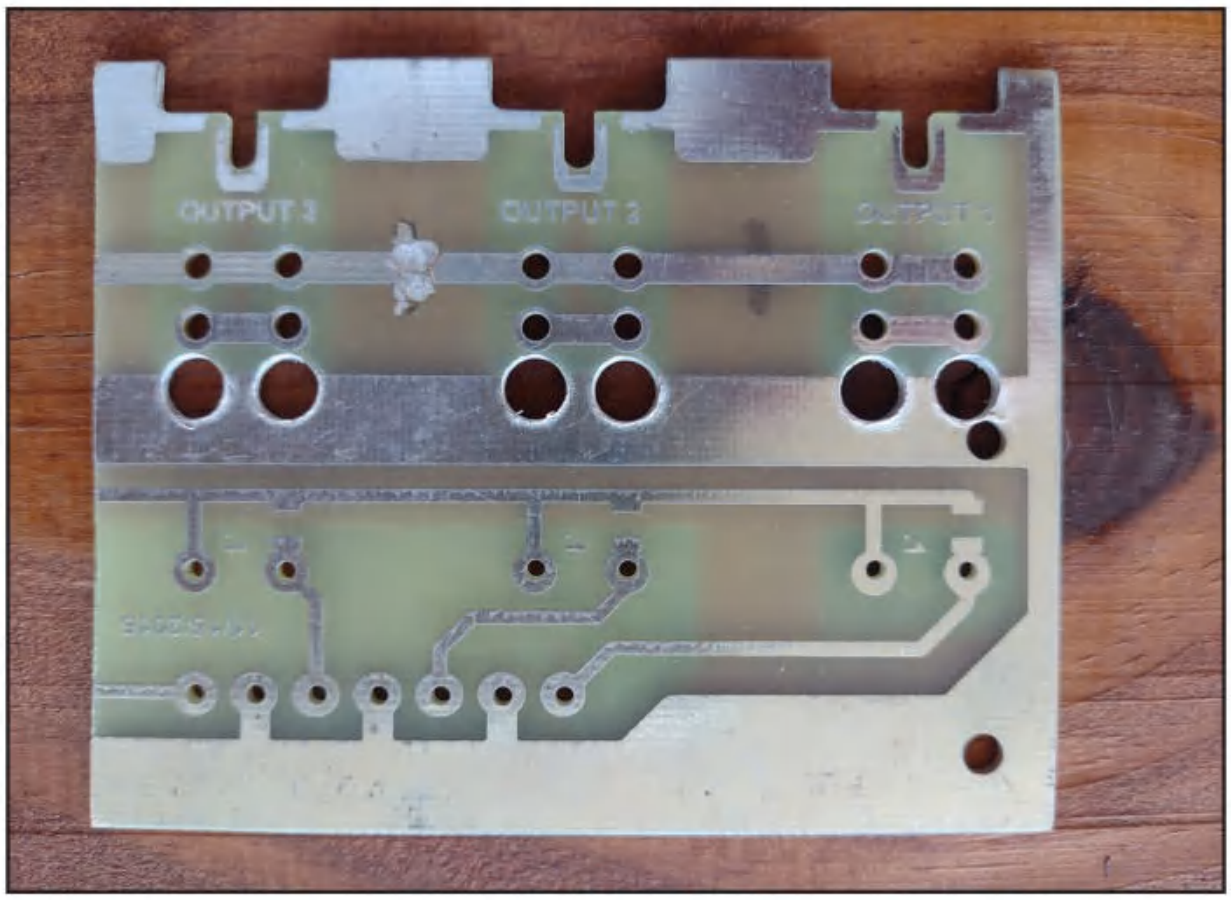

Photo B: The modified relay circuit board. See text for details.

the three relay coils in the antenna center unit. At the bottom of the 80-meter band, all three relays are inactive, resulting in open contacts for them, and the toroid inductors are active in the circuits providing loading to resonate the antenna near 3.5 MHz. At the top of the band, all three relays are active with 12 VDC connected to their coils, resulting in closed contacts for the relays, and the toroid inductors are shorted and inactive in the circuits to resonate the antenna near 4.0 MHz. When the antenna is installed, with the control box set to select a frequency near the top of the band, the antenna elements should be trimmed to tune the resonance to just below 4.0 MHz. A nanoVNA is convenient for tuning and measuring results.

The antenna control unit can be assembled in a small plastic electrical box or small electronics box and placed in a convenient spot on the station's operating table. The required rotary switch was found on Amazon for about $15. In

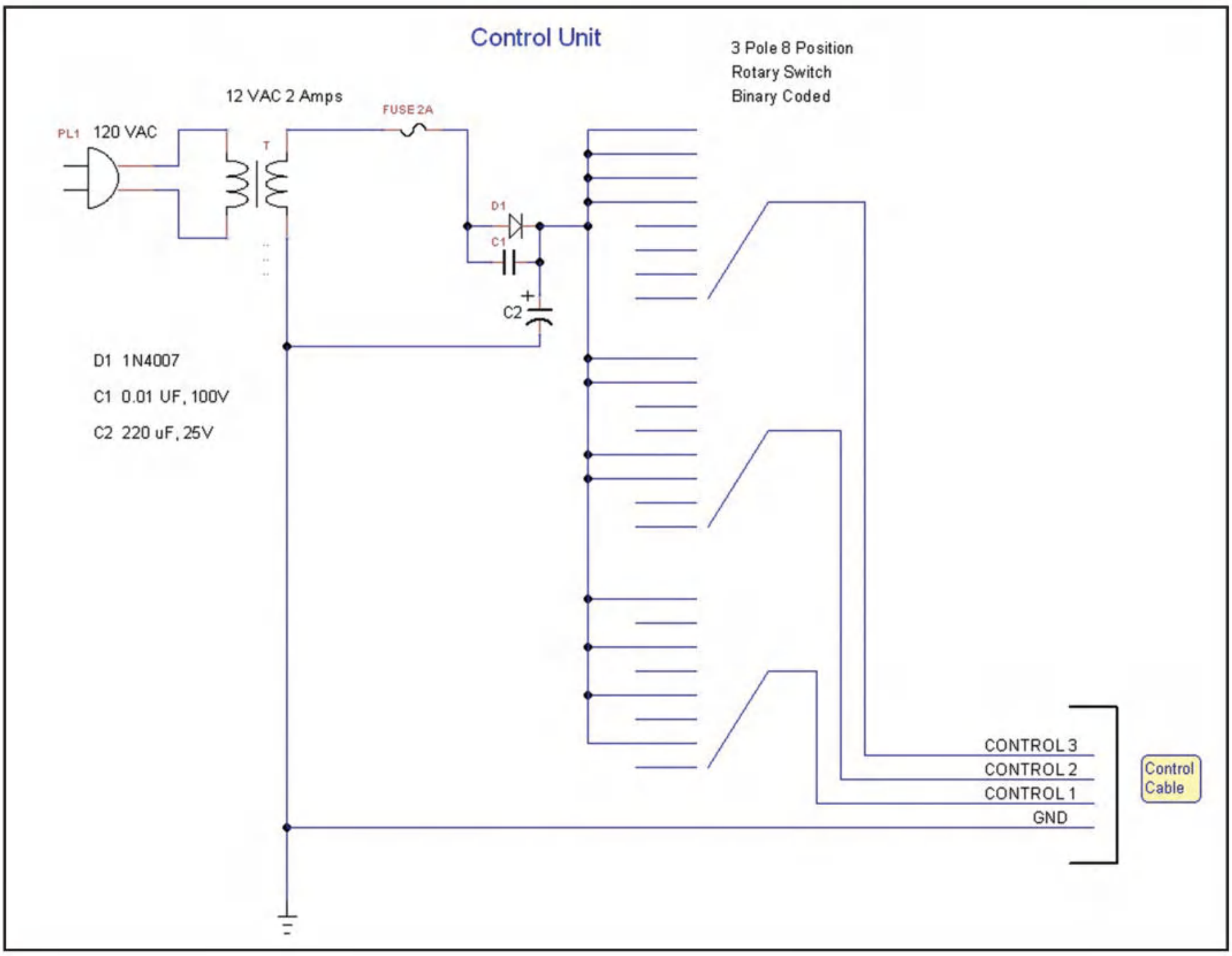

Figure 10: Schematic of the antenna control unit

some cases, 4-pole 8-position switches are available, which also work fine.

Tuning Relays

A number of manufacturers produce low-cost power relays in large volumes priced at several dollars in small quantities intended for usage as ON/OFF switches for 220/120 VAC power control. They typically support 16 to 20 amps of 50/60 Hz current with ratings of 4 to 5 KVA for power. These relays are very attractive for amateur radio usage, and they are commonly used in ham equipment such as remote antenna switches, remote antenna configuration switches and automatic antenna tuners. Specifications for these switches are rarely available for RF frequencies, but one key issue is that they are not used for hot switching of high-power RF. They are only switched when no RF power is present or with low power RF available such as during automatic antenna tuning.

What about their properties when high power RF is present and the relays are either open or closed? When the relays are closed, the key issue is RF current carrying capability. At 50 ohms, 1,500 watts (the legal limit of RF power for USA hams) results in a current of about 5.5 amps RMS. With these relays rated at 16 to 20 amps for 50/60 Hz AC, they have good margins for operations near 50 ohms at the legal limit for RF with the contacts closed, even with large de-rating factors.

These relays are intended for 220/120 VAC operations, so the breakdown voltage rating of open contacts is a question. The open contact breakdown voltage is typically specified at 1,000 VRMS for 50/60 Hz. Multiple sources suggest that this value should be de-rated by about a factor of 0.8 to 800 VRMS for HF frequencies and especially for 2 to 4 MHz. Please note that this value and de-rating factor are much different than contact voltage breaking values with current present while opening the relay contacts, which involves breaking a corona discharge as the contacts move from a closed to an open position. Contact voltage breaking values are substantially more frequency-dependent than open contact breakdown voltage values. For this reason, these relays should not change position when high power RF is present.

The RF current at 1500 watts of power for 40 ohms impedance is 6.1 amps. The largest loading inductor is about 5 µH, including stray inductance. That inductor then produces an RF voltage of 766 VRMS at 4 MHz, and the relay with open contacts must withstand voltage breakdown. An estimated rating for these relays at 4 MHz is 80% of the 60 Hz rating of 1000 VRMS or 800 volts, so the voltage rating of the relays is OK for 1500 watts of power. The antenna with integrated tuning was tested a few kHz from both the top and bottom of the band at about 900 watts without any problems. High duty cycle operation such as digital or RTTY modes near the legal power limit may lead to overheating of the balun or inductor toroid cores in this design, but SSB and typical CW operations should be fine at full power.

Conclusions

Integrated tuning is found in some high performance HF antenna products such as those from SteppIR, Optibeam, Array Solutions and others, but low-cost solutions for simple wire antennas are generally not available. For hams, integrated antenna tuning is especially desirable on 80 and 160 meters. Using three low-cost power relays and three toroid inductors, it is possible to build inverted vee or dipole antenna center units providing eight tuning steps across the band while operating at high power. An 8-position rotary switch in a control unit provides for selecting eight operating center frequencies resulting in SWRs less than 1.5:1 for nearly all frequencies (with several points between 1.5 and 1.7:1. An internal balun in the antenna center unit improves impedance matching as well as balanced drive to the antenna using coax to connect the antenna center unit to the radio shack equipment. A 4-wire control cable parallels the coax. Only a few components are required for this antenna center unit with integrated tuning and for the control box, and this solution can be easily constructed at low cost by most hams.

announcements *(from page 30)*

TAMPA, FLORIDA — The TAMPA AMATEUR RADIO CLUB will hold the TarcFest from 7:00 a.m. to 1:00 p.m. on Saturday August 19 at the Tampa Amateur Radio Club, 7801 N. 22nd St. Contact: Bill Bode, N4WEB. Website: <http://www.hamclub.org>. Email: <n4web@hamclub.org>. Phone: (813) 382-9262. Talk-in 147.105+ PL 146.2. VE testing.

WINFIELD, INDIANA — The AMATEUR RADIO ASSOCIATION OF NEWTON COUNTY will hold the ARANCI Hamfest from 6:00 a.m. to 2:00 p.m. on Saturday August 19 at the Christ Presbyterian Church, 7416 E 109th Ave. Contact: Michael Swiader, KA9E. Website: <http://arancіradio.com>. Email: <ka9e@usa.com>. Phone: (815) 409-5070. Talk-in 444.250. VE testing.

CORTLAND, OHIO — The WARREN AMATEUR RADIO ASSOCIATION will hold the WARA Tailgate Swap Meet from 7:00 a.m. to noon on Sunday August 20 at the Mosquito Lake State Park, 1439 Wilson Sharpsville Rd (state route 305). Contact: Andrew Juchnowski, AB8MO. Website: <https://www.w8vtd.com/hamfest/>. Email: <hamfest@w8vtd.com>. Phone: (234) 238-2312. Talk-in 146.970- (100 Hz normally off).

MARLBOROUGH, MASSACHUSETTS — The FEMARA will hold the Northeast HamXposition, ARRL New England Division Convention times TBA from Thursday August 25 to Saturday August 27 at the Best Western Royal Plaza Hotel, 181 Boston Post Rd. Contact: Michael Raisbeck, K1TWF. Website: <https://hamxposition.org/>. Email: <k1twf@hamxposition.org>. Phone: (508) 574-5432. Talk-in 147.27/146.2, 223.94/103.5, 449.925/88.5. VE testing.

BARABOO, WISCONSIN — The YELLOW THUNDER AMATEUR RADIO CLUB will hold the Circus City Swapfest time TBA on Saturday August 26 at the Badger Steam and Gas Engine Club Property, E3347 Sand Road. Contact: Thomas Harrison, N9PQJ. Website: <http://yellowthunder.org/>. Email: <n9pqj@arrl.net>. Phone: (608) 963-0762. Talk-in 147.315 PL123.0. VE testing.

BREWSTER, MINNESOTA — The NORTHERN PLAINS REGIONAL RADIO COUNCIL will hold the Northern Plains Regional Radio Council Hamfest time TBA on Saturday August 26 at the Brewster American Legion Post, 825 3rd Avenue. Contact: Randy Donahue, WBØZSO. Website: <https://tinyurl.com/2s4ezbc3>. Email: <wbØzso@arrl.net>. Phone: (605) 610-9419. Talk-in 146.67 - 141.3.

DAVENPORT, IOWA — The DAVENPORT RADIO AMATEUR CLUB will hold the 52nd Annual Davenport Radio Amateur Club W0BXR Hamfest from 8:00 a.m. to 3:00 p.m. on Saturday August 26 at the Iowa Army National Guard, 5300 West Kimberly Road. Contact: Robert Kordick, KCØOYK. Website: <https://drac.club/>. Email: <KCØOYK@ARRL.NET>. Phone: (563) 324-4832. Talk-in 146.8800 -0.6 MHz PL 77hz. VE testing.

JOPLIN, MISSOURI — The JOPLIN AMATEUR RADIO CLUB, INC. will hold the Joplin Hamfest from 12:00 p.m. to 6:00 p.m. on Friday August 26 and from 8:00 a.m. to 2:00 p.m. on Saturday August 26 at the Joplin Family Worship Center, 5290 E 7th St. Contact: Jim Scott, WB0IYC. Website: <http://joplinhamfest.org/>. Email: <jim.scott@scottelectronic.com>. Phone: (417) 781-2211. Talk-in 147.210 MHz PL 91.5. VE testing.

MACEDON, NEW YORK — The RARA and RVHFG will hold the RocCityNet Hamfest starting 7:00 a.m. on Saturday August 26 at the Log Cabin Restaurant, 2445 W. Walworth Rd. Contact: Michael Happell, W3MJH. Website: <https://roccitynethamfest.com/>. Email: <mjhappell@gmail.com>. Phone: (585) 402-5235. Talk-in 145.110. VE testing.

BRIGHTON, COLORADO — The DENVER RADIO CLUB will hold the DRC Hamfest from 9:00 a.m. to 1:00 p.m. on Sunday August 27 at the Adams County Fairgrounds, 9755 Henderson Road. Contact: Gerry Villhauer, WØGV. Website: <https://wØtx.org/>. Email: <wØtx@wØtx.org>. Phone: (303) 467-0223. Talk-in 145.490 or 448.625 PL 100.0. VE testing.

NEW KENSINGTON, PENNSYLVANIA — The SKYVIEW RADIO SOCIETY will hold the Skyview Radio Society Swap N Shop from 8:00 a.m. to 1:00 p.m. on Sunday August 27 at the Skyview Radio Society Clubhouse, 2335 Turkey Ridge Rd. Contact: John Italiano, WA3KFS. Website: <http://www.skyviewradio.net/>. Email: <radiofreebob@gmail.com>. Phone: (724) 339-3821. Talk-in 146.640 131.8 PL.

You've most likely heard of audio books, and maybe enjoy listening to them. But what about CW books? WA4EFS has a project that can help you improve your cultural literacy and your Morse code skills at the same time!

The World's Great Literature ... in Morse Code!

BY LLOYD MILLIGAN,* WA4EFS

In this article I will attempt to give an account of my CW trainer in all its shameless excess. The "Mother of All Keyers" (MOAK, for short; Photo A) is now capable of conversing in Morse, not in the way an advanced modern chatbot would converse, but let's be candid, an exchange of signal reports is not exactly a fluid conversation, either! No matter, if conversation becomes too stilted, or if you need something to help you sleep, the MOAK will read to you from a book! How about a bedtime story—in Morse, of course?

The earliest version of this project dates to a ham radio club meeting several years ago at which one of the members passed around an Arduino Uno-based device he had made. This 'show and tell' made me curious to explore the Arduino platform. Around that same time, my wife, Rebecca Milligan, N4EFS, was learning Morse code, and had built the Arduino-based Morse trainer described by N4TL in the September 2016 issue of *QST*. I decided to design and build a similar device, as a way of learning about Arduino, and possibly to incorporate additional features that might be useful for training. The original MOAK user interface consisted of two push-buttons, a potentiometer (speed control), and a 4-line LCD. A photo and circuit description of this original project can be found at <https://tinyurl.com/yeyv83k4>.

Early iterations of the MOAK were not terrible. One original feature was pseudo-text. The MOAK generated a sort of gibberish that resembled English, though not actual English language words. Copying pseudo-text was perhaps more challenging than copying 5-character groups. Sending practice consisted of keying back random strings that were displayed on the MOAK text-only screen, and optionally sounded-out ('Listen and Send'). However, sending practice was limited to paddle-keying—straight key practice was not supported, as it is in the current version.

I am not obsessed with Morse code, although I wouldn't fault anyone for imagining such. It is just that Morse is a timeless concept, and one that lends itself to applications of an evolving nature. The MOAK endured multiple iterations, some of which were documented and some not. The main evolutionary change was to replace the LCD and buttons with a touch screen. That particular "enhancement," based on the PJRC Teensy 3.5 development kit and HiLetgo 2.8-inch TFT, is described at <https://tinyurl.com/2yywsex5>.

Unfortunately, the Teensy 3.5 is no longer manufactured and is out-of-stock from the usual sources. You can get one on eBay, but might balk at the price! After sending my last Teensy 3.5 to a ham friend, I decided to port the MOAK (now in version 3) to the Teensy 4.1 platform. This more advanced mod-

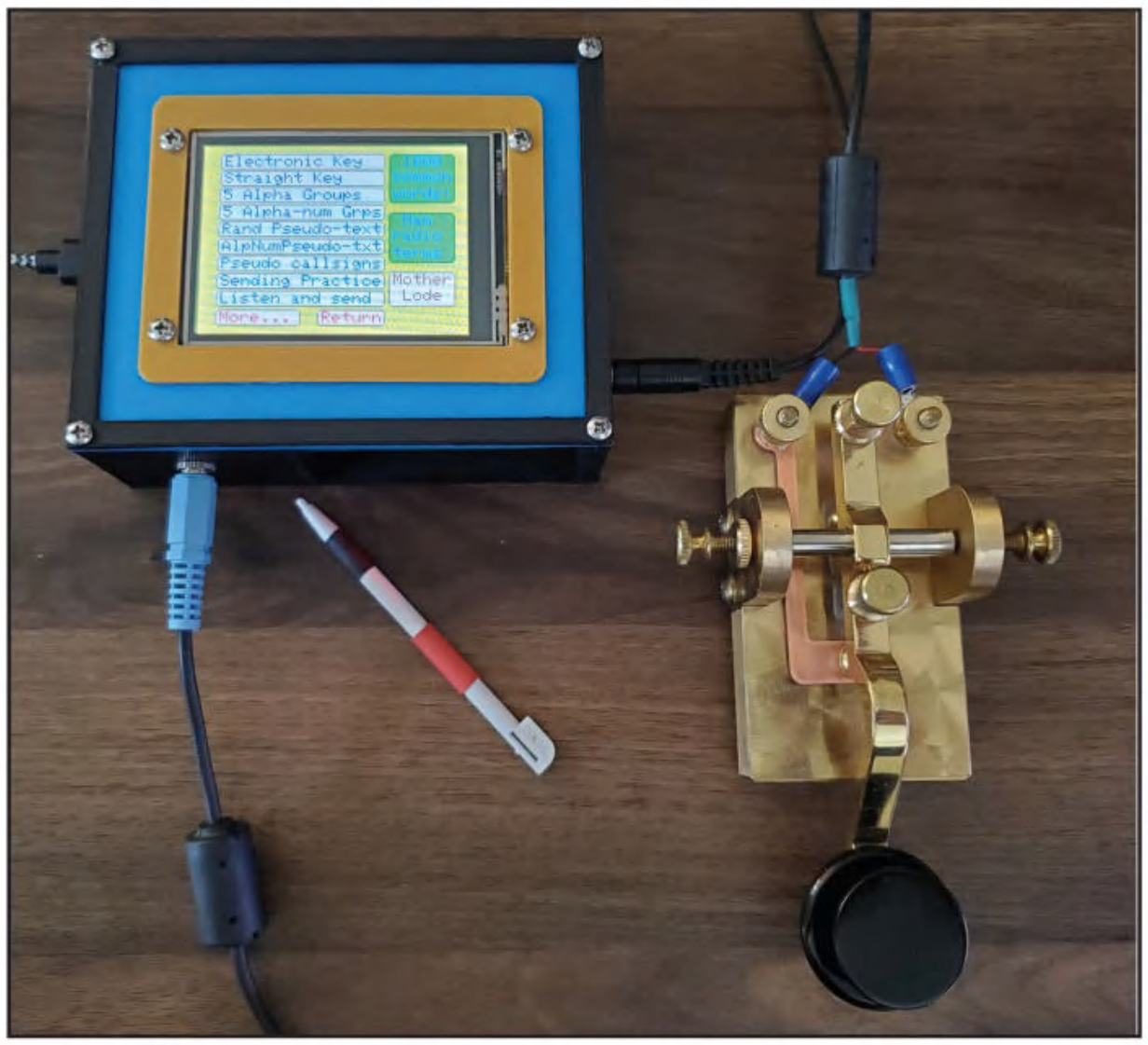

Photo A: Startup screen of WA4EFS's Arduino-based "Mother of All Keyers."

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ule remains readily available from multiple sources as of June 2023. When this effort was finished, I began to reflect on Teensy 4.1's features. In particular, the platform includes a built-in real time clock (RTC) and an on-board micro-SD card slot. Surely I should do something with these appealing features. That is when inspiration struck.

'Mother Lode' is the name I thought of to label an option that would exploit Teensy 4.1's integral micro-SD slot. MOAK version 3 had added the 1,000 most common English words as a new code practice option. English words were presented randomly, roughly in proportion to their frequency of occurrence. Obviously, with a micro-SD, it would be possible to store a massive amount of natural language text for Morse practice. Whole books could be stored, possibly whole libraries.

Micro-SD cards I had previously purchased or had seen on store shelves had multi-gigabyte capacity. I wondered if low-capacity micro SDs might be obtainable at proportionately lower cost. Books in text format require very little storage. The *King James Bible* consumes just over 4 MB as plain text, and most books (Photo B) take half this amount or less. As it turns out, small capacity micro-SD cards are readily available in multi-packs, and the cost works out to less than $2 per unit.

Thousands of copyright-free books are available for download from Internet sources, perhaps the most prominent being Project Gutenberg.[1] Many are classics—well-known titles. The first book I downloaded for micro-SD card experimentation was *Moby Dick*. Right away it was clear that some sort of repackaging would be needed to facilitate using the book as a Morse practice source. The downloaded file starts with about 20 lines of metadata, while another 350 lines of copyright information and related material are appended to the end. The Morse application code would need to find the start of the actual book, and where the book itself ends. Fortunately, these locations are easily identified with the aid of Notepad++ (and probably other text editors in common use). Simply open the downloaded book in your favorite text editor. Move the cursor to the first character of the book text, bypassing metadata, and note its numeric character position. Do the same for the last character of the book. These two numbers should be inserted as a new line at the very beginning of the downloaded text file (first character position, space, last character position). The MOAK computes the exact beginning and end of the book using the two values, taking into account the length of the inserted line.

Morse does not distinguish upper and lower case. The common part of Morse—the part that we ham operators routinely use—includes only a small subset of punctuation. Furthermore, as a general rule, accented characters, special symbols and such are not translatable to Morse. By good luck, my first test download *Moby Dick* was ASCII-encoded. However, a couple of subsequent downloads did not work at first because they were not plain text. It is important to save downloaded books as unadorned ASCII text encoding. I went a step further, replacing selected none 7-bit ASCII characters. For example, I substituted double hyphens '—' for dashes '–'. Maybe a single Morse dash would be better. Of course, any edits that change the character count should be made before pinpointing the start and end of the book.

Clearly it is not desirable to start natural language listening practice in the middle of a word, or even in the middle of a sentence. That is what happens when the excerpt is selected from a random character position between the start and end of a book. Better is to find the beginning of a sentence and start from there. Once all this was implemented and proven to work with the first example book, I downloaded several additional books. Each had to be saved (in some instances re-encoded) as plain text (and with the file extension '.txt') in order to be usable in the desired way.

When the 'Mother Lode' option is chosen, the MOAK opens a random book and proceeds to a random spot in the book to begin its practice transmission from the beginning of the next sentence. The selected title (derived from the stored file name) is displayed on the screen. Text is sounded-out at the last previously selected keying or listening speed. If you don't like the MOAK's book choice or random starting place, touch 'Return' and select the option again (Photo C).

Keyed Control Sequence

As previously noted, Teensy 4.1 has an integral real-time clock. A 3-volt button battery (coin cell) suffices to maintain time when the Teensy is powered-off. So the MOAK could easily be made to announce time in Morse. But how would the user request the time? After adding the 'Mother Lode,' there was no room for another touch-button on the MOAK's main options screen. Furthermore, a Morse time announcement would be a short-duration phrase at best, not worthy of a dedicated option. This dilemma, together with a different unrelated concern, led to the keyed control sequence idea. The Morse stroke symbol '/' (dah-di-di-dah-dit) is normally used to modi-

Photo B: That book on your shelf that you've been meaning to read … listen to it in Morse!

Sequence	Effect
/c	Clear ticker
/d	Annunciate date in Morse
/dMMDDYYYY	Set date to month day year
/n	New line
/s	Current speed in Morse
/t	Time in Morse
/tHHMM	Set time to hours mins (24-hr)
/x	Exit to main menu
/z	Toggle Eliza on/off
/8	Shortcut to 'Sending Practice'
/9	Shortcut to 'Listen and Send'
//	Display random BMP

Photo C: Keyed control sequences.

fy a callsign, for example to indicate that a station is operating from a different jurisdiction. However, I thought it would be safe to overload the symbol's meaning by insisting that a two-character control sequence, consisting of stroke and another character, be bounded by the space character. Keying '/t' would ask the MOAK to announce the time in Morse.

Once the control sequence concept was coded, then of course other uses for it sprang to mind. One of these became the most outrageous of the MOAK-4's soon-to-be-implemented features. But first I made a much more useful enhancement. Previously, the sending practice options worked only with an electronic key (paddle), not with a straight key. Electronic key speed was set using a touch-screen control in the 'More...' options group. With a straight key, it would be necessary to detect the user's actual keying speed and somehow match it. I had previously experimented with this idea in another project and sort-of knew what to do. After selecting the 'Straight Key' option, the user would key-in three letter Vs (di-di-di-dah). That would enable the MOAK to detect keying speed and decode other characters keyed at a similar speed. This method worked better than I recalled it having worked in my previous experiment from a few years ago. In any case, it occurred to me that if enabling straight-key character decoding in the sending practice options worked, why not also enable it for free-form sending practice in the 'Straight Key' option screen itself. The upshot was that the user can now key-in anything and have their keyed-input displayed as text in both the 'Electronic Key' and 'Straight Key' options. On exiting from either of these options, the type-of-key selection persists so that either straight key or paddle may be used for 'Sending Practice' or 'Listen and Send.' And that's not all...

Photo D: Joseph Weizenbaum. (Wikimedia photo)

This may be where the MOAK-4 project jumped the rails. Once keyed-characters were being echoed in the type selection options, the effect was like sounding-out or exhibiting one side of a conversation—perhaps not an inappropriate complement to listening practice. On the other hand, it would be more interesting if the MOAK could reply to whatever was being keyed. I had a momentary thought of interfacing the MOAK with an AI (artificial intelligence) chatbot. Then I remembered 'Eliza.' In the mid-1960s, an MIT computer science professor named Joseph Weizenbaum (Photo D) came up with Eliza. His creation was a minor sensation in its day. It is fair to say that Eliza was the world's first chatbot, decades before the term 'chatbot' had been invented. Weizenbaum is today acclaimed as one of the founders of artificial intelligence.

Conversation with Eliza is stilted—it would be so in any language, but perhaps is even stranger in Morse. Eliza relies on spotting keywords in its input text. This part doesn't work if the Morse is keyed imperfectly. Let's say you mean to key 'dream' but slip and key two dots instead of one for the letter 'e'. Unlike Google, Eliza won't understand that 'driam' was meant to be 'dream'. Well, no harm or not much harm, because even with perfect keying, a conversation with Eliza is not likely to sustain interest for more than a few exchanges. Although it should be said that sometimes the combination of keyed text and Eliza's response can be quite funny. In truth, though, implementing Eliza on the MOAK was one of those things that could be done, and so it happened.

Physical circuit construction is simpler than for previous versions of the MOAK. The external keying circuit (level converter and relay) is omitted, though still supported in software and thus easily reinstated. In place of assembling the audio amplifier from discrete components I have substituted an LM386 sub-board.[2] Another simplification was to remove support for the two or four-row character cell LCD. Finally, although Teensy 4.1 analog and digital pins are not 5-volt tolerant, this should not pose a problem, as the SPI interface operates on 3 volts and no external 5-volt signal connects to the Teensy in this application.

The schematic (Figure 1) shows connections between the Teensy 4.1 (large middle rectangle) and the touch-screen (TFT SPI right), and also the LM386 sub-board. Layout of components is not critical. For the prototype, I glued the coin-cell battery clip to the left side (inside) of a 3D-printed enclosure. For reference, it may be helpful to compare Teensy pin numbers to those referenced in the Arduino IDE sketch. Note that the tone pin changed from DIO 8 in previous versions of the MOAK[3] to DIO 7 in this revision. The square-wave tone that is produced by the microcontroller is smoothed by a low-pass filter consisting of three 2.2K resistors (1/4 watt) and

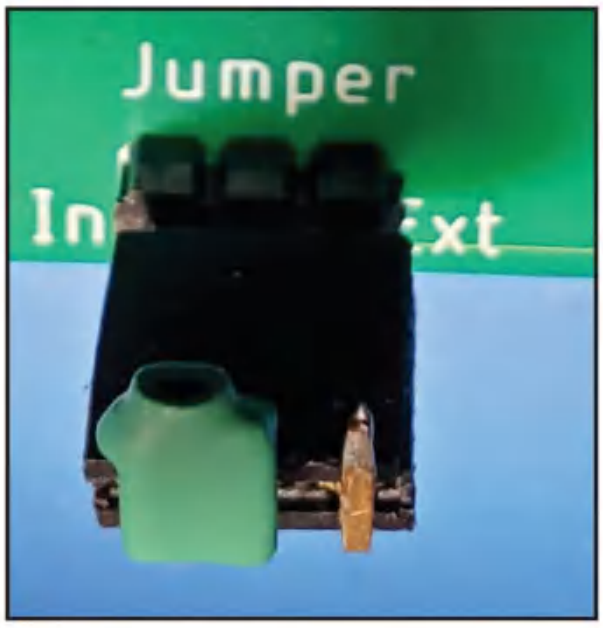


Photo E: Audio amplifier power jumper; shown with 5 volts (Int) selected.

three 0.22 µF capacitors. Output of this filter is coupled to the LM386 sub-assembly via a 10 µF capacitor and 1K trimmer potentiometer. The LM386 sub-assembly also includes a trimmer, but as this small board plugs into a header with the on-board trimmer facing downward, the latter is rather awkwardly situated for adjustment. Once the audio output level has been set, it should not need to be changed, whether used to drive headphones or an amplified speaker.

An important detail is the 3-pin header (Photo E) labeled 'Vdd Jumper' on the schematic (upper left). Jumping pin 1 to pin 2 (middle pin) supplies 5 volts (e.g., USB power) to the amplifier sub-assembly, while connecting pin 3 to pin 2 would supply an external voltage (e.g., 9 to 12 volts) to the amplifier, provided the unit has an external power supply connected. I have tested both configurations but generally use the 5-volt supply, as my unit is most often plugged into the computer by my desk.

The key jack is wired in the usual way for use with a paddle, dot side to tip and dash side to ring. However, the straight key connects to ring and ground, not tip and ground. (This is because I sometimes use my paddle as a straight key and prefer using the dash side in this way.) I made an adapter for my wife's straight key, with two female jacks, so that her key could be unambiguously connected either to her transceiver or the MOAK. For a MOAK parts list and additional construction suggestions please see note 4.

After a bit of vacillating, I decided to have prototype boards made (Photo F), in part so that I could verify (or not) the schematic, and in part for the fun of playing with them. I don't think it would be

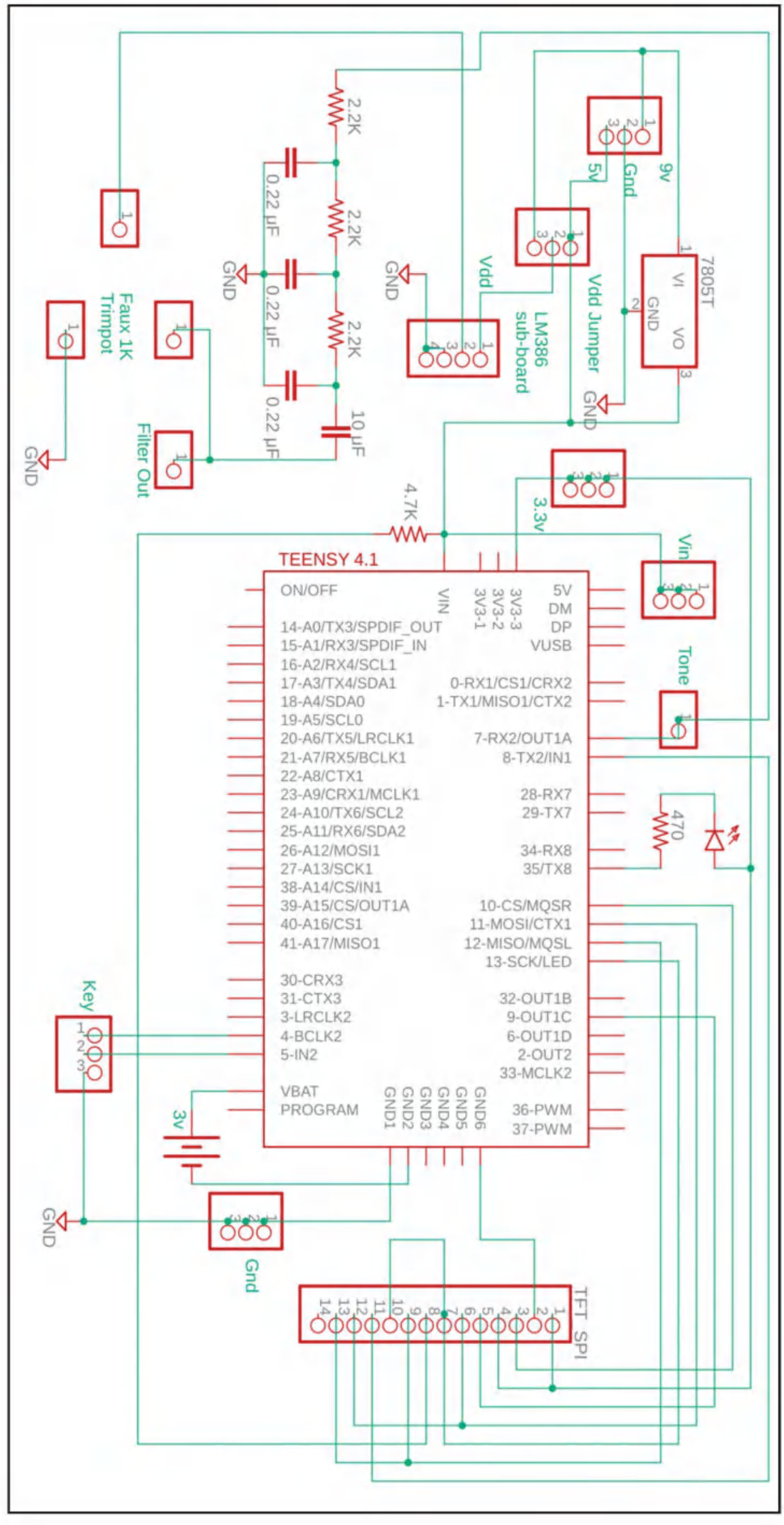


Figure 1: Schematic diagram.

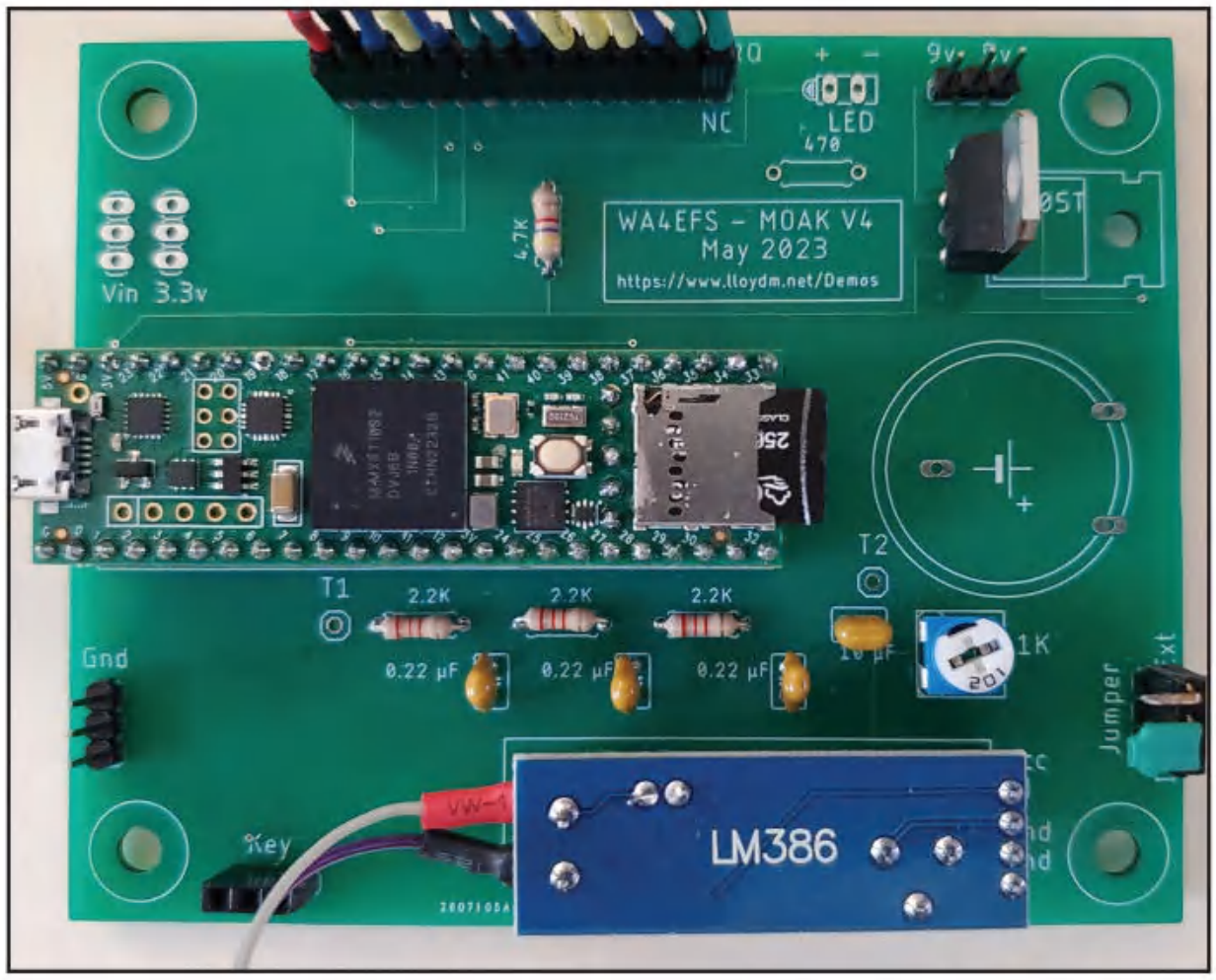


Photo F: Prototype circuit board.

possible to beat the price that JLCPCB[5] charges to manufacture small two-sided prototype boards: five for $2 (US). Shipping from China to eastern US via DHL (3 days) runs about $20.

The project's application firmware (or software) consists of a Teensy 4.1 compatible c++ (Arduino IDE) sketch and four data files, three of these the same as in MOAK-3, and the fourth for the Eliza port. MOAK-4.1.7.zip[6] should be extracted to the same structure as the zip archive: the sketch plus a sub-folder named Data, containing the four .c extension #include files referenced in the sketch. As packaged, the application can be opened and compiled in the Arduino IDE version 2.1.0. The application is also available in precompiled (hex) format, suitable for loading using the *Teensy Loader Program* from PJRC. This format is useful if you do not have the Arduino IDE or requisite libraries available. See the previously referenced 'construction suggestions' link (note 4) for details.

Chances are the MOAK will eventually acquire even crazier features than those in its current litany: Listening practice using 5-character groups (alpha or alphanumeric), using pseudo-text, or pseudo-callsigns or ham radio abbreviations, or the 1000 most common English words, or *the world's great literature*, plus sending practice using either a straight key or electronic key paddle to key back character strings that are displayed or sounded, or querying the date or time, or simulating two-way Morse communication by conversing with a very strange bot named Eliza. Those are the features that have something to do with Morse. The MOAK also has a screensaver that kicks in after 30 seconds of idling at the main options screen. Touching the screen or pressing the key restores the menu. I hope that the MOAK will prove helpful to those who want to learn Morse code or improve their skills in a fun and different way, and are willing to undertake the challenge of this project.

Notes:
1. <https://www.gutenberg.org/>
2. <https://tinyurl.com/2h6ttune>
3. <https://lloydm.net/Demos/moak.html> and <https://lloydm.net/Demos/TFT.html>
4. <https://tinyurl.com/y6jp7jan>
5. <https://jlcpcb.com/>
6. <https://tinyurl.com/4v6y9spk>

the listening post

BY GERRY DEXTER

Positive Developments from Kyrgyzstan and Algeria

What's this? The word "positive" is rarely paired with shortwave news from the Kyrghyz Republic, which is always in the running against North Korea for first place in the world sleaze championship. It may even have slipped down a point or two, having allowed another broadcaster to operate - and a Christian one at that! The new station (the name is unclear so far) operates on 5130 kHz. The station targets Afghanistan, largely in Dari. The new guy's 15 kW is no match for the government's 100-kW giant on 4010. (Note Mark Taylor's tentative log further down of the rarely-noted Kyrghyz government station.)

Early May saw the emergence of a new Algerian station – ifrikya FM – dedicated to serving all of Africa. In addition to an FM channel, the newcomer will also be relayed on 13590 (Bechar) and 13790 (Ouargla). The new voice will broadcast in five languages and focus on politics, sports and cultural issues. I've no info yet on specific times but keep an ear on those frequencies.

Your shortwave broadcast station logs are always welcome. But please be sure to double- or triple-space between the items, list each logging according to the station's home country and include your last name and state abbreviation after each. Also needed are copies of QSLs, station schedules, brochures, pennants, station photos and anything else you think would be of interest. The same holds for your amateur radio operators who also listen to shortwave broadcasts...I know you're out there! You, too, are also most welcome to contribute!

Listener Logs

Here are this month's logs: All times are in UTC. Double capital letters are language abbreviations (SS = Spanish, RR = Russian, AA = Arabic, etc.). If no language is mentioned, English (EE) is assumed.

ALASKA- KNLS, Anchor Point, 7355 at 1228 on the war against terror (Brossell, WI); 11870 at 1200 with M/W in CC (Barton, AZ).

ALGERIA - Radio Algerienne, 17600-Bechar in AA at 2022 (Brossell, WI)

AUSTRIA - Adventist World Radio, 15265-Moosbrunn at 1620 in Urdu (Barton, AZ)

AUSTRALIA - Reach Beyond, 11900 at 1242 in Hindi (Brossell, WI); 15460-Kununurra at 1200 in Canarese, an Indian regional language (Barton, AZ).

BOTSWANA - VOA Relay, 15580-Mopeng Hill at 2136- 2201* with M hosting EE pop, ID before close (D'Angelo, PA)

BRAZIL (all in PP - gld) Radio Nacional Amazonia, Brasilia, 11780 with news at 1203. (Brossell, WI)

Radio Brazil Central, Goiania, 11815 with non-stop pop at 0035. ID and anmts at 0102. (D'Angelo, PA)

CANADA - Bible Voice, 11590 via Uzbekistan at 1320 with a Christian hymn, W preaching in KK (Taylor, WI); 15310-Nauen at 1602 in (l) Oromo. (Brossell, WI)

CHINA - China Radio Intl, 11900-Jinhua with "The World Today" at 1605, 12095-Urumqi with instls at 1345 to close when BBC-Krangi comes on; 13645 via Mali at 1710 with M in Swahili and African vocals, 15125 via Mali at 1630 in AA with African vocals at 1320 (Barton. AZ);

This building houses the headquarters of Bangladesh Betar.

A control room at the new ifrikya FM in Algiers, Algeria.

*c/o CQ magazine

Trans World Radio seems to be everywhere, including a big operation in India.

11955-Kunming in Malay at 1238, 12025 in KK at 1323. (Brosseil, WI)

GUAM - KSDA/Adventist World Radio, 12065-Agat at 1425 just above noise level in Chin but off suddenly at the half hour; 12080 in Telugi (Inda) at 1600 with music. Off at 1629. (Barton. AZ)

KTWR/Trans World Radio, 12040 in Karen at 1242. (Brossell, WI)

INDIA - TWR-India, 13690 via Armenia at 1430 in Hindi with W vocals. (Barton, AZ)

JAPAN - Radio Japan, 11815-Yamata at 1251 with a roundtable discussion in JJ (Brossell, WI); 1400 with news (Barton, AZ).

NEW ZEALAND - Radio New Zealand 7245 with "News at Midnight" (Brossell, WI); 7440-Rangataiki at 1415 on the Anglican church in Barbados (Barton, AZ).

NORTH KOREA - Voice of Korea, 12015 with M and long talk in KK; on another date had FF at 1445 (Barton, AZ); 15245 at 1311 with anti-U.S. commentary (Brossell, WI).

OPPOSITION

Radioni Diree Shaggar (via France to Somalia), 15415 in Somali at 1010. (Brossell, WI)

Omria Media House (via Romania to Eritrea), 15385 at 1506 with W/M in Oromo (Taylor, WI)

Voice of Freedom (S. Korea to North), 5920 at 1 104 in KK with NK jammer (Taylor, WI)

Radio Denge Welat, (via Uzbekistan to Kurdistan), 17470 in Kurdish at 1327 (Taylor, WI); 1610 with M.E. music. (Barton, AZ)

Radio Tamazul (via Vatican to S. Sudan) on immediately after Radio Dabanga closed at 0430. (Barton, AZ)

Radio Dabanga (via France to Sudan), 15550 in Sudanese at 1615. (Brossell, WI)

PIRATES - WORK, 6932 via NAPRS at 0142, ID, long iazz bridge, rock-a-billy, spy numbers. Nice QSL the next day … Hobby Broadcasting, 6935u via NAPRS at 0147 with discussion between two pirate operators. Off at 0128 after ID and email… B Side Radio, 6925u at 0132 pgm of mostly big band iazz, talks about the music, ID and off at 0301 ... ACID, 6949.1 at 0157 with prock (Taylor, WI).

PREVIOUSLY REPORTED - Radio Free Whatever, Ball Smacker Radio, Dog House, KIPM, Cloudsplitter, Crapolla, Wolverine, Thunder Chicken.

PHILIPPINES - Radio Pilipinas, 15190-Tinang at 1900 in Tagalog, using many SS and EE words. (Barton, AZ)

ROMANIA - Radio Romania International, 9850-Tiganesri at 0346-0356* with M/W chatting in EE, nice ID and closing anmts at 0355 (D'Angelo, PA); 15200-Tiganesti at 1755 with ID at TOH, M in Romanian, domestic music (Barton, AZ)

SAO TOME - VOA Relay, 6080 Pinheira at 0418 with news, features and remote reports. (D'Angelo, PA)

SAUDI ARABIA - Al Azm Radio, 11745-Jeddah at 0024 with an AA drama pgm, later M interview another M (D'Angelo, PA)

SWEDEN - IBRA Radio, 12095 via Uzbekistan, at 0003, M with vocal, radio play in Bangla, W with contact info, then off (D'Angelo, PA).

news bytes *(from page 7)*

Photo B: WB2MGP with "Young Ham Lends a Hand" winner Bernadette Wagner, KE8LWO, at the Dayton Hamvention Youth Forum

Bernadette Wagner, KE8LWO (Photo B), and Kees VanOosbree, WØAAE, age 19. The award recognizes young hams who have "given back" in some way to their community, school, neighbors handicapped individuals, seniors, or to military personnel in need of assistance.

According to Carole, Bernadette's dedication to recruiting other young people into ham radio, her involvement her local ham radio club, volunteering with the scouting community, her commitment to community service through her church, and her selflessness in helping her younger siblings are all examples of her outstanding character and her desire to make a positive impact on the world.

Kees, said Perry, is currently the QSL manager for YOTA Americas. He also handles public relations, scheduling young operators, managing logs, and recruiting operators. In addition, he is active in a Remote Ham Radio for Youth initiative where he assists all those who need help. (Kees was also named 2023 Amateur Radio Newsline Young Ham of the Year, see page 14).

The Young Ham Lends a Hand program is supported by the Radio Club of America, Quarter Century Wireless Association, and Evan Rolek, K9SQG. The winner receives $100.

TURKEY - Voice of Turkey, 7275-Emerlier at 0351, W with contact info, other anmts, sked, ID and off. (D'Angelo, PA)

UNITED STATES - WJHR, Milton, 15555 at 1922 with Tom Wallace, Bible thumping, ID and more religion. (D'Angelo, PA)

VATICAN - Vatican Radio, 15565-SM Galeria in Amharic at 1550. (Brossell, WI)

QSL QUESTS - Al Caravan Radio emailed D'Angelo a full data reply for 5910.

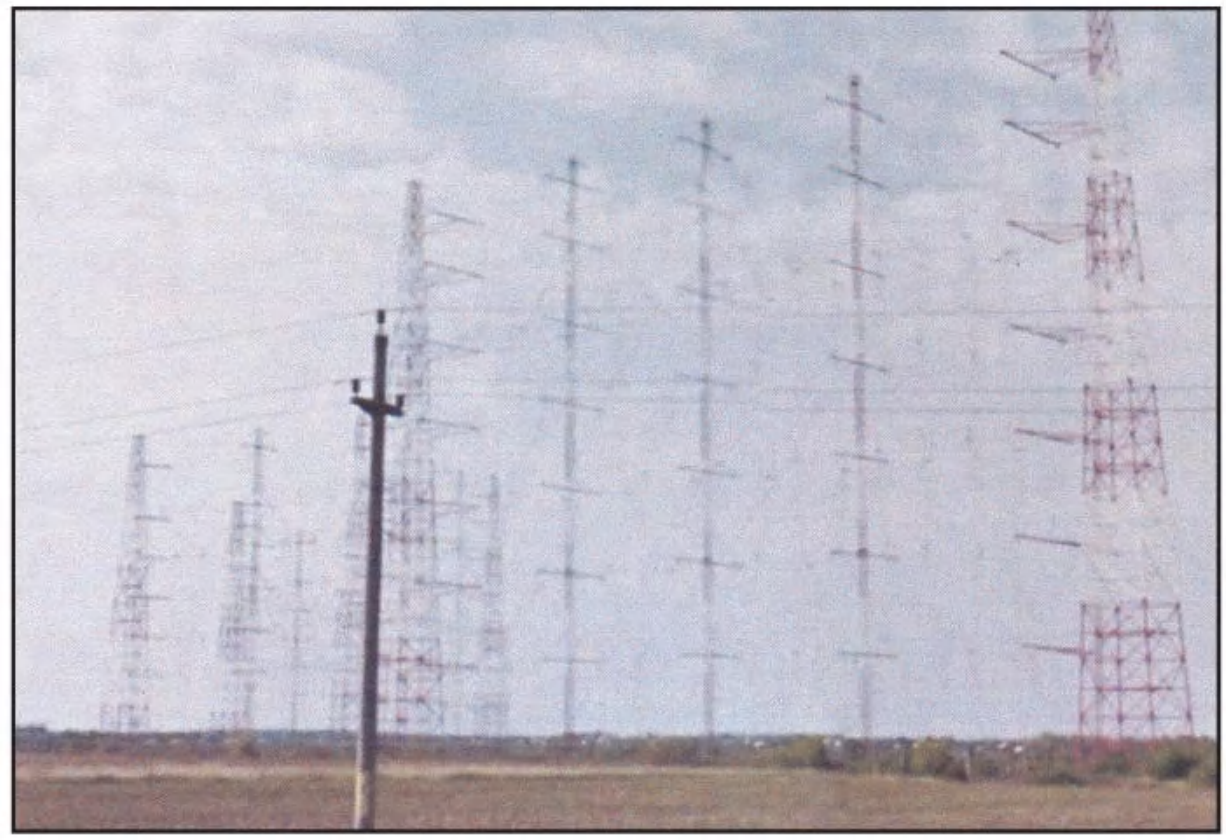
AS TIME GOES BY: Voix du Pathet Lao (clandestine), 9660 from Sam Neua in (l) Lao at 1212 on January 12, 1972

Just Saying...

My hospital stay put me way off schedule, so I was behind in getting the '23 WRTH. I'm just sayin', the new publisher, Radio Data Center in Freising, Germany, has every right to be exceptionally proud of their efforts. My only negative is the type face used, which I find rather hard to read! The continental maps are much improved and FM fans will find themselves well treated.

Thank You, Thank You

Back slaps, fist bumps and high fives to reporters: Mark Taylor, Madison, WI; William Hassig, Mt. Pleasant, IL; Rick Barton, El Segundo, AZ and Bob Brossell, Pewaukee, WI.



Tall towers at Tiganesti, part of Radio Romania International.

Seems almost everyone (including me!) began their shortwave careers with a Hallicrafters S-38b! (CQ archive photo by K2RED)

emergency communications

BY JOHN FERGUSON,* K3PFW

Ethereal Adornments – Part 1

Basic antennas and how they evolved

This is the first column of a series on antennas that we will revisit over the next several months. Granted, this is a column on emergency communication, but you are going to need an antenna or two if you plan on communicating. There is a reciprocity theorem that states, "Antennas work better when connected to a radio, and radios work better when connected to an antenna." Ever tried to tune up your rig when you forgot to connect the antenna? Ever wonder why that darn antenna wasn't hearing anything?

Antennas, their design and performance have probably been the subject of the more intense and emotional discussions in the amateur radio community over the years than almost anything else. Where did they come from? How did they evolve?

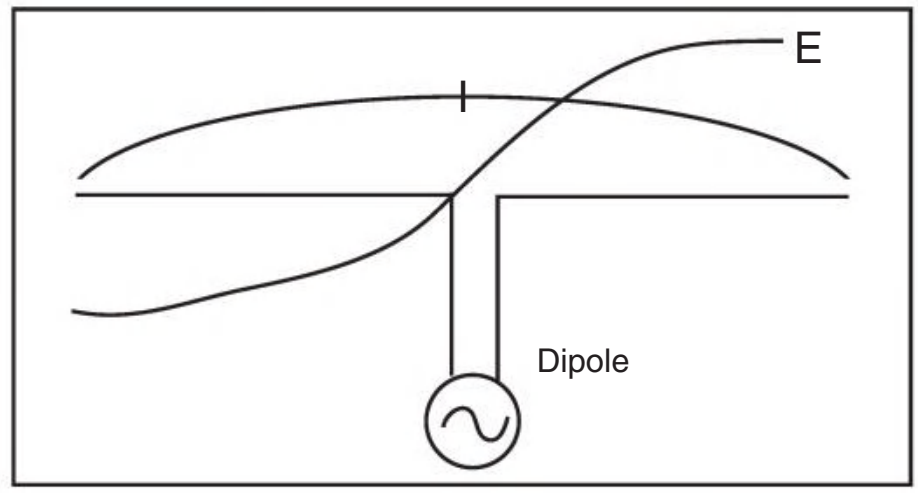


Figure 1: Dipole current (I) and voltage (E) distribution.

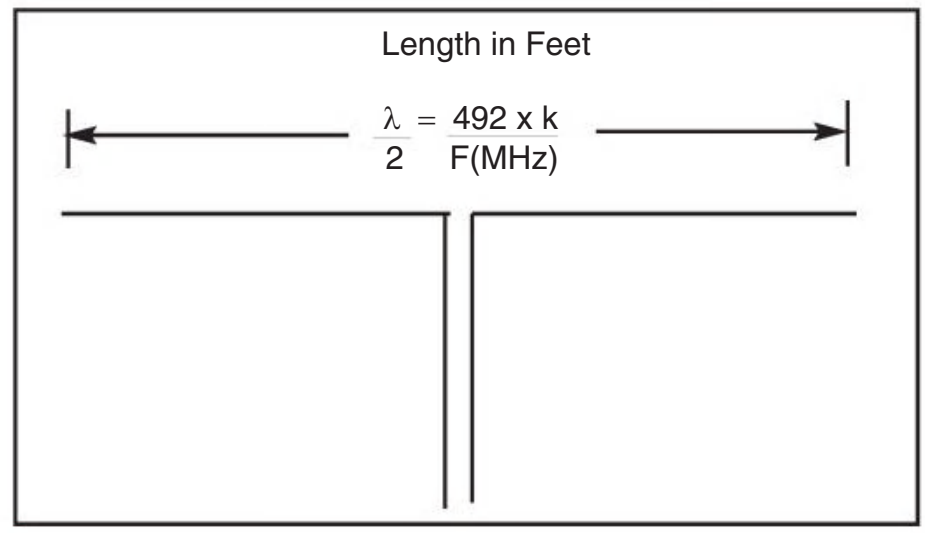


Figure 2: Dipole with balanced feedline.

A History Lesson

The German physicist, Heinrich Hertz, around 1885, proved Maxwell's Theory by creating and receiving electromagnetic waves, and thus radio was born. He found his discovery interesting but of little practical use. The Hertzian Antenna, which transmitted the first radio waves, we know today as the dipole. Hertz is also credited with the loop antenna, which he used as a crude receiver in his initial discovery, as well as the parabolic reflector we use in the SHF spectrum.

It was the work of an Italian nobleman, Count Guglielmo Marconi, that demonstrated the practical application of Hertz's discovery, when in 1895 he was able to transmit and receive signals over a one-and-a-half-mile path. He went on the span the English Channel, and later the Atlantic. The antenna he used we now call the vertical.

From the simple dipole and vertical, the development of antennas over the last 130 or so years has produced some amazing and interesting designs. Among others, that evolution has brought us the Yagi, and parasitic elements. It is my intent to explain, without a lot of math, the relationships behind the common antennas we use today.

Different Antennas

In Figure 1, we see the basic dipole with the voltage and current distribution that we would expect. The length of the dipole as commonly used in amateur radio is functionally a half wavelength. The formula in Figure 2, "Lambda (Greek letter for wavelength) divided by 2 is equal to the quantity 492 (related to the velocity of light) times "K", divided by "F", the frequency of interest in Megahertz (MHz)". This is the fundamental formula for establishing the physical length of a half wavelength conductor. The factor "K" is derived from a graph of the ratio of the conductor diameter to the half wavelength of interest. The graph can be found in many resources such as the *ARRL Handbook*, the *ARRL Antenna Book*, and textbooks on the subject. However, if we are primarily interested in medium frequency (MF) and high frequency (HF) dipoles using wire, the number "468" may be substituted for the quantity "492 x K." The factor "K" only becomes important as the diameter of the conductor becomes significantly large in relation to the wavelength. An example would be a piece of one-inch metal tubing for a dipole at 28.3 MHz. It would be shorter than a value derived by using good ol' 468 by about 2.5 inches. In the VHF, UHF, and SHF ranges this issue becomes critical.

In Figure 2, the 'elementary doublet" as it is sometimes referred to, is the antenna that was used here at my QTH for years. It was my only antenna for 75/80 and 40 meters. I also used it in Air Force MARS on the region and area nets. Note that the dipole is inherently 'balanced' and should ideally be fed with a balanced feedline. Usually, this is the parallel transmission line commonly referred to as "ladder line." Coaxial cable is inherently *unbalanced* (more on this in a moment). My dipole was 130 feet long, up about 50 feet, fed with lad-

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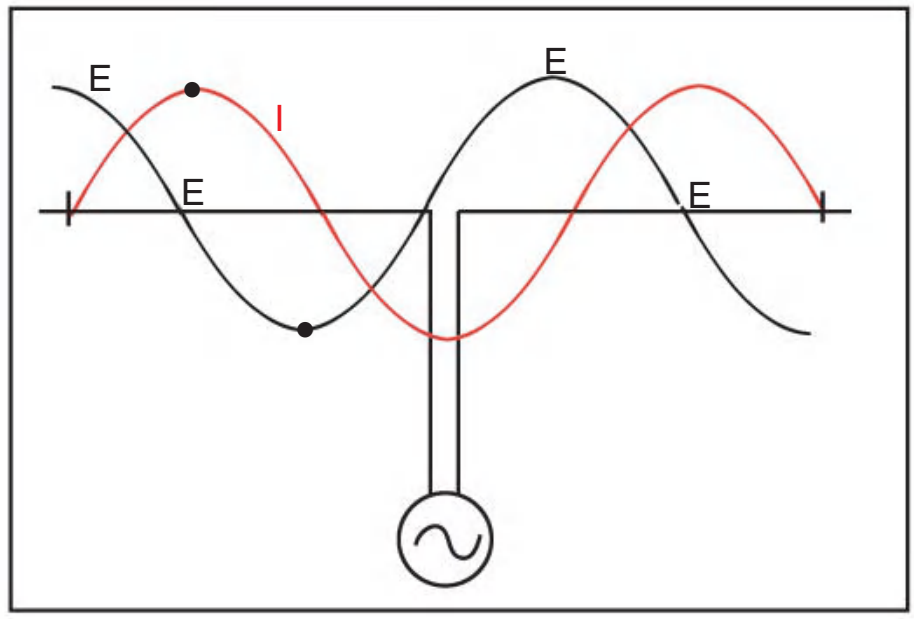


Figure 3: Third harmonic I and E distribution.

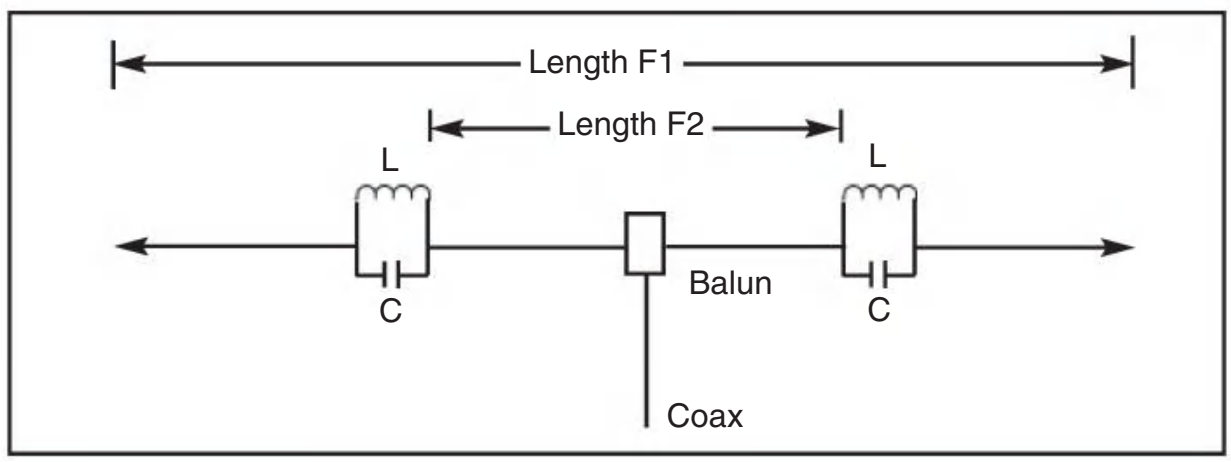


Figure 4: Two-band trap dipole.

der line. I used PVC conduit to route the feedline from where it entered the gable end of the house, through the attic, and down through the ceiling in the corner of the office/radio room. I used a balanced tuner, sitting on top of an equipment rack.

As technology has moved forward, and the "dip and tune" of the Pi network that us old-timers remember has passed. Today's rigs, although they may have a "tuner," are designed for coaxial cable. Yes, coaxial feedline is a neater, non-radiating (most of the time) solution. But dipoles don't like it. Enter the *balun*, a transformer-like device that will change balanced (bal) to unbalanced (un), and vice-versa. A balun with a 1:1 ratio at the feed point of the dipole will allow it to be fed with coax, and not upset the balance.

Using the formula in Figure 2, we can calculate the half-wavelength fundamental operating frequency of a dipole. The HF allocations we have are harmonically related, and this is both a blessing and a curse. A dipole will operate quite well on its third harmonic, so a 40-meter dipole (7 MHz), will also work on 15 meters (21 MHz), as in Figure 3. It won't work well on its second harmonic, unless the feed is something like the elementary doublet. The issue is the feed impedance. The two band trap dipole of Figure 4 was a staple found in many manufacturers' catalogs for years. Two parallel tuned circuits (traps), resonant at F2, effectively shortened the dipole to the higher frequency by isolating the ends. The two inductances also provided some "inductive loading" which allowed a physically shorter antenna for the lower frequency (F1). This helped fit an 80/40 trap dipole onto small residential lots.

So with multiple MF and HF allocations, size restricted real estate, and a small piggy bank, how do we operate multiple bands with minimal ethereal adornments? Hams are nothing but resourceful and creative. A relatively new entry on the multiband antenna scene is the End Fed Half Wave (EFHW) as shown in Figure 5. A high ratio, 49:1 or greater, balun matches the high impedance found at the end of a half wavelength wire to the unbalanced low impedance of coaxial cable and the modern transceiver input. Add an internal tuner in the rig, and you're good to go. It's not all "blue sky and calm seas," however. There are feed line radiation issues with currents induced on the outside of the coax shield. A short counterpoise, or an "isolator" usually takes care of this. The isolator is a 1:1 unbalanced-to-unbalanced (unun) type of transformer. Also on the horizontal end-fed antenna shelf is the end-fed "random wire." The "random" means it's not a resonant half wave at any frequency of interest. It's usually fed with a 9:1 balun, and suffers from the same issue of currents on the outside of the coax shield.

The comment sometimes made that "verticals radiate poorly in all directions" was probably due to ground losses.

Figure 6 is a schematic of the Marconi antenna, basically a vertical quarter-wave radiator as we know it today. It's sort of like taking a horizontal dipole, turning it up vertically and smooshing it into the ground. It is no longer a balanced radiator like the dipole and can be, and often is, fed directly with coax. The current and voltage distribution is the same as half of the dipole in Figure 1. Technically, as half of a dipole, it's called a monopole. The early commercial Marconi wireless antennas were necessarily huge, operating at wavelengths of 200 meters and greater. Much of the early maritime traffic was at 500 kilocycles (600 meters).

Since the vertical works against "ground," losses in the 'Earth' contribute to loss of efficiency and reduced signal strength. The comment sometimes made that "verticals radiate poorly in all directions" was probably due to ground losses. Radials, conductors a quarter-wavelength long, spread out around the base of the radiator overcome ground losses. The magnetic mount mobile antenna on top of your car uses the metal roof as the ground. Commercial AM broadcast stations (550 – 1600 kHz) use vertical antennas with an extensive field of radials. A quarter wavelength at the low end of the AM broadcast band is approximately 447 feet. The two common variations of the vertical in Figure 7, the "folded monopole" and the inductively base loaded vertical appear in commercial and amateur antennas. Base loading with a coil of the vertical radiator allows for a shorter radiator, and practical HF antennas for the mobile operators. The use of "capacitive hats" and other top loading arrangements can also physically shorten a radiator for a given frequency. A good example of this is the "Inverted L" in Figure 8. This configuration might allow you to get a reasonably decent 160 meter antenna on a residential lot if there are a couple of tall trees or other types of "sky hooks"

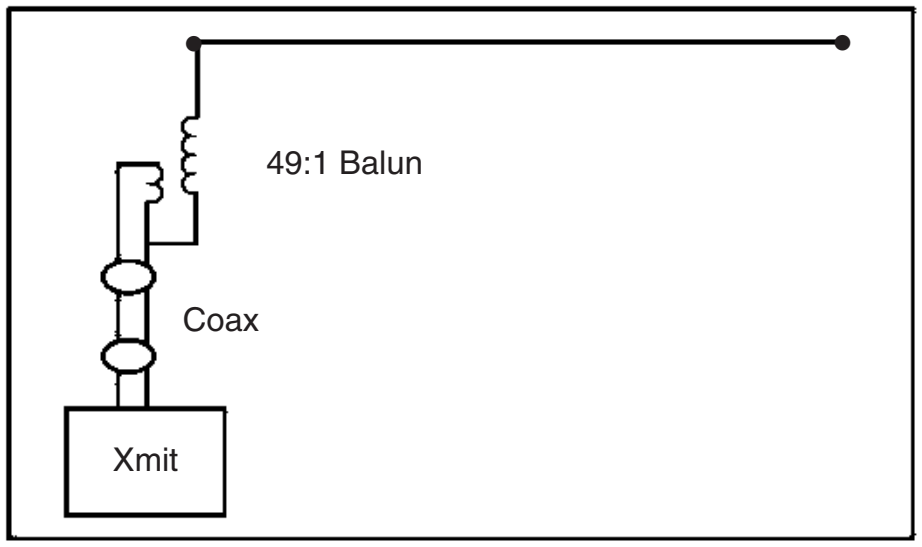
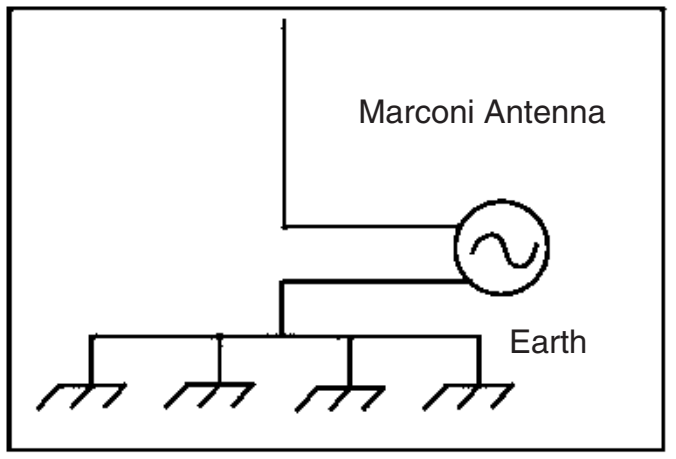


Figure 5: End-fed half-wave (EFHW).

Figure 6: Development of the vertical from a dipole.



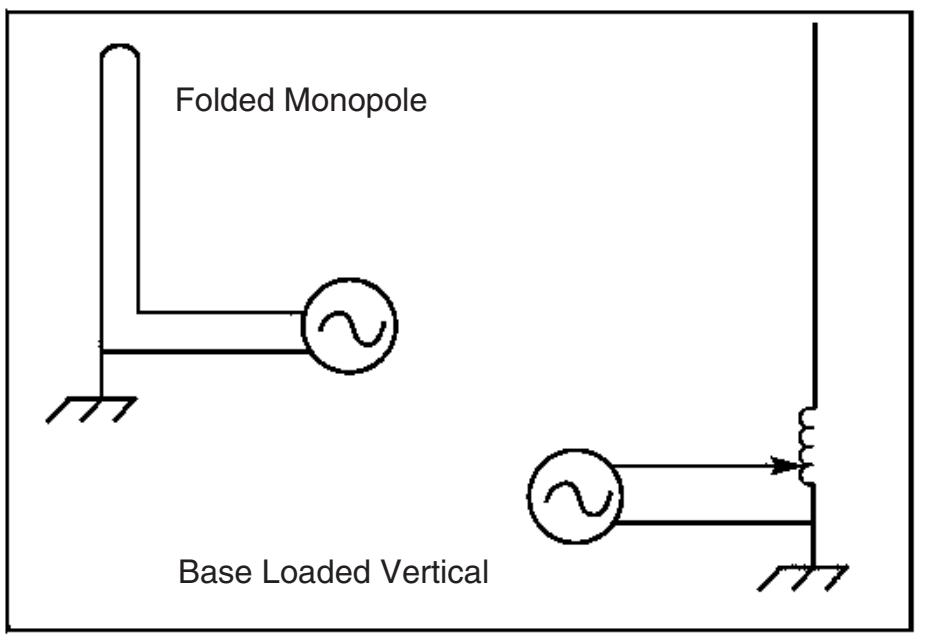


Figure 7: Vertical variations.

around. The “Inverted L” is sometimes described as a top loaded vertical, the horizontal wire acting somewhat as capacity top loading.

The range of antenna types and designs we have today evolved from the simple Hertzian radiator and its modification by Marconi and others. So what does all this mean for you, as you try to get a reasonable signal on the air? Study your unique situation. Review and evaluate what type of antenna might be appropriate for your individual situation. The more you narrow your search, the more likely you are to find something appropriate without wading through pages and pages of entries that don’t apply. The devil, you will find, is in the details. No one size or solution fits everybody’s situation.

For 30 meters (10.100 – 10.150 MHz) down to 160 meters (1.8 – 2.0 MHz), you are probably looking at horizontal wire antennas or a vertical. Horizontal dipoles are more likely to

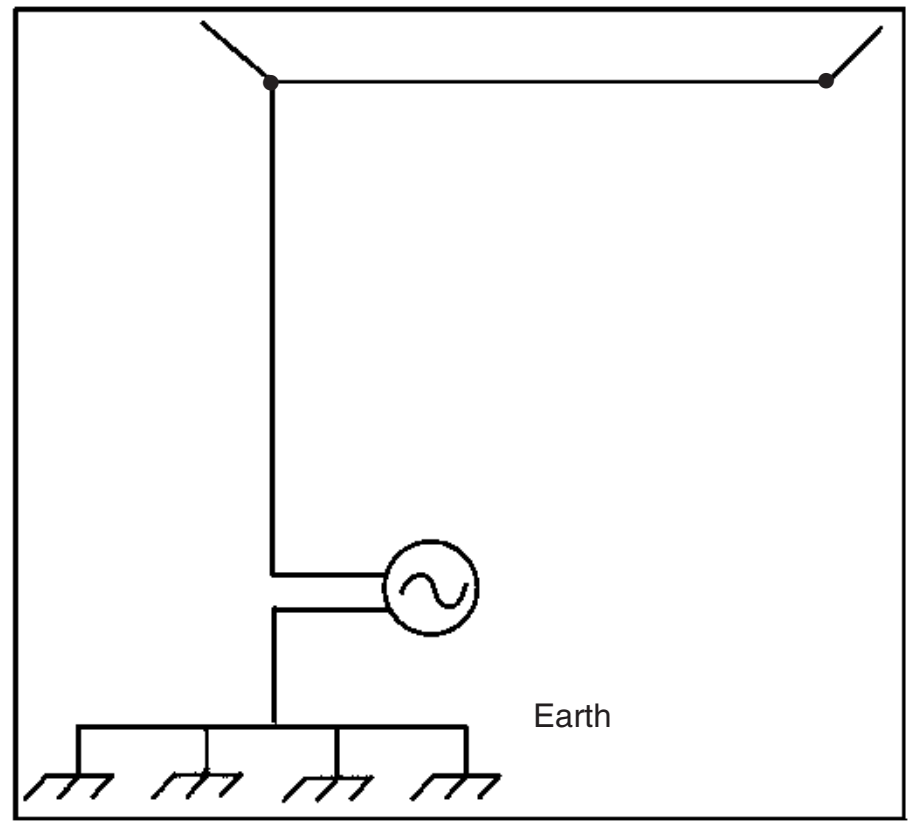


Figure 8: The inverted “L.”

get you a higher “take-off angle” than a vertical of any credible size. The take-off angle is the angle referred to the ground of the center of any major lobe of radiation. The height at which most hams are able to hang a dipole will not give you that nice pattern in the textbooks. That occurs when the antenna is at least a half wavelength above ground. Verticals of a good portion of a quarter wavelength tend to exhibit lower take-off angles, particularly over ground with good conductivity or an adequate number of radials. For 20 meters (14.000 – 14.350 MHz) and up, what you want to work, how much room you have, and the size of your piggy bank tend to make most of the decision for you. Beams, also known as Yagis (after their inventor, Prof. Yagi), are basically dipoles enhanced with elements called reflectors and directors. They offer directivity and forward gain. Wavelengths these frequencies are short enough that vertical radiators in the half and five-eighths lengths provide some inherent gain over the “quarter wave.”

It is impossible in 2000 words or so to even begin to cover all the details of even the most basic of antenna installations. The antenna itself, how it’s mounted, hung, etc. The type of feedline, tuner or no tuner, local coverage or DX; the list of details is lengthy. I would hope that the brief introduction to basic antennas will give you an idea of where to start your study and planning for the antenna(s) at your QTH and/or for deployable emergency/public service use. In future columns, there will be more detail on particular antenna types. There’s a 70-foot all band vertical in the planning stages here at the home QTH and I will most likely be sharing the details of the construction, installation and testing. A local ham, Bill Saunders, N3ID, has a favorite saying, “That which is not tested, will not work.” So do make testing part of your installation work.

Probably the most important thing to do is give priority to safety, in the design, in your work installing it, and in its operation. Then when you are all done, perform the now-required, as of May 3, 2023, RF exposure evaluation for controlled and uncontrolled areas. Then enjoy the fruits of your labor, and make some contacts. My station is now functional, so if you’re looking for an HF contact with Delaware, let me know and we will see if we can arrange a sked.

kit building

BY JOE EISENBERG,* K0NEB

A Long Schlep to Dayton and (a) Smoking Pot

My 42nd journey to the Dayton Hamvention was taken by car, around 800 miles each way from here in Nebraska. When flying, the amount of stuff you can bring with you is by nature quite limited. But this year, the things I was really after were quite small so I was able to drive. Of course, those were mostly kits and I brought a couple of them home with me.

For those who attended the Four Days in May seminars, a special treat was in store from Hans Summers, GØUPL (Photo A). Hans not only announced a great new kit, he had plenty of them there and ready for sale! The new kit is the QMX, a multiband SDR-based pocket-sized transceiver capable of both digital modes and CW operation. The kit is really kind of a merger

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Hamfest Hotline #5855

Photo A: Hans Summers, GØUPL, shows and sells his newest kit the QMX 5-band multimode QRP transceiver kit at Four Days in May during the Dayton Hamvention.

Photo B: From left, the new QMX pocket sized multimode transceiver kit, the QDX multiband digital modes only kit, and the QCX Mini CW single-band transceiver kit.

between the QCX Mini and the QDX kits, thus the QMX name (Photo B). It adds an LCD digital display and front panel mode and frequency controls of the QCX Mini to a multi-band SDR and promises in the future to incorporate SSB operation as well. Although SSB is not yet enabled in the QMX, it is one of many "magic" additions anticipated to be made by future upgrades to the firmware.

Summers stated he has incorporated lots of new undisclosed "magic" features into this kit, and as part of the assembly, you will be installing a microphone! The ability to add new functions to the QMX comes from the use of a CPU that is only using 25% of its capacity using the initial version of firmware. That gives it lots of space to add many more features. The form factor is identical to the QCX Mini single band CW transceiver kit. For portable operation, including SOTA and POTA, this kit is very small and capable of making many contacts while being compact and easy to operate. I have had great results on FT8 operating portable using my QDX, and the QMX has the same 5-watt digital mode output capability, but on 5 HF bands. The QMX operates on the 80-, 60-, 40-, 30-, and 20-meter bands.

Like the single band QDX, the QMX has a built-in sound card as well as CAT control, meaning only a USB cable is needed to operate digital modes with a PC. Like the QDX, all the surface-mount components are preinstalled. You only need to mount the through-hole parts, but keep in mind that those include 11 toroids. Many of these toroids are on a very compact core and include a trifilar, as well as two binocular style toroids, and a multi-tapped toroid (Photo C). These are very similar to the ones seen in the QDX and QCX. However, one toroid will have 8 leads, including a couple of one-turn wires. These wires actually do not make a complete turn around the core and just pass through their respective holes. As I have said before, you count turns on a toroid by how many times the wire passes through the center hole, and in this case these two leads each just pass through their center holes without wrapping around them. This special transformer is part of the system for measuring SWR, a new feature.

There are several small PC boards that are broken apart from the main board to form the smaller boards that make up the QMX (Photo D). It is very important to sand or file off the rough parts left after separation to allow them to fit the case properly.

Some of the toroid leads are thick enough to not be able to be passed through the PCB holes if they are pre-tinned, so using an emery board to remove the insulation from those specified leads would be a good idea. For some of the others, tinning is OK. Make sure to carefully read the instructions for each toroid as you wind them and prepare the leads as the ability of tinned leads to pass through the board is different on each toroid. In my next column, I will go over the processes I have found that need to be highlighted and then complete my assembly of this great new kit.

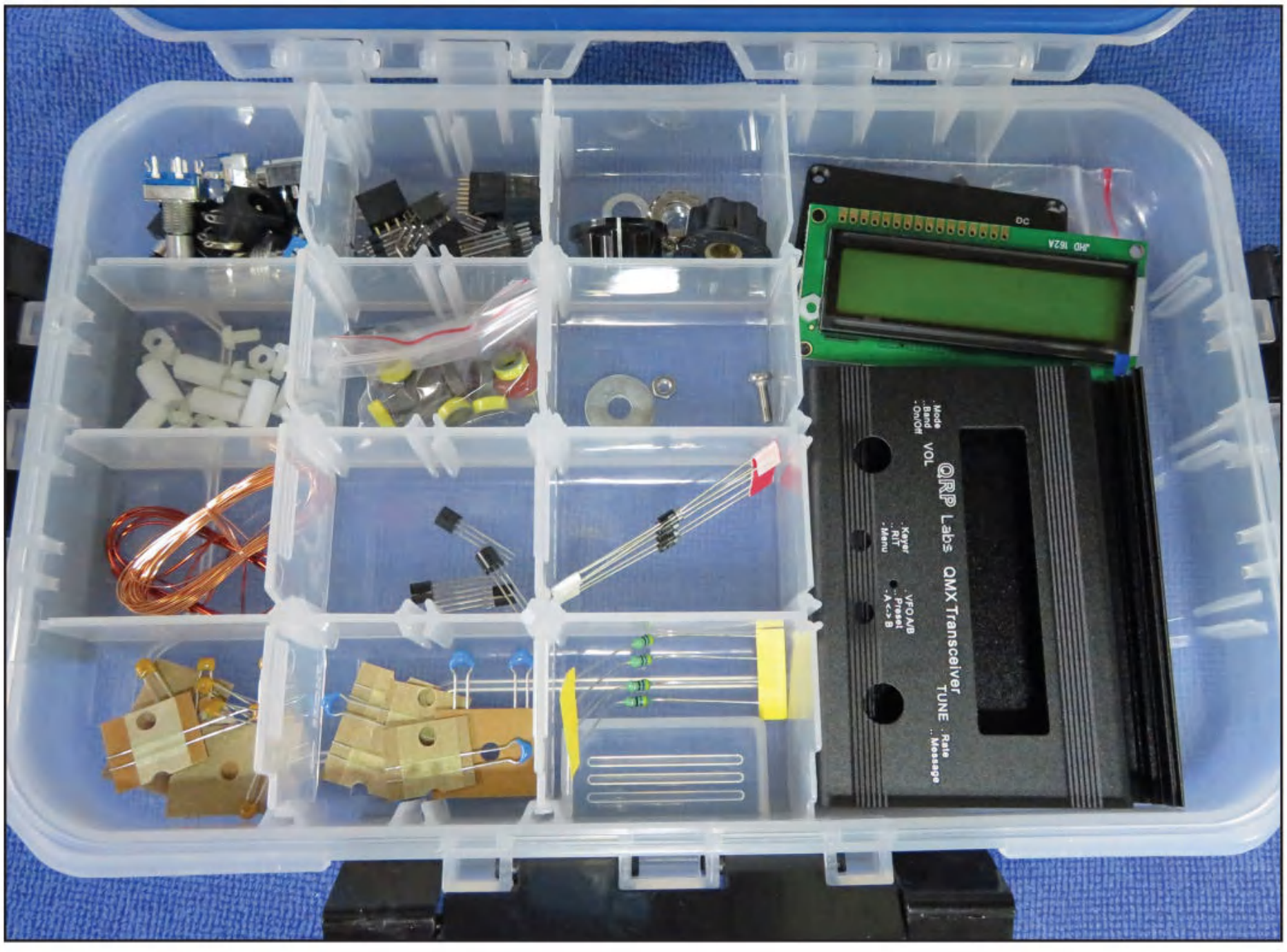

Photo C: The QMX parts are sorted and ready to begin assembly. Other than a trimpot, there are no resistors to mount!

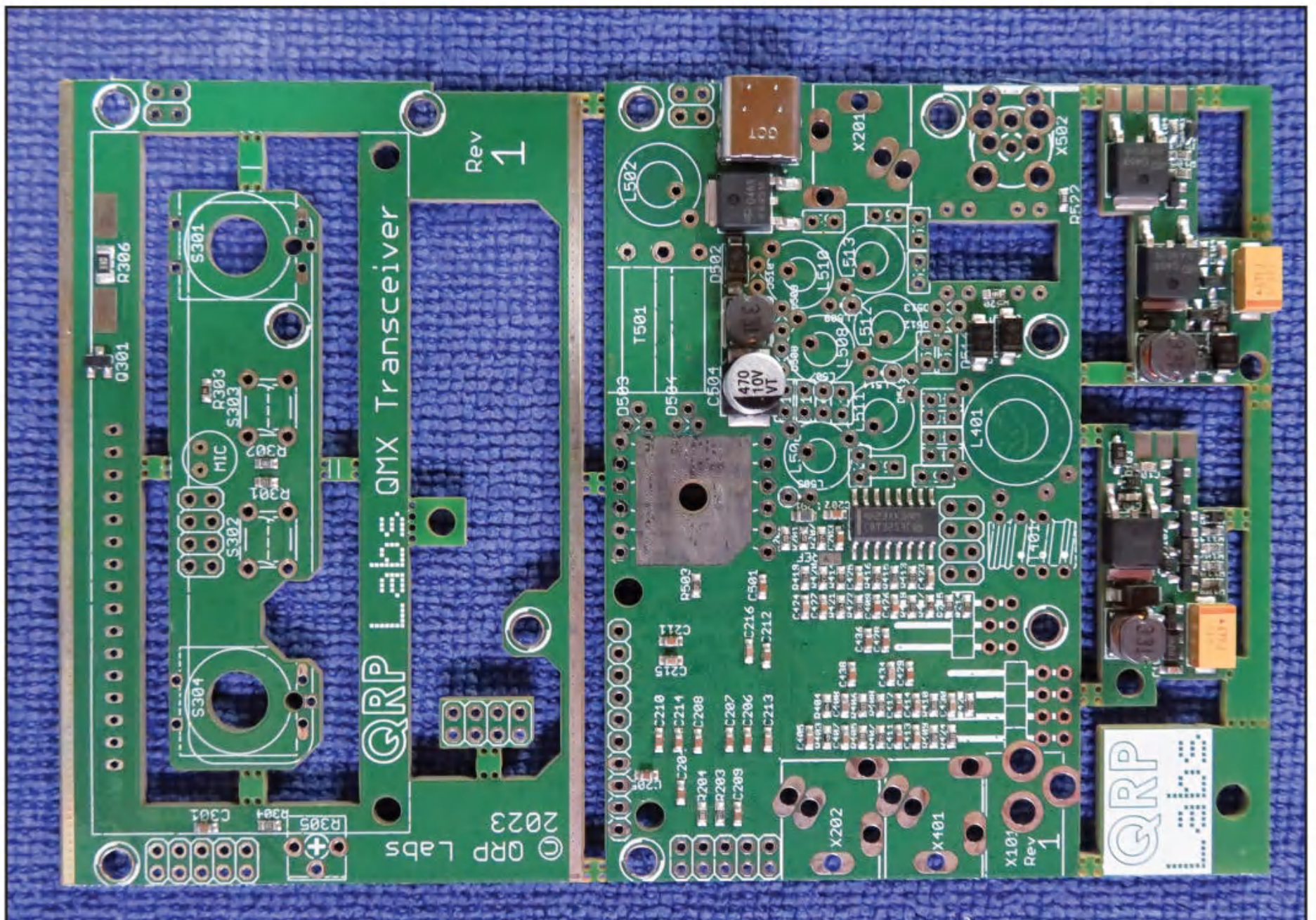

Photo D: The PC board is in multiple segments that must be separated before assembly. The QRP Kits logo segment on the lower right is actually a souvenir key fob tab!

You can order the QMX kits at <www.qrp-labs.com>, and I highly recommend ordering the matching case along with the kit.

Solder Pots

When working with kits that have a lot of wires that need to be prepared or toroids that can be tinned, a solder pot is a very useful tool. A solder pot allows you to tin wire leads and even strip and tin many toroid leads without having to hold a soldering iron and solder blob to the part. A solder pot is basically a bowl of hot melted solder that gives you a pool in which to dip wires as well as enameled wire leads. I found an inexpensive one on Amazon, but right after I got it I found that there are some drawbacks to this type of solder pot. The internal wiring has a ground lead rather loosely connected to a ground post that is painted, making for a poor or non-existent connection (Photo E). Should the heating element fail, it could allow the bowl or case to become energized with line voltage. Simply removing the bottom cover and using my Dremel® tool, I was able to grind off the paint on the lug side and then used a different screw of similar size and a nut to tightly secure the ground lug. I had success using 4-40 hardware (Photo F).

Solder for a solder pot is supplied in a 1-pound bar, and in order to fit the solder into the pot to be melted, it is best to use a hacksaw or other similar tool to cut the bar into smaller pieces, adding them in as the solder melts (Photo G). The solder suggested for a solder pot has no flux because that

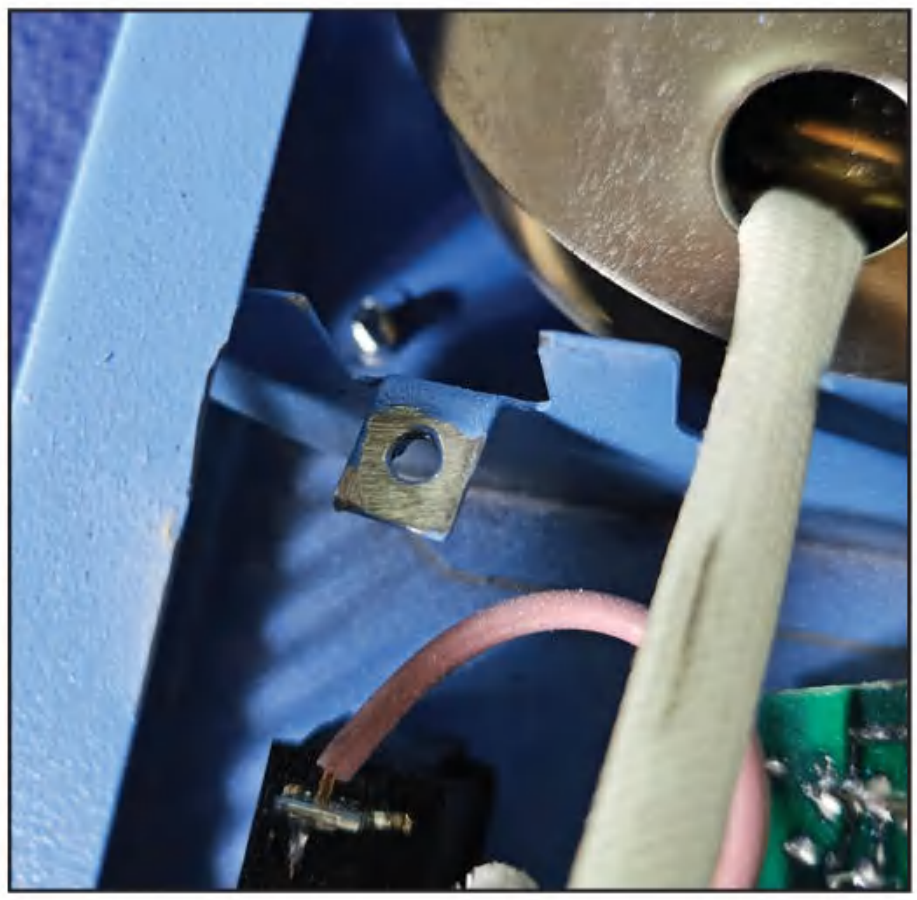

Photo E: The previously questionable ground connection with the paint taken off and ready to reconnect the ground wire.

would result in lots of toxic fumes as the flux was burned off in the process. Do not use solder that has any kind of flux at all. Even without flux there will be some smoke possible during the initial melting process. If flux is needed, the wire ends that need to be tinned can be dipped in liquid flux first. I found my solder pot on Amazon under a variety of names, but still identical for under $30.

I will continue with my look at using a solder pot as well as my adventures with the QMX kit in future issues (Photo G). Until next time, 73 de KØNEB

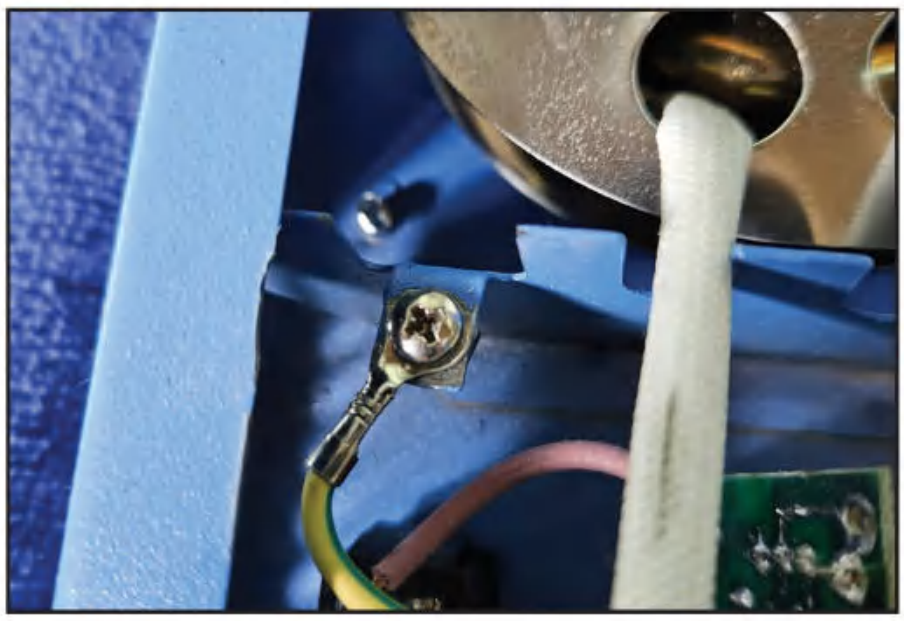

Photo F: The improved ground connection is complete and the case bottom is ready to be put back on.

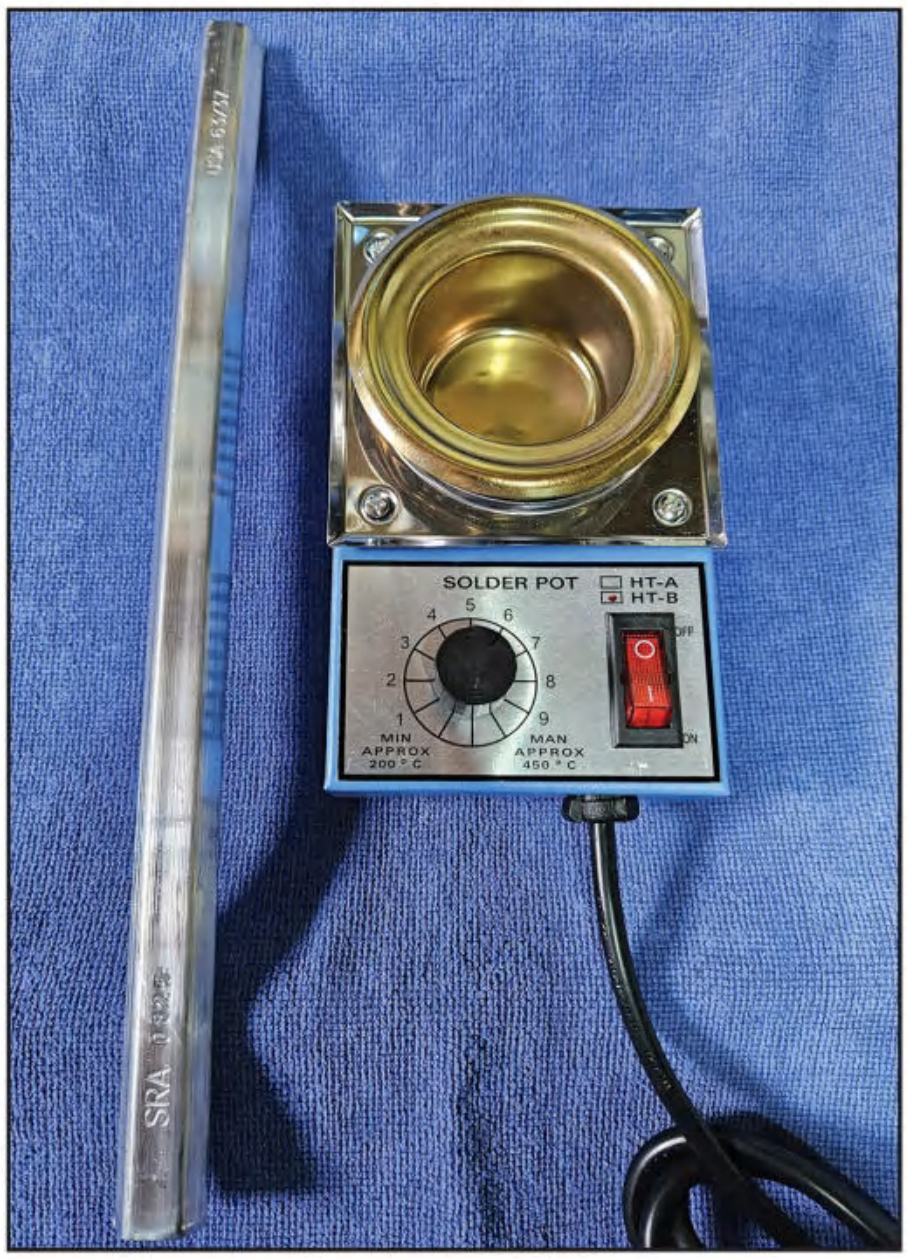

Photo G: The one pound bar of 63/37 solder is ready to begin being melted into the solder pot. Be sure to break it up using a hacksaw or similar tool to speed up the process.

learning curve

BY RON OCHU, KOØZ

H.R. 4006, All For One and One For All!

As a matter of courtesy, I try to avoid political, religious, and money discussions over ham radio. I try to heed the advice the Irish satirist Jonathan Swift gave in 1721, "You cannot reason someone out of something he or she was not reasoned into." Sometimes these topics, especially contentious ones, can lead to arguments that can quickly generate more heat than light. Not a pleasant experience to be involved in either as a participant or a listener. As ham radio operators, we must constantly remind ourselves when we are on the air, we are ambassadors of goodwill. Our radio emissions know no geographical boundaries. However, for us to be on the air, we need antennas from which to tickle the aether (ionosphere).

Antenna Restrictions

Radio amateurs are finding it increasingly difficult to erect even modest antennas if they live anywhere close to a metropolitan area. Sprawling subdivisions come with HOAs (homeowners associations). According to Rocket Mortgage's definition, "Homeowners associations – HOAs for short – are private organizations that oversee the management of some residential communities. HOAs establish sets of rules and regulations called bylaws for those living in the community to follow. They're most often found in charge of common-interest communities, such as planned neighborhoods, townhouses and multi-unit apartment buildings or condominiums," <https://www.rocketmortgage.com/learn/hoa>. Unfortunately, ham radio operators and their antennas are not always favorably found to be within the "common-interest" of some communities, partly as a result of boiler-plate language. Many HOA's use already established, written guidelines and by-laws that exclude antennas. Three decades ago, the FCC (Federal Communications Commission) struck a balance between localities and ham radio stations by requiring "reasonable" accommodations for amateur antennas. However, the FCC policy specifically excludes from its scope HOA requirements as voluntary private contracts.

Rural vs. Suburban – A Matter of Perspective

I've lived in both semi-rural and suburban America. Living in a St. Louis, Missouri metro suburb, I am restricted to one 40-foot tower/antenna structure. I needed to get a building/construction permit and to have it inspected. When I lived in central Illinois in a small rural town, the city did not require any building permits and I could put up as many towers as I wanted with no height restrictions! On the other hand, not far from my home, a homeowner kept a blue tarp over a storm-damaged roof for well over five years! When I moved back to my property in St. Peters, I brought my disassembled antennas and stored them in my backyard suburban lot. Within a couple of months, the city reminded me by letter that I could only have one tower/antenna structure. Evidently, some anonymous, nosy neighbor saw my neatly stored, disassembled antenna aluminum, and felt compelled to call the city. Fortunately, I have my permit from thirty years ago, so nothing came of it, except for a reminder. In the rural area, hardly anyone cares, but in a metropolitan subdivision, just one discontented person can upset the balance. Both cases are a matter of perspective. Cell phones are a modern-day necessity. Cellular phone service needs towers. In rural settings, cell phone towers are in plain sight. On the other hand, suburban areas try to disguise cell phone towers as massive flag poles with huge flags (Photo A). Often, these cell phone towers are higher and more obtrusive than any typical suburban ham radio tower installation. For many city-lot dwelling radio amateurs, it may not be practical to move out into the country. For that matter, many rural counties are starting to adopt antenna restrictions. The problem of antenna zoning restrictions is no longer just an urban/suburban issue. At first glance, finding a reasonable compromise for hams may appear to be a losing battle. However, hope springs eternal

Another Perspective

Thankfully, there are reasonable politicians with vision and appreciate ham radio's value to America's national interests!

Photo A: A suburban cell phone tower masquerading as a flagpole in an area with antenna zoning restrictions.

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Ham radio proves itself time and time again during emergencies by providing communications during the emergency and for public service events. *CQ* magazine provides ample coverage of these stories. Let's not forget that ham radio also further serves the national interest by providing STEAM (science, technology, engineering, arts, and math) training. Hams dedicate their personal resources to making technology work. A case in point – a few years ago, while I was living in central Illinois, an EF3 tornado tore through three rural counties. Before it was spent, it damaged a town that provided my internet service. I was without internet service for over three days. I needed to send storm-related data files to the National Weather Service's St. Louis office. I used W9FE's HF Winlink gateway station (which did have internet capability) to transfer the files in a timely manner to the NWS. This is just one small example out of hundreds that ham radio operators make on a year-round basis. It's deeply gratifying when our elected officials recognize the Amateur Radio Service's contribution to our nation's national interest with supportive legislation. Especially when the proposed legislation is a truly bi-partisan, meaningful well-written bill that can positively affect radio amateurs.

Photo B: Representative Bill Johnson, OH-6 is a co-sponsor of bi-partisan H.R. 4006. (Source: Rep. Johnson's website)

Photo C: Representative Joe Courtney, CT-02 is a co-sponsor of bi-partisan H.R. 4006. (Source: Rep. Courtney's website)

House Resolution 4006

Earlier, I wrote, "I try to avoid political, religious and money discussions over ham radio." However, (I was tempted to use the word, "but," but there is always a but, isn't there?) in the case of HR 4006, I wish to make an exception. This proposed bill not only recognizes the importance of the Amateur Radio Service, but it also provides concrete, factual reasoning as to why radio amateurs are vital to national interests. Most importantly, this proposed bill provides for enforcement of its provisions. This proposed bill will not give urban/suburban ham radio operators free reign to erect anything they'd like, but it does strike a *reasonable* balance with local regulatory agencies and radio amateurs. This bill offers a win-win compromise which should accommodate most interests. H.R. 4006 is bipartisan. Representative Bill Johnson (R) OH-06 (Photo B) and

Representative Joe Courtney, (D) CT-02 (Photo C) are the sponsors of the resolution. H.R. 4006 isn't the first resolution supporting ham radio antennas to have been introduced before Congress. This House Resolution incorporates prior language used in past attempts to pass a "radio amateur antenna friendly bill." Congressman Bill Johnson released the following statement after introducing H.R. 4006, the Amateur Radio Emergency Preparedness Act, to govern private land use restrictions on amateur radio: "Antennas are essential for all wireless communication, whether TV broadcasts, wireless internet, Wi-Fi, or amateur radio. Existing federal law provides for the installation of TV broadcast and wireless internet antennas and satellite dishes at private homes, but amateur radio antennas are not included in the statute as currently written. This bill would correct that."

"I reintroduced the Amateur Radio Emergency Preparedness Act to remove barriers to disaster and emergency communications and training, and to promote education in STEM subjects related to critically needed wireless technology," Rep. Johnson said. "Passage of this bill will promote developing and sustaining our nation's wireless future and facilitate and encourage amateur radio operations as a public benefit."

"As their actions during recent natural disasters such as Hurricane Sandy proved, amateur radio operators in Connecticut can be a critical component of disaster response and emergency management. It is in our communities' best interest that we give them the capabilities to operate at the highest level, and with the re-introduction of this bill, we've taken a strong step in that direction," added co-sponsor Rep. Courtney.

Why Bother?

One may ask, why should I even bother with this latest legislative attempt? Sine all politics is local and political subdivisions such as HOAs are encroaching on radio amateurs to erect even modest antennas in subdivisions, it behooves hams to advocate for our need to erect reasonable antenna structures. If we naively think, like in a Hollywood western, the calvary is going to save us in the nick of time, then think again. We, as ham radio operators, *are* the proverbial calvary and we *can* make a difference. After all, the squeaky wheel is the one that gets the grease. A bi-partisan bill, introduced early on in the legislative session has a better chance of passing both the House and the Senate. Democracy can, at times, be infuriatingly slow. It takes repeated attempts to push a bill through the legislative process. Much like the process of water carving out a landscape over time, constant pressure brings about change. Does this resolution address every antenna zoning issue? No, but it does go a long way, if passed, to allow radio amateurs to erect reasonable antennas. If you care to read H.R. 4006 here's the link: <https://tinyurl.com/htm7979v>.

Participating in the Legislative Process

There are a number of things requiring a little time and effort that we can do to support H.R. 4006. For some reason, people are reluctant to contact their Congressional representatives. Congressmen have staff that tally up constituent emails, letters and phone calls urging the legislator to support or not to support legislation. If they only hear from lobbyists against H.R. 4006 and not from ham radio constituents, then the legislator may think there is little enthusiasm for it within the ham radio community in his/her legislative district. Remember the adage, "all politics is local?" Make your Congressperson aware you support H.R. 4006. Send an email or post a letter urging your legislator to co-sponsor H.R. 4006. It isn't hard to do and it will allow you to participate in the legislative process.

Talking Points

Your email to your congressman does not need to be lengthy. Include a few talking points about why ham radio antennas serve our national interest. Ham radio provides emergency and public service communications. Ham radio creates a national pool of trained communicators. The Amateur Radio Service utilizes STEM (science, technology, engineering and math). Ham radio operators are FCC-licensed. Urge your family and friends to send an email. The more the better! I remember a congressman from 40 years ago told me at the time, for every letter received regarding a bill, the staff calculated that between family and friends there were 20 additional constituents with the same opinion. I bet things haven't changed too much since then, except snail mail is replaced with email.

Phone Calls

If you're so inclined, make a phone call to your legislator's office urging him/her to co-sponsor H.R. 4006. It's highly unlikely you'll actually chat with the congressperson, but staff will gladly pass your message to the legislator. Legislators have an office in Washington D.C. and an office somewhere within their legislative district. A Google search will give you phone numbers and addresses.

Pay the Legislator a Visit!

Emails and phone calls are helpful. What's even more effective is taking the time out to visit your congressperson's district office. If Congress is in session, it isn't necessary to travel to Washington D.C. A visit to the legislator's district office is very effective. When I lived

Photo D: A photo taken five years ago of the Taylorville, Illinois, district office of Rep. Rodney Davis, IL-13.

Photo E: Congressman Davis's Taylorville district office secretary. She was very polite and receptive. We had a very nice, short meeting regarding ham radio antennas which resulted in the congressman co-sponsoring pro-antenna legislation.

in central Illinois, my congressional district was IL-13. The Honorable Rodney Davis was my congressperson. I urged local clubs to support a House Resolution similar to H.R. 4006 in our club newsletter. I printed up some letters urging Mr. Davis to co-sponsor the resolution and I brought them to the monthly club meeting. I asked club members to include their address and signature on the letter to prove they were constituents. Next, I made a trip to Mr. Davis's Taylorville, IL office (Photo D) one afternoon and introduced myself to his secretary (Photo E). She politely listened to me as I explained why I felt Mr. Davis should support the resolution and I gave her the letters. She was very nice and told me she'd send them to the congressman. It was a very pleasant visit and she thanked me for taking the time to make my views known. It took a total of ten minutes. Approximately two to three weeks later, I received a letter from Mr. Davis informing me that he would co-sponsor the bill! Unfortunately, that particular resolution was introduced late into the legislative session, and it never got onto the House floor for a vote. Selecting a club representative or two to pay your congressperson's office a visit can be a fun and very worthwhile activity. Why you're at it, invite the legislator to Field Day or a club meeting the next time he/she is back in town from Washington D.C. He or she just may take you up on the offer!

Contact the House Speaker

In addition to contacting your congressperson, and if you're enthusiastic, don't stop there. Email the House Speaker, the Honorable Kevin McCarthy, urging him to encourage the House to support H.R. 4006 and move it out of committee and put it to a vote on the House floor. If enough ham radio operators take the time to make their voices heard, then maybe, just maybe we can get this proposed bill out of the House and on to the Senate. If it gets to the Senate, then we will start this process over again with our respective state senators. Democracy is a deliberate process requiring a little work.

All for One and One for All!

Dumas' The Three Musketeers' motto of, "All for one and one for all" applies nicely to what we as a ham radio community can do to assist each other and our nation. Hopefully, this article's reasoning makes sense. Allowing everyone, especially urban/suburban ham radio operators to erect and maintain reasonable antennas does serve our nation's interest. Some rural areas are increasingly no longer immune from antenna zoning restrictions. To quote Ben Franklin, "An ounce of prevention is worth more than a pound of cure." Thank you for reading *CQ* and I hope to hear you on the air.

73, Ron KOØZ

homing in

BY JOE MOELL,* KØOV

Foxhunters Win Medals in the Lone Star State

"I had no idea what I was getting myself into." That's how Michael Hart, KC6MEH, replied when I asked about his first time competing in USA's national championships of Amateur Radio Direction Finding (ARDF). Michael had limited experience at first, but by the time he went home, he was enthusiastic and eager to teach the sport to hams and Scouts in his hometown.

KC6MEH was one of 26 male and 8 female foxhunters who traveled to eastern Texas in mid-April for the 22nd annual USA Radio-Orienteering Championships. They came from nine states plus Ontario, Canada. All competitions took place in the 3026-acre Cooper Lake State Park (CLSP) near Sulfur Springs, Texas, which is about 95 miles northeast of the Dallas/Fort Worth airport.

New Mexico Orienteers was the hosting organization, using maps provided by the North Texas Orienteering Association. The Event Director was Jerry Boyd, WB8WFK; course designers were Nadia Schlarlau, KO4ADV (sprints), and Charles Scharlau, NZØI (all others). Additional logistics and communications support was provided by Backwoods Orienteering Klub and White Rock Lake Amateur Radio Club.

The main feature of CLSP is Jim Chapman Lake, a popular summer destination for boating, fishing, swimming and water skiing. The foxhunting courses were by the south shore. Tent and RV camping was available. Non-campers stayed in nearby hotels.

Matthew Robbins, AA9YH, demonstrates the FoxRex 3500 80-meter ARDF set by Rig Expert to first-timer Michael Hart, KC6MEH. (Photo by Bob Frey, WA6EZV)

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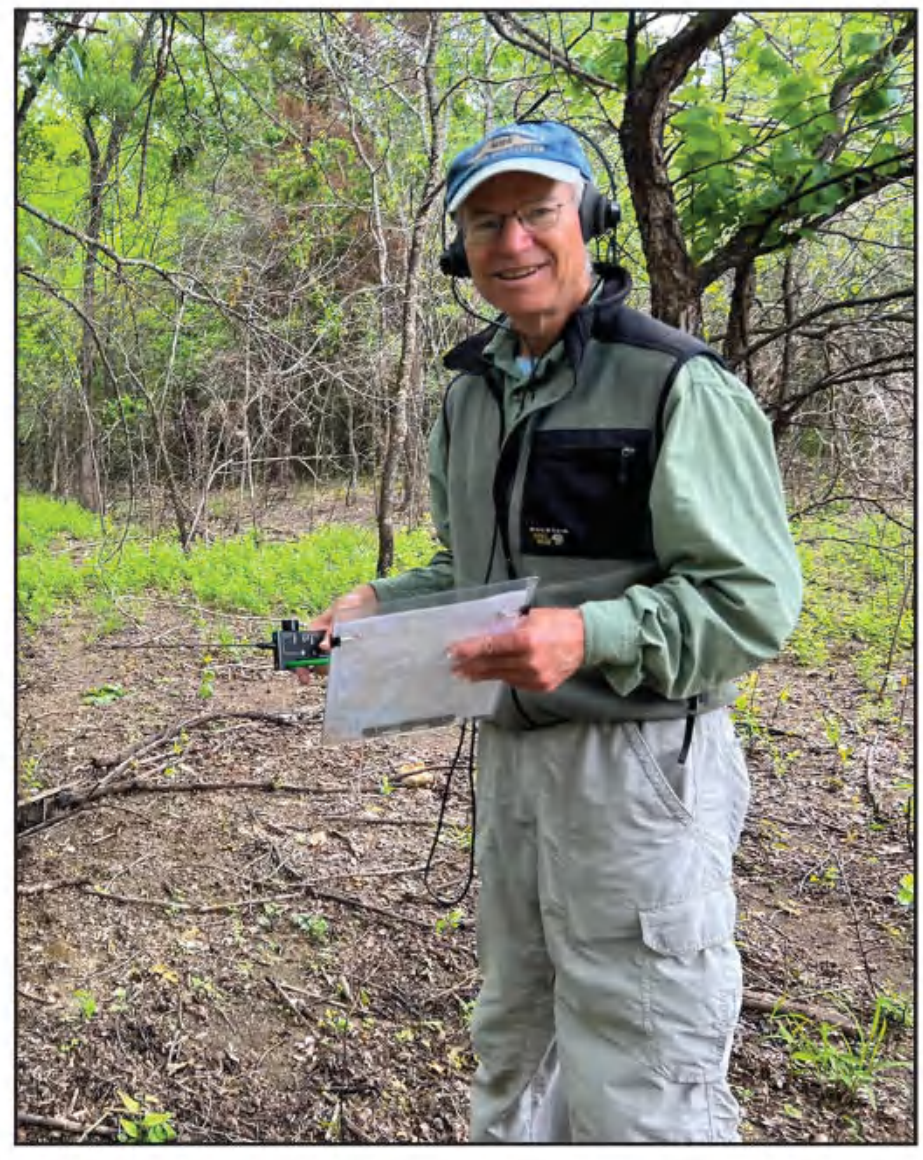
The gathering point each day was a group shelter on the lakeshore. Practice, training and equipment testing took place on Wednesday, April 19, with transmitters on two-meter AM and 80-meter CW, in accordance with the detailed rules developed over three decades by committees of the International Amateur Radio Union (IARU).

Start With a Sprint

Thursday was the first day of formal competition. The day's event was the sprint, which was added to championship ARDF in 2012. A sprint course has two loops. The first has five slow-keyed 80-meter transmitters on one frequency, each transmitting for 12 seconds in sequence. The second has five fast-keyed 80-meter transmitters on another frequency, sending the same sequence. Competitors run through the start corridor leading to the area with slow-keyed transmitters.

After finding all of the required transmitters from the first loop in any order, they run through a spectator corridor to the area with fast-keyed foxes. After finding all required transmitters from this loop in any order, they run to the fin-



Bill Wright, WB6CMD, has been on ARDF Team USA to the world championships frequently since his first trip in 2016. He told me that he was happy about being consistent at this year's national championships, taking second or third in his category in each event. (Photo by Ken Harker, WM5R)

ish line. After checking in at the shelter, competitors set out on a 3.2-kilometer trail hike to the starting area. According to competitor Bill Wright, WB6CMD, it was best not to hurry. "You don't want to wear yourself out before you even start and then have to walk back afterward."

The terrain in this part of Texas is much different from the runnable forests that are typical ARDF sites elsewhere. Bill explained, "The maps had been used for an orienteering meet three years ago. In that time, vegetation changes and those changes are usually for the worse. I saw white on the map and thought it's runnable, but it really should be dark green because I had to fight to get through it."

To make it easier and safer, the course designers kept the transmitters close to the many trails. But competitors had to discover this for themselves. "The map was pretty good for some parts of the course," says Bill, "but for some other parts it wasn't. The sprint area was OK and pretty level. It looked on the map like you could run through it, but I tried it and got chewed up by the vines."

Imre Polik, KX4SO, was fastest in M21 (males ages 21 to 39), which was the only category required to find all ten sprint foxes. He did the 2.6-kilometer course in 47:36. The fastest pace on the sprint course was that of Vadim Afonkin, KB1RLI, who found his required eight transmitters on a 2.4-kilometer course in 25:48.

Friday's event was foxoring, another relatively new event that closely resembles classic orienteering because there are circles on the provided map near the continuously-transmitting QRP 80-meter transmitters. Competitors use their orienteering skills to get to the circle locations, then perform direction-finding to home in on the foxes that can only be heard there. The foxoring course was in another part of the south shore area, with a 1.2-kilometer hike to the start and then a hike back afterward.

Thunderstorms on Thursday afternoon kept the course-setters from completing placement of all of Friday's foxoring transmitters then, so the start of foxoring had to be delayed. One transmitter was non-operating, apparently damaged by a storm. It was a required fox for about half of the competitors. Most attempted to find the flag by sight once they had orienteered their way to the map circle. Norbert Linke discovered it in 3 minutes and 2 seconds and some others did it in less than four minutes. Norbert's total time on the 5.4-kilometer ten-fox course was 52:09.

On to the Classics

The first classic event took place on Saturday. These transmitter hunts are called classics because they were the first form of radio-orienteering, beginning over forty years ago in northern Europe and Scandinavia. Five transmitters are placed in a wooded area of 1000 acres or more. They transmit for 60 seconds each in rotating order on the same frequency.

Competitors are individually timed as they travel from the starting point to the finish, finding the transmitters required for their category along the way in any order. To ensure fairness, there are many additional rules for classic events, covering impounds, start procedures, course monitoring, protests and so forth.

Two sets of transmitters were in the woods this day, one set on 80-meter CW and the other on two-meter AM. Persons in the categories for men ages 21 through 59 sought the two-meter transmitters and all others looked for the 80-meter transmitters. Another lightning-caused problem was discovered this day when one two-meter transmitter would not transmit the standard MCW tones in the AM mode. It was switched to FM mode, which worked but was difficult to tune in on some of the European AM ARDF receivers.

Tony Levand, AA9CC, studies his map and gets ready to begin an 80-meter course in 2022 with his large RDF loop. This year, he captured M60 gold on the two-meter course in the rain on Sunday. (Photo by Imre Polik, KX4SO)

On two meters, Vadim Afonkin found his required four transmitters on a 5.3-kilometer course in 1:10:40 for the best time of the day. Norbert Linke had five required transmitters to find and he did the 7.2-kilometer course in 1:22:17. On 80 meters, the best male time was turned in by Iurii Kolesnykov for three required transmitters on a 4.4-kilometer course in 39:40 and the best female time was by Adalia Schafrath-Craig for three required foxes on a 3.9-kilometer course in 56:45.

It is typical for 80-meter course times to be faster on average than equivalent two-meter courses. Eighty-meter signals do not reflect from terrain features to cause incorrect and confusing bearings like two-meter signals often do. The nulls on 80-meter ARDF sets provide sharper bearings than the pattern peaks of two-meter Yagis. In addition, 80-meter receiver-antenna sets are smaller, lighter and less awkward to carry than two-meter sets

A Day of Cold Rain

Sunday, the final day, featured another classic event. Those who hunted on two meters on Saturday sought 80-meter transmitters this day, and vice-versa. Once again, weather bedeviled the organizers, delaying transmitter placement. The original plan was to relocate all of them to prevent any unfair advantage of familiarity. However, many participants had tight travel plans and the weather delays threatened to keep them from finishing in time to make their flights home. So the 80-meter courses from Saturday were unchanged and only the short-course two-meter transmitters were moved. All competitors were on the honor system to not disclose any information about the Saturday courses to those who would run them on Sunday.

On eighty meters, the best time of the day was 44:04 by Norbert Linke for all five transmitters on a 6.7-kilometer course. On two meters, best time for four required transmitters was 1:22:48 by Tony Levand, AA9CC on a 4.6-kilometer course. For three required transmitters, best was

Adalia Schafrath-Craig won first place in the category for women age 19 and under in foxoring and both classic events. (Photo courtesy Robert Haddow, VE3RXH)

KO4ADV at 58:24 for a 4.3-kilometer course. AA9CC wrote that there was constant rain and 50-degree temperatures. "It was typical Chicago weather, but darn cold for Texas."

Silver medalist William Wright, WB6CMD said, "I was much slower than usual. It was very muddy and slippery and I was being very cautious. I didn't notice any problems with two-meter signal reflections because the terrain was pretty flat and we weren't close enough to the lake to get reflections from the water. But I did notice that my bearings weren't as trustworthy, perhaps because of the rain and wet trees. They were frequently in error by up to 45 degrees."

Congratulations to all of the gold medal winners. They are, in alphabetical order: Elizabeth Afonkin (W19 sprint); Vadim Afonkin, KB1RLI (M50 sprint 2m); Matt Craig (M50 foxor); Robert Frey, WA6EZV (M70 sprint foxor 2m 80m); Erin Hammer (W35 sprint 80m); Iurii Kolesnykov (M60 sprint foxor 80m); Natalia Leoni (W55 sprint); Tony Levand, AA9CC (M60 2m); Norbert Linke (M21 foxor 2m 80m); Nicolai Mejovoi (M50 80m); Alla Mezhevaya (W45 sprint foxor 2m 80m); Imre Polik, KX4SO (M21 sprint); Adalia Schafrath-Craig (W19 foxor 2m 80m) and Nadia Scharlau, KO4ADV (W55 foxor 2m 80m).

What About You?

If you have been attending on-foot transmitter hunts in your area and can navigate your way in the woods with a map and compass, consider joining the fun at the next USA ARDF Championships, which will be near Chelsea, Michigan. Practices and competitions will take place over a full week in October 2024, with exact dates to be announced.

The Event Director will be Joseph Burkhead, KE8MKR. The championship courses will be designed by KE8MKR and NZØI. Medals will be awarded for each event in each of the IARU age/gender categories. Assisting will be members of the Southern Michigan Orienteering Club and the Chelsea Amateur Radio Club. As the details are firmed up, much more information will be posted in my "Homing In" website.[1]

All in the Family

This year's USA championships had a special feature, a family competition as reported by Matt Sanderson, KC9SEM, of Glen Ellyn, Illinois. Matt and his wife Patty, N9PLS, are long-time participants in the regular mobile transmitter hunts of the Chicago area. Their children, Jacob, KD9VLF, and Mackenzie, KD9VVU, have been riding along since infancy. "Jacob got his license during Field Day last year," Matt told me. "Mackenzie got hers in October, so she was nine and he was eleven."

Matt's family attended a foxhunting forum at Hamvention where they met long-time Ohio radio-orienteer Bob Frey, WA6EZV. According to Matt, "Bob said, 'Why don't you come out and try it?' So last year when the USA championships were in Virginia, my daughter and I went there. Mackenzie was nine at the time. I reached out to Ruth and Joseph[2] and they were very accepting of the idea that we could try this out together."

KC9SEM and KD9VVU had such a good time in 2022 that the entire family decided to travel to Sulfur Springs for the 2023 championships. They wanted to compete against each other in two-person teams. There's no provision for that in the IARU rules, but the organizers created a special two-meter family category for them on Saturday, the first classic competition day. Their goal was to find four foxes.

Team 1 was Patty and daughter Mackenzie. "They found two of the transmitters," Matt reported. "They thought they found a third one but it turned out to be one of the 80-meter foxes. Patty relied on Mackenzie to orienteer them around the trails. I think they did all right for Mackenzie being ten years old."

Team 2 was Matt and his son. "Jacob did great," said Matt. "I had the antenna and he had the clipboard with the map. I would ask where he thought we were. I had him draw bearing lines on the map and then asked where he thought the transmitter would be. I put it all on him. We found three foxes and I think we just missed the time limit by about 30 seconds. It was great because the organizers and other participants were very supportive," Matt concluded. "We know we didn't qualify for medals because we were teams, but it gave the kids experience and it was fantastic for them. It was nice to have people that we didn't know welcome us with open arms, accept us

This family foxhunts together in Chicago almost every weekend. This year, they all went to the championships in Texas. Patty Sanderson, N9PLS, is Mom; Matt Sanderson, KC9SEM, is Dad, and the junior ops are Mackenzie, KD9VVU, and Jacob, KD9VLF. (Photo by Bob Frey, WA6EZV)

Bob Frey, WA6EZV, has been active in ARDF for over 20 years and has been on ARDF Team USA for the world championships. At this year's USA Championships, he medaled in all four events as he approached his 75th birthday. (Photo courtesy Adalia Schafrath-Craig)

and provide the opportunity to experience the sport."

Matt says he plans to take the family to Michigan next year for the USA championships. I'm sure that before long, Mackenzie and Jacob, as well as their parents, will be taking on the courses as individuals.

World Championships Later This Month

ARDF Team USA is now preparing for the 21st IARU World Championships, which will take place in Liberec, Czech Republic, from August 27 through September 2, 2023. There will be separate classic ARDF events on separate days for national teams on 80 meters and two meters, plus competitions in sprints and foxoring.

For the World Championships, each country may send up to three competitors in each of eleven age categories, in accordance with IARU rules. Based on 28 nations' letters of intent, there will be over 330 competitors at the world championships this year.

The Team Selection Subcommittee of ARRL's ARDF Committee has issued invitations to 14 men and 6 women, based on their participation in USA's 2022 and 2023 national championships and other qualifying events. If all of the invitees travel to Liberec, this will be the largest ever USA ARDF team.

Get Ready for JOTA

Hams and Scout leaders are now planning the 66th annual Jamboree On The Air (JOTA), which will take place October 21-22, 2023. All over the country, Scouts will experience the thrill of talking with other Scouts on amateur radio. In some places, they will also hunt hidden transmitters.

I have worked with local Scout troops and councils for over 20 years to include radio direction finding at JOTA events. Reports of JOTA transmitter hunting activities have come in from around the country, but it is still being done in relatively few places. If your club likes to hunt transmitters, why not bring this adventure to the Scouts in your town? Remember, hunters do not need to be licensed hams.

If your local JOTA includes a camporee or other outdoor event, put out some QRP transmitters, give antennas and receivers to the Scouts and take them out in twos and threes to find them. There are lots of helpful hints in the JOTA page of the "Homing In" website.[3] For even more Scouting fun, help them get the radio merit badge using the new provisions that incorporate radio direction finding.[4]

My dream is for transmitter hunting became a part of JOTA activities in every state. Now is the time to talk to the clubs that will be sponsoring JOTA events in your area about selecting locations that are ARDF-friendly. I look forward to getting photos and stories of your JOTA transmitter hunts this year. Also, I'm writing up the results of this year's CQ World Wide Foxhunting Weekend,[5] so if you haven't sent your club's report, now is the time. Tell us how your hunt brought out the newcomers and challenged the local experts. Happy hunting!

NOTES:
1. <http://www.homingin.com/farsnews.html>
2. Ruth Bromer, WB4QZG, and Joseph Huberman, K5JGH, organized the 2022 USA ARDF Championships at Triangle, Virginia. My report is in "Homing In" for August 2022.
3. <http://www.homingin.com/joek0ov/jota.html>
4. <http://www.homingin.com/ARDFinRMB.html>
5. <http://www.homingin.com/joek0ov/nfw.html>

analog adventures

BY ERIC P. NICHOLS,* KL7AJ

Hard Copy

I occasionally think about things – it's an activity I highly recommend. One of the things I recently thought about was the issue of whether a book (you know, one of those stacks of paper with symbols made of ink impressed upon the sheets) is an analog or a digital device. Because a book is *old* technology, one is naturally inclined to put it in the category of analog technology, which is nearly synonymous with *old.* However, since books are, for the most part, written in *black and white*, there is generally a strict demarcation between where ink exists and where ink does not exist, which implies that they are somewhat digital in nature.

Despite being sort of a high-tech guy, I like books. Lots of them. This is not to say that I don't read a lot of stuff online…and submit a lot of stuff online…at least for the past twenty years or so. When I first started writing technical articles, I wrote stuff out *longhand*, because I hadn't yet learned how to type (though I could copy CW at 45+ WPM). After I discovered that fewer and fewer folks were willing to take my highly analog handwriting and convert it into decipherable semi-digital typed letters and words, I took the bull by the horns and learned how to type for myself.

Ecclesiastes 12:12 informs us, "And further, by these, my son, be admonished: of making many books *there is* no end; and much study *is* a weariness of the flesh."

Despite this admonition, a relatively small number of us are compelled to continue to contribute to this flesh-wearying business. And despite wise King Solomon's advice, I find many books in my library most worthy of much study, and quite frankly quite invigorating...at least to the mind, if not the flesh.

At one time, I had my books separated into technical/electronics texts, and everything else. After years of entropy, I find that my technical/electronics texts and everything else are fairly well shuffled on the shelves. Several visitors to my shack have commented that I must be a Renaissance Man or something. Not really; I just have a lot of random books. I do have a large shelf full of all the classic literary works that everyone is *supposed* to have read but virtually nobody actually has. To my credit, I *am* actually, gradually, working my way through the "liberally educated human being" required reading list, the last being "Two Years Before the Mast", by Dana. It really is a rollicking tale, highly recommended if you need more swash in your buckle.

The top shelf (quite literally) in my office has my most valued books (Photo A)...not necessarily the most frequently used ones. The "McGraw Hill Electronics Engineers' Handbook" is probably the most authoritative EE book around, and it's what I refer to whenever I run into an electron snag. The "English-Chinese Dictionary of Science and Technology" is a real treasure, given to me by a Chinese physicist when I was working at the Hipas Observatory...and trying to learn a bit of Mandarin in the process. To its right is "Miscellaneous Papers", by Heinrich Hertz, published in 1896. This is probably my most valuable book. Photo B shows the frontispiece. This book was presented to a certain Frederick Ray.

Photo A. Eric's "top-shelf" books – both literally and figuratively

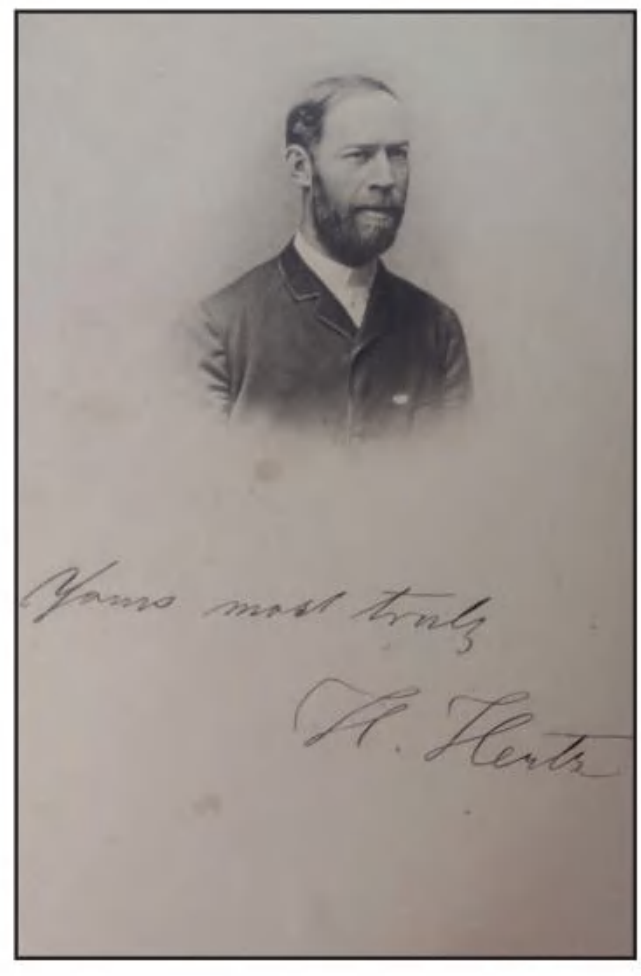


Photo B. The frontispiece to "Miscellaneous Papers" by Heinrich Hertz. You can see why Eric considers it his most valuable volume … and he picked it up at a garage sale in Fairbanks!

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How it ended up in Fairbanks, I'll never know, but I picked it up at a garage sale.

I also have a copy of Hertz' better known "Electric Waves", which I am re-reading for the something-teenth time. To its right is a pristine three volume set of Oliver Heaviside's "Electromagnetic Theory", a ponderous work indeed. And to its right, my treasured 1964 RSGB "Radio Communications Handbook", and to its starboard, two copies of William Orr's famous "Radio Handbook". Semi-finally, there's "Physical Design of Yagi Antennas" by David Leeson. And final finally, a stack of *Popular Electronics*, *Popular Mechanics*, and *Electronics Now* magazines from the dark ages. A few of my other volumes are in Photo C.

My dad was an aeronautical engineer, designing helicopters in Silicon Valley before it was Silicon Valley (or even Vacuum Tube Valley). Lots of folks don't realize that aviation and early aerospace dominated the region long before the Hewlett-Packard fellows opened their garage. For many years, I had dad's vast collection of classic aeronautical texts, which I finally donated to the UAF Aero Sciences department, so at least I know they're in good hands. It's always sad when you hear of beautiful, priceless collections of books going to landfills. Yes, books are big and bulky, and heavy, but

Photo C. A little more of KL7AJ's home office library.

they do deserve loving homes. Alas, it seems a lot of even respectable, venerable libraries aren't interested in classic book collections anymore.

I'm curious to hear what's in *your* library! What do you consider "must have" books for any radio amateur? As well as "must have" books for any human being. (I've found that occasionally, the categories of radio amateurs and human beings actually overlap!)

I hope you've enjoyed this brief glance at the KL7AJ eclectic and electric collection. In our next adventure, we will revisit the NanoVNA and explore the lesser-known two-port network analysis.

Until then, keep them soldering irons sharp! 73, Eric

mobiling

BY JOHN KITCHENS,* NS6X

The Do's and Don'ts of Modding My Avalon and more

Spring has been a busy time – multiple trips, field activations, new antennas at the house, licensing classes, local hamfests, and family fun. My major trip was to Xenia, Ohio, for Hamvention. I drove with Jeff Reinhardt, AA6JR, and Rob Hanson, W6RH, in my Toyota Avalon hybrid, and it was a great adventure. Jeff reported on it in his "Magic in the Sky" column in the last issue of *CQ*.

For the trip, I had decided to use the IsoPwr to isolate the radio battery from the vehicle's electrical system, and to keep it charged. The Avalon starting battery is in the right rear wheel well, with an access cover in the trunk. Thank you, Toyota, for making this easy! I bought a new Group31 battery to use for radio and accessory power. The entire power and battery installation (Photo A) took less than 30 minutes, once I had the needed parts.

West Mountain Radio was out of stock on the IsoPwr, so I had bought a used one from one of the radio websites, like <QRZ.com> or <EHam.net>. I did an internet search and found that Impulse Electronics had one left in stock. I quickly made a phone call, let them know I wanted it and went to their website to complete the purchase. It was in my hands in three days. The used one took a week to arrive, but still with plenty of time for the install. Now I had two, with a plan. One would be for my Avalon and the other for my truck. No more attaching wires to the battery through the engine compartment.

The IsoPwr took a set of positive and negative wires from the vehicle battery. It uses PowerPoles, so a quick installation of a set of PowerPoles on one end and ring lugs to connect to the battery. Heavy wire is not needed, as the only current is going to charge the battery from the vehicle battery. I used 10-gauge wire. The battery box for the radio battery had PowerPoles installed, so short positive and negative wires with PowerPoles on either end connected from the IsoPwr to the battery. The third connection on the IsoPwr is for the radios. I connected another set of 10-gauge wires to a PowerPole distribution block into which the radios were connected.

An Icom IC-7100 provided HF and backup VHF/UHF frequencies while a Yaesu FT-7900 was used for VHF and UHF. Antennas for the dual band VHF and UHF were a Comet and Diamond on a trunk lid mount Photo B). The initial HF antenna was mounted on an MFJ trailer-hitch mount. I had the trailer-hitch receiver (Photo C) installed for the antenna and to carry a bicycle rack when not on the air mobile. We also had a Kenwood TH72A for APRS, with an external antenna. Family and friends tracked us across the country. The Power Pole block was used to charge cell phones, the Kenwood, and whatever else we came across that needed 12 volts.

Lido Products cup holder mounts were used to make a firm and secure mount for the radio control heads (Photo D). The Lido mount fits into a cup holder. The base expands to fill

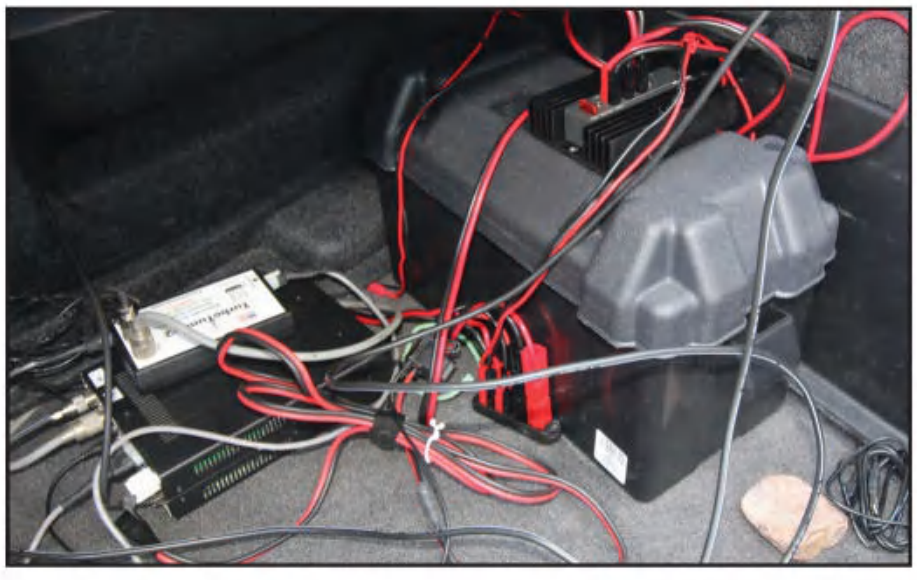

Photo A. Power installation in the trunk of NS6X's Toyota Avalon hybrid. Vehicle battery is in the compartment behind the battery box. The West Mountain Radio IsoPower is mounted on top of the battery. The IC-7100 radio is beneath the TurboTuner 2 for the Little Tarheel II antenna. The power distribution comes from the IsoPower to the PowerPole block and then to the IC-7100, FT-7900 and a PowerPole block in the passenger compartment.

Photo B. The Toyota Avalon hybrid ride of The Lost Boys, W6RH, AA6JR and NS6X. Two VHF/UHF antennas, packet antenna and the Little Tarheel II HF antenna.

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the cupholder using a rotating screw-type ring, making the mount secure. I was not able to pull the radio out of the cupholder… It has worked well over the years, holding the control heads for not only the FT-7900 and the IC-7100, but an IC-706 and a KX-1 and KX-3. The radio affixes to the mount using the ¼ x 20 threaded base. The entire mount and radio control head can easily be removed from the cupholder and placed in the trunk when the vehicle is left unattended. The control cables are simply popped out of the head.

A Bit Of A Problem With The HF Antenna Mount

The radios were mounted in the trunk using Velcro®. The Avalon was not affected by the RF, although the Tarheel did not like the way I installed it. There were several problems I discovered in this setup. The first was that the MFJ hitch mount extended approximately eight inches. Likewise, it was about eight inches off the pavement. With three well-fed men, the car sagged a bit. Time for new shocks, maybe? The coax was routed along the bottom of the antenna mount based upon its design. We had a TurboTuner for the IC-7100 and Little Tarheel II that worked great, but no so much when the coax became pinched and the connector damaged when the car and mount would bottom out, scraping the pavement. The tuner continued to get an SWR match, although I found that the coax connector had been smashed, and the coax severed, at one of the mount scrapings.

Photo C. The MFJ hitch receiver mount that had a few issues with the lower-slung car, The car would bottom out, causing the antenna mount to drag, damaging the coax and coax connector. (See Photos E and F for more on this.)

Photo D. The IC-7100 and FT-7900 control heads are mounted on Lido Products cupholder mounts that fit snugly into the vehicle's cupholders.

Photo E. The Big Tarheel antenna would work better than the Little Tarheel II when on a hitch mount. This Tarheel mount, on a truck belonging to Larry Bever, K7TME, also has more ground clearance to help with not bottoming out. Larry's QERZ.com site has some gorgeous photos of his apparently remote home.

Photo F. K7TME also has his antenna system well grounded.

Photo G. Operators at the April Micro Field Day of <TheBoredNet.net> in the parking lot of Rancho Potrero Park in the Santa Monica Mountains National Recreation Area, POTA park K-6048.

Several antenna and HF problems were solved at Hamvention after talking with the helpful Tarheel people. I had forgotten that the Little Tarheel II will not properly load when the coil is not mounted above surrounding car metal. I was happy to spend a few dollars more to buy a Diamond trunk lid mount from the Tarheel folks. The Big Tarheel would not have been a problem (see Photos E and F).

HF Problem Solved

The new mount was easily and quickly installed – it took about 15 minutes. The mount came with a short coax cable, so the antenna was connected, and signals were heard and people talked to. Solar weather activity did not help radio wave propagation, but we were finally able to make many decent QSOs, when the bands would briefly open. It was frustrating though, as I enjoy 10 meters. Due to conditions, not one QSO was made on 10 meters.

Photo H. Tom Essenpreis, KB9ENS, visited the <TheBored Net.net> Micro Field Day from Gardena, California. He bought the Winnebago camper conversion of a Sprinter van and installed the electronics and radios.

We made SSB and CW QSOs on 20, 30, and 40 meters. I forgot a key, so used the mike push-to-talk switch to complete the circuit to send CW. A bit clumsy, but it worked. I first did that during a VHF contest. I was on a mountain, with multiple antennas set-up, and needed CW for 1296. So, I used the mike. It works.

Micro Field Days

During the COVID-19 lockdown, with many hams well into the most at-risk age group and living alone, a group of younger hams decided to check on the shut-in hams, to make sure that they were okay, and that they had someone to talk with, using their hobby. So The Bored Net was started, working morning and evening, seven days a week. The “agnostic group,” as the sort of leaders of the group describe it, continues to operate a daily morning net, except Sundays. As we have somewhat forgotten about COVID, and people, including hams, are able to get out, the <TheBoredNet.net> group started celebrating the outdoors and being able to be outside. This is not a unique system, as several groups around the country do something similar. Hams in Tucson, Arizona, and the Pacific Northwest QRP group operate once a month, even in June, and then the <TheBoredNet.net> finds an easily accessible location from which to operate portable and have fun. Ben Kuo, AI6YR, has loaded a screen door and a floor lamp as his antenna. He made QSOs thousands of miles distant with his screen door portable. One of the go-to locations is in a parking lot, in the Rancho Potrero area along Potrero Road that is in a POTA location, K-0648, the Santa Monica Mountains National Recreation Area. On April 23 and again on June 17, about 10 stations were set up (see Photos G, H, and I)≥ The site is a well-compacted dirt and decomposed granite parking lot with restrooms and trailhead access to the Point Mugu State Park, another POTA location.

Photo I. The van conversion by Winnebago on a Sprinter chassis, brought to Micro Field Day by Tom Essenpreis, KB9ENS.

These micro Field Days can be a way to sort out station problems, learn about your equipment and how to operate portable, and most importantly to see friends, make new friends and to have fun. There are end fed half waves, verticals of many sorts, and for example I had my new BuddiHex out, with QRP radios, 100-watt radios, tuners, solar power to gasoline generators, and more. Think about getting together a group of your fellow hams to go to an easy public site and have some fun. The time is not about making many QSOs, but more about getting out and socializing in a simple manner. Some people even bring a picnic lunch. People have made their first HF QSO at these micro Field Days.

SARC Hamfest

I'll be going to several hamfests in the southwest this summer. Throughout Arizona – the Ft. Tuthill Hamfest is back as the Flagstaff Hamfest, and then into New Mexico and maybe again to Oregon. Saturday, June 17, the Satellite Amateur Radio Club had their first hamfest that was back at what was once the Union Oil picnic area, but now the New Love Picnic Grounds in Santa Maria/Orcutt California. When I began going to the event many years ago, it was held on Father's Day. I liked to spend my Father's Day at a Santa Maria BBQ and ham radio. Hamfests are a lot of work, and the SARC did a fine job.

The club usually meets the first Saturday of the month at their club headquarters on Vandenberg Space Force Base. A great location, and free use of the old building for a maintenance trade. The club keeps down the weeds and maintains the building.

While I had duties at the ARRL table (I am the Santa Barbara Section Manager), I did have a QRP HF radio sta-

tion setup where several hams, and a few non-hams, were able to make a few QSOs. An EFHW is something new to me. I am learning to use it effectively.

SEAPAC Convention

The ARRL Northwestern Division convention was held at the Seaside, Oregon, Convention Center (Photo J). I towed a small travel trailer that is not yet radioactive. That is a radio project to be completed soon. The old days of kerchunking a local repeater and finding a local ham to talk with are long gone. I found four people on repeaters, and 11 on 146.52. I would like to find out what is happening in the area, where to go for a good meal or where to not go, roads to avoid, and help when I run out of gas. (That used to be somewhat common for me, and part of the adventure for the kids. I have since gotten over that.)

Photo J. The rooftop mobile antennas of David Chan, WZ6X, on his Chevrolet Traverse while parked at the Seaside Convention Center for the SeaPac convention. David was also at the Satellite ARC hamfest in Santa Maria, California, a long mobile trip from his home in American Canyon

There are two weekends in August coming up on which lighthouses and lightships are recognized by operating an amateur radio station at the lighthouse.

I did find beautiful lighthouses that apparently have not been activated during Lighthouses on the Air weekend. There are two weekends in August coming up on which lighthouses and lightships are recognized by operating an amateur radio station at the lighthouse. For information about the events, and more go to <arlhs.com/events/>.

The Lido Products cupholders mentioned earlier were at a commercial booth at SeaPac and Hamvention (Photo K). I was able to work out a few ideas and issues with the products, specifically how to use them, and which one to buy.

This is my third Mobiling Column. I have been having a good time preparing for the column, deciding what to write about. There is a lot of material to use. I like hearing from the readers. Let me know what you are doing for mobile radio, suggestions and more. I was at the Santa Barbara Radio Club meeting last week. There were two new hams who just passed the test and received their licenses. They knew nothing about operating radios, mobile or otherwise. Everything is new to them.

We may have talked about how important a ground is, and how to ground to a vehicle's chassis a few years ago. These two new young men, and hundreds more like them, don't know. They do not understand SWR, significance of the size of coax or the length and the correlation to the frequency being used, and many, many more topics. So ask questions. Seek help. Let me know what you would like to read about in this column. So until next time, give me a shout at <NS6X@CQ-amateur-radio.com>. Maybe we'll have a QSO one of these days.

72/73.

Photo K. The Lido cupholder mounts at the Lido Products display at SeaPac. The mounts expand in the cupholder to fits and remain snugly in place.

qrp: low-power communications

BY R. SCOTT ROUGHT,* KA8SMA

No Trees were Harmed in the Writing of this Column!

Exciting times are upon us as Solar Cycle 25 continues to strengthen, and I am hearing more and more stations operating QRP, and I am finding many of these stations are hunting and activating parks in the Parks on the Air (POTA) program. POTA is a great way for QRP operators to get out in the field to test equipment and antennas as pipsqueak signals can generate huge pileups. I am looking forward to more POTA activations over the next few years as these outings satisfy my thirst for portable operation, provide a good venue for me to experiment with different antennas and configurations (I often deploy two or three different antennas at parks for side-by-side comparison) and most importantly, allow me to unwind after a long day at the office.

Stayin' Out of Trees

Over the past year I have heard scuttle that officials at some parks (both in and outside the POTA program) are asking hams to not use trees as antenna supports. I have always relied on "nature's poles" to support my antennas when I am in the field and am always careful not to damage branches or leave wires behind. I am aware that many states and municipalities, including my state of Michigan, have ordinances in place to protect trees and vegetation on public property. The ordinances generally state that no person shall fasten any sign, wire, rope or other material, or run any wire or rope through any tree or shrub, in any park or public place. I agree these types of ordinances are necessary for the common good; however, I believe those who enforce these rules need to exercise latitude when considering the circumstances at hand. For example, a hammock holding two people that is supported by a rope strung between two trees is different than a piece of No. 18 masonry line tossed into a tree to support an antenna constructed with 22-gauge wire. Depending on the park official's interpretation of the ordinance, explaining these types of differences can be a challenge, especially when you are visiting their park.

Although I have never had an issue at a park or any other location regarding the use of trees as antenna supports, I am making a change in my portable operations and moving to fiberglass telescopic poles for antenna supports. To quote Confucius, "A man who does not plan long ahead will find trouble at his door".

My go-to antennas for portable operations are the Inverted V and End Fed Halfwave (EFHW). I have found both to be excellent performers and are easy to erect as they require only one support. I have two telescopic poles that do a fine job in supporting these antennas, the SOTABEAMS Tactical 7000 HDS which extends to 23 feet and collapses to 23.5-inches and the Spiderbeam 10M Mini Fiberglass Pole which extends to 33 feet and collapses to 28.5 inches. These poles make great travel companions due to their small size when collapsed. Both poles are telescoping, meaning they have multiple tapered rods that pull out until the diameter of the rod being extended pulls up the next larger diameter rod. Each rod is secured with a friction fit that is achieved by pulling the rod

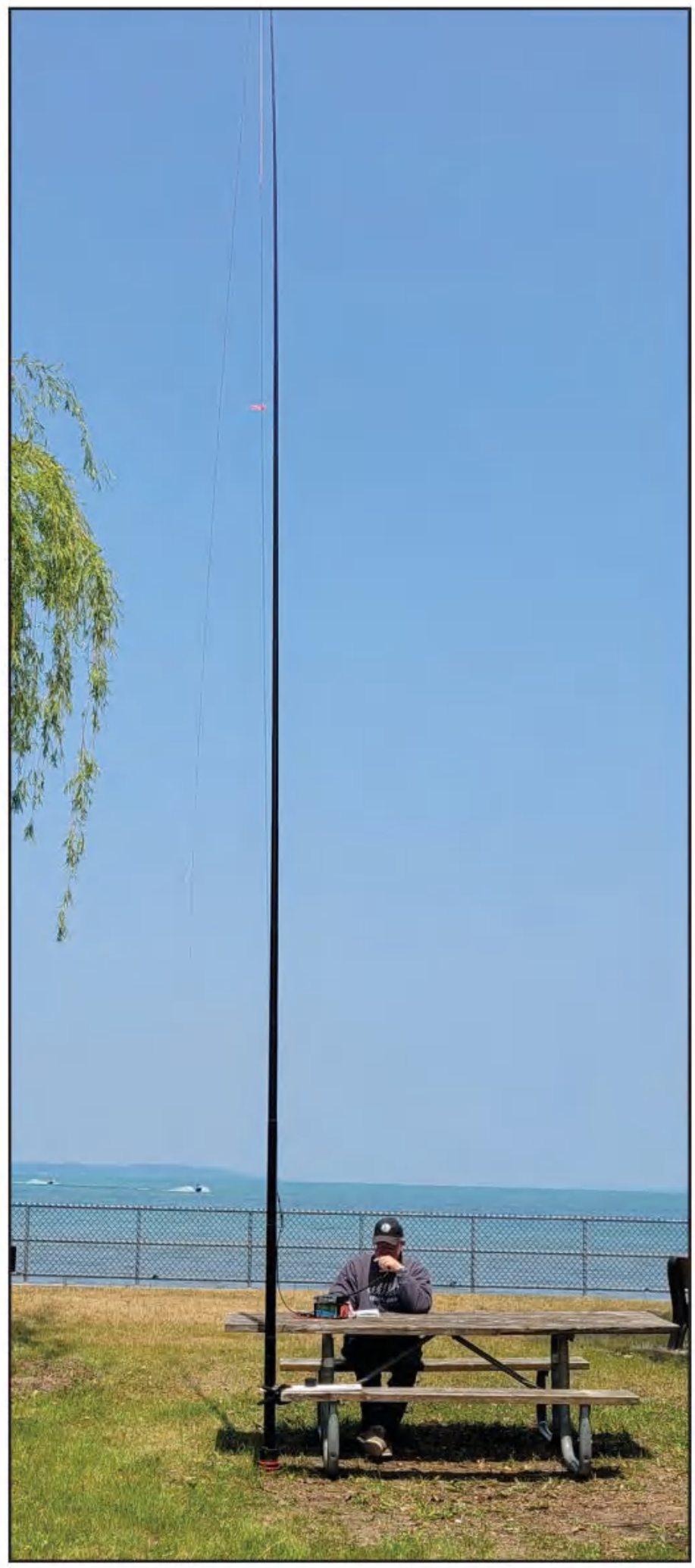

Photo A: KA8SMA operating portable with the Spiderbeam telescopic pole affixed to his operating position with the homebrew mounting system (Photo by Helen Rought).

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upwards and giving it a twist to lock it in place. Collapsing the rods is achieved by untwisting each tapered rod and allowing it to slide downward.

Erecting these poles is simple and can be done in less than one minute as long as you do not use guys which adds more time and effort during setup. To keep the pole in the air without guys I homebrewed a mounting system that secures the pole to my operating position (usually a picnic table) and stabilizes the bottom of the pole to prevent it from moving around (Photo A).

I made my mount from a scrap piece of one quarter-inch plywood. The mount measures 20 inches (length) by 5 inches (width) and has a hole on each end for bracing each pole (Photo B). One hole is 2 inches in diameter and supports the SOTABEAMS Tactical 7000HDS and the other hole is 2.5 inches in diameter for the Spiderbeam. To make the holes I removed the end cap from each pole, positioned each pole approximately one inch from the ends of the plywood, and traced around the bottoms of the poles with a marker to create an outline for cutting. I used a jig saw to cut each hole. Prior to cutting I drilled a 3/8-inch hole near the center of each circle as a starting point. It is important that you use patience while cutting with a jig saw or your circles will become misshaped or larger than desired. As it turned out my hole for the Spiderbeam pole is a little larger than needed as I was working too fast and cut just outside the trace line. If available, a hole saw would be a better choice to complete this task. After cutting, I sanded the interior of each hole to remove any rough edges and painted the board.

To stabilize the base of the telescopic pole, I use a drink stake (Photo C). My wife purchased a set of these stakes (Cuisinart Model No. CDH-444) from an online vendor last year to use while camping as they offer an easy and convenient way to keep your drinks off the ground while relaxing in a camp chair. She has yet to realize that I commandeered one from her set for my pole mount – Hi honey! Since the stakes are designed for cups that have a larger diameter than either of my poles, I wrapped two pieces of 1-inch (interior diameter) foam pipe insulation around the base of each pole to enlarge its diameter so they would have a snug fit in the drink holder (Photo D). The pipe insulation is fastened to each pole with zip ties and black duct tape. Due to the smaller diameter of the SOTABEAMS pole, I wrapped a second layer of foam insulation over a portion of the first layer so it would fit the drink holder.

Setup is easy! Upon arrival at a park, I claim a picnic table, remove the cap from my pole, slip it through the plywood mount and place the bottom of the pole into the drink stake. I then align the drink stake with the end of a seat on the picnic table and push the stake into the ground until the bottom of the drink holder is resting on the ground (I do not use the bottom rod that came with the drink stake). Also note that I wrap the coils of the drink holder with two zip ties to add stabilization, as they are "springy". After the drink stake is in the ground, I secure the mount to the picnic table seat with a spring clamp (Photo E). I generally use one spring clamp; however, during windy conditions I add a second one. After the mount is fastened, I raise the pole to support either an Inverted V or an EFHW antenna. This setup gets my antenna quickly in the air, keeps my antenna support lines out of nearby trees and most importantly, I have no worries about the park police ruining my day of playing radio in the park.

Keep Your Pole Clean!

On Memorial Day weekend, I did a POTA activation at a local park and ran

Photo C: The drink stake I commandeered for stabilizing the bottom of the telescopic pole. Note the two zip ties around the drink holder. I do not use the bottom piece of the stake.

Photo B: The wooden mount for securing the telescopic pole to the operating position.

Photo D: Closeup showing pieces of pipe insulation wrapped around and fastened to the base of the Spiderbeam telescopic pole.

into trouble collapsing one of my telescopic poles. The rod at the top of the pole was locked in place and would not collapse. This was a first for me as I have never had an issue in collapsing a telescopic pole. After a few minutes of fiddling, I decided to push downward on the top section with brute force. After a few good pushes the rod slipped downward into place. When I got home, I erected the pole again and could feel friction between the rods while sliding them upward into position. I also noticed scratches on several of the rods, especially in the friction grip portions of each rod. A look inside the pole revealed sand and grit was lodged in the annular space between the walls of each rod. This quickly explained the scratches and the issue with collapsing the rods.

To fix this problem I unscrewed the bottom cap from the pole and removed each rod from the pole for a thorough cleaning. I washed each rod in the kitchen sink with warm water and dish soap, rinsed them off and then set them aside to dry. After the rods were dry I put the pole back together. Based on the amount of residue in the bottom of the sink I estimate there was less than a quarter teaspoon of grit and sand inside the pole…surely enough to create a problem. My question is, how did this material get inside the pole? I have operated in a lot of dusty and sandy environments (i.e., near dirt roads, sandy beaches, etc.) and suspect these locations, coupled with my not wiping down the pole to remove any particulates, is the root cause. To avoid this problem in the future, I am using a clean cloth to wipe down each telescoping section after each use and periodically disassembling each pole and washing the rods to remove debris (Photo F).

Prior to disassembling and washing the rods I applied a silicone spray (lubricant) to the pole in an effort to make the rods slide more easily. However, I discovered the lubricant loosened and moved grit around inside the poles, which made collapsing the rods more difficult. I therefore do not recommend using lubricant on the rods.

POTA's Plaque Event 2023

During the first weekend in June, I participated in POTA's Plaque Event. I was in the Rover category in which operators travel (rove) from park to park during the 48-hour contest, activating as many locations as possible. To activate a park one needs to make at least 10 contacts using any mode. I worked this event last year (2022) and placed 5th by activating 43 parks during the 48-hour period. There is no QRP category for the Plaque Event so those who do not increase their power (like me) are pitted against hams using more power. Although this may be a disadvantage, an effective antenna system and good operating skills will level the playing field. During this year's event, I was able to make the mandatory 10 contacts (using 5 watts) at several parks in less than 4 minutes when band conditions were good. When bands were not cooperative, it sometimes took as long as 30 minutes to activate a location. Thankfully the bands were in good condition this year and I was able to activate 56 parks in 48 hours.

There were a couple of rules changes for this year's Plaque Event. The first was its separation from the Support Your Parks Weekend. In past years, the Plaque Event was held during the Summer Support Your Parks Weekend, which is the third full weekend in July. Earlier this year, POTA made the Plaque Event a standalone event as many hams requested an opportunity for activators and hunters to participate in a competitive event. The second change was eliminating multiple refer-

ence parks (i.e., "N-fers") and counting them as a single park for the Plaque Event. In other words, a park that qualified as a "2-fer" (a park that qualified as contacting two parks – a park within a park) would only be worth one park. This is a rule change that several other hams and I asked POTA to change for this year's Plaque Event since some areas of the country (and world) have multiple parks embedded within another park, but many areas do not. This helped level the playing field so those who had the ability to activate multiple parks (2'fers, 3'fers, etc.) were equal with those who live in areas that do not have these types of parks.

I am aware that many in the QRP community have requested the POTA group create a QRP category for the Plaque Event. It is my understanding POTA cannot create categories for power levels since the logs are submitted only by park activators (not park hunters) and there is no simple way for an activator to distinguish between power categories when making contacts with hunters. However, I am going to request the POTA group consider creating a QRP category for park activators since they are the ones submitting the logs and can identify their power level when submitting logs. We will find out where this goes.

Until October, 73

Photo E: The telescopic pole in position! The mount is clamped to the seat of the picnic table and the base of the drink stake is resting atop the ground.

Photo F: Preventative maintenance - my SOTABEAMS telescopic pole disassembled, washed and drying on a towel. Note the heavy scratching on the rods.

antennas

BY KENT BRITAIN*, WA5VJB

A 70-Centimeter "Kitchen Array"

BY BOB ROSE,* KC1DSQ & BOB GLORIOSO,# W1IS

WA5VJB has been very busy with his day-job and didn't have time this month to write a column. Two of our regular antenna article contributors, Bob Rose, KC1DSQ, and Bob Glorioso, W1IS, are filling in as guest editors with a look at an antenna that might even help you lose weight by making it harder to bake cookies! – W2VU

A batch of chocolate chip cookies cooling on an 11.5 x 16.5-inch stainless steel cooling rack was the inspiration for this project (Figure 1). There it was, the perfect reflector for a simple, inexpensive, 70-centimeter antenna.

Some online research followed,[1,2] along with a few sessions on EZNEC to simulate a few configurations that could exploit the rack. We started with two of them in a corner reflector configuration and found that it provided performance similar to a 10-element Yagi, 13 dBi gain on a four-foot boom. As we pondered how to make a simple corner reflector out of two of the racks, we thought a comparison to a single reflector was worth throwing into the mix. That turned out to be a good idea as the principal difference was loss of a few dBi of gain and three to five dB of front-to-back ratio (F/B), though the F/B of the simple flat reflector was an acceptable 12 dB or 2 S-units. The SWR curve and patterns are shown in Figures 2, 3, and 4 respectively.

The design places a dipole approximately five inches in front of the reflector, Figure 5. The SWR can be adjusted by adjusting the distance from the reflector. Closer to the reflector lowers the impedance. Farther from the reflector increases it.

Construction

The photo of a completed antenna (Photo A) will help you understand the construction. Start with the rack by bolting a 4" x 8" x 1/16" piece of aluminum to the rack using 1/4"- 20 bolts and large washers (fender washers will do) to cover the wires on the rack. Tape the aluminum to the rack and mark the aluminum to be drilled so the hole is centered over one of the grid spaces in the rack. We found putting the bolts diagonally across from each other near the top and bottom of the aluminum piece works well. Drill and mount the aluminum plate. The remainder of the holes will also have to be lined up with the grid spaces in the rack. Keeping the plate on helps. Drill two 1/4" holes for the dipole supports that are positioned two grid spaces below the vertical center of the rack and two grid spaces to the left and right of the horizontal center of the rack.

Next, cut a 2" x 4" piece of plexiglass to hold the dipole. Drill two 1/4" holes in the plexiglass centered on the dipole support holes and 1/2" from the edge of the plexiglass. The dipole supports use plastic threaded rods because metal

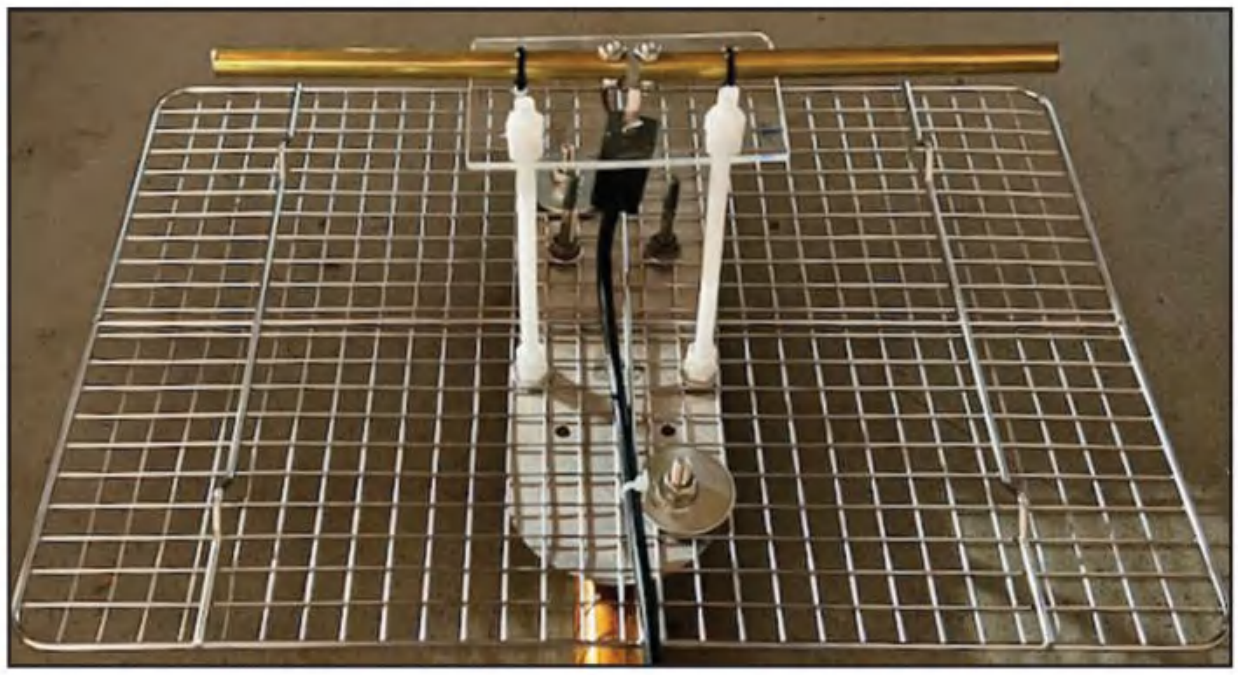


Photo A: The 70-centimeter "Kitchen Array."

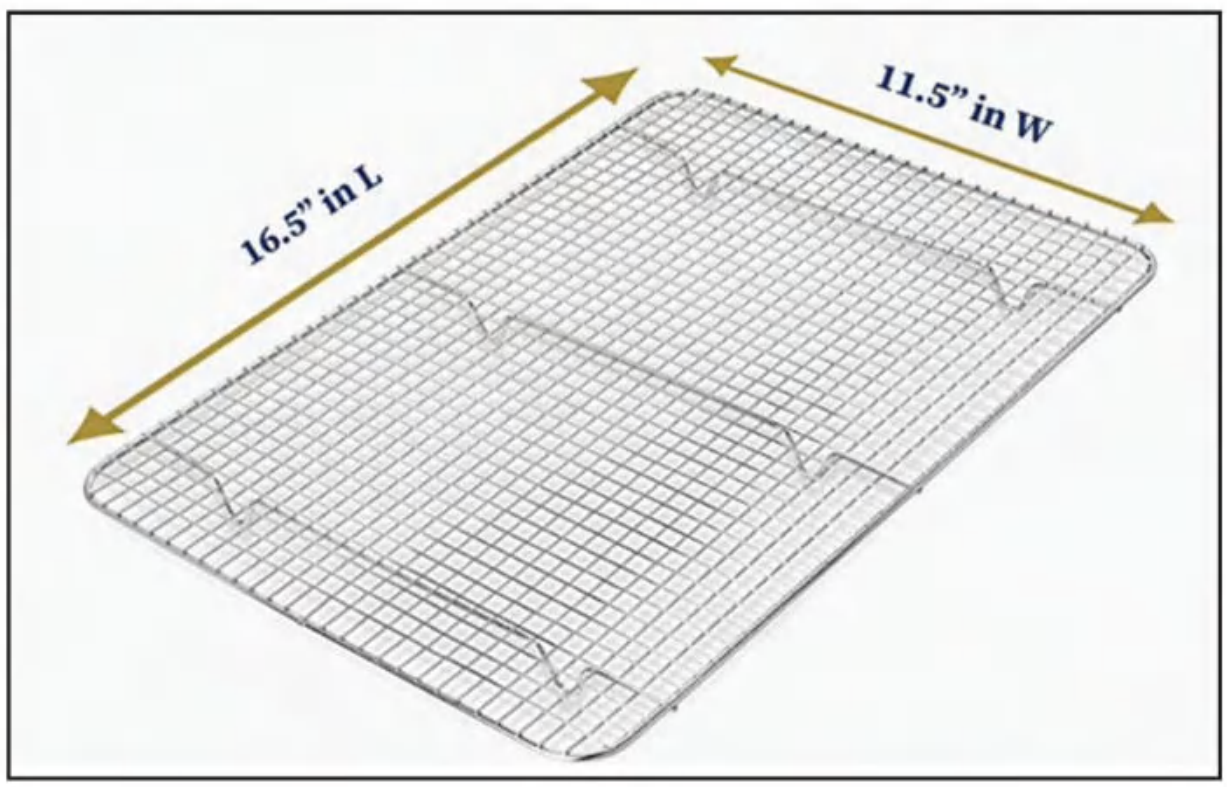


Figure 1: Cooling rack NO MORE!

* E-mail: <b.rose@comcast.net>
# E-mail: <rglorioso@me.com>

rods detune the antenna, alter the pattern, and reduce the bandwidth. We used 1/4"-20 threaded rods made of Acetal® plastic because of its moisture resistance. These are available from McMaster-Carr for 2-foot rods.[3] Cut two 8” lengths for the supports. Fasten them to the aluminum plate with Acetal 1/4”-20 nuts, also available from McMaster-Carr.[4]
Fasten the plexiglass dipole support to the support rods using Acetal nuts. The support plexiglass should be positioned 5 inches above the reflector. Mark the point on the plexiglass that sits above the center of the reflector. This will position the dipole over the center of the rack. Drill two 1/8” holes spaced 1/2” apart along the long dimension of the reflector, centered on the center mark
Fasten the coax feedline to the dipole support plexiglass using 6-32 x 3/4” stainless steel screws with flat washers and nuts. Solder a #18 wire to the shield and wrap it around the head of the screw between two #6 washers. Wrap the inner conductor around the other screw between two #6 washers.
Prepare each 5-1/2” dipole half with a 1/8” hole carefully drilled starting with a 3/32“ drill 1/8” from the end. The dipole halves are fastened with a nut on the screw through the plexiglass connected to the coax below. Drill holes in the plexiglass for tie-wraps to hold the dipoles in position.
If you plan to mount this on a mast, drill holes in the aluminum plate to hold the appropriate U bolt. It may be mounted vertically or horizontally depending on the desired polarization. The bandwidth is wide enough to cover the entire 70-centimeter band.
Although the actual SWR of this antenna is quite low across the whole 30 MHz of the band (Figure 6) the length of the dipoles may be adjusted to give lowest SWR in the part of the band of most interest to you. You can adjust the lengths of each half of the dipole with a file or grinding wheel.

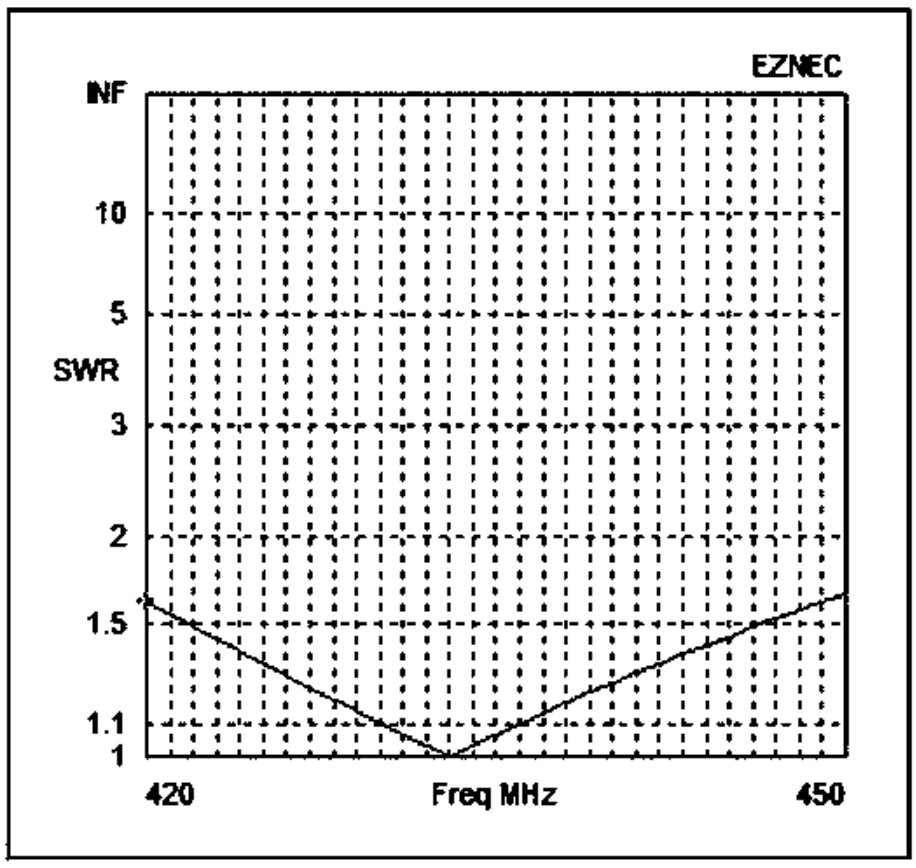


Figure 2: Modeled SWR curve.

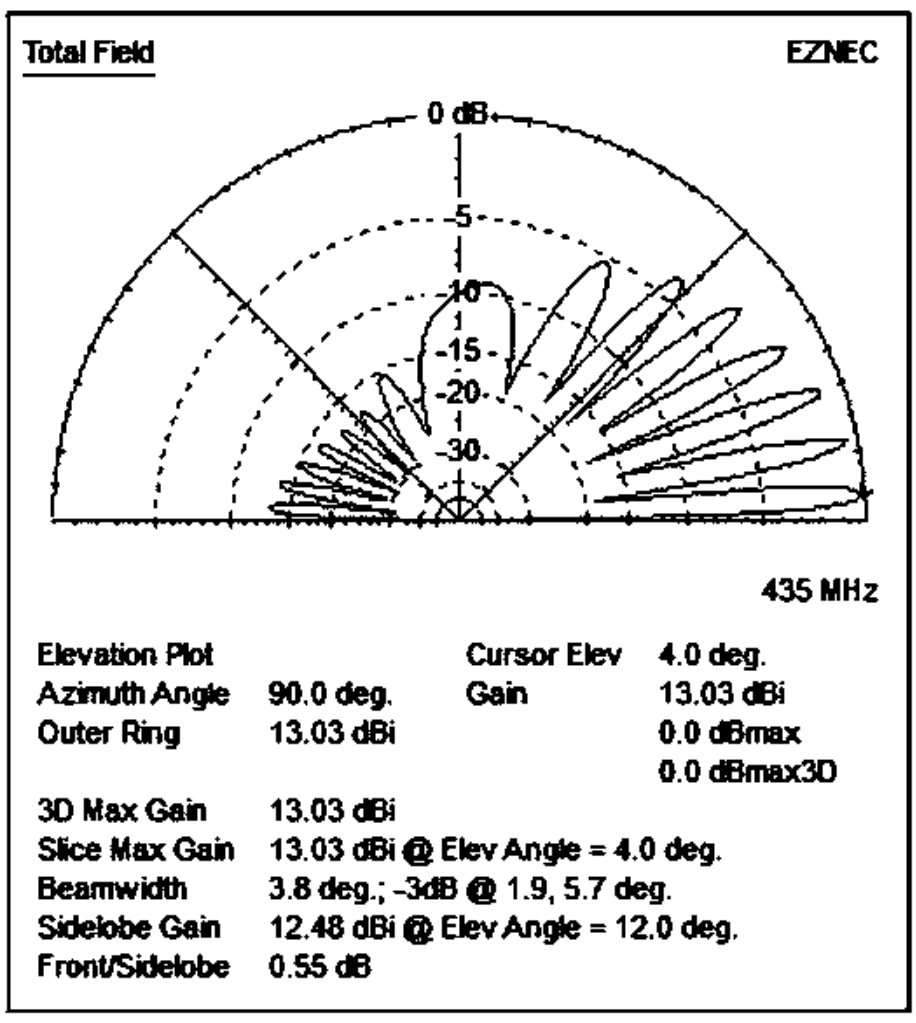


Figure 3: Elevation plot.

Testing

The antenna was run through on-the-air tests at both short (50-foot) and long (2-mile) ranges and the measured F/B ratio

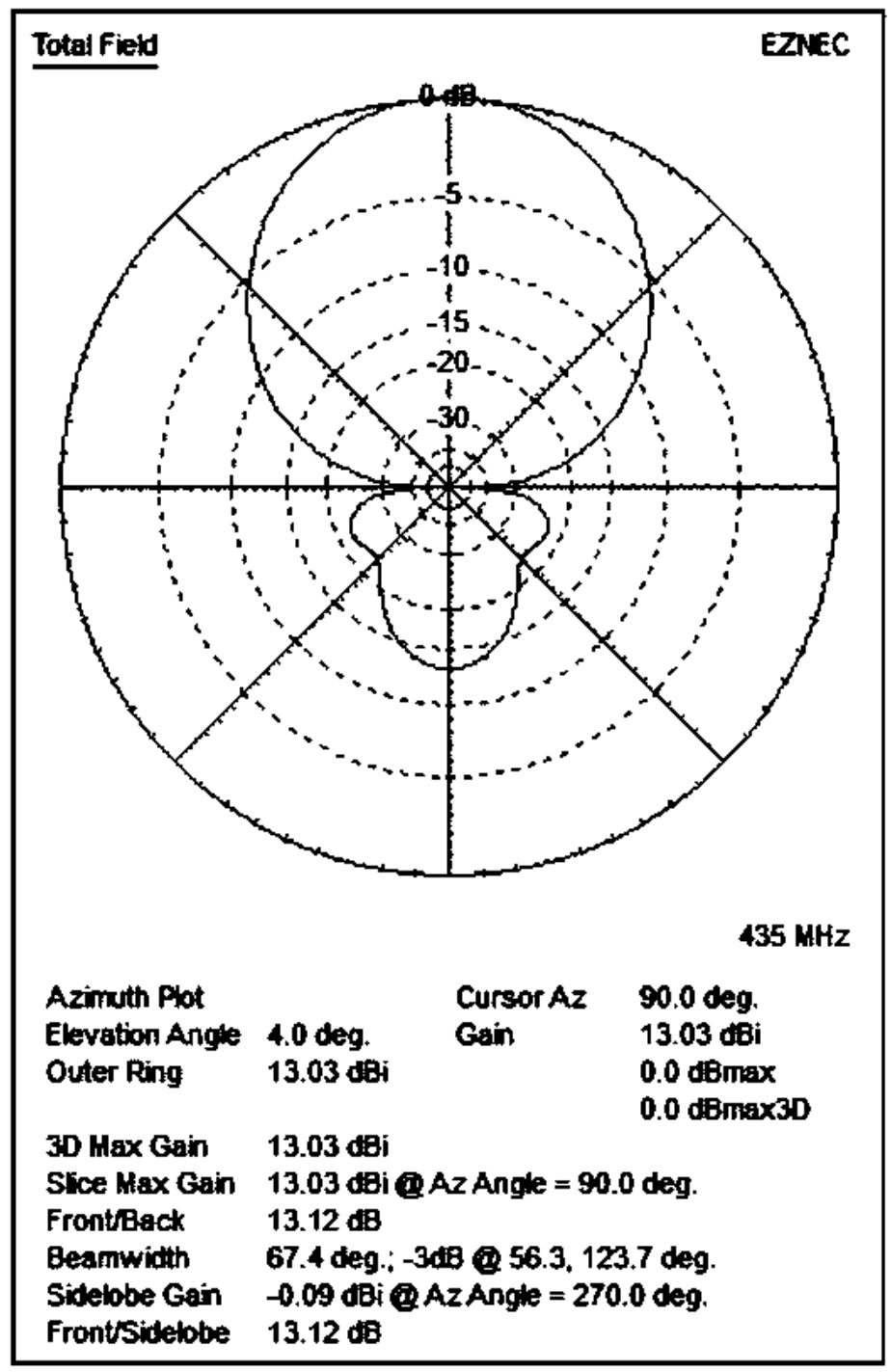


Figure 4: Azimuth plot.

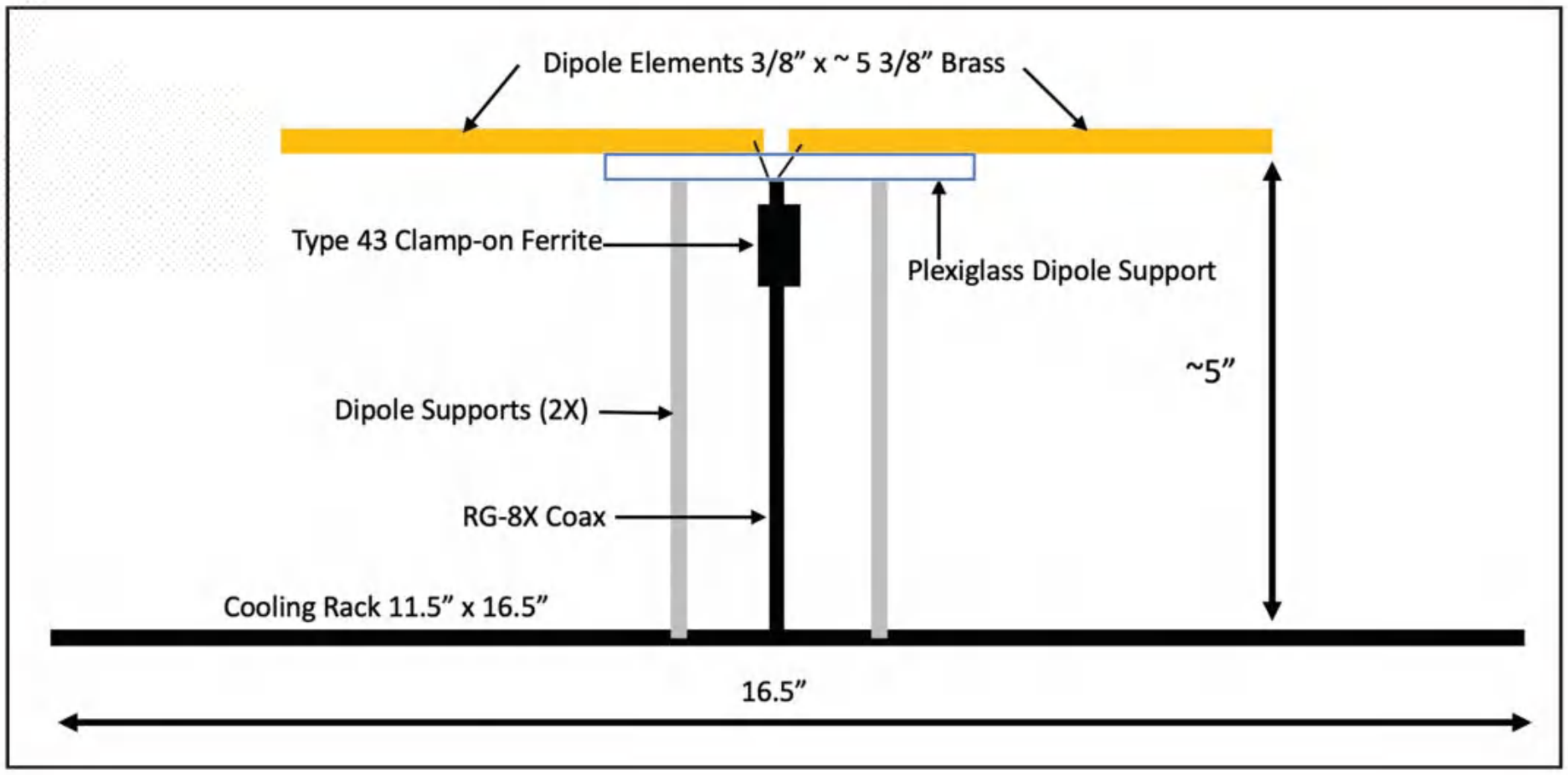


Figure 5: Schematic layout.

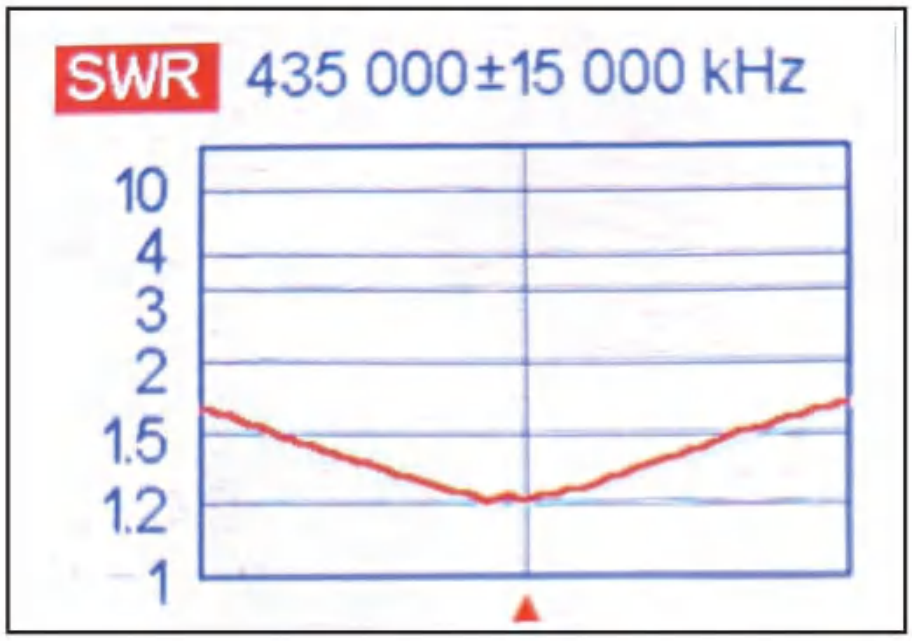


Figure 6: Measured SWR across the 70-centimeter band.

was consistently 2 S-units, or 12 dB, as predicted by our modeling. Measuring gain is a little trickier and was done in our short backyard range (50 feet) by comparing signal strengths of a dipole and the "Kitchen Array" driven by the weak signal from a Nano VNA configured as a signal generator. Again, the "Kitchen Array" averaged 1.5 to 2 S-units, or 9 to 12 dB gain, over a dipole as predicted by our simulations.

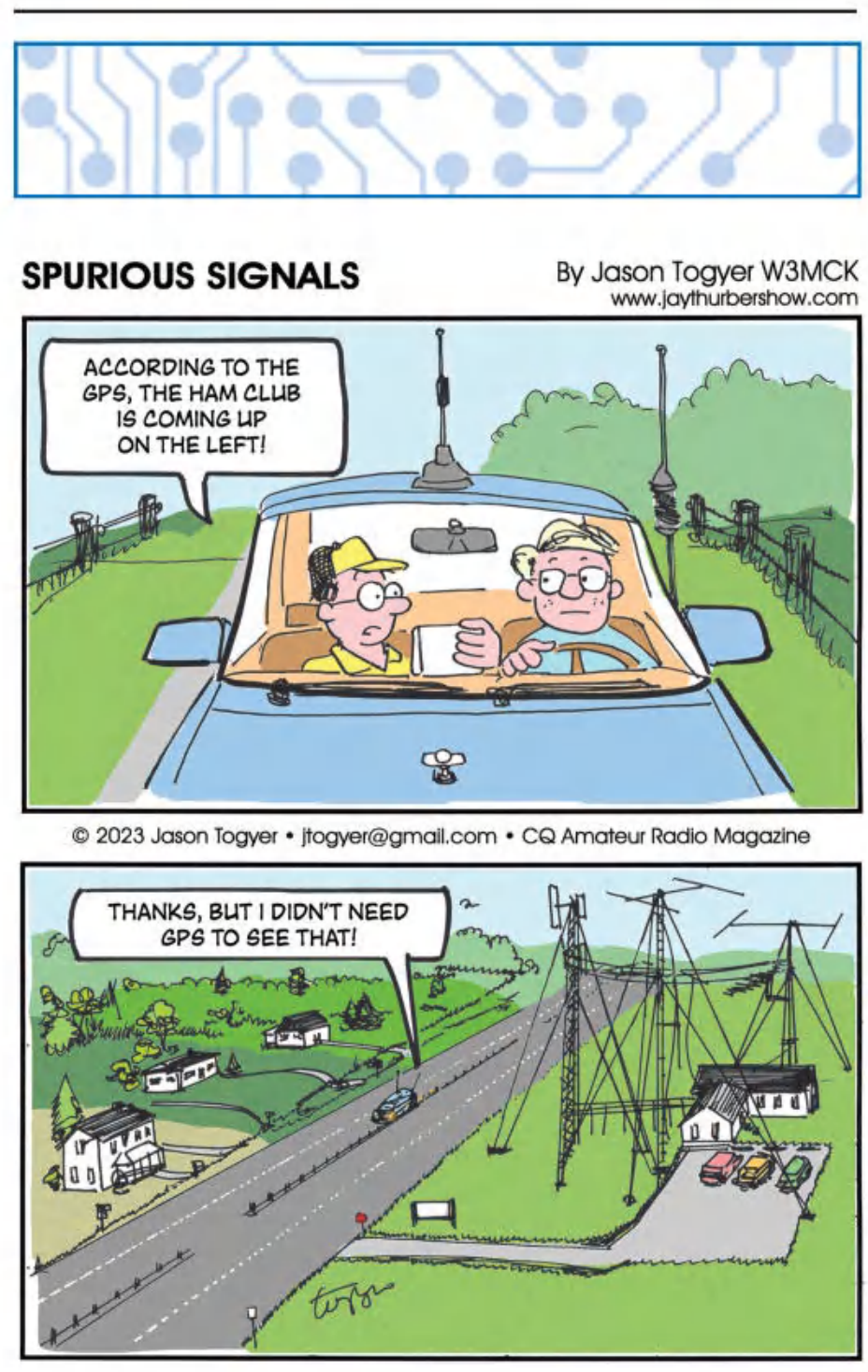
References:

1. Cebik, L.B., "The Flat-Plane Reflector for 432 MHz" <https://tinyurl.com/2knd87vh>

2. Glorioso and Rose (W1IS/KC1DSQ), "Wire Antennas 160 Meters to 70 Cm: Concepts, Construction and On-the-Air," OCFmasters.com and Amazon.com

3. <https://www.mcmaster.com/98873A200/>

4. < https://www.mcmaster.com/99223A029/>



vhf plus

BY TRENT FLEMING,* N4DTF

More on Antenna and Receiver Performance

Putting the best signal on the air is an important topic, and one I try to talk about a lot. The devil, as they say, is often in the details. Admittedly, buying a new radio is a lot more exciting than improving the quality of your feed line, but I will tell you that feed line and connector performance are critical to the success of your station. Last month, we talked about receiver performance in the VHF+ range, with help from Rob Sherwood, NCØB. I have much more from my interview with Rob that I'll share in coming episodes, but Rob sent me down a rabbit hole with talk about feed lines, including patch cables, and specifically with N connectors. He mentioned that Frank Donovan, W3LPL – who is well known to many hams as a world-class contester, educator, and all-around friend of our hobby – has been talking about problems with certain types of N connectors, especially those that feature a "floating pin." Frank was kind enough to share some of his presentation materials with me, and his comments are below:

> "My talk included a brief discussion of problems resulting from obsolete N connectors with floating pins that most hams using N connectors still have in their stations. The problem with floating pins is that most are improperly installed by amateurs *and* professionals. The pin depth must be precisely correct. If it is just 1/2 mm too long, it can permanently damage the mating female connector. Just 1/2 mm too short and the mating pressure to the female socket is inadequate for a reliable connection. If the coax is mounted vertically on a tower, migration of the center conductor of the coax can cause the floating pin to pull back, completely disengaging it from the mating female socket."
>
> *Below are some talking points from Frank's 2022 Antenna Forum presentation:*
>
> N and UHF connectors are commonly used - both have insignificant measured loss on 6 meters
> High quality silver-plated PL-259 UHF connectors - much more reliable center pin mating force than N connectors
> Common N connector failures caused by pin installation errors
> - unreliable mating caused by insufficient pin length and pin pullback
> - damage caused by excess pin length and axial pin misalignment
> Captive pin N connectors solve N connector reliability issues
> - assures the necessary +/- 0.020 inch (+/- 1/2 mm) pin depth tolerance
> - prevents connector damage caused by pin misalignment
> - prevents unreliable connection caused by pin pullback
> Never use cheaply made off-brand connectors and adapters. This includes nickel plated or "astro-plated" connectors and adapters. Instead, use only name-brand silver plated connectors and adapters. (See Photo A for an example, from Newark, of an appropriate connector.)

Photo A. Example of silver-plated PL-259 from Newark Electronics.

Thank you, Frank, for helping us to better understand "connections"!!!!

Following up on a couple of points here, many of us must manage our resources (i.e., budget) so I want to emphasize Frank's point about N and PL-259 connectors doing equally well at 6 meters. At 50 MHz, the important thing is a quality connector and feedline. Above 50 MHz, and especially beginning at 432 MHz, line loss is a much bigger issue. N connectors, especially "captive" ones as described above, will make a difference, as will the quality of your feed line, including any jumpers you are using. Upgrade as you can, keeping this in mind.

One thing Rob, NCØB, mentioned to me was using dual shielded cables to further reduce loss. My point is this: Don't buy the first thing you see. Do a little research, ask questions of the vendor and of seasoned amateur operators and acquaint yourself with the performance of feed line relative to the frequencies you plan to operate. Bottom line: Use the best materials you can afford and realize you probably can't do it all at once. The performance of your radio and your antennas depends heavily on how well they are connected.

N4DTF in the ARRL June VHF Contest

I am happy to report that your humble editor spent a lot of time in the chair during this contest, thanks in part to a very patient and understanding XYL. Other than a couple of hours on Saturday dominated by thunderstorms, and church and family activities on Sunday, I worked as much as I could. My total was 53 stations on phone and 33 on FT8. My pattern was simply to tune the band and work as many phone stations as I could. When phone got slow, I switched over to FT8 and worked all I could, then went back. I was rewarded with a good number of new grids on 6 meters, thanks in part to some excellent roving work in many areas of the country.

* <n4dtf@cq-amateur-radio.com>

Of course, Murphy came along and my IC-9100, which had worked well on FT8 earlier in the week, threw a bit of a tantrum, leaving me with only phone on 2 meters and 432 MHz. So those contacts were limited to a few local grids, nothing new or exciting there. I did call CQ on 144.200 late both nights, and early Sunday morning, to no avail. Not sure if it was a lack of band conditions or if everyone was on FT8. I'd love to have some reports from those around the country who did well on 2-meter phone, SSB or FM.

SLAMS in the June VHF Contest

From EM48, Herbert Ullmann, AF4JF, sent along a report on his group's contest operating, as well as their work to advance the use of the microwave frequencies in general. Thank you, Herbert, for sending this along:

> The SLAMS abbreviation stands for "Saint Louis Area Microwave Society". We have 19 full members, but we are running an email reflector that has 58 subscribers. SLAMS is not an official club, we have no presidents, trustees, etc. We only have 3 moderators who maintain the blog, the Groups.io account and the activity. When we need to make a decision, we vote. That's what the "membership" is for – only members can vote.
>
> The SLAMS group was founded on November 15, 2008, for one reason – to support microwave activities. The one and only condition to become a SLAMS member is to be active on any microwave band above 900 MHz or at least work on it. We have no membership dues. We meet on monthly basis – one "in person" meeting and one "virtual". It's usually a breakfast meeting followed by a trip to nearby park where we test our equipment. During the COVID times, we started Zoom meetings every first Tuesday of the month (some exceptions, like July 4th). This turned out to be interesting for our members who live further away, so we keep both meetings now.
>
> Although we have so many members, we do not have much activity in contests. The ARRL VHF this June was, as far as we know, only attended by Ron Ochu, KOØZ, Harry Haeusser, WAØCNS, and me (AF4JF), as rovers. Another of our members, Zack Widup, W9SZ, who lives farther away, attended the contest from portable locations but limited his bands due to damage his gear suffered during the last contest (the microwave sprint). Mel Whitten, KØPFX, attended the contest from his home QTH.
>
> We have a tradition here in Saint Louis. The weekend of the June VHF contest is also the weekend of one local hamfest. It is close to the grid line, so we usually operate Saturday from somewhere else, then come

Photo B. SLAMS portable microwave setup by WAØCNS. See text for details.

to Granite City to attend the hamfest, have a group lunch in a famous local restaurant and then go to another grid (EM58) to continue contesting.

If you look at the article on our blog site <https://tinyurl.com/mr2rs6es>, you will see some pictures in chronological order. You will also see that we have held a "test session" one week before the contest, just to make sure our equipment was ready. (Photo B shows a typical SLAMS microwave setup in the field.)

Some highlights:

- I used new transverters from SG-Lab in Bulgaria for 902, 1296 and 2304MHz

- I used new rover setup with non-dish antennas on a rotor mounted on a luggage rail on my SUV

- Harry Haeusser, WAØCNS, used new multi-band microwave station he built using SDR Adalm Pluto and Raspberry Pi called "Project Langstone" <https://tinyurl.com/ym8rkf5v>.

- Ron, KOØZ, just received his 10-GHz station back from DEMI (Down East Microwave) where they repaired damage the transverter suffered during another outdoor activity

Our first day was a little unusual. Normally, we all go to Winfield, Missouri in EM49 and move around the EM48/49 grid line to work each other on all our bands (which means 50 MHz to 122 GHz, currently, except 78 GHz). This year, Harry went to High Ridge in EM48rl, close to his QTH and about 40 miles away from our (Ron's and my) location in EM49oa. To make it more complicated, the road to our usual location in EM49pa (at the river dam and lock) was closed, so we had to go to a backup location which is on the hilltop, but this time of year is covered by foliage. That was a problem even on 2304 MHz, let alone higher bands.

Funny that we did not hear each other on 50 MHz with Harry – the propagation was good that day, but not for the 40 miles between us!

The second day was very rainy. We had very little attendance at the hamfest and outdoor operation was difficult, but we still managed to work each other in EM48 (Ron and I were in EM49 the first day). After the hamfest, Harry and I went to EM58as (Edwardsville, Illinois), set up one kilometer apart and worked each other on all our bands except 10 GHz and up (I forgot to bring my IF radio for these bands). Even so, it was still eight QSOs on eight different bands. I left Harry in EM58 to a spree of 50-MHz callers and returned to Saint Peters, EM48qs, to pick up my IF radio and set up in a local park to work Ron, who returned earlier from the hamfest. We worked each other on 10 GHz. As a bonus, we demonstrated the 10 GHz to two other local guys who became interested in the 3-centimeter band. We (the SLAMS) have a loaner 10-GHz rig (thanks to our member John Germanos, WB9PNU), so these newly interested guys can try it with us next time before they get their own station.

Thanks, Herbert, for an interesting report. That's a lot of activity for a relatively small group of hams. It reminds us that microwavers are a friendly sort and more than willing to help hams who are interested in getting involved on these higher frequencies. If you are in the greater St. Louis area, please look these fine folks up and get involved!

Awards and Activities

I'm very pleased to report that Jeff Wheeler, W7JW, in EN82, completed his Fred Fish Memorial Award on 6 meters during the recent ARRL VHF contest weekend. For those who don't know, the FFMA is earned by making confirmed contacts with all 488 grid squares in the continental U.S. on 6 meters. Jeff is understandably excited, and offers the following comments:

> "I'm happy to report that FFMA has been completed. I worked KN6UWK in DMØ2 on Saturday morning and AA5PR in DM53 Sunday morning. This morning all confirmed in LoTW and 3 QSLs checked locally; all submitted to ARRL Sunday afternoon.
>
> A BIG thanks to both operators for being QRV. Thanks also to Al Bailey, K8SIX for all of his work in getting KN6UWK operational in DMØ2. While Al crowdfunded the KPA500, he paid for it upfront before starting the request for donations. He also purchased at his expense a hard cover transport case for the KPA500 and a new 7-element LFA, all before the 6-meter E season started. Al deserves recognition for his legwork, emails with Base commanders and suppliers.
>
> Another BIG thank-you goes to John Klem, AA5PR, who built a cool little self-contained 6-meter remote trailer. I had emailed John several times over the past summers and he kept telling me, "stand by, I have a plan." I didn't know what he was up to until Saturday morning when he contacted me on Slack with his plan. While roving on his own during the contest, several times he took the time to log into his remote and look for me. On Sunday morning, he found me. His 100-watt, solar-powered, Moxon remote somewhere in DM53 exchanged pretty good reports on FT8 and the deal was done. FFMA from Michigan achieved.
>
> Thanks to all the others, like AG6EE, KB7Q, ACØRA, et. al., who go out across this great country activating grids for the rest of us. Best of luck to all FFMA chasers this summer. I suspect another dozen FFMA will be issued in 2023."

Again, Jeff, congratulations – we certainly owe a debt of gratitude to all those who rove and otherwise work to make it easier for us to make the needed contacts!

On the Air

Our friend Mario Karcich, K2ZD, reports continuing success in his quest for 6-meter DX. On June 13th at 2015 Z Mario worked D2UY for 6-meter DXCC # 223. According to Mario, D2UY was 0 DB here and gave him a -13db report. *Mario, keep up the good work and thanks for the report!*

Ed Locker, K5GUN, in grid EM50, reported 2-meter Es contacts during the VHF contest. At 2302z on June 11, he worked VE3DS on phone, and at 2336z he worked VE3MIS on 2-meter FT8. Ed says he basically waits all year for one good Es opening on 2 meters. Ed was running 100 watts from an IC-9100 into an eggbeater antenna! Well done, Ed!

At the end of May, Phil Miguelez, WA3NUF, reported that the 222.060 W3CCX/B beacon located at FN20tk is back on the air. Please send signal reports on this or any of the other W3CCX beacons to WA2OMY (<talgarth@comcast.net>) or WA3NUF (<PhilNUF@aol.com>).

Thanks, Phil, for letting us know. These beacons are important guides to propagation and we appreciate the effort required to keep them on the air!

That's all for this month – please keep those reports of activity and projects coming!

Summer is Sizzling with Deals...

Two Calendars To Choose From - Still 10 Months of Viewing

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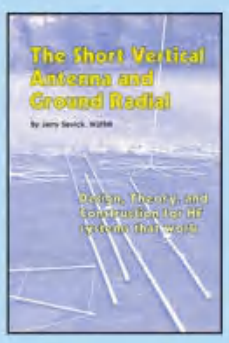
The Short Vertical Antenna and Ground Radial

by Jerry Sevick, W2FMI



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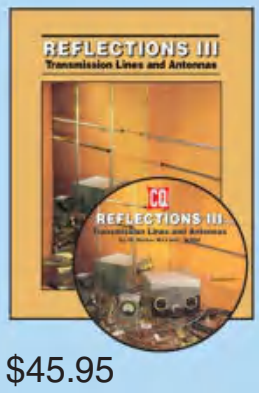
by Walt Maxwell, W2DU



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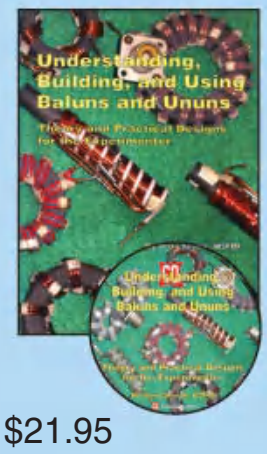

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awards

BY STEVE MOLO,* KI4KWR

Young Ladies Radio League Awards

While at the Dayton Hamvention® this year, a few members of the YLRL approached me to promote the awards they are offering in 2023. This group has eight awards available to obtain and we will cover each with a brief description and how to obtain. The information and illustrations are courtesy of the YLRL website, <www.ylrl.net>.

YLRL Annual Award

This year's YLRL Annual Award (Photo A), available only to YLRL members, is about working other YLs *over the radio*. Internet help is not permitted. Work 12 different YLs anywhere in the world. Contacts may be made by any communication mode used in amateur radio. Contacts made on Echolink do not count this year. The certificate is about using your radios and antennas to make contacts.

Log each YL contact with the following information: Their Call, Time (UTC), Date, Signal Report Sent and Received, First Name, Location or QTH. Contacts must be during the year 2023. There is a log sheet with this format that you can download from our website.

Send to Carol J. Laferty, YLRL Certificate Manager, 55 E. Cardinal Lane, Clearfield, KY 40313, or via email to <cjf1941@roadrunner.com>.

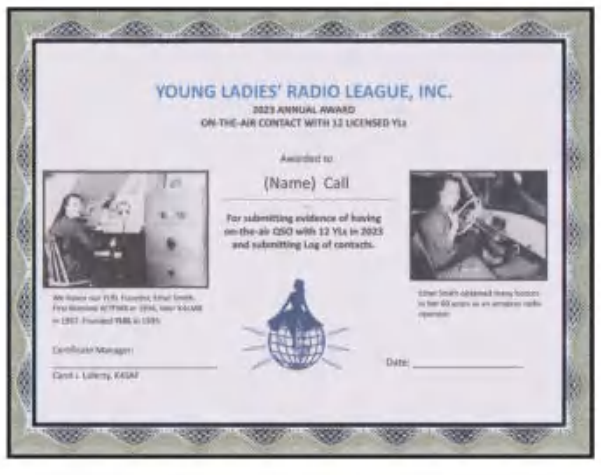

Photo A. The 2023 YLRL Annual Award is available only to current members of the Young Ladies Radio League (Images courtesy YLRL website).

*Email: <KI4KWR@cq-amateur-radio.com>

Photo B. The YL Century Club award is earned by working 100 YL operators anywhere in the world. It is open to all amateurs.

YL Century Club (YLCC)

The YL Century Club award (Photo B) is available to any licensed amateur in the world.

Two-way communications must be established on authorized amateur bands, with stations, mobile or fixed, operated by 100 different duly-licensed women amateurs anywhere in the world.

The same YL using different call letters will NOT count.

Any and all amateur bands may be used.

List of claimed contacts must be arranged alphabetically by call sign.

Endorsements: Using the same method of confirmation as the original, endorsements will be made to the original certificate when 50 additional YLs are worked and confirmed.

Gold stickers will be awarded to applicants who have worked their additional contacts from the same country; otherwise, silver stickers will be awarded.

Please indicate whether you are applying for a gold or silver sticker when submitting your application.

Worked All States YL (WAS-YL)

WAS-YL (Photo C) is available to any licensed amateur in the world.

Contact must be made with a duly licensed YL in each of the 50 states in the U.S.

The District of Columbia may be counted for Maryland.

There are no time or band limitations.

In qualifying for this certificate, it is possible to work the SAME YL in another state.

The list of contacts must be arranged alphabetically by state A-Z.

Photo C. The WAS-YL award is issued for contacting a YL operator in each of the 50 U.S. states.

Worked All Continents YL (WAC-YL)

Available to any licensed amateur in the world.

To earn WAC-YL (Photo D), two-way communications must be established on the amateur radio bands with YLs on the six continents: North America, South America, Europe, Africa, Asia, and Oceania (which includes Australia and New Zealand).

Any and all authorized amateur radio bands may be used.

Contacts may have been made over any period of time, with duly licensed women operators.

Submit a list of claimed contacts alphabetically arranged by continent.

Photo D. WAC-YL is earned by contacting a YL amateur on each continent.

Photo E. Work YLs in 10 of the 40 CQ Zones of the World to earn this award.

Worked All Zones – YL (WAZ YL)

The WAZ YL award (Photo E) is available to any licensed amateur in the world.

Work YLs in 10 different CQ zones.

Any and all authorized amateur radio bands may be used.

Contacts may have been made over any period of time or QTH.

Submit a list of claimed contacts arranged numerically by CQ zone number.

For each additional 10 zones, a sticker can be added.

A plaque is available when all 40 CQ zones are confirmed.

DX-YL Award

The DX-YL award (Photo F) is available to any licensed amateur in the world.

Work 10 DIFFERENT licensed women operators outside your own country.

USA and possessions are counted as separate countries, as well as Alaska and Hawaii.

Any and all amateur bands may be used.

Contacts do not have to be with 10 different countries, just 10 different DX YLs. Use current approved DX country list.

The log must be arranged alphabetically by call sign.

Photo F. The DX-YL award requires you to work at least 10 YL operators outside your own country.

Endorsements: Stickers will be awarded for each 10 additional DX YLs, subject to the same confirmation as above.

When 100 DX YL contacts have been confirmed for DX YL certificate, you may apply for either the special paper certificate, or an engraved plaque.

Photo G. The YL-DXCC award goes to hams who work YL operators in 100 different DX entities.

YL-DXCC

The YL-DXCC award (Photo G) is available to any licensed amateur in the world.

Two-way communications must be established on authorized amateur bands with stations (fixed or mobile), operated by licensed YLs from 100 countries on the most current ARRL list of countries.

Any band or mode may be used.

The log must be arranged alphabetically by country.

Endorsements: After receiving the certificate, a silver sticker will be awarded for contacts with YLs in 25 additional DX countries. List requirements are the same as for the original application.

YL-Digital Modes

The YL Digital Modes award (Photo H) is available to any licensed amateur in the world.

Two-way communications must be established on authorized amateur bands with stations (fixed or mobile), operated by licensed YLs using digital modes only.

Contact must be made with 25 YLs using a digital mode (FT8/FT4, PSK31, RTTY, CW, SSTV, etc.). ALL contacts must be made using the same mode.

The log must be arranged alphabetically by call sign.

Endorsements: After receiving the first certificate, a sticker may be awarded for each additional digital mode in which 25 YL contacts are made. (i.e., if the first 25 contacts were made using

Photo H. For those hams who prefer FT8/FT4 and other digital modes, YLRL makes the YL Digital Modes award available for contacting at least 25 YL ops using digital modes.

FT8, an endorsement may be earned for making 25 contacts with YLs using another mode for all 25.)

An additional endorsement after that may be earned for CW contacts, SSTV contacts, or Hellschreiber contacts, etc.)

All certificates/awards have a specific log procedure. Details are available via <https://ylrl.net/certificates/>. Submission for the awards may be made via this website using a simple form with the logbook being uploaded at the same time.

Young Ladies' Radio League, Inc. Since 1939

For 75 years the Young Ladies' Radio League, Inc. (YLRL) has helped women find their voice in Amateur Radio with members of all ages and interests.

The YLRL sponsors a number of certificates for both YLs and OMs. Members can earn special YL Certificates.

YL-Harmonics is our bi-monthly publication highlighting what women are doing in Amateur Radio.

YLRL gives out scholarships to YLs each year.

For more information on the YLRL, the current dues amounts, weekly YL Net locations or how to join please go to our website at www.ylrl.org or contact the Publicity Chairwoman, Cheryl Muhr, NØWBV at n0wbv@earthlink.net. All Officer information is also listed both on the website and in each edition of the magazine and you may contact any Officer as well.

With thanks to the OMs who encourage and support us.

Visit us at www.ylrl.org

BY BOB SCHENCK,* N2OO

INDEXA Celebrates 40 Years of Promoting DX

INDEXA

[Full disclosure: DX Editor N2OO is the current president of INDEXA]

This September marks the 40th anniversary of INDEXA, the International DX Association!

INDEXA was first incorporated in 1983. What originally started as an "on the air" DX net evolved first into a repository for donated equipment supplied to DXpeditions or deserving DX stations. QSL card printing was also provided. As vendors and manufacturers came on board donating/loaning equipment to DXpeditions, INDEXA further evolved into a fundraising organization that would pass along support to DXpeditions. These funds would help offset DXpedition expenses. Over these 40 years, INDEXA further evolved into what it is today; one of the largest DX funding organizations in the world with over 1,000 members worldwide.

For further information about INDEXA, please visit their website at <www.indexa.org>. Annual dues are only $20.00. I especially recommend watching the videos found under these tabs "INDEXA Overview," "Humanitarian Fund" and "DXpedition Planning."

To celebrate the 40th anniversary, INDEXA is announcing a special 10-day "on the air" activity called the "INDEXA QSO Party," aka IQP, which is being organized by INDEXA board member Ralph Fedor, KØIR, for this coming September. Everyone is welcome to participate. His announcement follows:

INDEXA, The World of DX, and an Announcement

BY RALPH FEDOR, KØIR

When you speak into your microphone, touch your paddle, or hit the enter key to unleash a digital signal, you climb aboard your magic carpet and begin a journey to an unknown destination. The response may come from thousands of miles away. It may be from an old friend or someone you've never met before. You may never meet again, or you may become the best of friends. You never know.

This is the thrill, the magic, we as DXers know. We have an affinity for it and we develop a kinship of like-mindedness and rapport. We feel it when we meet casually on the air, in pileups, and at our gatherings and conventions. This day-to-day magic is punctuated by the exuberance we feel when we work a new country, a new band country, or a DXpedition to a rare and remote spot on our planet. All of us, worldwide, know this magic and

The WPX Program

CW

4090	VE4GH
4091	K5BRY

SSB

4488	NA6MB
4489	IZ7VII
4490	DK7MM

Mixed

4611	VA7USD
4612	KK7ME
4613	NA6MB
4614	IZ7VII
4615	HB9GVF
4616	N5YT
4617	KI5QPZ
4618	KG5SSW
4619	AD2AG
4620	WD4ETU
4621	W6MEW
4622	LU6XQB

Digital

1943	AJ4NN
1944	VA7USD
1945	KK7ME
1946	NA6MB
1947	AD2AG
1948	JA3LVJ
1949	N5YT
1950	NØJDK
1951	KN6RSY
1952	KI5QPZ
1953	KFØFTC

CW: 700 KB4DE. 1100 JH7CUO. 2100 HB9DHG

SSB: 350 K4NWX. 400 IZ7VII. 550 NA6MB. 1200 HB9DHG. 1300 ISØHXK. 1600 EA3EQT

Mixed: 450 IZ7VII, KI5QPZ, AD2AG. 550 VA7USD, K1EHT, W6MEW. 600 KK7ME, KFØFBK, KA1SAW. 650 KIØHA. 700 KB4DE. 850 NR6AM. 950 K4NWX. 1000 IU1HGN. 1050 N2YU. 1100 LU6XQB. 1200 W5BR. 1250 KM4VI. 1300 NA6MB, VK3PIA. 1350 NA5WH. 1500 JH7CUO. 2150 PU4MMZ. 2200 EA3EQT. 2850 HB9DHG. 4000 KB1EFS. 7350 IK6DLK

Digital: 450 K1EHT, KI5QPZ, KFØFTC, AD2AG. 500 VA7USD, KIØHA. 550 AJ4NN, W6MEW. 600 KK7ME, KFØFBK. 700 K4NWX. 800 NR6AM. 900 N2YU, JK1BIB. 1050 NA6MB, IU1HGN. 1100 LU6XQB. 1150 W5BR. 1300 VK3PIA. 1350 NA5WH. 1400 JA7PKV. 1950 HB9DHG. 2250 EA3EQT. 3100 KB1EFS

40 Meters: NA6MB, K1EHT, AD2AG, VK3PIA, W6MEW, HB9DHG
30 Meters: NR6AM, HB9DHG
20 Meters: VA7USD, NA6MB, JA7PKV, AD2AG, W6MEW, HB9DHG
17 Meters: NA6MB, ISØHXK, JK1BIB, KM4VI, HB9DHG
15 Meters: NA6MB, ISØHXK, JK1BIB, HB9DHG
10 Meters: KK7ME, NA6MB, NR6AM, VK3PIA

Africa: ISØHXK, HB9DHG
Asia: NA6MB, ISØHXK, JA3LVJ, NA5WH, HB9GVF, KIØHA. W6MEW, LU6XQB
Europe: AJ4NN, KK7ME, NA6MB, IZ7VII, JK1BIB, K1EHT, HB9GVF, KIØHA, KB4DE, KFØFTC, AD2AG, WD4ETU, LU6XQB
Oceania: NA6MB, AA8SW, JA3LVJ, NR6AM, W5UJ
North America: AJ4NN, VA7USD, KK7ME, NA6MB, VE4GH, K5BRY, AD2AG, K1EHT, KN6RSY, KI5QPZ, KIØHA, KG5SSW, KFØFTC, AD2AG, W6MEW, LU6XQB, HB9DHG, K4NWX
South America: NA6MB, NR6AM, JH7CUO, HB9DHG

Complete rules and application forms may be obtained by sending a business-size, self-addressed, stamped envelope (foreign stations send extra postage for airmail) to "CQ WPX Awards," P.O. Box 355, New Carlisle, OH 45344 USA. Note: WPX will now accept prefixes/calls which have been confirmed by eQSL.cc. and the ARRL Logbook of The World (LoTW).

*Please Note: The price of the 160, 30, 17, 12, 6, and Digital bars for the Award of Excellence are $6.50 each.

*email: <n2oo@comcast.net>

are bound together by it. I know of no other hobby that can compare.

For forty years INDEXA, the International DX Association, has helped make this magic happen. It began with a few individuals supplying equipment to DXpeditions and has grown to an organization of over one thousand members and 15 board members and officials who collectively help make DX happen. The yellow INDEXA banner has flown over hundreds of INDEXA-sponsored DXpeditions and helped make millions of DXpedition QSOs possible. INDEXA's members and officials are from all over the world. This blend of worldwide voices helps INDEXA make good choices. You can learn more about INDEXA at <www.indexa.org>.

INDEXA's fortieth anniversary is in September of 2023. To mark the event and celebrate the unity and goodwill of amateur radio's DX community, INDEXA is sponsoring the INDEXA Worldwide QSO Party, a ten-day on-the-air event running from September 1st through 10th of this year.

Everyone can work everyone. Be as casual or competitive as you like. Pause to say hello to friends if you wish. INDEXA membership is not required.

Everyone can work everyone. Be as casual or competitive as you like. Pause to say hello to friends if you wish. INDEXA membership is not required. The event will cover 160 to 10 meters and you may use SSB, CW, or RTTY in any mix you choose. The emphasis is on fun, but there will be QSO points, bonus points, multipliers, and plaques, and awards.

QSL of the Month
Barbara Dunn, G6YL – UK's First Licensed YL


Lilystone Hall, Stock, Ingatestone, Essex, England.

To Radio E B 4 Z Z

Your Signals heard worked at 1418 G.M.T.

Date 9.12.24 Strength R7 - R9 QRM bad

Note R.A.C. Wave 45 λ

G6YL

Receiver here—Loose Coupled Circuit, Detector and one L.F.
Transmitter—Hartley.
Aerial—Hertz. Please Q.S.L. Rcvd. Thx
45 ft. long 50 ft. high

BARBARA DUNN—YL.
OWNER-OPERATOR—G6YL.

B. Dunn

U are my 135 EB 930 !

Photo A: G6YL's QSL card not only included a photo but a printed notation that she was a YL operator, just in case anyone had any doubts! "QSL of the Month" photos and information provided courtesy of the K8CX Ham Gallery <www.hamgallery.com>

Photo B: G6YL's shack featured QSL cards from her many contacts as well as the gear described on her QSL card as a Hartley transmitter and a receiver consisting of a "loose-coupled circuit, detector and one L.F." (That's LF, not IF – this was before the days of superheterodyne receivers that employed intermediate frequency circuits. – ed.)

G6YL, Barbara Mary Dunn, was born February 25, 1896, in Carlisle, Cumbria, England, and became a Silent Key in September, 1979. Licensed on April 14, 1927, she was Britain's first licensed YL.

It was in 1923 that Miss Barbara Dunn received her introduction to broadcast radio. She says it was "YLish curiosity" that prompted her to find out the meaning of certain scratchy signals which interfered with broadcast reception at her old home in Stock, Essex. Having discovered that these were spark signals from ships and coastal stations, she deserted the ranks of broadcast listening and set out to learn Morse code. She mastered the code entirely by listening on a crystal receiver on 600 meters. After five months of self-instruction, the code was copied at 20 WPM. At Christmas, 1925, a short-wave receiver opened up fresh fields. Many hams received useful reception reports, signed "B. Dunn." In 1927, with encouragement from a friend, Gerry Marcuse, G2NM, she was persuaded to seek admission to the ham fraternity. Her first 2-way QSO was on November 21, 1927 with GI6YW. All pf Europe and much DX was worked. Most of her QSL card collection can be seen on <hamgallery.com> (Photo A and B).

73, Tom K8CX

what's new

Impulse Electronics "Grab-N-Go" Radio Package

Every ham involved in emergency communications should have a "go-kit," a complete station for emergency deployment that's ready to go when needed, so you don't have to spend valuable time finding and packing gear when every minute counts. If such a kit is something you've thought about but never found time to assemble, Impulse Electronics has a solution for you, its new "Grab-N-Go" radio package for quick deployment.

The Grab-N-Go is a completely self-contained station including everything from a radio and antenna to built-in solar charge controller, so you can directly plug in a solar panel generating up to 150 watts. Here's a rundown of what comes packed inside the custom carrying case:

- Anytone AT-779UV UHF/VHF 20-watt radio
  - Output Power: VHF>20W, UHF>18W
  - 500 channels
  - CTCSS/DCS encode and decode
  - DTMF+2Tone/5Tone encode and decode
  - 1.4 Inch TFT display
  - Tone Pulse frequency
  - Scrambler (*Remember – Codes and ciphers intended to obscure the meaning of transmissions are generally prohibited on amateur frequencies. – ed.*)
  - Compander
  - VOX function
  - FM broadcast
  - GMRS optional
- Bioenno BLF-1220A LiFePO4 20Ah Battery & Charger
- T320 Case with
  - 12 Volt PowerPole outlet
  - Automotive 12 Volt socket
  - Digital voltmeter with Type A and C USB QC3.0 charging ports
  - 150-Watt MPPT solar charge controller
  - Mag-mount antenna with cable included inside case

The "Grab-N-Go" package retails for $629.95. Additional details and ordering information are available at <https://tinyurl.com/4m9fy8yw>.

The INDEXA Worldwide QSO Party will be listed on WA7BNM's Contest Calendar and the event website will come alive soon at <www.indexaqsoparty.com>. The website will give you detailed information on rules and regulations, the exchange, downloads, logging, a logging program, scoring, and log submissions.

Please join us and the amateur radio family from around the world to celebrate INDEXA's 40 years of sponsoring DX. It's a way for INDEXA to say "thank you" to our members and donors for their 40 years of support. We'll see you on the air.

The WAZ Program

SINGLE BAND WAZ

6 Meter

218	K5RK	32 Zones
219	JN1GTG	37 Zones
220	N8DX	27 Zones
221	9K2GR	33 Zones
222	DF2GH	25 Zones
223	YO7NE	28 Zones
224	IK4CIE	26 Zones

10M CW

227	YO7NE

10M Digital

12	OE3SGU

12M CW

118	N6PF

12M Digital

18	JL1EEI

15M CW

387	V51YJ
388	YO7NE

15M Digital

27	YO7NE
28	KW4J

15M SSB

693	WV6E

17M CW

146	V51YJ
147	YO7NE

17M Digital

47	W7HR
48	YO7NE

20M CW

699	V51YJ
700	YO7NE

20M Digital

88	IK0AOC
89	JG1EBU
90	W7HR
91	DM1HR
92	YO7NE
93	JE1LES

20M SSB

1278	WV6E

30M CW

175	SP2LNW
176	YO7NE
177	N6PF

40 CW

346	YO7NE

80M CW

115	DF2RG
116	YO7NE

160M

709	JH1NYM	31 Zones
710	W0IZ	30 Zones
711	YO7NE	40 Zones

MIXED WAZ

Mixed

10548	WV6E
10549	N2YF
10550	K5CD
10551	N9AZZ
10552	PA2IP
10553	IK0AOC
10554	JG1EBU
10555	EA4CY
10556	W1FP
10557	9A5BWT
10558	KD4EE
10559	VE3YXO
10560	IK2ULM
10561	JE2TLZ
10562	YT3H
10563	JE1LES
10564	JJ0WAJ
10565	NZ1I
10566	KW4J
10567	PY2OP
10568	7L1CDK
10569	JA8KPJ
10570	JA8MIO

SINGLE MODE WAZ

CW

1267	HA2NA
1268	WV6E
1269	JL1RUC
1270	N2ZA
1271	YO7NE
1272	K4ZMV
1273	PY2OP

Digital

508	HA2NA
509	N2YF
510	K5CD
511	K9FD
512	IK0AOC
513	JG1EBU
514	KI0HA
515	EA4CY
516	W7HR
517	G7IRN..
518	W0IZ
519	K2WJ
520	YO7NE
521	JE1LES
522	N4QS
523	NZ1I
524	JA8KPJ

SSB

5572	HA2NA
5573	WV6E
5574	V51YJ
5575	IK2ULM
5576	YO7NE

SAT

88	JA1QJI	25 Zones
89	JA1GZK	25 Zones

Rules and applications for the WAZ program may be obtained by sending a large SAE with two units of postage or an address label and $1.00 to: WAZ Award Manager, Jose Castillo, N4BAA, 6773 South State Road 103, Straughn, IN 47387. The processing fee for all *CQ* awards is $6.00 for subscribers (please include your most recent *CQ* mailing label or a copy) and $12.00 for nonsubscribers. Please make all checks payable to Jose Castillo, N4BAA. Applicants sending QSL cards to a *CQ* checkpoint or the Award Manager must include return postage. N4BAA may also be reached via email: <n4baa@cq-amateur-radio.com>.

5 Band WAZ

As of June 15, 2023
2518 stations have attained at least the 150 Zone level, and 1147 stations have attained the 200 Zone level.

As of June 15, 2023
The top contenders for 5 Band WAZ (Zones needed on 80 or other if indicated):
CHANGES shown in BOLD

Callsign	Zones	Zones Needed
AJ9C	199	23
AK8A	199	17
DF2GH	199	31
DM5EE	199	1
EA5RM	199	1
EA7GF	199	1
H44MS	199	34
HAØHW	199	1
HA5AGS	199	1
I5REA	199	31
IKØXBX	199	19 on 10M
IK1AOD	199	1
IT9GSF	199	1
IZ3ZNR	199	1
JA1CMD	199	2
JA5IU	199	2
JA7XBG	199	2
JH7CFX	199	2
JI4POR	199	2
JK1BSM	199	2
JK1EXO	199	2
K1LI	199	24
K3LR	199	23
K4HB	199	26
K5TR	199	22
K7UR	199	34
KZ4V	199	26
N3UN	199	18
N4NX	199	26
N4WW	199	26
N4QS	199	18
N4XR	199	27
N8AA	199	23
N8DX	199	23
N8TR	199	23 on 10M
RA6AX	199	6 on 10M
RU3DX	199	6
RWØLT	199	2 on 40M
RX4HZ	199	13
RZ3EC	199	1 on 40M
S58Q	199	31
SM7BIP	199	31
SP9JZU	199	19 on 10M
SV8CKM	199	1
USØSY	199	1 on 15M
VE2EBK	199	26
VK3HJ	199	34
VO1FB	199	19
W1FJ	199	24
W1FZ	199	26
W3LL	199	18 on 10M
W3NO	199	26
W4LI	199	26
W6DN	199	17
W6RKC	199	21
W6TMD	199	34
W9OO	199	18 on 10M
W8CZN	199	24
W9XY	199	22
ZL3CW	199	34
9A5I	198	1, 16
AB4IQ	198	23, 26
DL6JZ	198	1, 31
EA5BCX	198	27, 39
F5NBU	198	19, 31
F6DAY	198	2 on 10M & 15M
G3KDG	198	1, 12
G3KMQ	198	1, 27
G4OWT	198	1, 27
HB9FMN	198	1 on 80M & 10M
I1EIS	198	1 & 19 on 10M
JA1DM	198	2, 40
JA3GN	198	2 on 80M & 40M
JA7MSQ	198	2 on 80M & 10M
JH1BNC	198	2 on 80M & 10M
JH1EEB	198	2, 33
KØDEQ	198	22, 26
K1BD	198	23, 26
K2EP	198	23, 24
K2TK	198	23, 24
K3JGJ	198	24, 26
K3WA	198	23,26
K3XA	198	23,34
K4JLD	198	18, 24
K9MM	198	22, 26
KI1G	198	24, 23 on 10M
KZ2I	198	24, 26
LA3MHA	198	31 &32 on 10M
N4GG	198	18, 24
N5AO	198	22, 23
N7IR	198	17, 22
NXØI	198	18, 23
ON4CAS	198	1,19
OZ4VW	198	1, 2
RL3FA	198	2 on 80 & 10M
UA4LY	198	6 & 2 on 10M
UN5J	198	2, 7
US7MM	198	2, 6
W5CWQ	198	17, 18
W7AH	198	22, 34
W9RN	198	26, 19 on 40M
WC5N	198	22, 26
WL7E	198	34, 37
Z31RQ	198	1, & 2 on 10M
ZL2AL	198	36, 37

The following have qualified for the basic 5 Band WAZ Award:

Callsign	5BWAZ #	Date	# Zones
JL1RUC	2506	05/16/2023	200
N2YF	2507	05/20/2023	152
K5CD	2508	05/26/2023	178
IK0AOC	2509	05/26/2023	160
VK4KX	2510	05/26/2023	151
WX4F	2511	05/27/2023	150
JL1UXH	2512	05/27/2023	196
SP2LNW	2513	05/27/2023	200
JG1AID	2514	05/28/2023	163
W7HR	2515	05/29/2023	185
W9VOB	2516	06/04/2023	158
YT3H	2517	06/08/2023	200
KW4J	2518	06/12/2023	168

Updates to the 5BWAZ list of stations:

Callsign	5BWAZ #	Date	# Zones
SV8CKM	1251	3/2/2002	199
IK8GYS	1617	11/22/2008	193
N6PEQ	1932	4/17/2016	188
V51YJ	2057	7/1/2018	193
W0IZ	260	4/9/1984	195
K2WJ	2386	6/24/2022	171

New recipients of 5 Band WAZ with all 200 Zones confirmed:

5BWAZ #	Callsign	Date	All 200 #
2506	JL1RUC	5/16/2023	1145
2513	SP2LNW	52/7	1146

Rules and applications for the WAZ program may be obtained by sending a large SAE with two units of postage or an address label and $1.00 to: WAZ Award Manager, Jose Castillo, N4BAA, 6773 South State Road 103, Straughn, IN 47387. The processing fee for the 5BWAZ award is $10.00 for subscribers (please include your most recent *CQ* mailing label or a copy) and $15.00 for nonsubscribers. An endorsement fee of $2.00 for subscribers and $5.00 for nonsubscribers is charged for each additional 10 zones confirmed. Please make all checks payable to Jose Castillo. Applicants sending QSL cards to a *CQ* checkpoint or the Award Manager must include return postage. N4BAA may also be reached via email: <n4baa@cq-amateur-radio.com>.

*Please note: Cost of the 5 Band WAZ Plaque is $100 shipped within the U.S.; $120 all foreign (sent airmail).

CQ DX Awards Program

RTTY Endorsement

N9PA 89

Mixed Mode Endorsement

K8SIX 245

The basic award fee for subscribers to *CQ* is $6. For nonsubscribers, it is $12. In order to qualify for the reduced subscriber rate, please enclose your latest *CQ* mailing label with your application. Endorsement stickers are $1.00 each plus SASE. Updates not involving the issuance of a sticker are free. All updates and correspondence must include an SASE. Rules and application forms for the CQ DX Awards may be found on the <www.cq-amateur-radio.com> website, or may be obtained by sending a business-size, self-addressed, stamped envelope to CQ DX Awards Manager, Please make checks payable to the Award Manager, Keith Gilbertson. Mail all updates to Keith Gilbertson, KØKG, 21688 Sandy Beach Lane, Rochert, MN 56578-9604 USA. We recognize 341 active countries. Please make all checks payable to the award manager. Photocopies of documentation issued by recognized national Amateur Radio associations that sponsor international awards may be acceptable for CQ DX award credit in lieu of having QSL cards checked. Documentation must list (itemize) countries that have been credited to an applicant. Screen printouts from eQSL.cc that list countries confirmed through their system are also acceptable. Screen printouts listing countries credited to an applicant through an electronic logging system offered by a national Amateur Radio organization also may be acceptable. Contact the CQ DX Award Manager for specific details.

CQ DX Honor Roll

The CQ DX Honor Roll recognizes those DXers who have submitted proof of confirmation with 275 or more ACTIVE countries. With few exceptions, the ARRL DXCC Countries List is used as the country standard. The CQ DX Award currently recognizes 340 countries. Honor Roll listing is automatic when an application is received and approved for 275 or more active countries. Deleted countries do not count and all totals are adjusted as deletions occur. To remain on the CQ DX Honor Roll, annual updates are required. All updates must be accompanied by an SASE if confirmation of total is required. The fee for endorsement stickers is $1.00 each plus SASE. (Stickers for the 340 level and Honor Roll are available.) Please make checks payable to the Award Manager, Keith Gilbertson. Mail all updates to Keith Gilbertson, KØKG, 21688 Sandy Beach Lane, Rochert, MN 56578-9604 USA.

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contesting

BY TIM SHOPPA,* N3QE

Maximizing Distance Scoring in the World Wide Digi DX Contest

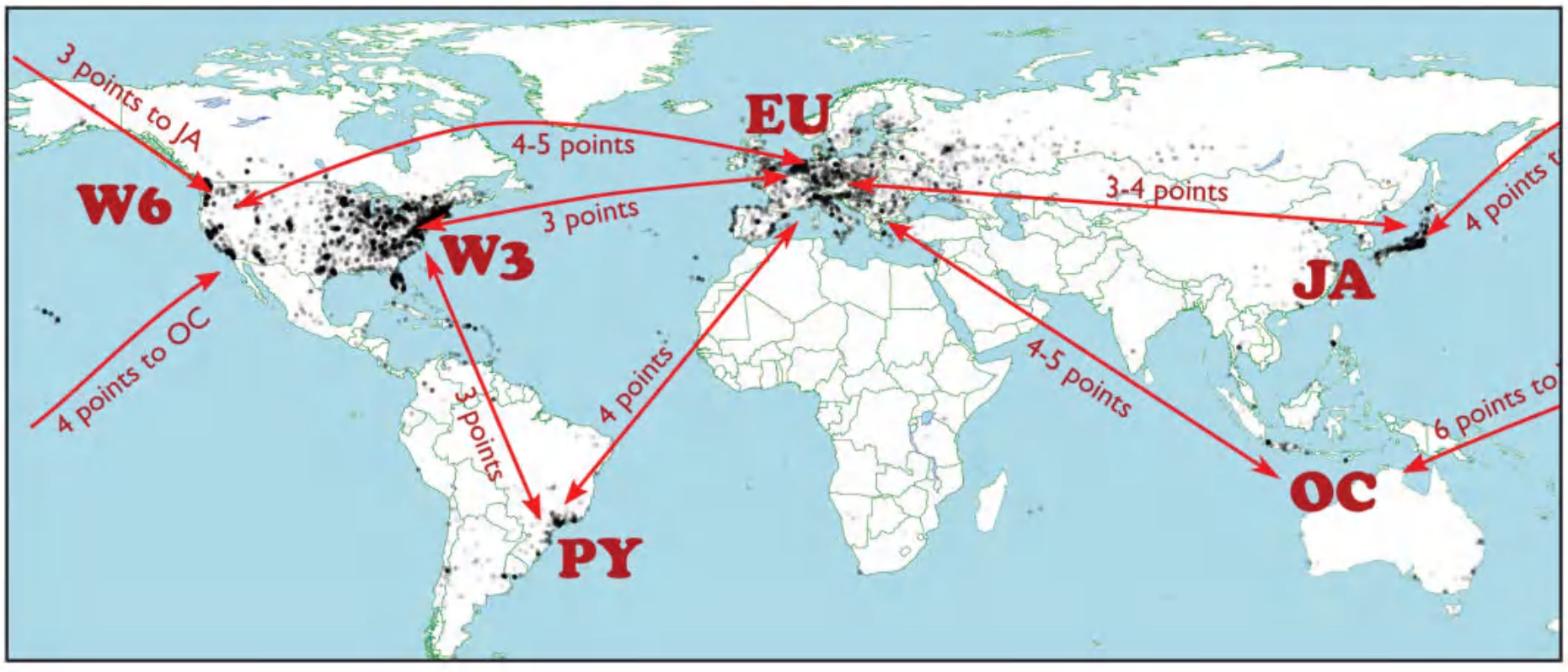


Figure 1: Common high-point-value QSOs in the WW Digi DX contest. Grey and black dots mark logs of high contester density; geographic information is taken from all 2022 ARRL public contest logs.

The last weekend of August will have the fifth running of the World Wide Digi DX Contest. In this 24-hour FT4 and FT8 contest, QSOs are awarded points based on distance-based scoring, and the first two characters of the locator grids count as per-band multipliers. Let's check out the recent trends in WSJT-mode contesting as we approach solar maximum, and can maximize our score and fun on August 26 and 27 this year.

DX propagation was astonishingly good in the second running of the ARRL International Digital Contest in the first week of June. The solar flux peaked near 170 that weekend and not only was the 20 meter band open all night (typical for summertime near solar max), I found the 15 meter FT4 and FT8 segments bustling with activity from Japan and Eastern Europe for several hours after my local midnight – an entirely new late-night high-band experience for me. Like the WW Digi contest, the ARRL digital contest also uses distance-based scoring, and finding all that juicy DX encouraged me to switch my plan from part-time operation to being on for all 24 allowed hours.

email: <n3qe@cq-amateur-radio.com>

So what directions, times and bands should we concentrate on for the highest point values? WW Digi awards at least 1 point for every QSO, no matter how close. Beyond this base, we rack up another point for each 3000 kilometers of distance. The circumference of the Earth is about 20000 kilometers, so the very most distant QSOs can earn up to 7 points. Figure 1 highlights with grey and black dots the parts of the world packed most densely with contesters; arrows show particularly important high-point value paths.

Contest stations in Australia and Oceania have a clear advantage in distance-based scoring; in 2022's WW Digi contest, ZM1A in New Zealand averaged 5 points per QSO, with almost every QSO worth between 4 and 6 points. South American stations also have a big advantage; the highest overall score in 2022 was from ZW5B's multi-multi team in Brazil, with an average of 4.1 points per QSO. For them, North American contacts were worth 3 points, and most European contacts were worth 5 points.

Contesters in North America and Europe will have a high density of 1-pointers in their immediate vicinity. By going to the highest-frequency open band available for DX, the skip pattern will avoid many of the 1-point locals and a CQ is more likely to yield a 3-to-7-point intercontinental QSO. What will be the highest open band in the last weekend of August? The 20-meter band will likely be open for DX all night. During the day, the 15-meter band will be an excellent choice. If the solar flux peaks up again, 15 meters will be increasingly useful into the evening. For certain, most northern hemisphere stations will be able to rack up high-point value QSOs to South America on the 10 meter band; in August, it is not completely certain that 10 meters will open substantially between North America and northern Europe.

The WW Digi not just about points – it's also important to rack up per-band multipliers. Unlike VHF contests in which every individual 4-character grid square is a mult, in the WW Digi contest the multiplier is the first two letters – the "field" – that begins each locator grid. For example, both FM19 and FM18 count as the same multiplier, FM. Multipliers count per band in WW Digi, and as part of your planning, please take time to rack up some low-point value local mults even on the low bands. If we are lucky enough to avoid the worst of summer QRN, high multiplier counts of several dozen are possible on

the 40- and 80-meter bands with only moderate effort. Most US and EU stations with even a compromise 160-meter antenna will be able to work 4 fields as multipliers on 160 without much effort.

FT4 vs FT8 for Contesting

FT4 has gotten much more popular in both contest and non-contest HF usage in the past year. I've chatted a lot with local club member Tyler Stewart, K3MM, about FT4's short cycle time (7.5 seconds) and resulting higher QSO rate than FT8. He told me "FT4 has grown substantially, making it nearly a bottomless pit of contacts." His ARRL Digital contest stats show that 80% of his activity in that event was on FT4. I was mostly on FT4 myself in that contest, and I was very impressed with how contest activity and at least some non-contest activity have been shifting to the more rapid-fire FT4 mode. Almost always, if there were new contacts to make on FT4, I found myself preferring it over FT8.

We already talked about band choice and mode choice. Let's move on to contest vs non-contest segment choice. For example, on the 20 meter band, the segment of 14.074-14.077 MHz has non-contest FT8 activity no matter whether there's a contest on or not. During the Digi contest weekends on the most popular bands, designated "contest segments" fill with contesters. The contest segment for 20-meter FT8 is 14.090-14.093 MHz. A full list of contest-preferred segments is in the WW Digi rules.

Note that on the low bands – especially 160 and 80 meters – you may not find any activity at all in the organizer-suggested contest segments. You'll likely only find any activity on 80- and 160-meter non-contest FT8.

Why would you prefer the contest segments? In the contest segments, you'll find the vast majority of both running and S&P (search-and-pounce) stations using "contest exchanges," including grid square but skipping over the signal report. In the non-contest segment, a sizable plurality of stations won't come back to your CQ with their grid square, but instead they'll come back with a signal report. Manually asking for the guy's grid square is unlikely to work – he's simply excluded it from his macros, he is likely running on full auto-sequencing, and he is not going to manually switch over to grid square. It seems very likely the majority of stations in the non-contest segment don't even know there's a contest going on.

For HF WSJT-X activity, stations arbitrarily pick either the odd or even transmit cycle; we are deaf to any transmissions on own transmit cycle. This leads to the need to at least occasionally flip cycles between odd and even, where you'll find a set of new callers and new CQing stations.

Calendar of Events

All year	CQ DX Marathon	bit.ly/3FyPiui
Aug. 2	VHF-UHF FT8 Activity Contest	http://www.ft8activity.eu/index.php/en/
Aug. 5	European HF Championship	https://euhf.s5cc.eu/euhfc_rules/
Aug. 5-6	10-10 Int'l Summer Contest SSB	http://bit.ly/1FrFeBc
Aug. 5-6	ARRL 222 MHz and Up Distance Contest	http://bit.ly/2IJZcy9
Aug. 5-6	Batavia FT8 Contest	https://batavia-ft8.com/
Aug. 5-6	North American CW QSO Party	http://ncjweb.com/NAQP-Rules.pdf
Aug. 6	SARL HF Phone Contest	http://bit.ly/H0IqQf
Aug. 9	VHF-UHF FT8 Activity Contest	http://www.ft8activity.eu/index.php/en/
Aug 11-14	Olivia Digital QSO Party	https://groups.io/g/olivia
Aug. 12	FISTS Summer Saturday Sprint	http://www.fistsna.org/operating.html
Aug 12	Kentucky State Parks on the Air	https://k4msu.com/kypota/
Aug. 12	SARL Youth Sprint	http://bit.ly/H0IqQf
Aug. 12-13	Maryland-DC QSO Party	https://www.w3vpr.org/node/325
Aug. 12-13	Worked All Europe CW Contest	https://bit.ly/36ubggF
Aug. 16	VHF-UHF FT8 Activity Contest	http://www.ft8activity.eu/index.php/en/
Aug. 19-20	ARRL 10 GHz and Up Contest	http://www.arrl.org/10-ghz-up
Aug. 19-20	CVA DX Contest CW	http://cvadx.org/regulamento-cvadx-2023/
Aug. 19-20	International Lighthouse Lightship Weekend – ILLW	https://illw.net/
Aug. 19-20	SARTG RTTY Contest	http://www.sartg.com/index.html
Aug. 19-20	North American SSB QSO Party	http://ncjweb.com/NAQP-Rules.pdf
Aug. 20	ARRL Rookie Roundup RTTY	http://www.arrl.org/rookie-roundup
Aug. 20	FISTS Summer Sunday Sprint	http://www.fistsna.org/operating.html
Aug. 25-27	Hawaii QSO Party	http://hawaiiqsoparty.org/
Aug. 26-27	ALARA Contest	http://www.alara.org.au/contests/
Aug. 26-27	CVA DX Contest SSB	http://cvadx.org/regulamento-cvadx-2023/
Aug. 26-27	Kansas QSO Party	http://www.ksqsoparty.org/
Aug. 26-27	Ohio QSO Party	http://www.ohqp.org/index.php/rules/
Aug. 26-27	YO DX HF Contest	https://www.yodx.ro/en/
Aug. 26-27	World Wide Digi DX Contest	https://ww-digi.com/
Aug 26-27	W/VE Island QSO Party	https://usislands.org/qso-party-rules/
Aug. 27	NJQRP Skeeter Hunt	http://w2lj.blogspot.com/p/njqrp-skeeter-hunt.html
Aug. 27	SARL HF CW Contest	http://bit.ly/H0IqQf
Sept. 2	AGCW Straight Key Party	https://www.agcw.de/contest/htp/htp-en/
Sept. 2-3	All Asian DX Phone Contest	https://bit.ly/3CrQCho
Sept. 2-3	Colorado QSO Party	http://ppraa.org/coqp
Sept. 2-3	G3ZQS Memorial Straight Key Contest	https://www.fistsna.org/operating.html
Sept. 2-3	RSGB SSB Field Day	bit.ly/3TxCrxl

Systematically switching between odd and even, FT4 and FT8, and contest and non-contest segments, will yield the most complete coverage of a band. In the ARRL Digital contest, I adopted such a plan: I started on odd-cycle in the FT4 contest segment. When rates started dropping, I switched over to the even cycle in the same segment for a whole new pool of callers. After that slowed down, I switched over to the odd and then even FT8 contest segments. After those began drying up, I finally moved to the non-contest segments, emphasizing S&P over running to avoid the problem of callers who respond to CQs without their grid square. After running through this full cycle on a single band, I could go back to where I started, with contest-segment FT4 on the same band, and find some new callers. Eventually I would start over on an entirely new band's contest FT4 segment and find different propagation to a different part of the world.

Note that the WW Digi contest has high power, low power, and QRP categories. My previous WW Digi entries were at high power, but the ARRL Digital mode contest – which does not allow more than 100 watts – made it perfectly clear that 24 hours of exciting activity awaits those who don't have an amplifier. I'll likely be going high power again for WW Digi, with the justification that it'll make it easier to work 80-meter and 160-meter multipliers through late-August QRM.

While you can enter the WW Digi by running just the WSJT-X software standalone, you'll enjoy it more and be alerted to mults on your band if you integrate WSJT-X with the N1MM+ logger. By following the detailed directions at the N1MM+ website <https://bit.ly/3qj2Aaj>, you'll be rewarded with an important new part of the N1MM+ user interface, the "decode window." You'll soon realize that during a contest the decode window is the preferred way of finding stations calling CQ. Available multipliers appear in the decode window with a red highlight and you should prioritize those while you're going S&P.

Weekly Practice Sessions

Rather than learn all the WSJT-X skills or test your station configuration for the first time in a big weekend contest, you have the opportunity now to practice WSJT-X mode contesting during the week, every week. The new Thursday night NS FT4 sprint began the last week of May, and the half-hour event was amazingly useful for me. The weekly 0100Z Friday session (that's Thursday evening for those of us in North America) has 15-20 contester participants and operating SO1R I've been able to consistently make 30 more or QSOs in the half hour. You can learn more about this event at <https://www.ncccsprint.com/ft4ns.html>.

Sept. 2-3	SARL Field Day	http://bit.ly/H0IqQf
Sept. 2-3	PODXS 070 Club Jay Hudak Memorial 80M Sprint	http://bit.ly/2MkaaNt
Sept. 3-4	Tennessee QSO Party	https://tnqp.org/rules/
Sept. 4	RSGB Autumn Series SSB	bit.ly/3TxCrxl
Sept. 4-5	MI QRP Labor Day CW Sprint	https://www.miqrp.net/contest
Sept. 6	VHF-UHF FT8 Activity Contest	http://www.ft8activity.eu/index.php/en/
Sept. 9	FOC QSO Party	http://www.g4foc.org/qsoparty
Sept. 9	OSPOTA Contest	http://ospota.org/
Sept. 9-10	Alabama QSO Party	http://alabamacontestgroup.org/aqp/rules/
Sept. 9-10	ARRL EME Contest	http://www.arrl.org/eme-contest
Sept. 9-10	Veron SLP Contest	http://bit.ly/2L9eT1L
Sept. 9-10	Worked All Europe SSB Contest	https://bit.ly/36ubggF
Sept. 9-11	ARRL September VHF QSO Party	http://www.arrl.org/september-vhf
Sept. 10	North American CW Sprint	http://ncjweb.com/Sprint-Rules.pdf
Sept. 13	VHF-UHF FT8 Activity Contest	http://www.ft8activity.eu/index.php/en/
Sept. 13	RSGB Autumn Series CW	bit.ly/3TxCrxl
Sept. 14	Bavarian Contest Club QSO Party	https://bit.ly/42VQn9f
Sept. 15	AGB NEMIGA Contest	https://bit.ly/2AWBbRK
Sept. 16	Feld Hell on Wheels Sprint	http://bit.ly/2JcbOwW
Sept. 16-17	ARRL 10 GHz and UP Contest	http://www.arrl.org/10-ghz-up
Sept. 16-17	Iowa QSO Party	http://www.w0yl.com/IAQP
Sept. 16-17	New Hampshire QSO Party	https://w1wqm.org/nh-qso-party/
Sept. 16-17	New Jersey QSO Party	http://bit.ly/1nDlf8V
Sept. 16-17	QRP Afield	http://bit.ly/2QACxFu
Sept. 16-17	SARL VHF/UHF Digital Contest	http://bit.ly/H0IqQf
Sept. 16-17	Scandinavian CW Activity Contest	https://www.sactest.net/blog/
Sept. 16-17	Texas QSO Party	http://txqp.net/
Sept. 16-17	Washington State Salmon Run	http://salmonrun.wwdxc.org/rules/
Sept. 17	BARTG Sprint PSK63	http://bartg.org.uk/wp/contests/
Sept. 17	North American RTTY Sprint	http://ncjweb.com/Sprint-Rules.pdf
Sept. 18	RSGB FT4 Contest Series	bit.ly/3TxCrxl
Sept. 20	VHF-UHF FT8 Activity Contest	http://www.ft8activity.eu/index.php/en/
Sept. 28	RSGB Autumn Series Data	bit.ly/3TxCrxl
Sept. 23	AGCW UHF/VHF Contest	https://www.agcw.de/contest/vhf-uhf/
Sept. 23	Masonic Lodges on the Air	http://cqmorelight.com/rules
Sept. 23-24	Maine QSO Party	http://www.ws1sm.com/MEQP.html
Sept. 23-24	CQ WW RTTY DX Contest	http://www.cqwwrtty.com
Sept. 30- Oct. 1	AWA Amplitude Modulation QSO Party	bit.ly/3Qkdp4w
Sept. 30-Oct. 1	UK/EI DX Contest, CW	https://www.ukeicc.com/dx-contest-rules.php

Many folks (including me) have described FT8 as being slow and boring. That's certainly not the case for FT4, which moves twice as fast – just 7.5 seconds for the overall cycle, with at most 5-second transmissions. If you're going to click on a CQing station in the decode list in FT4, you have only a second or two to start transmissions – wait any longer and you're too late. The NS FT4 Sprint has attracted my attention over five consecutive weeks now, and I'm developing an understanding for some of the nuances of WSJT contesting.

One such nuance that I've become increasingly aware of is an element of chaos in WSJT-X modes because not everyone agrees as to when a QSO is actually complete. Ed Muns, WØYK, has been campaigning to reduce not-in-log (NIL) rates and unnecessary acknowledgement cycles in FT4/FT8 contesting by recommending everyone follow an optimal exchange pattern based on two fundamental rules. By following this pattern, not only will NIL rates be reduced, but on-air efficiency will be maximal. The first rule is: "Always log the QSO when receiving a R, RRR, RR73, or 73 message". The matching rule for the QSO partner is "Always log the QSO when sending R, RRR, RR73, or 73 message". Note the high symmetry of these rules – both sides are using a single acknowledgement to recognize that the QSO is complete.

The recommended message sequence for the Thursday night FT4 takes this to the extreme; you can find a detailed breakdown of the optimal sequences at <https://tinyurl.com/3b8v6ekz>. Theoretically, both running and S&P stations with optimal exchanges can achieve one QSO every 15 seconds. Essentially, every acknowledgement message in FT4 contesting can by interpreted the same way as a "TU" in CW contesting or a "Thanks" in SSB contesting. Treat the "R", "RR73" or "73", as not just an acknowledgement of a complete QSO instructing your current caller to log you, but also as an invitation for a new caller.

August and September Contest Highlights

The CW and SSB modes of the North American QSO Parties are August 5 and August 19. All entrants are limited to no more than 100 watts, so you'll be able to be heard if you get on and call CQ with a simple station. Operate up to 10 of the possible 12 hours from 1800Z to 0600Z. Multipliers are per band so you'll optimize your score by planning for some off-time in daylight hours, allowing you to use the last two hours after the sun has set across all of the continental US to work valuable new mults on the opposite coast on the low bands. Full rules are at <https://ncjweb.com/naqp/>.

The second weekend of both August and September have these 48-hour Worked All Europe DX Contests on the CW and SSB modes. Stations outside Europe work European stations for QSO points and per-band mults. Additionally, you can exchange QTCs (simulated traffic exchanges) with European stations for additional points. With anticipated superb high-band conditions, I'm confident that even low power US stations will be asked for QTCs. Find full rules at <https://bit.ly/3NUOzZQ>.

The triumvirate of CQ World Wide DX contests kicks off in the last weekend of September with the biggest RTTY contest of them all, the 48-hour CQ WW RTTY DX Contest. I'll offer some advice on high-band solar maximum fall propagation planning in next month's column; until then you'll find the rules and rules FAQ for this one at <https://cqwwrtty.com/>.

propagation

BY TOMAS HOOD,* NW7US

Fact or Fiction?

Quick Look at Current Cycle 25 Conditions:
(Data rounded to nearest whole number)

Sunspots:
Observed Monthly, May 2023: 138
Observed Monthly, June 2023: 163
Twelve-month smoothed, November 2022:101
Twelve-month smoothed, December 2022: 107

10.7 cm Flux:
Observed Monthly, May 2023: 156
Observed Monthly, June 2023: 162
Twelve-month smoothed, November 2022: 142
Twelve-month smoothed, December 2022: 145

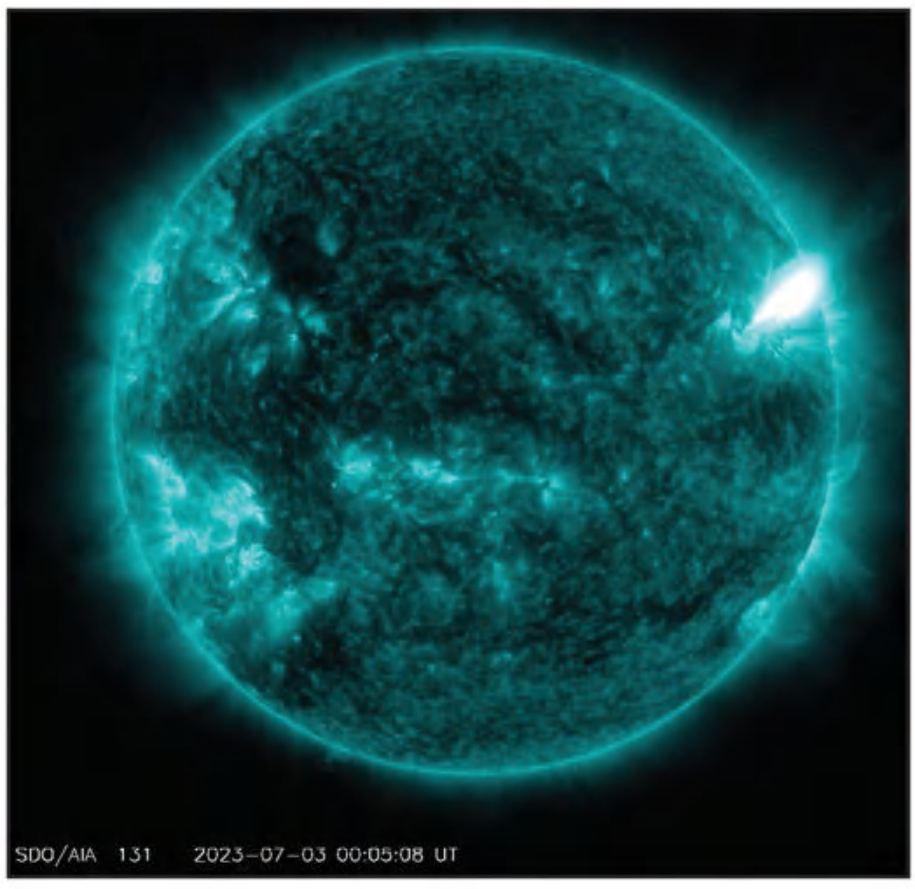
One Year Ago:
(Data rounded to nearest whole number)

Sunspots:
Observed Monthly, May 2022: 92
Observed Monthly, June 2022: 72
Twelve-month smoothed, November 2021: 50
Twelve-month smoothed, December 2021: 55

10.7 cm Flux:
Observed Monthly, May 2022: 134
Observed Monthly, June 2022: 116
Twelve-month smoothed, November 2021: 98
Twelve-month smoothed, December 2021: 102

You may have heard a fellow amateur radio operator make the statement, "a solar flare is heading our way, so conditions will be terrible." Even in popular news media we find or hear statements like this. A report like, "A spectacular coronal mass ejection on July 4 sent a solar flare heading our way at a speed of 1,400 kilometers per second. The flare, said to be of medium size, is likely to result in a solar storm with spectacular aurora and other space weather effects that have the potential to cause some communications, navigation, and power-grid problems." Do a search on your favorite search engine for 'solar flares heading our way' and see at how popular this phrase has become. The problem with these statements is that they are inaccurate.

Is it true that solar flares head our way? In truth, the answer is one of clarification. Technically, solar flares do not head our way, in the way that these statements imply. Faithful readers of this column know that solar flares often trigger a complex series of events that may lead to the release of solar



This image, captured by the Solar Dynamics Observatory AIA instruments at the 131-Angstrom wavelength (invisible to the naked eye, but false-colored for our benefit), shows the eruption of an X-class (X1.1) solar flare from Active Region 3345 (AR3345), as the sunspot group's magnetic complexity triggered this very strong explosion. This burst of energy caused an R3-level radio blackout over the Pacific region, which is what was in daylight at the time of the flare. (Source: SDO/AIA, NASA)

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LAST-MINUTE FORECAST

Day-to-Day Conditions Expected for August 2023

	Expected Signal Quality			
Propagation Index	(4)	(3)	(2)	(1)
Above Normal: 1-8,11-17,21-22,24-31	A	A	B	C
High Normal: 18-20,23	A	B	C	C-D
Low Normal: 9	B	C-B	C-D	D-E
Below Normal: 10	C	C-D	D-E	E
Disturbed: n/a	C-D	D	E	E

Where expected signal quality is:
A--Excellent opening, exceptionally strong, steady signals greater than S9
B--Good opening, moderately strong signals varying between S6 and S9, with little fading or noise.
C--Fair opening, signals between moderately strong and weak, varying between S3 and S6, with some fading and noise.
D--Poor opening, with weak signals varying between S1 and S3, with considerable fading and noise.
E--No opening expected.

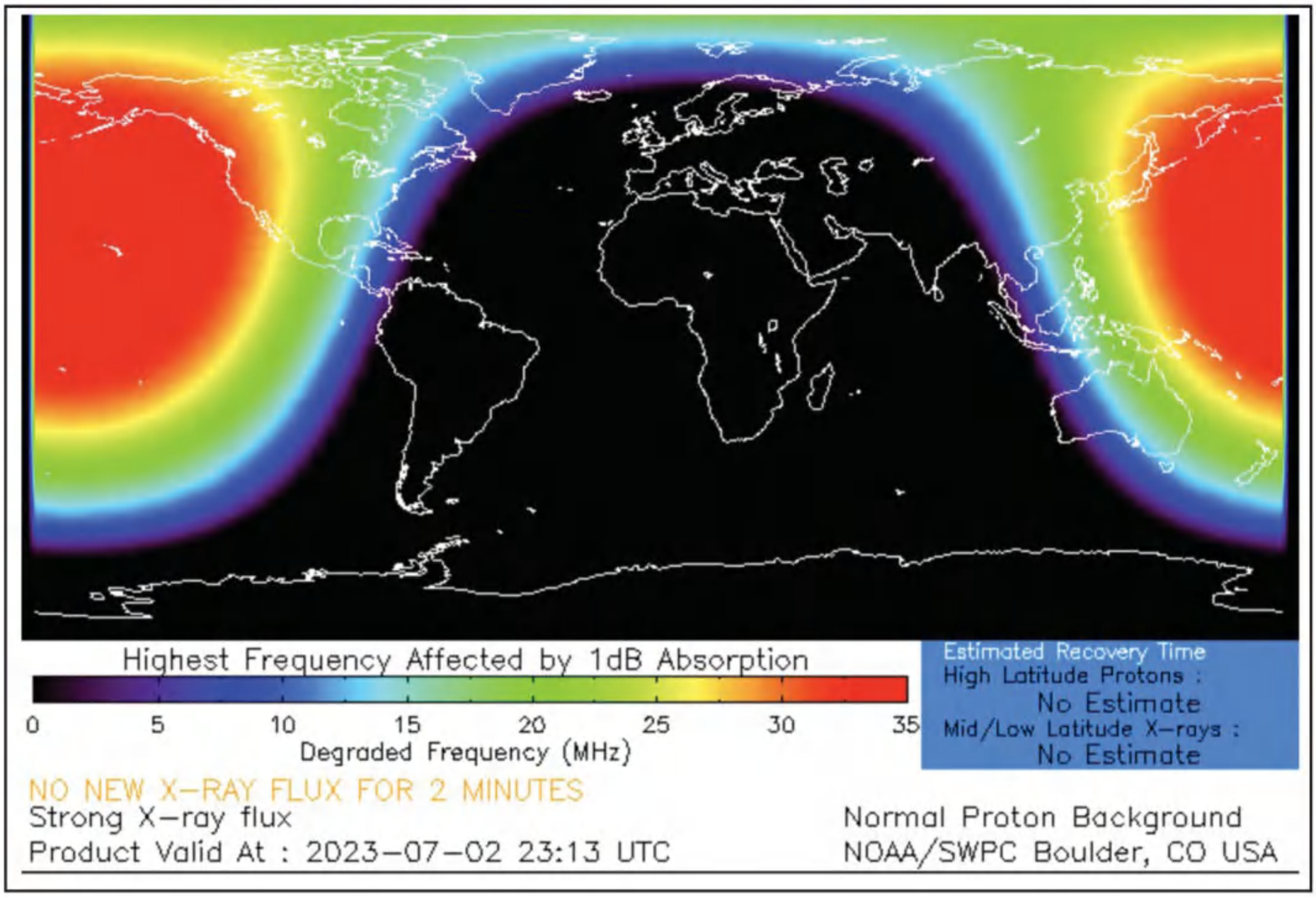
HOW TO USE THIS FORECAST

1. Using the Propagation Charts appearing in "The CQ Shortwave Propagation Handbook, 4th Edition," by Carl Luetzelschwab, George Jacobs, Theodore J. Cohen, and R. B. Rose.

a. Find the *Propagation Index* associated with the particular path opening from the Propagation Charts.

b.With the *Propagation Index*, use the above table to find the expected signal quality associated with the path opening for any given day of the month. For example, an opening shown in the Propagation Charts with a *Propagation Index* of 4 will be excellent on August 1 through August 8, good on August 9, then only fair on August 10, and so forth.

2. Alternatively, you may use the *Last-Minute Forecast* as a general guide to space weather and geomagnetic conditions throughout the month. When conditions are *Above Normal*, for example, the geomagnetic field should be quiet, and space weather should be mild. On the other hand, days marked as *Disturbed* will be riddled with geomagnetic storms. Propagation of radio signals in the HF spectrum will be affected by these geomagnetic conditions. In general, when conditions are *High Normal* to *Above Normal*, signals will be more reliable on a given path, when the ionosphere supports the path that is in consideration. This chart is updated daily at <https://SunSpotWatch.com> provided by NW7US.



At the peak phase of the X1.1-level x-ray flare, at about 2313 UTC on 2 July 2023, the energy of the flare (which only takes about eight minutes to arrive at Earth) triggered an R3 (strong) radio black out over the Pacific region as can be seen in this graphic. Even the highest bands on shortwave were affected, though not as strongly as the lower bands. (Source: NOAA/SWPC)

plasma clouds that do come our direction, but also know that the flare itself is a nearly instant release of energy much like the flashing of a flash bulb on a camera.

Solar flares are good examples of some of the most energetic natural explosive events known to man. Complex magnetic looping structures concentrated in an active sunspot region suddenly snap apart. Radiation is emitted across virtually the entire electromagnetic spectrum, from longwave radio frequencies, through the optical spectrum (the bright flash of a solar flare that is seen by the naked eye), to x-rays and gamma rays at the shortest wavelength end. The amount of energy released is the equivalent of millions of 100-megaton hydrogen bombs exploding at the same time!

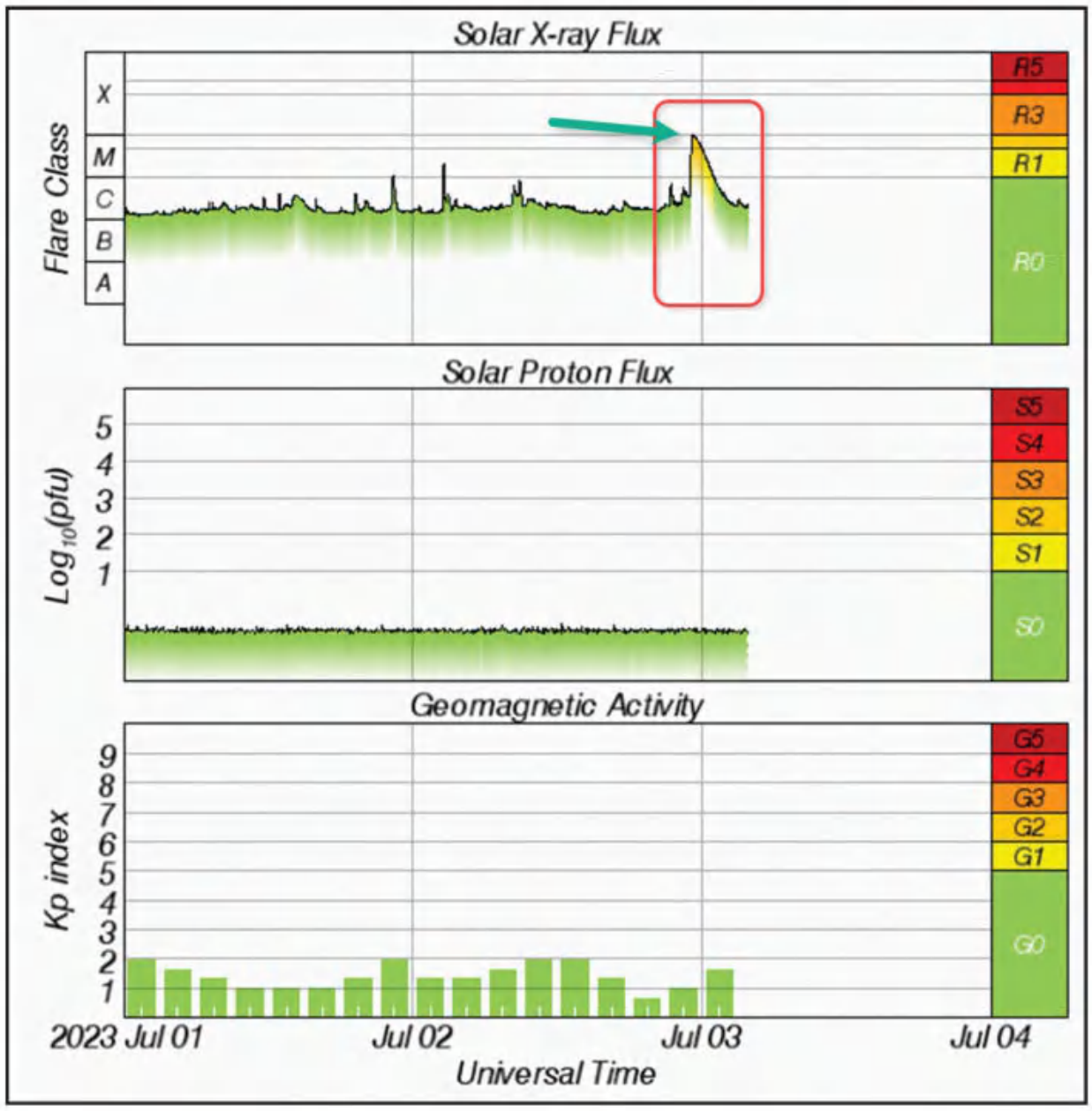
This release of energy is nearly instantaneous—and because this radiation of light and radio energy travels at the speed of light, it takes only about eight minutes for the energy to reach Earth. When an x-ray flare occurs on the Earth-facing side of the Sun, it takes only eight minutes for the full impact of the flare's energy to reach our planet! That's why it is misleading for someone to say, "a solar flare is heading our way and the HF bands are going to be terrible tonight," as if sometime in the coming hours, the results of the flare are going to make it here.

The x-rays from these events penetrate the lower ionosphere and cause the *D*-region, which acts as a sponge that soaks up radio signals, to become more energized. The more ionized the *D*-region, the higher the frequencies that are absorbed, and the stronger the absorption of the lower frequencies. Thus, radio signals from distant locations that travel through a flare-enhanced ionosphere are absorbed and become inaudible. These fadeouts, what used to be called radio blackouts but are now known as "Sudden Ionospheric Disturbances" (SIDs), last only minutes for minor flares, to maybe an hour or more for the largest of flares. Once the flare is exhausted, the x-ray radiation fades, and the ionosphere slowly recovers to its normal level of ionization.

It might be that there is confusion about what may be heading toward the Earth, when people talk about a "solar flare is heading our way." As all this magnetic energy is being released during the explosive moment of a solar x-ray flare, the Sun heats and accelerates the s plasma caught up by the complex tangle of magnetic fields, and sometimes releases these plasma particles as huge clouds out into interplanetary space. These billion-ton clouds are known as coronal mass ejections (CMEs), and they ride the solar wind out away from the Sun.

A CME travels very fast, but not as fast as the speed of light. Depending on how intensely the plasma was ejected during the explosive solar flare, the coronal mass ejection could take anywhere between one to four days to arrive at the Earth. That is, if the CME is directed toward the Earth. Not all CMEs are ejected toward the Earth.

If a CME is directed toward the Earth, it can cause a lot of havoc. When they hit our magnetosphere, we could see the



Peaking at 2314 UTC at a level X1.1, the X-class x-ray flare was the strongest of the first days of July. Previous flares measuring in the low M-class range caused some degradation of propagation on lower bands, but no major radio blackout as was experienced during the X1.1 flare. (Source: NOAA/SWPC)

geomagnetic activity turn stormy, which will cause longer-term degradation of HF propagation, as well as trigger auroral conditions. Geomagnetic activity has the effect of lowering the ionization of the various ionospheric layers, which brings down the maximum usable frequency (MUF) over a given signal path. This lowering is much like what happens at night, when the ultraviolet radiation of the sun is blocked, and the ionosphere settles down. The stronger and longer the geomagnetic storm, the more depressed the ionospheric propagation becomes.

Some people think of the coronal mass ejection and the resulting geomagnetic storms collectively as a "solar storm." This may lead some to think of this as the "solar flare that is heading our way leading to bad radio conditions." But now we know that a solar flare is a nearly instantaneous event that affects radio propagation on the sunlit side of the Earth, with a possible longer-term event known as the coronal mass ejection. But wait! There is one more related event.

Faithful readers of this column know that the Sun is always generating a solar wind. The solar wind is made up of protons and other particles that stream away from the Sun at varying speeds. When CMEs plow through interplanetary space, they plow through this gaseous material, first in the Sun's atmosphere and then out in the solar wind. Shock waves in front of the CME can accelerate these protons in our direction, causing what we know as "the proton storm."

When these accelerated protons of a CME are aimed toward the Earth, they penetrate our magnetosphere and are funneled down toward the polar regions, forced along the Earth's magnetic field lines. These highly energized protons cause the *D*-region of the ionosphere to become highly ionized, effectively absorbing first the lowest wavelengths of the high frequency spectrum, to the highest of the shortwave spectrum if the proton storm is extremely intense. This is known as a "polar cap absorption" event (PCA), and can occur as quickly as within hours of an x-ray flare, or perhaps days after the flare. When a PCA occurs, and radio signals over the polar regions are absorbed, it shuts down radio paths between DX locations depending on the polar paths, such as between central Europe and the United States.

We'll continue diving into the science of the ionosphere and space weather, as well as using computer software tools that aid in understanding, analyzing, and predicting radio signal propagation. Stay tuned each month!

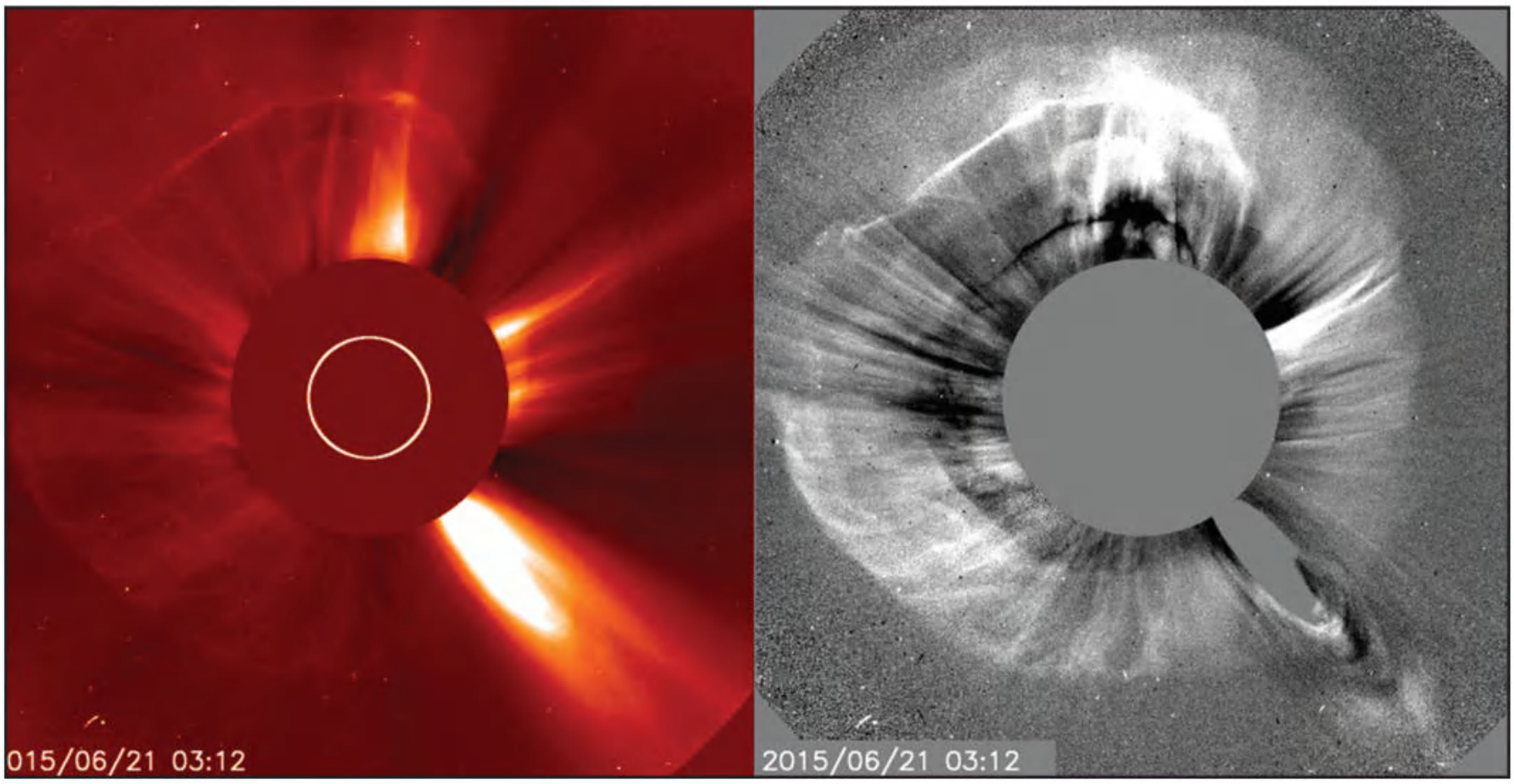
August Shortwave Propagation

At last! With August comes a shift from summertime toward wintertime ionospheric conditions in the Northern Hemisphere. While most days in August will exhibit summertime conditions, conditions will begin to conform more to a winter pattern of higher daytime and lower nighttime usable frequencies. Moving into August, summer conditions caused by the sunbaked, thinned ionosphere will prevail. But as we move into September, with less sunlight over the pole, the maximum usable frequencies (MUFs) should become higher, with longer windows on higher bands.

Being in mid-summer with moderate to high 10.7cm flux numbers, 20 meters will be the most used nighttime DX band, while bands up through 10 meters will become primary bands for DX during various times through the day, between many regions of the Earth. The low bands are too noisy and experience a high amount of absorption, even at night, up through the 40-meter band.

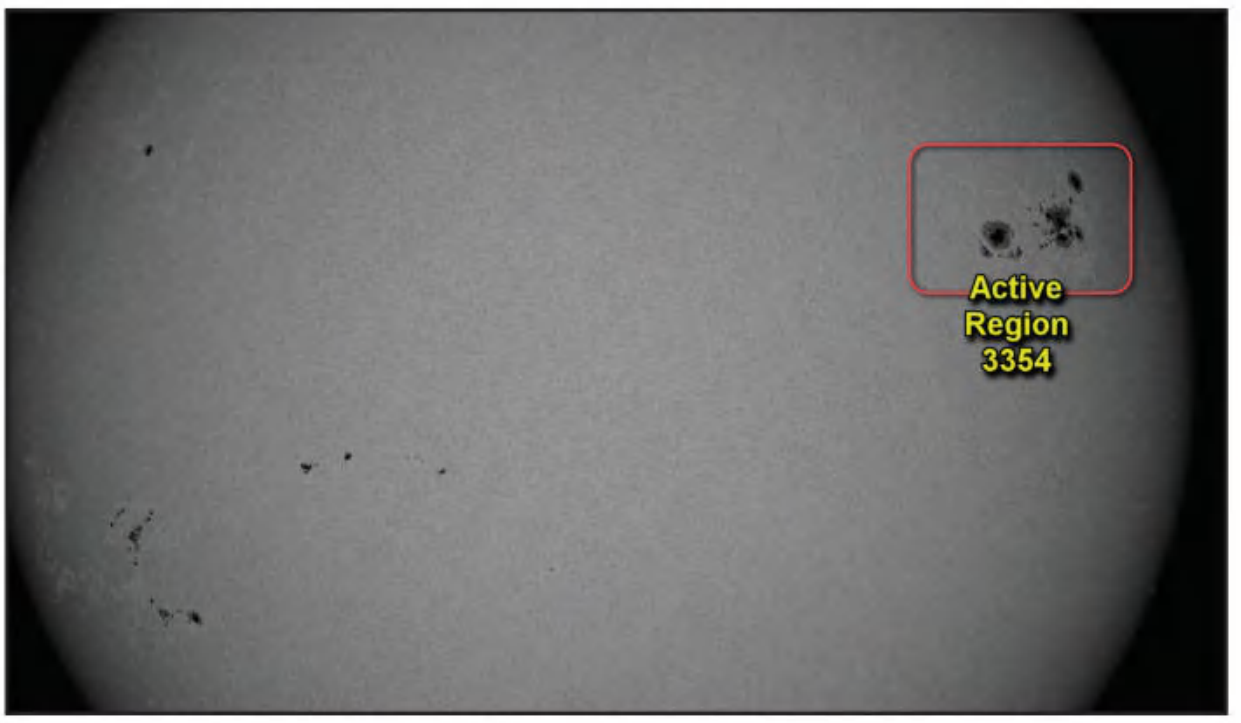
Daytime: While 10 through 20 meters should be open for DX throughout the daylight hours, peak signals are expected during an approximate two-hour window immediately following sunrise and again during the late afternoon. Good to fair openings occur on the 10- and 12-meter bands during the hours of daylight, particularly along an arc extending across central Africa, Latin America, and into the far Pacific area. Peak conditions should occur during the afternoon hours, but as we move into September, earlier and later windows will open.

Nighttime: Between sundown and sunrise, 20 meters is expected to be the best DX band, but there may be surprises on 17 and 15 meters. On the 20-, 30-, and 40-meter bands, openings should be possible to nearly all areas of the world,



View of a CME on June 20, 2015 from the Solar and Heliospheric Observatory, or SOHO. Earth-directed CMEs like this one are often called halo CMEs, because the material shooting off from the sun looks like a ring around the disk of the sun. This halo can be seen more clearly in the right-hand image called a difference image, which is created by subtracting two consecutive frames to see how the image has changed. If a CME is directed Earth-ward, the plasma cloud will interect with Earth and if magnetically oriented correctly can trigger geomagnetic storms, degrading shortwave radio propagation. (Credit: NASA/SOHO)

often with exceptionally strong signal levels. Until midnight, good DX conditions may be found on 15 and 17 meters for openings toward Latin America, the far Pacific, and into Asia. Fairly good nighttime DX conditions are also expected on 30, 40, and 80 meters despite the high static at times. Openings should be possible before midnight along an arc extending from northern Europe, through Africa, and into Latin America. By late August it should be possible to work some DX on 160 meters during the hours of darkness. Conditions on this band, as well as on 40 and 80 meters, will tend to peak just as the sun begins to rise on the light, or easternmost, terminal of a path.



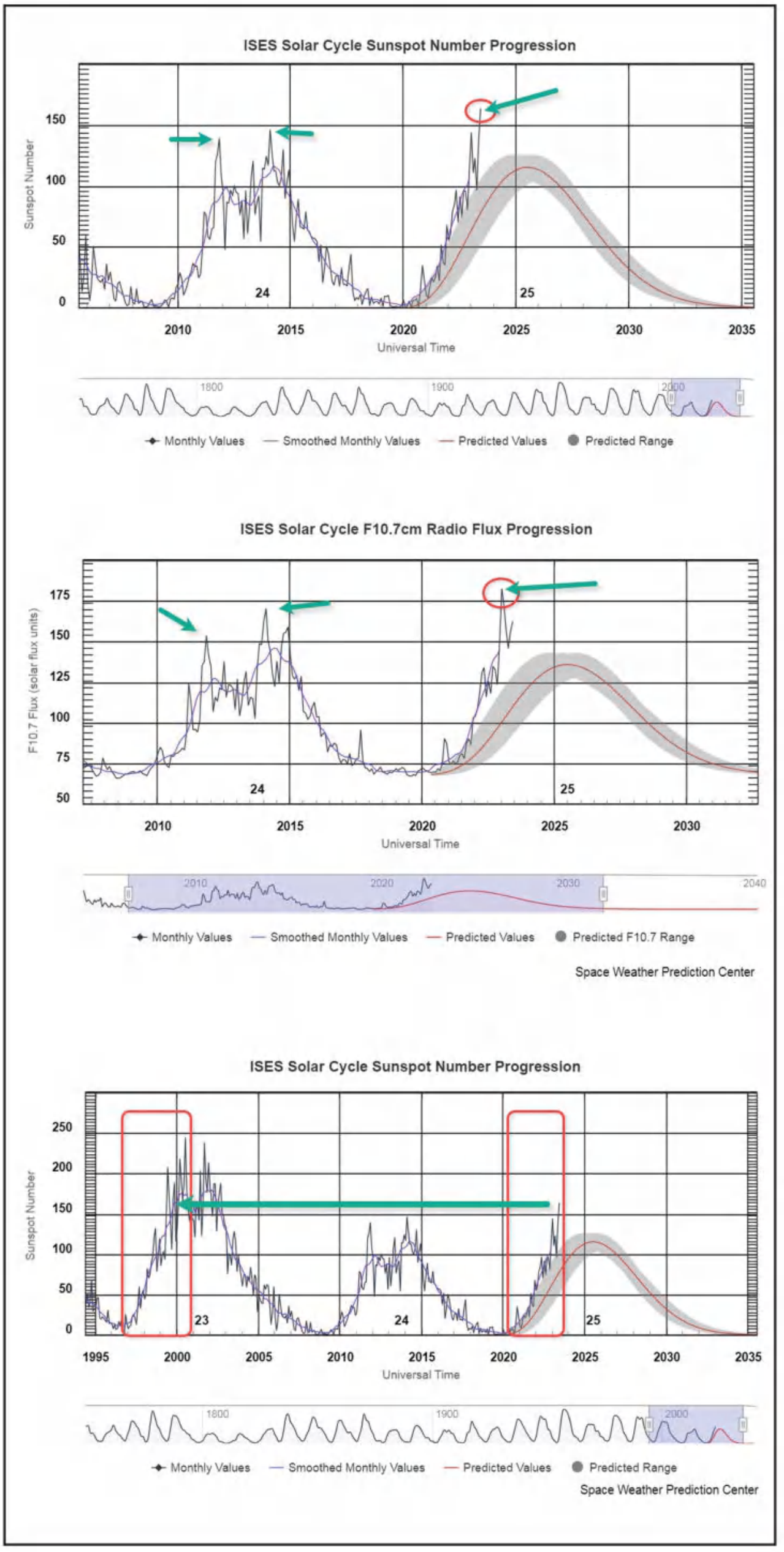
The source of the X1.1-class x-ray flare on 2 July 2023 is Active Region 3354, as can be seen in this visible-light image taken by SDO with the HMI intensitygram instrument. That is a very large sunspot region, with a complex magnetic structure which became unstable, erupting in many M-class flares, and the X-class flare at the time this column is going to press. (Source: SDO/HMI)

Short-Skip Conditions

For openings over distances ranging between 50 and 250 miles, use 80 and 40 meters during the day, and 80 and 160 meters at night, as even with summertime noise, close-in communication can be had. Between 250 and 750 miles, the best bands should be 40 and 30 meters during the day, and 40 and 80 meters at night. For openings between 750 and 1300 miles, the best bands should be 20 and 17 meters during the day, with good openings also possible on 15 and 12 meters. From sundown to midnight try 40 and 30 meters. From midnight to sunrise try 80 meters. Between 1300 and 2300 miles, the best daytime bands should be 20 and 17 meters, with some activity on 15. Try the 30- and 40-meter bands during hours of darkness.

VHF Conditions

Sporadic-E propagation usually tapers off during August, but it may offer frequent opportunities on ten meters. Some 6-meter sporadic-E (E_S) openings are expected during the month over distances of approximately 750 to 1300 miles. Be sure to check the 2-meter band



for an occasional short-skip opening between approximately 1200 and 1400 miles. While E_S short-skip openings may occur at any time, there is a tendency for them to peak between 8:00 a.m. and noon, and again between 6:00 p.m. and 9:00 p.m. local daylight time.

Aurora? There is a fair chance for aurora-mode propagation events during August this year. We expect coronal mass ejections (CMEs) this month, as well as the likely recurring coronal holes that will contribute to high-speed solar winds. The CME-related massive clouds of plasma will race toward the Earth on elevated solar winds after an x-ray flare and will trigger aurora and geomagnetic storms. Auroral-scatter-type openings, on both 6 meters and 2 meters, can range from a few hundred up to about a thousand miles, and they are usually characterized by very rapid flutter and Doppler shift on SSB signals.

Also, this month, for the very patient, check the 6-meter band for possible trans-equatorial (TE) openings between 8:00 p.m. and 11:00 p.m. local daylight time. This type of propagation favors openings from the southern tier states into deep South America, with the signal path crossing the magnetic equator at a right angle. TE openings during August are rare, but they can occur. Very weak signals and severe flutter fading usually characterize them.

For a complete calendar of meteor showers in 2023 check out <https://tinyurl.com/mr344zc2> .

If you use Twitter.com, you can follow <@hfradiospacewx> for hourly updates that include the K index numbers. You can also check the numbers at <https://SunSpotWatch.com>, where this columnist provides a wealth of current space weather details as well as links. Please report your observations of any notable propagation conditions, by writing this columnist via Twitter, or via the

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There is no doubt any more that this sunspot cycle, Cycle 25, has already exceeded the peak of Cycle 24, and we are not even near the expected peak of the cycle! Both the F10.7-cm flux levels and the monthly sunspot count have reached higher peaks than we witnessed at all in Cycle 24. This is great news for 10- and Six-Meter F-region propagation (worldwide propagation, at that). The coming months of autumn and winter will be very lively with DX signals filling up the higher bands. (Source: NOAA/SWPC)

behind the bylines...

... a little bit about some of the authors whose articles appear in this issue.

Matt Canel, KE8NZR ("The 2023 Field Day Experience for a University Amateur Radio Club," p. 8), is a recent mechanical engineering graduate of Case Western Reserve University and is founder of 3D Music, LLC, which manufactures acoustically-accurate 3D-printed violins. Co-author David Kazdan, AD8Y, is a typical ham radio underachiever. He is an electrical engineer, holds a Ph.D. in biomedical engineering, is a board-certified anesthesiologist and is currently teaching in the electrical engineering and computer science department of Case Western Reserve University. He is also the faculty adviser and station trustee of the Case Amateur Radio Club, W8EDU.

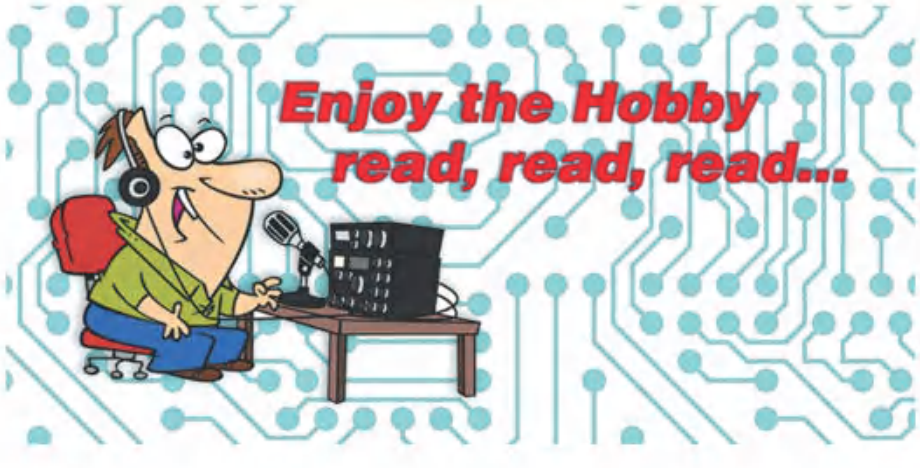
Chris Kunze, DK6ED ["The DK6ED Double Loop (Version 3)", p. 31`], was born in 1956 and has been licensed since 1972. He earned 5-Band DXCC in 1979 and DXCC #1 Honor Roll in 2002.

Chris holds a doctorate in environmental engineering and works as a structural engineer. He is also officer-in-charge of a German municipal fire brigade and busy in development aid.

Nelson Sollenberger, KA2C ("An Inverted Vee for 80 Meters with Integrated Tuning," p. 37), owns a farm in St. Thomas, Pennsylvania and was originally licensed in 1970 as WN3PKU. His ham shack is really a shack – a separate building at the base of 40-foot foldover tower. See photos of his shack and the farm on his <QRZ.com> page.

Lloyd Milligan, WA4EFS ("The World's Great Literature … in Morse Code!" p. 45), was born in Belfast, Northern Ireland and emigrated to the United States at age 12. He was first licensed in 1961 and earned a Ph.D. in experimental psychology in 1970 but made a career change into computing in 1979. Lloyd and his wife, Becky, N4EFS, live in Chapin, South Carolina.

Guest Antennas editors Bob Rose, KC1DSQ and Bob Glorioso, W1IS ("Antennas: A 70-Centimeter 'Kitchen Array'," p. 79), are frequent contributors to these pages, generally writing about antennas but sometimes touching on other topics as well. They have recently published a book, "Wire Antennas 160 Meters to 70 Cm: Concepts, Construction and On the Air" (see <https://tinyurl.com/3ppvceut> for details).



Space Weather and Radio Propagation Facebook page at <https://fb.me/spacewx.hfradio>.

CURRENT SOLAR CYCLE PROGRESS

The Royal Observatory of Belgium reports that the monthly mean observed sunspot number for May 2023 is 137.9, and for June, 163.4, which exceeds the peak of Solar Cycle 24! The twelve-month running smoothed sunspot number centered on November 2022 is 101.0, and on December, 110.03. A smoothed sunspot count of 104, give or take about 9 points is expected for August 2023.

The Dominion Radio Astrophysical Observatory at Penticton, BC, Canada, reports a 10.7-cm observed monthly mean solar flux of 156.04 for May 2023, and 162.39 for June (exceeding Cycle 24's peak). The twelve-month smoothed 10.7-cm flux centered on November 2022 is 141.9, and for December, 144.8. The predicted smoothed 10.7-cm solar flux for August is 132, give or take 7 points.

Geomagnetic activity level this month is expected to range from quiet to stormy, resulting in occasional degraded propagation. Remember that you can get an up-to-the-day *Last-Minute Forecast* at <https://SunSpotWatch.com> on the main page.

I welcome your thoughts, questions, and experiences regarding this fascinating science of propagation. You may e-mail me, write me a letter, or catch me on the HF amateur bands. If you are on Facebook, check out <https://fb.me/spacewx.hfradio> and <https://fb.me/NW7US> — speaking of Facebook—check out the *CQ Amateur Radio Magazine* fan page at <https://fb.me/CQMag>. Also, please check out the new alternative social networking ham radio group at <https://amateurhamradio.locals.com> and please share this with your amateur radio friends and clubs.

Olivia Mode HF Weekend QSO Party


August Olivia Digital Mode QSO Party

Second Weekend in August

2023 August 11, 12, 13, 14 (UTC)

This certifies that Amateur Radio Station,

NW7US

participated during the QSO weekend special event,

working _____ Olivia Digital QSOs.

Thank you,

The Olivia Digital DXers Club

http://OliviaDigitalMode.org

One of the great digital modes that affords you the chance to have a keyboard-to-keyboard ragchew is Olivia. Your columnist is an avid participant in on-air Olivia QSOs, and there's a growing group of enthusiasts. We are planning our August 2023 Olivia Digital Mode on HF Weekend QSO Party, starting at 00:00 UTC on 11 August, 2023, and ending at 23:59:59 UTC on 14 August, 2023. For more information, please visit <http://OliviaDigitalMode.org> - and you may join our Discord Olivia Server with this invitation link: <https://discord.gg/yktw8vC3HX>. (Source: NW7US)

160-Meter Contest *(from page 25)*

Number groups after calls denote score, total QSOs, W/VE multiplier, countries worked. Total multiplier is the addition of the W/VE and countries. Multi-op scores follow single-op listings. An asterisk (*) denotes low power. State, province, and country certificate winners are listed in bold.

2023 CW RESULTS

SINGLE OPERATOR

NORTH AMERICA

UNITED STATES

CONNECTICUT

K1KI	530,725	1133	57	58
W1WEF	302,124	849	56	46
W1AN	195,888	601	50	38
W1JQ	54,739	256	42	25
*W1QK	49,678	334	43	16
*AJ1G/M	22,790	229	39	4
K1BUK	12,956	115	36	5
*W1ARY	8,636	108	33	1
K2RB	6,399	99	27	0
*KA1J	5,632	60	26	6

MAINE

*N1CGP	38,000	304	42	8
*WW1ME	25,300	222	39	7

MASSACHUSETTS

*K1ZM	320,112	852	57	47
K5ZD	112,476	352	46	32
*N1QY	36,720	305	40	8
NB1N	16,940	204	33	2
*N1DM	4,884	96	22	0

NEW HAMPSHIRE

*KG1V	923	25	13	0

RHODE ISLAND

W1XX	170,595	590	48	37
NC1CC	98,496	459	51	25

VERMONT

*K1EP	30,968	256	43	6
K1IB	15,785	171	30	5
*N2HX	6,075	99	25	0

NEW JERSEY

KU2M	205,751	623	55	36
AF2F	80,788	367	51	25
K2MTG	24,350	194	42	8
W2OIB	17,820	164	39	5
K2CJ	10,998	102	33	6
W3PR	7,161	95	30	1
*KD2JC	5,136	83	21	3
KD2EPM	4,000	82	20	0
*KR2D	720	21	15	0

NEW YORK

WF2W	490,968	1232	58	50
N2MF	419,440	1000	56	56
W2XL	259,722	827	56	38
WA2JQK	79,431	321	56	31
WS9M	73,843	221	43	34
*N2WK	51,968	355	44	14
*N2RI	31,836	326	37	5
*W1WV	24,157	191	40	9
W2QL	13,728	98	41	7
*KK2B	5,642	92	26	0
NY2NY	611	19	13	0

DELAWARE

AA1K	598,561	1243	58	55
*N8NA	44,226	241	45	18

MARYLAND

*KD4D	331,065	908	57	48
N3QE	243,840	832	55	41
K3TC	126,690	522	53	29
*WK3A	68,976	306	47	25
NC3Y	49,623	412	44	7
*WA3FAE	38,100	336	43	7
*N3TE	24,950	185	41	9
*K3KU	23,166	270	38	1
W3DF	18,778	72	19	22
*K9ZU	8,032	106	32	0
*KE3GK	686	23	14	0

PENNSYLVANIA

W3BGN	309,570	841	56	46
K3UL	305,292	875	55	48
W3TS	289,773	945	56	43
K3UA	55,944	359	50	13
WK2G	52,965	407	46	9
*K3SWZ	47,168	266	45	19
N3XZ	43,608	135	41	28
*N2EM	39,032	297	49	7
*WS3C	29,256	267	42	4
NA3F	20,787	220	38	3
*W3PAX	11,375	143	34	1
*N3FB	9,554	124	33	1
*K3ES	9,400	109	40	0
*KD3HN	1,995	40	21	0
*N3JNX	1,568	40	16	0
*K3HW	574	22	14	0

ALABAMA

AG4W	112,285	457	51	34
*W4RYW	15,180	143	40	4
*NV4B	10,582	123	34	3
*KV4AC	6,176	86	32	0
*AB4WL	1,584	33	20	2

FLORIDA

*WA1S	81,082	445	48	23
W1RCR	54,378	450	44	10
N4KS	41,310	322	44	10
N4EK	30,973	300	42	5
N4FP	18,963	149	41	8
*WA3LXD	18,576	155	41	7
*W4LT	16,318	167	37	4
N1TO	10,404	120	32	4
*N4AO	10,120	99	34	6
*N4KM	9,792	120	33	3
*K8MR	4,592	71	24	4
*N2YF	4,536	64	23	5
*KA3EHL	1,840	46	20	0
*NK4O	649	21	8	3
*KQ4Y	44	4	4	0

GEORGIA

WF4W	38,760	273	46	11
W4ATL	25,382	218	44	5
*AA4LR	21,935	238	39	2
*W4DWS	8,028	115	36	0
K4ZMV	5,100	27	0	20
*W4EMI	1,188	29	17	1
*KE4QCM	484	22	11	0

KENTUCKY

K4WW	68,115	532	50	7
WE5P	38,340	299	46	8
AB4IQ	22,850	195	45	5
*KC4WQ	21,238	238	39	2
KD4EE	20,680	207	43	1
*KC4OBX	8,056	86	36	2
*N0MH	6,545	76	34	1
*KM4FO	6,368	95	32	0

NORTH CAROLINA

N4XD	398,454	1003	57	49
N4AF	178,560	550	50	43
N4PSE	74,368	495	52	12
N6NT	68,310	551	49	6
KO2Q	42,560	250	48	16
*N3CKI	26,840	268	40	4
*W1CTN	22,513	205	41	6
WG8Y	12,792	91	44	8
N4CW	11,970	129	33	5
K3WA	10,656	147	32	0
*K3YDX	6,728	107	29	0
K4QPL	6,084	99	25	1
NC4JP	4,128	40	37	6
W4JFA	2,910	41	29	1

SOUTH CAROLINA

*W4JM	54,672	301	50	18
NN4SS	49,416	373	51	7
*K4FT	47,082	350	47	10
*WA8OJR	22,220	223	40	4
K7OM	18,568	186	43	1
*KY4ID	6,592	93	31	1
*WS4C	4,154	57	29	2
*AA4SD	1,843	43	17	2

TENNESSEE

AC4G	126,720	443	53	37
*K1GU	68,266	508	47	11
*W4DAN	56,916	480	47	7
AA4DD	48,307	281	54	13
W6UB	17,934	197	41	1
W4UT	15,239	125	44	5
*KK9DX	14,617	132	44	3
WB4YDY	14,406	151	40	2
AK4R	9,828	105	42	0
*N4HL	3,625	62	25	0
*NY4JB	3,276	54	28	0
*WD4OHD	2,100	39	24	1

VIRGINIA

K3ZM	788,240	1408	57	61
W4CB	295,713	865	54	45
K4ZW	122,625	609	51	24
*K7SV	103,272	491	53	25
K1EEE	85,698	476	48	21
*K4OAQ	80,535	520	48	17
WN7S	68,676	512	51	8
*W4YE	43,725	331	44	11
N4DJ	41,650	386	47	2
*KB4CG	40,137	342	46	5
N4CF	29,100	234	42	8
*K4ORD	24,165	220	38	7
K4RDU	16,605	168	36	5
*K4YCR	13,817	142	38	3
*K4HQK	13,616	149	33	4
*W4PJW	11,850	172	30	0
*W5VS	10,602	117	37	1
WF7I	8,820	62	33	9
*K4FJW	7,378	107	29	2
*KK4R	6,188	94	28	0
*WR4I	6,180	87	28	2
*K7LU	5,325	90	25	0
*K4CAB	4,032	69	23	1
N8AID	3,175	48	22	3
K3WD	2,360	53	20	0
*K8SYH	517	19	11	0
KW4CW	350	16	10	0
*W7HJ	175	11	7	0

ARKANSAS

W5ZN	326,230	1072	56	45
*WA5SOG	26,265	225	47	4
KD5J	11,058	128	37	1
*WB5BHS	2,001	42	23	0

LOUISIANA

*KV8S	16,380	185	40	2

MISSISSIPPI

WQ5L	106,097	437	53	26
*K5XU	11,248	145	36	1

NEW MEXICO

W0ZW	14,405	141	40	3

OKLAHOMA

K5WE	23,828	230	42	4
*N5XE	23,205	200	47	4

TEXAS

K5WA	157,872	634	57	31
*W0UO	126,822	799	56	13
K5RX	119,652	622	55	23
K5GN	113,560	457	55	30
*NN5T	28,056	214	50	6
*NZ5A	23,655	162	49	8
*WY6K	23,138	239	44	2
K5MV	18,048	165	42	6
N5REL	16,121	154	45	2
AK5Y	12,212	113	36	7
*K5SBR	5,907	77	29	4
*K5GQ	5,904	65	32	4
*AD5L	5,145	61	31	4
*AJ4F	5,049	68	32	1
*K5IX	3,048	62	24	0
*AJ5ZX	736	23	16	0
*WA5LFD	705	18	13	2
*KF5DDV	65	5	4	1

CALIFORNIA

K6NA	94,128	489	56	18
W6AYC	60,480	390	53	10
K0XP	48,977	281	52	15
K6NR	34,770	267	51	6
*W6JTI	29,848	207	47	9
N6JV	29,016	225	44	8
*N6XI	20,548	195	41	3
N6TQ	19,176	162	40	7
W6RKC	14,850	121	38	7
*N9BD	11,480	114	37	3
*N6LL	11,439	106	35	6
N6TTV	10,430	118	32	3
KG6AO	9,614	99	35	3
K6FA	9,087	97	36	3
*N6PN	7,936	103	29	2
KE6QR	7,812	110	30	1
*N6PE	3,484	50	23	3
*KA9A	2,448	46	15	3
N6RO	2,288	29	18	4
*KF6NCX	1,128	40	11	1
*K6CSL	530	25	10	0
W6JBR	100	10	5	0
*W6GSQ	1	2	0	0

ARIZONA

W8KA	125,510	711	54	16
KH7X	87,555	582	56	9
*N7IR	80,535	539	55	10
KC7V	72,256	485	54	10
N7GP	53,600	301	51	16
N7RK	38,430	252	54	7
*AC7A	28,280	214	51	5
K7NO	23,085	159	49	8
W7JET	16,380	174	40	2
N7WS	14,406	105	43	6
N7DSX	2,680	60	18	2
*K7AZT	2,332	50	21	1
*N0UD	2,075	36	23	2
K7FA	900	22	18	0
*W9CF	429	18	10	1

IDAHO

WJ9B	91,000	569	55	10
*K7ARJ	9,460	96	43	1
*KA7T	9,196	98	35	3
K7OVG	4,917	64	33	0
*W7TX	48	6	4	0
W7QDM	40	2	0	2

MONTANA

KJ9C	19,400	153	45	5
*KS7T	9,962	129	33	1

NEVADA

WU7W	715	26	12	1

OREGON

K7RAT	54,208	342	53	11
*AF7NX	5,017	57	26	3
NE7D	2,156	35	20	2
*N7JI	1,500	40	13	2
*W7MTL	132	11	6	0

WASHINGTON

K7RL	24,000	196	46	4
W7HJL	12,012	117	41	1
*W7TMT	10,030	127	33	1
AD7XG	5,332	61	28	3
W7WR	4,290	63	24	2
NN7M	3,525	59	24	1
N3QQ	2,457	39	16	5
K7IU	2,242	45	18	1
W0AO	1,785	35	21	0
*W7ZDX	1,386	51	11	0
W7DRA	429	15	11	0

WYOMING

*WY7M	61,140	441	53	7
*AC7AF	4,582	73	29	0

MICHIGAN

NA8V	526,693	1256	58	55
*WA1UJU	89,019	619	56	7
*N8PPQ	41,644	309	52	6
*KB8TYJ	35,604	348	46	0
*N8LR	22,542	256	39	0
W8RU	22,313	162	44	9
*KB8TL	20,210	211	43	0
*K7DR	19,920	225	39	1
*W8CO	19,649	163	42	7
*K8MJZ	17,644	165	42	2
*K8VT	15,124	184	38	0
*NF8M	6,960	71	38	2
*KE8GC	5,181	74	33	0
W8YV	4,560	61	29	1
*AC8PL	360	15	12	0

OHIO

W8CAR	186,235	807	57	28
*W1NN	177,567	783	58	29
K8ZR	131,693	591	56	23
K8RR	120,398	650	56	18
KW8N	69,747	367	50	17
*K8AJS	37,076	311	47	5
*W8WTS	36,288	256	43	11
K8RYU	30,432	265	43	5
*W8TB	27,489	238	47	4
*KE8PX	21,476	169	46	6
*N8HP	18,144	195	41	1
*KG9Z	12,987	149	37	2
*W8KNO	11,040	153	32	0
*K8VUS	7,622	90	36	1
*N8KQ	5,740	89	28	0
*KB8GAE	5,589	93	27	0
N8TCP	5,445	72	33	0
*ND8D	5,379	71	33	0
*NS8O	3,892	62	28	0
*WB8PIY	3,300	66	22	0
*AA8P	3,132	48	29	0
*WB8WUA	2,714	50	23	0
*N8DNA	1,596	39	19	0
K8ALM	900	21	20	0

WEST VIRGINIA

K8JQ	98,557	603	52	15
*N8II	46,312	356	49	7
*N4RA	7,770	99	34	1
K3XO	1,316	1	1	13

ILLINOIS

*KG9X	153,497	809	57	22
*W9KM	96,200	631	54	11
N9DJ	66,150	446	52	11
K9BGL	53,192	354	51	10
*W8LVN	41,616	367	48	3
*K9WA	41,122	308	52	6
*WD9CIR	36,150	326	49	1
N9EP	22,396	229	42	2
*WO9S	16,121	146	47	2
*AG9A	16,020	160	45	0
*W9NXM	14,028	152	42	0
*N9LQ	11,040	123	40	0
N9RU	9,196	109	38	0
*W9ILY	5,610	75	34	0
*NJ9R	5,115	70	33	0
*K9PMV	4,914	79	27	0
*KC9IL	3,312	63	23	0
*N5EP	850	22	17	0

INDIANA

W9RE	227,682	877	56	35
*WD8DSB	115,441	746	55	12
*W8FIB	60,390	432	54	7
K9WWT	40,066	401	46	0
K0TQ	39,572	329	48	4
*NY1V	20,160	168	43	5
*AA9WJ	15,652	160	42	1
*AJ9C	11,152	146	34	0
*WB9NOO	8,416	118	32	0
*KJ9X	8,155	100	35	0
*KX9DX	6,240	95	30	0
K9DUR	3,288	58	24	0
KY9KYO	64	4	3	1
*N9EDL	44	4	4	0

WISCONSIN

*K9AY	92,278	505	57	17
K9MA	89,298	589	55	11
*N7ZZ	45,704	334	53	5
N9GH	25,228	207	50	3
KW9R	21,056	200	46	1
KA9FOX	16,740	150	40	5
*W9KHH	7,714	88	38	0

COLORADO

K0SX	62,181	426	54	9
K7TD	30,856	232	49	7
*K0XF	19,551	182	48	1
*K0EU	17,505	180	44	1
*W4IFI	12,650	130	46	0
*KJ0I	11,088	96	46	2
*KX0R	10,045	112	41	0
K0KLA	10,032	86	42	2
*W8XAL	1,533	28	20	1

IOWA

W0FLS	105,552	617	57	15
*NG7A	56,763	397	56	7
*K0KT	16,685	144	42	5
*N9HDE	1,312	38	16	0

KANSAS

NS0R	71,862	546	53	6
W0BH	14,388	150	43	1
*K0HCV	2,925	54	25	0
*W0YJT	1,098	32	18	0
N0XM	672	24	14	0

MINNESOTA

W0PR	144,396	692	57	27
*AC0W	64,239	505	52	5
K0PK	59,649	440	54	5
*K0EA	42,336	331	51	5
N0UY	41,358	287	54	7
NI0K	32,480	249	52	4
*KI0F	21,252	207	46	0
*W0PI	15,750	165	42	0
K0TC	12,880	137	40	0
*WB0CFF	11,094	107	42	1
*W0ZF	8,892	105	37	1
*AA0AW	8,550	98	37	1
KF0GV	3,300	57	25	0
*WA0MHJ	2,622	51	23	0
*N0KK	2,068	41	22	0
*W0UC	1,420	31	20	0
*KB0NES	1,037	26	17	0
*KJ0P	243	12	9	0
*AF0Z	152	8	8	0

MISSOURI

N0TT	169,936	774	57	29
NI0G	74,295	485	55	10
NW0M	48,399	429	47	4
*AI6O	27,940	220	50	5
N0IS	24,327	192	49	4

NEBRASKA

N0GN	47,618	358	53	5
*WD0BGZ	25,650	190	53	4
*K0KPH	3,840	58	30	0

CANADA

NEW BRUNSWICK

*VE9VIC	23,976	120	26	11

NOVA SCOTIA

*VA1MM	6,820	68	22	0

PRINCE EDWARD ISLAND

VY2WW	261,699	525	41	42

QUEBEC

*VE2OWL	39,400	207	38	2
*VE2OXP	2,128	26	19	0

ONTARIO

VE3JM	823,914	1194	58	59
VE3DZ	738,108	1134	58	58
VE3AT	668,322	1101	58	49
*VE3MGY	378,314	876	58	28
VA3AR	178,434	524	54	15
VE3KP	141,657	406	53	16
*VE3XL	134,792	477	47	11
*VE3MM	103,820	365	47	11
*VE3UZ	91,368	402	43	4
*VE3PN	78,540	258	44	16
VE3YT	65,879	256	45	8
*VE3WG	64,582	273	46	3
*VE3ADQ	57,575	246	47	2
*VA3EC	55,900	275	41	2
VE3BR	43,252	202	40	4
*VE3DS	42,911	192	44	3
*VA3FN	39,319	205	40	1
*VA3WB	18,704	139	28	0
*VA3OKG	14,620	69	40	3
*VA3EON	12,366	97	27	0
*VE3JZT	6,474	54	26	0
*VE3QN	1,717	22	17	0
*VE3KTB	792	15	12	0

SASKATCHEWAN

*VE5SF	14,837	85	37	0
*VE5CPU	3,703	34	23	0

ALBERTA

VE6BBP	172,250	551	56	9
*VA6RCN	7,917	62	28	1

BRITISH COLUMBIA

VA7MM	53,346	215	46	5
VE7JKZ	15,576	99	30	3
*VA7GI	270	9	6	0
*VA7ZM	135	6	5	0
*VE7AB	96	6	4	0
*VA7ST	42	4	3	0

NORTH AMERICA

Barbados

*8P1W	360	7	5	3

Cuba

*CO2RQ	67,677	261	42	9
*CO2VDD	1,045	18	9	2

Dominican Republic

*HI3T	70,840	242	44	12
*HI3AA	31,390	143	36	7
*HI8A	825	13	7	4

Mexico

*XE1AY	13,498	77	29	5
*XE2OK	120	6	4	0

Puerto Rico

WP3R	63,505	176	42	23

US Virgin Islands

KP2M	437,144	656	56	50

AFRICA

Canary Islands

EA8A	2,870	22	0	14

Madeira Islands

CR3W	974,792	950	44	59
CQ3J	93,279	186	13	38

Tunisia

*3V8SF	120,960	253	0	48

ASIA

Asiatic Russia

*UD8D	3,852	36	0	12
*RJ9M	2,220	24	0	12
*RC0L	1,716	87	0	4
*RW9DX	1,488	22	0	8
*UA9MQN	1,332	20	0	9
R0WC	600	20	0	6
*RA9YQB	180	10	0	4
*RM8W	90	3	0	3
*UD0O	14	2	0	2

China

BY4SZ	5,837	91	4	9
BD7OB	1,917	43	0	9
*BG1WNU	1,660	71	0	5
*BA5CW	144	12	0	3
*BG8PM	2	1	0	1

Georgia

4L9M	552,244	727	15	62
4L2M	235,528	408	4	55

Hong Kong

*VR2T	250	8	0	5

Israel

4Z5LY	35,744	115	0	32

Japan

JH4UYB	127,435	351	16	39
JA7ACM	9,979	170	4	13
*JA6BZI	6,171	87	0	17
JA2IVK	6,112	107	4	12
*JA7KPI	4,914	124	3	10
JA7KQC	4,662	36	4	14
JI1AVY	3,456	72	6	6
*JE1SPY	3,340	117	1	9
JH6TNH	2,856	56	1	11
JL4DJM	2,366	26	0	13
JH2KKW	1,953	59	1	8
JA6ELV	1,728	54	0	9
*JA6ACZ	1,692	50	0	9
JF5SIM	1,328	47	1	7
*JH4CES	1,246	45	0	7
JA6FFK	1,225	58	1	6
*JA1EMQ	1,099	47	0	7
JR2UBS	1,008	23	1	7
JA1MJN	1,001	43	0	7
JA1TMG	1,000	74	0	5
*JK1HWU	985	81	0	5
JH4CPC	805	16	0	7
JA9FHB	780	23	0	6
JR1IJV	744	38	1	5
JI1FOE	740	51	0	5
JR2PMT	600	48	0	5
*JK1OLT	570	41	0	5
*JA8RWU	515	41	0	5
JH9CEN	460	30	0	5
*JE5HTN	333	51	0	3
JN7TAN	295	16	1	4
JH1HIC	284	28	0	4
JH8FIH	280	26	0	4
*JA7AMK	270	7	0	6
*JF1UOX	216	20	0	4
*7K1PYG	180	45	0	2
*JK8PBO	180	24	0	3
*JF1GZZ	174	42	0	2
JA1KXT	168	11	0	4
JF2FIU	165	20	0	3
*JA0BZY	150	6	0	3

*JO6NZN	144	18	0	3
*JK1VMC	140	32	0	2
*JF1LMB	117	14	0	3
*JE2PCY	110	11	0	2
JA2VQF	108	15	0	3
JL1JJD	105	16	0	3
*JA0JHQ	102	24	0	2
*JA1BBC	94	22	0	2
JE1QHP	88	19	0	2
*JH1UES	78	18	0	2
JM4WUZ	68	3	0	4
*JH6NBW	66	8	0	3
JR1CAD	62	14	0	2
*JH5HDA	54	12	0	2
JA6BWH	52	10	0	2
JR3UIC	48	5	0	3
JJ7PMS	42	4	0	3
JJ1QLT	36	18	0	1
*JR1USU	12	6	0	1
*JH0MUC	8	4	0	1
*JI1CAZ	6	3	0	1
JH1NXU	4	2	0	1
*JE6TUP	2	1	0	1
*JR7ASO	2	1	0	1
Kazakhstan				
UP7L	292,544	552	0	56
*UN7CN	1,183	24	0	7
Kuwait				
9K2NO	609,783	713	23	64
Mongolia				
JT1CO	210,656	438	0	58
Republic of Korea				
HL5IVL	54,638	234	3	31
DS2JJV	9,540	151	0	12
HL2WA	7,194	132	0	11
HL2CFY	5,660	117	0	10
HL2ZN	1,194	42	0	6
*HL3AMO	812	45	0	4
*DS3EXT	90	12	0	2
*HL2ASZ	50	5	0	2
HL5BCH	44	8	0	2

EUROPE

Albania				
*ZA1ME	16,950	111	0	30
Austria				
*OE6JTD	39,064	204	2	36
*OE2GEN	33,054	151	0	42
*OE1CIW	21,268	164	0	26
*OE3KAR	4,384	56	0	16
*OE8MOS	2,512	33	0	16
Belarus				
EU4E	440,742	936	18	69
*EW2ES	63,999	331	0	39
EW3LN	57,948	262	0	44
*EW1TO	29,047	190	0	31
*EU3A	24,272	111	3	38
*EU6O	13,752	115	0	24
Belgium				
*OT5K	13,984	83	0	32
Bosnia-Herzegovina				
*E79D	255,408	732	5	63
E74E	59,899	273	0	43
*E75RKP	1,875	25	0	15
*E75RKM	1,710	23	0	15
*E74SL	820	16	0	10
*E70FLY	192	7	0	6
Bulgaria				
*LZ4TX	373,907	893	15	64
LZ5R	366,048	827	20	62
*LZ7X	119,244	408	1	56
LZ5N	59,829	234	4	45
*LZ1AQ	15,498	114	0	27
Croatia				
9A2AJ	382,940	891	18	64
*9A3B	161,014	607	1	52
*9A2EY	36,003	223	0	33
*9A9CW	24,570	167	0	30
*9A4WY	21,570	145	0	30
9A4CC	704	14	0	11
Czech Republic				
*OL0A	265,536	731	14	58
OK1OA	228,822	681	15	51
OK1DWF	207,368	756	3	53
*OK5D	146,776	545	7	49
*OK1MNW	145,719	462	8	55
*OK1DKR	118,085	426	13	42
*OK1MMN	104,776	384	6	50
*OK1FMX	65,280	346	0	40
*OK1MGW	57,113	289	0	41
*OK1UKY	51,040	263	0	40
*OK2PIM	50,840	259	2	38
OK1EP	46,494	161	10	44
*OK1FGD	31,581	206	0	33
*OK1HEH	30,591	200	0	33
*OL2C	29,133	156	1	38
*OK1MDK	26,690	167	0	34
*OK1DXW	24,650	155	0	34
*OK6TW	21,286	158	0	29
*OK2IW	18,414	117	0	33
*OK8KM	15,418	125	0	26
*OK2GU	6,504	56	0	24
OK2BMU	5,355	27	13	8
*OK1FIA	3,600	50	0	15
*OK1FFA	1,974	30	0	14
OK1DW	1,100	11	2	9
Denmark				
OZ1KZX	52,542	250	2	40
*OZ5UR	800	16	0	10
England				
*G2X	137,472	393	19	45
G3RWF	135,051	431	15	44
G4BUO	122,342	315	24	43
G3T	112,728	350	16	45
M0X	110,400	339	17	43
*M0NDZ	55,720	177	11	45
G3VYI	51,858	241	3	40
M0SDV	44,080	234	6	32
*G4FEV	16,660	97	1	33
*G0JOS	12,572	92	0	28
*G4CXQ	5,640	57	0	20
G4TUK	5,040	34	0	28
*G3SNT	2,800	35	0	16
*G4CMY	806	12	0	13
*M0SAR	195	12	0	5
Estonia				
*ES5NY	27,684	151	0	36
European Russia				
RA3XM	94,446	376	0	54
RM2U	88,800	293	8	52
RX6LRU	67,980	271	0	55
RK3DK	53,460	255	0	45
R3OM	50,190	264	0	42
*RA3UAG	50,102	272	0	41
RL6C	37,800	181	0	45
R1NW	33,336	198	0	36
R3ZJ	32,604	161	0	44
*UA4UAR	19,776	147	0	32
*R2RZ	19,040	122	0	35
*R4RN	18,560	134	0	32
R4DI	17,984	125	0	32
UA4PN	16,617	135	0	29
*UB1Q	16,380	122	0	30
*R7KW	16,224	101	0	32
*RN1CW	13,727	74	0	37
*RM7C	11,908	93	0	26
*R4SA	11,880	113	0	24
*R2UZ	10,388	84	0	28
*RA3BQ	9,576	91	0	24
UA4K	8,547	89	0	21
*RA3XCZ	7,896	87	0	21
*UA3YDI	7,539	84	0	21
RG5Z	6,475	49	0	25
*RU6CO	6,095	60	0	23
*RA6LUU	6,006	69	0	21
*RC5Z	5,073	60	0	19
*RX3VF	4,536	67	0	18
*UA4CNJ	4,410	62	0	18
*RC7KF	3,360	36	0	20
*R3PIQ	2,752	48	0	16
*RW4HBG	1,599	27	0	13
*RN4A	1,596	34	0	12
*RA3V	1,188	21	0	12
*RK4S	774	26	0	9
*UA4FDL	720	20	0	9
*R3BV	704	31	0	8
*RT4W	525	20	0	7
*UA6AUA	120	4	0	3
RW4WD	36	3	0	3
*RA5BM	14	2	0	2
European Turkey				
*TA1NAI	3,040	36	0	16
Fed. Rep .of Germany				
*DL0MCM	258,932	728	19	57
*DK5DQ	211,623	662	16	53
DK8FD	195,432	620	12	56
DL2SWW	180,378	583	16	50
DK1NO	174,720	593	12	53
*DL1CW	158,688	645	8	49
DL2DSA	120,954	484	3	54
DH8BQA	119,145	593	2	45
*DL5CL	106,240	335	17	47
DL1DTL	92,750	394	2	51
*DK6SX	80,756	345	4	48
*DK3YD	79,536	395	6	42
DL5KVV	77,116	333	5	47
*DL0NG	75,625	301	12	43
*DL2NBU	74,025	364	1	46
*DJ9CN	69,300	303	4	46
DL4ZA	63,798	359	0	42
*DJ9KH	59,641	333	0	43
*DL4JU	57,528	269	3	44
DL5YL	56,628	346	1	38
DJ7OQ	54,097	238	1	46
*DL7DZ	53,833	304	0	41
*DJ8QP	53,277	287	5	38
DJ4KW	47,642	256	2	39
*DJ9SN	47,040	268	0	40
DK3BK	46,424	159	4	52
*DJ9MH	45,786	275	0	39
*DJ2IA	45,770	211	5	41
*DO1AYJ	44,763	240	0	43
DK3GI	39,760	260	0	35
*DL8RBR	38,988	226	0	38
*DL4SZB	36,754	169	2	45
*DL2ZA	36,240	209	1	39
*DL0RUS	35,595	248	0	35
*DL3ARM	35,490	210	0	39
*DH2URF	34,314	159	1	41
*DL4SL	31,788	199	0	36
*DL1KVN	30,744	202	0	36
*DL2YDS	29,070	203	0	34
*DL5KBO	28,730	202	0	34
*DL8DWW	27,640	149	0	40
DF6RI	27,470	148	5	36
*DL2TOS	26,904	155	0	38
*DL9MFY	26,250	209	0	30
DH6BH	25,662	142	2	37
*DO4OD	22,160	115	0	40
DK3AX	22,112	162	0	32
DL1ATZ	21,060	118	0	39
*DL1JML	18,990	139	0	30
*DL8WAZ	18,865	107	0	35
*DK7GH	18,560	133	0	32
DK1FT	18,249	127	0	33
*DL1HSI	17,949	133	0	31
*DL1GWS	15,979	124	0	29
*DL3KWR	15,678	140	0	26
*DK0MN	15,225	130	0	29
DL2OM	14,787	109	0	31
*DK9OV	13,527	116	0	27
*DL8SDC	13,020	110	0	28
*DL1KLF	12,772	83	0	31
DF5BX	12,069	101	0	27
*DL3TU	11,225	108	0	25
*DF1XC	10,894	96	0	26
DL7LX	10,556	83	0	28
*DJ3CS	10,272	103	0	24
*DL2GAN	9,775	85	0	25
DL7VMM	8,952	82	0	24
DJ8QA	8,710	82	0	26
DK8CB	7,616	59	0	28
*DB8AH	6,675	62	0	25
*DL2RUG	5,236	50	0	22
*DJ2FR	4,142	48	0	19
*DL8UKE	3,743	49	0	19
*DM3AA	3,440	37	0	20
DL9MKN	3,192	34	0	21
*DK3PM	3,060	54	0	15
*DK4YU	3,008	48	0	16
*DL9SUD	2,790	34	0	18
DF5MA	2,686	31	0	17
*DL7GA	1,274	21	0	13
*DL8FMA	1,118	19	0	13
*DK9VS	1,008	15	0	14
*DF5DK	693	15	0	9
*DK1VY	600	15	0	10
*DC7DX	100	4	0	4
*DL8JKN	76	5	0	4
*DL9LA	2	1	0	1
Finland				
*OG2T	142,740	547	3	49
OH1VR	90,252	386	5	41
*OH2BA	89,595	396	2	43
*OH5TS	42,294	221	0	38
*OH1XX	37,027	98	11	50
*OH5VT	18,970	106	0	35
OH2T	16,675	116	0	29
OH1X	15,411	93	0	33
*OH1MAR	11,121	65	0	33
OH3PE	8,206	77	0	22
France				
*TM6M	341,301	642	33	54
*F1FPL	35,014	169	3	38
F4VSD	5,890	62	0	19
*F4DVO	2,025	27	0	15
Greece				
*SV1CKZ	64,656	262	0	48
*SV1GRD	17,820	106	0	33
*SV3AWG	13,068	92	0	27
*SV1ME	558	11	0	9
Hungary				
*HA1BC	98,049	404	1	48
*HA2EOU	32,096	204	0	32
*HA0MK	23,820	163	0	30
Italy				
IV3SKB	439,236	1019	23	60
IZ8EPX	89,544	338	10	42
IZ1ANU	79,084	233	9	59
IK1JJM	65,231	332	0	41
*IK2WXQ	54,336	226	3	45
*I3PXN	43,764	217	0	42
*IV3EAD	36,442	196	0	38
*IK8UND	24,408	140	0	36
*I4IKW	23,970	147	0	34
*IN3MNS	18,873	146	0	27
4U9A	18,720	131	0	30
*IK8PGM	9,480	83	0	24
*IZ4BOY	6,576	53	0	24
*IK2AHB	4,464	55	0	18
*I1MMN	4,313	45	0	19
*IK0ISD	3,906	43	0	18
*IZ2BVC	2,816	41	0	16
*IK2IKW	981	26	0	9
*IK8YFU	954	22	0	9
*I4JEE	781	18	0	11
*IZ2CSX	270	8	0	6
*IU1HFK	222	7	0	6
*IU6FUB	96	6	0	4
Jersey				
MJ5E	1,004,435	1424	47	62
Latvia				
*YL5W	81,480	387	0	42
YL2SM	33,354	195	0	34
Lithuania				
LY4T	178,092	495	16	52
LY7L	116,285	321	14	51
LY2NK	105,644	481	1	43
*LY2MM	79,212	391	0	41
*LY9A	75,686	372	2	39
Netherlands				
PA4VHF	392,124	891	25	57
PA3EYC	254,610	706	19	50
*PA0TCA	31,175	140	6	37
*PA7KY	19,833	121	0	33
*PA3EEG	4,320	47	0	18
*PA0PIW	3,757	46	0	17
*PA3GUO	3,128	38	0	17
North Macedonia				
Z35F	272,205	757	11	58
Norway				
*LC9X	196,020	624	15	45
LA4C	129,132	345	16	52
LA7SI	385	11	0	7
Poland				
*SP2YWL	197,160	659	5	55
*SQ9IDE	141,284	561	1	51
*SP7JLH	133,140	449	7	53
*SP3JUN	116,963	490	4	45
*SQ5EF	60,610	334	0	38
*SP8HWM	58,634	323	0	38
SN6W	55,225	233	0	47
SQ6MIH	42,462	208	1	41
*SP2HMT	41,520	214	0	40
*SQ9ZAX	24,480	139	0	34
*SP3AMO	21,696	143	0	32
*SP3JIA	20,960	105	4	36
*SP2EWQ	20,856	124	3	30
SP9TPZ	19,210	110	0	34
SP6ECA	19,044	104	0	36
*SP9DTE	16,170	113	0	30
*SP9FMP	15,167	105	0	29
*SP5BYC	13,113	87	0	31
*SP3CMX	4,356	49	0	18
*SP6LUV	1,800	15	0	15
Republic of Kosovo				
Z61DX	49,400	245	0	40
Romania				
*YO2IS	36,750	211	0	35
*YO2CMI	11,803	76	0	29
*YO2URS	9,282	87	0	21
*YO5DAS	8,829	65	0	27
*YO4SI	7,098	66	0	21
Sardinia				
IS0JHQ	381,696	812	27	57
*IS0JXO	4,256	46	0	19
Scotland				
GM4Z	458,810	870	37	49
GM5X	161,070	440	22	43
GM2V	146,160	408	21	42
*2M0GUI	1,560	27	0	13
*GM4JYB	630	9	6	1
Serbia				
*YT8A	330,008	747	20	63
YT9W	282,150	697	22	53
*YT7B	106,330	436	0	49
*YU3A	80,256	333	1	47
Sicily				
*IT9VJO	7,368	59	0	24
Slovak Republic				
OM5R	494,846	1091	22	61
OM7K	484,677	1022	23	64
*OM5NL	283,751	749	15	58
*OM2XA	267,075	665	20	55
OM6AL	122,314	539	6	40
*OM5ALL	55,556	259	0	43
*OM2DT	46,207	181	5	44
*OM3CDN	34,813	230	0	31
OM5VS	17,754	108	0	33
*OM4DU	14,283	108	0	27
*OM7AT	3,675	55	0	15
Slovenia				
*S57NAW	135,603	435	9	52
*S53AR	131,340	435	9	51
*S58RU	41,160	203	0	42
*S50X	11,088	79	0	28
*S56C	9,158	102	0	19
*S52FT	8,448	75	0	24
*S57X	8,140	78	0	22
*S58MU	3,675	37	0	21
*S50IPA	2,465	31	0	17
*S51NM	1,440	21	0	15
*S51B	441	10	0	9
*S57SU	343	10	0	7
*S51DD	312	9	0	8
Spain				
*EA5/RV2A	28,006	146	0	38
*EA3Y	25,560	143	0	36
Sweden				
SM2U	378,102	863	22	60
SM0HRP	72,004	300	6	41
*SM5CSS	43,776	233	0	38
*SM5DXR	36,201	223	0	33
*SM5LW	24,192	135	2	34
*SM5ACQ	17,664	112	0	32
*SE0B	11,784	100	0	24
SM5ENX	8,903	60	0	29
*SM2OTU	7,216	67	0	22
*SM7TZK	4,780	52	0	20
Ukraine				
UT5ECZ	113,360	434	3	49
*UW5KW	83,153	335	2	47
*UT3SO	81,328	349	3	43
UT5UGR	63,600	321	0	40
*UW8SM	40,400	199	2	38
*US7UK	37,323	184	0	39
*UR7EC	36,216	201	0	36
UY5OO	35,098	144	6	40
UR7R	29,733	184	0	33
*UT0CK	16,692	130	0	26
*UT1KWA	12,168	105	0	24
*UT7NY	12,024	99	0	24
*UR4CW	8,340	50	2	28
*UR5UJ	8,162	73	0	22
*UW3WF	2,788	33	0	17
*US5WBJ	570	19	0	6
Wales				
*GW4TSG	1,200	20	0	12

OCEANIA

Australia				
VK2GR	10,511	52	0	23
VK2PW	3,940	26	5	15
Hawaii				
KH7A	140,479	241	47	12
Indonesia				
*YC2VOC	770	28	0	7
YB7YGR	539	13	0	7
*YC1CKK	164	11	0	4
*YB1LZ	99	11	0	3
*YB1LUE	34	17	0	1
*YB1BML	26	13	0	1
*YC1COZ	20	10	0	1
*YC1CBY	14	7	0	1
*YB1NIN	12	6	0	1
YB2MM	10	5	0	1
*YC1YU	8	4	0	1
*YB1MIG	4	2	0	1
Philippines				
4F2KWT	34,474	161	3	19

SOUTH AMERICA

Bonaire				
*PJ4/N8VW	60	3	0	3
Ecuador				
*HC1BI	20	2	0	2

QRP

NORTH AMERICA

UNITED STATES

CONNECTICUT				
W1IG	10,469	152	28	1
MAINE				
NY1E	9,180	137	27	0
KO1H	2,400	45	20	0
MASSACHUSETTS				
WB2CPU	21,528	237	38	1
W1FJ	12,886	160	33	1
NEW YORK				
KR2AA	3,297	68	21	0
PENNSYLVANIA				
W7LG	4,941	81	27	0
FLORIDA				
K3TW	22,995	224	41	4
GEORGIA				
K4PQC	6,664	92	34	0
W4SKB	384	9	16	0
KENTUCKY				
K4TO	41,310	336	49	5
NORTH CAROLINA				
WB4MSG	47,850	354	49	9
VIRGINIA				
K4XL	80,250	402	54	21
N3UA	12,120	117	33	7
WX3M	9,858	138	31	0
WU4G	7,584	102	31	1
K2PI	7,458	97	32	1
W1IE	5,084	73	31	0
K2EKM	4,554	87	22	0
CALIFORNIA				
WQ6X	21,060	154	45	7
K6MI	1,235	34	12	1
ARIZONA				
N6HI	96	12	4	0
MICHIGAN				
K2YAZ	5,713	82	29	0
KC8R	735	20	15	0
OHIO				
K8ZT	15,337	134	45	4
ILLINOIS				
WB9AYW	2,200	46	20	0
INDIANA				
N9SE	82,080	457	56	16
KB9RPG	9,170	113	35	0
WISCONSIN				
WE9R	42,483	375	49	2
W1QC	11,438	134	38	0
K9TY	9,922	105	40	1
AF9J	256	16	8	0
COLORADO				
NO2D	1,180	28	20	0
IOWA				
N0NI	113,091	720	57	12
W0GJ	1,540	29	21	1
MINNESOTA				
ND0C	3,458	59	26	0
KE0TT	3,075	57	25	0
MISSOURI				
N0LMQ	4,060	67	29	0

CANADA

NORTH AMERICA

Cuba				
CO6EC	456	11	5	3

AFRICA

ASIA

Asiatic Russia				
UA0SBQ	5	1	0	1
Asiatic Turkey				
TA2TC	330	7	0	6
China				
BH4EUJ	580	31	0	4
Japan				
JE3AKU	546	33	0	6
JA6WFM	402	46	0	3
JH7UJU	194	47	0	2
JR1NKN	82	19	0	2
JR1ABS	78	18	0	2
JK7DWD	66	15	0	2
Republic of Korea				
DS1TUW	750	57	0	3

EUROPE

Belarus				
EU8U	48,602	252	0	38
Bosnia-Herzegovina				
E77Y	121,900	485	0	50
E73SW	423	10	0	9
Czech Republic				
OL1A	174,704	579	9	52
OL4W	135,405	552	2	49
OL5Y	120,981	508	0	49
OK1FKD	103,286	505	0	43
OK6OK	67,548	366	0	39
OK1HMP	38,284	241	0	34
OK2FD	28,140	169	0	35
OK1LO	14,761	109	0	29
England				
G5Q	48,676	227	0	43
European Russia				
RT1L	17,395	99	0	35
RA4ACX	8,762	72	0	26
RQ7R	3,570	41	0	17
Fed. Rep. of Germany				
DK7HA	179,862	639	13	49

DL5SFC	65,136	317	0	46
DK3UW	58,097	339	1	40
DL8LR	52,752	284	0	42
DM2DZM	48,009	295	0	39
DL1JDQ	43,548	262	0	38
DG3T	21,700	141	0	35
DL8ZAJ	12,124	97	0	28
DK3WM	10,440	63	0	36
DL7ED	9,900	65	0	33
DL8MF	9,425	85	0	25
DL2DCX	3,800	47	0	20
DL1FY	282	10	0	6
DJ4MF	30	3	0	2
DJ5TT	14	2	0	2
Finland				
OH3KQ	11,568	102	0	24
Hungary				
HA1TI	38,836	212	0	38
HG7J	6,516	78	0	18
HA5BA	1,580	34	0	10
Italy				
IK0XBX	44,298	190	3	43
IZ7AUH	605	10	0	11
IZ5RAQ	1	-1	0	1
Luxembourg				
LX1NO	3,689	44	0	17
Netherlands				
PF5T	33,111	170	2	37
PA5DX	1,980	27	0	15
Norway				
LA8OKA	2,128	31	0	14
Poland				
SQ2ICX	42,804	215	1	40
SQ3JPV	20,820	149	0	30
HF5WIM	12,015	94	0	27
SP8D	9,792	91	0	24
SO7NA	640	19	0	8
SP6IHE	100	4	0	4
Romania				
YO8BSE	31,857	171	0	37
YO8WW	20,910	93	0	41
YO3GNF	1,288	18	0	14
Slovak Republic				
OM7PY	11,544	98	0	24
Slovenia				
S51Z	96,726	404	1	48
S59DJK	180	9	0	5
Spain				
EA3O	102,856	392	5	47
Switzerland				
HB9AYZ	27,195	158	0	35
HB9CPS	21,720	145	0	30
Ukraine				
UT4WA	26,172	149	0	36
UR5FEO	17,794	114	0	31
UT4UBZ	6,575	50	0	25

OCEANIA

Australia

VK2CCC	60	7	0	3
VK3GK	8	4	0	1

Indonesia

YC1CAR	22	11	0	1
YC1HBP	2	1	0	1

SOUTH AMERICA ASSISTED

NORTH AMERICA

UNITED STATES

CONNECTICUT

W1NG	107,423	372	54	35
W1TJL	103,695	279	52	41
W2TT	39,480	297	48	8
K1ZZ	29,700	146	32	23
*N1EN	22,428	223	38	4
W1UK	17,249	86	25	22
W1EQ	12,948	128	32	7
W1NK	10,045	71	28	13

MAINE

K1JB	102,000	330	45	35
W1AO	76,206	272	45	33
K1BZ	47,532	249	47	21
KV1J	32,505	230	46	9

MASSACHUSETTS

N2KW	241,786	603	53	53
W1GD	212,420	522	48	47
*WO1N	138,826	594	51	31
W1HNZ	74,328	320	46	30
K1RV	65,280	449	46	14
*AC5XK	51,000	426	41	9
W1TO	50,563	320	44	15
KA1IOR	46,782	188	38	31
AK1MD	41,354	231	45	17
W1FV	31,992	79	3	40
W1TC	30,305	184	38	17
K1DJ	23,535	195	36	9
KB1W	21,375	206	41	4
KK1W	20,910	211	35	6
*W1DYJ	12,002	147	33	1
NF1A	10,560	100	34	6
*K1TH	6,000	107	24	0
*KU1N	250	5	0	5

NEW HAMPSHIRE

K1AR	413,592	955	57	57
K1TR	215,270	693	54	41
N1KWF	135,464	506	47	35
AJ1AJ	40,850	348	45	5
*K1RO	39,052	285	40	12
*K8LT	33,072	229	40	12
NF1O	10,010	117	32	3
*AE1T	7,420	107	28	0
*KA2KON	2,376	63	18	0
NE1F	40	2	0	2

RHODE ISLAND

K1TZQ	253,236	716	50	44
W2DAN	17,646	91	35	16
AB1JV	6,032	76	25	4

VERMONT

W1SJ	325,950	941	55	51
N1IBM	80,182	207	51	43
KK1L	66,092	220	51	31
K2LE	15,953	140	37	6

NEW JERSEY

N2NT	322,455	684	56	49
N2BA	224,264	696	54	43
KR2Q	132,132	631	48	29
K2RET	125,398	418	50	41
NE2V	116,154	487	51	30
KE2D	104,490	390	54	32
N2SR	64,369	427	43	16
KA2K	54,648	280	48	21
W2IRT	48,069	293	47	16
K3TS	42,480	266	44	16
W2MKM	41,750	365	45	5
KC2LSD	37,206	267	42	12
W2KV	28,207	103	41	26
*NJ2OM	25,270	290	35	3
N2AXX	19,600	121	35	15
WR2G	17,304	148	30	12
*N2UU	5,280	98	24	0
N2OO	456	16	12	0

NEW YORK

AB3CX	539,136	1133	58	59
N2ZX	399,485	991	58	51
K2NV	226,745	771	56	45
N2GC	197,657	579	57	44
WA2CP	114,787	557	53	26
N2RC	99,792	441	52	29
N2NI	85,624	295	47	30
K2TER	60,635	345	48	19
AA2EQ	45,686	362	45	8
K4RUM	38,784	348	44	4
W2KA	35,397	236	44	13
N2SQW	34,268	270	46	6
*W0LL	34,162	184	43	19
*K1PTF	29,197	299	42	1
N2TTA	24,072	182	37	14
KM2L	23,500	209	41	6
*WA2QAU	22,080	191	39	7
WT2J	19,277	225	35	2
KE1IH	17,472	137	40	8
K2YR	16,764	108	34	10
N2SO	13,376	120	39	5
*W2GDJ	12,012	98	35	7
WA3AFS	7,998	41	32	11
*KB2URI	7,236	110	27	0
*K3MTT	3,668	51	27	1
*WB2WPM	3,384	60	24	0
AI2N	2,226	50	21	0
*N2WPT	168	9	7	0

DELAWARE

N3DXX	245,024	661	55	49
NW3Y	116,323	334	50	39
K9RS	48,360	199	39	26
*N3TTT	923	28	13	0
KD3TB	280	11	10	0

MARYLAND

K3RA	305,213	690	59	54
K3MM	274,560	607	53	51
K3CCR	214,226	722	54	40
AB3CV	205,868	487	56	51
*NS3T	119,440	580	53	27
AA3S	111,000	544	49	25
K3STX	104,409	475	51	30
N3OC	76,464	415	50	22
AG4Q	71,179	300	48	31
W3LL	54,020	265	50	23
W2CDO	50,982	378	49	9
W3OU	44,957	227	46	21
K3AU	37,440	200	36	24
*WB8YYY	35,694	278	46	8
W3JX	34,221	172	37	24
K1RH	21,620	193	39	7
*NT3U	18,620	151	41	8
*WT3K	15,279	200	32	1
N3FJP	13,360	137	38	2
*W3UL	9,170	102	31	4
KG4USN	8,928	116	30	2
NX3Z	1,710	43	18	0
WX3B	1,470	40	15	0
*K3MAW	430	17	9	1

PENNSYLVANIA

AA3B	484,035	1024	57	58
W8FJ	400,472	837	58	55
N3RS	385,503	881	58	53
NN3Q	346,032	874	58	50
K3WW	296,415	822	56	49
W3MA	257,670	776	57	48
NT2DR	210,680	617	50	42
K3CY	197,492	592	52	45
WY3A	193,844	588	54	44
KF3B	116,410	497	39	31
*NJ3K	114,304	596	55	21
K3MD	110,994	569	53	25
K3OO	100,845	296	42	39
K3NM	95,095	281	55	40
W3FV	85,050	490	55	15
K3PP	61,337	212	50	33
N3ST	61,125	256	45	30
N3FCP	53,179	226	46	25
W3GH	51,816	252	47	21
*AG3I	49,818	359	42	15
KB3Z	48,918	305	48	14
K3WJV	46,458	317	46	12
NO3U	44,073	296	48	11
N3EEN	42,636	205	46	20
K3PH	33,075	178	46	17
K3QIA	31,698	224	42	12
W3FIZ	30,016	210	46	10
KU2C	29,370	100	38	28
NF3R	28,500	230	45	5
N3ZA	21,465	190	41	4
*KG5TA	17,380	165	39	5
*K3RL	14,212	123	36	8
NY3B	10,166	127	34	0
K3WGR	9,555	80	30	9
*W3KB	8,580	109	31	2
WA3AAN	3,600	69	24	0
W3EA	3,575	64	25	0
N3RM	2,700	45	25	0
*KA3D	799	22	17	0
K6ND	378	15	9	0
*WS2E	40	2	0	2

ALABAMA

K4WI	52,704	360	51	10
KX4X	50,512	221	55	22
*K8PO	1,020	30	17	0

FLORIDA

N4WW	300,380	611	58	57
N6AR	228,072	599	55	49
NN7CW	134,100	495	55	35
WO4O	119,705	434	53	36
N4BP	107,084	481	50	26
KM4HI	33,480	214	49	11
W2TR	16,686	117	42	12
*K4RFK	12,672	107	36	8
*KT3T	7,752	71	32	6
K4ZDM	2,921	54	20	3
*WC4H	945	17	19	2
W1BQ	144	9	8	0

GEORGIA

NO9E	326,778	921	57	50
K4EA	219,564	583	55	53
W4AX	75,537	236	46	31
AA4CF	43,940	244	47	18
K2MK	17,848	152	40	6

KENTUCKY

*ND4Y	46,299	316	50	11
*K4FN	23,920	224	43	3
*N8UX	16,440	176	39	1
N4QS	11,729	134	35	2
*W4PF	10,944	126	38	0
AJ4A	8,346	82	36	3

NORTH CAROLINA

N1LN	536,192	1223	58	60
K2AV	349,544	992	58	46
W4RM	272,332	852	56	47
K8AC	246,636	943	58	35
K5EK	140,335	628	55	30
AD8J	66,397	389	49	18
N4DE	39,585	201	46	19
*K4BSK	29,232	265	42	6
W4DAO	27,555	189	43	12
*N4NTO	11,655	137	34	3
K4KZ	6,636	105	28	0

SOUTH CAROLINA

NU4E	186,690	489	57	48
*N3HEE	162,708	767	56	28
KD4S	13,886	89	43	10
*KY4GS	3,197	65	23	0
WA8NLX	1	-5	0	0

TENNESSEE

AD4EB	248,600	944	58	42
K4RO	185,133	646	56	45
W4NZ	161,994	693	57	30
AA4NU	113,440	552	58	22
KE0L	103,894	487	55	27
K3IE	64,025	407	52	13
AF4T	53,625	432	49	6
*WF7T	36,676	299	46	7
KT4O	22,128	204	46	2
K9JU	20,350	170	44	6
W1EG	17,088	140	41	7
*WK9M	16,132	200	36	1
K3JWI	14,564	141	39	5
WM4Q	6,734	82	37	0
N1OKL	6,265	65	32	3
*KS4X	4,840	52	39	1
*W4CMG	3,432	57	26	0
*N9TF	2,950	56	25	0

VIRGINIA

K2KW	487,084	1135	58	58
W4NF	400,488	1009	58	53
NR4M	274,964	776	54	52
N3MK	113,620	345	56	39
WA4JUK	110,700	548	49	26
K4QS	91,630	376	53	32
K1GG	79,212	335	53	29
N3CW	77,034	385	52	22
N3JT	58,212	312	41	22
NN3W	39,000	237	43	17
W4PM	37,296	339	43	5
*K4FTO	33,354	274	45	6
N6DW	28,497	176	46	13
N4PD	28,184	221	43	9
N3MN	25,795	181	46	9
W3IP	25,664	121	46	18
AC8Y	17,542	132	42	7
WB3D	17,204	163	41	3
*NJ4Q	16,687	181	41	0
*KA4RRU	16,340	153	37	6
AB4SF	13,140	149	32	4
W4VIC	12,138	153	33	1
*K4GM	10,034	138	26	3
*K4MI	8,330	104	34	1
K4AEN	4,862	47	30	4
*NN4RB	4,464	84	24	0
N4HB	4,374	68	25	2
*W8KRZ	2,320	52	20	0
K5VG	2,280	54	19	0

ARKANSAS

K5RM	43,884	368	50	3
W5KI	26,447	220	52	1
*KM5G	14,070	148	42	0
W9DCT	7,296	90	37	1

LOUISIANA

KA5M	24,908	199	45	7

MISSISSIPPI

W2GS	25,281	202	48	5

NEW MEXICO

N2IC	165,816	634	55	39
N5FO	109,120	535	56	24

OKLAHOMA

W5TM	189,553	799	56	35
N5UM	34,500	244	52	8

TEXAS

N5RZ	212,394	851	56	35
AD5A	73,500	423	50	20
WB0TEV	63,437	318	57	16
W0VX	56,070	391	55	8
K5PI	54,316	237	49	25
K5NZ	35,460	248	51	9
K5TIA	25,080	186	48	7
K5LY	19,834	193	45	2
K5PAR	15,778	141	45	4
K5NA	10,922	94	36	7
N5NEN	5,810	69	33	2
*K5DHY	4,805	63	30	1
KE5MMT	960	19	12	4

CALIFORNIA

WU6P	119,592	661	57	15
W4EF	71,489	418	55	12
NC6K	41,720	318	49	7
W6DR	31,436	211	50	8
N6IE	19,796	153	41	8
NA6O	18,368	127	50	6
K6NV	16,684	158	39	4
K6KM	11,500	98	47	3
*WE6Z	5,488	78	25	3
N5KO	4,836	57	28	3
K6RC	1,548	51	11	1

ARIZONA

N7AT	73,219	394	53	20
W6XI	53,544	295	55	14
N7KU	37,677	276	48	9
K7WP	24,584	185	50	6
NI5L	14,362	144	40	3
KB7AZ	9,560	97	37	3
W7RH	4,698	40	22	7
N6SS	3,097	29	10	9
K9DR	156	13	6	0

MONTANA

K7QA	76,384	524	54	8

OREGON

N7XU	41,832	259	54	9
N7IP	27,888	204	51	5
WB6JJJ	15,000	117	46	4
K9PY	12,556	111	39	4
*W7VO	3,192	56	19	2
KN7K	2,520	57	17	1

UTAH

K7NJ	277,732	985	58	40
W7CXX	68,640	459	55	10
NK7C	16,074	134	42	5
WF4U	11,074	88	44	5
*WA7YAZ	2,900	71	20	0

WASHINGTON

K7SS	20,445	168	42	5
W6OAT	15,410	115	38	8
AC7DC	1,406	34	19	0
*K7NT	387	17	9	0

MICHIGAN

W8MJ	276,262	990	58	40
KG8CW	42,402	132	42	32
*W8GP	34,394	241	48	10
*AC8CE	30,070	175	50	12
K7RB	18,200	198	38	2
*K8BB	12,870	139	35	4
*K8GT	3,614	59	26	0
WB8ASI	3,536	56	26	0

OHIO

K1LT	438,700	1199	58	49
N8TR	180,030	450	57	45
*WB8JUI	121,286	690	56	18
W3HKK	88,642	397	55	27
WB2RPW	83,930	476	54	16
*AB8OU	37,468	252	49	9
*K8BL	37,232	296	43	9
KI6DY	28,290	309	41	0
W8EH	27,995	215	50	5
*K8LY	27,168	248	44	4
*KB8VAO	25,404	167	48	10
*N8OH	24,864	253	40	2
NO8C	24,198	294	37	0
N8PW	20,470	187	44	2
KC9LA	11,520	118	37	3
*W8XY	8,480	119	32	0
N8NB	3,900	36	22	8

WEST VIRGINIA

WA8KAN	35,344	334	45	2

ILLINOIS

K9NR	274,204	987	58	40
K9CT	195,400	698	57	43
N7US	109,089	680	55	14
AC9S	102,480	634	55	15
*K9MMS	81,213	490	57	12
K9NO	76,000	375	52	24
K9YY	58,464	395	54	9
*W9FY	46,386	388	51	3
*KY0Q	43,628	384	51	1
N2BJ	42,984	341	50	4
*WB9HFK	35,015	335	46	1
W9YK	34,176	326	47	1
KC9EE	32,750	285	45	5
AI9T	25,380	195	46	8
KC9K	24,750	211	47	3
K0PG	23,108	186	49	4
KB0V	19,788	151	45	6
W9PDS	14,574	154	41	1
*N9CO	7,783	66	36	7
W9NZ	7,752	96	34	0
*KA9I	5,610	73	33	0

INDIANA

KK9V	271,200	937	57	43
K9NW	212,430	680	58	39
W9TC	81,543	393	54	23
*K9WX	45,604	390	47	5
N9TTK	22,272	200	45	3
W9PA	20,405	152	47	6
WN9O	18,497	102	38	15
*K9EI	6,018	75	34	0
N9DR	312	6	1	5

WISCONSIN

W0AIH	277,032	1038	58	44
*KX9RT	110,364	695	57	11
W9EWZ	69,636	261	56	28
*WT9Q	62,048	498	52	4
*W9XT	56,682	327	53	14
K9WO	56,580	328	55	14
W9NJY	55,100	496	48	2
KW9E	41,350	362	46	4
W9RN	7,770	90	36	1

COLORADO

KV0Q	243,900	869	58	42
KS9W	113,688	667	56	16
KE0UI	71,872	473	54	10
W0PSY	27,246	197	50	7
*N0GM	15,216	142	45	3
N0RN	13,250	98	46	4
*AF0E	9,126	95	37	2
N0KQ	1,170	31	18	0

IOWA

W7II	56,280	352	57	10
N0AV	54,575	410	52	7
*K0DD	25,069	184	47	6
*KE0IAT	10,535	109	41	2

KANSAS

AB0S	31,590	252	48	6
AD0AB	8,200	92	39	1
*KS0AA	6,188	88	34	0

MINNESOTA

N0HJZ	143,976	691	58	26
K0MD	49,706	386	53	5
N0MK	27,772	223	49	4
*K0PC	22,695	200	51	0
*WB0N	17,712	151	45	3
W0PMO	15,147	111	46	5
*W0NY	6,696	83	34	2
K9DU	6,615	78	30	5
W0AD	3,640	48	26	2
K0TLG	520	23	10	0

MISSOURI

*KK0U	99,200	690	57	7
NX0I	53,070	375	56	5
KI0I	38,822	268	52	7
*WO7U	8,385	100	38	1

NEBRASKA

W0ZA	49,720	416	53	2
*NF0N	5,746	83	34	0

SOUTH DAKOTA

*K0KX	41,220	285	53	7
*K7BG	10,660	124	41	0

CANADA

NEWFOUNDLAND

VO1HP	250,096	406	40	48
*VO1NA	203	10	7	0

LABRADOR

VO2NS	960	22	12	0

NEW BRUNSWICK

VE9HF	404,808	672	53	48

NOVA SCOTIA

VA1RST	262,656	450	50	46

QUEBEC

VA2WA	863,052	1213	58	60
VA2EW	136,137	358	46	23
VA2AM	111,872	184	46	46
VA2UR	70,361	162	42	29
*VA2CZ	13,020	89	30	1
*VE2HLS	11,005	78	29	2
VA2EBI	1,177	25	11	0

ONTARIO

VE3EJ	974,208	1385	58	60
VE3VN	454,464	746	56	52
VE3NZ	279,868	765	56	18
VE3CT	107,604	345	50	13
*VE3VY	72,432	317	43	5
*VE3MA	58,300	283	44	0
VE3TW	58,080	278	43	1
*VA3TMV	16,960	111	31	1

MANITOBA

VE4GV	59,616	228	49	5

ALBERTA

VE6WQ	72,504	264	51	6

BRITISH COLUMBIA

VA7KK	16,870	100	33	2
VE7IO	1,222	20	13	0

NORTH AMERICA

Alaska

KL7KY	1,278	22	4	5

Mexico

XE2S	65,493	226	48	9
*XE2T	7,940	79	18	2

AFRICA

Canary Islands

ED8X	285,736	327	36	52
ED8M	14,256	46	7	26

Madeira Islands

CT3KN	380,464	446	29	57

ASIA

Asiatic Russia

R8OM	206,016	386	0	58
R8WX	200,805	385	0	55
UA9MA	42,300	129	0	36
RA0WU	18,642	92	0	26
*RA9MX	4,480	39	0	16
*R9HAG	3,588	36	0	13
RZ9YI	580	20	0	5

Asiatic Turkey

*TA3NE	23,530	92	0	26

TA3RT	15,065	66	0	23
*TA9J	350	8	0	5
China				
BA4DL	22,656	170	2	22
BA3OM	1,662	57	0	6
BY4DX	1,408	73	0	4
BH4SCF	464	27	0	4
*BH7QP	354	11	0	6
*BI4VIP	162	18	0	2
*BG4FQD	93	8	0	3
Cyprus				
P33W	1,165,682	1112	37	69
Israel				
*4Z5PN	242,896	362	11	57
Japan				
JR4OZR	24,704	154	7	25
JH2FXK	22,400	125	9	23
JE1BMJ	12,216	116	2	22
JF3IPR	9,656	179	5	12
JF3LOP	8,160	131	1	16
JS2MKU	7,824	154	4	12
JA6MWW	6,545	82	0	17
JF2QNM	5,400	48	0	18
JA4OPW	4,676	77	3	11
JI1LET	4,550	74	0	14
JA5BZL	4,352	29	2	14
*JF3BFS	4,279	136	4	7
*JN1ILK	3,216	81	2	10
JQ1ABC	3,080	114	2	8
JJ1WWL	2,684	71	0	11
JE1NVD	2,464	108	0	8
*JK1LSE	2,424	112	1	7
JA0FVU	1,680	70	0	8
JO7KMB	1,526	76	0	7
*JJ1AEB	1,512	74	0	7
*JG6JAV	1,260	54	0	7
JF3DRI	1,162	44	1	6
JH5MXB	1,100	15	4	6
JH9DRL	1,014	57	0	6
JK1HIX	931	39	2	5
JH1BBT	920	14	0	10
JF7PHE	833	34	1	6
JH3FUK	525	9	0	7
JQ1UXN	525	35	0	5
JA7MSQ	395	29	0	5
JR2AWS	390	53	0	3
*JI1HFJ	324	44	1	2
JO4CFV	280	23	0	4
*JG1OGM	275	7	0	5
*JG1EIQ	237	32	0	3
JA0GCI	235	8	0	5
*JA6GMC	235	8	0	5
*JA7SUR	180	42	0	2
*JH7XVB	129	17	0	3
JA1PTJ	100	4	0	4
JH1ERJ	96	5	0	4
*JH2GZY	88	4	0	4
JG7AMD	38	8	0	2
JE1DXC	5	1	0	1
Kyrgyzstan				
*EX8MJ	1,650	19	0	11
Qatar				
*A75GC	70	4	0	2
Republic of Korea				
*HL5YI	980	32	0	7
Saudi Arabia				
*HZ7C	10,300	54	0	20
Thailand				
HS5NMF	14,208	69	0	24
United Arab Emirates				
A65BB	1,595	16	0	11

EUROPE

Austria				
OE8TED	424,080	851	27	63
OE5TXF	327,006	851	14	60
*OE6VIE	242,352	687	12	56
OE2S	197,625	496	16	59
OE2LCM	175,916	486	15	53
OE1TKW	166,600	448	11	59
OE3G	141,831	555	0	51
*OE4EIE	75,670	318	0	47
OE1SGU	55,556	261	0	43
*OE6RNT	21,616	157	0	28
Balearic Islands				
EA6UP	163,800	494	9	54
EF6T	74,936	239	10	48
Belarus				
EW1I	150,670	441	15	50
EW1M	136,296	491	0	54
EW4A	112,838	493	0	46
EU3AA	98,021	255	14	53
EW8DX	92,872	391	0	47
EW8R	60,074	237	2	47
EU1A	56,772	180	9	48
EU7SV	31,302	127	1	46
*EU7X	22,533	116	0	37
EW4M	19,656	144	0	28
EU1ST	18,657	141	0	27
EW1OW	12,740	96	0	26
Belgium				
OR3A	392,574	795	28	63
*ON6NL	103,104	424	1	47
OQ5M	103,080	313	17	43
OT1A	74,008	233	11	47
*ON6FC	23,901	156	0	31
*ON7XN	585	13	0	9
Bosnia-Herzegovina				
*E70X	10,302	59	0	34
*E70AW	3,400	28	0	25
*E74CX	470	10	0	10
Bulgaria				
*LZ2WP	85,644	320	0	52
*LZ4A	36,667	195	0	37
LZ2ZG	16,112	84	0	38
Crete				
SV9DJO	51,500	196	0	50
Croatia				
9A5W	904,568	1335	43	73
9A5Y	639,441	1180	30	69
9A/UW1GZ	178,002	561	9	53
9A5CW	123,133	412	1	58
*9A/EI8KW	104,040	464	0	45
*9A6KX	83,766	370	0	46
9A/IZ3NVR	80,546	348	0	46
*9A6A	45,177	250	0	37
9A6D	25,795	82	6	49
9A2U	14,654	84	3	31
*9A2EU	1,155	15	0	15
Czech Republic				
OL0W	484,748	988	30	62
OK6Y	449,469	887	27	66
OK8AU	255,010	715	17	53
*OK2BFN	254,464	713	15	56
*OK1AY	187,712	694	4	52
*OK1FPS	183,024	600	9	53
OK5ET	172,315	528	8	57
*OL3R	163,404	664	2	49
OK1P	152,586	473	13	50
OK1PI	149,184	470	7	57
OK8AW	131,436	501	5	49
OK1VK	128,960	396	10	54
OK1VD	119,130	349	13	53
OK1DO	96,470	347	10	45
*OK2YZ	88,332	355	0	51
*OK2SG	65,296	244	6	47
*OK1DLX	47,124	222	0	44
*OK2DM	38,874	217	0	38
*OL6B	23,135	139	0	35
*OK1BLU	21,270	150	0	30
*OL1T	15,225	113	0	29
*OK8SMS	14,756	111	0	28
*OL2AQM	9,570	63	0	30
*OK2VV	4,494	42	0	21
*OK2PGY	3,762	46	0	18
Denmark				
OZ0B	389,412	812	28	59
OZ3SM	238,878	652	18	51
OU2W	178,050	438	19	56
OZ2TF	107,590	396	4	49
*OZ1AAR	95,316	397	5	42
*OZ7BQ	81,250	318	6	44
OZ8SW	24,672	94	5	43
5P5Q	500	10	0	10
England				
G4FAL	680,512	977	44	68
G3P	675,045	1070	42	63
M5S	435,360	760	38	58
G6M	382,590	733	31	59
G6T	299,454	621	27	60
G3SJJ	267,976	596	26	56
G4PIQ	243,648	567	25	56
*G0BNR	239,967	426	31	60
G4AMT	216,552	365	37	47
*M5M	64,446	283	6	40
M7T	61,870	267	1	45
*G3RLE	61,732	270	3	43
M4J	60,268	228	9	43
G0KPE	51,210	215	11	34
*M7V	44,148	160	10	42
*M4X	40,303	193	4	37
G0W	36,240	186	1	39
M0AGP	20,916	114	2	34
G4SND	18,954	97	1	38
*M0IPU	9,925	82	0	25
*G4A	9,156	68	3	25
*G3SZG	4,575	41	0	25
*M8A	4,420	49	0	20
G3ZGC	2,560	20	7	9
Estonia				
ES3TI	227,825	670	12	53
*ES1BH	470	10	0	10
European Russia				
RW7K	638,916	1030	27	84
RX3APM	517,884	905	26	77
RG2A	295,848	679	16	68
RM4F	227,766	495	14	73
RV1CC	213,994	610	13	58
R3ZZ	190,968	527	11	62
R5WW	144,720	385	14	58
UA1OMS	109,785	338	1	64
RC3FL	84,216	304	3	55
RK3ER	81,879	357	2	47
RT3G	79,500	315	3	50
R3ST	77,550	301	3	52
RO1M	71,328	311	2	46
RU4PU	69,112	268	0	53
RW1F	63,945	292	0	45
RN3BL	62,944	234	0	56
RT1B	62,479	305	0	43
R4KO	40,365	189	0	45
R4WDX	39,732	191	0	43
RK2M	36,200	202	0	40
*UA3AP	34,780	206	0	37
*R4GM	33,440	191	0	38
RC2A	32,723	164	0	43
UA6CC	31,374	163	0	42
R5DT	31,332	164	0	42
RM5F	29,970	169	0	37
*UA5R	29,562	156	0	39
RA4Y	26,793	145	0	39
RA1OHX	21,352	142	0	34
*R4YT	18,564	123	0	34
RN5M	15,216	53	2	46
*UA3VRV	10,776	117	0	24
*RA3GAA	10,189	98	0	23
RD4A	8,064	89	0	21
RA3S	7,905	40	2	29
RD5R	5,676	58	0	22
*RX3MM	2,970	55	0	15
UI4P	1,729	28	0	13
RU3DNN	1,128	24	0	12
*RN4HAB	510	29	0	6
RA6DT	270	6	0	6
*UA6YI	25	0	0	5
European Turkey				
*TC100TC	21,300	134	0	30
*TA1L	4,930	29	0	29
Fed. Rep. of Germany				
DK6WL	689,920	1194	40	70
DR5X	637,560	1158	38	67
DL7ON	596,925	1100	34	71
DF3VM	561,612	1060	39	63
DK5KK	539,100	1032	33	67
DJ0MDR	502,848	1061	31	66
DL6MHW	431,136	905	30	66
DK9IP	391,368	866	32	60
DL7URH	376,728	865	26	62
DK3WW	358,600	836	26	62
DK2OY	315,068	762	24	59
DD2ML	297,824	750	20	62
DJ5AN	296,852	605	34	60
DL1BUG	267,415	711	21	58
DC3CC	265,164	754	16	60
DK3UA	259,005	488	28	65
DL5LYM	217,360	576	21	59
DM5GG	216,784	700	13	55
DL4CF	212,290	642	14	57
DL1NEO	203,820	498	22	57
DA0BCC	196,910	614	13	57
DA0RR	196,910	594	19	51
DJ5MW	196,080	460	24	56
*DJ9DZ	187,440	558	17	54
DK2LO	184,875	503	19	56
DF8XC	183,120	397	25	55
*DJ5MO	181,230	558	18	52
DL7YS	170,154	516	16	53
*DF7A	166,440	635	8	52
DK1AX	162,936	460	18	54
*DL8TG	159,424	534	17	47
DL5SE	155,229	592	4	55
DL50DAH	152,264	615	3	53
DL1NKS	152,224	486	18	49
*DF4XF	149,544	532	10	52
DH7KU	137,142	540	2	55
*DK2RO	135,212	308	23	54
DJ0IF	132,825	413	13	56
DH0GHU	131,985	468	12	51
DL4ME	131,950	438	15	50
*DL4WA	128,340	474	11	49
*DL7AU	127,140	463	9	51
*DM7W	124,758	471	10	48
*DD5M	117,646	427	13	46
DK8ZZ	112,490	332	17	53
*DJ2MX	111,210	463	5	50
DL9GTB	106,176	416	5	51
DJ8EW	105,768	464	2	50
DG5E	101,920	320	16	49
DL6JZ	100,812	326	12	50
*DK5TA	100,350	468	0	50
DK7ZT	97,746	298	14	52
*DP3P	97,625	391	7	48
DK4RR	95,612	407	2	51
*DL7ALM	92,112	440	2	46
DF8V	92,022	441	2	47
DL7FER	89,397	298	9	54
DL4HRM	85,840	299	9	49
DK8FS	85,734	247	17	49
DF8AA	83,570	284	10	51
DF7TV	82,768	329	7	49
*DJ4MX	80,028	309	5	52
DJ5IW	79,408	307	5	51
DK2BJ	78,520	346	3	49
*DK2A	76,793	454	0	41
DL5YM	76,480	454	2	38
DF2RG	73,968	345	3	45
DM3XRF	64,778	300	6	43
*DL3YM	64,578	297	2	45
DC6O	64,501	271	1	52
DL5ST	64,414	341	1	42
*DJ3RA	61,488	280	4	44
*DH1TST	61,251	266	4	47
DL3IAE	60,950	241	13	40
*DK5WO	55,432	319	0	41
*DF7RG	55,309	316	0	41
*DL7UGN	54,135	270	0	45
DJ9RR	53,055	247	1	44
*DL9SEV	51,700	235	7	40
*DK5MB	46,782	212	3	43
DK1TW	46,412	256	0	41
*DJ4WT	43,638	251	0	42
DL9UP	41,940	201	3	42
DF4PD	40,680	123	12	48
DJ1SL	40,514	181	2	45
DL1SWT	39,001	199	0	43
*DJ5CW	37,000	246	0	37
DJ5KW	34,732	204	0	38
*DL5ANS	33,880	228	0	35
*DL2RMC	33,120	197	5	35
*DL5ARM	32,976	214	0	36
DB7BN	32,956	146	1	43
DL9DRA	30,415	98	5	50
DL8DYL	29,610	72	25	17
*DJ1XT	29,356	156	0	41
*DK2AT	28,280	189	0	35
*DM6EE	25,530	155	0	37
DL6UAA	25,124	115	1	43
*DL4FDI	24,624	155	0	36
*DC8SG	23,976	142	0	37
*DJ6OI	23,218	96	6	41
*DL9FBF	20,720	126	0	37
*DF1LON	18,880	138	0	32
*DL1EAR	18,768	122	1	33
*DL6NBC	16,578	138	0	27
*DF2AJ	16,568	97	0	38
*DL6RBH	16,380	125	0	30
*DL3IAS	16,100	96	1	34
DF3CB	16,074	96	0	38
DJ3TF	15,503	82	10	27
*DP4X	14,580	110	0	30
DF9VJ	14,140	112	0	28
DL4VK	13,890	105	0	30
*DK5IR	13,888	99	0	31
*DL6MFK	13,860	96	0	30
DM7XX	13,104	100	0	28
*DL6TK	11,847	77	0	33
*DL2LDE	11,466	59	0	39
DL4LAM	11,160	55	0	40
*DM0E	10,925	102	0	25
*DJ1MM	9,324	42	0	42
*DL9DBZ	9,198	107	0	21
*DJ4CW	9,126	84	0	26
*DL1MHJ	6,804	65	0	21
DL0EB	6,090	42	0	29
*DL5CW	4,316	37	0	26
*DH1VY	3,111	42	0	17
DF0SAX	550	10	0	10
DL0DRL	500	10	0	10
*DF7CB	2	1	0	1
Finland				
OG4T	178,368	533	7	57
OH3Z	123,482	424	6	52
OH3OJ	103,455	463	2	43
*OH6NIO	69,936	297	1	46
OG7F	68,112	304	0	44
OH2KW	54,266	249	0	43
OH2BO	51,330	144	11	48
OH3EX	42,471	218	0	39
OH7GGX	13,788	71	0	36
OH3JR	10,664	42	0	43
OH7MFO	6,864	65	0	22
OH3D	6,116	57	0	22
France				
F6EZV	268,050	670	17	58
*F4VVG	45,214	244	0	37
F6FYA	17,010	97	0	35
F5DRD	16,296	117	0	28
*F8CRS	14,328	80	1	35
Greece				
SV2JAO	36,138	190	1	37
*SV2AEL	31,450	161	0	37
SV1RK	9,430	80	0	23
SV1ABB	6,160	55	0	22
Hungary				
HA8BE	436,278	970	20	66
*HA8WY	253,875	643	18	57
HA5JI	244,360	499	25	57
HA8BT	202,112	615	11	53
*HA7MF	175,455	547	14	49
*HA6NL	133,952	398	13	51
HG6O	126,567	388	11	52
HA5UX	121,728	516	0	48
*HG8W	104,856	414	1	50
HA3NU	102,704	418	1	48
*HA5PT	101,898	372	8	46
HA2KMR	101,088	422	3	45
HA3OU	50,274	244	0	42
HA8VV	28,710	81	14	41
*HA5MIG	26,010	156	0	34
HA8V	25,884	143	0	36
*HA3YE	24,189	148	0	33
*HA8EV	21,728	161	0	28
*HA5LV	11,875	97	0	25
*HA8AR	11,440	91	0	26
*HA6NN	8,820	92	0	20
Ireland				
*EI3LC	1,455	20	0	15
Isle of Man				
MD2C	483,075	788	35	60
Italy				
IK0YUT	602,400	1052	34	66
IK1PMR	422,840	918	24	64
I2WIJ	300,720	678	25	59
I2IFT	185,445	569	12	53
IK4DCX	145,476	546	1	53
IC8R	104,265	326	10	53
I3FDZ	100,486	444	0	47
*IK6VXO	78,550	314	0	50
IK3SWB	75,012	162	22	54
IZ3GFZ	65,050	258	0	50
I1HJT	56,000	192	11	45
I2SVA	45,360	218	0	42
IK2LFF	39,228	190	0	42
IK6BAK	37,000	205	0	37
*IV3FPX	34,359	179	0	39
I3FIY	33,360	171	0	40
IK4AUY	32,970	152	4	38
IK3ORD	31,631	131	0	47
IK2ANI	31,524	175	0	37
IK5TBK	19,928	61	3	50
I1NVU	19,872	112	0	36
IZ8DVD	17,480	89	0	38
*IK7LMX	13,601	96	0	29
*IU0ITX	7,920	68	0	24
IZ0CKJ	7,395	46	2	27
I7CSB	2,875	22	0	23
*I4VEQ	2,268	25	0	18
*IW0HEX	100	4	0	4
*IZ0EHL	24	3	0	2
Kaliningrad				
UA2FZ	238,720	500	24	56
*UD2F	86,198	361	1	46
RN2FA	59,488	265	0	44
Latvia				
YL3FT	748,440	1144	35	75
YL7X	669,814	1100	34	72
YL2KO	134,976	456	1	56
*YL2EA	62,325	273	1	44
YL2VW	49,162	202	0	47
*YL2PP	25,994	120	0	41
*YL0A	5,510	58	0	19
Lithuania				
LY4A	892,254	1248	42	79
LY5W	576,180	1078	25	72
LY7M	458,453	768	29	74
LY3B	122,554	408	12	46
LY2TS	100,656	420	4	44
*LY7K	94,514	445	1	42
*LY2DX	86,057	366	4	43
*LY4Y	73,461	312	3	44
LY5R	65,568	270	1	47
LY5O	55,660	239	5	41
LY2OU	20,319	106	2	37
*LY3QN	2,184	43	0	12
Luxembourg				
LX7I	818,688	1326	41	63
*LX1ER	26,414	105	3	44
Netherlands				
PA9M	548,475	938	39	64
PA5KT	444,768	799	36	60
PA4WM	401,490	765	31	59
*PA0O	194,004	540	18	50
PA3AAV	181,235	499	20	47
PA4M	83,936	393	0	43
PA3EWP	64,584	235	4	50
PA5WT	64,070	299	1	42
PA1M	48,813	176	9	44
*PA3GVI	47,432	217	1	43
PA1LEX	36,645	212	0	35
*PA3CWN	36,636	171	2	41
*PC4H	35,187	193	0	37
*PH0AS	31,746	166	1	38
*PA3DTR	27,246	144	1	37
PA5MW	15,655	97	1	30
PA6X	10,234	60	0	34
*PA3EVY	9,568	85	0	23
*PA8KW	8,400	69	0	25
PE1RDP	7,982	61	0	26
PA1T	7,616	51	1	27
*PE4BAS	5,192	47	1	21
*PA3BUD	4,780	48	0	20
*PH7A	1,045	11	3	8
Norway				
LB5WB	274,092	643	22	56
LA5LJA	78,815	268	9	46
LA4WKA	55,660	186	12	43
LA7XK	51,012	174	11	41
LB1GB	39,102	202	1	37
LA9L	38,454	141	0	51
LB6KC	33,226	179	0	37
LA3TK	19,532	100	0	38
LB2TB	15,334	57	6	35
*LA3ZA	9,024	55	0	32
*LA/DL4HCF	4,600	46	0	20
Poland				
SN7Q	898,092	1352	42	72
SN1W	489,552	957	30	63
SP9JZU	418,473	745	30	69
SP3HLM	414,829	868	24	65
*SN7O	395,600	884	22	64
SP5UFK	372,969	805	21	66
SP4Z	335,572	725	20	66
SP3GTS	300,753	690	21	60
SQ7U	297,887	669	18	65
*SP2R	240,448	705	13	55
SP9LAS	236,106	562	18	60
SO3O	225,918	720	10	53
HF1K	219,492	641	12	55
*SP7CF	193,192	625	9	53
*SP/UR5AS	182,424	544	12	54
*SN5J	176,008	634	5	51
SP9ATE	150,683	431	11	56
*SP7M	126,976	417	4	58
*SP9JZT	87,124	393	2	44
SP8PAI	85,680	355	4	44
*SP7IIT	78,023	391	0	41
*SN4D	66,478	321	0	43
SP4G	51,876	241	0	44
*SQ9FMU	51,300	282	0	38
*SQ3R	46,552	220	1	43
SP6AEG	32,604	110	9	43
SP3JDZ	24,464	109	0	44
*SP8FB	21,500	97	1	42
*SP3BBS	10,902	98	0	23
*SP8K	10,414	44	1	40
*SP5NZF	8,260	60	0	28
SP5GH	7,296	36	1	37
*SP2DKI	6,456	58	0	24
*SP2WGB	4,642	41	1	21
*SP5BN	2,329	31	0	17
SP3QDM	1,260	12	4	8
SQ3WW	5	1	0	1
Portugal				
CR6K	336,202	559	36	61
CT1GFK	66,248	243	1	51
CT7ANO	18,681	90	6	33
Romania				
YO8DOH	300,070	768	19	55
*YO3APJ	234,390	542	23	55
YQ6A	222,622	521	18	61
*YO5AVN	169,458	543	5	56
YO9AYN	128,797	424	6	53
YO9HP	108,000	390	1	53
*YO7SR	56,340	251	0	45
YO9BPX	30,478	115	0	49
*YO2GL	25,641	153	3	30
*YO2MAX	19,401	132	0	29
*YO7BGA	7,475	64	0	23
Sardinia				
IS0AFM	4,626	50	0	18
Scotland				
MM9I	381,410	794	27	59
*MM1E	119,448	352	14	49
MM2T	108,500	333	12	50
GM3YEH	103,530	333	13	45
Serbia				
YT7KM	486,780	928	27	68
YU5R	380,619	878	18	63
YU7BW	337,884	871	16	58
YU7KW	202,560	617	8	56
YT0W	149,408	526	5	51
YU5W	124,117	508	0	49
*YU3TA	86,292	367	0	47
YT4T	50,688	230	1	43
*YU7D	41,790	195	0	42
*YT5N	32,375	178	0	37
*YU1FG	23,126	151	0	31
Sicily				
*IT9IVU	111,072	420	1	51
*IT9LKX	12,402	95	0	26
Slovak Republic				
OM5AW	501,505	985	31	64
OM2VL	408,273	671	38	59
OM4MW	129,654	530	0	49
OM3GI	128,856	258	24	54
*OM6RM	72,180	323	0	45
*OM8LA	68,800	322	0	43
OM3BY	49,692	243	0	41
*OM5UM	26,520	182	0	30
*OM6MW	11,688	100	0	24
Slovenia				
S50K	734,448	1220	37	70
S53O	633,776	1098	35	69
S53M	615,483	1114	34	65
S58M	533,140	1044	29	66
S57Q	495,018	1041	22	67
S51YI	481,844	950	28	66
S56X	434,364	978	23	61
S51DX	317,772	779	22	56
S53F	267,675	585	24	59

S52F	204,336	547	13	59
S58Y	96,420	315	10	50
*S53FO	94,272	405	0	48
*S51J	71,916	386	0	39
S54O	69,043	298	0	47
S53K	64,484	282	2	45
S53MM	55,395	256	0	45
*S57KM	42,365	239	0	37
*S55KA	41,316	190	0	44
*S59DR	29,880	211	0	30
*S57S	17,520	121	0	30
S51SL	16,640	104	0	32
*S56DX	3,344	36	0	19
S59ZZ	830	18	0	10
Spain				
ED3Z	190,872	565	12	54
*EA2AZ	187,332	514	18	49
*ED1R	123,441	319	18	51
EF1A	71,736	239	13	43
EB7A	61,957	225	6	47
EA3AKA	59,032	246	2	45
EE4Y	39,004	151	5	44
EA7Q	34,496	145	8	36
*EA4AOC	32,580	136	7	38
*EC1A	19,166	102	1	36
EA4IS	1,155	14	0	15
EA5JX	416	10	0	8
Sweden				
SE0X	414,450	872	23	67
SF1Z	182,845	539	12	53
SM5EPO	162,165	565	5	52
SM7PEV	159,835	464	12	53
*SD6F	104,909	428	2	47
SE3P	100,827	391	3	48
SM3U	97,550	387	0	50
*SD0N	44,955	246	0	37
*SM5FUG	33,388	201	0	34
*SM6IQD	32,970	193	1	34
SM3PZG	30,065	170	0	35
SM6CNN	28,956	147	0	38
*SM5EFX	27,093	166	0	33
SM7BCX	21,511	72	10	39
*SM6OPM	20,646	136	0	31
SM2M	15,136	94	0	32
Switzerland				
HB9TOC	315,210	729	22	57
HB9CVQ	146,550	581	1	49
HB9DQL	133,672	543	0	49
HB9IJC	133,300	403	15	47
HB9AWS	94,374	380	4	45
HB9EHJ	49,680	214	0	46
HB9TSW	28,800	183	0	32
HB9FMN	10,528	63	0	32
*HB9HDV	9,048	78	0	24
*HB9IIH	5,856	75	0	16
*HB9BXQ	3,380	34	0	20
HB9HFN	3,234	22	4	18
*HB9HFM	1,200	20	0	12
Ukraine				
UT6UD	612,161	1034	31	70
UY1HY	202,908	519	19	55
UY0ZG	188,632	466	18	55
US6EX	146,112	444	6	58
UW1M	98,580	308	5	55
*UZ1WW	74,137	300	2	47
*UY5ZZ	72,436	276	3	49
UW7LL	70,350	277	4	46
*UR7MZ	49,248	200	0	48
*UZ1RM	44,562	213	0	42
US2YW	40,446	191	0	42
*UX0FF	30,094	139	3	38
*UX1VX	18,744	110	0	33
UT3UV	17,928	133	0	27
*UR5RP	4,602	38	0	26
Wales				
MW5B	1,067,664	1408	47	71
*GW4W	36,388	160	3	41

OCEANIA

Australia

VK3TZ	455	11	0	7

Hawaii

KH6LC	928	14	0	8

Indonesia

*YC1PZ	180	13	0	4
*YB1BX	123	15	0	3
*YB1HR	123	15	0	3
*YC1JEL	105	12	0	3
*YB1DBU	99	11	0	3
*YB1BD	56	10	0	2
YC1LJT	48	8	0	2
YB1BA	32	16	0	1
YB0SAS	10	5	0	1
*YB3BLJ	4	2	0	1
*YC3TEN	2	1	0	1

New Zealand

ZL3IO	18,676	72	7	22
ZL4AS	343	8	2	5

SOUTH AMERICA

Aruba

P40AA	1,195,191	978	58	65

Bonaire

PJ4DX	62,000	101	33	29

Brazil

PY5XH	10,266	42	19	10
PY4HO	1,020	13	1	11
PY5AMF	8	4	0	1

Curacao

PJ2T	1,252,320	1048	58	62

MULTI OP

NORTH AMERICA

UNITED STATES

MAINE

K1LZ	853,492	1330	58	66
K1RX	690,305	1324	58	63
MASSACHUSETTS				
W1UE	512,658	1055	55	59
N1RR	440,990	986	56	54
K1VR	20,010	74	32	26
N1SOH	13,596	175	30	3
RHODE ISLAND				
W1OP	27,830	136	36	19
NEW JERSEY				
N2AA	709,341	1335	58	65
NEW YORK				
NJ1F	35,554	198	38	20
KM1P	315	16	9	0
MARYLAND				
WA3EKL	293,822	808	56	51
PENNSYLVANIA				
K3LR	705,789	1431	58	61
NE3F	240,312	625	53	49
NS3L	29,000	241	43	7
FLORIDA				
K0DI	523,448	1191	58	60
K2DM	6,440	69	31	4
KENTUCKY				
N4SS	361,874	1102	58	49
VIRGINIA				
N4RV	487,084	1110	58	58
W4TG	60,480	494	47	7
CALIFORNIA				
NX6T	98,980	585	57	13
K6YA	5,430	68	27	3
ARIZONA				
NA7TB	282,295	1001	58	43
WASHINGTON				
W7VJ	50,808	360	50	8

CANADA

LABRADOR

VO2AC	1,126,800	1338	54	66
NEW BRUNSWICK				
VE9ML	67,320	243	40	15
QUEBEC				
VE2OJ	437,285	875	58	37

NORTH AMERICA

Belize

V31MA	236,379	464	50	37
Puerto Rico				
WP3X	522,699	780	56	55
US Virgin Islands				
NP2ZA	417,120	650	57	53

AFRICA

African Italy

IG9/S59A	1,664,970	1464	38	76

ASIA

Asiatic Russia

RT8U	144,955	324	0	53
RN9A	115,650	277	0	45
UC8Y	16,392	82	0	24
RK9CYA	6,810	53	0	15
RK9CXC	3,262	28	0	14
China				
BY1RX	13,632	154	0	16
BI4SSB	12,416	141	3	13
Japan				
JA3YBK	128,340	340	18	42
JF1AMX	24,480	197	10	20

EUROPE

Bosnia-Herzegovina

E7DX	1,072,375	1505	45	70
E7CW	393,600	902	18	64
Croatia				
9A0BB	806,637	1276	40	71
9A2W	231,619	674	10	57
9A6K	151,453	500	8	51
Czech Republic				
OL1R	838,605	1304	39	72
OL4A	701,742	1174	38	71
OK7O	639,450	1180	32	66
OK5T	618,423	1130	33	68
OL1C	400,160	930	23	59
OL7T	329,850	868	16	59
OL3A	228,784	522	23	56
England				
G4AQG	373,320	759	28	62
Estonia				
ES7A	416,909	924	20	63
European Russia				
RU1A	698,880	1064	41	71
RT4F	450,110	867	19	76
UA4M	215,436	540	11	67
R1DX	211,344	570	19	55
RA5G	173,595	496	10	61
RT2A	114,802	389	1	60
RY6Y	110,258	400	5	53
Fed. Rep.of Germany				
DR4A	641,130	1146	39	66
DA0T	562,020	1101	36	66
DP6A	555,345	985	36	69
DL0LA	462,880	1092	25	63
DP9A	427,240	1028	26	62
DL7A	321,112	837	23	59
DA2X	234,159	491	26	63
DM3F	184,470	595	13	53
DM1T	78,733	429	0	43
Finland				
OG9W	315,921	768	18	61
OH7K	302,533	736	12	65
Hungary				
HG8DX	834,460	1325	39	71
HG7T	682,004	1158	37	69
HA3DX	463,554	958	25	66
HA5TOP	255,337	749	12	55
HG5C	102,000	411	0	50
Ireland				
EI9E	409,768	750	33	59
Italy				
IQ2CJ	789,372	1266	43	65
IZ2KXC	502,930	982	28	67
IQ3RK	385,637	815	28	61
IQ5PO	81,549	332	3	48
Liechtenstein				
HB0DX	979,888	1519	41	71
Lithuania				
LY2XW	445,004	868	27	65
LY2K	364,824	853	22	59
LY2J	196,470	657	7	52
Luxembourg				
LX/PA4O	712,800	1264	35	65
Netherlands				
PI4AMF	156,632	531	13	43
PI4CC	94,608	399	1	47
Poland				
SP8R	923,364	1331	42	75
SN2B	776,407	1263	36	73
Serbia				
YT5A	544,143	1063	25	68
Slovak Republic				
OM2Y	874,060	1293	41	75
Slovenia				
S50C	1,030,302	1490	43	74
S50W	670,539	1208	33	68
Spain				
EA5RS	557,642	903	41	62
EA5C	189,852	427	25	53
Sweden				
SC7DX	681,144	1209	32	69
SK3W	574,103	882	38	71
SD6D	116,127	454	5	46
SK6EI	17,045	96	1	34
Switzerland				
HB7X	679,120	1115	41	63

OCEANIA

Hawaii

KH6AQ	389,091	566	54	15
Indonesia				
7A0D	100	21	0	2
7A1A	96	20	0	2
Philippines				
DV3A	35,800	147	2	23

SOUTH AMERICA

Brazil

PY2NA	2,414	20	9	8
PR2R	60	6	1	3

CHECK LOGS:

9A/W3WM 9A1AA 9A1DR AC2OC AD4ES DJ8RS DL1AMQ DL1EMY DL7URB DL7VEE DM5DX DM5SB DR5W EA3GCV EA4KG EA5JDN EU1KY EU2EU G3OGP GU4EON HA3IC IK1YDB JH1WOY K3WWT K8OZ LA4PM LA9OI LY3NX LY5G LZ1YF LZ3YY N3IQ N6MZ OG5O OK1DMP OK2BOB OK2BPU OK2OHA OK2OKO OK2PAY OL6M OM2XW OM3SX P3AA PA0VLY R3AT R3XCJ R7RF RA1QD RK4NB RM2A RV6ASU RW3RN RX3DTN RZ1O S50U S51MM S52W S52WW S53DIJ S53V S59EIJ S59T SM0Q SN2M SP2LNW SP5OXJ SP6CC SP7QO SP9GMI SP9HZW SP9XCN SQ9NFC SV3RF SV9FBG UA1CUR UA3AGW UA3P UA6JBX UA6JQ UB3DDA UX2HB UX5UN VE3VSM WX2S YO2CEQ YO2LDU YO6DDF Guest Ops 2M0GUI (2M0GUI @2M0GUI) 3V8SF (KF5EYY) 4L9M (R3XA) 4U9A (E73A/9A3A) 7A0D (YD0NVU YD0AWI YD0RFS YC0LOU YB0DJX YB0JVZ) 7A1A (YB1KEL YB1ACN YE1AR YB1BB YD1AAE) 9A/EI8KW (EI8KW) 9A/IZ3NVR (IZ3NVR) 9A/W3WM (F5SNJ) 9A0BB (9A2KD 9A3XV 9A4M 9A5M) 9A2U (9A7R) 9A2W (9A5TW 9A9K 9A3PM) 9A3B (9A2VR) 9A5Y (9A3LG) 9A6K (9A5M 9A4EK) A75GC (RN1B) AC8Y (K8LF) AD4ES (AD4ES W4SO) AJ1G/M (AJ1G) BH4EUJ (BA4DL) BI4SSB (BD4TS BH4TVU BH4QBV) BY1RX (BA1RB BA1AJ BD1RX BD1KV BD1GO BD1IIJ BG1DX BG6BHA BH1LHS BH3QBY) BY4DX (BG4GOV) BY4SZ (BH4WPN) CQ3J (CT3MD) CR3W (DL5AXX) CR6K (CT1ILT) DA0BCC (DL2OE) DA0T (DL8KX DK8MM DL4HG DL7AT DL8UD) DA2X (DL8DYL DL9DRA) DC6O (DL3DW) DD5M (DJ0ZY) DF0SAX (DL9DRA) DF7A (DL1WA) DF8V (DF8VO) DG3T (DF5RF) DG5E (DK2CX) DK0MN (DK3YD) DK2A (DC8YZ) DL0DRL (DL9DRA) DL0EB (DL4ML) DL0LA (DL5RMH DL6RAI DL8RDL) DL0MCM (DL6KWN) DL0NG (DK8NC) DL0RUS (DJ2QV) DL1EAR (ANDREAS) DL50DAH (DK1KC) DL6MFK (ROBERT) DL7A (DF4XG DH2IF DJ2XY DL2OAT DO5NU) DM0E (DG1HXJ) DM1T (DL9SCO DF8TY) DM3F (DH5FS DL3JAN) DM7W (DL8MAS) DP3P (DF1OE) DP4X (DJ4MX) DP6A (DL6DH DL8OH) DP9A (DK4WA DL1RTL DL5YYM DL7UGN DL8UAT DM5JBN) DR4A (DB2WD DC8SG DH2WQ DJ9KM DK5PD DL6WT) DR5W (DL1RTL) DR5X (DL8LAS) DV3A (DU3JH DU3LA DU3TW) E7CW (E77FA E75M E73QI) E7DX (E76C E77DX E77EA) EA5C (EA5KM EA5C) EA5RS (EB5A EA5RS) ED1R (DH1TW) ED3Z (EA3ICJ) ED8M (EA8DIG) ED8X (EA1DAV) EE4Y (EA4GOY) EF1A (EA1X) EF6T (EA3AIR) EI9E (EI5KG EI6GF EI2FG EI4II) ES7A (ES7GM ES7GN ES5NY YL3JA) G0W (G0VDZ) G2X (G0DCK) G3P (G3WPH) G3T (G3VGZ) G4AQG (G3XDK, G4BVH, G4FNL) G5Q (G3SVL) G6M (G4BYG) G6T (G4MKP) GM2V (GM3WOJ) GM4Z (GM4ZUK) GM5X (GM4YXI) GW4W (GW4EVX) HA1BC (DL1MAJ) HA3DX (HA4FB, HA4FF, HA2VH, HA4XH,) HA5TOP (HA5UA HA7GSZ) HB0DX (DL1MGB DL2JRM DL3DXX DL7CX) HB7X (HB9BGV HB9DDO) HB9FMN (Pierre-ANDRE) HF1K (SP1MGM) HG5C (HA3FLT HA3FLT) HG6O (HA6OA) HG7T (HA7TM HA5CAR HG5DX YO5OHO) HG8DX (HA8DJ .HA8DZ.HA8DU.HA8FM .HA8KW.HA8JV.) HG8W (HA8ZO) HZ7C (7Z1SJ) IC8R (IC8OZM) IG9/S59A (S59A S57DX S54W S51V S52OT S50O) IQ2CJ (IK2JUB IK2PFL) IQ3RK (I3VUK, I3VWK, IK3CHK, IK3VUU, IZ3ETC, IZ3KSO, IZ3SQW) IQ5PO (I5NXH I5NSR I5BAZ IK5EKB IK5RUN IK5OJB IZ5VCI) IZ2KXC (IK2QEI IK2UJS IZ2KXC IV3ZXQ) JA3YBK (JG3KIV, JG3MRT, JG3WDN) JF1AMX (JF1AMX JF1HYA JK1JHU) JI1FOE (-) K0DI (K0DI WW2R K4SME N2CEI) K1LZ (K1LZ K3JO NA1NA) K1RX (K1RX K1BX WA1T K1WHS) K1VR (K1VR NN1C) K2DM (K3ZGA K2DM) K3AU (K2YWE) K3CCR (N3UM) K3LR (K3LR K3UA N3GJ N2NC) K3WWT (K3WWT @K3WWT) K4ZDM (K2DM) K6KM (K6KM @W6SRR) K6YA (KA6MZE AA6XV W4NJK) K7LU (K7LU @K7LU) K7RAT (N6TR) KH6AQ (KH6AQ NH6V) KH6LC (N6KB) KM1P (KM1P K1SJ) KO2Q (HARRY) KP2M (KT3Y) LA/DL4HCF (DL4HCF) LA4C (LB8CA) LC9X (LA9XGA) LX/PA4O (PA4O PA8AD) LX7I (DL3BPC) LY2J (LY2J LYR346) LY2K (LY2K, LY4L) LY2XW (LY2XW LY2MV) LY4Y (M0UNN) LZ4A (LZ1YQ) LZ5N (LZ1HW) LZ5R (LZ2HM) LZ7X (LZ1UQ) M0X (M0RTI) M4J (G0DVJ) M4X (G3SZU) M5S (G4IRN) M7T (G3YYD) M7V (M0VAA) M8A (M0HDF) MD2C (MD0CCE) MJ5E (GU4YOX) MM1E (MM0GOR) MM9I (GM0OPS) MW5B (G3WVG) N0UD (WB0OAJ) N1RR (N1RR KI1U) N1SOH (N1SOH W1FM) N2AA (K2TW KE2D KU2C KS3F N2HM W2CG W2GD W2NO W2RQ) N3IQ (ND3F) N4AO (WC4E) N4RV (N4RV NN3W) N4SS (W5MX N4AAJ W4ZXT) N5EP (N5EP @N5EP) N6HI (N6HI @N6HI) N6TQ (N6TQ @N6TQ) N7AT (K8IA) N7KU (NJ6D) N7RK (N7RK @N7RK) N7XU (K4XU) N8DNA (N8DNA @N8DNA) N9SE (N9SE @N9SE) NA6O (NA6O @W6SRR) NA7TB (KY7M AA7A N7NR K9DR) NC1CC (WA1BXY) NE3F (NE3F W3RE N3BNA) NJ1F (NJ1F K1RQ) NK4O (NK4O @NK4O) NP2ZA (OH1ZAA K9VV) NS3L (NS3L N3SET) NX6T (N6KI K6PO @WA6TQT) OE2S (OE2VEL) OE3G (OE3KAB) OE5TXF (G3TXF) OG2T (OH5LLR) OG4T (OH4MFA) OG5O (OG55W) OG9W (OH2BCI OH2CV OH2KW OH5BQ) OH2BA (M0CFW) OH3D (OH3EX) OH3Z (OH1NX) OH7K (OH7XI OH7MA) OH7MFO (OH7KC) OK1P (OK1FIG) OK5D (OK1DTP) OK5T (OK1RP OK1DZR OK1DGU) OK6Y (OK2PTZ) OK7O (OK1DOL, OK5DF) OL0A (OK1CZ) OL0W (OK1DSZ) OL1A (OK1CW) OL1C (OK1DUG OK1FPQ OK1NG OK1JAX OK1IPS) OL1R (OK1NY OK1IW OK1MV OK5MM OK1TN OK1HGM OK1NI) OL1T (OK6DJ) OL3A (OK1DX, OK1IC) OL3R (OK1VWK) OL4A (OK1JKT, OK1RI, OM6AM, OM6NM) OL4W (OK1IF) OL6B (OK6AB) OL7T (OK2BXU OK2PKU OK2BZM) OM2Y (OM2IB OM2KI) OM5R (OM5WW) OM7K (OM7RU) OQ5M (ON5ZO) OR3A (ON6CC) OU2W (OZ1ETA) OZ0B (OZ1ISY) P33W (RA3AUU) P3AA (R2AA) P40AA (DL4MM) PI4AMF (PA3GRM PC3M) PI4CC (PA3FAL PC8M PA2DK) PJ2T (K8ND) PR2R (PY2YYZ PY2ZEA) PY2NA (PY2NA PY2NDX PY2YU) R1DX (R1DX R1ZM) R2RZ (SERGE) R4SA (VLAD) RA5G (R3GG R3GM R5RA RN3GQ) RK9CXC (UA9D) RK9CYA (RK9CR, UC8C) RM2U (RU3UR) RN4A (RZ4AA) RN9A (RK9A RL9A RN9A UC9A) RT2A (UA3AB R2AB) RT4F (RK4FD RK4FU UA4FER R4GM) RT8U (RK9UE, RT8U) RU1A (RW1A, RV1AW, RN1A) RW7K (rw7k) RY6Y (RQ6A RV6ASU RJ6D) S50C (S53BB S53CC S53RM S53WW S55OO S57AL S57C) S50IPA (s58mu) S50W (S51DI S51RE S57XZ S57K) S53M (S51FB) SC7DX (SM0GNS, SM0HPL, SM7GIB) SD0N (SM0NSJ) SD6D (SA6NIA SM6RXZ) SD6F (SM6JWR) SE0B (SA0BXV) SE0X (SM0MDG) SE3P (SA0BYP) SF1Z (SM0HEV) SK3W (SM3SGP SM5IMO) SK6EI (sa6fax, sm6lpf, sm6lpg) SM0Q (SM0OGQ) SM2M (SM2LIY) SM2U (SM0CXU @SM0T) SM3U (SM0MPV) SN1W (SQ1DNJ) SN2B (SP2MKI SP2MKT SQ2GXO) SN2M (SP2XF) SN4D (SP4GAP) SN5J (SP5JXK) SN6W (SP6DNZ) SN7O (SP7IVO) SN7Q (SP7GIQ) SP/UR5AS (UR5AS) SP2YWL (SP2FWC) SP7QO (sp7qo) SP8PAI (SP8HZZ) SP8R (SP8GQU SP8BVN SQ8JLA SP8BRQ) SQ3R (SQ3HMM) SV9DJO (sv9djo) TC100TC (TA1PB) TM6M (F1AKK) UA4CNJ (SERGEY) UA4K (RM4HZ) UA4M (RA4LW, UA4LL) UP7L (UN6LN) UR7R (UX1RX) UW1M (UR5MW) V31MA (V31MA V31QV V31PS) VA6RCN (VE3RCN) VA7GI (VA7GI @VA7GI) VE2OJ (VE3AV, VE3OP, VE3ZY, VE3ICV) VE3MM (VE3MM @VE3MM) VE9ML (VE9ML VE9BK) VO2AC (VO2AC VE3KG) VR2T (VR2EH) VY2WW (K4IQ) W0AIH (K0TG) W0LL (K8FC) W1OP (K1DT, W1GS) W1UE (W1UE W1KM) W3GH (WC3O) W4AX (K5JR) W4CB (W2RU @W4CB) W4TG (W4TG N2AW) W7DRA (W7DRA @W7DRA) W7HJL (W7HJL,) W7VJ (W7VJ KU7T) W8FIB (TOM) WA2CP (KC2GOW) WA3EKL (WA3EKL KB3VQC WT3K K6ZO K3MYI K3MTR N3DPB) WB8WUA (WB8WUA @WB8WUA) WP3X (KP4AA W1VE) WU4G (WU4G @WU4G) YL0A (YL2KA) YL5W (YL2GN) YL7X (YL2LY) YQ6A (YO6BHN) YT0W (YU1JW) YT5A (YT1AD YT3M YU1KX YU2FG) YT5N (YU7AF) YT8A (YU1EA) YU5R (YT2AAA)

2023 SSB RESULTS

SINGLE OPERATOR

NORTH AMERICA

UNITED STATES

CONNECTICUT

*KC1SA	546	21	13	0
MAINE				
K1LZ	334,853	812	52	51
MASSACHUSETTS				
N1DPM	74,908	528	49	12
K5ZD	18,447	168	35	8
*W1IZZ	8,991	101	33	4
KB1OIQ	3,630	72	21	1
*W1AST	3,200	71	20	0
*N1DM	407	17	11	0
*AI1G	216	12	9	0
W1UJ	70	7	5	0
*N1ADX	18	3	3	0
NEW HAMPSHIRE				
AF1T	103,156	536	52	22
NA1E	44,250	394	46	4
*W1LJD	12,684	143	36	6
W1NT	6,554	100	27	2
RHODE ISLAND				
W1XX	83,223	470	40	23
*WB2VVV	4,728	95	23	1
NEW JERSEY				
W2OIB	15,808	178	33	5
*N2GXJ	11,661	131	36	3
*N2CJ	8,928	125	29	2
KC2G	7,514	92	30	4
KC2SGV	5,697	101	27	0
*KD2JC	638	29	11	0
NEW YORK				
WF2W	135,864	761	53	21
W1WV	62,048	438	43	13
*WA2QAU	42,064	422	42	2
WB2SIH	16,596	210	34	2
W2XL	7,254	125	24	2
*N2MTG	6,786	113	25	1
*AC2RL	6,138	86	30	1
*K2CS	4,410	68	29	1
K9VB	4,144	67	27	1
*K2OLF	2,921	59	23	0
*N2JJ	330	15	10	0
K2XA	320	16	10	0
*KV2X	112	8	7	0
*N2USM	2	1	1	0
DELAWARE				
*KS3D	36,623	292	42	11
KA3HED	19,110	218	36	3
MARYLAND				
N1EK	13,068	164	34	2
*K3KU	11,563	178	30	1
N3QE	8,820	138	30	0
*WK3A	7,616	102	29	3
KG4USN	4,508	73	27	1
*W6WU	4,128	77	23	1
*KA3JNN	3,168	60	24	0
*N3TE	3,128	55	22	1
NC3Y	2,160	48	20	0
*KD2QAR	2,064	40	24	0
PENNSYLVANIA				
W3BGN	112,812	615	43	25
W3TS	68,086	502	49	10
N3XZ	17,894	150	35	11
*KC3GBS	14,076	172	34	2
*K3SWZ	11,772	138	32	4
*KN3A	9,450	119	33	2
*K3VZ	7,068	102	30	1
KB3RCT	6,409	97	28	1
*KA2VLP	6,264	95	27	2
*W3PAX	3,036	63	21	1
*WS3C	2,834	50	25	1
K3UA	2,162	40	22	1
*NV3C	1,672	47	19	0
*WJ3U	1,656	46	18	0
*N3LT	855	24	15	0
*KA3KSP	468	18	13	0
ALABAMA				
NK4T	22,100	194	42	10
*KW4SW	13,115	138	39	4
*AB4WL	32	4	4	0
FLORIDA				
*WA3LXD	10,868	125	33	5

*KB4EE	6,845	80	32	5
*N2YF	715	26	12	1
*WB4FSU	714	24	13	1
KO4KGP	555	17	14	1
*K4SBZ	60	6	5	0
GEORGIA				
W4AMP	14,985	148	40	5
*WC4Y	9,768	142	32	1
*AA4LR	8,132	97	35	3
*WA4ZKO	4,557	62	29	2
*KE4QCM	2	1	1	0
KENTUCKY				
*W4IOD	8,510	99	34	3
*KC4WQ	7,491	99	31	2
*K4PKM	5,408	80	31	1
*KC4OBX	1,472	32	23	0
NORTH CAROLINA				
NG4C	37,850	327	39	11
N4PSE	23,368	234	40	6
N1LN	15,470	200	33	2
*K4TMC	14,240	205	29	3
NW3U	7,130	102	29	2
*KK4RV	5,472	74	29	3
*N4NTO	2,442	51	21	1
*W1REP	330	15	11	0
SOUTH CAROLINA				
*WA4LDU	19,440	178	41	7
*KR4NO	5,040	78	29	1
*KM4RK	3,640	58	26	2
N4WPJ	216	12	9	0
TENNESSEE				
W4KW	72,219	573	48	9
AD4EB	18,684	243	35	1
AC4G	11,309	105	36	7
*KJ4JPV	4,263	66	28	1
W4NZ	4,225	73	22	3
*WD4PTJ	2,500	47	24	1
*NY4JB	1,995	40	20	1
NK4I	408	17	12	0
*KW4LU	380	19	10	0
VIRGINIA				
K3ZM	250,792	820	53	41
KW4CW	27,370	255	39	7
W4NYY	21,216	255	35	4
K4CGY	15,200	166	35	5
*W4YE	7,616	99	32	2
N4DJ	7,425	105	32	1
N4CF	6,180	94	29	1
*KV4ZY	5,190	76	29	1
KC4RCR	4,374	68	26	1
NN4RB	3,689	55	30	1
*W3QD	3,672	77	24	0
*KB4GM	3,325	54	23	2
*K4FTO	3,200	61	25	0
N8AID	2,832	53	24	0
*KB4CG	2,736	51	24	0
*K4NTO	2,222	49	22	0
*K4YCR	2,178	45	21	1
*K4CAB	2,088	38	23	1
*K1APC	1,780	43	20	0
*K4HQK	1,728	48	18	0
K3WD	1,653	42	19	0
*KD4TTP	1,648	47	16	0
*KG4WOJ	1,406	36	18	1
*K4FJW	1,000	25	20	0
*K4GDA	350	12	9	1
K5VG	2	1	1	0
ARKANSAS				
W5KI	882	23	18	0
LOUISIANA				
K5TS	20,400	190	42	6
*AG5JW	1,564	35	21	2
NEW MEXICO				
*K5TFL	6,612	77	35	3
*N5JDT	1,444	31	17	2
AB5SJ	8	0	0	1
OKLAHOMA				
*KA5PMV	5,511	79	32	1
TEXAS				
K5TR	74,152	530	50	12
K5RX	42,334	298	50	11
N5REL	13,552	134	39	5
*AE5LQ	4,896	72	30	2
*NW5Q	1,617	37	20	1
WA5DSS	1,140	24	17	2
*NN5T	615	19	14	1
*W5PKK	560	20	14	0
*W5JCC	234	13	9	0
*KC5MVZ	126	9	7	0
N5TJ	72	6	6	0
N5AF	40	4	5	0
CALIFORNIA				
AI6LY	3,942	63	25	2
N6AA	3,813	50	28	3
*N9BD	2,886	47	25	1
N6TQ	938	22	13	1
*N6LL	203	9	5	2
ARIZONA				
W8KA	41,760	312	50	8
*K7HKR	1,300	28	18	2
K7AEZ	1,254	31	21	1
N7DSX	896	21	13	3
KC7V	84	5	3	1
IDAHO				
W7TMD	1,070	40	10	0
*KA7T	550	21	10	0
*AG7UN	288	11	7	1
MONTANA				
*N7AGP	17,350	141	48	2
*KS7T	1,003	26	17	0
OREGON				
*N8YEL	2,366	69	12	1
WB6JJJ	473	13	10	1
UTAH				
NG7M	528	18	11	0
WASHINGTON				
*N7AU	8,704	103	33	1
KD7UO	3,686	78	18	1
WA7TV	3,168	50	23	1
*K7STO	2,990	49	22	1
K7IU	2,478	46	20	1
*KC7H	1,820	51	12	1
*N7QOZ	1,261	34	12	1
N3EG	1,100	41	11	0
KA6RWL	1,044	22	17	1
*KG7PD	343	19	6	1
*W7MTH	230	14	5	0
*KG7P	165	11	4	1
MICHIGAN				
*WN8HCV	65,502	547	50	4
NA8V	36,848	320	44	5
N8GEO	26,158	289	38	3
*N8PPQ	19,383	231	38	1
*W8CO	6,660	77	32	4
*K8VT	216	12	9	0
*W8RU	208	10	8	0
OHIO				
ND8DX	171,509	873	55	24
KW8N	55,100	404	48	10
KD8TNF	42,734	427	45	1
*N8CWU	22,345	252	39	2
*KE8BKP	9,205	111	32	3
*K8VUS	8,702	103	37	1
*W8TB	8,456	139	28	0
*N8WCP	7,560	98	33	2
*N8HP	7,006	103	30	1
KE8NBC	5,508	71	33	1
*W8KNO	3,068	59	26	0
*N8HHG	2,875	53	25	0
*AB8SZ	1,804	38	22	0
*KD8TJB	1,215	36	15	0
*WO3X	1,170	31	18	0
*WB8WUA	280	14	10	0
WEST VIRGINIA				
*N4RA	22,760	254	36	4
KE8KMX	9,842	119	35	2
*N8II	4,374	75	27	0
*KE8SNO	192	12	8	0
ILLINOIS				
N9DJ	19,530	195	42	3
*WO9I	18,606	208	41	1
K0PG	15,867	180	40	1
WA9KIA	8,954	112	36	1
*WR9L	5,664	81	31	1
*AG9A	3,321	57	27	0
*WB9HFK	2,756	50	26	0
*KB9FPY	1,659	38	21	0
*WG9L	850	25	17	0
INDIANA				
*WD8DSB	25,326	275	39	3
W9RE	22,176	199	42	6
K9GX	15,744	170	38	3
*KB9VMW	15,180	142	41	5
KJ9Z	8,991	113	36	1
*KB9OZI	8,448	116	32	1
*NY1V	4,380	67	29	1
*KD9VNI	3,336	61	23	1
*WN9O	2,550	45	24	1
*KD4ULW	1,449	33	21	0
*WB9NOO	1,332	34	18	0
*AJ9C	1,083	27	19	0
WISCONSIN				
N9GH	24,440	202	45	7
*W1QC	6,630	83	32	2
NN9C	3,848	64	25	1
*WB9BWP	3,150	57	25	0
*KD9GDY	2,376	45	24	0
*KD9KEQ	675	21	15	0
IOWA				
*N0NI	36,816	329	50	2
KA9OZP	7,104	83	35	2
*W0FLS	6,426	76	29	5
KANSAS				
*N0LLH	1,738	38	22	0
MINNESOTA				
K0SIX	33,984	330	47	1
N0UY	16,356	155	44	3
N0OK	12,096	121	38	4
*N0HDR	4,818	63	32	1
*AE0TG	1,260	32	18	0
MISSOURI				
*AI6O	28,435	283	45	2
NW0M	7,326	93	36	1
KD0ETU	22	3	0	2
NEBRASKA				
WD0BGZ	32,552	291	49	3
KB0ARZ	3,689	61	31	0

CANADA

NEW BRUNSWICK				
*VE9RLW	2,928	39	16	0
PRINCE EDWARD ISLAND				
VY2WW	79,173	262	37	20
QUEBEC				
*VA2KD	4,906	47	22	0
*VA2LGQ	2,688	36	16	0
*VE2LJV	5	1	1	0
ONTARIO				
*VE3MGY	168,207	605	48	9
VA3AR	89,460	443	41	1
VE3HJ	54,280	286	40	0
VE3BR	36,024	195	37	1
VE3CKO	34,486	165	38	5
*VA3AC	29,036	181	33	1
*VE3WG	13,860	101	27	1
*VE3KMQ	12,615	90	28	1
*VE3LRL	12,582	98	27	0
*VA3GKO	10,752	95	24	0
*VE3NQM	8,640	75	24	0
*VE3MT	6,408	57	24	0
*VE3MM	5,460	60	20	0
*VA3EON	2,175	29	15	0
*VA3RKM	1,792	28	14	0
*VA3FN	450	10	9	0
ALBERTA				
VE6BBP	23,104	129	35	3
VE6TL	4,620	49	20	1
*VE6TN	4,104	50	18	1
*VA6RCN	185	11	5	0
BRITISH COLUMBIA				
VA7MM	4,320	53	17	1
*VE7DX	3,162	41	16	1
*VA7EU	1,265	25	10	1
*VA7FC	595	20	7	0

NORTH AMERICA

Cayman Islands				
ZF2VE	166,140	440	47	24
Costa Rica				
TI5CDA	47,966	145	37	21
Cuba				
*CO2RQ	3,717	34	16	5
*CO8NDZ	3,611	29	16	7
Mexico				
XE2S	11,745	80	26	3

AFRICA

Canary Islands				
ED8W	77,948	152	15	37
EA8DET	3,630	25	0	15

ASIA

Asiatic Russia				
RA9SDT	10,428	51	0	22
RZ9WU	6,308	35	0	19
*RC0L	130	13	0	2
UA9UUD	120	4	0	4
China				
*BI4VIP	34	4	0	2
*BI1MCZ	24	3	0	2
*BI1JNP	4	2	0	1
Cyprus				
P35A	26,320	78	4	31
Georgia				
4L2M	96,008	224	1	43
Japan				
*JE1SPY	378	60	0	3
JH9URT	340	38	0	4
JA9FHB	124	8	0	4
JA0JHA	112	8	0	4
*JA8RWU	16	8	0	1
JR3UIC	6	3	0	1
JF2FIU	4	2	0	1
Kuwait				
9K2NO	36,670	101	0	38
Mongolia				
JT1CO	1,550	23	0	10

EUROPE

Austria				
*OE2GEN	13,175	106	0	25
*OE20AAW	9,476	83	0	23
*OE6HWF	6,270	56	0	22
*OE5EDR	1,045	19	0	11
Azores				
CU3AC	780	13	0	12
Belarus				
EU4E	84,366	386	2	41
Bosnia-Herzegovina				
E70T	50,224	233	0	43
*E78ZX	3,940	39	0	20
*E78T	3,740	44	0	17
*E74SL	3,096	35	0	18
Bulgaria				
LZ5DB	10,538	97	0	22
*LZ2ZG	3,515	36	0	19
Croatia				
*9A3B	19,198	133	0	29
9A/W3WM	11,736	98	0	24
*9A1MM	6,090	58	0	21
Czech Republic				
*OK1LRD	115,056	506	2	45
OK4U	113,805	522	1	44
*OK6AB	40,716	215	2	37
*OK7AW	34,593	183	1	38
OK1OA	29,172	183	0	33
*OK1HBO	25,544	175	0	31
*OK1UKY	20,996	155	0	29
*OK2BRQ	20,100	142	0	30
*OK2TS	18,645	118	0	33
*OK1BJ	17,316	141	0	26
*OK1DXW	6,555	60	0	23
*OK5ET	5,280	56	0	20
*OK1MDK	3,740	47	0	17
*OK1TRJ	970	20	0	10
Denmark				
OZ11A	42,592	268	0	32
*OZ4NA	24,032	152	0	32
OZ1T	1,905	25	0	15
England				
M0NPK	54,912	190	15	37
*M0EBJ	35,013	216	1	32
*M0PLX/M	34,281	176	3	36
*G7LRR	26,272	169	0	32
M0MCV	14,670	99	0	30
*G0CNN	4,484	49	0	19
*2E0TKO	3,472	44	0	16
*G3SNT	600	12	0	10
*M0MGF	45	3	0	3
Estonia				
*ES4MD	6,490	58	0	22
European Russia				
RC5Z	34,480	180	0	40
RW1A	25,262	159	0	34
RD1AH	23,030	146	0	35
*UA3BL	13,980	100	0	30
RT1M	8,096	73	0	23
*R3DCB	8,046	63	0	27
*R3LCV	6,696	61	0	24
RL5A	5,588	53	0	22
*RU4CK	3,152	39	0	16
*R3LA	3,003	27	0	21
*RA6LUU	2,848	42	0	16
*R7NP	2,520	32	0	15
UB3DDA	2,128	34	0	14
R4FCJ	1,344	30	0	12
*UA1CUR	900	18	0	10
*RV1CB	352	10	0	8
*RA3V	125	5	0	5
Fed. Rep. of Germany				
DK5NJ	73,436	426	0	44
DH1UK	57,150	269	6	44
*DL0NG	44,655	297	3	36
*DG5MLA	38,608	266	0	38
*DL4ZA	35,820	265	0	36
DJ7OQ	31,710	185	1	41
*DK1IJ	27,714	252	0	31
*DJ1WF	27,676	193	2	35
DL4GBA	27,540	183	0	36
*DH4RJ	26,355	186	0	35
*DL6MI	24,955	177	0	35
*DL8DSL	24,080	144	2	38
*DL9OLI	22,950	176	0	34
*DL1ABR	22,902	182	0	33
DB5SM	21,450	166	0	33
*DL2TOS	20,580	150	0	35
*DO1AYJ	19,648	153	0	32
*DG1FK	17,690	176	0	29
DL2SAX	16,890	133	0	30
*DK5DQ	16,268	151	0	28
*DL2NBJ	16,128	121	0	32
*DL8UV	15,616	122	1	31
DH8BQA	15,066	111	2	29
DL5AWE	14,787	119	0	31
*DL1OMP	14,703	128	0	29
*DK0BM	14,355	142	0	29
*DK2CC	14,012	104	0	31
DL1DJH	13,398	131	0	29
*DK3YD	13,286	134	0	26
*DJ8QP	13,144	98	0	31
*DJ4WT	13,020	111	0	31
*DL5ALW	12,988	78	0	34
DL1BUG	12,731	106	0	29
*DL8ZU	12,528	111	0	29
*DM6EE	12,366	118	0	27
*DL1MHJ	12,075	125	1	24
*DF2TH	11,490	88	0	30
*DF7GG	11,284	98	0	28
DM2MX	11,259	95	1	26
*DL2ZA	10,868	107	0	26
*DO4OD	10,868	103	0	26
*DL0TY	10,504	106	0	26
DK6CQ	9,772	85	0	28
*DL2KBX	8,175	80	1	24
*DM4KJ	7,912	97	0	23
*DO2DAP	7,900	103	0	20
*DO6CH	7,176	85	0	23
DF4PD	6,425	61	0	25
*DM5SB	6,175	59	0	25
DK1FW	6,150	51	2	23
*DL5NEN	6,020	80	0	20
*DK6QW	5,460	67	0	21
DL1ATZ	5,359	51	0	23
*DL6MFK	5,244	51	0	23
DK4VW	4,769	67	0	19
*DK9OV	4,446	60	0	19
*DG1UE	4,422	51	0	22
DF1TB	4,032	42	0	21
DM4EZ	3,979	37	0	23
*DM2AWM	3,724	47	0	19
*DJ9SN	3,519	48	0	17
*DL8ZAJ	3,360	57	0	16
*DK2CB	3,348	39	0	18
*DL3DRN	3,248	62	0	14
DF6RI	3,152	55	0	16
*DL1KVN	2,985	50	0	15
DL6HBQ	2,928	48	0	16
DF5MA	2,816	46	0	16
*DB2ZJ	2,030	38	0	14
*DL7UN	1,904	25	0	16
*DL9RDM	1,652	31	0	14
*DG7JH	1,248	24	0	13
DJ2IA	1,222	20	0	13
*DL9GMN	1,209	21	0	13
*DG8MDN	1,170	24	0	13
*DK4RR	260	14	0	5
*DF2FM	230	14	0	5
*DB3KB	228	10	0	6
*DL9VK	204	8	0	6
*DL2OO	136	9	0	8
*DM4KR	120	6	0	5
*DL6DBP	76	5	0	4
DL5KVV	72	15	0	2
*DL4LT	69	7	0	3
*DO1WI	48	5	0	3
*DF1DT	18	3	0	2
*DL4NHP	2	1	0	1
Finland				
*OG2T	40,470	215	0	38
OH4KA	400	10	0	8
France				
F6FYA	35,013	213	0	33
*F1FPL	10,643	74	0	29
*F4HZZ	2,800	35	0	16
Greece				
*SV6EXH	9,342	69	0	27
Hungary				
*HA8WY	60,120	266	4	41
*HA1BC	25,410	155	0	33
Iceland				
TF3T	18,464	110	1	31
Ireland				
*EI3ENB	13,635	99	2	25
*EI4KU	13,442	104	0	26
Italy				
I5JVA	446,173	810	31	60
IK1PMR	110,211	433	9	42
*IK7YTT	73,723	262	11	42
*IU1NKS	23,790	173	0	30
*IK2AQZ	13,748	102	0	28
IV3RYP	12,060	83	0	30
*IZ5NRF	5,764	52	0	22
*IU3OCN	5,681	63	0	19
*IZ8PWN	3,268	38	0	19
IW2OEF	2,288	33	0	16
I2SVA	1,920	27	0	16
IZ1LAY	1,508	25	0	13
*IK3BVD	729	21	0	9
*IZ2CSX	329	10	0	7
*IZ1JII	320	8	0	8
Latvia				
YL2EA	12,818	87	0	29
*YL3KW	3,825	45	0	17
Lithuania				
LY5W	167,501	557	6	53
*LY4L	83,893	392	2	41
LY4T	37,074	203	2	35
LY2OU	35,568	192	1	37
LY2NK	22,348	123	0	37
*LY9A	13,050	108	0	25
LY5O	3,570	50	0	15
Netherlands				
PA4VHF	182,428	607	9	50
*PA1HD	6,360	53	0	24
*PA0TCA	2,414	28	1	16
North Macedonia				
*Z32TO	3,520	44	0	16
Norway				
*LA8OKA	17,504	109	0	32
*LC9X	6,693	59	1	22
Poland				
*SP6LUV	100,009	423	4	45
*SP9DTE	62,202	305	1	41
*SQ8MFM	59,508	325	0	38
*HF9F	45,486	252	0	38
SP6A	36,062	192	1	37
*HF9E	32,375	195	0	35
*SN550K	22,048	138	0	32
SP9TPZ	14,732	106	0	29
SQ7BFS	13,068	103	0	27
SP8MRD	11,908	96	0	26
*SQ9EDZ	11,600	85	0	29
*SQ5EF	10,850	93	0	25
*SQ9PPT	7,203	74	0	21
*SP8OV	6,371	59	0	23
*SO6OO	3,186	39	0	18
*SP3CMX	890	19	0	10
Portugal				
CT1AL	5,911	49	2	21
Romania				
YR8D	145,580	487	2	56
*YO5OHB	13,891	96	0	29
*YO8RZJ	8,211	72	0	23
*YO8COK	3,553	35	0	19
*YO2LIM	3,363	34	0	19
*YO7CKQ	315	9	0	9
Scotland				
MM1E	31,228	167	2	35
Serbia				
YT9W	100,000	387	6	44
*YT8A	96,692	416	1	45
*YU1P	18,067	125	0	29
*YT2SMS	8,900	72	0	25
Slovak Republic				
OM7K	107,916	410	6	45
*OM0AB	32,835	202	0	33
*OM2DT	19,516	114	0	34
*OM2JK	12,208	88	0	28
*OM7AT	520	13	0	8
*OM1APT	488	14	0	8
Slovenia				
S53O	233,574	685	15	51
*S51I	23,310	141	0	35
Spain				
EA1DGT	20,412	113	4	32
*EA3MR	19,516	121	2	32
EA1AT	13,504	89	0	32
EA3OH	11,144	83	0	28
*EA4JR	4,158	43	0	21
EE4Y	1,736	26	0	14
Sweden				
*SB5X	12,272	95	0	26
SB6A	2,656	35	0	16
*SM6USS	1	-1	0	1
Switzerland				
HB9FWB	32,597	176	0	37
HB9GHU	4	2	0	1
Ukraine				
*UT7NY	9,639	70	0	27
*UT0CK	4,978	51	0	19
UZ1U	4,884	43	0	22
Wales				
*GW4W	1,200	24	0	10

OCEANIA

Australia				
VK3IO	856	28	5	3
VK2PW	28	3	0	2
Indonesia				
YB2DX	518	45	0	7
*YB9KA	384	16	0	6
*YC2VOC	208	48	0	2
*YB1BX	180	41	0	2
*YC1PZ	168	38	0	2
*YB1DBU	160	36	0	2
YC0RXA	160	36	0	2
*YC1AMI	156	35	0	2

*YC1LJT	156	35	0	2
*YC1IDB	152	34	0	2
*YB1HDR	148	33	0	2
*YB1HR	144	32	0	2
YF1AJC	144	32	0	2
YE3DFB	136	30	0	2
*YB1JCD	78	39	0	1
*YC1COZ	74	37	0	1
*YB1BML	64	32	0	1
*YC2KME	64	32	0	1
*YC1EBM	60	30	0	1
YB0NSI	58	29	0	1
*YB1JBV	54	27	0	1
YC0AWI	52	26	0	1
YC0ATP	50	25	0	1
*YC1CBY	50	25	0	1
YB3BGM	48	24	0	1
*YB0DOS	42	21	0	1
*YB2CPO	40	20	0	1
*YB1ELP	36	18	0	1
*YC1BYQ	34	17	0	1
*YF1AQS	32	16	0	1
*YB1FFH	30	15	0	1
*YB1OWI	24	12	0	1
YF1AJD	24	12	0	1
*YB1HBO	18	9	0	1
*YC1YU	6	3	0	1

SOUTH AMERICA

Brazil

*PU2USK	16	8	0	1
*PP5DZ	6	3	0	1
*PP5LTI	6	3	0	1
PY9MP	4	2	0	1

Venezuela

YV2IF	140	4	2	2

QRP

NORTH AMERICA

UNITED STATES

CONNECTICUT

NN1DX	994	34	14	0

MASSACHUSETTS

K1ZM	56,760	374	43	17

PENNSYLVANIA

W7LG	912	27	16	0

FLORIDA

K3TW	1,170	24	15	3

NORTH CAROLINA

WB4MSG	24,123	257	39	4

VIRGINIA

K2EKM	12	3	2	0

OHIO

K8ZT	126	9	7	0
KC8ZKI	126	9	6	0

ILLINOIS

KD9NYE	1,349	31	19	0

MISSOURI

N0LMQ	240	12	10	0

CANADA

NORTH AMERICA

Puerto Rico

KP4KE	7,860	51	26	4

AFRICA

ASIA

China

BI1JY	8	4	0	1
BI1NZZ	4	2	0	1

Japan

JH7UJU	14	7	0	1

EUROPE

Austria

OE3MDB	4,347	41	0	21

Belgium

ON5RZ	14,950	115	0	26

Bosnia-Herzegovina

E70E	8,880	76	0	24

Croatia

9A/IZ3NVR	12,648	106	0	24
9A9I	8,901	77	0	23
9A4QV	1,586	25	0	13
9A5M	80	4	0	4

European Russia

RD3K	43,134	209	0	42

Fed. Rep. of Germany

DL8LR	27,084	200	1	36
DK2LO	23,800	181	1	33
DL2OE	13,472	103	0	32
DL2LDE	3,762	48	0	19
DM4KW	2,960	43	0	16
DL0AZ	376	13	0	8
DL9MFY	210	7	0	6
DL4XT	2	1	0	1
DL7HH	2	1	0	1

Finland

OH3KQ	3,536	46	0	16

Hungary

HA1TI	23,925	148	0	33

Netherlands

PA2TMS	23,494	138	0	34
PA3ETM	4,284	51	0	17

Norway

LA7WRA	1,380	23	0	12

Poland

SP8DR	2,608	35	0	16

Serbia

YT1BD	1,694	26	0	14
YU3LAX	420	12	0	7

Slovak Republic

OM7PY	5,136	42	0	24

Spain

EA3F	10,426	85	0	26

Switzerland

HB9EHJ	5	1	0	1

Ukraine

UR5FEO	7,375	57	0	25
UT0NB	5,175	40	0	25
UT4UBZ	4,268	38	0	22

OCEANIA

Indonesia

YC1HBP	8	4	0	1
YB1ICC	6	3	0	1

SOUTH AMERICA

Brazil

PY2KDU	8	4	0	1

ASSISTED

NORTH AMERICA

UNITED STATES

CONNECTICUT

W1TJL	32,550	260	38	12
W1BR	3,792	70	24	0

MAINE

K1JB	22,520	235	36	4
K1BZ	9,537	124	31	2

MASSACHUSETTS

K3JO	75,003	272	41	28
*K1EP	73,664	459	45	19
K1OFO	53,865	368	41	16
AK1MD	26,708	248	36	8
*WO1N	19,539	211	34	5
N1ROZ	16,296	173	36	6
KV1J	2,800	56	18	2
K1DJ	2,090	49	19	0

NEW HAMPSHIRE

K1RX	27,871	233	37	10
*KA2KON	288	16	9	0

RHODE ISLAND

AB1JV	15,048	184	34	2

VERMONT

N1IBM	28,260	261	37	8

NEW JERSEY

N2FI	68,027	512	49	10
K2RET	22,512	228	36	6
WO2T	18,600	194	34	6
AB2E	18,464	256	30	2
KE2D	15,400	157	35	5
W2YC	14,018	141	39	4
W2CG	7,400	67	30	7
WR2G	6,820	97	28	3
K3TS	6,570	98	28	2

NEW YORK

WU2X	99,946	325	44	33
WA2CP	37,590	389	36	6
AA2EQ	15,132	176	38	1
*WA2JQK	15,047	165	35	6
KE1IH	13,167	182	31	2
K2EP	10,044	118	32	4
WA3AFS	7,110	99	29	1
N2NKX	5,504	73	30	2
N2RC	1,407	29	20	1
*K2SI	1,343	35	17	0

DELAWARE

N3TTT	56,109	328	43	16
K9RS	32,913	248	42	11
AA3R	27,416	255	36	10

DISTRICT OF COLUMBIA

*AC5XK	2	1	1	0

MARYLAND

K3MM	77,860	386	47	21
W3LL	73,470	511	52	10
K1RH	46,512	434	41	7
AG4Q	37,306	360	41	5
K3AJ	35,010	342	41	4
N3IQ	34,316	327	39	7
N3DUE	11,376	137	34	2
W3FR	9,310	112	35	3
AA3S	8,000	112	30	2
K3TN	7,192	108	28	1
N3AM	4,408	67	29	0
*WB8YYY	4,394	77	26	0
W3OU	3,874	70	26	0
N3FJP	3,717	84	21	0
N4ZR	3,614	62	25	1
*NT3U	3,562	61	25	1
WX3B	2,286	62	18	0
W3RMO	444	17	12	0
*AJ3M	2	1	1	0

PENNSYLVANIA

*N3AAA	65,094	504	47	10
K3WW	34,481	371	37	4
K3NM	25,200	214	40	8
NF3R	24,999	288	35	4
W3FV	19,055	221	34	3
WY3A	17,208	210	32	4
K3OO	17,150	213	31	4
K3MD	15,444	210	30	3
KG5TA	11,029	114	37	4
NY3B	10,116	130	35	1
W3FIZ	7,488	100	29	3
*AG3I	6,328	104	28	0
N3ZA	5,940	98	26	1
KB3Z	3,567	49	26	3
K6ND	1,599	9	0	13
*N3RM	1,552	47	16	0

ALABAMA

KX4X	38,720	291	44	11
K4WI	31,605	296	43	6
KN4PHS	13,202	149	38	3

FLORIDA

N6AR	59,466	344	43	23
KM5AT	9,009	93	32	7
KM4HI	9,000	112	32	4
WO4O	5,005	45	25	10
AD4ES	2,120	50	18	2
*WW4LS	901	25	16	1
K3ZGA	65	5	4	1
N8NBE	44	4	3	1
ND8L	44	4	3	1
N4FMO	27	3	2	1
AD4J	18	3	3	0
K4ZDM	14	2	1	1
K2DM	5	1	0	1
W2TR	1	-3	0	0

GEORGIA

K4BBH	6,516	80	33	3
*N4CN	2,860	49	25	1
K4VTE	2,047	40	22	1
*K4SHW	1,170	31	18	0

KENTUCKY

K4ISV	135,351	666	53	28
*N4SS	78,183	527	47	16
*AC6ZM	7,665	92	32	3

NORTH CAROLINA

WJ2D	34,560	200	43	17
KE4YOG	4,960	67	28	3
N4GU	4,860	84	26	1

SOUTH CAROLINA

K3DNE	10,764	135	33	3
NU4E	8,436	101	36	2
*K4FT	3,132	51	28	1

TENNESSEE

AA4DD	5,487	80	29	2
AF4T	1,400	32	19	1
*WA4VGZ	448	13	13	1

VIRGINIA

K2KW	50,563	340	43	16
W3IP	46,844	411	41	8
W4NF	37,320	419	37	3
*W4IM	17,064	212	33	3
WB3D	14,360	156	37	3
N4HB	11,359	133	34	3
K4XL	11,084	137	30	4
*KK4BZ	8,330	111	33	1
K5VIP	6,944	98	31	1
*KA4RRU	6,322	100	28	1
N4PD	5,984	78	30	2
KK4ADQ	3,926	71	26	0
N6DW	2,886	48	25	1
*K4MI	2,880	57	23	1
K8LF	1,620	36	20	0
*WB4KFO	1,260	35	18	0
*KM4IAJ	1,050	32	15	0
*NJ4Q	684	24	12	0

MISSISSIPPI

NA5NN	60,140	403	48	14
N5YT	9,471	97	35	6

NEW MEXICO

K8OZ	19,061	177	46	3

TEXAS

K5NZ	9,348	100	37	4
K5PAR	3,052	46	26	2
*WK5AT	2,016	42	24	0
*WA2VYA	42	3	2	1

ARIZONA

N7RK	10,980	109	42	3
N7AT	1,512	29	19	2
K7WP	520	13	10	3
KN7Y	52	5	3	1

OREGON

KU1CW	34,827	253	49	8

WASHINGTON

AC7DC	672	24	11	1
W0AO	612	22	9	0

MICHIGAN

KG8CW	21,882	231	40	2
*K8BB	2,457	41	26	1

OHIO

*KC9LA	30,691	293	41	6
W8KEN	16,008	132	39	7
KA8G	10,152	129	34	2
AC9GK	9,972	125	35	1
*AB8OU	5,684	92	29	0
N8NB	1,975	35	25	0
*W8WTS	330	15	11	0
K8ALM	120	10	6	0

WEST VIRGINIA

AA8FM	2,825	52	25	0

ILLINOIS

KB0V	62,748	431	51	12
*KG9X	25,452	282	40	2
N9IO	14,784	157	38	4
WB8BZK	7,425	99	32	1
*KA9I	1,820	38	20	0
W9YK	928	29	16	0

INDIANA

N4SV	35,055	354	42	3
K9NW	20,683	214	39	4
AG9S	17,138	188	39	2
*KB9RDS	12,180	165	35	0
*N9TTK	4,212	72	25	2

WISCONSIN

KA9FOX	36,720	293	48	6
*WE9R	31,650	284	47	3
K9TY	16,426	178	42	1
W0ELT	2,262	38	25	1

IOWA

*AE0DX	17,415	182	41	2

KANSAS

AD0AB	1,826	40	22	0
*KS0AA	476	17	14	0

MINNESOTA

K0RC	11,676	133	41	1
W0PMO	10,406	108	41	2
K0RJW	8,568	110	35	1
*K4IU	1,224	34	18	0
*W0SEI	611	22	13	0
*W0ADL	280	14	10	0
*N0EO	18	3	3	0

MISSOURI

N0PB	78,993	503	54	13
NX0I	8,547	108	36	1

NEBRASKA

N0GN	27,336	250	47	4

SOUTH DAKOTA

*K0KX	2,184	39	26	0
*K7BG	24	4	3	0

CANADA

NEW BRUNSWICK

*VE9ML	6,624	60	22	1

ONTARIO

*VE3PJ	67,746	333	40	2
*VE3VY	36,670	198	36	2
VE3EJ	16,905	100	31	4
VE3TW	8,375	70	25	0
VE3VN	3,212	28	19	3
VA3WW	3,120	33	20	0
*VE3JZT	2,718	32	18	0
*VE3BFU	2,085	29	15	0

ALBERTA

VE6AO	1,040	22	13	0

NORTH AMERICA

Belize

*V31PS	100	4	2	2

Dominican Republic

*HI3K	4,500	37	20	5

US Virgin Islands

NP2X	13,338	62	29	10

AFRICA

ASIA

Asiatic Russia

UA9MA	3,952	26	0	16

Asiatic Turkey

*TA3NE	44,055	135	0	33
TC100TC	18,042	113	0	31

China

BA4DL	111	8	0	3
*BG4GOV	10	2	0	1
BH1NEK	2	1	0	1
*BI1GCQ	2	1	0	1

Georgia

4L5EE	9,476	44	0	23

Japan

JH9DRL	144	21	0	3
JA4CZM	2	1	0	1
JA7ZP	2	1	0	1

United Arab Emirates

A65BB	1,440	13	0	12

EUROPE

Austria

OE2VEL	47,044	249	0	38
*OE4EIE	44,538	229	0	39
OE1TKW	43,320	217	0	40
OE6MMD	30,702	182	0	34

Belarus

EW1M	39,216	199	0	38
*EW2T	4,800	48	0	20

Belgium

*ON6NL	19,020	128	0	30

Bosnia-Herzegovina

E77DX	27,125	153	0	35

Bulgaria

LZ4TX	171,227	542	7	54
LZ6Y	28,268	147	2	35
*LZ2ZY	18,447	111	0	33
LZ4A	11,426	78	0	29
*LZ2WP	8,256	68	0	24

Crete

SV9FBG	34,225	178	0	37

Croatia

9A5VS	10,395	56	1	34
*9A2EU	9,022	69	0	26

Czech Republic

OK6Y	119,021	498	2	47
OK1K	100,832	450	1	45
*OK2BFN	60,148	280	3	41
*OK6RP	54,440	284	0	40
OK1DOL	41,000	210	0	40
OK1CRM	27,740	149	0	38
*OK2YZ	24,120	144	0	36
*OK1DPU	17,510	107	1	33
*OK1DLX	15,712	103	0	32
*OK8SMS	3,648	48	0	16

Denmark

OZ1FHU	48,222	254	0	38
*OZ1KVM	22,902	139	0	33

England

G5K	145,530	426	18	45
G4PIQ	44,600	221	2	38

Estonia

ES3V	6,630	50	0	26
*ES7A	675	15	0	9

European Russia

*UA7K	91,104	353	5	47
RZ3B	75,870	343	1	44
RC3FL	33,540	178	0	39
RM4F	17,885	98	2	33
*UB7K	14,592	89	1	31
RW1F	14,550	122	0	25
RN1B	10,125	85	0	25
RK2M	6,808	63	0	23
RA1OHX	5,302	51	0	22
RT3G	4,368	42	0	21
UA1OMS	2,940	29	0	20

European Turkey

*TA1CM	28,332	154	0	36

Fed. Rep. of Germany

DK6WL	180,096	636	14	53
DR1E	130,740	521	12	48
DK9IP	104,367	448	10	47
DJ7YP	98,050	460	9	44
DK2OY	97,944	424	9	47
DL9UP	72,051	387	0	47
DJ5AN	70,524	313	9	45
DA0RR	69,736	383	2	44
DL7URH	65,900	312	7	43
DL5RMH	60,720	326	1	45
DK3BK	56,330	326	0	43
*DP3P	51,982	275	5	42
DL9LA	51,772	307	2	41
DL50DAH	50,046	355	1	37
DP7R	48,254	252	2	44
*DA2R	48,092	272	3	41
DJ5IW	45,150	270	0	43
DK5PD	44,352	255	0	42
DL5LYM	43,091	267	0	41
DL1NEO	37,886	247	1	37
DL8RDL	36,670	244	0	38
DB2WD	33,948	231	0	36
DL7ON	33,000	205	0	40
DL6WT	32,572	251	0	34
*DL7BF	32,508	230	0	36
*DK5MB	31,836	179	2	40
DK2CX	30,888	220	0	36
DL4VK	29,716	193	0	38
DL3LAB	29,682	228	0	34
DL1NKS	28,008	201	1	35
*DD2ML	25,344	199	0	33
*DJ5MO	24,346	153	0	37
DJ2TG	24,222	187	0	33
DL9LBA	21,816	151	0	36
DG0LFG	20,952	141	0	36
*DL6RAI	20,196	158	1	32
DL3ABL	19,573	127	2	35
DH0GHU	19,285	133	2	33
DA0T	17,358	136	0	33
DH2WQ	16,730	114	0	35
DK5KK	16,380	156	0	28
*DJ5AM	15,878	116	1	33
DF2RG	15,345	111	0	33
*DJ2MX	15,136	127	0	32
DK8MM	15,090	129	0	30
*DL1RTL	14,450	104	0	34
*DJ0IF	13,775	113	0	29
*DK2AT	13,689	132	0	27
*DL2MLU	13,680	114	0	30
DF8DX	13,440	116	0	30
DJ5MW	13,419	132	0	27
*DJ9MH	13,082	102	1	30
*DL2NBU	12,960	128	0	27
*DK5TA	12,447	118	0	27
DK7ZT	11,760	93	0	30
*DJ4MX	11,732	109	0	28
DC2VE	11,529	116	0	27
*DF8V	11,480	106	0	28
*DL6RBH	11,225	115	0	25
*DM3Y	10,712	107	0	26
*DL4VAI	10,244	104	0	26
*DL5NDX	10,028	113	0	23
DL6MHW	10,008	102	0	24
DJ6TB	9,792	105	0	24
*DO4DXA	9,352	86	0	28
DL1T	9,240	98	0	24
DL7YS	9,152	95	0	26
*DJ5CW	8,832	96	0	23
DL3BXX	8,220	73	0	30
DF3VM	8,140	101	0	22
*DF7CB	7,062	87	0	22
DL0ER	6,699	83	0	21
*DG4DX	6,348	66	0	23
DL8OBF	6,336	69	0	24
DF7A	5,490	85	0	18
*DJ8EW	5,214	63	0	22
DB7BN	4,826	67	0	19
DG2NMH	4,784	53	0	23
*DL3IAS	3,852	56	0	18
DG5E	3,780	45	0	20
*DM7HB	3,744	56	0	18
*DC2CB	3,315	51	0	17
*DF8XC	2,550	33	0	17
*DO9SR	1,248	25	0	12
DM3JAN	968	23	0	11
DL5ST	423	10	0	9
*DL5HAI	162	6	0	6

Finland

OH1Z	115,100	468	1	49
OG5O	15,270	101	0	30
*OH1XX	6,304	39	0	32
*OH7GGX	4,180	37	0	22

France

F5PYJ	37,160	174	8	32
*F5DRD	3,895	41	0	19
*F6IIT	950	19	0	10

Greece

SV2GJV	51,260	232	2	42
SV7QNV	24,780	147	0	35
*SV2AEL	8,234	75	0	23

Hungary				
HA8BT	41,496	214	2	37
HA8MV	35,853	195	0	37
HG8YKO	23,904	151	0	32
*HA6NL	16,874	133	1	25
HA3OU	11,472	97	0	24
*HA8EV	1,248	22	0	12
Italy				
IK0NMJ	115,620	371	15	45
IZ0CKJ	76,881	322	3	46
IK2CLB	19,573	105	0	37
IV3WMS	11,966	80	0	31
I2WIJ	6,785	62	0	23
IC8POF	1,352	22	0	13
*IW2FUT	1,020	20	0	12
*IZ5OQX	621	15	0	9
Kaliningrad				
*R2FC	9,048	76	0	24
Lithuania				
LY4A	329,825	782	12	67
*LY7K	52,640	266	1	39
LY7M	20,510	115	3	32
LY7T	11,313	86	0	27
*LY2BKT	8,832	81	0	23
*LY3AB	8,400	72	0	25
LY2CX	1,062	26	0	9
Luxembourg				
LX1ER	148,170	523	8	47
LX1LC	37,316	196	0	38
Netherlands				
PH0AS	51,086	249	3	38
*PA4EL	26,307	143	0	37
*PC4H	13,552	98	0	28
*PE1EWR	12,636	96	0	27
*PA3DTR	9,204	74	0	26
PC2K	2,032	26	0	16
Northern Ireland				
MI5K	61,740	290	3	39
Norway				
LC5K	71,852	310	1	45
LA5LJA	21,356	111	1	37
LA1B	13,253	91	0	29
*LA9TY	7,398	55	0	27
LB6VI	36	3	0	3
Poland				
SN7D	182,878	589	13	48
SP9N	178,814	621	6	52
SN9B	175,020	584	9	51
SP3GTS	103,740	409	5	47
SQ1OD	66,384	284	3	45
*SP/UR5AS	62,484	315	3	38
HF1K	60,632	285	3	41
*SO9P	28,832	181	2	32
*SP2R	28,595	171	0	35
SP4Z	26,418	147	2	35
*SQ8B	26,052	138	1	38
*SQ9PUW	23,310	141	0	35
*SP8FB	17,061	109	0	33
*SP5UFK	16,828	131	0	28
*SQ7OVT	10,176	92	0	24
SQ9IWT	8,208	71	0	24
*SP7JS	5,060	55	0	20
Portugal				
CT7AHV	9,450	61	5	22
Scotland				
MM9I	13,720	97	1	27
Sicily				
*IT9IVU	10,750	85	0	25
IT9IMJ	1,320	21	0	12
Slovak Republic				
OM3TWM	214,592	649	13	51
OM2VL	20,434	117	2	32
*OM6MW	16,716	120	0	28
*OM5UM	6,042	63	0	19
Slovenia				
*S54ZZ	85,376	376	1	45
S53F	36,252	203	0	36
S57W	32,844	197	0	34
*S55X	29,140	193	0	31
S54O	26,560	170	0	32
S53ZO	21,054	128	1	32
*S57KM	18,225	150	0	25
*S55KA	12,675	105	0	25
S51DX	10,780	100	0	22
Spain				
ED3C	71,472	298	4	44
EA2DR	60,348	243	13	34
EC1T	44,784	177	10	38
*EF1T	42,930	188	7	38
EC7WR	30,222	127	6	40
EA1BXJ	19,880	114	2	33
EA1HV	2,839	34	0	17
Sweden				
SK6EI	34,000	202	0	34
*SM6MVE	19,256	133	1	28
SM5EPO	11,154	89	0	26
*SM6IQD	8,650	71	0	25
SM2M	7,728	56	0	28
Switzerland				
HB9CXZ	194,481	599	14	49
*HB9IIH	110	5	0	5
Ukraine				
UT6UD	129,696	450	8	48
UT5ECZ	14,322	90	0	31
*US6IKF	5,796	48	1	22

OCEANIA

Indonesia				
YB1JYL	164	37	0	2
*YC3TEN	164	37	0	2
*YB1LZ	148	33	0	2
*YC1CKK	144	32	0	2
*YB1DIU	84	42	0	1
YB1BA	76	38	0	1
YB0SAS	72	14	0	2
*YB2TDP	64	32	0	1
*YB2NDX	16	8	0	1
YC3PW	12	6	0	1
*YB9BCS	6	3	0	1
New Zealand				
ZL3IO	225	5	4	1

SOUTH AMERICA

Brazil				
PP5JR	264	21	0	4
PY5XH	141	18	1	2
PY2GTA	14	7	0	1
PY5AMF	12	6	0	1
*PY2NA	10	5	0	1

MULTI OP

NORTH AMERICA

UNITED STATES

CONNECTICUT				
KE1LI	18,054	246	34	0
MASSACHUSETTS				
N1RR	54,400	229	41	23
N1SOH	3,675	63	24	1
NEW YORK				
NJ1F	3,696	57	27	1
MARYLAND				
WA3EKL	57,780	411	45	15
PENNSYLVANIA				
NE3F	77,490	520	45	18
ALABAMA				
K4GIG	4,408	70	28	1
FLORIDA				
N2CEI	195,976	848	53	35
GEORGIA				
AD4XT	32,985	339	39	6
KENTUCKY				
K4TG	50,050	448	43	7
VIRGINIA				
N4RV	167,440	797	51	29
W4RN	37,741	350	39	8
MISSISSIPPI				
W5SGL	28,152	281	39	7
CALIFORNIA				
K6YA	1,170	27	17	1
OHIO				
W8UCO	22,596	244	40	2

CANADA

NORTH AMERICA

Belize				
V31MA	20,680	101	35	5
Costa Rica				
TI1T	5,184	37	19	8
Puerto Rico				
KP4AA	33,216	132	34	14

ASIA

China				
BD1KV	20	2	0	2

EUROPE

Bosnia-Herzegovina				
E7CW	129,546	469	8	46
Bulgaria				
LZ5R	256,880	628	19	57
Croatia				
9A2W	101,871	412	2	47
Czech Republic				
OL1R	189,222	555	13	53
OK2KEA	23,727	153	0	33
England				
M0HFC	45,903	246	1	38
European Russia				
RK5K	45,270	203	1	44
RD3DS	9,018	71	0	27
Fed. Rep. of Germany				
DR5Z	150,960	606	9	51
DP6A	145,851	581	11	50
DM7C	141,187	590	8	51
DL7A	124,018	519	11	48
DR4W	114,228	489	8	49
DA2X	94,350	460	6	45
DP5L	76,752	392	3	45
DA0BCC	59,502	322	5	42
DK0TP	42,914	237	3	40
DR2T	37,962	267	0	37
Greece				
SX2I	93,389	405	0	47
Hungary				
HG8DX	336,461	786	23	56
HA3DX	191,704	598	11	51
Italy				
IQ5PJ	96,576	419	3	45
IQ5PO	29,716	162	0	38
Lithuania				
LY2ZO	87,849	410	0	43
LY2K	68,376	323	1	41
Norway				
LA100K	45	3	0	3
Poland				
SP8R	235,960	680	14	54
SP1KZE	23,004	133	0	36
HF550MK	13,216	100	0	28
SP6ZHP	4,374	54	0	18
Republic of Kosovo				
Z66BCC	105,800	453	0	46
Serbia				
YU7ADY	75,852	350	1	42
Slovak Republic				
OM5M	32,305	185	0	35
Slovenia				
S59A	344,080	812	22	58
Spain				
EA1RKF	32,088	145	9	33
Sweden				
SE0X	135,800	540	1	49
Switzerland				
HB9NFB	113,652	521	1	43

OCEANIA

Hawaii				
KH6AQ	106,808	207	45	7
Indonesia				
7C1B	178	43	0	2
7A0D	172	39	0	2
7A3A	172	39	0	2
7E3E	172	39	0	2
7E1A	156	35	0	2
7C1A	92	46	0	1
Philippines				
DV3A	5	1	0	1

SOUTHAMERICA

Bonaire				
PJ4G	136,644	235	41	18

CHECK LOGS

DF9HI DL1ONI DL6MRM DL7VEE EF6T IU1IPB LY2SA OM2XW PR2R R3AT RA1QD RA5G RT8U S52WW S53DIJ S53V S59EIJ S59T SN550R SN8K SQ9KDT Guest Ops 7A0D (YC0LOU YB0BAC YD0ASO YD0BIP YC0SJA YD0NVU YD0PTL YD0CVD YD0RWY YC0RFS) 7A3A (YB3BIY YB3KM YB3RVA YB3TAA YB3LOJ YC3CTE YF3ALI YF3FXC) 7C1A (YB1GAL YC1FNY YC1NET) 7C1B (YB1BIQ YB1CYG YC1CT) 7E1A (YC1BWU YD1LNS YD1IIV YD1EEO) 7E3E (YF3CYT YF3EQM YF3FZR YC3GFN YG3AQV) 9A/IZ3NVR (IZ3NVR) 9A/W3WM (F5SNJ) 9A2W (9A5TW, 9A9K) 9A3B (9A2VR) AD4XT (AD4XT, KM4SLW) AE0TG (AE0TG @AE0TG) BD1KV (BD1KV BH1LHS) BI1JY (BH1RQN) DA0BCC (DK4WW DM6DX) DA0RR (DF6QV) DA0T (DL8UD) DA2R (DO1RDH) DA2X (DM7XX, DL5JJ, DL3DXX, DO1ISE) DF7A (DL1WA) DF8V (DF8VO) DG5E (DK2CX) DG7JH (Jochen) DK0BM (DK7CH) DK0TP (DL5VZ DC1SRW DB2TU DG1GHY DH1RZ) DL0AZ (DL5SFC) DL0ER (DK5KK) DL0NG (DK8NC) DL0TY (DJ6DP) DL1T (DK5KK) DL2OO (LOTHAR_GRINGEL) DL50DAH (DK1KC) DL7A (DB7HI DB8XG DD9HK DF4XG DH2IF DK9HN DL7TJ DO5NU) DM3Y (DL7UGN) DM7C (DH5CM DL7CX DL8CX) DP3P (DL9OBD) DP5L (DH1TST) DP6A (DL5KUT DL6DH DL8OH) DP7R (DL1GWS) DR1E (DB1WA) DR2T (DL3EBB DL6OS) DR4W (DL4NAC DK2ZO DL6KAC DL4LAM DK7AM) DR5Z (DM1CG DF2NU UT1AN DJ1AN) DV3A (DU3TW DU3LA DU3JH) E7CW (E77FA E74AL) EA1RKF (EA1FBR, EA1HUD, EA1IOF, EA1IUO, EA1JAV, EA1WZ) ED3C (EA3IBV) ED8W (EA8DO) EE4Y (EA4GOY) EF1T (EA1FCH) ES3V (ES3TI) F5PYJ (CLAUDE) G5K (G0BNR) GW4W (GW4EVX) HA1BC (DL1MAJ) HA3DX (HA4FB HA4XH) HB9NFB (HB9ATX HB9SNC HB9CQL HB9FWW HB9FWC HB9GFN HB9EWL HB9EBC HB9FEH) HF1K (SP1MGM) HF550MK (SP9RQH SP9IVD SQ9MCI) HF9E (SP9GOJ) HF9F (SQ9LPO) HG8DX (HA8DJ HA8DZ HA8DU HA8FM HA8KW) IK2AQZ (ik2aqz) IK7YTT (ik7ytt) IQ5PJ (IZ5PXX IK5FKE IV3DLW IZ5WTV IU5FFM IU5JHK) IQ5PO (IU5CTX, IU5CZU, IU5MPN, IU5PCC, I5NSR, I5NXH, I5OYY) K1LZ (LU9ESD) K4GIG (KI4KWR, AB4BT, AG4OS, KJ4DWX) K4TG (K4TG KA8D) K5TR (AI5A) K6YA (KA6MZE AA6XV W4NJK KN6QI) K7AEZ (K7AEZ @K7AEZ) K7HKR (K7HKR @K7HKR) KA6RWL (KA6RWL @KA6RWL) KB0ARZ (RICH) KE1LI (KE1LI, NI1A, KB1TIM) KH6AQ (KH6AQ NH6V) KP4AA (KP4AA K3MM) KS3D (KJ3N) KW4SW (KW4SW @KW4SW) LA100K (LB5PI LB8LI) LA1B (LA4XLA) LC5K (LA5YJ) LC9X (LA9XGA) LY2K (LY2K, LYR346) LY2ZO (ROLANDAS LY4R LAIMONAS KASPARAS EDVINAS) LZ4A (LZ1YQ) LZ5R (k1lz lz3nd) M0HFC (M0HFC 2E1TAP M0ORH) M0PLX/M (M0PLX) MI5K (MI0SLE) MM1E (MM0GOR) MM9I (GM0OPS) N1RR (N1RR DXSP0T) N1SOH (N1SOH W1FM) N2CEI (K4SME K0DI N2CEI) N3IQ (ND3F) N4RV (N4RV NN3W) N4SS (W5MX) N4SV (WBS) N6TQ (N6TQ @N6TQ) N7AT (K8IA) N7RK (N7RK @N7RK) NA5NN (K2FF) NE3F (NE3F W3RE KS3F) NJ1F (NJ1F K1RQ) NP2X (K9VV) OG2T (OH5LLR) OG5O (OG55W) OH1Z (OH1LEG) OK1K (OK1XOE) OK2KEA (OK2VV OK2MRJ) OK4U (OK1TP) OK6Y (OK2PTZ) OL1R (OK1NI OK1FJX OK1HGM OK2MTW OK1NY) OM5M (OM5M, OM1AWG, OM1APT, OM1JTA, OM4DW) OM7K (OM7RU) P35A (5B4AQN) PJ4G (K2NG, NE9U, PJ4NX) PP5JR (pp5jr) PR2R (PY2ZEA) RA5G (RJ3FF R3GG) RD3DS (RD3DS, RZ3DJI) RK5K (RW3O UA3OO RN3OG) S59A (S51V S56DX S57DX S57UN S59A) SE0X (SM0MDG DD1MAT) SK6EI (SA6FAX) SM2M (SM2LIY) SN550K (SQ5CZN) SN550R (SP4JCP) SN7D (SQ7D) SN8K (SQ8ERS) SN9B (SQ9OB) SP/UR5AS (UR5AS) SP1KZE (SQ1NXW, SQ1BHH, SP1KML, SP1TMB, SP1MWN) SP6ZHP (UT8IA MYKHAILO_ANUFRIYEV OLHA_ANUFRIYEVA) SP8R (SP8BRT SP7VC SQ8JLA) SX2I (SV2BFN SV2BXZ SV2JAO SV2OIX) TI1T (TI2CC / TI2MOT) V31MA (V31MA V31PS) V31PS (DK6SP) VA6RCN (VE3RCN) VE3MM (VE3MM @VE3MM) VE6AO (VE6CCL) W2TR (N4FMO) W3QD (W3QD @W3QD) W4RN (W4RN WYATT) W5SGL (MCARA CLUB MEMBERS) W8UCO (W8UCO, KE8ANU, KD8ZWI, NX8Y, N8IG, W8RNO, WA8OMQ, K8JWL) WA2CP (KC2GOW) WA3EKL (WA3EKL K6ZO KB3VQC K3MTR W1TRT N3DPB) WB8WUA (WB8WUA @WB8WUA) WN8HCV (W8GP) YC3TEN (YC3PW) YO8COK (yo8cok) YR8D (YO8SSB) YU1P (Pedo) YU7ADY (YU7ZZ, YT7E, YT5FM, YU7CM, YT7PA) Z66BCC (DL2JRM DL7AT)

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- My $20 Transmitter
- A Transceiver-to-Computer Interface Box

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HAWAII DX VACATION: SteppIR antennas, amplifiers, private. KH6RC, <www.leilanibedandbreakfast.com>.

HAM TRAVELERS Discount travel, tours, cruises, more. www.GreatExpectationTravel.com

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NEAT STUFF! DWM Communications: <http://qth.com/dwm>

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HAM RADIO GIFTS: <www.mainestore.com>

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TELEGRAPH KEY INFORMATION AND HISTORY MUSEUM: <http://w1tp.com>

FT243 AND HC6U CRYSTALS: www.af4k.com

OLD QSLs Available. 50's and 60's, DX and USA. Specify call, send SASE. W5SQA@arrl.net

QRP KITS: <www.breadboardradio.com>

RFI Filters <www.RFchoke.com>

FMTV ARTICLES: Comprehensive transmitter and receiver deviation calibration, standards, intermodulation, power amplifier calculations. WB9OQM, http://mathison.freeshell.org

www.SecondHandRadio.com

HF Mobile or Fixed Virtual X Antenna Patent: For Sale or License. Request Free Power Point Presentation file. Shows design details, pictures, prototype tests. Design applies to a broad frequency range for mant antenna arrays/beams/verticals. <lgslay@sbcglobal.net>. Larry Slay, K5WUL

FOR SALE: Samlex Power Supply Model SEC 1223, 13.8V @ 25 amps. Not working. Includes operating manual and schematic. Price $50 or best offer. Contact Harry, W9HRQ, at <harrygraziano@gmail.com> or phone 1-773-334-4492.

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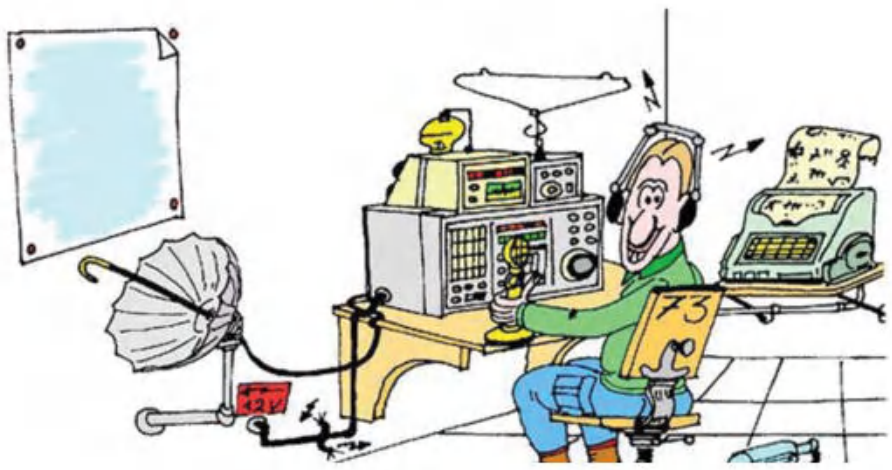

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