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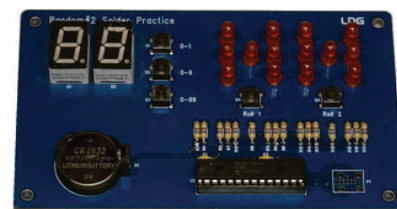
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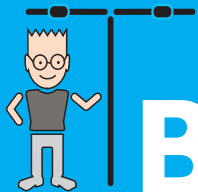


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Write for QST

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Our Cover

The Youth on the Air (YOTA) organization offers opportunities for young hams in the Americas to help build skills and camaraderie in the next generation of amateur radio operators. One of the most well-known YOTA activities is its summer camp, which is held in various locations in the Americas and gives young hams experience on the air, as well as fun downtime with peers. Read all about the 2023 camp, held in Ottawa, Canada, in "YOTA Camp: More than Just Ham Radio," by Abby Kimi Matsuyoshi, KK7CFJ, and Jack Roberts, W9RFT.



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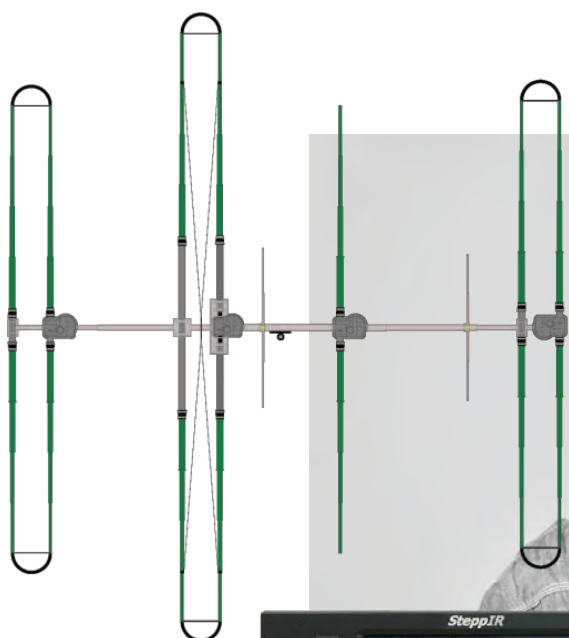
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X50A (1 Section)	2m/70cm	5.6	200	UHF or N
X30A (1 Section)	2m/70cm	4.5	150	UHF
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F22A (2 Section)	2m	10.5	200	UHF
CP22E (Aluminum)	2m	8.9	200	UHF
F718A (Coax Element)	70cm	15	250	N
Dualband Mobile Antennas				
SG7900A	2m/70cm	62.2 in.	150	UHF or NMO
SG7500A	2m/70cm	40.6 in.	150	UHF or NMO
NR770H Series	2m/70cm	38.2 in.	200	UHF or NMO
MR77 Series	2m/70cm	20 in.	70	Mag Combo
AZ504FXH	2m/70cm	15.5 in.	50	UHF
AZ504SP	2m/70cm	15.5 in.	50	UHF
NR7900A	2m/70cm	57 in.	300/250	UHF
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Second Century

Building a Future for Amateur Radio

The future lies in engaging younger people with radio communications and amateur radio, and ultimately leading them to become active hams and ARRL members. Significant things have been happening to advance the future of ARRL and amateur radio more broadly. I know these things would have escaped my purview during the decades that I was “just a member,” so let’s put the pieces together.

We started to see movement in this area from the ARRL Board voting in 2021 to create the Youth Licensing Grant Program, which assists young people under the age of 18 by reimbursing their one-time \$35 FCC application fee for new license candidates, and reducing the cost of an ARRL VEC exam session to \$5. Southeastern Division Director Mickey Baker, N4MB, championed this motion in the hope that large groups, like Scouts, will have an easier entry into the world of amateur radio.

Next, in 2024 the ARRL Board created a free associate membership for students aged 21 and younger. The success of our Collegiate Amateur Radio Program (CARP) has shown that students have tremendous enthusiasm for amateur radio. Providing free access to ARRL resources, like *QST* and all our magazines and archives, can encourage them to go further with their ham careers.

Another initiative launching this year is a coding competition for young people to apply their programming skills to a challenge that will inspire creativity and a deeper understanding of amateur radio. First Vice President Kristen McIntyre, K6WX, is leading a team to launch this program for the 2024-25 school year. The competition provides up to \$25,000 in awards that students can use for college.

On NBC’s *Today* show earlier this year, you might have seen students from Harbor Creek High School in Pennsylvania making a live contact with the International Space Station as part of the ARISS program. The students, through generous donations of money and supplies from ARDC and Tim Duffy, K3LR, of DX Engineering, constructed their own satellite station. The event was made possible by the students’ Assistant Principal Drew Mortensen, AC3DS, a graduate of the ARRL Teachers Institute on Wireless Technology. ARRL Education and Learning Manager Steve Goodgame, K5ATA, was on hand to cheer on the students and had advice on next steps for the school to pursue EME contacts.

Steve isn’t stopping there. Last December he worked with Mike Dahlhofer, K8MRD, who runs the popular YouTube channel Ham Radio Tube, to create a multi-hour telethon that raised more than \$20,000 toward an additional Teachers Institute session. We have limited means to conduct these game-changing sessions, which are mostly funded by donations, so Steve has taken to fundraising to bring more teachers, and many more students, into amateur radio. Look for Steve this December with another telethon, this time hosted by Josh Nass, K16NAZ, on his YouTube channel Ham Radio Crash Course.

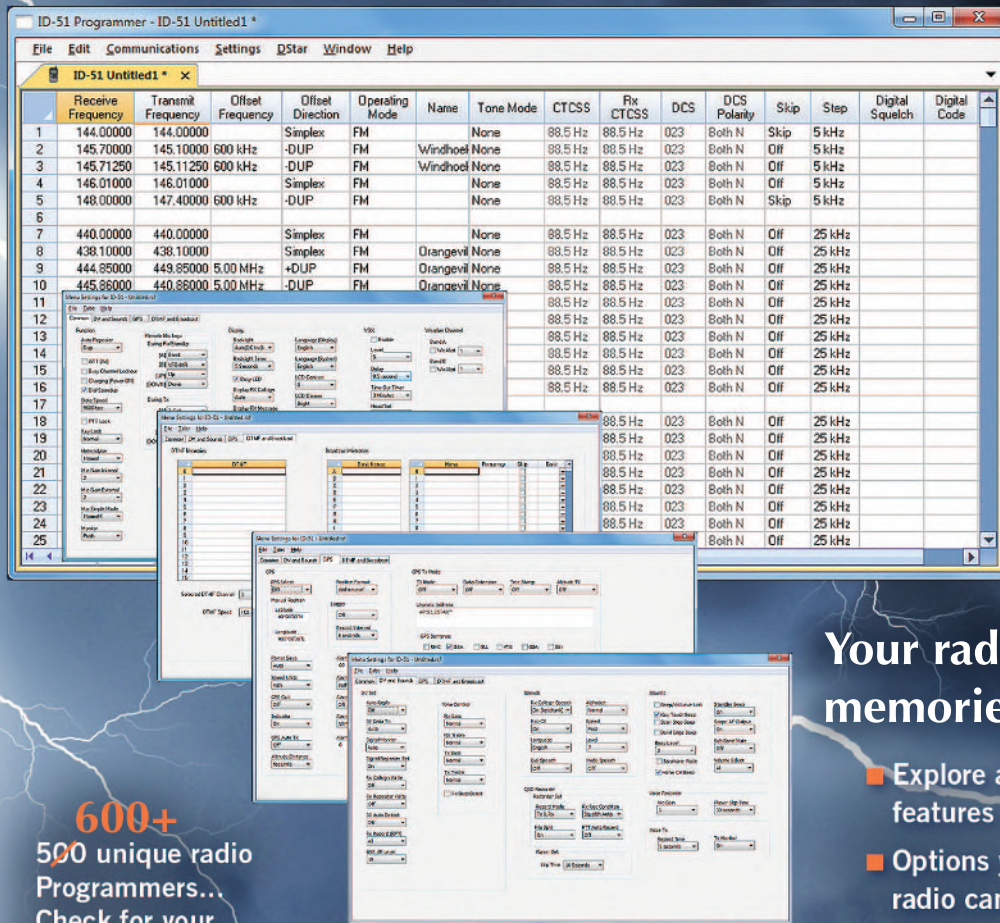
The ARRL Board is going through its own renaissance. There has been an influx of people in their 30s and 40s taking on Director and Vice Director seats. Andy Milluzzi, KK4LWR, is the youngest member, hailing from the Southeastern Division and a product of our collegiate program where he is co-advisor with his brother Tony, KD8RTT. The Central Division now boasts two younger members — Brent Walls, N9BA, and Josh Long, W9HT, who is a graduate of the ARRL Teachers Institute. You, as a member, can encourage younger ARRL members to run for office, and make sure you vote in each election!

Of course there is more, from the more than 100 scholarships we award each year through the ARRL Foundation, to our new corporate strategy where inspiring and educating youth has become our third advocacy, alongside our ongoing work to promote and protect amateur radio. There will be more to follow! So please, be radio active. Work with younger hams in your club to get them active. Be a connector. Perhaps you know someone who might volunteer for ARRL in these pursuits. And keep Steve Goodgame’s December telethon on your radar!

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

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See review in October 2024 QST page 43

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Member Spotlight

Jan Heise, K4QD

Jan was born in November 1941 (a month before the attack on Pearl Harbor), and he grew up on a farm in northwest Ohio. During World War II, his father was a paratrooper in the 82nd Airborne Division, and five of his uncles served in the Navy, Marines, and Army Air Corps. This family background helped inspire Jan to join the US Air Force immediately after high school. He was fortunate to get his first choice in careers as a communications-electronics technician.

"I spent 4 years in France and Germany supporting microwave systems," Jan said. "After returning to the States, I was introduced to amateur radio in 1964 by a coworker while assigned to a tactical control detachment at Fort Bragg, North Carolina. I was initially licensed as WN4VQD. A few months later, I upgraded to WA4VQD."

Jan's military career took him around the world, and amateur radio came along with him. "I had a 3-year tour at the Pentagon assigned to the Defense Communications Agency. While stationed there, I had the privilege of upgrading to Advanced class at the Federal Communications Commission office in Washington."

His next assignment brought him to Wright-Patterson Air Force Base in Dayton, Ohio. While there, he was an active member of the Dayton Amateur Radio Association and closely involved with Dayton Hamvention®.

After Dayton, Jan was sent to Montgomery, Alabama, and he joined a group of military hams there. They sponsored classes and recruited a number of new amateurs. His wife Joyce attended the classes and was eventually licensed as WA4OMS.

Retirement from the Air Force didn't mean retirement from work. In fact, Jan started a second career in information technology at Harris Corporation in Melbourne, Florida, where he remained

for 20 years. During this time, Jan also became active in Scouting, spending 10 years as a Scout Leader while his son was in the program. He is proud to note that his son and two grandsons are all Eagle Scouts.

DXing and Contesting

Jan's amateur radio interests have varied over the years. Before retiring from the military, he upgraded to Amateur Extra and was intensely involved in the Military Auxiliary Radio System.

Contesting would soon become his passion, along with chasing DX. Jan finally earned a place in the ARRL DX Century Club Honor Roll, and today he is just three entities short of working them all.

In 1995, Jan had the good fortune to help his friend and Harris Corporation coworker Al Hernandez, K3VN, plan and participate in the VP8SGP DXpedition to South Georgia Island. Jan said that trip was one of the most memorable experiences of his life.

Later, Jan and Billy Gallier, W4WX, made several contest and DXpedition trips to Guantanamo Bay, Ascension Island, and others. He befriended Bob Valler, VP8BFH, in the Falkland Islands during his South Georgia Island trip, and in 1998, Jan visited Bob and spent 3 weeks operating from Port Stanley.

Amateur Radio and the Outdoors

Jan was quick to discover that camping and amateur radio were a perfect combination. In 2016 he participated in ARRL's National Parks on the Air program when he and his wife took a recreational vehicle tour of the western states.

In 2021, Jan was introduced to the Parks on the Air (POTA) program. He later became involved in World Wide Flora and Fauna (WWFF), an older program from which POTA evolved. Most of his



current POTA and WWFF activations are on CW, but he also makes an effort to operate SSB, FT8, and FT4.

Healthy Clubs Ensure a Vibrant Future

Jan has a positive outlook for amateur radio. He feels that clubs have key roles to play in ensuring that the hobby will be around for decades to come. "I believe my local Platinum Coast Amateur Radio Society (www.pcars.org) in Melbourne, Florida, is a good model for a successful club," Jan said. "Over the years I have served three terms as president, 2 years as hamfest chairman, 3 years as equipment custodian, and 3 more years on the Board of Directors."

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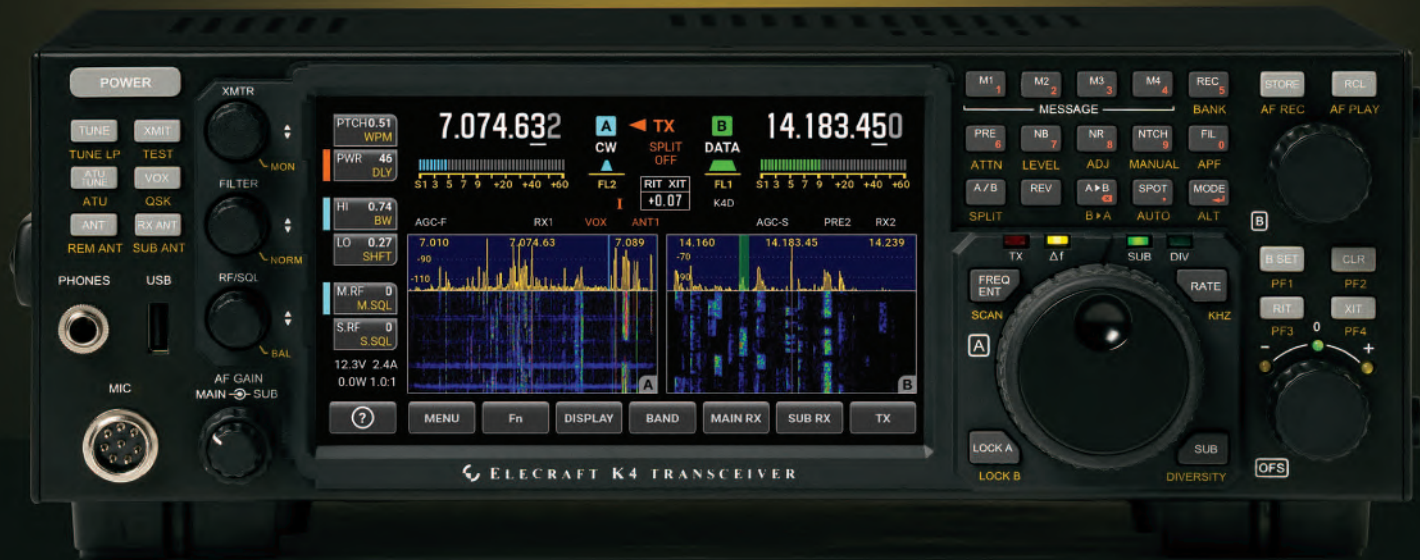


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Up Front

Victory Nickel Code Message

An interesting photo was received from Robert Schlegel, N7BH. The Canadian Victory Nickel was created to help promote the war effort, rally spirits, and offer hope. It was struck between 1943 and 1945, and was made of tombac, a brass alloy, as nickel was needed for the war effort. The design was inspired by Winston Churchill's famous "V for Victory" sign. This was the first coin designed, engraved, and struck entirely in Canada. The designer, Thomas Shingles, hand-cut the master matrix. If you look closely at the photo, you will see a Morse code message just inside the rim of the coin — "we win when we work willingly." The message begins just below the first leg of the "N" in "CENTS," and proceeds clockwise around the edge of the coin. The use of code in the design is not surprising given Morse code's importance in World War II.



1943 Canadian Victory Nickel.
[Robert Schlegel, N7BH, photo]

Special Pizza

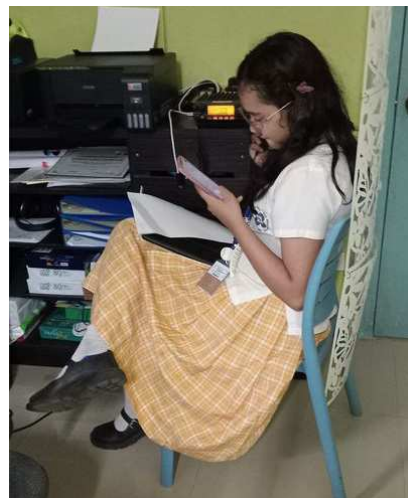
Tom Kravcar, WB9FUB, sent in this photo of a pizza box that identifies whether you are a CB'er or a ham.



[Tom Kravcar, WB9FUB, photo]

Mentoring Future Scientists

The Agham Radio Club, part of the Philippine Science High School, Bicol Region Campus, fosters fellowship, advancement, and service to the community. Mark Anthony M. Del Rosario, DV4MDR, a teacher and club founder, shares that club members participate in hands-on activities such as basic antenna construction, practice modulation, use of slow-scan television in emergency communications, and foxhunting. Agham Radio Club also offers activities in line with the licensing requirements of the Philippines' National Telecommunications Commission (NTC).



A member of the Agham Radio Club on the air.



Members of the Agham Radio Club learn about various aspects of amateur radio, including slow-scan television.



Members of the Agham Radio Club working on a project.
[Mark Anthony M. Del Rosario, DV4MDR, photos]

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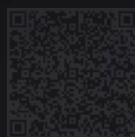
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Correspondence

Letters from Our Members

Thoughts About a Valued Amateur's Retirement

• I was saddened to see MFJ ended its Starkville, Mississippi, operations in May with Founder Martin Jue's retirement. I taught civil engineering at Mississippi State University (MSU) in Starkville from 1975 until 2010. I met Martin when I first arrived in Starkville, and he has been my friend ever since.

Martin is a brilliant engineer, an inventor, and an astute businessman. He helped many MSU students by hiring them for part-time work. Martin has always been dedicated to amateur radio. I vividly remember visiting him at his office/workshop when he was developing his first antenna analyzer.

Martin is generous, caring, and humble. I wish him a well-deserved rest and a joyful time with his family in retirement.

Harry Cole, K4VBY

Bulverde, Texas

• After 52 years, I think retirement is well earned for Mr. Jue, and perhaps it's a good thing. It might force amateur radio operators to think about making their own equipment again. Sure, it's easy to buy pre-built radios, antenna tuners, and all the other wonderful pre-made equipment we are used to, and yes, you will still be able to do that.

Think about making your own SWR meters, antenna tuners, or antennas from scratch again by ordering the parts from other companies. Think about really understanding the equipment you are using because you made it yourself.

Perhaps Mr. Jue's retirement is a hidden treasure in that amateurs can once again discover the fun of making their own equipment. The resources are out there; you just have to search for them. I know I will give it a try.

Stephen Bartels, KK6ZJC

Fairfield, California

VE Team Feedback

I just wanted to take a moment to thank all the Volunteer Examiners (VEs) from the Manatee Amateur Radio Club (Bradenton, Florida) for your incredible work in coordinating, preparing, and administering the amateur radio license exam. Organizing such an important event takes a lot of effort, and I'm truly grateful for everything you do.

I recently took the Technician, General, and Extra exams, which was a challenge, but I managed to pass. The whole experience was smooth and well-organized, and I know this wouldn't have been possible without the dedication of the VEs.

I also want to acknowledge that you all do this on a volunteer basis, and it's clear that your passion for the amateur radio community drives your commitment. Your personal contribution is a testament to your dedication, and I can't thank you enough for making it all possible.

Sheila Hascall, KA4S

Palmetto, Florida

Article Considerations

• The article "Creating Off-the-Grid Power for Emergency Use" in the July 2024 issue of *QST* covered the basic equipment needed to use solar panels to charge a battery and run a radio station. However, it did not address why the parts were chosen and how to determine what is best for the individual operator.

The questions I get the most from amateurs are "What size battery do I need?" and "How many solar panels should I buy?" The answer depends on the rig's RX and TX current draw, the accessories in use, and the operator's duty cycle. Using these to calculate the current draw per hour can easily reveal how quickly your battery will drain. Buy a battery that allows you to operate 50% longer than you plan to. In

addition, given the wattage of the solar panels, it is relatively easy to calculate how long it will take to fully charge a battery. Buy enough solar panels to charge your battery in a reasonable amount of time.

It is all simple math, but most amateurs do not understand how to determine the right solar gear to buy for their activation. Currently, the charge and drain times are found through trial and error, and money is wasted on wrongly sized equipment. I believe most amateurs are aware of the parts necessary to operate using solar power, and you will see more operators using solar power once they are armed with the proper knowledge.

Jim Giercyk, N2SUB

Greenville, South Carolina

• "Power Tool Batteries for Portable or Emergency Operation" by Gordon S. Novak, Jr., AF5KA, in the July 2024 issue of *QST*, is a very interesting, useful, and well-written article. I never thought of using my power tool batteries for ham radio, but it makes a lot of sense.

It seems to me that a lot of people — not just hams — would be interested in the idea of a supply of 12 V dc at a meaningful current level during a power outage, for whatever use.

Denis Battrum, N5KX

Liberty, Missouri

Life Member

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PreciseRF HG3 QRO-B Stepper Magnetic Loop Antenna – reviewed in May 2024 QST



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Our Washington, D.C. regulatory affairs team filed a technical report against an effort from stock traders that would obliterate our HF bands. The fight to safeguard our spectrum requires ARRL's 24/7 vigilance.



To keep 60-meters usable for radio amateurs, ARRL is working with the FCC to keep the 100 W power limit and the existing five channel allocation. ARRL is protecting the rights of all Amateur Radio Operators and the advancement of American expertise in wireless technology.



A delegation from ARRL and the International Amateur Radio Union represented our interests at the ITU World Radio-communication Conference 2023 (WRC-23) in Dubai, United Arab Emirates, in November and December. This huge effort at a significance expense needs your support.

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W1AW Schedule

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

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

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

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

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

Code bulletins are sent at 18 WPM.

For more information, visit us at

www.arrl.org/w1aw

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

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

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

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

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

♦ Notes: On Fridays, UTC, a DX bulletin replaces the regular bulletins. W1AW is open to visitors 10 AM to 3:45 PM Monday through Friday. FCC-licensed amateurs may operate the station during that time. Be sure to bring a reference copy of your current FCC amateur license. In a communication emergency, monitor W1AW for special bulletins as follows: voice on the hour, teleprinter at 15 minutes past the hour, and CW on the half hour.

W1AW code practice and CW/digital/phone bulletin transmission audio is also available real-time via the *EchoLink Conference Server* W1AWBDCT. The conference server runs concurrently with the regularly scheduled station transmissions. The W1AW Qualifying Run texts can also be copied via the EchoLink Conference Server.

During 2024, Headquarters and W1AW are closed on New Year's Day (January 1), Presidents Day (February 19), Memorial Day (May 27), Independence Day (July 4), Labor Day (September 2), Veterans Day (November 11), Thanksgiving and the following day (November 28 and 29), and Christmas Day (December 25).



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Digital Test Equipment

The ins, the outs, and the architecture of digital test equipment.

Paul Danzer, N1II

All test equipment is going digital. However, before we look at equipment, let's talk about digital technology and digital computers. There are two inventions that make today's digital equipment so widespread. The first is not the transistor, which most people would assume; it is a loom. In 1801, French weaver and merchant Joseph Marie Jacquard demonstrated a loom controlled by a set of cards punched with holes. When the loom was active, the cards designated the fabric cords that would be raised for every shuttle pass. In other words, this was a programmable machine with a stored program. If a different pattern was needed, the new program was run with a new set of cards. The second invention uses the same memory to hold both program and data. This is part of what is called von Neumann architecture. Before, early computers like the Electronic Numerical Integrator and Computer, which was operational in the 1940s, used a combination of fixed wiring and plugboards to set the program. This approach made it very slow to reprogram these machines for different tasks, just like the looms. Figure 1 illustrates the basic von Neumann architecture, whereby the same memory holds both program and data. John von Neumann, a mathematician and computer scientist, wrote a paper in 1945 outlining this type of computer architecture. This even-

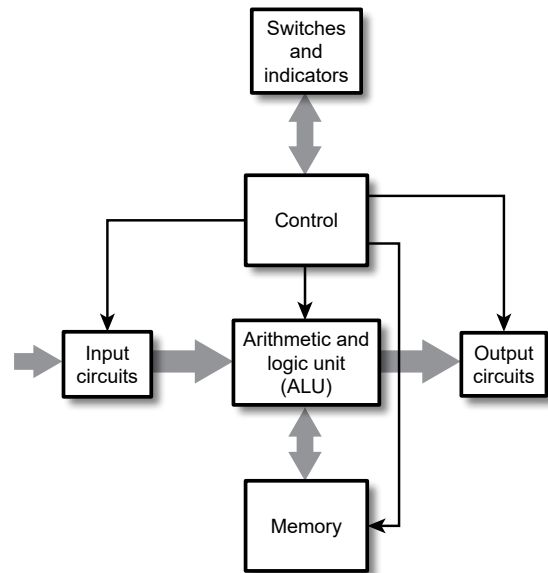


Figure 1 — A basic computer block diagram.

ually became the basic design for small computers, including home and personal computers.

Figure 2 shows the building blocks of Figure 1 and how they talk to each other to form digitally based test equipment, as well as small computers. Each element or section has an address, which is a digital number

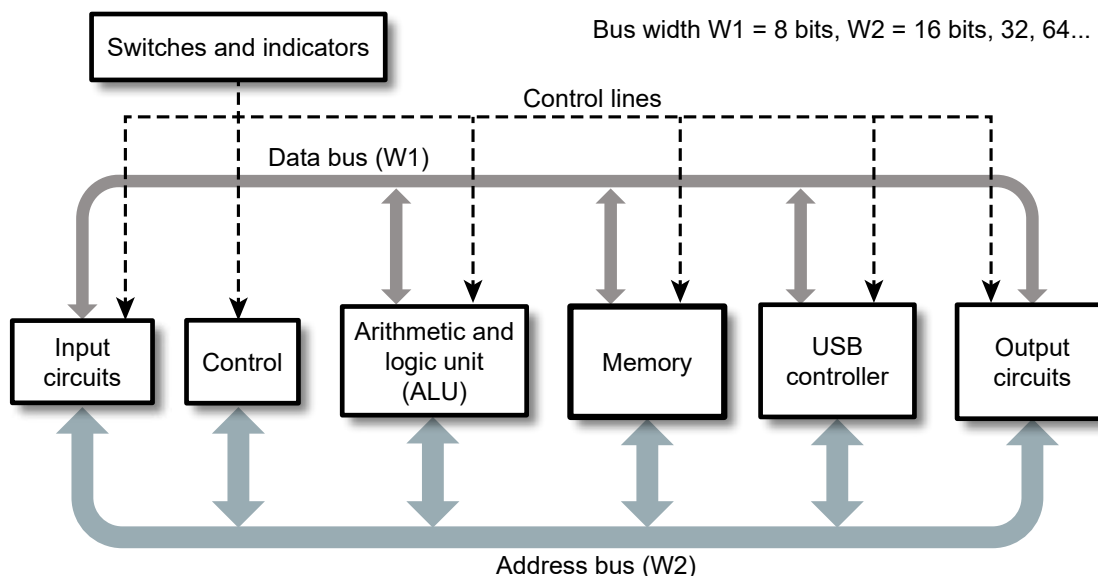


Figure 2 — The signal path in a bus system.



Figure 3 — A digital meter front panel. You can see the LCD panel (left), the soft switches (middle), and the mechanical switches (right).

that identifies it. For example, if the arithmetic and logic unit (ALU) wants to send information to an output circuit, it places the selected output circuit address on the address bus: a set of 8, 16, 32, 64, or more wires.

The data it wishes to send goes to the data bus. Finally, the command to either send or receive data goes through the control lines; this set of wires is usually unique to the particular system design.

Most current digital computer-based instruments include a USB connection to provide input, output, and occasional power supply connections. In the following

sections, typical instrument block diagrams are shown. However, every manufacturer optimizes their hardware to meet the requirements of their various customers.

A Digitally Based Multimeter

The front panel of a representative unit (the Owon XDM1241) is pictured in Figure 3. Three input jacks plus a ground jack are on the lower right, similar in function to older non-digital units. From here, things get much different. “Hard” switches on the right-hand side can have either single or multiple functions. The LCD has a set of “soft” switches whose functions depend

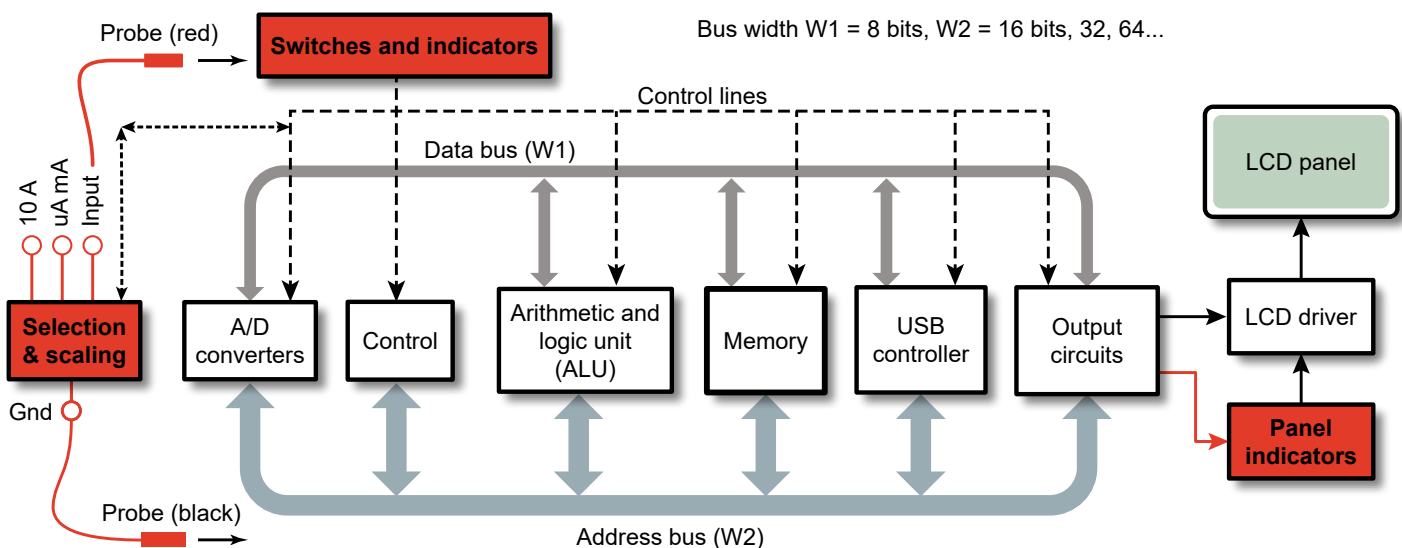


Figure 4 — Signal flow in the digital multimeter. The items in red are those added to the computer hardware to turn it into a multimeter.

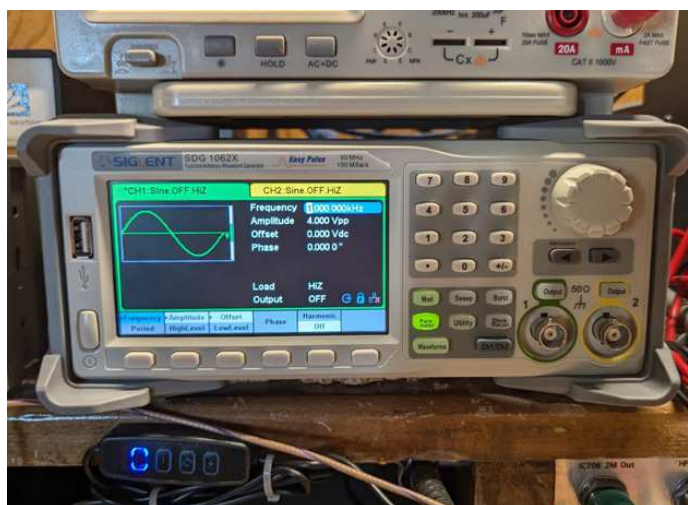


Figure 5 — Compare this signal generator panel to the digital multimeter panel.

on the selected hard switch. The switch selections and settings are typically displayed in text on the LCD. Some manufacturers elect to have this information sent directly from the control block, while others send it by way of the data bus.

The similarity between the general-purpose computer of Figure 2 and the digital multimeter of Figure 4 explains why these multimeters can store a sequence of values and perform arithmetic operations on them. The combination of an analog front end with a follow-on digital processor also allows features such as autoranging and automatic calibration. Some displays also include a bar graph so that peaking or nulling voltages is easily accomplished.



Figure 7 — The Siglent Technologies SDS1104X-E. The LAN and USB connectors on the lower left are used to input programs, control the unit, update the firmware, and save screen data.

Waveform Generation

The capabilities of today's digital signal generators are much greater than older analog generators, which could offer only a limited variety of waveforms. As an example, the Siglent Technologies SDG1062X (see Figure 5) can supply two simultaneous waveforms at a maximum frequency of 60 MHz.

The signal generator block diagram in Figure 6 is slightly different than previous figures due to the way waveforms are generated. Any particular waveform is generated by an equation stored in memory. Here, the use of memory can offer several hundreds of waveforms because they are stored not in memory-occupying sequences, but in software form commands.

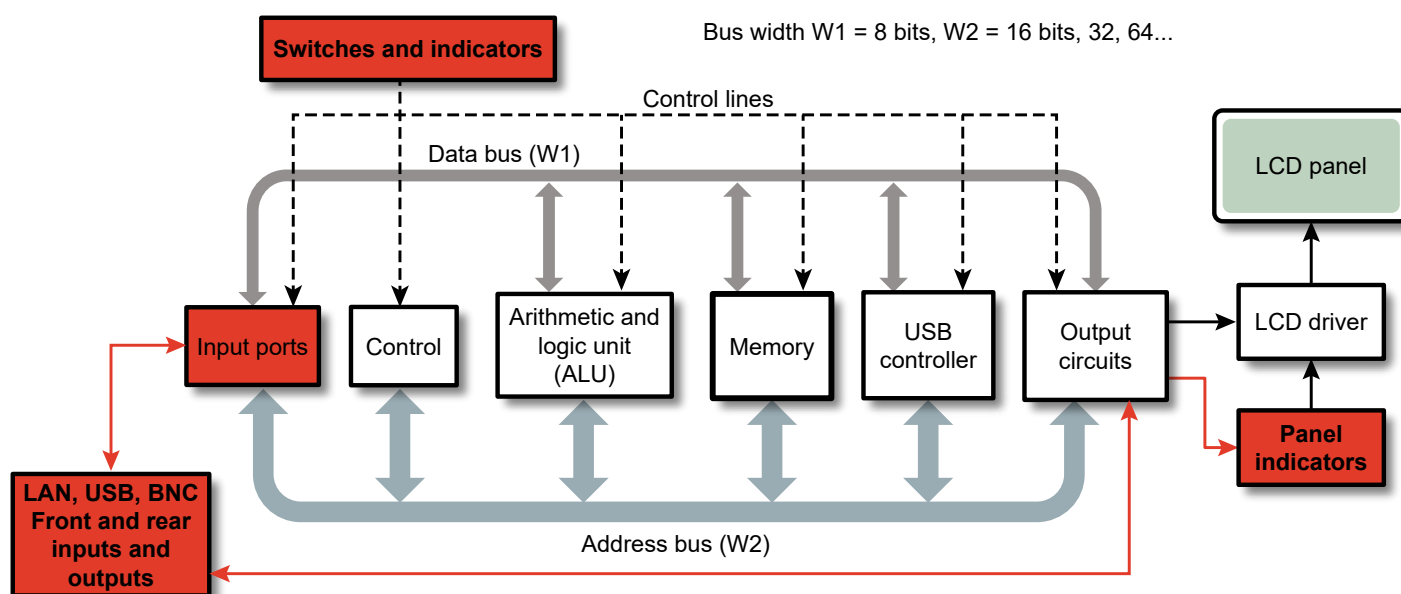


Figure 6 — A block diagram of a modern digital signal generator. The items in red are those added to the computer hardware to turn it into a waveform generator.

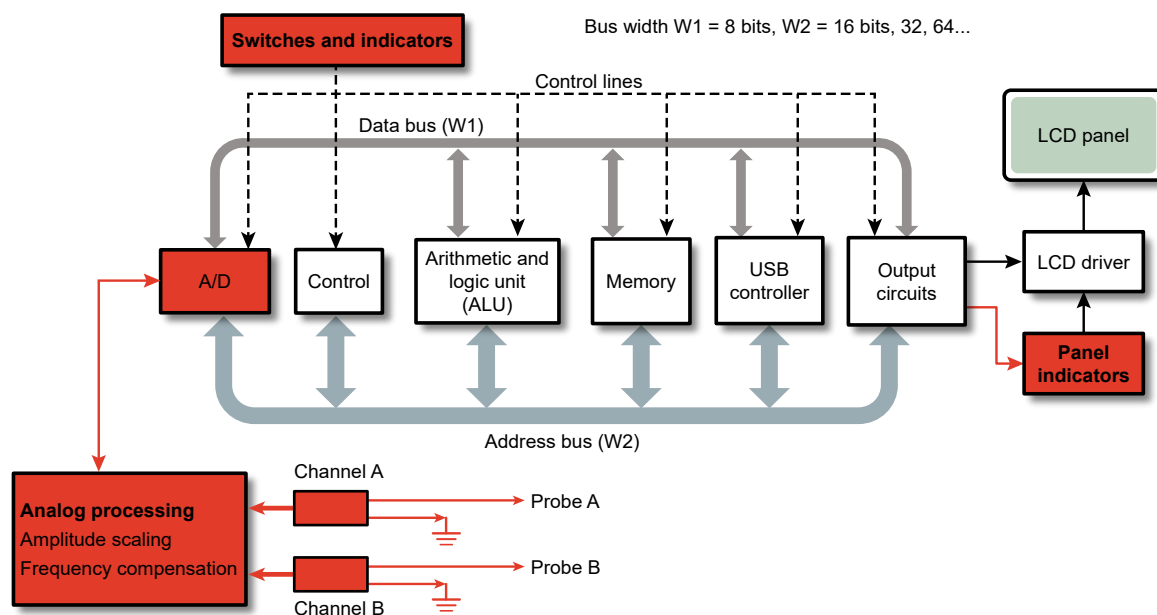


Figure 8 — The signal flow remains the same for the oscilloscope, although the diagram shows only two of the four probes. New software and control information are generally made through an interface module connected to the bus system or the USB controller. The items in red are those added to the computer hardware to turn it into an oscilloscope.

The block diagram also shows that the various ports (BNCs, USBs, and LANs) can be set as inputs or outputs. The LCD panel can illustrate the selected waveform, as well as its frequency and amplitude. A user can also define a custom waveform. The commands or equations that generate these outputs can be entered through the I/O block shown in the lower-left corner of the figure.

Digital Oscilloscopes

Digital oscilloscopes, such as the Siglent Technologies SDS1104X-E (see Figure 7), have similar layouts: mechanical switches on the right, soft switches on the right side of the LCD, and the LCD display on the left. The SDS1104X-E is a four-channel unit, so there are four BNC inputs and four channel-selection switches. It can be used as two dual-channel oscilloscopes or as four independent oscilloscopes.

The block diagram in Figure 8 shows the primary difference being the use of two A/Ds at the end of the analog processing block. While limited by the size of the memory and the processing speed, the same basic design is shared for the four-channel capability.

In Summary

The three examples in this article show that most test instruments can be designed and built around the

same architecture as a personal computer. Because most measurements are analog except for communication waveforms, the block diagrams show instruments built up with an analog processing front end and A/D conversion, as well as memory to either capture values or process them, or to hold programs to generate a set of values. And, of course, there is a display or readout to display pictures, graphs, and text.

Finally, with today's technologies, the unit size is usually less than 1 cubic foot with a weight of only a few pounds. If you carefully examine the specifications of an instrument, you may find that you can often add additional capabilities for just a few dollars more, such as a waveform generator built into an oscilloscope.

All photos provided by the author.

Paul Danzer, N1II, an electronics engineer, started out as a teenage radio amateur in 1953. He spent 33 years working in the defense industry on radars and digital equipment and was awarded 11 patents. After leaving these positions, he telecommuted to the ARRL offices in Newington, Connecticut for 3 years, where he edited several ARRL books and wrote several articles for QST. Paul then embarked on a second career for 18 years as a college professor, teaching computer-related electronics and PC applications. Now retired, he spends his time writing and testing various amateur-related kits and equipment, fishing, and dog-walking. ARRL has twice awarded him the Bill Orr, W6SAI, Technical Writing Award. You can reach Paul at n1ii@arrrl.net.

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



The Ampkeyer

Switch almost any amplifier with almost any radio.



Figure 1 — Mike Bryce's, WB8VGE, ampkeyer.

Mike Bryce, WB8VGE

The desire to run high power happens to all of us — it's a rite of passage. I'll admit, I've been bitten by the high-power bug at one time, too. It's a lot of fun to break through a pileup when you're pushing 1000 W into your antenna.

Amplifiers are not cheap, so most hams first get into the world of high power by buying a used amplifier. The popular Heathkit SB-200 is around \$250 to \$400 and will push 600 W — a noticeable increase from the usual HF transceiver. The Collins Radio 30L-1, R. L. Drake L-4B, and Heathkit SB-220 are still producing power, although their basic designs are around 60 years old.

In the mid '60s, when tubes ruled the land, transceivers used a set of relay contacts to key the amplifier, and that relay didn't care about the voltage of the key line. For operators today, that's a problem. Today's modern HF transceiver can't handle the keying voltage some of these old amplifiers use. For example, the SB-200's key line sits at -180 V. Connect it to your Icom IC-7300, and you'll blow the little surface-mount device (SMD) switching transistor off the printed circuit board (PCB).

To avoid a trip to the repair shop, you need a device to buffer the amplifier's key line to the input of the radio (see Figure 1).

Keyer Contents

This ampkeyer will monitor the external key line from your HF radio and key an external high-power amplifier. Your radio sees only 12 V at 10 mA, so it's safe from the high-voltage key line. Some of its features include:

- Keying just about any amplifier
- Three output keying circuits
- The ability to key two amplifiers from two different radios
- Keying with high-to-low or low-to-high key lines from your transceiver
- An optical coupler so your HF radio doesn't connect directly to the amplifier
- Standby operation so you can bypass those old Heathkit amplifiers without turning them off
- An adjustable TR delay (you can defeat this if you like)
- Ease of build on a single PCB

Nearly all HF radios that I know of switch their external key line to ground, and the ampkeyer takes advantage of that feature.

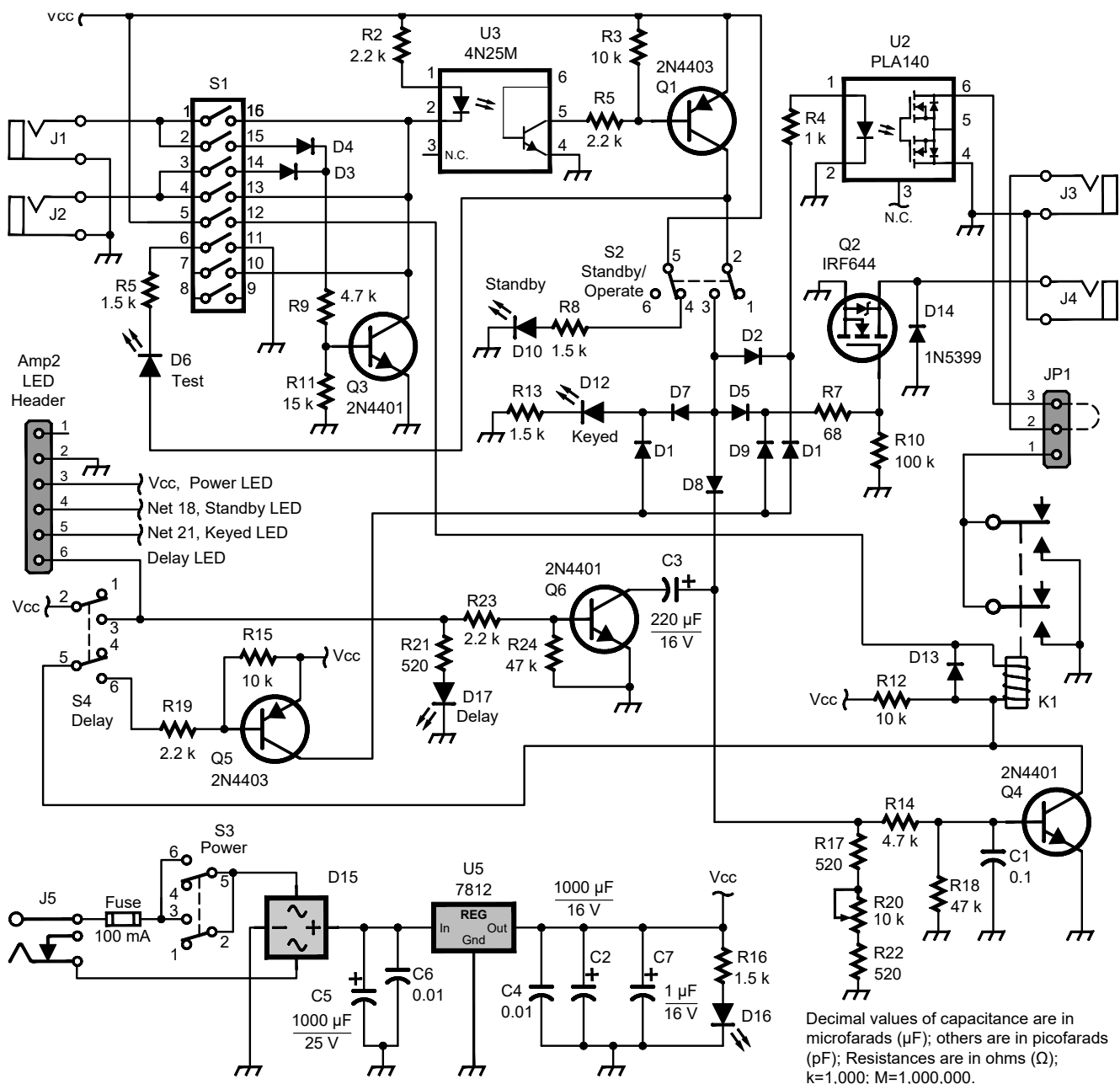


Figure 2 — Ampkeyer schematic diagram. All the component values have a wide tolerance.

When you key your HF radio, the ampkeyer senses the change on the key line and then pulls the amplifier's key line to ground, keying the external amplifier. There are three ways it may key your amplifier: with a power metal-oxide-semiconductor field-effect transistor (MOSFET), a high-speed relay, or a solid-state relay.

The power MOSFET will handle 250 V dc at 11 A. It will key only amplifiers that have a positive key line, like Heathkit's SB-220, Drake's L-4B/L-7, and Dentron amplifiers. There are, of course, many amplifiers that have a positive key line, including the new solid-state amplifiers. The high-speed solid-state relay will key

positive or negative key lines up to 250 V at 250 mA. Lastly, a high-speed relay will handle up to 1 A at 250 V. This will key either polarity (see the sidebar "A Quick Peek at Switching Speeds" for more information).

The ampkeyer provides an adjustable drop-out delay. For example, if you're running 100 W QSK CW during a contest, and you turn on your SB-200, it can't follow the QSK keying. Instead of wading through menus on your radio to find the correct one to set the external key line delay, a simple push of a button on the ampkeyer will provide an adjustable drop-out delay. The delay controls all the output keying devices.



Figure 3 — Inside the ampkeyer. The solid-state relay was not installed on this PCB. Many of the resistors are SMD. The steering diodes are in the upper right, while the power supply components are in the lower left of the PCB. PCB material is used for the front and rear panels. Small LEDs are pressed into the PCB.

Of course, there are times when you don't need your amplifier, so a standby/operate switch will place it in standby. This is a great feature because the old Heathkit amplifiers required you to turn the amplifier off if you wanted to bypass it.

How It Works

As shown in Figure 2, there are two radio inputs — J1 and J2 — and they go through S1 (a dipswitch) to optical coupler U3. Switch settings 1 and 3 route either input to U3. When the transceiver's key line goes to ground (in transmit), the optical coupler turns on. Your transceiver will see only 10 mA of current at 12 V (the current of U3's internal LED). That pulls the base of Q1 low, and 12 V is routed to standby/operate switch S2. When S2 is in standby, the standby LED D10 will illuminate. In the operating position, 12 V is sent to steering diodes D5, D8, D2, and D7.

The power MOSFET (Q2), now fully enhanced via R7, will pull the external amplifier's key line to ground and key the external amplifier. Resistor R10 discharges the gate of Q2 when the transceiver returns to receive. Diode D14 does double duty. First, it clamps any voltage spike caused by the external amplifier's internal TR relays when they turn off, and second, it will protect Q2 if you connect a negative key line.

Steering diode D8 sends 12 V to R14 and saturates Q4, which pulls the coil of K1 to ground. The contacts within K1 close and key the external amplifier. Relay K1 can be disabled via dipswitch S1-5. Diode D2 supplies U2 (the PLA140 solid-state relay) with power, and its

output goes to an external amplifier. Because of space restrictions on the PCB, jumper U4 is used to select either the relay or solid-state relay outputs.

With two radio inputs, you can use your SB-200 connected to an HF transceiver on one output line, while a second transceiver (perhaps a VHF/UHF all-mode) connects to the radio's input 2. Then, your external VHF/UHF amplifier will be keyed by the all-mode VHF/UHF transceiver. Of course, either input will key either output. So, if you're operating on 6 meters with a VHF amplifier, you can't be on the HF transceiver at the same time.

It's rare, but sometimes you'll come across a transceiver whose key line doesn't go to ground when in transmit, but switches from low to high. If that's the case, S1 can be configured to send the keyed +12 from the transceiver through steering diodes D3 or D4, turning on Q3, which pulls pin 2 of U3 low, allowing the rest of the circuit to operate normally. You can set either radio 1 or radio 2 input to either sense level.

When the delay button is depressed, two things happen. First, transistor Q6 is turned on and connects the negative lead of C3 to ground. Second, the delay LED illuminates. The base of Q5 is connected to the collector of Q4. Should K1 be disabled, resistor R12 keeps Q5's collector high.

A Quick Peek at Switching Speeds

Back in the day, when you pressed the push-to-talk (PTT) button, the transceiver would switch from receive to transmit. An extra set of contacts on the main switching relay would control an external amplifier. Today, there's a lot of magic that happens inside a modern transceiver. When you push the PTT button, the time between requesting transmit and RF being produced can take several milliseconds, if not longer, and the external key line of the transceiver might not switch until after the transceiver is producing RF.

The ampkeyer monitors the transceiver's key line, and when it switches, so does the ampkeyer. The power MOSFET will switch within 1 to 2 milliseconds. The typical relay switching time is 2 to 3 milliseconds. The solid-state relay is about 1 to 2 milliseconds. If the transceiver's key line hasn't switched when the PTT is pressed, then there's a possibility of hot switching. There's nothing that I know of that would prevent that from happening, simply because the transceiver is producing RF before switching its external key line.

The amplifier is also a problem. Heathkit's SB-200 open-frame TR relay wasn't fast from day one, and after 6 decades, it hasn't gotten any faster. Switching speeds of 15 to 50 mS are certainly possible — and that's after the transceiver has gone into TX (and the ampkeyer has keyed the amplifier).

With the delay button active, the voltage on capacitor C3 holds Q4 on. The hang time is adjustable via R20. With Q4 on, its collector is low and turns on Q5. This transistor supplies the delay timeline with VCC to keep U2 and Q2 on as well. Steering diode D11 provides 12 V to drive the keyed LED.

A bridge rectifier eliminates the need to worry about input power polarity, while a 100 mA chemical fuse protects the ampkeyer. An LM7812 regulator powers the ampkeyer. Power requirements are less than 30 mA and can range from plus or minus 13 V dc to 20 V ac. Yes, the LM7812 falls out of regulation with low dc input, but that hasn't been an issue.

Building the Ampkeyer

Because I wanted to shoehorn this project into a 100-millimeter case (see Figure 3), I chose to use some SMD resistors. They are size 1206 and are about as large as you can get for an SMD part.

A PCB set is available (contact me for price and availability), making assembly a lot easier. If you use the PCB, I suggest mounting the SMD parts first. There's absolutely no reason that you couldn't use perfboard to assemble the circuit, as well. Obviously, the SMD parts won't work with perfboard.

The PCB is designed to slide into a 100 × 75 × 35-millimeter two-piece clamshell case. The front and back panels are PCBs, with the front inside foil containing the LEDs and current-limiting resistors; a multi-pin connector connects the two. The same resistors may be mounted on the main PCB, if you choose not to use the front-panel PCB.

Testing

There are no adjustments, and provided the PCB was assembled correctly, the ampkeyer should work when powered on.

To test the ampkeyer, set switches S1-1 on. Radio 1 input S1-2 is on. Enable the relay with S1-5 on. With the standby switch in operate, ground the radio 1 input, and you should see the keyed LED light and hear the relay click. With radio 1 input still grounded, set your volt-ohm-milliammeter (VOM) to continuity, and verify the power MOSFET output goes to ground. Check the PAL140 and relay outputs, too.

To test for low-to-high keying input, set S1-1 to off and S1-2 to on. Apply +12 V to radio 1 input. The ampkeyer should operate normally. If S1-6 is on, then D6 will light any time either input is pulled to ground (I found this feature quite handy when hooking up transceivers). There are umpteen different output configurations,

depending on the manufacturer of the radio. Monitoring this LED saves a lot of time. If it turns on, then the transceiver is hooked up correctly.

If you have a new radio and an old amplifier, then the ampkeyer is what you need to break through the pileups and keep your new radio safe and happy. Supplementary materials can be found on *QST* in Depth (www.arrl.org/qst-in-depth).

See *QST* in Depth for More!

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

- ✓ Additional photos
- ✓ Parts list

Mike Bryce, WB8VGE, earned his license in 1975, and currently holds an Amateur Extra-class license. He retired after nearly 50 years at Republic Steel, and often runs QRP on the low end of 40 meters. When the bands fold, you'll find Mike up to his elbows fixing a broken radio. His spare time is divided by keeping the water levels topped off in the batteries for his solar-powered station and working in his greenhouse. Mike has authored numerous ham radio and solar-power articles over the years, as well as ARRL's *Emergency Power for Radio Communications*. He can be reached at prosolar@sssnnet.com.

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



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Product Review

PreciseRF DPM6000A SWR/Power Meter

Reviewed by Phil Salas, AD5X
ad5x@arrl.net

PreciseRF is known for providing quality amateur radio products and professional test equipment. One such product is the DPM6000A SWR/Power Meter. The DPM6000A is a dual-channel unit that permits measuring voltage standing wave ratio (VSWR), return loss, reflection coefficient, and mismatch loss. It can directly measure RF signals from -60 dBm to $+20$ dBm from 0.001 to 500 MHz. Optional couplers, which permit power measurements up to 100 W from 1 – 100 MHz, and up to 1500 W from 1.8 – 54 MHz, are available. Measurements can be displayed in both Watt and dBm formats. The DPM6000A also includes a 100 MHz frequency counter, and a 50 MHz 0 dBm reference test port that can be used for a variety of applications. The full specifications of the DPM6000A are given in Table 1.

Interfaces

The DPM6000A arrived with a 3-foot BNC-to-BNC cable and an ac-to-9-V-dc adapter with a pendant cable terminated in a 2.1×5.5 -millimeter plug. The operating current is not specified, but I measured 250 mA at $+13.8$ V dc. On the front panel (see the lead photo), a multi-pin connector on the left is for a future sensor. The left BNC connector is the frequency counter input. The right BNC connector is the RF input for direct $-60/+20$ dBm measurements up to



500 MHz. Finally, there is a 50 MHz 0 dBm reference N-connector output on the right.

The rear panel (see Figure 1) has a BNC connector for a 10 MHz precision clock output (**CLOCK OUT**), as well as a BNC connector for an external clock input. A rear-panel switch selects either the internal or external reference. The remaining BNC connectors provide for direct measurements of forward and reflected power when using external couplers. The **FORWARD** BNC can also be used for direct $-60/+20$ dBm measurements in lieu of the front-panel RF input connector. If you use the front-panel RF input connector, you must jumper the rear-panel RF **LOOP** and **FORWARD** connectors together with a short BNC cable.

Figure 1 — The DPM6000A rear panel.



Some Performance Testing

For my first tests, I looked at direct measurements. For this, press the **SET** button until **SELECT COUPLER** appears. Then press the **ENTER** button until “0 dB NONE (2W MAX)” appears. Then press the **HF-VHF** key.

Bottom Line

The PreciseRF DPM6000A SWR/Power Meter is an accurate mW-reading instrument up to about 150 MHz. Optional couplers provide the ability to read ham station power levels up to 1500 W from 160 – 6 meters.

I began by checking the output of the DPM6000A 50 MHz reference. This is specified at 0 dBm $\pm$ 0.2 dB when measured with the supplied 3-foot BNC/BNC cable (a BNC/N adapter is required). I have both an HP 437B power meter with an HP 8481A (–30 dBm to +20 dBm) power sensor, and a Mini-Circuits PWR-6GHS+ power sensor (–30 dBm to +20 dBm). Both have been recently NIST-calibrated. I used my tinySA Ultra as a signal generator so I could look at other frequencies. The tinySA Ultra was set to –17 dBm output. This is not a precision instrument, but it permits making power reading comparisons between the DPM6000A and the HP and Mini-Circuits sensors. The results are shown in Table 2.

As you can see in Table 2, the DPM6000A measurement is very close to the Mini-Circuits and HP sensors at 50 MHz. Within the NIST-calibration accuracy of all three units, and considering that the HP and Mini-Circuits sensors were tested at a different facility, these all line up well at 50 MHz. However, at 150 MHz, the DPM6000A reads about 0.5 dB higher than the HP and Mini-Circuits sensors. At 300 MHz, the



Figure 2 — The DDC-1 100 W coupler.



Figure 3 — The DDC545A 1500 W coupler.

DPM6000A reads about 1 dB low, and at 450 MHz it reads about 3 dB low.

Next, I looked at the DPM6000A's very useful relative feature. Here you set an input at a 0 dB relative level. I used the 50 MHz reference output and the direct input to check the dynamic range accuracy of this reference feature. To do this, I connected the 50 MHz reference output to the direct input and set that as the 0 dB reference. Then I connected an HP precision 50 MHz 30 dB reference attenuator in series with the reference output and found that it indicated –29.96 dB. Next, I checked a 10 dB attenuator, which showed 9.74 dB attenuation. And finally, I connected both attenuators in series and measured –39.7 dB. I expected –39.9

dB based on the individual measurements; however, being within 0.2 dB over a 40 dB range is excellent. I followed this up by calibrating a number of attenuators I have on hand. You can use this feature on other frequencies if you have a separate signal source.

To accurately measure higher power levels, as well as other transmission parameters, you must use an optional dual-directional coupler. With firmware version

Table 1
PreciseRF DPM6000A SWR/Power Meter Specifications

Item	DDC-1	DDC545	Direct Input
Coupling:	–30 dB $\pm$ 2 dB	–45 dB $\pm$ 1 dB	
Directivity:	> 30 dB typ	> 30 dB typ	
SWR/return loss:	1.1:1/25 dB	1.1:1/25 dB	
Frequency range:	1 – 100 MHz	1.8 – 54 MHz	1 kHz – 500 MHz
Power range:	–30/+50 dBm	–15/+65 dBm	–60/+20 dBm $\pm$ 0.5 dB
No. channels:	2 (fwd/ref)	2 (fwd/ref)	2 (fwd/ref)
Reference source:	50 MHz/0 dBm	$\pm$ 0.2 dB into 50 Ω	
Spurious signals:	–65 dB		
Short-term stability (40 hours):	0.05 dB		
Long-term stability (12 months):	0.5 dB		
Counter:	1 kHz – 100 MHz, 8-digit TCXO 1 PPM @ 0 dBm		
Input/output:	Front panel: sensor, counter input, direct input, power ref Rear panel: clock in/out, loop, fwd, ref, +9 V dc	Fwd/ref W/dBm, SWR, peak power, return loss, reflection coefficient (ρ), mismatch, % power, direct freq, counter freq	
Measurements:	20 $\times$ 2 OLED		
Display:	50 MHz reference N-female. All others are BNC-female.		
RF connectors:	+9 to +14 V dc. 2.1 $\times$ 5.5-millimeter dc jack. 9 V dc ac adapter provided.		
Power required:			
Size (height, width, depth):	3.5 $\times$ 6 $\times$ 7 inches (without protrusions)		
Weight:	1.88 pounds		

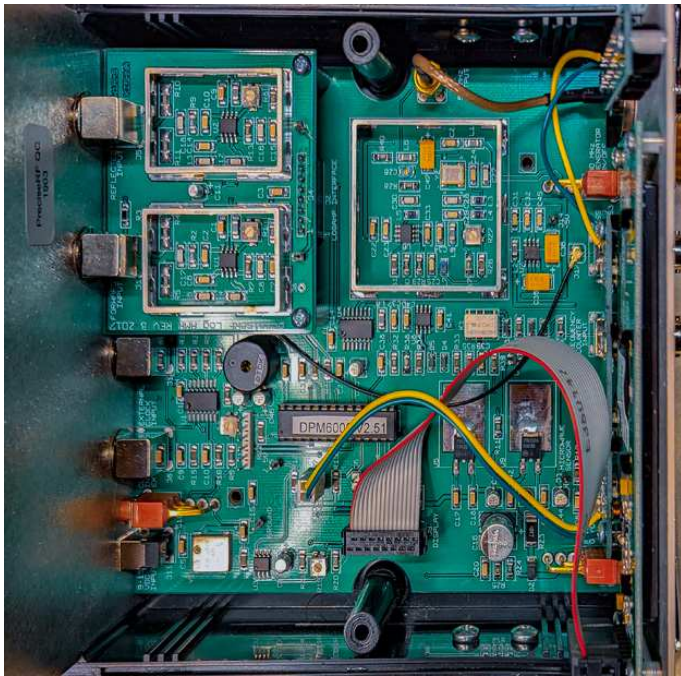


Figure 4 — The location of the internal plug-in ROM, labeled ROM (DPM6000 V2.51) in the lower middle section of the printed circuit board.

2.61 or later, the DPM6000A provides for selection of 20 and 30 dB couplers, as well as a custom coupler. The custom coupler setting defaults to a 45 dB coupler, but it can be adjusted for any coupler with a coupled port up to -60 dB. The optional PrecisionRF DDC-1 is a 1 – 100 MHz 30 dB 100 W dual-directional coupler. Its input and output ports and the forward and reflected ports all use BNC connectors. The optional DDC545A is a 1.8 – 54 MHz 45 dB 1500 W dual-directional coupler. It uses SO-239 connectors for the RF input and output, and BNC connectors for the forward and reverse interfaces. Both couplers have a specified coupling tolerance of ± 1 dB. Figure 2 shows the DDC-1 coupler, and Figure 3 shows the DDC545A coupler. You must provide your own BNC cables for the forward and reflected interconnections, as these are not provided with either coupler. Use the “**SELECT COUPLER**” procedure to select the 30 dB DDC-1, or the custom coupler setting for the 45 dB DDC545A coupler.

I began by checking both couplers’ forward and reverse coupling and directivity. I compared these

measurements using both the DPM6000A’s 50 MHz reference output and an Array Solutions VNAuhf, which permits sweeping the couplers over their full specified range. Directivity is important as it can result in errors in return loss/VSWR measurements due to some forward power being coupled into the reverse port. The coupling parameters are important as there can be quite a bit of inaccuracy if the couplers are off by their specified values. The ± 1 dB specification of the DDC-1 and DDC545A couplers can result in errors from +26% to -21% . Table 3 summarizes my measurements. The DDC545A is only spec’d to 54 MHz.

Table 3 shows that the DDC-1 coupler has very good directivity up to 6 meters. The DDC545A coupler’s directivity is good up to 10 meters, and adequate on 6 meters. Both couplers’ coupled outputs measured quite close to the VNA when using the 50 MHz reference and relative reading of the DPM6000A. And the coupled outputs of both couplers were very flat over their full range.

Next, I made some power measurements with both couplers. The results are shown in Table 4. The actual power readings are based on a NIST-calibrated Mini-Circuits PWR-6+ sensor and calibrated attenuators.

As you can see, the errors are fairly consistent with the couplings measured with the VNAuhf. For example, a 0.3 dB variation results in about a 7% error. Beginning with firmware version 2.61, you can select a **CUSTOM COUPLER** setting and input the actual coupling for improved accuracy. To do this, calibrate the coupler using the 50 MHz reference output and the relative feature of the DPM6000A. Then select the **CUSTOM COUPLER** and use the **UP/DOWN** buttons to set the coupling to what was measured. As I felt that the DDC-1 accuracy could be improved, I used this procedure to measure its coupling, which I then input into the **CAL CUSTOM COUPLER** screen. As you can see in Table 3, the re-calibrated DDC-1 is closer to the Mini-Circuits PWR-6+ readings. As using the relative feature in the DPM6000A to calibrate couplers is very easy, you may want to use this to verify that the coupler is within 0.3 dB of its rated coupling. If not, input your

Table 2 — PrecisionRF DPM6000A Power Measurements vs HP and Mini-Circuits Sensors					
Frequency	DPM6000A Ref	TinySA Out	DPM6000A	PWR-6GHS+	HP 8481A
50 MHz	0 dBm ± 0.2 dB	N/A	+0.22 dBm	+0.35 dBm	+0.38 dBm
50 MHz	N/A	-17 dBm	-18.41 dBm	-18.33 dBm	-18.30 dBm
150 MHz	N/A	-17 dBm	-17.2 dBm	-17.7 dBm	-17.6 dBm
300 MHz	N/A	-17 dBm	-19.1 dBm	-18.0 dBm	-17.9 dBm
450 MHz	N/A	-17 dBm	-21.2 dBm	-18.0 dBm	-17.9 dBm

Table 3 — Coupler Measurement Summary						
	----- DDC-1 (± 2 dB spec) -----			----- DDC545A (± 1 dB spec) -----		
Frequency	Fwd Cplg	Rev Cplg	Directivity	Fwd Cplg	Rev Cplg	Directivity
1.8 MHz (VNA)	-29.7 dB	-29.7 dB	48.3 dB	-45.04 dB	-45.02 dB	31 dB
28 MHz (VNA)	-29.8 dB	-29.8 dB	26.7 dB	-45.13 dB	-44.90 dB	22 dB
50 MHz (VNA)	-29.7 dB	-29.9 dB	21.7 dB	-45.22 dB	-45.50 dB	16 dB
50 MHz (ref)	-29.9 dB	-29.8 dB	21.6 dB	-45.14 dB	-44.65 dB	15 dB
100 MHz (VNA)	-30.2 dB	-30.9 dB	14.7 dB	N/A	N/A	N/A

Table 4 — DDC-1 and DDC545A Coupler Measurements							
	-----Before Cal-----			--- After Custom Cplr Cal ---			
Frequency	PWR6+	DDC-1	Deviation	DDC-1	Deviation	DDC545A	Deviation
1.8 MHz	100 W	114 W	+14%	112 W	12%	103 W	+3%
14 MHz	100 W	109 W	+9%	105 W	5%	100 W	0%
28 MHz	100 W	107 W	+7%	101 W	1%	97 W	-3%
50 MHz	100 W	95 W	-5%	94 W	-6%	97 W	-3%

measured coupling into the **CUSTOM COUPLER** screen on the DPM6000A. If you want to measure coupler performance, you will need some 50 Ω terminations. This is addressed in the sidebar titled “Terminations for Coupler Calibration.”

For SWR testing, I checked the DPM6000A with the DDC-1 and the DDC545A couplers against a reference 50 Ω load, and shorted and open microwave attenuators of 6 dB (1.7:1 SWR), 3 dB (3:1 SWR), and 1 dB (8.7:1 SWR). The 50 Ω load has a return loss greater than 40 dB. Because the attenuators are not perfect (especially due to open-circuit stray capacitance at

higher frequencies), I also measured the attenuators on my Array Solutions VNAuhf for comparison, as shown in Table 5. As you can see, the SWR accuracy is quite good over the HF 6-meter ham bands. However, notice the 1.41 SWR measured with the DDC545A on 6 meters into 50 Ω . This corresponds closely with the 15 – 16 dB directivity measured on this band (see Table 2). The coupled reflected signal is 15 – 16 dB below the coupled forward signal, which looks like a 15 – 16 dB return loss. This corresponds to about a 1.4:1 SWR.

Table 5 — SWR Load Measurement Tests				
	1:1 SWR	1.7:1 SWR	3:1 SWR	8.7:1 SWR
Frequency	DDC-1/DDC545/VNA	DDC-1/DDC545/VNA	DDC-1/DDC545/VNA	DDC-1/DDC545/VNA
1.8 MHz	1.02/1.06/1.0	—	—	—
1.8 MHz (short)	-/-/-	1.7/1.6/1.7	3.0/3.0/3.2	10.6/9.4/11.0
1.8 MHz (open)	-/-/-	1.6/1.8/1.66	2.8/3.2/3.0	7.7/8.0/8.0
14 MHz	1.02/1.11/1.0	—	—	—
14 MHz (short)	-/-/-	1.7/1.5/1.70	3.0/2.9/3.2	10.7/9.3/10.9
14 MHz (open)	-/-/-	1.6/1.9/1.66	2.8/3.3/3.0	7.2/8.0/7.9
28 MHz	1.05/1.19/1.0	—	—	—
28 MHz (short)	-/-/-	1.6/1.5/1.70	3.0/2.9/3.2	12.2/10.1/10.7
28 MHz (open)	-/-/-	1.7/2.0/1.66	2.8/3.6/3.0	6.2/8.5/7.9
50 MHz	1.2/1.41/1.0	—	—	—
50 MHz (short)	-/-/-	1.5/1.3/1.70	2.9/2.8/3.1	12.7/10.6/10.6
50 MHz (open)	-/-/-	1.7/2.4/1.66	2.8/3.9/3.0	5.7/9.2/7.9

Terminations for Coupler Calibration

When making coupler measurements, you need to terminate unused coupler ports with a good 50 Ω load. I have been using Amphenol/Connex 132360 SMA terminations for several years, as these have excellent return loss up to at least 1 GHz. A four-pack is available from Amazon for \$28. There are less expensive terminations on Amazon, but I have not evaluated any others besides the Amphenol/Connex terminations. Of course, using these SMA terminations requires BNC/SMA, UHF/SMA, and/or N/SMA adapters for couplers using other than SMA ports. For measuring the PreciseRF DDC-1 coupler you will need two BNC/SMA adapters, and for the DDC545A coupler you will need one BNC and one UHF adapter (see Figure 5).

I used the following, available from Amazon:

Qty.	Description	Price
2	DHT Electronics SMA-F/UHF-M adapter	\$6.50
2	DHT Electronics SMA-F/BNC-M adapter	\$5.50
2	F41-2 N-M/SMA-F adapter	\$9.99 (only necessary for couplers with N-connectors)

My Array Solutions VNAAuhf has an N-connector interface. In order to measure the UHF and BNC terminations, I added in-line N-to-UHF and N-to-BNC adapters. So, the actual performance of the SMA-terminated loads is probably a bit better because of some possible degradation due to the added in-line adapters. I made the following measurements:

N/SMA termination	>40 dB RL to 500 MHz
N/BNC adapter to BNC/SMA termination	>40 dB RL at 50 MHz, 36 dB RL at 144 MHz, 26 dB RL at 450 MHz
N/UHF adapter to UHF/SMA termination	35 dB RL at 50 MHz, 26 dB RL at 144 MHz, 17 dB RL at 450 MHz



Figure 5 — UHF and BNC 50 Ω terminations.

Ham Station Features of the PreciseRF DPM6000A

The DPM6000A has some very nice display features for ham station use. The default power-on display shows bar graph and digital indications of RF power and SWR. The display can be changed to show forward and reflected power in Watts and dBm, forward PEP and average power, forward and reflected power in Watts, SWR and return loss, mismatch loss and reflection coefficient, and power loss in percent, Watts, and dBm. The peak hold time for PEP readings is adjustable, as is the maximum bar graph full-power display. I particularly liked the capability of simultaneously displaying PEP and average power.

Firmware Updates

PreciseRF updates the firmware occasionally in order to improve performance and/or correct bugs. As the firmware is contained in a plug-in ROM, you can request the ROM from PreciseRF if you are comfortable opening the DPM6000A and changing the ROM. The location of the labeled ROM (DPM6000 V2.51) is in the lower middle section of the printed circuit board, as you can see in Figure 4. This is easy to replace but if you don't feel comfortable doing this, you can return the DPM6000A to PreciseRF for the upgrade.

Conclusion

The DPM6000A is a good mW-reading power meter up to about 150 MHz, above which the accuracy begins to suffer. I found the 50 MHz reference and the relative power measurement capability to be really nice for calibrating couplers and attenuators. However, I do have a few criticisms: First, 6-foot BNC cables should be provided with the optional 30 dB and 45 dB couplers, as are provided by other power meter manufacturers. Providing an optional short BNC jumper for the rear **LOOP** and **FORWARD** connectors would benefit those who will use the front-panel RF input port. And finally, a BNC/N cable, rather than the supplied BNC/BNC cable, would make more sense for 50 MHz reference port applications.

Manufacturer: PreciseRF, 13690 Wisteria Dr. NE, Aurora, OR 97002, www.preciserf.com. *Price:* DPM6000A, \$975; DDC-1, \$175; DDC545A, \$260; NIST calibration certificate, \$75 (only certified for the 50 MHz reference output).

PreciseRF TDR-Cable Radar Pro[®] Pulse Generator

Reviewed by Phil Salas, AD5X
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The PreciseRF TDR-Cable Radar Pro[®] is a precision TDR pulse generator with an integrated measurement computer. The TDR-Cable Radar Pro permits direct measurements and readouts of time to fault, reflection coefficient, cable length, velocity factor, line impedance, return loss, SWR, and cable loss. With its 25-picosecond resolution, you can measure line lengths from 1 inch to 50,000 feet (2.5 centimeters to 15 kilometers). This means you can even analyze circuit board-level performance. In order to take these measurements, an external oscilloscope is necessary. PreciseRF recommends an oscilloscope with a 200 MHz bandwidth in order to achieve the precision available. The unit specifications are given in Table 6.

Using the TDR-Cable Radar Pro

PreciseRF has both Appnote #7 and a video on their TDR-Cable Radar Pro web page that are well worth viewing prior to using the unit (see www.preciserf.com/shop/tdr-cablesout-pro). Appnote #7 provides a detailed description of TDRs and testing, and also serves as the instruction manual, as it provides connection diagrams and step-by-step usage instructions.

The TDR-Cable Radar Pro has both a pulse output and a step output. The pulse output is most useful for



measuring circuit board traces and cable loss. The step output is used for measuring reflection coefficient, cable impedance, return loss, VSWR, and distance to fault.

When connecting the TDR-Cable Radar Pro output to your oscilloscope, it is important that the oscilloscope input be terminated in a 50 Ω load. As an example, my Tektronix TDS2022B has a 1 M Ω input impedance, so I needed to put a BNC Tee with a 50 Ω load on the oscilloscope's input.

Bottom Line

The TDR-Cable Radar Pro is easy to use and an excellent unit for determining many factors in a transmission system.

Table 6
PreciseRF TDR-Cable Radar Pro Specifications

Selectable step output Zs:	50, 75, 300 Ω
Cable line library:	Yes
Pre-trig delay:	100 ns
Step TDR-Cable Radar Pro DUT rise time (50 Ω):	≤ 1.75 ns (20 – 80%)
Step TDR-Cable Radar Pro out into 50 Ω :	≥ 2.4 V peak to peak
Resolution step TDR:	≤ 4.5 centimeters (400 ps)
Pulse TDR-Cable Radar Pro DUT:	≥ 2 V peak to peak
Rise time, pulse width (50 Ω):	≤ 150 ps (20 – 80%), width ≤ 350 ps
Resolution pulse TDR:	≤ 2.5 millimeters (20 ps)
Range:	2.5 centimeters – 15 kilometers
Measurements:	Distance to fault, reflection coefficient, return loss, impedance, VSWR, velocity factor, line loss dB/100 ft/100 MHz
Option 1:	VZ500 terminator optional
Option 3:	Ni-MH 800 mAh rechargeable battery (4 hours operation)
Option 4:	NIST calibration
Option 5:	200 MHz DSO Hameg Oscilloscope
Input dc voltage range:	9 – 14 V dc (2.1 $\times$ 5.5-millimeter dc jack). 9 V dc ac adapter included.
Power consumption:	160 mA
Size (height, width, depth):	3.5 $\times$ 6 $\times$ 7 inches (without protrusions)
Weight:	1.5 pounds

My first measurement was a distance-to-fault test. I physically measured about a 50-foot length of RG8X. For most cables, you can select the cable type from the TDR's menu so it will automatically know the velocity factor and the loss per 100 feet. If you are unsure of the velocity factor (i.e., you don't know what type of cable you have), you can easily determine this using the **MEASURE VELOCITY FACTOR** feature of the TDR, though this does require a physical measurement of the cable length.

I open-circuited the end of the cable for my distance-to-fault measurement, though any discontinuity would suffice. Next, the oscilloscope was used to measure the pulse width. This is easily done using the cursor feature in most modern digital oscilloscopes. Looking at Figure 6, you can see that the cursors are 116 ns apart. When input into the TDR, the TDR-Cable Radar Pro calculated that the length of the coax to the short was 48.15 feet — much easier than using a tape measure!

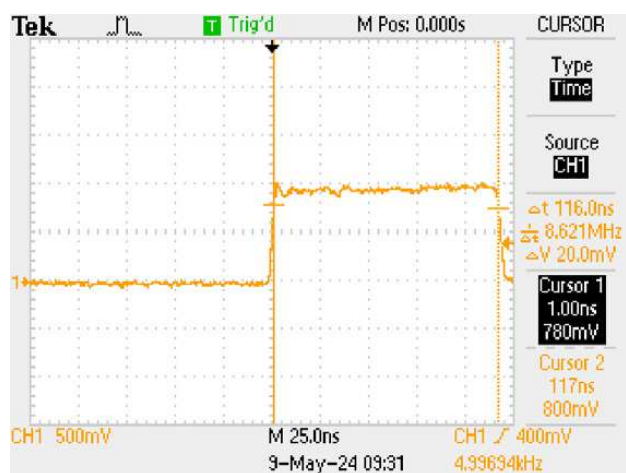


Figure 6 — Example of distance-to-fault measurement.

Next came some SWR and return loss measurements. For this I used a 31.4-foot section of RG8X cable terminated in both a 200 Ω 4:1 Hi-Z SWR, and a 12.5 Ω 4:1 Lo-Z SWR. I used the precision SWR test box described on page 3 of the March 2021 issue of QEX. Using the oscilloscope, the forward and reflected pulse peak-to-peak amplitudes were measured. Figures 7 and 8 show the peak-to-peak measurements of the reflected pulses for the Hi-Z and Lo-Z cases, respectively. For the Hi-Z measurement, I recorded a forward pulse of 1.06 V and a reflected pulse of 0.720 V. When these readings were input into the TDR-Cable Radar Pro, the calculated values were: reflection coefficient (ρ) = 0.67, SWR = 5.06:1, and return loss = 3.3 dB. For the Lo-Z measurement, the measured forward signal was 1.02 V, the reverse signal was 0.696 V, and the TDR-Cable Radar Pro displayed ρ = 0.68, SWR = 5.25, and return loss = 3.3 dB. While these readings seemed somewhat reasonable, considering my ability to exactly read the oscilloscope display, I thought they were too far off from the expected 4:1 SWR. PreciseRF

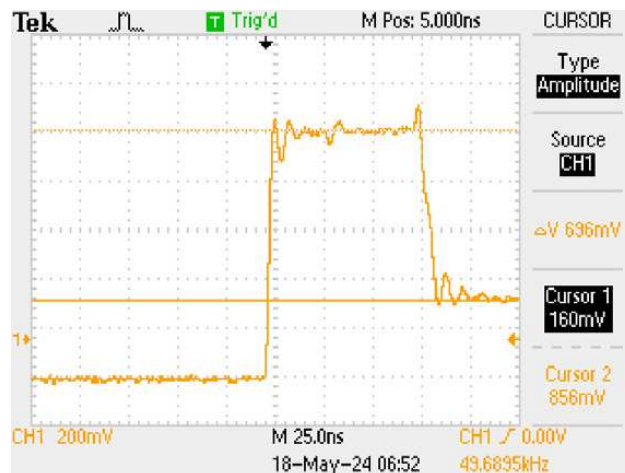


Figure 8 — Lo-Z 4:1 SWR measurement.



Figure 7 — Hi-Z 4:1 SWR measurement.



Figure 9 — Reflected pulse/cable-loss measurement.

looked into this and determined that there were two firmware issues: the formula that calculated the reflection coefficient was incorrect, and there was a screen that incorrectly labeled ZL as Zo. After correcting the firmware, PreciseRF sent me an updated TDR-Cable Radar Pro.

With the updated firmware, I repeated the tests. When I input the oscilloscope data, both the Hi-Z and Lo-Z readings gave TDR-calculated results of $\rho = 0.6$, SWR = 4.12:1, and return loss = 4.2 dB. So, if you have a TDR-Cable Radar Pro firmware version less than V2.10, the unit must be returned to PreciseRF for this to be corrected, as the firmware is in an EEPROM that is soldered in place.

Finally, I wanted to measure coax loss to see how it compared with specifications. I connected a 42-foot length (as determined by the distance-to-fault measurement) of RG8X that was shorted at one end. For this measurement, the pulse output is used. The TDR-Cable Radar Pro inputs are the actual coax length, the forward pulse amplitude, and the reverse

pulse amplitude. Using the oscilloscope cursors, I measured a forward pulse of 600 mV and a reflected pulse of 288 mV. Figure 9 is the pulse trace showing the reflected pulse amplitude. The TDR-Cable Radar Pro calculated loss was 3.3 dB/100 feet at 100 MHz. The specification for new RG8X is 3.262 dB/100 feet at 100 MHz.

Final Comments

The TDR-Cable Radar Pro is an excellent unit for determining many factors in a transmission system. The internal ability to calculate these parameters makes it very easy to use. It is important to note that no data is saved when you turn off the instrument. So, you must always re-select your cable parameters prior to testing.

Manufacturer: PreciseRF, 13690 Wisteria Dr. NE, Aurora, OR 97002, www.preciserf.com. Price: TDR-Cable Radar Pro, \$775 (+\$75 for a NIST calibration certificate); VZ500 Variable Terminator, \$125 (+\$75 for a NIST calibration certificate); 800 mA NiMH battery, \$45.

WA4MCMkits GM-102 SWR and Wattmeter Kit

Reviewed by Mark Wilson, K1RO
k1ro@arri.net

The GM-102 power and SWR meter kit from Don Friend, WA4MCM, covers 1.8 to 50 MHz and measures power up to 2000 W. The SWR/power sensor is built in its own enclosure and connected to the meter case with a 5-foot cable. Processing and display functions are handled in the main unit by an

ESP32-S3 microcontroller and 3.5-inch color thin film transistor (TFT) touchscreen. Three user-selectable meter face options are available for displaying forward power, reflected power, and SWR. A companion Windows application replicates the screen and some control functions on a PC. The unit requires a 12 V dc power source, and a small power cube is included.



Getting Started

The kit arrived in a small box with components cleverly packed, with virtually no extra space in the box. Components and hardware were packaged in clear plastic bags with labels detailing the contents (see Figure 10). For the most part, components within the bags were grouped according to when they are used during construction. The manual includes a comprehensive parts inventory list with photos of each part, along with helpful descriptions and component markings.

Documentation is excellent. The 60-page “Assembly Manual” PDF is available for download from the WA4MCMkits website (see www.wa4mcmkits.com/support-files). It includes color illustrations and photos, step-by-step assembly instructions, calibration and testing steps, troubleshooting help, and schematic diagrams. A separate 20-page “Operation Manual” details meter setup and operation, firmware updates, and the companion PC application.

Kit assembly requires basic workshop tools: a good soldering iron with a thin tip, diagonal cutters and needle-nose pliers, wire stripper, #1 and #2 Phillips head screwdrivers, several nut drivers or small sockets/wrenches, a ruler to measure wire lengths, and a multimeter. For calibration, you’ll need a nonconductive straight-slot screwdriver or alignment tool to adjust variable capacitors and resistors. I also used a printed circuit board (PCB) holder and headband magnifier to help with soldering.

Building the Kit

The GM-102 uses several PCBs. The builder installs through-hole components on a main board, an SWR/power sensor board, and a TFT display board interface. Any surface-mount parts are already installed. A small analog-to-digital converter (ADC) module requires just installation of a header connector. The TFT display and ESP32-S3 microcontroller boards are fully assembled and connect to the main board during final assembly.

Following the manual, I built the main board first. Each step includes a written description of the part(s) to be used, along with helpful tips. In many cases, the

Bottom Line

The GM-102 SWR/power meter kit is fun to build, simple to use, and accurate. The bright touchscreen display offers three meter face choices, and a companion Windows app can place the meter face and controls on your station computer screen.

assembly steps feature detailed photos with arrows or labels to show details such as electrolytic capacitor and diode polarity or connector orientation. With the clear instructions, component bag labels, component marking details/photos in the manual, and PCB solder mask labeling, it would be difficult to make a mistake if you pay attention. The solder pads are small, and some are close together, so I needed that headband magnifier. The only somewhat critical part of main board assembly is making sure that headers are installed flush and perpendicular to the board. The ADC and microcontroller boards will plug into these headers.

The TFT interface board is tiny and requires just soldering a right-angle 14-pin header and a 14-pin insulation-displacement contact (IDC) connector. Later on, this board will be used to connect the TFT display to the main board with a short ribbon cable.

The last board is for the SWR/power meter sensor, which will be built in a small aluminum box separate from the main unit. Construction begins with a transformer made by winding eight bifilar turns (two wires per turn) on a small toroid core. The manual shows how to make this transformer in six detailed steps with close-up photos. The kit includes red and green enameled wire for the transformer, along with a small piece of sandpaper to remove the insulation prior to soldering. The toroid core slips over a short piece of brass tubing soldered to the board. An included wood fixture made positioning and soldering the brass tube



Figure 10 — The GM-102 kit components.

easy. The rest of the SWR/power meter sensor board assembly is straightforward.

Final assembly goes quickly. Place the LM384 IC in its socket, and then plug the ADC and ESP32-S3 micro-controller modules into headers on the main board. The TFT display module and bezel mount in the cutout on the front panel, and a plastic “locking key” secures it. Connect a ribbon cable between the display module and main board, install and connect the rear-panel power switch, and you’re done. Figure 11 shows the completed main unit.

Final assembly of the SWR/power sensor box involves installing connectors and the PCB. A wire runs between the two SO-239 jacks, through the brass tubing that runs through the toroid core. Figure 12 shows the finished sensor unit.

Calibration

Initial testing showed that the meter display and touchscreen controls worked as expected. In addition to the detailed instructions in the “Assembly Manual,” WA4MCMkits offers a video demonstration of the calibration process on YouTube (see www.youtube.com/@wa4mcmkits704). I found that video to be helpful.

The first calibration step is balancing the sensor unit’s SWR bridge. You’ll need a transmitter capable of 100 W RF output on 40 meters and a 50 Ω resistive load. With everything connected, set the meter for the 20 W reflected power range, place the unit into the calibra-

tion mode from the touchscreen, transmit a steady carrier, and adjust the **BALANCE ADJUST** capacitor in the SWR/power sensor for a null using a tuning tool or nonconductive screwdriver. At first I was unable to find any null. After reading the “Troubleshooting” section in the manual, I traced the problem to an intermittent solder connection on the toroid in the sensor unit.

With the **BALANCE** adjustment completed, the next step is to calibrate the forward and reflected power readings in each of the three ranges. Note that with the latest firmware, you can choose either 20/200/2000 W or 10/100/1000 W for the full-scale forward and reflected power ranges. If you change your mind later on, you will have to go through the calibration process again for the new range.

The manual recommends two ways to perform the power calibration: comparing the GM-102 to a wattmeter of known accuracy, or using a calibrated RF probe. A third method, measuring the voltage at the sensor unit’s output with a multimeter and performing some calculations, is described but not recommended because of varying component tolerances.

I used my Array Solutions PowerMaster for comparison during the calibration procedure. Calibration is performed on the 40-meter band, with half-scale power levels (for example, 5/50/500 W for the 10/100/1000 W scales). There are six adjustments total, for forward and reflected power in each of the three power ranges. Transmit at the appropriate power level, and then adjust one of the six blue multi-turn variable resistors along the top of the main board until the



Figure 11 — The main unit assembled and ready for calibration using the blue variable resistors along the top left edge of the PCB.



Figure 12 — Inside the SWR/power sensor.

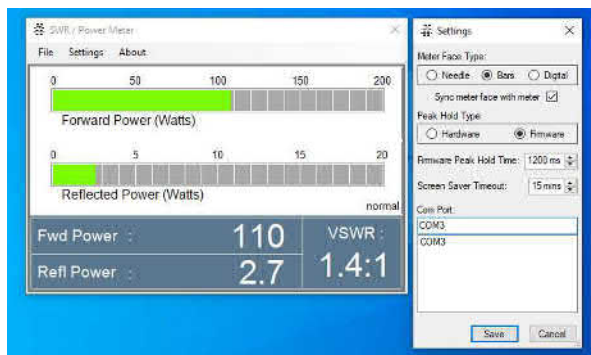


Figure 13 — The companion Windows application replicates the GM-102 display on a PC, and some parameters are adjustable from the pop-up **SETTINGS** menu. This is the **BAR GRAPH** display. You can also select the **NEEDLE** or **DIGITAL** displays described in the text.

GM-102 reading matches the reference power meter. The variable resistors are visible in Figure 11, and a corresponding LED lights so you know you're adjusting the right one.

Although the calibration procedure is performed at only 40 meters, I found power readings to be in good agreement with my PowerMaster on most bands. It was within 5% on 160 to 10 meters, and about 12% high on 6 meters. See Table 7 for the ARRL Lab's measurements.

Operation

All settings and controls are accessed via the touch-screen. The kit includes a small stylus, which I found helpful for touching some areas of the screen too close together for my fingers. Touching the gear icon in the upper left corner of the screen brings up a configura-

tion menu. From here, you can choose the full-scale power ranges (20/200/2000 or 10/100/1000 W), pick one of three meter face displays, set the screen-saver time-out, and adjust peak hold settings.

The **NEEDLE** meter face selection replicates a classic analog meter in the top two-thirds of the display, with a digital display of forward power, reflected power, and VSWR shown in the bottom portion. Touch the top section of the display to cycle through the three power levels. Switch the **NEEDLE** display between forward and reflected power by touching the lower section of the screen. I noticed that the **NEEDLE** screen flickered as the power reading changed, something not apparent in the other two meter face choices.

The **BAR GRAPH** meter face shows bars for forward and reflected power simultaneously in the top two-thirds of the screen, along with the digital display in the lower portion. You can adjust the power range of each bar independently by touching the screen (for example, 200 W forward and 20 W reflected). The third meter face (**DIGITAL**) fills the screen with large numbers for forward power, reflected power, and VSWR. This display is easy to read at a distance.

To smooth out display fluctuations on SSB or CW, the meter includes a selectable **PEAK HOLD** function (touch **NORMAL** or **PEAK HOLD** on the screen). Originally, **PEAK HOLD** was implemented in hardware, but the latest update adds a firmware implementation with hold time adjustable from 100 milliseconds to 2 seconds.

Table 7
WA4MCMkits GM-102 SWR and Wattmeter (Firmware V1.2.2)

Manufacturer's Specifications

Frequency range: 1.8 – 50 MHz;
calibration point: 7 MHz.
RF power range: 20/200/2000 W or
10/100/1000 W.
Accuracy: $\pm 10\%$ of full scale.
Insertion loss: Not specified.

Power requirements
Meter size and weight (height, width, depth)
Sensor unit size and weight (height, width, depth)

Forward Power

Frequency (MHz)
10 W CW
100 W CW

Forward power levels determined with calibrated Telepost LP-100A Digital Vector Wattmeter.

Measured in the ARRL Lab

As specified. Tested in amateur bands only.

As specified.

As specified. See measurements below.
1.8 MHz, 0.04 dB; 3.8 MHz, 0.09 dB;
7.175 MHz, 0.01 dB; 10.125 MHz, 0.03 dB;
14 MHz, 0.03 dB; 18.125 MHz, 0.08 dB;
21.2 MHz, 0.09 dB; 24.945 MHz, 0.09 dB;
28 MHz, 0.06 dB; 50 MHz, 0.28 dB.

9 – 15 V dc at 150 mA. At 13.8 V dc, 116 mA.
3.75 × 4.5 × 3.4 inches; 11 ounces.
1.6 × 3.25 × 2.25 inches; 4 ounces.

Indicated Power on GM-102

Frequency (MHz)	1.8	3.5	7	10	14	28	50
10 W CW	9.4	9.8	9.9	10	10	10.9	11.6
100 W CW	96.8	98.7	100	101	103	107	110

SWR (using 10 W input and resistive loads)

SWR
1:1
2:1 (25 Ω)
2:1 (100 Ω)
3:1 (150 Ω)
4:1 (200 Ω)

-----GM-102 Readings at Frequencies in MHz-----

SWR	1.8	3.5	7	10	14	28	50
1:1	1.0	1.0	1.0	1.0	1.0	1.1	1.1
2:1 (25 Ω)	1.8	1.7	1.7	1.7	1.7	1.6	1.6
2:1 (100 Ω)	1.8	1.8	1.8	1.9	1.9	2.0	1.8
3:1 (150 Ω)	2.6	2.6	2.6	2.7	3.0	3.0	2.9
4:1 (200 Ω)	3.7	3.7	3.8	3.8	3.8	4.0	3.7

While trying the GM-102 on various bands, I noticed that my receiver noise floor on 40 meters increased about 4 S-units from normal with the power meter switched on. I traced this noise to the wall cube power supply that came with the kit. Changing the GM-102 power source to my station power supply or a battery completely eliminated that noise.

Computer Interface

WA4MCMkits offers a companion Windows application that replicates the meter face and control menu on a PC screen. After I connected to my PC via the GM-102's rear-panel USB jack, I found that Windows 10 already had the needed drivers and created a virtual serial port for the GM-102. I found the COM port number in Windows Device Manager, selected that in the application, and connected to the GM-102, as shown in Figure 13. The display doesn't take a lot of screen space, so you can leave it up with logging or digital mode software or other applications.

WA4MCMkits has released several firmware updates to add features or fix bugs. The firmware update process uses the GM-102's USB jack and is described in the "Operation Manual" as well as a helpful YouTube video. The procedure involves downloading a file from the WA4MCMkits website, pressing a couple buttons on the ESP32-S3 microcontroller board, and loading the new firmware using a tool on the Adafruit website. The manual cautions that failure to follow the update steps exactly may result in "bricking" the unit, requiring repair assistance from the vendor.

Final Thoughts

I enjoyed building and using the GM-102. The outstanding packaging, instructions, and support videos make this kit a good choice for builders at any level. After calibration, the power and SWR readings were in close agreement with my high-quality station wattmeter. It would be a good addition to any HF station.

Manufacturer: WA4MCMkits, <https://wa4mcmkits.com>. *Price:* \$250 plus shipping.

New Products

Mastrant Rope Winder

Mastrant has released a new rope winder that can be used with ropes ranging from 1 to 6 millimeters in diameter. It is designed to allow the rope to be wound in a figure-eight shape to prevent twisting and looping. Various holes on its side are designed to catch and secure the ends of the rope conveniently. The hole in the middle is used to hold the winder with one hand when unwinding the rope. The winder is made of 2-millimeter aluminum sheet and can hold 160 feet of 3-millimeter rope, 100 feet of 4-millimeter rope, and 70 feet of 5-millimeter rope. You can purchase the rope winder for just over \$7 from www.mastrant.com.



Ask Dave

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

Grounding Issues and CW Tools

Keys, Paddles, and Keyers

Q Robert is starting to enjoy Morse code (CW) with a straight key. He asks: What’s the best key for learning iambic keying?

A Congratulations on discovering the alluring mysteries of CW! First, let’s define some vocabulary. The thing your hand touches is called a *key*. Just like a key to a lock, it’s either open or closed. A simple up-and-down motion that turns a circuit on and off defines the action of a straight key. Most people learn Morse code with a straight key. A straight key usually keys (turns on) the RF signal by direct connection to the transmitter. One issue with the straight key is that a radio operator who sends CW for hours may find themselves with a debilitating condition called carpal tunnel syndrome. There is a technique you can learn that involves moving your arm from the elbow with your wrist moving more fluidly to avoid this.

Hundreds of key designs have been introduced over the years, and a few have become standard technology. Thousands of classic J-38 straight keys were available after World War II, and even today, these are sought after as the standard to which all others are compared.

The next wave of keys was the semi-automatic *bugs*, so called because of the bug-like logo of the Vibroplex company that made keys. These keys, designed for expert operators, create a “dah” when the paddle is pushed one way, but when pushed the other, a spring and mass mechanism vibrate to generate “dits” automatically. The bug keys the transmitter directly.

The next step was to create a fully automatic keying system that has two parts. The first is the key, which makes contact with a wire when pressed one way and a different wire when pressed the other. Such keys are called *paddles*. One variation has a single paddle, but most come with two paddles, allowing both to be pressed at the same time. The classic set of paddles is the Bencher BY-1, and most paddles today are variations of this theme. I’ve had a BY-1 for decades, and they are still made today and readily available.

This introduced the concept of a *keyer*. The keyer interprets the motion of the paddle into dots and dashes sent to the transceiver. Nowadays, all new radios have keyers built in. Most have additional features, such as memories.

So, when we talk of an iambic keyer, we mean the device that interprets the motions of the paddles. Finding a keyer to practice with is harder because they are built into radios. Many radios have provisions to cause the keyer to create audible dits and dahs without actually keying the transmitter. However, practicing with paddles without using a radio requires a code practice oscillator that can create both dits and dahs. These are available but require some research. One inexpensive example is the Open CW Keyer, available for about \$30.

You’ll find that both new straight keys and paddles can be expensive. You can spend hundreds of dollars on a key. A father-son outlet called cwmorse.us sells a myriad of keys, including straight keys, paddles, and variations thereon. I have one of their straight keys and a set of their double paddles and can vouch for their quality.

Grounding and Length of Coaxial Cable

Q Don Dziubakowski, NO4T, asks: Can you explain your reasoning behind grounding both ends of shielded lines? Over the years, we were taught never to ground both ends of shielded lines unless the ground points were at the same potential, so I am surprised that you recommend it, especially because the grounds could be at different potentials. Regarding feed lines, feed-line length can impact the resulting signal sent to the antenna. Other sources seem to agree that certain lengths should be avoided if operating on a given frequency.

A There’s a lot going on here. First, let’s look at the issue of various ground rods being at different potentials. We solve this problem by bonding the ground rods together with a thick wire. The amateur best practices for grounding are found in the second edition of ARRL’s *Grounding and Bonding for the Radio Amateur*. In addition, your station’s ground rod

should be bonded to the ground rod at the entrance panel for your electric utility.

Regarding feed lines, I've also heard the old hams' tales of if your transmitter is 50 Ω out, your cable has a characteristic impedance of 50 Ω . Then if your antenna is also 50 Ω at the feed point, any length of coax will do, even that $1/4 \lambda$ coax. If your antenna is not exactly 50 Ω , then the antenna will not absorb all the power and will reflect some back. The reflection coefficient, written as Γ (capital Greek gamma), is a complex quantity, meaning it has both a magnitude and a phase angle. The standing wave ratio (SWR) is entirely a function of the magnitude of the reflection coefficient and is not affected by the phase angle. Because of this, adding extra length to your feed line affects the SWR very little because the percentage of reflected power stays the same.

If your SWR at a given frequency is less than 2:1, you can use your rig's built-in antenna tuner to set things right. If it's more than 3:1, you probably should address whatever is causing the problem. This can be caused by an antenna that's too long or short or antennas not being fed at the correct location.

The ARRL Antenna Book for Radio Communications comes with several software programs, one of which is called *Transmission Line for Windows*. You can use this simple software to look at many combinations of feed lines, including different line and antenna impedances.

Grounding in Bedrock

Q Jeremy Solmonson, KI0DAY, asks: How do I put in ground rods near the antenna when I have only 3 feet until I hit bedrock? I measured the depth of bedrock at multiple locations and found the bedrock takes up my entire yard.

A Many hams have this problem, which is addressed in ARRL's *Grounding and Bonding for the Radio Amateur*, available from the ARRL store. As shown in Figure 1, you can insert the ground rod at an angle until it is fully underground. If you don't mind digging a bit, create a trench 8 feet long and at least 30 inches deep. Then lay the ground rod at the bottom of the trench and make your connection using a crimp or welded (not soldered) connector. Pack the bottom of the trench with

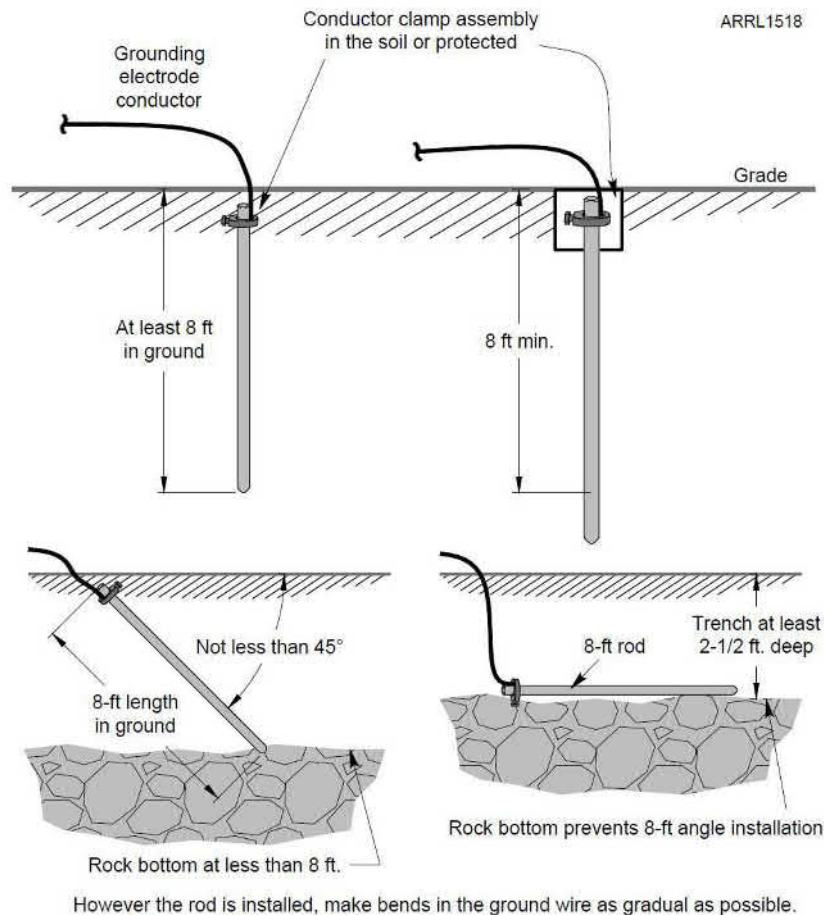


Figure 1 — This is Figure 6.1 from ARRL's second edition of *Grounding and Bonding for the Radio Amateur*. The bottom two diagrams show methods for getting an 8-foot ground rod entirely underground.

Ground Enhancement Material (GEM) before burying the ground rod. You can get GEM from an electrical supply house. Attach the ground to the antenna's radial plate and "bond" (connect) it to your main station ground rod. This bonding should also include the home's electric utility ground rod.

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

Microwavelengths

Transverters — Verifying Performance

The last three “Microwavelengths” columns described microwave transverters: the basic transverter, the local oscillator, and testing and troubleshooting. I hope that you have been inspired to attempt a transverter. At some point, you will want to verify its performance.

After bench-testing a transverter, it's time to make some contacts. The first one is usually across the backyard, with very loud signals, which can be misleading. Increase the distance to down the road, then a few miles, and finally, some real DX at tens or hundreds of kilometers.

If you can operate next to another station, perhaps at a rover site, you can compare signals. The North East Weak Signal Group and the San Diego Microwave Group get together to compare and measure stations. It is a chance to compare minimum discernable signal and transmit effective radiated power (ERP) tests on 10 GHz and higher bands. These tests require some dedicated equipment that most microwavers don't have. So, what can be done with simple equipment at a low cost?



Figure 1 — Measuring NF using a small horn to compare sun, sky, and ground noise. The reflector reduces unwanted ground noise when measuring sun and sky noise.

Verifying Performance

Relative transmit ERP is pretty straightforward. Detect the radiated signal with a second antenna at a reasonable distance using a power indicator or the tinySA Ultra spectrum analyzer and adjust for the maximum.

At microwave frequencies, performance is determined by the noise figure (NF) more than gain. Measuring NF is difficult. The tinySA Ultra can measure NF but

requires a calibrated noise source (a rare and expensive item). A more convenient noise source is the sun.

Until recently, measuring sun noise (see the “Microwavelengths” column in the July 2013 issue of *QST*) required dedicated equipment. The computer program *TotalPower*, developed by Mario Natali, IØNAA, makes it much easier. Only a laptop and low-cost RTL-SDR dongle are required. The dongle connects to the IF output of a transverter to detect noise and display a plot of the noise level.

Noise Figure

The NF of the receiver alone can be estimated by connecting directly to a small antenna and measuring the ground noise and cold sky. I connected my 10 GHz Earth-Moon-Earth (EME) preamp, as shown in Figure 1, directly to a feedhorn through a short waveguide. The wider beamwidth of the feedhorn might pick up some ground noise even when pointed straight up, so it is placed inside a spare dish that shields it from the ground but does not add any gain. The RF and power cables exit through the hole in the center of the dish. The noise is plotted by *TotalPower* in Figure 2. First, the horn is pointed at the sun, then at the cold sky higher than the sun. Finally, it is pointed at the ground to read ground noise. The cold sky section on the graph has two parts; the second part is with the dish reflector removed. The spike in the middle is when I removed the reflector. The cold sky noise level is slightly higher without the shielding effect of the reflector.

We measure the difference Y_{dB} between ground noise ($T_{ground} = 290$ K) and cold sky ($T_{sky} \sim 30$ K) to calculate the receiver system noise temperature T_{system} with the following equation:

$$Y_{db} = 10 \log_{10} \left(\frac{T_{system} + T_{ground}}{T_{system} + T_{sky}} \right)$$

To solve the equation for T_{system} , I used the nfskydb.xls calculator spreadsheet (see the *QST* in Depth web page) by Ed Munn, W6OYJ (SK). In Figure 2, the difference Y_{dB} is 6.1 dB; the calculated $T_{system} = 55$ K; the calculator also converts to the equivalent NF of 0.75 dB. The rated NF of the preamp is 0.6 dB, so the

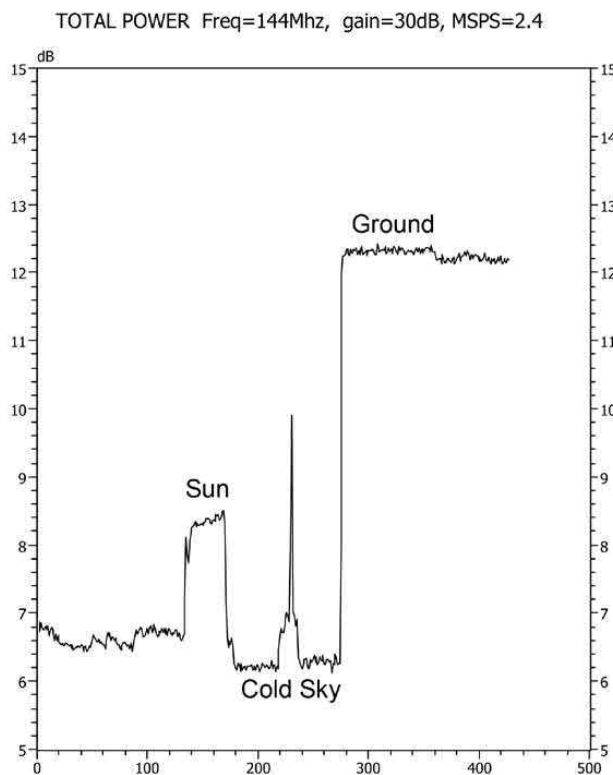


Figure 2 — The noise plot from the *TotalPower* program as a small horn is pointed toward the sun, cold sky, and ground, measured at the 144 MHz IF frequency.

shallow reflector probably didn't keep out all the ground noise.

System

I also pointed my 10 GHz rover system with an 18-inch dish at the sun, then at the cold sky, and finally at the ground to read ground noise, which is greater than the sun noise. *TotalPower* plotted the noise again, as shown in Figure 3.

This is a drift plot for about a half hour as the Earth rotates and moves the sun out of the beam of the dish until only the cold sky is left, which I verified by moving the dish to point straight up. At the end of the plot, I pointed the dish at the ground to read ground noise.

The difference between sun noise and cold sky in Figure 3 is about 2.3 dB. The sun's temperature is roughly 6,000 K, but the small dish only receives a small part because the sun (~0.5 degrees diameter) fills only a small part of the beam diameter (~4 degrees). For this small dish, the received sun noise is less than the ground noise. A large dish with a 0.5-degree beam would see the full sun temperature, perhaps 20 dB greater than the cold sky. Some EME stations have large enough dishes to see this much sun noise.

The difference between cold sky and ground is about 3.4 dB, so T_{system} calculates to about 189 K 3 (NF = 2.2 dB, for the transverter plus coax relay and cables).

Conclusion

With modest antennas, sun noise is a good indicator of decent system performance and is useful for comparisons, especially for system changes and improvements. The *TotalPower* program makes this much easier because you can't hear these small differences. To quickly check system performance with *TotalPower* even without the sun, put your hand over the feedhorn and look for an increase in noise.

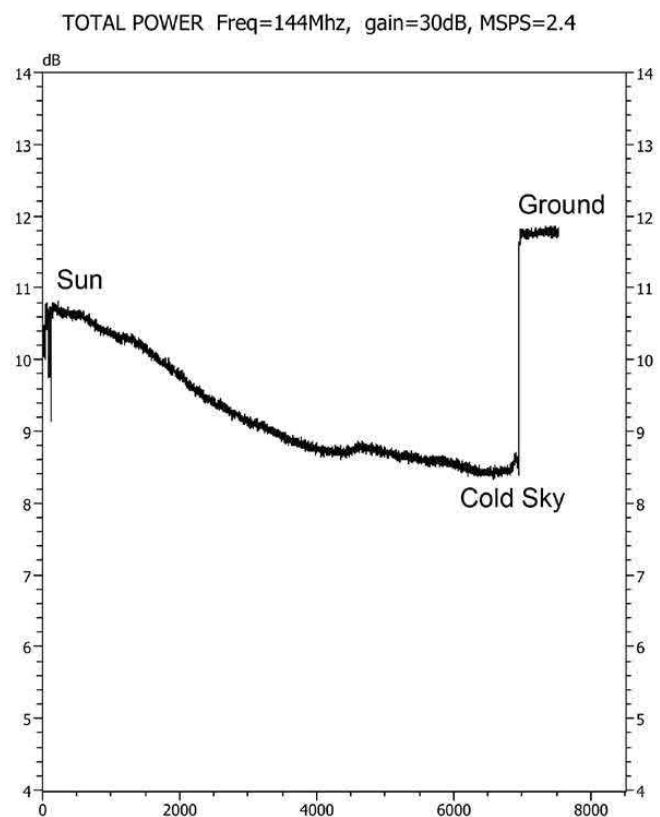


Figure 3 — 10 GHz transverter noise drift plot from *TotalPower* as the Earth rotates and moves the sun out of the beam of the dish until only the cold sky is left. Then the dish is pointed at the ground.

Microwave Update

The premier microwave conference will be held this year in Vancouver, Canada, on October 3 – 5, 2024. Find more details about the event at www.microwaveupdate.org. Hope to see you there!

See QST in Depth for More!

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

- The `nfskydb.xls` calculator spreadsheet

Technical Correspondence

Fixture for Programming PIC Processors with the PICkit™ 3 Programmer/Debugger

I started programming PIC microprocessors in 2002 using a PICSTART Plus programmer manufactured by Microchip Technology Inc. (www.microchip.com), the same company that makes the PIC line of processors. This programmer incorporated a zero insertion force (ZIF) socket that could handle processors with as many as 40 pins. However, this device is now obsolete and is not supported by Microchip's recent versions of the integrated development environment (IDE). So, I purchased a PICkit™ 3 programmer/debugger from Microchip, which is supported by their current software.

The PICkit 3 programmer is intended to program processors already installed on a PC board, and it can also be used for in-circuit debugging for many PIC processors — a particularly useful capability. Because of this design, it does not include a ZIF socket for directly programming a processor chip. However, I occasionally still need to program processors that have been removed from a PC board. This note describes the ZIF socket fixture I built for this purpose.

I purchased an inexpensive 40-pin ZIF socket from Adafruit Industries (www.adafruit.com) and soldered it onto a

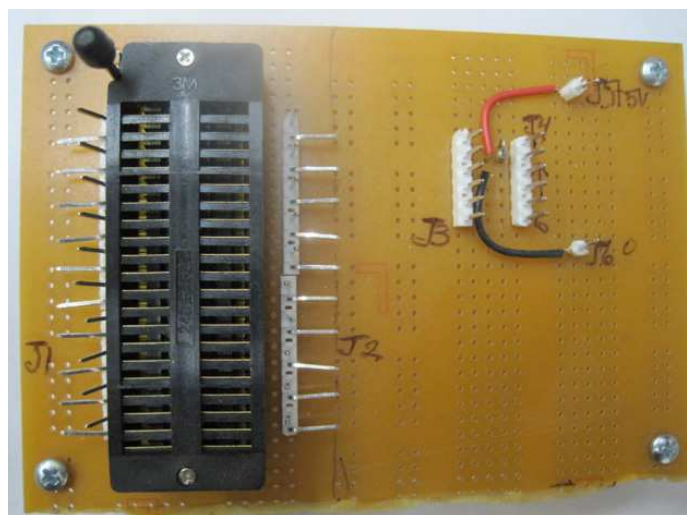


Figure 1 — The circuit board adapter used to program PIC microcontrollers. [Bill Kaune, W7IEQ, photo]

Table 1 — J3 Pin Assignments

Pin	Symbol	Function
1	Vpp/MCLR	Supplies processor's master-clear pin
2	VDD	+5 V to processor VDD pin(s)
3	VSS	To ground pin of processor
4	ICSPDAT	Programming data to processor
5	ICSPCLK	Programming clock to processor
6	Not used	Not used

small piece of prototype board that I purchased from RadioShack. Figure 1 is a photograph of the board and ZIF socket. Different PIC processors use different pins for power, ground, and programming. To provide flexibility, I soldered a 20-pin Molex (DigiKey WM4008-ND) header along each side of the ZIF sockets, with each header pin connected to the nearest pin of the ZIF socket. Figure 2 shows a schematic of the unit, and Table 1 features the J3 pin assignments. Headers J1 and J2 are the 20-pin units mentioned above. Located to the right of the ZIF socket are two six-pin Molex headers (J3 and J4). Below them are two one-pin headers (J5 and J6), which are used for the 5 V dc supply. An inexpensive alternative to this would be to place a USB socket on the board and connect pins 1 and 4 of the USB socket to J5 and J6, respectively, in addition to using a computer or a USB wall wart power supply.

I bent down every other pin of J1 and J2 almost parallel to the surface of the board to make room for the sockets that will attach wires to individual pins.

The PICkit 3 plugs into J4. I made a set of jumper wires that connect the pins of J3 to the appropriate pins of J1 and J2 to the ZIF socket. Figure 3 shows the jumper assembly. The

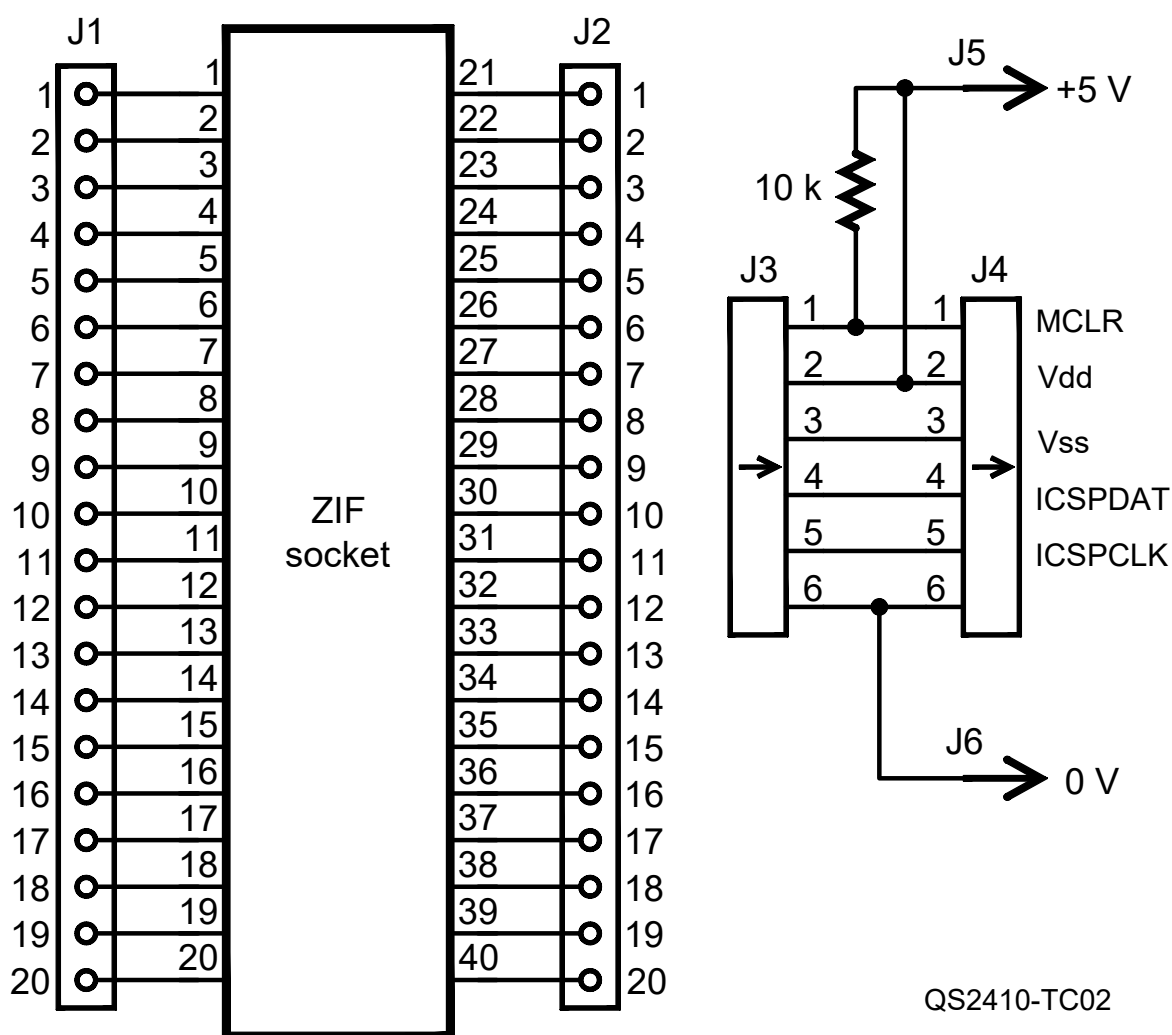


Figure 2 — The schematic of the adapter board.

six-pin female socket on the right plugs into J3. The one-pin female sockets on the other end of the wires were made by using a small diagonal cutter to cut one-pin sockets from a multiple-pin socket. Each socket requires a crimp terminal. I crimp and then solder these onto the end of a wire.

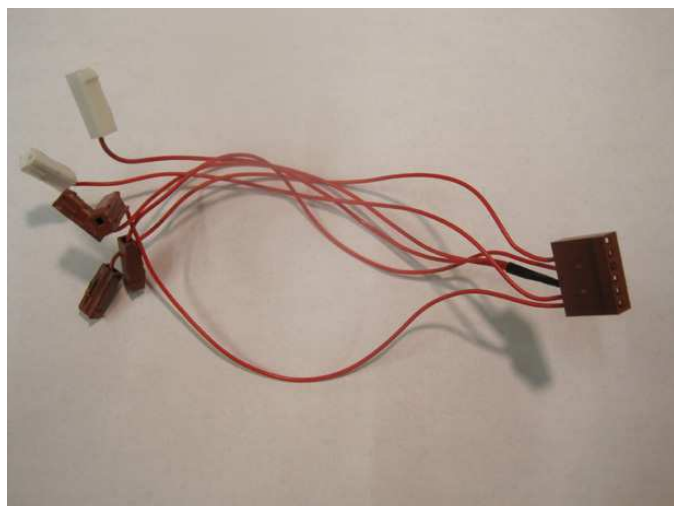


Figure 3 — The adapter's jumper cable used to configure the adapter board for differing PIC pinouts. [Bill Kaune, W7IEQ, photo]

To program a particular PIC processor:

1. Insert the processor in the ZIF socket.
2. Plug the PICkit 3 programmer into J4, and apply +5 V to J5 and ground to J6.
3. Connect the various jumper wires to the appropriate pins of the ZIF socket.
4. Connect the PICkit 3 to a computer running a recent version of Microchip IDE.
5. Instruct the IDE to program the chip. —
Bill Kaune, W7IEQ, w7ieq@arri.net.

Technical Correspondence items have not been tested by QST or ARRL unless otherwise stated. Although we can't guarantee that a given idea will work for your situation, we make every effort to screen out harmful information.

Materials for this column may be sent to tc@arri.org. Please include your name, call sign, complete mailing address, daytime telephone number, and email address on all correspondence. Whether you are praising or criticizing a work, please send the author(s) a copy of your comments. The publishers of QST assume no responsibility for statements made herein by correspondents.

A Visit to the RSGB National Radio Centre

The former ARRL Chief Operations Officer visited our sister society and made a special contact.

Harold Kramer, WJ1B

The Radio Society of Great Britain (RSGB) National Radio Centre (NRC), located in historic Bletchley Park in Milton Keynes, England, is a must-see for any amateur radio operator visiting England. It is operated by RSGB, ARRL's sister society in England. Bletchley is also the home of a separate attraction, the National Museum of Computing.

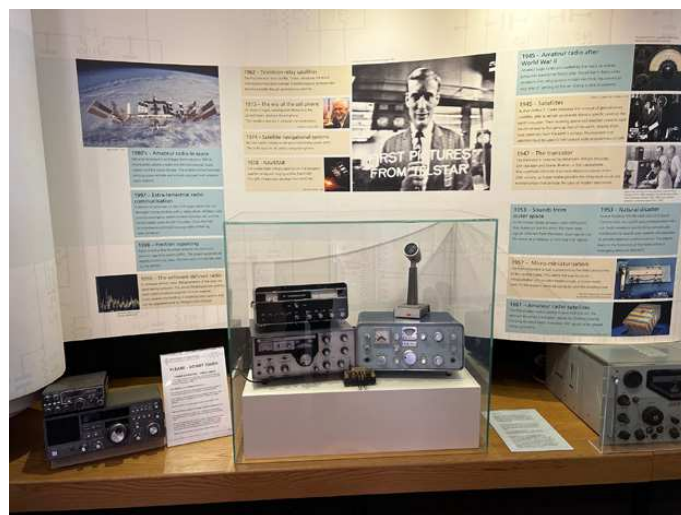
Bletchley Park, located on a sprawling 50+ acre site in the countryside, was the top-secret center of the Allied codebreakers during World War II, where messages from the German Enigma machine were decrypted. It is open 7 days a week all year long (excluding Christmas, New Year's Day, and the days surrounding them).

I had the pleasure of visiting the NRC in May 2023. I was welcomed by NRC Coordinator Martyn Baker, G0GMB, who manages the facility, and RSGB General Manager Steve Thomas, M1ACB. Martyn told me that except for the original mansion at Bletchley Park, the buildings at the site were built plainly to avoid being detected by the enemy during the war.

The NRC is an education center and a showcase for amateur radio technology that was built and financed by RSGB. It features exhibits and displays where visitors can learn not just about amateur radio, but the basic principles of radio and the history of radio communications.

When you enter the NRC, there is a reception area and a theater with an introductory video. Past the reception area are exhibits about amateur radio's past, present, and future technology. Another display describes the operation of fundamental radio circuits, and there is a colorful and instructive display of radio frequency spectrum usage.

The NRC's displays of World War II and Cold War radio equipment focus on amateur radio's contribution to the wartime decoding efforts. At the outbreak of the war in 1939, the British Secret Intelligence Service established a unit known as the Radio Security Service



An NRC exhibit detailing the timeline of radio technology.

to detect and monitor enemy radio transmissions. Volunteer radio amateurs were recruited by RSGB, and they became known as the Voluntary Interceptors. They were skilled CW operators who monitored enemy Morse code transmissions, which were sent to Bletchley for decoding and analysis.

I was particularly impressed with the special exhibit about getting started in amateur radio. It displays inexpensive equipment, such as VHF/UHF handhelds, that illustrates how a person can participate in amateur radio without spending a lot of money. Additionally, the NRC is the home of GB3RS, a fully operational station that — like W1AW — is open to visitors and used by licensed operators.

According to Martyn, the NRC welcomed just short of 90,000 visitors in 2023. Most of these visitors were non-hams who came to visit the Bletchley Park Museum. He said that “on a quiet day, the NRC receives about 100 visitors, but on a busy weekend, there are between 400 and 700 visitors each day.” He added, “Typically, from the large group of visitors, we might expect three to five visiting radio amateurs each day, although this varies considerably.”



The author at GB3RS completing a scheduled contact with W1AW.

Having visitors from the general public is a great way to introduce people to amateur radio. There is plenty of informative literature available at the NRC. The 55 friendly and knowledgeable volunteer guides at the NRC can also speak to visitors about the topic. Martyn, who manages this team of dedicated volunteers, told me that on weekdays, at least two volunteers are always on duty when the NRC is open. Four volunteers are usually available on weekends. While I was there, members of the South Normanton, Alferton and District Amateur Radio Club were visiting and operating GB3RS.

About GB3RS

GB3RS, located inside the NRC, is a state-of-the-art amateur radio station that was built to be a public demonstration of amateur radio communications and a showcase for amateur radio technology. It uses a FlexRadio FLEX-6600 with a Gemini amplifier and a three-element SteppIR Yagi for SSB, CW, and digital mode coverage from 10 through 50 MHz. On 80 and 40 meters, a Yaesu FTDX5000 is used for SSB, CW, and digital modes, and it is connected to resonant dipoles strung between the buildings.

A Kenwood TS-2000 is used for local VHF and UHF FM repeaters on 2 meters and 70 centimeters. It's also used for polar orbiting satellite communications via crossed circular polarized horizontal and vertical satellite antennas, with PC control of elevation and azimuth. An Icom IC-9700 is used for 2-meter and 70-centimeter SSB, CW, FT8, and D-STAR with dual

2-meter/70-centimeter horizontally polarized beams. For OSCAR 100 (QO-100), a Yaesu FT-818 and an SDRplay with *SDR Console* software is used with a separate dish for receive and an offset patch feed antenna for transmission.

Licensed US amateurs can operate the station if they hold an Amateur Extra- or Advanced-class license. Guest operators must bring a copy of their license and provide a photo ID. Although you can simply stop in and operate during a visit, RSGB cannot guarantee operating time without a prior booking.

W1AW Contact

I thought that it would be interesting to have a scheduled contact between GB3RS and W1AW while I was visiting the NRC. I arranged a date and time with W1AW Station Manager Joe Carcia, NJ1Q, to give it a try. We agreed to attempt our contact at 14:00 UTC, which is 10:00 AM at W1AW and 3:00 PM at GB3RS.

At GB3RS, we used the FLEX-6600 running 400 W (the maximum power allowed in England) to their SteppIR Yagi. At W1AW, Joe was using a Yaesu FTDX9000 with a Quadra amplifier on 14.309 MHz while running 800 W into W1AW's 20-meter beam on the 120-foot tower.

On our first try, we could barely hear W1AW on 20 meters. We later decided to try 15 meters because the propagation-prediction websites indicated that this would be a better path. With W1AW using the four-element Yagi on the 60-foot tower, their signal was 59 on 21.235 MHz in England. All of the visiting club members, volunteers, and RSGB staff members enjoyed the contact between the two sister societies. You can watch it on RSGB's YouTube channel at www.youtube.com/theRSGB — just search the channel for my name.

If you are visiting England, Bletchley Park is a scenic, 45-minute train ride from London, and it is definitely worth a visit.

All photos provided by the author.

Harold Kramer, WJ1B, was first licensed in 1962 as KN1ZCK. He was the Publisher of *QST* and Chief Operating Officer of ARRL from 2005 until his retirement in 2016. He began his career in the emergent cable television business in 1973 and remained in that field until 2000, when he became Chief Technology Officer of Connecticut Public Broadcasting. He holds degrees from the University of Connecticut and the University of Hartford. Harold can be reached at wj1b@arrrl.net.

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



What to Expect from the Solar Cycle 25 Surge



The highest sunspot activity since 2002, combined with revolutionary advances in digital communications technology, make this the most productive solar maximum ever for HF operators of every license class, especially for those using low power in challenging environments.

Frank Donovan, W3LPL

This article provides insight into how the solar maximum greatly enhances HF and 6-meter propagation and provides practical advice about capitalizing on solar maximum propagation over the next 2 years and maybe more. Written from a North American operator's perspective, its general principles apply globally.

HF operators during the Solar Cycle 25 solar maximum often focus on the dramatically improved 12- and 10-meter daytime global propagation that began in January 2023. However, solar maximum also greatly enhances 40- through 10-meter nighttime propagation. Enhanced day and night solar maximum propagation is expected to continue for all license classes through 2026. Figure 1 shows NASA's sunspot number forecast through 2032.

HF operators benefit from the increased sunspot activity and the revolutionary advances in digital communications technologies such as FT4 and FT8 that provide good communications under weak-signal conditions. The new technologies opened global HF DXing to operators with even the most basic HF

stations, especially when operating under challenging conditions.

Fully automated DX spotting networks such as PSK Reporter and DX Maps capitalize on very high levels of global FT4 and FT8 activity to provide all HF and 6-meter operators — regardless of mode preference — with unprecedented real-time knowledge of global propagation. The Reverse Beacon Network provides similar capabilities for digital and CW operators. Spotting networks can also provide real-time reports of how well an operator's transmissions are being received globally.

Activity alerting services such as HamAlert provide automated real-time notifications when specified stations are active, making tedious manual searches for call signs, DXCC entities, CQ zones, etc., no longer necessary.

10- and 12-Meter Propagation

Ten- and 12-meter global propagation improved suddenly and dramatically beginning in January 2023. Both bands provide reliable global propagation from dawn through at least early evening most of the year, except during the annual 3-month summer decline of the F2 region maximum usable frequencies (MUFs).

Reduced F2 region MUFs that significantly degrade 10- and 12-meter propagation every summer are unrelated to the solar maximum. Instead, reduced summer MUFs are caused by seasonal high-altitude hemispheric winds blowing atoms and molecules from the dayside to the nightside F2 region. Strong winds in the northern hemisphere from mid-June to mid-October significantly deplete the volume of essential oxygen atoms, which are one of the most important sources of atoms and molecules needed for ionizing the F2 region, and the resulting elevated MUFs.

Ten- and 12-meter horizontally polarized antennas only 20 feet high produce adequate low-angle radiation

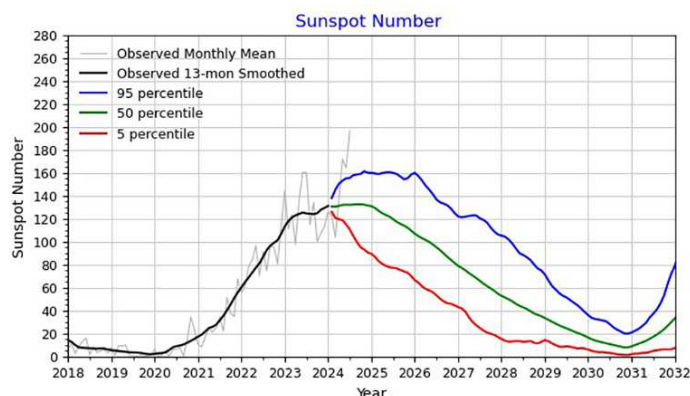


Figure 1 — This graph shows NASA's sunspot number forecasts from August 8, 2024. This graph is updated monthly through 2032. The unexpected July and August surge in sunspot activity is likely to produce future sunspot activity corresponding to the blue curve or perhaps much higher. Visit www.nasa.gov/solar-cycle-progression-and-forecast for more information and updates before the 10th of every month. [Photo courtesy of NASA]

to support reliable global communications. However, similar antennas at that height for other HF bands do not produce sufficient low-angle radiation for reliable global communications.

US Technician-class licensees are authorized to operate in the bottom 500 kHz of the 10-meter band, providing excellent opportunities for worldwide DXing. By using alerting services such as HamAlert, DXCC and other awards can be easily achieved using modest stations during the next 2 years.

15- and 17-Meter Propagation

Reliable 15- and 17-meter global propagation is expected to occur from dawn to late night during most days through 2026, after which both bands will gradually become mostly daytime bands. Low power is particularly effective on 17 meters because stations using high power and large antennas are less prevalent than on 15 and 20 meters.

20-Meter Propagation

Twenty meters has been the workhorse day and night DX band for 100 years. Since 2023, solar maximum has improved global propagation so much that it's now nearly a 24-hour DX band during most of the year. Unfortunately, 20 meters is a poor DX band during summer midday hours, especially during the solar maximum years. From several hours before noon until several hours after noon during most summer days, the ionosphere's much lower-altitude E region reflects 20-meter propagation mostly to ranges less than 2,200 kilometers (1,300 miles). This prevents propagation to the high-altitude F2 region necessary for almost all 20-meter global propagation.

30-Meter Propagation

Solar maximum combined with FT4 and FT8 digital communications radically transformed 30 meters into a major global DX band. Global propagation begins several hours before sunset and continues throughout the night until several hours after sunrise almost every day of the year. Low power is particularly effective because few 30-meter stations use more than 100 W, and large, high antennas are not widely used. Low power and simple antennas will continue to provide excellent global coverage nearly every night of the year through 2026, after which middle-of-the-night global propagation will gradually degrade.

40-Meter Propagation

Forty meters has been the workhorse nighttime DX band for 100 years. Solar maximum transformed it into an exceptionally reliable DX band from dusk

throughout the night until after sunrise. Solar maximum almost eliminated the propagation dropouts that occur frequently during winter nights throughout the solar minimum. Forty meters is particularly effective for low-power DXers because high power and large antennas are not in as widespread use as they are on 20 meters. Low power and simple antennas provide excellent global coverage every night of the year throughout the 11-year solar cycle.

80-Meter Propagation

Eighty-meter global propagation is moderately degraded during solar maximum years. Late nights continue to provide excellent propagation opportunities, particularly during the hours near midnight and for about an hour before sunrise, especially from November through February. Low power and simple antennas produce surprisingly good global coverage during many late nights in the winter. Global 80-meter propagation will gradually improve as solar maximum begins to wane after 2026.

160-Meter Propagation

Global propagation on 160 meters significantly degrades during solar maximum years. Although global propagation occurs regularly from November through February, only operators with efficient vertically polarized antennas can usually capitalize on it. Many operators overcome degraded 160-meter propagation by using FT8 digital communications. Global propagation will gradually improve as the solar minimum approaches in about 2030.

6-Meter Propagation

Six-meter propagation greatly benefits from the solar maximum from October through April during strong solar cycles. While Solar Cycle 25 has so far produced only very infrequent transatlantic 6-meter F2 propagation, 6-meter DXers should be alert for the likelihood of transatlantic F2 propagation from late October 2024 to February 2025 if sunspot numbers persist significantly higher than 200 for about a week or more. Figure 2 includes the Sunspot Index and Long-Term Solar Observations' (SILSO) estimated daily international sunspot numbers for July and August 2024 and the average monthly international sunspot number for August 2024.

Transequatorial propagation (TEP) from the northern to the southern hemisphere occurs frequently during solar maximum from late March through early May and less frequently from late October through early November. Stations in the Caribbean, Central America, and occasionally those in the southern tier of the US

states experience strong TEP much more frequently than those in northern locations. Northern stations propagate into the southern hemisphere only when more northern sporadic-E or F2 propagation couples them into TEP propagation.

Basic Antennas for Global HF and 6-Meter Communications

Simple horizontally polarized antennas such as half-wave dipoles, end-fed half-wave (EFHW) antennas, or unobstructed quarter-wave verticals can provide global DX contacts every day of the year throughout the 11-year solar cycle. The minimum recommended heights of horizontally polarized half-wave dipoles, EFHWs, and Yagi antennas capable of providing adequate low-angle radiation for reliable global communications are listed in the table below. Doubling these heights is not necessary, but it will significantly improve their low-angle performance.

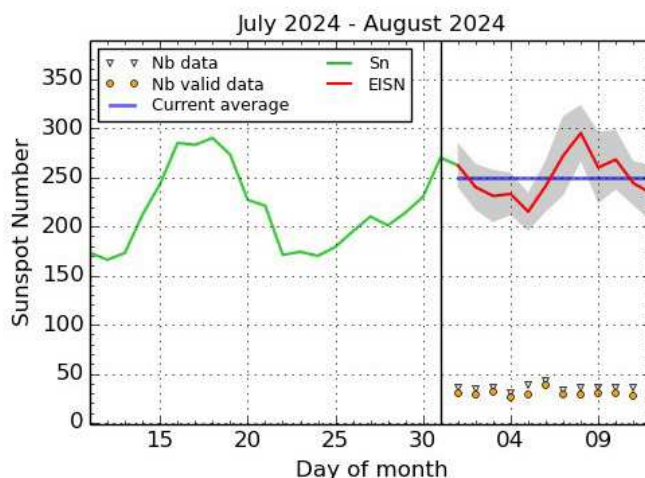
Minimum Recommended Heights of Horizontally Polarized Antennas	
Band	Minimum Height
10 meters	20 feet
12 meters	20 feet
15 meters	25 feet
17 meters	30 feet
20 meters	35 feet
30 meters	45 feet
40 meters	50 feet
80 meters	50 feet

Horizontally polarized antennas for 160 meters perform poorly at any height for global propagation, while inverted-L or vertical antennas with at least 40 feet of vertical wire are much more effective. Inverted-L and vertical antenna performance is improved significantly by increasing the length of their vertical wire to about 70 feet.

Six-meter vertically polarized antennas are poor DX antennas. A small Yagi on a 20-foot mast can make many DX contacts (see Joe Reisert's, W1JR, article "Simple, Small 2- and 6-Meter Yagis" in the June 2024 issue of *QST*). Its performance can be improved significantly by raising its height to as much as 50 feet. Small, lightweight Yagi antennas ideal for portable operations are particularly effective when installed only 20 feet high over sloping, unobstructed terrain.

Further Reading about Antennas and Propagation

ARRL's book *Here to There: Radio Wave Propagation* presents the principles of radio propagation in an



SILSO graphics (<http://sidc.be/silso>) Royal Observatory of Belgium, 2024 August 12

Figure 2 — The red and green curves show the unexpected surge in daily sunspot numbers for July and August. The blue line shows the average sunspot number for August. Visit www.sidc.be/SILSO/eisnplot for more information about the estimated international sunspot number and frequent updates of this graph. [Photo courtesy of SILSO]

easy-to-understand style. The propagation chapter in the 100th edition of *The ARRL Handbook* is a superb source of detailed propagation information. The 25th edition of *The ARRL Antenna Book* is the ultimate source for basic and detailed antenna information.

I'd like to offer a special thank you to my article reviewers John Dorr, K1AR; Domenic Mallozzi, N1DM; Thomas Greenwood, W1ER; Joseph Reisert, W1JR; Rick Miller, N1RM; Jim Pierson, Jr., N1SZ; Nicholas Elias, N3AIU; Thomas Valenti, K3AJ; Michael Cresap, W3IP; Michael Dodd, N4CF; Carl Luetzelschwab, K9LA, and Daniel Hausauer, W0CN. They provided valuable comments that made this article much more useful to readers.

See QST in Depth for More!

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

- Record High Solar Cycle 25 Solar Maximum Sunspot Numbers Impacts

Frank Donovan, W3LPL, began his ham radio adventures at age 12 during the Providence Radio Association, W1OP/1, 1959 Field Day. His multioperator teams have made more than 1 million DX contacts in CQWW and ARRL DX contests. Frank contributed to the updated propagation section of the 100th edition of *The ARRL Handbook*. He retired 13 years ago as a chief engineer at General Dynamics Corporation. He can be reached at donovanf@erols.com.

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



The 222 MHz Amplifier Project

Seventeen amplifiers were built and distributed around the country in an effort to generate more activity on this underutilized band.

Dave Olean, K1WHS

The 222 MHz band has been around since 1934. Being authorized only for amateur use in International Amateur Radio Union Region 2 (the Americas), growth on this band has been lethargic because few manufacturers build equipment that includes it. Most activity on 222 MHz today involves FM and repeaters for local communications. Most hams think only FM is used, but there's a small and dedicated group of weak-signal DXers that have consistently used it for DXing.

A lack of readily available equipment for FM, SSB, and CW has limited participation on the band, and with activity lacking, our 220 to 225 MHz allotment has been ripe for the picking by other commercial interests. In the 1970s, the FCC considered turning 220 MHz into a new citizens band, and in 1988, they removed the bottom 2 MHz of the band and gave it to commercial and government land mobile interests. Any thought of building or converting equipment for the band was squashed by the thought of losing the rest of it soon after — the 222 MHz band has struggled ever since.

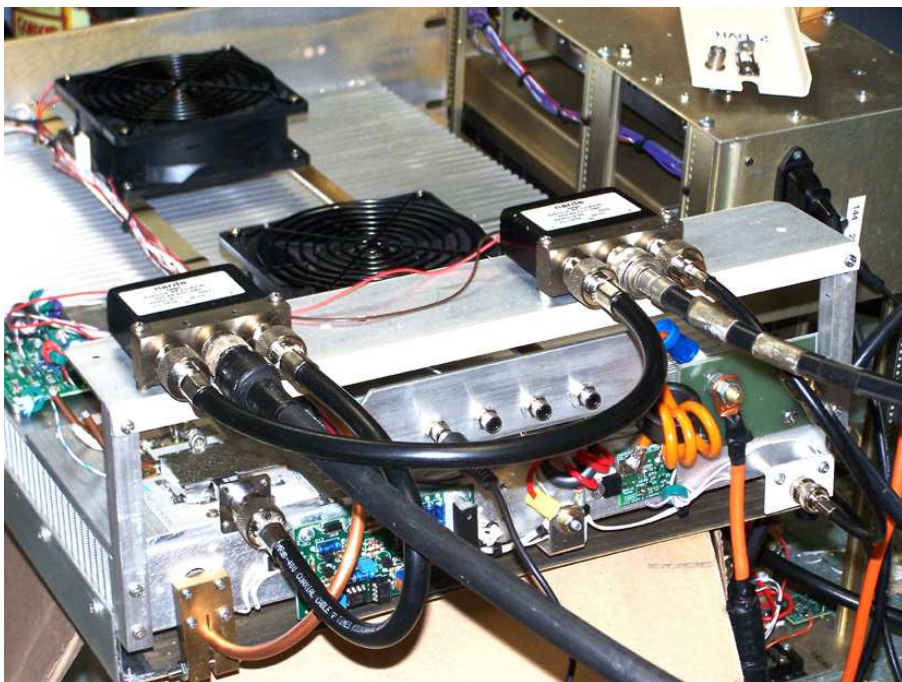
Encouraging 222 MHz Operations

Very few hams have made contacts in all 50 states on 222 MHz. There was a flurry of activity in the mid-1980s, when 10 amateurs achieved their Worked All States (WAS) Award. Contacts were made using propagation modes, such as tropospheric ducting, meteor scatter, aurora reflections, and Earth-moon-Earth (EME) communications. Another surge in activity for WAS hunters on this band is currently in progress, and some awards have been issued during the last 3 years.

I have long felt that I should promote the band and thought that dedicating one evening a week for hams to make contacts on it would help. With that, a number of hams started a Tuesday evening practice.

The 222 MHz band can provide DX excitement with contacts out to 500 or 1,000 miles on CW, SSB, or digital modes with today's amateur equipment. To get started, you should have at least 100 W and a decent Yagi antenna with low-loss coaxial cable.

VHF DXers searching for elusive contacts from all 50 states on 222 MHz have been relying on portable meteor scatter and EME expeditions to achieve their goals. While folks like Peter Van Horne, KA6U; Gene Shea, KB7Q; Wyatt Dirks, AC0RA, and others have provided many new states and grids for hunters, I thought it would be nice to have some 222 MHz capable stations active in some of the rarer states on a full-time basis. I planned to provide 1500 W solid-state amplifiers to as many of the rarer states as possible. When a local TV station was transitioning to digital TV, I was able to obtain a supply of 1500 W TV amplifier pallets — all I had to do was convert them into something that hams could use. The units had to be simple to operate and have suitable protection circuits and adequate cooling. I was fortunate, as the Larcant transmitters were designed for high VHF TV channels and would work well on the 222 MHz band with no RF



One of 17 Larcant solid-state amplifiers built for use on 222 MHz.



Amplifier construction took many hours to complete.

modifications. These RF amplifiers could provide a solid foundation for hams to start using meteor scatter and EME modes.

If you're not familiar with the latest practices on VHF, you might be surprised to learn that you can make EME contacts on 222 MHz with just a single Yagi aimed at the horizon. You need a good receiver and low feed-line losses, but the task is not that difficult today. Having a 1500 W amplifier makes all of this more than possible (some EME contacts have been made with less than 500 W). The secret is using *WSJT-X*, specifically the JT65 and Q65 modes, which allow you to decode signals that are 10 to 15 dB weaker than that of a CW signal (you no longer need antennas as big as your house for EME operations). My ideal 222 MHz EME station would consist of an HF transceiver and a transverter for 222 MHz that could drive my 1500 W solid-state amplifier. Two 16-element



In the digital edition of *QST* (www.arrl.org/qst), Dave Olean, K1WHS, talks with Mike King, KM0T, a Larcan amplifier recipient, about how the amplifier has impacted his operations on 222 MHz.

Yagis on a small azimuth elevation rotator would work fine. A single 5 wavelength Yagi would also work well.

Building and Testing the Amplifiers

I ordered connectors, Teflon wire, nuts and screws, chunks of 1/4-inch semi-rigid coax, circuit boards, low-pass filters, and metal panels. Retired Apollo Program Engineer George Whitehead, W1BOF, helped me assemble and tune the filters.

Once all the amplifiers were finished, it was testing time. The routine involved connecting a suitable exciter that could develop about 35 W at 222 MHz. A large, 50 V dc power supply was connected, and an amplifier was then attached to a large attenuator. Actual power output was then measured. The amplifier keying circuits were checked and transmit duty cycles evaluated, testing the effectiveness of the cooling system. (This Larcan solid-state amplifier has a huge heatsink that's roughly 15 × 21 inches, so we mounted several fans above the heatsink to blow cool air across the metal fins while the amplifier is in operation.) A few temperature measurements are made of critical field-effect transistors to make sure that they're all properly installed and will handle the high-power levels that the amplifier is able to produce.

It's very gratifying to see an amplifier working well, and interesting to catch a few errors made during construction.

Distribution

We wanted to place amplifiers where they could foster more activity. The plan was to give precedence to rare states ahead of areas that had suitable activity with stations that were already capable of EME and meteor scatter operation. I questioned DXers across the country for candidates at the start of the project. I also posted notices on various VHF email reflectors. Of course, there were many responses from active states, but only a few from rare states.

There's been a considerable amount of activity in New England and the Mid-Atlantic states during our Tuesday night practices, but there was little activity in other, more remote areas at first. One remotely located station — Walter Miller, AJ6T, in Tennessee — always appeared during the Tuesday evening practices. He had a single Yagi and 10 W but joined every Tuesday night making FT8 or other digital contacts beyond 400 miles — that's dedication! He upped his power to 30 W and extended his range slightly. He was a prime candidate for one of the amplifiers. Now, he's capable of making meteor scatter and EME contacts from the rare state of Tennessee.



Dave Olean, K1WHS, ready to distribute some of the amplifiers.

Positive Results

Now that all of the amplifiers have been distributed, new stations are appearing on the band. Contact totals are slowly increasing and the future is looking a little brighter for 222 MHz WAS. So far, 18 such WAS certificates have been issued. I'm hoping that the next batch of 222 MHz WAS awards might become a bit easier to achieve once the 222 MHz amplifier project kicks into high gear. Time will tell, but the combination of having regular Tuesday night activity, plus the proliferation of many high-power amplifiers in rare states with some very dedicated operators, bodes well for the future of the 222 band.

All photos provided by the author.

Dave Olean, K1WHS, has been an active ham since 1962. He's a veteran of the US Army Signal Corps and has been employed in the antenna industry for many years, working for Cushcraft Corporation and others. In 1994, Dave started Directive Systems. He retired in 2013 and has been spending his time VHF and 160-meter DXing. Currently, he's promoting DX activity on the 222 MHz band. Dave can be reached at k1whs@metrocast.net.

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Strays

Ulrich Rohde Seminar Available

On May 7, 2024, Ulrich Rohde, N1UL, presented a seminar titled "Problems and Solutions in HF/UHF Systems" as part of the Massachusetts Institute of Technology's Microsystems Technology Laboratories Spring 2024 Seminar Series. The abstract of the seminar indicates, "Military communications stations using many setups with closely spaced antennas (Shipboard operation) can be overwhelmed by cosite problems. A typical problem is reciprocal mixing and blocking/desensitization. This presentation explains the mechanism [of] how these interferences occur and how, for a practical system, they can be minimized. As a working example, the modern SDR transceiver architecture is selected." The seminar is available as a PDF at www.mtl.mit.edu/sites/default/files/media/documents/2024/ulrich-l-rohde-sdr-talk_2019.pdf.

YOTA Camp: More than Just Ham Radio

Two young hams detail their memorable experiences at last year's camp.



2023 YOTA campers, staff, and chaperones outside of Carleton University's Mackenzie Engineering Building.

Abby Kimi Matsuyoshi, KK7CFJ, and Jack Roberts, W9RFT

"I am ready for questions, over," said NASA astronaut and SpaceX Crew-6 Mission Commander Stephen Bowen, KI5BKB. At that moment, we felt a rush of excitement. We couldn't believe it was happening; our dream of contacting an astronaut in space became a reality at the 2023 Youth on the Air (YOTA) in the Americas camp, a week-long summer camp for young operators aged 15 to 25 who are from North, Central, and South America.

Under the guidance of Ruth Willet, KM4LAO, and the Amateur Radio on the International Space Station (ARISS) program, eight YOTA campers were selected to ask Bowen questions within a 10-minute period. A total of 17 questions were asked that covered topics like life on the ISS and how contacts were logged and sent to ground stations. Even though the contact seemed brief (and the campers could've asked count-

less more questions), the experience will never be forgotten. This is just one of many incredible experiences at YOTA camp.

Camp Details

The goal of the YOTA camp program is to build skills as well as foster lasting friendships and mentor relationships with younger operators. Last year, 29 young people from all over the US, Canada, and Argentina, as well as guests from Germany and Croatia, participated in the camp at Carleton University in Ottawa, Canada. Throughout the week, young operators led activities and sessions for campers on various topics, such as Parks on the Air® (POTA) operations, building kits, learning CW, foxhunting, satellite passes, and making HF station contacts, among others. In addition to operating the YOTA camp shack using the special event call sign VE3YOTA during free time, campers had the honor of operating at Diefenbunker: Canada's Cold War Museum.



Abby Kimi Matsuyoshi, KK7CFJ, holds the tracker balloon during the final preparations before launch. The balloon was tracked until contact was lost 428 miles northeast of Ottawa.

Making Everlasting Friendships

Outside of the countless fun ham radio activities we participated in, we also spent time forming unforgettable friendships with fellow campers. For several campers, this was their first time meeting other young operators in person outside of where they lived. Memorable activities included watching the Northern Lights sound and light show on Parliament Hill, a fun-filled day at Calypso Waterpark, and evening gaming sessions playing Super Bomberman in the lounge.

YOTA camp is valuable because there are many different facets of ham radio that each camper can enjoy. So, if a question arises, whether it be general or specific, we all now have a strong network of hams to turn to for help.

Exploring the World of Ham Radio

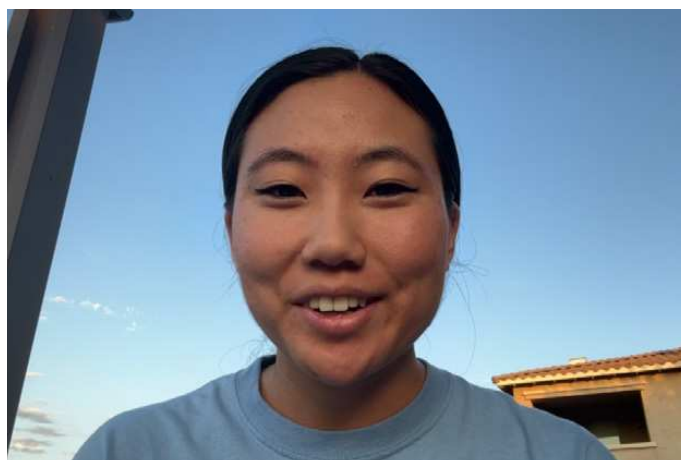
YOTA camp provided us with many valuable experiences — we each enjoyed a unique adventure.

Abby Kimi: YOTA camp is one of a kind because you get the full experience, from start to finish. You get to build your own antenna, use it as part of your POTA setup, and make a contact [with it]. A memorable moment at camp was setting up the antenna and Icom IC-705 with another camper, Adam Nissim-Stem, VA3BHT, and making a contact with Germany [with] 5 W. I am forever grateful to camp for helping me achieve my dream of contacting an astronaut in space, launching a weather balloon, and making my first FT8 contact.

Jack: Before I went to YOTA camp, there were many aspects of the hobby that I was uncertain of. Due to a lack of resources, I had never been able to get behind the microphone and make contacts on HF before, which made me “mic shy.” YOTA camp gave me the opportunity to operate on some really nice radios and make as many contacts as I wanted, ultimately boosting my confidence on the air. Thanks to camp, I have a renewed interest in ham radio and the basic skills necessary to succeed in this amazing hobby!

See You Next Year

Campers are forever grateful to YOTA and its supporters, Radio Amateurs of Canada, and ARISS for making dreams come true. If you're interested in volunteering or applying for an upcoming YOTA camp, visit www.youthontheair.org and YOTA social media pages to learn more.



In the digital edition of QST (www.arrl.org/qst), Abby Kimi and Jack share updates to their ham radio journeys since attending YOTA camp.

All photos taken by Sterling Mann, N0SSC, and Sam Rose, KC2LRC.

Abby Kimi Matsuyoshi, KK7CFJ, is from Arizona and has been a ham since November 2021, after being introduced to the hobby by a local amateur radio operator. She is passionate about amateur radio, finding herself exploring the many facets of it, such as operating CW and building kits. Outside of ham radio, Abby is a student pilot and full-time staff assistant for a local office. She can be reached at kk7cfj@gmail.com.

Jack Roberts, W9RFT, has been a ham since January 2020. Despite having a slow start to the hobby, he's beginning to branch out into the broad world of radio and is learning new things about it every day. Jack currently serves as the webmaster and PR specialist for Youth on the Air. Outside of ham radio, he attends Purdue University studying cybersecurity. Jack can be reached at jack@w9rft.com.

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



ARRL Board Establishes Third Advocacy: Inspiring and Educating Youth

ARRL President Rick Roderick, K5UR, led the Second Meeting of the ARRL Board of Directors on July 19, 2024, in Windsor, Connecticut.



The Board Meeting was called to order at 9 AM EST on Friday, July 19. [Bob Inderbitzen, NQ1R, photo]

Meeting Highlights

The Board unanimously accepted a report establishing a 3-year strategy for ARRL and recognized the efforts of the Strategy Working Group. They authorized CEO David A. Minster, NA2AA, to proceed with further planning.

The strategy articulates continued commitment and enhancements to the existing advocacies, promoting and protecting amateur radio. A new advocacy is being created, committing ARRL to develop the next generation of radio amateurs through the expansion of existing programs and the creation of curriculum-based initiatives targeted at middle and high school STEM education programs.

ARRL Strategy — July 2024

- Promoting Amateur Radio - Protecting Amateur Radio - Inspiring and Educating Youth	Advocacy
Serving Members and Driving Growth Through Technology	Digital Transformation
Expanding Our Means and Financial Capability	Development

The strategy calls for investments in information technology to continue along the path of ARRL's Digital Transformation. This will include evaluating membership models, content delivery methods, and next-generation software products along with the infrastructure improvements required to support them.

In committing to dramatically expanding ARRL's capabilities and activities in the STEM education space and investing in upgrades and additions to information technology, the Working Group's report recognized that revenue from membership dues is insufficient to fund these initiatives. The report acknowledged that dues contribute less than half the revenue required to operate ARRL. Efforts are required to develop new sources of revenue and seek support from donors and grants from both public and private organizations.

A Revised Mission Statement

The report of the Strategy Working Group, accepted by the Board, included a revised mission statement to reflect ARRL's commitment to promoting and protecting amateur radio, and its investment in its future.

ARRL Mission Statement

ARRL's mission is to promote and protect the art, science, and enjoyment of amateur radio, and to develop the next generation of radio amateurs.



John Litz, NZ6Q, accepted an appointment to the ARRL Board as Vice Director of the Pacific Division in April. [Bob Inderbitzen, NQ1R, photo]

The Board established the ARRL Information Technology Advisory Committee (ITAC), acknowledging the importance of providing information technology-based services to ARRL members, and to improve and protect ARRL systems. ITAC will engage experts in the field of IT to help oversee the development, operations, and evolution of the ARRL IT system infrastructure and applications.

The Board reassigned the Logbook of The World® (LoTW®) Maintenance Committee to the newly established ITAC. ITAC will support the Maintenance Committee's responsibilities with LoTW® development, including technical changes and future upgrades to the system.



ARRL's 16th President, Rick Roderick, K5UR, presided over the meeting. [Bob Inderbitzen, NQ1R, photo]

The Board recommended and authorized the creation of additional publications, including books and online resources, and products such as antenna kits, to help expand ARRL's commitment to help hams who are faced with limits on station building capabilities due to space limitations and/or limited resources.

The Board created a study group to review the current structure of ARRL governance and the Field Organization and suggest changes that would improve the organization and better support the membership.

The Board approved expanding the policy for recording roll call votes to being required for any pending motions pertaining to ARRL governance documents.

Awards and Recognitions

The Board bestowed the following awards:

- ◆ The ARRL Hiram Percy Maxim Award to Kees Van Oosbree, W0AAE, for his service and activity as a young ham;
- ◆ The ARRL Technical Innovation Award to Hans Summers, G0UPL, for the QRP Labs QMX transceiver kit;
- ◆ The ARRL Technical Service Award to Edward Menasian, N8LPQ, for creating several ways for hams to learn and share technical information.

The complete minutes of the 2024 Second Meeting of the ARRL Board of Directors are available at www.arrl.org/board-meetings.



During the meeting, Roanoke Division Vice Director Bill Morine, N2COP (left), was recognized by President Rick Roderick, K5UR (right), for his generous lifetime giving to ARRL, making him a new member of the ARRL Maxim Society. [Bob Inderbitzen, NQ1R, photo]

The 2024 QST Antenna Design Competition

The QST Antenna Design Competition is back for 2024! You don't have to be an antenna expert to enter — or win. Just send us your best design for a portable, mobile, or base station antenna, and it will be evaluated according to the competition rules. Entrants are encouraged to consider the needs of new hams, as well as hams living in environments with antenna restrictions. Even if your design doesn't earn a prize, it may still be published in QST.

Choose your category wisely, and send only one entry per person or team. The deadline is **December 16, 2024!**

Official Competition Rules

Entry Categories:

Enter in one of three categories:

- 160 meters, LF or VLF
- 80 through 10 meters
- 6 meters and up

Entries Must Include:

- Drawings with dimensions (hand drawings are acceptable)
- A list of materials required to build the antenna
- A description and summary of any testing, modeling, and measurements (including SWR data)
- High-resolution photographs of the installed antenna
- The entry category you've chosen for your design
- Your name, call sign, postal address, and email address

Send your entry to:

QST

Attn: Antenna Design Competition
225 Main St.
Newington, CT 06111

Or email your entry to **qst@arrl.org**. In the subject line, include your call sign and the words "Antenna Design Competition."

When using email, the total size of all attached files must not exceed 6 megabytes (MB). If you need to send more than 6 MB of attachments, please use several separate email messages.

Only one entry per individual or team will be accepted. Entrants must be ARRL members. ARRL Headquarters staff and QST advertisers are not eligible.

Non-Commercial Designs Only: Antennas based on submitted designs must be the sole creation of the entrants and not available for sale.

Submission Deadline: December 16, 2024

Judging: All entries will be reviewed, and the most promising entries will be evaluated through software modeling. Winners will be chosen based on performance as predicted in modeling, as well as ingenuity of design, mechanical and electrical safety, and durability.

Prizes: First-place winners — individuals or teams — in each category will receive checks in the amount of \$500. Second- and third-place winners — individuals or teams — in each category will receive checks in the amount of \$250 and \$100, respectively. Winning designs will also be eligible for publication in QST magazine.

Disclaimers: By participating in the competition, you are verifying that you are the owner and producer of the design, and that no third-party ownership rights or patents apply to your design. While ARRL will not claim ownership of your design, through your participation you are granting ARRL a perpetual, worldwide, non-exclusive, royalty-free right to publish your entry materials in all media now known or hereinafter created, anywhere in the world, for any lawful purposes.



This page displays two past winners of the 2017 QST Antenna Design Competition, 80 through 10 meters category, both published in the March 2018 issue of QST. The photo to the left is "Cat Whiskers," The Broadband Multi-Loop Antenna," by Jacek Pawlowski, SP3L. The

background photo is "A Three-Element Moxon-Style Vertical Yagi Antenna for the 75-Meter Band," by Al Christman, K3LC, and Joe Johnson, K3RR.

Upcoming Elections and How to Vote

From the ARRL Ethics and Elections Committee

Each year, elections are held for Directors and Vice Directors in five of the 15 ARRL Divisions, for terms of 3 years. Electronic or paper ballots are made available by October 1 to full members in Divisions with contested seats, and ballots are counted on the third Friday of November. In 2024, a Director and Vice Director will be declared elected in the following Divisions, for terms beginning January 1, 2025: Central, Hudson, New England, Northwestern, and Roanoke.

Two years ago, the ARRL Ethics and Elections Committee informed members of improvements made to modernize Division elections (see “Modernizing the ARRL Division Director and Vice Director Elections” in the October 2022 issue of *QST*). That effort has involved transitioning members to use electronic ballots. The transition was designed to be more convenient and efficient, and reduce the increasing expense of printing and mailing ballots.

Election Services Co. (ESC) of Melville, New York, will conduct the election. This is the same third party that conducted the ARRL elections in 2023 and 2022.

As ARRL continues its transition this year, eligible members will receive a printed postcard from ESC providing instructions on how to use their online voting site to access candidate statements, photos, and the electronic ballot, and to vote online. The postcard will also include instructions for requesting a paper ballot, if preferred. Members with an email address on file will receive the postcard and an email message from ESC. Members without an email address on file will receive only the postcard.

Whether you choose to vote online or by mail, the system will permit only one vote.

ESC provides the online voting website, collects and processes electronic and paper ballots, and computes the election results. Should members require assistance or have questions, ESC will provide help.

In the future, as ARRL moves toward a fully electronic election process, members will receive only email notices. The emails will contain instructions for voting electronically or requesting a paper ballot.

If your Division has an election coming up, we encourage you to review the email address associated with your ARRL membership by reviewing your account at **www.arrl.org/myARRL**. You must be logged in to the ARRL website to view your account. If you need assistance reviewing or modifying your account information, contact ARRL Headquarters (see page 14).

If You Need Help Voting...

During an election, members can contact ESC for assistance:

Election Services Co.

Telephone: 866-720-4357

Email: **ARRLElection@ElectionServicesCorp.com**

Happenings



Amateur Radio Participates in World's Largest Naval Exercise

"Partners: Integrated and Prepared" was the theme for Rim of the Pacific (RIMPAC) 2024, the world's largest international military maritime exercise. Starting on June 27 and ending on August 1, the exercise encompassed many islands in the Hawaiian chain.

The event included 29 nations, 40 surface ships, three submarines, 14 national land forces, more than 150 aircraft, and more than 25,000 personnel, including radio amateurs working with healthcare facilities.

Assistant Section Manager and State Government Liaison of the ARRL Pacific Section Michael Miller, KH6ML, said 36 amateur operators from Hawaii volunteered to demonstrate the value of amateur radio in emergency preparedness and response.

"It turned out very good," said Miller. "Some of the hospitals, staff, and administrators involved had their first experience with amateur radio. The operators were able to blend their skills using public service radios, satellite phones, as well as amateur radio."

Miller pointed out that hospitals on the smaller islands don't usually have a full-time communications officer, so working with amateur radio gives them experience for future emergencies. The amateurs worked with Health Comm Hawaii, which provides amateur radio communications to healthcare associations in Hawaii during emergencies and disasters. "Health Comm Hawaii really needs 100 more operators for backup and to

build skill sets through monthly exercises," Miller added.

Vice Adm. John Wade, Commander, US 3rd Fleet and RIMPAC 2024 Combined Task Force (CTF) Commander, said the RIMPAC exercise has grown over the years to be the world's largest and premier joint maritime training opportunity. "The exercise's purpose is to build relationships, to enhance interoperability and proficiency, and to ultimately contribute to the peace and stability in the vitally important Indo-Pacific region," he said.

Many of the volunteers who participated in RIMPAC 2024 are also members of other vital emergency communication groups, such as the Amateur Radio Emergency Service®, the Radio Amateur Civil Emergency Service, and the Community Emergency Response Team.

Ted Rappaport, N9NB, Elected to IEEE VTS Hall of Fame

Professor Theodore "Ted" S. Rappaport, PhD, N9NB, has been elected to the Institute of Electrical and Electronics Engineers (IEEE) Vehicular Technology Society (VTS) Hall of Fame. The IEEE VTS Hall of Fame recognizes individuals whose truly outstanding leadership and contributions have had a significant impact on the technologies represented by IEEE VTS fields of interest. The VTS is one of the oldest societies in IEEE.

Dr. Rappaport is a tenured professor in the New York University (NYU) Electrical Engineering Department in

the Tandon School of Engineering, Courant Institute of Mathematical Sciences, and the NYU Grossman School of Medicine. He has co-authored more than 300 papers and 20 books, including the most cited books on wireless communications, adaptive antennas, wireless simulation, and millimeter-wave communications, which have been translated into eight languages.

Dr. Rappaport was first licensed in 1975 and joined ARRL that same year. He now holds an Amateur Extra-class license. He has been an ARRL Life Member since 1983 and received an ARRL scholarship to help complete his doctorate at Purdue University.

"Amateur radio has been more influential in my life than I could have imagined," said Rappaport. "At age 14, I was able to teach adults about amateur radio and electronics principles to help them become licensed operators. I believe that led to my career in academia and teaching."

The IEEE asked Dr. Rappaport to write the history of amateur radio, and he agreed on the condition it would be available to amateur radio operators and the public at no charge.



Professor Theodore "Ted" Rappaport, PhD, N9NB. [New York University photo]

Parts 1 and 2 of “The Crucible of Communications” are complete and can be read online. He is currently working on Part 3.

Dr. Rappaport’s induction ceremony will be in Washington, DC, October 9, 2024.

Grace Papay, K8LG, Is 2024 Young Ham of the Year

Grace Papay, K8LG, of Holland, Michigan, has been selected as the 2024 Bill Pasternak WA6ITF Memorial Amateur Radio Newsline Young Ham of the Year. Grace, age 18, is the daughter of Doug Papay, K8DP, and Carrie Papay, K8CLP.

Grace earned her Technician-class license in March 2021 and her Amateur Extra-class license in March 2022. She credited her father and her grandfather, John Papay, K8YSE, for drawing her into the hobby. “I got involved in amateur radio satellites,” Grace recalled. “I got on the air. And now, it has turned into something honoring my grandfather to a hobby I’m on every day and [that] I love.”

Grace attended Youth on the Air camps in Cincinnati in 2022 and Ottawa in 2023, where she said she was exposed to a variety of other amateur radio activities. She was part of the K3LR Islands on the Air Dave Kalter Memorial Youth DX Adventure in 2023, and was a team member for the J62K St. Lucia DX contest operation in 2024.

Grace is active on the HF bands and operates in the ARRL and CQ DX contests, ARRL Sweepstakes, and CQ WPX, as well as Youth on the Air events. For the past few years, Grace has been a regular presenter for the Youth Forum at Dayton Hamvention®. She is an active member of the Holland Amateur Radio Club, the Grand Rapids Amateur Radio Association, the West Chester Amateur Radio Association, and ARRL.

Generational Legacy Carried on in ARRL Teachers Institute

As ARRL continues to empower teachers to bring amateur radio and radio technology into their classrooms through the ARRL Teachers Institute (TI) on Wireless Technology, many generous donors have stepped up to enable the work.

Parents can make all of the difference in someone’s success. David Ginsberg, N3BKV, knows that well. His parents, Hy and Mimi Ginsberg, supported his passions. “Whether it was my mom driving me to the planetarium for weekend classes that allowed me to learn about the universe, [or] my father taking me to my first hamfest, they saw my passion for amateur radio and how it gave me a focus to learn about science, computers, and electronics,” he wrote.

David knew he wanted to pay that forward. To honor his parents’ dedication to fostering curious minds while also supporting the future of amateur radio, he established the Hy and Mimi Ginsberg Educator position within the TI.

The program equips teachers to incorporate amateur radio and wireless technology into STEM curricula. The TI is funded entirely by donor contributions through the ARRL Education Fund. Teachers pay an application fee, but all other costs of transportation, lodging, and course materials are covered. It costs \$4,000 to send a teacher through the program.

The first Hy and Mimi Ginsberg Educator is Danielle Adler, EdD, K6FIN. She is the founder of San Diego Youth Science, an organization that partners with many schools to advance youth involvement in marine sciences.

Dr. Adler is excited to take the knowledge she gained in the TI back to



ARRL Education and Learning Manager Steve Goodgame, K5ATA, with Hy and Mimi Ginsberg Educator Dr. Danielle Adler, K6FIN.

the young people she impacts, so they may get hands-on with radio. “Providing students with ways to participate in authentic science is incredibly impactful, and radio science can be a wonderful and relevant tool,” wrote Dr. Adler in a thank-you letter to David Ginsberg.

In the last 3 years, 175 educators have attended the TI. There are seven cohorts of the program in 2024, but the goal is to scale it to 10 for 2025. “There’s demonstrated success with this program, and a great opportunity to continue growing,” said ARRL Director of Development Kevin Beal, K8EAL. “By having the support of people like the Ginsberg family, ARRL will continue to enable educators to grow ham radio in the generation that will likely take humanity to Mars and beyond,” said Beal.

More information about the TI can be found at www.arrl.org/ti.

ARRL Southeastern Division Vice Director Jeff Beals, WA4AW, Silent Key

Vice Director of the ARRL Southeastern Division Jeffrey J. “Jeff” Beals, WA4AW, has become a Silent Key. He died on July 20, 2024. Born in 1951, Beals devoted a lifetime of

service to amateur radio, having served in many local clubs, the ARRL Field Organization, and the ARRL Board of Directors. He was an ARRL Life Member as well as a Volunteer Examiner. He was also elected Vice President of the Quarter Century Wireless Association in 2023.

Beals was first licensed at the age of 12 in his native Long Beach, New York. He was active with the local 5 Towns Radio Club, Nassau County Amateur Radio Emergency Service®, and Radio Amateur Civil Emergency Service (RACES). He held Amateur Extra-class and First-Class Radiotelephone licenses.

His service with amateur radio emergency communications (EmComm) included serving as Section Emergency Coordinator (SEC) for the ARRL Southern Florida Section, Assistant SEC, District Emergency Coordinator for the Gold Coast District, and Emergency Coordinator and County RACES Officer for Lee and Palm Beach Counties. He was also a member of the ARRL National Emergency Response Planning Committee. He was certified at all levels of ARRL EmComm courses, public relations training, and advanced Federal Emergency Management Agency training.

Beals received State of Florida commendations for his service with Hurricanes Andrew and Katrina. He was additionally deployed to Hurricanes Frances, Jean, Wilma, Matthew, and Irma.

ARRL Southeastern Division Director Mickey Baker, N4MB, recalls that Beals' passion for service involved getting others active. "Jeff was a connector — his superpower was finding volunteers and organizing events so that others would see the value of their service... He 'volunteered' many of us to charitable runs and bike rides, the South Florida Fair, and many other events that promoted amateur radio. He volunteered entire clubs [and] then challenged us to show," wrote Baker of his longtime friend.

Section Manager Nomination Notice

To all ARRL members in Arizona, Arkansas, Iowa, Kentucky, Mississippi, Montana, North Texas, Orange, and Wyoming. You are hereby solicited for nominating petitions pursuant to an election for Section Manager (SM). Incumbents are listed on page 16 of this issue.

To be valid, a petition must contain the signatures of five or more full ARRL members residing in the Sections concerned. It is advisable to have a few more than five signatures on each petition. A sample nomination form is available on the ARRL website at www.arrl.org/section-terms-nomination-information. Nominating petitions may be made by facsimile or electronic transmission of images, provided that upon request by the Field Services Manager, the original documents are received by the manager within 7 days of the request. It is acceptable to submit signatures that have been sent via email or mail under the following guidelines: The petition copies must be made from the original form supplied by ARRL or downloaded from the ARRL website. The form must be exactly the same on both sides (i.e., autobiographical information should appear exactly the same on all copies). All forms/copies must be submitted together.

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

We suggest the following format:

(Place and Date)

Field Services Manager, ARRL

225 Main St.

Newington, CT 06111

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

(Signature _____ Call Sign _____ City _____ ZIP _____)

Any candidate for the office of Section Manager must be a resident of the Section, an amateur radio licensee of Technician class or higher, and a full member of ARRL for a continuous term of at least 2 years immediately preceding receipt of a nominating petition. Petitions must be received at Headquarters by 4:00 PM Eastern Time on December 6, 2024. If more than one member is nominated in a single Section, ballots will be mailed from Headquarters no later than January 2, 2025, to full members of record as of December 6, 2024, which is the closing date for nominations. Returns will be counted February 18, 2025. Section Managers elected as a result of the above procedure will take office April 1, 2025.

If only one valid petition is received from a Section, that nominee shall be declared elected without opposition for a 2-year term beginning April 1, 2025. If no petitions are received from a Section by the specified closing date, such Section will be resolicited in the April issue of QST. A Section Manager elected through the resolicitation will serve a term of 18 months. A Section Manager vacancy occurring between elections is filled through appointment by the Field Services Manager. — *Mike Walters, W8ZY, Field Services Manager*



Celebrating the America's Cup Races on the Air

The New Zealand Association of Radio Transmitters (NZART) was asked to supply a special-event call sign to celebrate the Louis Vuitton 37th America's Cup yacht races that are being held this year in Spain. As a result, ZL6AMCUP was allocated to the event, with Phil Garside, ZL2RO, as the trustee of the call sign. You'll hear ZL6AMCUP on the air through November 30.

The reasons for NZART's involvement are easy to understand considering that the Royal New Zealand Yacht Squadron is the official home of the America's Cup after they won the 36th America's Cup races held in Auckland, New Zealand in 2021.

1940s Weekend at Bletchley Park

In June, the Radio Society of Great Britain (RSGB) held a "1940s weekend" at the Bletchley Park Museum. Bletchley Park is an English country house and estate in Bletchley, England, that was the primary center of Allied code breaking during World War II.

The RSGB National Radio Centre at Bletchley Park supported the event by hosting the World War II Special Operations Executive radio station, GB1SOE. The station, operating on the 40-meter band, attracted substantial visitor attention, as did National Radio Centre station GB3RS, which was busy on the air as part of the International Museums Weekends. Volunteer operators made contacts and invited visitors to pass greeting



Stefano Iotti, IZ4RDV, operating as IY4RFE at Villa Griffone Park. [ARI Fidenza/Associazione Radioamatori Italiani photo]

messages. According to RSGB, 1,211 people visited the National Radio Centre during the event.

Elettra Back On the Air

The *Elettra* was Guglielmo Marconi's steam yacht that functioned as his floating radio laboratory in the 1920s and 1930s. During World War II, the ship was requisitioned by the German Navy and was on patrol near Yugoslavia when it was attacked and partially sunk by Allied fighters in 1944.

After the war, the ship became the property of Yugoslavia, but it was recovered and returned to Italy in 1962 in the hope that it might be restored. This was not to be, however, and the *Elettra* was disassembled, and parts of the vessel were distributed throughout Italy to places that had been associated with Marconi.

Part of the keel of the *Elettra* ended up in Villa Griffone Park, and that's where the Associazione Radioamatori Italiani (ARI) Section of Fidenza hosted the 10th edition of its "Elettra Back On Air!" event in June. They operated for 2 days from a portable



Station GB3RS at the Radio Society of Great Britain National Radio Centre [Stefano Pinna, G7RDX, photo]



The “Elettra Back On Air!” station was set up near the remains of the *Elettra*’s keel. [ARI Fidenza/Associazione Radioamatori Italiani photo]

station near the keel using the call sign IY4RFE. According to the ARI, the event was a success with many contacts, primarily on the HF bands.

Wireless Institute of Australia Directors Meet with ARRL at Dayton Hamvention®

Wireless Institute of Australia Directors Lee Moyle, VK3GK, and Chris Dimitrijevic, VK3FY, attended this year’s Dayton Hamvention®, which was held at the Greene County Fairgrounds and Expo Center in Xenia, Ohio. While there, they met with

ARRL President Rick Roderick, K5UR. Their discussions touched on diverse topics concerning amateur radio, including membership trends and ideas for youth recruitment. Other Hamvention attendees from Australia included Chris Platt, VK5CP; Adrian Quinn, VK2TLQ; Peter Young, VK3MV; Phil Wait, VK2ASD; Steve Kennedy, VK6SJ; Nik Dimitrijevic, VK3FE, and Kaz Bialecki, VK1KAZ.

Summer Camp in Croatia

In August, the Croatian Amateur Radio Association organized the weeklong 16th annual Summer Radio Amateur Camp at the Technical Culture Center Zvezdano selo na Mosor. The gathering took place at a facility equipped with classrooms and dormitories.

The camp was designed for people 17 years of age and younger who wanted to learn about radio communications — both digital and analog — and gain more knowledge and skills in the fields of electronics, electrical engineering, physics, and information technology. Activities also included various amateur radio workshops and amateur radio direction finding.

The camp was led by Croatian Amateur Radio Association volunteers with many years of experience working with children. There was also a dedicated amateur radio station at the camp using the call sign 9A0HRS.



Wireless Institute of Australia Director Lee Moyle, VK3GK (left); ARRL President Rick Roderick, K5UR (middle), and Wireless Institute of Australia Director Chris Dimitrijevic, VK3FY (right), at the 2024 Dayton Hamvention®. [Wireless Institute of Australia photo]

Public Service

The Age of Winlink

During two Saturdays in June, the Oregon Disaster Airlift Response Team conducted its third annual Whale Run exercise involving general aviation aircraft supported by Winlink Global Radio Email®, a network of amateur radio and government stations that provides email via radio. It's engineered, operated, and administered by radio amateurs and supports email with attachments, GPS position reporting, and bulletins, among other assets. Winlink can automatically operate without any internet and uses smart-network radio relays called Radio Mail Servers, among other features.

The mode and supporting network have grown at a tremendous rate in the last decade and are now the standard for emergency communications among Amateur Radio Emergency Service® (ARES®) operators and emergency operations center (EOC) stations in many regions of the country.

During Whale Run, radio amateurs using Winlink sent landing area weather reports to pilots who were delivering nutritional and medical supplies to remote coastal communities. They tracked takeoffs and landings via Winlink on HF. The full-scale exercise involved 20 general aviation pilots who were supported by more than 40 radio amateurs from 10 different counties.

Also in June, the Angel Fall Complex exercise scenario in California was a cyberattack targeting the southern portion of the state's healthcare infrastructure. The goal of the Los Angeles County ARES was to ensure that mission-critical communications could still be maintained despite the disruption.

The exercise plan required use of VARA Chat, Winlink, and PinPoint APRS on the 2-meter and 1.25-meter bands. Operators needed to complete, rename, and transmit standard Los Angeles County forms as spreadsheets and documents. The VARA protocol introduced digipeater capability and enhanced weak-signal performance, among other improvements. VARA Chat was particularly effective for peer-to-peer transmitting of exercise documents on the internal network, offering high speeds and no size restrictions. In contrast, Winlink provided a bridge to the internet for external messages. As Winlink Express uploaded messages in the background and displayed them on the Winlink Message Viewer for registered Winlink

members, the exercise planners could monitor Winlink traffic and observe this part of the exercise in real time using the internet.

Winlink Forms

Winlink offers a comprehensive library of forms (or templates) that are valuable for training ARES operators. These forms, such as those from the Incident Command System (ICS) and Hospital Incident Command System (HICS), are based on official agency templates and provide practical insights into the Federal Emergency Management Agency (FEMA) and hospital emergency communications.

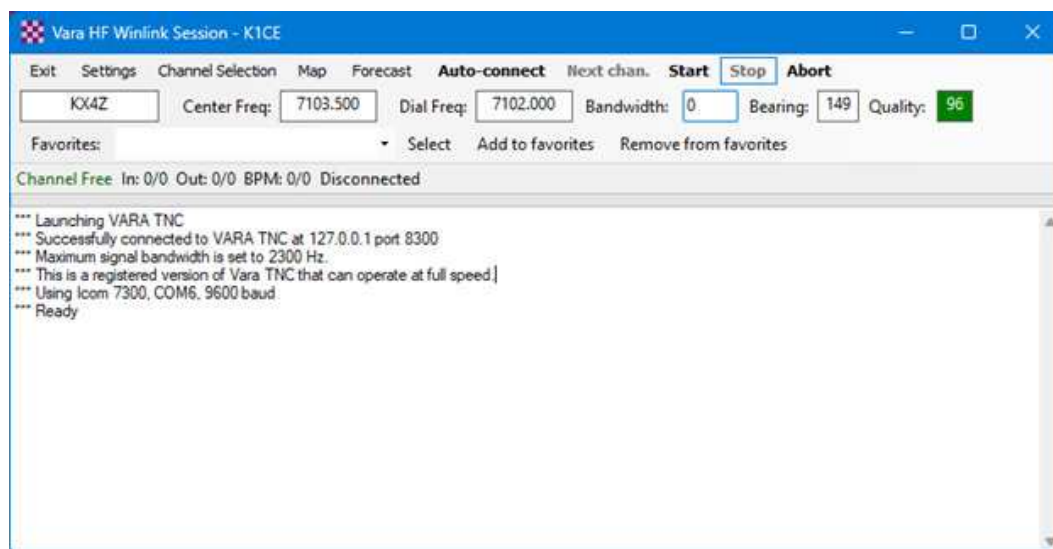
Additionally, FEMA provides a free Independent Study course called IS-201A: Forms Used for the Development of the Incident Action Plan and Incident Management, which helps contextualize the use of ICS forms. Some ARES organizations utilize Winlink to train operators on these forms before transitioning them to spreadsheets and documents used by agencies.

Winlink in International Communications

The International Health Service sends volunteer medical teams into remote areas of Honduras. There are no telephone or internet services there, so each team has a radio operator who sets up and operates an HF Winlink station. Dr. Steve Posner, KX5SP, a retired officer for the Commissioned Corps of the US Public Health Service and the Emergency Response Coordinator/Communications Director for the National Disaster Medical System, was deployed this year as an engineer and radio operator. He said the Winlink system was invaluable to operations. "We had an unexpected event that required the evacuation of one of our doctors from the middle of nowhere back to the US, which required a lot of communication and coordination."

Excellence in Training

The EmComm Training Organization™ (ETO; www.emcomm-training.org) is a 501(c)(3) nonprofit organization created to provide emergency communications training to amateur radio operators and others interested in emergency communications. It's been instrumental in the development of amateur radio's use of Winlink, and in training radio amateurs to use it.



Winlink Express is the user's email inbox/outbox processing screen, and the VARA HF Winlink Session is their connection processing screen. [Rick Palm, K1CE, image]

Winlink Thursdays have been an ETO staple for several years, with a new exercise conducted every week. For example, the July 25 exercise allowed operators to gain familiarity with custom forms — ascertain how to implement and make use of a simple served agency custom form; learn where custom forms may be stored, found, and used.

The American Red Cross Connection

The American Red Cross Nebraska/SW Iowa Region is working to develop Winlink capabilities for American Red Cross amateur radio operators.

An exercise using Winlink messaging was conducted on March 23, 2024. The exercise was controlled from the Heartland Chapter American Red Cross Amateur Radio Club station, W0EQU, located at the American Red Cross headquarters in Omaha, Nebraska. ARES organizations within the region participated, as did amateurs from across the country who had some American Red Cross affiliation. Operators were invited to submit Winlink Check-In forms to W0EQU via radio (if equipped) using the Winlink system. If an operator had the ability to use multiple radio paths (modes or frequency bands) to submit check-ins, that was invited.

In the end, W0EQU operators received 81 successful check-ins from 62 distinct amateur radio operators in 14 states, the most distant being Alaska. Twenty-eight of the messages originated over a VHF radio connection between the transmitting stations and the Winlink gateway station.

HF Peer-to-Peer Tested

A special test was conducted with Jerry Davis, KA4QVH, using VARA HF Peer-to-Peer. This mode allows for the passing of Winlink traffic directly from one station to another over HF radio without internet and would be used in the event of a widespread internet outage. The operators were successful in passing messages directly to each other over a distance of 808 miles.

The Kentucky Winlink Net (<https://groups.google.com/g/kentucky-winlink-net>) provides regular peer-to-peer nets that allow operators from all over the US and beyond to check in. Regular participation helps operators understand the performance of their own stations as well as changes in propagation over time.

RIMPAC Connections

During the 2024 Rim of the Pacific Exercise (RIMPAC) — the world's largest international military maritime exercise — Winlink Global Radio Email, which facilitated check-ins from hospitals, demonstrated its value. Amateur radio operators on Ford Island in Hawaii provided essential reports on patient numbers and emergency severity, helping to balance the load across medical facilities and ensuring efficient care.

ARRL Pacific Section State Government Liaison and Assistant Section Manager Michael Miller, KH6ML, reported that 36 operators from Hawaii volunteered to demonstrate the value of amateur radio in emergency preparedness and response. "Some of the hospitals, staff, and administrators involved had their first experience with amateur radio," he said. The amateurs worked with Health Comm Hawaii, which provides amateur radio communications to healthcare associations in Hawaii during emergencies and disasters.

More Information

Visit the Winlink website (www.winlink.org) for software downloads and more information. Winlink is supported by the Amateur Radio Safety Foundation, Inc.

Contest Corral

October 2024

Check for updates and a downloadable PDF version online at www.arrl.org/contest-calendar.

Refer to the contest websites for full rules, scoring information, operating periods or time limits, and log submission information.

Start - Finish Date-Time Date-Time				Bands	Contest Name	Mode	Exchange	Sponsor's Website
3	0000	4	0300	7	Walk for the Bacon QRP Contest	CW	13 WPM max; RST, SPC, name, mbr/pwr	qrptest.com/pigwalk40
3	1700	3	2000	3.5	SARL 80m QSO Party	Ph	RS, serial, grid or QTH	www.sarl.org.za
3	1700	3	2100	28	NRAU 10m Activity Contest	CW Ph Dig	RS(T), 6-char grid square	nrau.net
5	0000	6	2359	No WARC	Collegiate QSO Party	CW Ph Dig	School ID or SPC, RS(T)	collegiateqsoparty.com
5	0600	6	0600	1.8-28	Oceania DX Contest, Phone	Ph	RS, serial	www.oceaniadxcontest.com
5	0800	5	1400	902 and above	902 MHz and Up Fall Sprint	CW Ph Dig	6-char grid square	www.packratvhf.com/index.php/fall-sprints
5	1200	6	1159	1.8-28	Russian WW Digital Contest	Dig	RST(Q), oblast code or serial	www.rdrclub.ru
5	1400	6	1400	435 and above	IARU Region 1 UHF/Microwaves Contest	CW Ph Dig	RS(T), serial, 6-char grid square	www.iaru-r1.org
5	1600	6	1100	3.5,7	International HELL Contest	Dig	RST, serial	www.darc.de
5	1600	6	2200	1.8-28	California QSO Party	CW Ph	Serial, CA county or SPC	www.cqp.org
6	0600	6	0900	3.5	UBA ON Contest, SSB	Ph	RS, serial, ON section (if ON)	www.uba.be
6	2200	6	2359	3.5-14	Peanut Power QRP Sprint	CW Ph	RS(T), SPC, peanut no. or pwr	www.nogaqrp.org
7	1900	7	2030	3.5	RSGB 80m Autumn Series, CW	CW	RST, serial	www.rsgbcc.org
8	0000	8	0200	3.5-28	ARS Spartan Sprint	CW	RST, SPC, pwr	ars-qrp.com
8	1800	8	1929	3.5,7	DARC RTTY Sprint	Dig	RST, DOK/"NM," or serial	www.darc.de
8	1900	8	2000	3.5	IRTS 80m Evening Counties Contest	CW Ph	RS(T), serial, county (if EI/GI)	www.irts.ie
10	0001	10	2359	28	10-10 Int'l 10-10 Day Sprint	CW Ph Dig	Name, mbr or "0," SPC	www.ten-ten.org
12	0000	13	1559	3.5-28	Makrothen RTTY Contest	Dig	4-char grid square	www.pl259.org
12	0000	12	2359	1.8-28	QRP ARCI Fall QSO Party	CW	RST, SPC, mbr or pwr	qrparki.org
12	0300	13	2100	1.8-28,VHF/UHF	Nevada QSO Party	CW Ph Dig		nvqso.com
12	0600	13	0600	1.8-28	Oceania DX Contest, CW	CW	RST, serial	www.oceaniadxcontest.com
12	1200	13	1200	3.5-28	Scandinavian Activity Contest, SSB	Ph	RST, serial	www.sactest.net
12	1500	13	0500	1.8-28	Arizona QSO Party	CW Ph	RS(T), AZ county or SPC	www.azqp.org
12	1600	13	2200	No WARC	Pennsylvania QSO Party	CW Ph	Serial, PA county or ARRL/RAC section	paqso.org
12	1800	13	1800	1.8-28,50,144	South Dakota QSO Party	CW Ph	RS(T), SD county or SPC	www.sdqsoparty.com
12	2000	13	2000	1.8	PODXS 070 Club 160m Great Pumpkin Sprint	Dig	RST, SPC	www.podxs070.com
12	2130	12	2330	7	Argentina National 7 MHz Contest	Ph	RS, 2-digit year first licensed	www.lu4aa.org
13	0600	13	0900	3.5	UBA ON Contest, CW	CW	RST, serial, ON section (if ON)	www.uba.be
13	1300	16	0700	1.8-28,50,144	Classic Exchange, Phone	Ph	Name, RS, SPC, equipt model/mfgr	www.classicexchange.org
14	0000	14	0200	1.8-28	4 States QRP Group Second Sunday Sprint	CW Ph	RST, SPC, mbr or pwr	www.4sqrp.com
16	1900	16	2030	3.5	AGCW Semi-Automatic Key Evening	CW	RST, serial, 2-digit year first used a bug	www.agcw.de
16	1900	16	2030	3.5	RSGB 80m Autumn Series, Data	Dig	RST, serial	www.rsgbcc.org
17	0000	18	0300	14	Walk for the Bacon QRP Contest	CW	13 WPM max; RST, SPC, name, mbr/pwr	qrptest.com/pigwalk20
17	1900	17	2000	3.5-14	NTC QSO Party	CW	25 WPM max; RST, mbr, or "NM"	pi4ntc.nl
19	0000	20	2359	50-1296	ARRL EME Contest	CW Ph Dig	4-char grid square	www.arrrl.org/eme-contest
19	0000	20	2359	3.5-28	JARTS WW RTTY Contest	Dig	RST, age of operator	jarts.jp
19	0000	20	2359	1.8-28	YBDXPI FT8 Contest	Dig	4-char grid square	contest.ybdxpi.net
19	0001	20	2359	28	10-10 Int'l Fall Contest, CW	CW	Name, mbr or "0," SPC	www.ten-ten.org
19	1400	21	0200	No WARC	YLRL DX/NA YL Anniversary Contest	CW Ph Dig	Serial, RS(T), ARRL Section or PC	ylrl.net/contests
19	1400	20	0200	No WARC	New York QSO Party	CW Ph Dig	RS(T), NY county or SPC	www.nyqp.org
19	1500	20	1459	3.5-28	Worked All Germany Contest	CW Ph	RS(T), DOK or "NM" or serial	www.darc.de
19	1500	20	1500	1.8	Stew Perry Topband Challenge	CW	4-char grid square	www.kkn.net/stew
19	2000	19	2359	1.8-28,50	Feld Hell Sprint	Dig	RST, mbr, SPC, grid	sites.google.com/site/feldhellclub
20	0000	20	0200	14,21	Asia-Pacific Fall Sprint, CW	CW	RST, serial	jsfc.org/apsprint
20	0700	20	1000	144	UBA ON Contest, 2m	CW Ph	RS(T), serial, ON section (if ON)	www.uba.be
20	1300	23	0700	1.8-28,50,144	Classic Exchange, CW	CW	Name, RST, SPC, rcvr/xmtr model	www.classicexchange.org
20	1700	21	0100	1.8-28,50,144	Illinois QSO Party	CW Ph Dig	RS(T), IL county or SPC	w9awe.org/ilqp
20	2300	21	0100	1.8-28	Run for the Bacon QRP Contest	CW	RST, SPC, mbr or pwr	qrptest.com/pigrun
21	1300	25	2359	No WARC	ARRL School Club Roundup	CW Ph Dig	RS(T), class (I/C/S), SPC	www.arrrl.org/school-club-roundup
24	1900	24	2030	3.5	RSGB 80m Autumn Series, SSB	Ph	RS, serial	www.rsgbcc.org
26	0000	27	2359	1.8-28	CQ Worldwide DX Contest, SSB	Ph	RS, CQ zone	www.cqww.com
28	2000	28	2130	3.5-28	RSGB FT4 Contest	Dig	Signal report	www.rsgbcc.org
30	2000	30	2100	3.5	UKEICC 80m Contest	CW	6-char grid square	www.ukicc.com

There are a number of weekly contests not included in the table above. For more info, visit: www.qrpfoxhunt.org, www.nccsprint.com, and www.cwops.org. All dates and times refer to UTC and may be different from calendar dates in North America. Contests are not conducted on the 60-, 30-, 17-, or 12-meter bands. Mbr = Membership number. Serial = Sequential number of the contact. SPC = State, Province, DXCC Entity. XE = Mexican state. Listings in blue indicate contests sponsored by ARRL or NCJ. The latest time to make a valid contest QSO is the minute listed in the "Finish Time" column. *Data for Contest Corral is maintained on the WATBNM Contest Calendar at www.contestcalendar.com and is extracted for publication in QST 2 months prior to the month of the contest. ARRL gratefully acknowledges the support of Bruce Horn, WA7BNM, in providing this service.*

2023 – 2024 School Club Roundup Results

The next two School Club Roundups will take place on
October 21 – 25, 2024 and February 10 – 14, 2025.

The main objective of School Club Roundup (SCR), sponsored by the Long Island Mobile Amateur Radio Club and ARRL, is to introduce youngsters to the fun of operating amateur radio in a contest-style environment. However, it's structured as less of a contest and more of an on-air operating event. SCR has encouraged younger operators to become involved in amateur radio. Many SCR participants have obtained their own licenses and continue to be active on the air for years after graduation.

Some individual entrants have been under the impression that only contacts made with schools count toward your final score. While some individual participants may choose to work only schools, all contacts made during the event count. Additionally, entry categories are declared by the entrants. A school club entrant should indicate the highest grade level category that applies, which is not necessarily determined by the age of the students.

Participation and Recent Scores

Participation in SCR continues to rise. The October 2023 and February 2024 sessions maintained the trend of increased participation. The October session had 83 entries, while the February session saw 105 entries, which is one of the highest entries from one session. We hope that this trend will continue in the October 2024 and February 2025 SCR sessions.

Some of our regular successful participants in the Middle School category include the Schofield Middle School Radio Club, N4SMS, in South Carolina, with more than 180,000 points, and LaFayette Middle School's Rambler Radio Club, W4LMS, in Georgia, with more than 120,000 points.

The number of High School category entries increased to 21 schools. Lyle Strachan, KE0ZNV, who entered as a home-



Dresden Elementary Amateur Radio Station, KD8NOM, in Dresden, Ohio, took first place in the Elementary/Primary School category in the February 2024 School Club Roundup.

school, led the category, making 1,084 contacts. Forrest M. Bird Charter School Amateur Radio Club, W7FBS, in Idaho, constructed a center-fed dipole as a class project that was successfully used for the event.

The College/University category was led by the Purdue University Amateur Radio Club, W9YB, with more than 930,000 points — a very impressive score! The Virginia Tech Amateur Radio Association, K4KDJ, was back for the first time since the COVID-19 pandemic, claiming, "It was nice teaching the new people in the club how to contest and seeing them get their radio voice. Next year, we're [going to] beat Purdue." This informal competition helps add to the fun, although SCR is not really a contest.

For complete rules, logging sheets, and other resources, visit www.arrl.org/school-club-roundup.

The 2024 ARRL November Sweepstakes

CW: 2100 UTC Saturday, November 2 –
0259 UTC Monday, November 4

Phone: 2100 UTC Saturday, November 16 –
0259 UTC Monday, November 18



The ARRL November Sweepstakes is the premier domestic contest in the US and Canada. All levels of operators are welcome to join in the fun, from serious contesters to casual participants. Join thousands of operators as they attempt to beat personal records, win categories, and achieve the coveted Clean Sweep by working all 85 ARRL/RAC Sections in a single weekend.

Entrants may operate for a maximum of 24 of the 30 hours during the contest period. Off-times must be a minimum of 30 consecutive minutes without listening or transmitting. Exchange is serial number, precedence, your call sign, check, and ARRL/RAC Section.

Any Single Operator entrant can enter using the Limited Antennas Overlay. Operation is limited to the use of single-element antennas such as a single vertical, an end-fed wire, or a single dipole antenna no more than 50 feet above ground at its highest point. The antenna(s) may cover multiple bands, as in the case of multiband verticals and dipoles with fan or trap constructions.

Logs are due 7 days after the conclusion of the event. Electronic logs must be uploaded to our web app at <https://contest-log-submission.arrl.org>. Send paper logs to ARRL November Sweepstakes, 225 Main St., Newington, CT 06111. Sweepstakes CW logs must



Maria Polyanska, VE3OMV, placed first in the Youth Overlay in the Single Operator, Low Power category. She made 221 contacts in 57 Sections. [Maria Polyanska, VE3OMV, photo]

be submitted or postmarked by 0259 UTC Monday, November 11. Phone logs must be submitted or postmarked by 0259 UTC Monday, November 25.

For more information, paper entry and logging forms, and complete rules, visit www.arrl.org/sweepstakes or contact contests@arrl.org.

This Month in **QEX**

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

Coming up in the September/October 2024 issue of *QEX*:

- John Stensby, N5DF, shows how to build a low-cost, simple-design, temperature-compensated power sensor.
- Ken Pollock, WB3JOB, designs a signal generator for developing circuits of troubleshooting equipment on the workshop or test bench.
- Al Christman, K3LC, examines the use of “gull-wing”

elevated radials in combination with vertical monopoles whose feed points are located at or near ground level.

■ Ralph Crumrine, N0KC, discusses the most important details for using high-gain LDMOS devices in a low-VHF amplifier.

■ James A.R. Koehler, VE5FP, uses a low-cost Raspberry PI Pico for necessary digital processing, including the trigonometric function.

■ In his essay series, Eric Nichols, KL7AJ, reflects on “unintended consequences” in the development of the vacuum tube.

QEX is edited by Kazimierz “Kai” Siwiak, KE4PT (ksiwiaak@arrl.org), and is published bimonthly.

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

Club Station

20 Years as a Special Service Club

A club that exists to go above and beyond for their communities and for amateur radio is what defines a Special Service Club (SSC). In this month's column, Sun City Amateur Radio Club (SCARC), K5WPH, Vice President Ed Wood, KD5MFS, shares how this El Paso, Texas club has maintained its SSC status for 2 decades.

After 45 years of being an ARRL Affiliated Club, SCARC applied to be an SSC and has maintained that status for 20 consecutive years. Continued training, and reasons to use that training through club activities, keep member participation at a high level. The actions of the club, guided by the process of becoming an SSC, can help retain that level.

Only ARRL Affiliated Clubs (www.arrl.org/application-for-affiliation) can apply to become SSCs. The application (www.arrl.org/ssc-application), which must be renewed every 2 years, asks clubs to provide a short summary of how they've fulfilled the following

requirements: new ham development and training, public relations, emergency communications, technical advancement, operating activities, and miscellaneous activities.

Qualifying Club Activities and Projects

New Ham Development and Training

Schools are on the lookout for presentations for science classes and STEM education. A Facebook page and informational website with an activity calendar can generate an amazing following. SCARC publishes a quarterly newsletter that's emailed to membership and is also available on electronic media.

Participating in ARRL-sponsored Kids Day activities, Scouting, and school activities can generate prospective members. SCARC has participated in Scouting expositions and judged school science fairs, among other things.

Emergency Operations

National Weather Service (NWS) SKYWARN training programs are an excellent place to start when looking to fulfill this category. (Note that this is observer training, not storm-chaser training.) The NWS provides basic and advanced classes free of charge that can potentially be held during a club meeting. SCARC coordinates a short weekly on-air exercise requesting local weather condition data at hams' stations over a four-county area.



ARRL SSCs are rewarded with a downloadable certificate that they can print and hang in their clubhouse.

Also, there are trainings available for the use of Winlink and ARRL message handling as part of the Amateur Radio Emergency Service® (ARES®).

Public Relations

SCARC doesn't have a Public Information Officer, but various members use their personal contacts to promote ham radio. A member who works in the county administrative offices arranged to have a proclamation created and presented at a commissioner's meeting, recognizing ham radio and its potential during an extreme situation.

Other members make contacts with news publications and broadcast media. This may be as simple as the distribution of a press release explaining the purpose of ARRL Field Day and its relation to your club. Others have brought TV news crews to their Field Day.

Technical Advancement

SCARC holds two regular meetings per month. The third Friday is Program Night, which covers presentations and demonstrations on various topics, such as repeater system design and operation, junk box amplifiers, antenna types, construction of portable antennas, and tuner operation. Parks on the Air, Summits on the Air, satellite communications, digital modes, and antique radios are also potential topics.

Because of the variety of professional knowledge throughout SCARC's membership, there is always someone who can provide an answer, help solve a problem, or present a training program. In one instance, a ham presented on large cross-country pipelines and their relation to ham radio operations.

SCARC periodically offers license classes led by registered ARRL instructors. An ARRL Volunteer Examiner testing session takes place at the club during the first Saturday of odd-numbered months.

Operating Activities

Foxhunts have been a SCARC tradition since 1959. To engage more hams, SCARC, in cooperation with the West Texas Repeater Association (WTRA), provided a short training session on transmitter hunting and why we do it. This was followed by a build session to construct tape-measure antennas. Members who were experienced with these antennas helped others assemble their own. During the next month's Program Night, again coordinating with WTRA, two small transmitters were placed at a park near the clubhouse. Experienced operators were paired with new hunters as mentors; all the foxes were located and the new hunters were happy with their new skills.

SCARC provides communications during parades and events in the El Paso area. Prior to each event, operators

are briefed on incident command, tactical communications, and safety.

SCARC, other ham organizations, and individuals sponsor six weekly evening nets in El Paso that are structured for different bands to allow for hams of all license classes to participate.

And, of course, ARRL Field Day is an excellent opportunity for new hams to obtain some on-air experience.

Miscellaneous Activities

Our clubhouse is open for a Fifth Friday movie and pizza event, and also, once a month for a themed potluck dinner for members and their families. There's always a great turnout for these events. Our most recent themed potluck hosted more than 30 hams and their families.

Go Above and Beyond for Your Ham Community

Being an SSC means more than having just another piece of ham radio wallpaper — it's a recognition of club members' dedication to their ham radio experience, and, most importantly, the club's dedication to its members and local community. Join SCARC and the many other clubs demonstrating their hard work to improve the ham community by becoming an SSC!

Write for "Club Station"

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

ARRL Special Service Clubs

ARRL offers the Special Service Club (SSC) program for clubs that demonstrate that they're working to improve the amateur radio community by completing special projects, holding license classes, and working with local groups on events, among other activities. Visit www.arrl.org/ssc-application for more information about this program. Below is a list of new and renewing SSCs as of August 1, 2024.



Renewing SSCs

Lake Monroe ARS, N4EH
Rappahannock Valley ARC, K4TS
Jefferson ARC, W5GAD
Alliance ARC, W8LKY

Orlando, FL
Fredericksburg, VA
Metairie, LA
Alliance, OH

Ham Media Playlist

HOA Ham — Deploying Stealth Antennas

Amateur radio operators live all over the world — on acres of land, in high-rise apartments, and everywhere in between. No matter where they live, they require antennas. Some hams find themselves in areas more conducive to erecting antennas, having freedom to put up wire (or even towers) wherever they wish. There is one group of hams, however, who find themselves challenged with every construction project they dream up — those who live in an area that has a homeowners association, or HOA.

Those radio amateurs who have an HOA must be creative in order to deploy antennas. Many hams struggle, seeking help from others who have had success. Bob Hughes, KD4BMG, decided to help hams on his YouTube channel, “HOA Ham” (www.youtube.com/@HOAHamRadio).

Focusing on HOA Ham Radio

Finding himself in an HOA community as a ham radio operator, Bob did what many hams do in similar situations — he learned how to operate Parks on the Air and did much of his operating as a portable station. Because he had been setting up and taking down antennas at his home each time he wanted to operate, he was quite comfortable with the process when it was time to take his radio on the road.

Bob initially started his channel after purchasing an Icom IC-705 and an amplifier. He found information about his purchase lacking, so he decided to post videos explaining the things he struggled to find information on, such as hooking up cables, setting up the radio, etc.

Not long after posting these initial videos, Bob discovered that few hams were making videos about building stealth antennas. Because he became a ham long after purchasing his home in an HOA community, he had not considered restrictions on things a radio amateur would require, like antennas. In an effort to work around the rules of the HOA, Bob began recording his efforts to get on the air in a restrictive environment. As a result, HOA ham radio became the primary focus of his YouTube channel.



Bob, KD4BMG, installs Chameleon Antenna hardware on the wall of his home in a stealth antenna setup.

Stealth Antennas

One video that Bob is particularly proud of is making an antenna out of a wall-mounted flagpole. We are not talking about a standalone pole that requires cementing into the ground; rather, this is an inexpensive (approximately \$15) antenna that attaches to the side of the house. This is something that most HOA rules allow, so Bob showed the process of testing to make sure a particular flagpole would work, mounting it on the wall, and routing wire to the tuner. The video is interspersed with clips of contacts made with this antenna. Notably, Bob made a contact with M1EMC in Wiltshire, England, as well as several other contacts.

Bob views video creation a little differently than many HamTubers. Realizing that time is a precious commodity, he ensures that his videos deliver a return on the viewers' time investment. He tries to keep



Bob, KD4BMG, setting up the wall-mounted flag that will serve as a stealth antenna in plain sight.

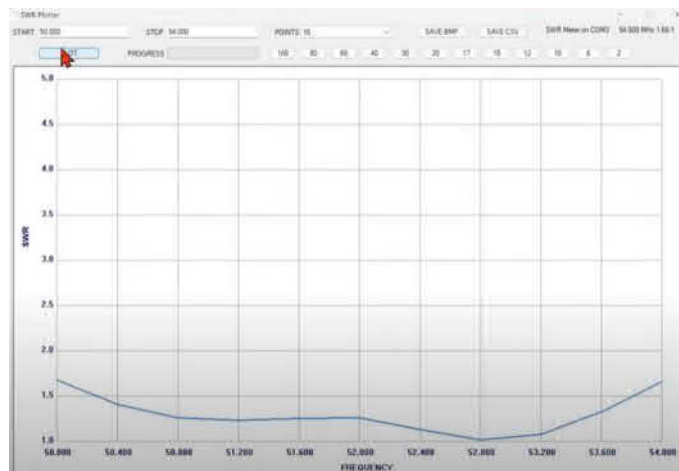


Bob, KD4BMG, tucks the elements of an off-center-fed dipole antenna into the roof vents of his home.

videos only as long as they need to be to convey the message he is putting forth.

Like many YouTube content creators, Bob reviews products, though he is very selective about what items he reviews and posts on his YouTube channel. Chameleon Antenna products tend to be a favorite of his to review. In one such video, titled “Stealth Ham Radio Antenna the HOA will Never Find – Chameleon CHA Porta Mast with CHA Hybrid Mini” (<https://tinyurl.com/HOA-mast>), Bob shows the installation of this mast and all required components without presenting every little detail. Instead, he shows the basics and goes into more detail on critical components. Bob discusses why he chose to go with this sort of mast system instead of a flagpole antenna, and gives several useful tips on how to easily set up and take down the mast and antenna. If you are looking for discreet antenna options, this is a must-see video, as it not only presents a reviewed product but also shows how to make effective use of the product.

Another popular stealth antenna video on HOA Ham is titled “Stealth Ham Radio Antenna the HOA Will



Bob, KD4BMG, shows the SWR readings on the roof-installed off-center-fed dipole on 6 meters.

Never Find: CHA OCF40 Dipole attached to the ROOF RIDGE VENT” (<https://tinyurl.com/HOA-stealth>). In this video, Bob shows a non-standard way to deploy an off-center-fed dipole on the roof of a home. He explains that because this antenna is not being configured in the way it was designed, it will not function exactly as expected. Bob also explains the importance of ensuring that safety is taken into account before climbing onto the roof of a home. After installing the antenna, as expected, Bob records a few contacts using the antenna.

If you are looking to move and may end up in an HOA community, if you are a ham who already lives in an HOA, or even if you have no restrictions but are looking for some tips on how to cleanly install an antenna, “HOA Ham” is a channel worth checking out.

Write for QST

The membership journal of ARRL is always open to manuscript submissions from ham radio operators.

QST looks for material that appeals to a broad cross-section of readers within the diverse amateur radio community. Feature articles published in QST fall into one of two broad categories: *technical* and *general interest*.

Technical articles outline a construction project or a technical concept. General interest articles are “everything else” that’s not technical: recaps of DXpeditions, grid expeditions, or public service activities, or personal accounts of trying a new mode or style of operating — anything relating to operating or the ham radio avocation.

Whether your manuscript has a technical or general focus, a strong “how-to” component will make it stand

out. Readers should come away from the article with specific ideas for recreating your experience.

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

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

How's DX?

CBØZA, CBØZEW, and CBØZW

In this month's column, Mike Crownover, Sr., AD5A, recalls his team's fraught — yet ultimately triumphant — February 2024 DXpedition to Robinson Crusoe Island.

The CBØZA DXpedition to Robinson Crusoe Island in the Juan Fernandez archipelago was very successful from a contact perspective, with more than 106,000 contacts from 6 to 160 meters and multiple modes, including SSB, CW, FT8, and Earth-moon-Earth (EME). However, the DXpedition almost did not happen.

The CBØZA DXpedition was originally a plan to activate a Chilean island for Islands on the Air (IOTA). Marco Quijada, CE1EW (SK), and Mike Crownover, Jr., AB5EB, had been talking about an IOTA activation for a couple of years but could never pull together a plan. But when Mike Jr. returned from the 3YØJ Bouvet Island DXpedition, his conversations with Marco switched to something bigger: a DXpedition to Juan Fernandez (CEØZ).

Marco had operated from Robinson Crusoe many years before, but like other DXpeditions there, he had to operate from the town of San Juan Bautista. From there, the path to North America is good, but the paths to Europe and Japan are blocked by mountains, and the local noise is oppressive. Using his contacts on the island, Marco was able to secure permission to operate from the local national park that includes Cerro Centinela. The peak is about 1,000 feet above sea level and has an unimpeded path to Japan, North America, and Europe. The opportunity to operate from that location made CBØZA not just another CEØZ DXpedition.

An Elevated Challenge

The mountaintop location provided logistical challenges. The DXpedition could not have fires of any type, and getting to the summit was difficult. Cooking — or even warming — food was not an option at the site. There was a sort of road to the top, but we didn't know how reliable it would be. Our contacts on the island told us we could walk an hour and 45 minutes one way, and/or ride horses and carry our gear on



The CBØZA operating site, located about 1,000 feet above sea level. Note the old Chilean Navy radio station ruins. [Mike Crownover, Sr., AD5A, photo]

mules. This was not an inviting scenario, to say the least. Finally, we were offered a ride to the top via a four-wheel-drive pickup. It was a relieving yet expensive option that would require multiple trips. Given these issues, we could only make tentative, on-island logistical plans.

Shocking News

The DXpedition was planned for February 2024. By November, all of the details were taking shape — then came some shocking news. While driving along a highway near Copiapó, Chile, Marco had a massive heart attack and passed away. He was only 50 years old. Obviously, the planning stopped. As the team mourned, the obvious question was whether we should continue with the DXpedition. After a couple of weeks, many team members dropped out, leaving only six operators.

Otis Vicens, NP4G, who is also a Bouvet veteran, took the lead. Otis had worked on some of the logistics of getting to the island with Marco and, fortunately, had been included in correspondence with the park ranger on Robinson Crusoe Island. The first step was to ensure that we could still operate from Cerro Centinela and that our flight charter could still be booked; we received confirmation on those issues. But with Marco's death, all of the website passwords, bank account information, and other DXpedition data were not recoverable.

A Race Against the Clock

The team of Otis, NP4G; Mike Crownover, Jr., AB5EB; Ez Prado, HI3R (NK4DX); Dercel, XQ3SK; Hal Turley, W8HC; Steve London, N2IC, and myself had a lot of



A view from the top of Cerro Centinela, overlooking San Juan Bautista. [Mike Crownover, Sr., AD5A, photo]

work to do in little time. We gathered in Melbourne, Florida, at the home of Chuck Green, AD4ES, to completely assemble the stations and computer networks to make sure everything would work. We immediately packed the non-electronic gear into a container and airfreighted it to Valparaíso, Chile. From there Guillermo Guerra, XQ3SA, would take the delivery and put it on a boat to Robinson Crusoe.

The team was to meet in Santiago, Chile, on February 8. The plan was to spend a couple of days in Santiago to pick up some needed supplies locally, see the city, and attend a BBQ at the home of Roberto Ramirez, CE3CT. A charter flight would take us to the island on Saturday morning.

Most international flights to Santiago land very early in the morning. Each team member had an arrival time between 6:00 and 7:00 AM. Everyone cleared passport control and gathered at the baggage claim except for me; I had mistakenly picked up an expired passport when I left for the airport. To make a long story short, a deportation order was issued. I had to fly back to Texas to pick up my current passport, and then fly back to Chile. I arrived at the terminal to catch the flight to Robinson Crusoe at 8:37 AM local time, with exactly no time to spare.

Once the team was finally together, we boarded the King Air 350 for the 2-hour flight to Robinson Crusoe. When you land on Robinson Crusoe, your gear is off-loaded and then taken to a small harbor about a mile away. This is where the passengers and luggage are loaded onto a boat for an open-ocean, hour-long ride to San Juan Bautista.

Our gear was inspected upon arrival, and we checked into the hotel. Gregg Marco, W6IZT, has developed a new generation of Radio in a Box (RIB) designs and asked us if we could allow a remote operation to test it out. Prior to the DXpedition, Gregg had recruited a team of operators around the world to get on the air from CE0Z. Ez, Dercel, and Hal set up the RIB in a hotel room and connected it to a homebrewed vertical and the internet. CB0ZEW was on the air within 2 hours of our arrival.

Steve, Mike Jr., Otis, and I took the first four-wheel drive to the top of Cerro Centinela. The trip was not for the faint of heart. Imagine the scariest mountain road you've ever been on, and then remove the guardrails and narrow it to one lane. Once on top, we surveyed the operating site and made a preliminary layout. It was getting dark, so we delayed moving our equipment until the next morning.

To accommodate required trips up and down the peak, we formed two teams with 24-hour shifts. During our off time, we stayed in a small hotel in town, which was a welcome relief. Weather on the mountain could be brutal, with temperatures around 50 °F and gale-force winds up to 50 mph that blew stinging rain. We had to relocate one of our stations back to town because the wind was more than the tent could stand.

Helping the Locals

Aside from the operation, the team performed multiple tasks that benefited the surrounding community. A repeater was repaired on top of the mountain that required 3 hours to climb. Ez and Dercel made the climb and used parts from three other repeaters to make a repeater available to the local Fisherman's Association. Ez also repaired some hospital equipment, and we donated a power supply to the police department to make their radio functional again. With the help of the International DX Association, a 3D printer was donated to the area's Women's Association. One local person commented that we were the first tourists to purposely help the people on the island.

Results

The operational results were very satisfying. Of note, CB0ZA made the first 6-meter EME contact with GM3POI and 27 EME contacts in total. The team also operated in the CW portion of the ARRL DX Contest as CB0ZW and set a CE0Z and CE record for MS-HP. The contact distribution was as follows: Europe 36.3%, North America 33.4%, Asia 23.2%, South America 5.4%, and Oceania/Africa 1.7%. For more information about the activation, visit www.qrz.com/db/cb0za.

The World Above 50 MHz

Solar Cycle 25 Now as High as Cycle 23

According to the Solar Influences Data Analysis Center of the Royal Observatory of Belgium, the average sunspot number in July for Solar Cycle 25 was 196.5. This is higher than every month since December 2001, which was during Solar Cycle 23. The best may be yet to come. Per the National Oceanic and Atmospheric Administration, Cycle 25's peak may be in July 2025. So, what does this mean for VHF DXers? This fall and winter, as well as spring 2025, may have the best F2 conditions on 6 meters in more than 20 years. Frank Donovan, W3LPL, and other propagation experts have noted it usually takes a sustained solar flux of more than 200 for routine F2 to occur from North America to Europe during the fall months. The solar flux was frequently more than 200 in July. As a result, you may have direct F2 on 6 meters from North America to Europe, and to Africa during the mornings. There may also be F2 and transequatorial propagation (TEP) to South America, F2 to Japan, and TEP to the South Pacific in the afternoons. There could be "over-the-pole" 6-meter openings to central Asia, and even long path for stations in North America.

October Long-Path Openings on 6 Meters

Long path was first worked on 6 meters during Solar Cycle 22. On October 9, 1988, at local midnight, SV1DH in Greece worked JG2BRI in Japan while beaming southwest. JG2BRI aimed his Yagi southeast. The path was nearly 31,000 kilometers, reaching down to the Antarctic, and then back north. Last spring, stations in the Caribbean and even a few in Florida experienced long-path propagation on 6 meters to Malaysia and Japan. With the sustained higher solar flux, these rare openings may be more frequent. They occur around the equinoxes.

Long-path 6-meter openings favor stations in the TEP zone. Examples include stations in the Caribbean, Hawaii, the Mediterranean, and the South Pacific. The most common long path is transequatorial. This is the long path experienced by stations in the Caribbean and northern South America when they work Japan. It requires a sustained solar flux of more than 165 and a Kp of less than 4. Another type of long path is transpolar, which took place during Solar Cycles 23 and 24, when stations in Hawaii beaming south over

Antarctica worked those in southern Europe. CEØY/W7XU in Easter Island worked stations in India via a path over the North Pole in 2001. Transpolar long path occurs only when the geomagnetic field is quiet (a Kp of less than 2). Carl Luetzelschwab, K9LA, discusses 10-meter long path at www.k9la.us/a_refresher_on_10m_long_path.pdf. Six-meter long path is similar.

What if you are not in the TEP zone? Perhaps sporadic E can get you there. These are the "sporadic-E links to TEP" often mentioned in this column. In October 2023, many stations in North America used sporadic-E openings to reach the TEP zone and work stations in South America and the South Pacific. In June 2024, seasonal sporadic E in North America played a significant role in E51EME's 6-meter success from the South Cook Islands. Sporadic E is not common in October, and the high solar activity seems to have dampened sporadic E this summer. But it does not take much sporadic E to make a big difference. With advances in technology, such as *WSJT-X*, *JTAlert*, internet chat rooms, software-defined radios, the automated PSK Reporter, DX Maps, and loop-fed array Yagis, it is easier than ever to find and work these rare 6-meter openings.

The Russell-McPherron Effect and Aurora

I mentioned the Russell-McPherron effect in the "Here and There" sidebar in the last column. It occurs due to cracks that appear in the Earth's geomagnetic field around the equinoxes, formed as a result of its orientation with the sun. This can create favorable interplanetary magnetic field polarity (Bz pointing south). Solar wind rushes in and increases geomagnetic activity. So, be alert to the notion that even a small coronal mass ejection (CME) or coronal solar wind stream can cause geomagnetic storming. It can magnify the effect of a major CME, like last May; this happened in October 2003 with the "Great Halloween Storms." Therefore, intense auroras may occur in October. CW is your best mode for aurora, followed by SSB and Q65-30C. FT8 does not work in such cases. For more information about recent solar activity, watch solar scientist Dr. Scott McIntosh discuss Cycle 25 at www.youtube.com/watch?v=Yj3TcoajK_o.



Larry Lambert's, NØLL, setup in grid DN90. [Larry Lambert, NØLL, photo]

July Grid Expeditions

Rare Fred Fish Memorial Award (FFMA) grid expeditions continued in July. Ed, N7PHY, activated DN37, DN67, DN68, and DN77. He noted “challenging conditions,” but had 401 6-meter contacts from DN77 and a total of more than 700 from the other grids. K8JH operated from CN71, and K9BG operated from DN95 on July 17 – 19. On July 20, I, NØJK, activated DM89. I made no contacts, but I received FT8 PSK flags from W2MKM (FN20) and W3LL (FM19). KE4TH activated DN53 on July 23 – 25. Larry Lambert, NØLL, went to DN90 on July 27 – 28. He made 30 MSK144 and 86 FT8 contacts. On July 31, AE5TC was active from EL79 with just a 20-meter Hamstick antenna and a tuner. He made 110 contacts (including one with me at 1350 UTC). If you happen to be traveling through or live in a rare grid, consider getting on 6 meters. Even a simple setup can do wonders.

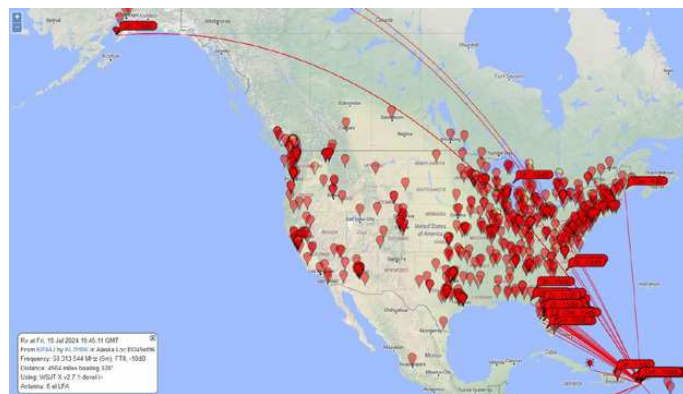
On the Bands

50 MHz. Despite a dismal summer for E_s, some bright spots and rare propagation occurred in July. On July 7, Mike, K7ULS (DN41), worked UT7UV (KO40) and OH1MA. He copied OG1X (KP10) calling K6EME (a nearly 8,000-kilometer path). The next day, NØLL (EM09) put OH2BCK (KO19), YL2SM, OH1LEU, YL2GD, and ES6RQ (KO23) in his log from 1719 to 1723 UTC. He said the opening was “easy to miss.” Brad, WF7T (EM66), logged KH6HI (BL01) on July 9 with strong signals. Greg Cerny, WQØP (EM19), worked OG2A the next day. The OHØZ Åland Islands team called WØMU (DM79) the same day!

A remarkable opening between Puerto Rico and Alaska took place on July 19. Edfel, KP4AJ, and Papo, KP4EIT, worked John, KL7HBK (BO49), at 1945 UTC. Edfel pointed out that fewer than 10 operators in Puerto Rico have worked Alaska on 6 meters, and that this was his 50th state on the band. John said that in addi-

tion to Puerto Rico, he worked stations in the EI, TF, and EA8 regions.

Mario, K2ZD (FN21), noted a “surprise spotlight opening to Japan” on July 21 for about 45 minutes, during which he logged 13 stations. On July 22, Phil Baldwin, NØPB (EM39), found Z37CXY in North Macedonia for a new country, and the next day, a 5-minute opening allowed him to log Urgent, 7Q6UJ (KH67). I, NØJK, noted CO8LY (FL20), XE3N (EL60), HI3T (EK49), and P43A (FK52) in via E_s on July 31. Glenn, K3SWZ (FN10), worked N7RF (EL09) on MSK144 from 2,298 kilometers away.



A PSK map showing the opening between Puerto Rico and Alaska on July 19. [www.pskreporter.info/pskmap]

144 MHz — no sporadic E? K7ULS mentioned that he has seen no 2-meter sporadic E this summer. I have received no reports for E_s on 2 meters, nor have I seen any spotted. This may reflect the overall lower E-layer ionization during summer 2024. W9UD has confirmed 48 states on 2 meters.

Here and There

The following stations achieved the FFMA this summer: AA5C, K4XO, K8SIX, and W5AJ. Robert, W5AJ, said his last grid was DN53, which he earned thanks to KE4TH. He credited Frank's, W3LPL, 6-meter antenna presentation as a contribution to his success. You can watch it at <https://youtu.be/84t7lz4wlms?t=11>.

John, K1OR (FN42), completed a record-setting 222 MHz meteor-scatter contact with Marshall, K5QE (EM31, SK), on August 14, 2023. The distance was 2,352 kilometers, and the prior record was 2,260 kilometers.

Marshall Williams, K5QE, became a Silent Key on July 26, 2024. He went on many grid expeditions, including DL79, DL88, EL58, and EL94. He built an elaborate contest station in southeast Texas. For more information, visit www.k5qe.com.

Special Events

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

Sep. 5 – Dec. 26, 0000Z – 2359Z, ZM100DX, various, New Zealand. Radio Society of Great Britain and New Zealand Association of Radio Transmitters (Otago Branch). **Re-enactment of the First Trans-Global Two-Way Radio Communication.** All bands, all modes, as available. QSL. See website for information. www.gb2nz.com

Sep. 14 – Sep. 15, 1422Z – 1412Z, W4CQF, Inglis, FL. Citrus County Amateur Radio Club and the US Coast Guard Auxiliary Flotilla. **US Coast Guard Auxiliary Anniversary.** 14.280 21.280. QSL. John Bescher, P.O. Box 947, Inglis, FL 34449. n4dxi@aol.com

Sep. 14 – Sep. 22, 0000Z – 2359Z, W6H, Rio Rancho, NM. Albuquerque DX Association. **Route 66 On the Air.** 3.866 7.266 14.033 14.266. QSL. Bill Mader, 4701 Sombrette Rd. SE, Rio Rancho, NM 87124. <https://adxa.groups.io/g/main>

Sep. 15, 1500Z – 2300Z, N16BB, Los Angeles, CA. Battle-ship Iowa Amateur Radio Association. **Battle of Incheon/Operation Chromite.** See website for frequencies. QSL per instructions on website. www.biara.org

Sep. 26 – Sep. 28, 1200Z – 2359Z, W4F, Spartanburg, SC. Spartanburg Amateur Radio Club. **Triple Tree Fly-In.** 7.210 14.200. QSL. SPARC Fly-In, 400 Glenwood Dr., Spartanburg, SC 29303. www.k4ii.org

Sep. 27 – Oct. 1, 0000Z – 2359Z, WW0WWV, Fort Collins, CO. WWV Amateur Radio Club. **WWV 105th Anniversary.** 7.048 7.248 14.048 14.248. QSL. * WWV ARC, P.O. Box 273226, Fort Collins, CO 80527. Please see the schedule on the WWVARC website and qrz.com for bands and modes. If you are interested in operating in this event and joining the WWVARC, write to secretary@wwvarc.org. www.wwvarc.org

Sep. 29 – Oct. 26, 0000Z – 2359Z, GB2NZ, various, United Kingdom. Radio Society of Great Britain and New Zealand Association of Radio Transmitters (Otago Branch). **Re-enactment of the First Trans-Global Two-Way Radio Communication.** All bands, all modes, as available. QSL. See website for information. www.gb2nz.com

Oct. 4 – Oct. 7, 0000Z – 2359Z, N9P, Wisconsin Rapids, WI. Wood County ARES/RACES/AUXC. **Nekoosa Giant Pumpkin Fest 2024.** 3.910 7.210 14.260 21.410. QSL. N9P Special Event, c/o Michael Krohn, W9BBF, 5421 Madison Cir., Wisconsin Rapids, WI 54494. w9wca.aresraces@gmail.com or www.facebook.com/WoodCoARES/RACES

Oct. 12, 1300Z – 2100Z, K3S, Baltimore, MD. Nuclear Ship Savannah Amateur Club. **President Ike Eisenhower's Birthday.** 7.1 14.15 21.1 28.1. QSL. K3LU, 980 Patuxent

Rd., Odenton, MD 21113. Please check spotting networks. www.qrz.com/db/k3s

Oct. 12, 1300Z – 2300Z, K5K, Lucedale, MS. George County Mississippi Amateur Radio Emergency Service Group. **3rd Annual Scratching Post QSL Party in Lucedale City Park.** 7.074 7.265 14.275 28.390. QSL. KD4VVZ, 258 Geiger Rd., Lucedale, MS 39452. www.gcmsares.org

Oct. 12, 1400Z – 1930Z, W5YL, Thibodaux, LA. Ascension and Thibodaux Amateur Radio Clubs. **BIG (Believe in Girls) Event.** 14.290; 14.230 SSTV; 18.125 DMR TG 907. QSL. AARC, P.O. Box 1617, Gonzales, LA 70707. www.k5arc.org or www.w5yl.org

Oct. 12, 1500Z – 2100Z, N4V, Nokomis, FL. Tamiami Amateur Radio Club. **Ham Radio Day at the Library.** 14.319 21.040. QSL. Tamiami ARC, P.O. Box 976, Nokomis, FL 34273. www.tamiamiarc.org

Oct. 12, 1600Z – 2300Z, N16IW, San Diego, CA. USS Midway Museum Ship. **Commemorating the Birthday of the US Navy on October 13, 1775.** 7.250 14.320; 14.070 PSK31 D-STAR on PAPA System repeaters. QSL. USS Midway Museum Ship COMEDTRA, 910 N. Harbor Dr., San Diego, CA 92101. www.qrz.com/db/ni6iw

Oct. 12, 1700Z – 2200Z, N6M, Rocklin, CA. ARRL Sacramento Valley Section. **Rocklin Maker Faire.** 14.074 14.290 146.520. Certificate. Carol F. Milazzo, P.O. Box 665, Citrus Heights, CA 95611. <https://rocklin.makerfaire.com>

Oct. 12 – Oct. 13, 1400Z – 2100Z, N2H, Rogersville, TN. Handcock-Hawkins Amateur Radio Team. **Rogersville TN Heritage Days.** 7.120 7.123 7.126 7.130. QSL. David Broome, 360 Rogers Rd., Rogersville, TN 37857. mebtfs@yahoo.com or www.facebook.com/groups/536078334756112

Oct. 12 – Oct. 14, 0000Z – 2359Z, K0C, Bridgeton, NJ. New Jersey Knights of Columbus Amateur Radio Club. **Celebration of Columbus Day.** 7.185 14.250 18.140 21.350. Certificate & QSL. Thomas M. Perrotti, N2JIE, 785 Vineland Ave., Bridgeton, NJ 08302-4822. www.nj2kc.org

Oct. 12 – Oct. 20, 0000Z – 2359Z, various, worldwide. US Affiliate (KFF) of World Wide Flora and Fauna. **Celebrating Earth Science Week (ESW) Sponsored by the American Geological Institute.** 7.044 7.184 14.044 14.240. QSL. QSL to station worked. www.wwff.us

Oct. 12 – Oct. 20, 0000Z – 2359Z, ZL4AA, Shag Valley Sheep Station, New Zealand. Radio Society of Great Britain and New Zealand Association of Radio Transmitters (Otago Branch). **Re-enactment of the First Global Two-Way Radio Communication.** All bands, all modes, as available. QSL. See website for information. www.gb2nz.com

Oct. 14 – Oct. 20, 0000Z – 2359Z, G2SZ, London, United Kingdom. Radio Society of Great Britain and New Zealand Association of Radio Transmitters (Otago Branch).

Re-enactment of the First Trans-Global Two-Way Radio Communication. All bands, all modes, as available. QSL. See website for information. www.gb2nz.com

Oct. 18 – Oct. 19, 1600Z – 2000Z, W4W, Johnson City, TN. Kingsport Amateur Radio Club. **Woolly Worm Celebration.** 7.187 14.240. Certificate. John Williams, 303 Autumn Creek Ln., Johnson City, TN 37615. jrwilliams37620@gmail.com

Oct. 18 – Oct. 20, 1900Z – 1900Z, W1AW/6, San Ramon, CA. Palo Alto Amateur Radio Association. **Pacificon 2024.** 7.050 14.270. QSL. W1AW, 225 Main St., Newington, CT 06111. www.pacificon.org

Oct. 19, 1400Z – 2000Z, K4RC, Williamsburg, VA. Williamsburg Area Amateur Radio Club. **Yorktown Special Event.** 7.265 14.265. Certificate & QSL. QSL Manager, WAARC, P.O. Box 1470, Williamsburg, VA 23187. *The Virginia Historic Triangle Certificate is available for contacting the Jamestown, Williamsburg, and Yorktown Special Event Stations.* www.k4rc.net/events/special-event-stations

Oct 19 – Oct. 20, 1000Z – 1400Z daily, N4C, Raleigh, NC. NC Ham Radio Operators. **North Carolina State Fair Ham Radio Exhibit.** 7.230 14.230. QSL. Travis Russell, 121 Pebble Dr., Clayton, NC 27520.

Oct. 19 – Oct. 20, 1400Z – 1800Z, W2LI, Union, NJ. Tri-County Radio Association. **90th Anniversary of Tri-County Radio Association.** 7.250 14.250; other HF frequencies possible. QSL. Tri-County Radio Association, P.O. Box 3393, Union, NJ 07083. www.tricountyradio.org

Oct. 19 – Oct. 21, 1400Z – 0600Z, W0D, Macon, MO. Macon County Amateur Radio Club. **Lester Dent — Doc Savage Special Event.** 3.950 7.250 14.280 28.400. Certificate & QSL. Dale Bagley, K0KY, 1402 Eastern Dr., Macon, MO 63552. www.maconcountymissouriarc.org

Oct. 26 – Oct. 27, 1000Z – 1400Z daily, N4C, Raleigh, NC. NC Ham Radio Operators. **North Carolina State Fair Ham Radio Exhibit.** 7.230 14.230. QSL. Travis Russell, 121 Pebble Dr., Clayton, NC 27520.

Oct. 31, 1400Z – 2000Z, W0YFZ, Anoka, MN. Anoka County Radio Club. **Halloween Special Event Station.** 7.250 14.250; 7.056 FT8. QSL. Anoka County Radio Club, P.O. Box 982, Anoka, MN 55303. www.anokaradio.org

Oct. 31 – Nov. 1, 1900Z – 0001Z, WA4TRS, Fairview, NC. The Road Show Amateur Radio Club, Inc. **BOO! On Bald Mountain.** 14.313 18.313. QSL. The Road Show ARC, 57 Echo Lake Dr., Fairview, NC 28730. www.wa4trs.org

Oct. 31 – Nov. 2, 0000Z – 2359Z, K0C, Bridgeton, NJ. New Jersey Knights of Columbus Amateur Radio Club. **Celebration of Date of Beatification of Blessed Michael J. McGivney, Founder of the Knights of Columbus.** 7.18500 14.25 18.140 21.350. Certificate & QSL. Thomas M. Perrotti, N2JIE, 785 Vineland Ave., Bridgeton, NJ 08302. www.nj2jc.org

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

*Some clubs may ask for a nominal fee to cover the cost of the certificate or QSL. Request will be made on the air during the event or on the club's website.

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

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

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

Convention and Hamfest Calendar

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

Abbreviations

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

Alabama (Headland) — Oct. 26 **FHRTV**

8 AM – noon. *Spr*: Wiregrass ARC. Headland Town Square, 100 Park St. *Tl*: 145.430 (186.2 Hz). *Adm*: Free.
www.w4dhn.org

Alabama (Montgomery) — Nov. 9 **DFHIRSTV**

8 AM – noon. *Spr*: Montgomery ARC. Alcazar Shrine Temple, 555 Eastern Blvd. *Tl*: 146.84 (123 Hz). *Adm*: \$8.
www.w4ap.org

Arizona (Marana) — Nov. 9 **DFHQIRSTV**

7 AM – 1 PM. *Spr*: Oro Valley ARC. Marana Middle School, 11285 W. Grier Rd. *Tl*: 146.62 (156.7 Hz). *Adm*: \$5.
www.tucsonhamradio.org

Arizona (Wickenburg) — Nov. 2 **HRT**

8 AM – noon. *Spr*: Hassayampa Amateur Radio Klub. Redeemer Lutheran Church Annex, 470 Rose Ln. *Tl*: 146.62. *Adm*: Free. Email: djgrooms@yahoo.com

Arkansas (Trumann) — Oct. 26

8 AM – noon. *Spr*: Crowley's Ridge ARC. Trumann Recreation Center, 16179 Pecan Grove Rd. *Adm*: \$5. Email: ag5qy@hotmail.com

ARRL PACIFIC DIVISION CONVENTION

October 18 – 20, San Ramon, California

DFHQIRSTV

Fri. 9 AM – 9 PM, Sat. 7 AM – 10 PM, Sun. 6 AM – 3 PM. *Spr*: Mount Diablo ARC. San Ramon Marriott Hotel, 2600 Bishop Dr. *Adm*: \$30 Advance, \$35 door. www.pacificon.org

ARRL CONNECTICUT STATE CONVENTION

October 13, Meriden, Connecticut

DFHSTV

8 AM – 2 PM. *Spr*: Meriden ARC. Maloney High School, 121 Gravel St. *Tl*: 147.36 (162.2 Hz). *Adm*: \$10. www.w1nrg.com

Florida (Bradenton) — Oct. 19 **FHRTV**

8 AM – 1 PM. *Spr*: Manatee ARC. Bible Baptist Church of Bradenton, 2113 Morgan Johnson Rd. *Tl*: 146.820 (100 Hz). *Adm*: \$5. Email: mryan5200@gmail.com

Florida (Crestview) — Oct. 5 – 6 **DHQIRV**

Sat. 3 PM – 6 PM, Sun. 8 AM. *Spr*: North Okaloosa ARC. Crestview Community Center, 1446 Commerce Dr. *Tl*: 147.360 (100 Hz). *Adm*: \$7; 12 and under, free; 90 and above, free; Boy Scouts in uniform, free. www.w4aaz.org/noarc/hamfest-2024

ARRL GEORGIA STATE CONVENTION

November 2 – 3, Lawrenceville, Georgia

FHRTSV

8 AM – 4 PM. *Spr*: Alford Memorial Radio Club, Gwinnett ARS. Gwinnett Co. Fairgrounds, 2405 Sugarloaf Pkwy. *Tl*: 146.76 (107.2 Hz). *Adm*: \$8 Advance, \$10 door.
www.stonemountainhamfest.com

Indiana (Bedford) — Oct. 12 **DFHIRSTV**

8 AM – 1 PM. *Spr*: Hoosier Hills Ham Club. Lawrence Co. 4-H Fairgrounds, 11265 US-50. *Tl*: 146.73 (107.2 Hz). *Adm*: \$5.
www.hoosierhillshamfest.com

Indiana (Lynnville) — Oct. 19 **DFHRT**

8 AM – 1 PM. *Spr*: Tri-State ARS of Evansville. Lynnville Community Center, 416 W. State Rd. 68, IN-68. *Tl*: 145.250 C4FM. *Adm*: Free. www.hamtoberfest.com

Indiana (Shelbyville) — Oct. 5 **DFHRT**

8 AM – noon. *Spr*: Blue River Valley ARS. Shelby Co. Fairgrounds, 500 Frank St. *Tl*: 145.48 (88.5 Hz). *Adm*: Free.
www.brvars.com

ARRL KANSAS STATE CONVENTION

October 5, Wichita, Kansas

FHRSV

8 AM – 1 PM. *Spr*: Valley Center ARC. RiverWalk Church of Christ, 225 N. Waco Ave. *Tl*: 146.94. *Adm*: \$5. www.vcarc.org

Kentucky (Hazard) — Oct. 26 **DFHRTV**

8 AM – 11 AM. *Spr*: Kentucky Mountains ARC. VFW Post 7387, 1700 N. Main St. *Tl*: 146.67 (103.5 Hz). *Adm*: \$10. Email: jlb741@yahoo.com

Maryland (Hollywood) — Oct. 12 **FHRTV**

8 AM – 1 PM. *Spr*: St. Mary's Co. ARA. Hollywood Volunteer Fire Dept., 24801 Three Notch Rd. *Tl*: 147.195 (156.7 Hz). *Adm*: \$5. www.public@smcara.groups.io

Massachusetts (Bourne) — Nov. 2 **DFHRTV**

9 AM – noon. *Spr*: Falmouth ARA. Upper Cape Cod Regional Technical School, 220 Sandwich Rd. *Tl*: 146.655 (88.5 Hz). *Adm*: \$5. www.falara.org

Michigan (Muskegon) — Oct. 12 **FHRTV**

9 AM – noon. *Spr*: Muskegon Co. Emergency Communication Services. Fellowship Church, 4200 Apple Ave. *Tl*: 146.820 (94.8 Hz). *Adm*: \$8. www.mcecs.net

Missouri (Nixa) — Nov. 9 **DFHRSV**

8 AM – 1 PM. *Spr*: Nixa ARC. Aldersgate Church, 460 Aldersgate Dr. *Tl*: 147.015 (162.2 Hz). *Adm*: \$10.
www.smlrs.info/narcfest2024

Missouri (Sedalia) — Oct. 12 **DFHQIRSTV**

9 AM – noon. *Spr*: Sedalia-Pettis Amateur Radio Klub. Our Savior Lutheran Church gymnasium, 3700 W. Broadway Blvd. *Tl*: 147.030 (179.9 Hz). *Adm*: \$5. www.wa0sdo.org

New York (Hicksville) — Nov. 10 **DFHQIRSTV**

8:45 AM. *Spr*: Long Island Mobile ARC. 201 Levittown Pkwy. *Tl*: 146.85 (136.5 Hz). *Adm*: \$6. www.limarc.org

New York (Horseheads) — Sept. 28 **FHRTV**

6 AM – 2 PM. *Spr*: Amateur Radio Association of the Southern Tier. Chemung Co. Fairgrounds, 170 Fairview Rd. *Tl*: 146.70 (123.0 Hz), 147.36 (123.0 Hz). *Adm*: \$6 Advance, \$8 door.
www.arast.info/arast_website/public/hamfest.php

Ohio (North Canton) — Oct. 27 D F H Q R S V

8 AM – 1 PM. *Spr:* Massillon ARC. Military Aviation Preservation Society, 2260 International Pkwy. *Tl:* 147.18 (110.9 Hz). *Adm:* \$5. www.w8np.net

Oklahoma (Ardmore) — Oct. 26 D F H Q R S V

8 AM – 3 PM. *Spr:* Central Oklahoma Radio Amateurs. Ardmore Convention Center, 2401 N. Rockford Rd. *Tl:* 146.97 (131.8 Hz). *Adm:* \$10 Advance, \$12 door. www.hamarama.org

Oregon (Rickreall) — Oct. 19 F H R V

9 AM – 3 PM. *Spr:* Mid-Valley ARES. Polk Co. Fairgrounds, 520 S. Pacific Hwy. W. *Tl:* 145.33 (186.2 Hz). *Adm:* \$10. www.swaptoberfest.org

Pennsylvania (Perkasie) — Oct. 20 D F H R T V

7 AM – 1 PM. *Spr:* RF Hill ARC. Upper Co. Campus of Bucks Co. Community College, 1 Hillendale Rd. (use Blooming Glen Rd. entrance: 40°22'57.2"N, 75°16'26.3"W). *Tl:* 145.31 (131.8 Hz). *Adm:* \$7. www.rfhillarc.club

ARRL SOUTH CAROLINA SECTION CONVENTION

October 12, Rock Hill, South Carolina

D F H R S T V

8 AM – 2 PM. *Spr:* York Co. ARS. Covenant Presbyterian Church, 1830 Celanese Rd. *Tl:* 147.030. *Adm:* \$5. www.ycars.org

Tennessee (East Ridge) — Oct. 18 – 19 F H R S T V

Fri. noon – 7 PM, Sat. 8 AM – 3 PM. *Spr:* Chattanooga ARC. East Ridge Community Center, 1515 Tombras Ave. *Tl:* 145.390 (107.2 Hz). *Adm:* \$10. Email: hamfest@w4am.net

Tennessee (Evansville) — Oct. 26

7 AM – 3 PM. *Spr:* Rhea Co. ARC. Rhea Co. Fairgrounds, 344 Eagle Ln. *Tl:* 147.39 (100 Hz). *Adm:* \$5. Email: hamoweentn@gmail.com

Texas (El Paso) — Oct. 26 F H R T

7 AM – 3 PM. *Spr:* El Paso ARC. El Paso ARC Clubhouse, 2100 San Diego Ave. *Tl:* 146.70. *Adm:* Free. www.w5es.net

Texas (Springtown) — Oct. 19 F H R S T V

8 AM – noon. *Spr:* Springtown Hamfest & Preparedness Expo. Cornerstone Community Church, 2233 E. Hwy. 199. *Tl:* 147.16 (110.9 Hz). *Adm:* \$1. Email: tsuhunny@gmail.com

Wisconsin (Lancaster) — Oct. 19 D F H R V

8 AM – 2 PM. *Spr:* Hidden Valleys ARC. Grant Co. Fair Grounds Youth and Ag Building, 916 E. Elm St. (county road A). *Tl:* 146.52. *Adm:* Free. Email: hvarchamfest@gmail.com

ARRL WISCONSIN STATE CONVENTION

November 2, Wisconsin Rapids, Wisconsin

H R S

9 AM – 4:30 PM. *Spr:* WeComm, Ltd. McMillan Memorial Library, 490 E. Grand Ave. *Tl:* 146.670 (114.8 Hz). *Adm:* Free. www.wi-arrrl.org

To All Event Sponsors

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

Events that are sanctioned by ARRL receive special benefits, including an announcement in these listings and online. Sanctioned conventions are also listed in *The ARRL Letter*. In addition, events receive donated ARRL prize certificates. Once the form has been submitted, your ARRL Director will decide whether to approve the date and provide ARRL sanction.

The deadline for receipt of items for this column is **the 1st of the second month preceding publication date**. For example, your information must arrive at HQ by **November 1** to be listed in the **January** issue. Information in this column is accurate as of our deadline; contact the sponsor or check the sponsor's website for possible late changes, driving directions, and other event details. Please note that postal regulations prohibit mention in *QST* of games of chance, such as raffles or bingo.

Promoting your event is guaranteed to increase attendance. As an approved event sponsor, you are entitled to special discounted rates on *QST* display advertising and ARRL web banner advertising. Call ARRL's toll-free number at 1-800-243-7768, or email ads@arrrl.org.

Field Organization Reports — July 2024

Public Service Honor Roll

This listing recognizes radio amateurs whose public service performance during the month indicated 70 or more points in six categories. Details on the program can be found at: www.arrl.org/public-service-honor-roll.

440 N9VC	195 KC9FXE	145 WM2C	119 KV8Z KO4KUS	KB8SIQ N8MRS W4EDN W1KX K8ED KZ8Q WB4RJW K2MTG KZ8Q WB4RJW K2MTG K3YAK KA2HZP N1LAH KC1KVY KC1HHO W1TCD	W8GSR K8KRA N8OD KB8HJJ WA3QPX AA3N KB8PGW KM4WHO AA4XV KM4WHO AA4XV W2QMI WB2VUF WX2DX N1CVO	80 AE2EY KR4ST KA8BJA K3EAM
417 W7PAT	185 ND8W	140 W2PAX W8DJG WO2H	118 K8RDN			
386 WA3EZN	180 WV5Q		115 K5OB KF8ATJ AG9G W3YVQ N1ILZ			
285 N2LC	170 W4DNA	135 WA3QLW AG9G W3YVQ N1ILZ	110 KO4OL KC8WH N4CNX WB8TQZ KB2QO KDØHHN N1IQI W1RVY			
283 W7EES	168 KE8DON WB8YY5	130 K8MDA W8MAL WK4WC N2JBA KY2MMM KW1U N1UMJ WZØC				
275 AD8CM	160 ACØKQ WB9WKO AC8NP W4CMH			99 WA1URS WB8R		
270 NW3X						
266 NØDMP	158 KD2NMG		108 KA9IKK	97 KT5EM WW3S		
260 KT2D	157 KD2GXL	126 KC8T	107 W8IM KD2LPM	96 N3KRX KE8CYC		
230 KD8UUB	155 KD8ZCM K9LGU	125 W1LEM	106 AE5MI	95 KE4RS KL7RF KC3MAL		
216 KB9PGY	150 KR4PI N8SY KK3F	124 W5WMC	104 N2DW	86 NØET		
214 WØPZD		120 WA4VGZ K7OED K3JL KY2D KV2J WC4FSU AD4DO W2AH	103 KC8YVF	93 KT4WX		
200 WM5N WA2BSS	146 KE8ANW		100 NX9K KB8GUN	90 KB9GO KC9UC WB4ZDU KT5SR		
199 KB3YRU				81 W5XX KB4OLY		

The following stations qualified for PSHR in previous months, but were not acknowledged in this column yet. (June) WDØBFO, KO4OL 110, WB4ZDU 90, W4NHO 83, WB8RGE 77, KAØDBK 75. (May) K3KRX 117, WW3S 99.

Section Traffic Manager Reports

The following Section Traffic Managers reported: AK, AL, AR, AZ, CO, CT, DE, EMA, ENY, EPA, GA, KS, KY, LA, MDC, ME, MI, MO, MS, NC, ND, NFL, NLI, NNJ, NNY, OH, OR, RI, SD, SFL, SJV, SNJ, STX, TN, WCF, WI, WMA, WPA, WV, WY.

Section Emergency Coordinator Reports

The following Section Emergency Coordinators reported: KY, MI, SCV.

Brass Pounders League

The BPL is open to all amateurs in the US, Canada, and US possessions who report to their SMs a total of 500 or more points or a sum of 100 or more origination and delivery points for any calendar month. Messages must be handled on amateur radio frequencies within 48 hours of receipt in standard ARRL radiogram format. Call signs of qualifiers and their monthly BPL total points follow.

KY2D 1,990, NX9K 1,816, WB9WKO 699, N9CK 637, WA3QLW 636, KK3F 614.

The following station qualified for BPL in June but was not acknowledged in this column yet.

W2PAX 502.

New Products

Mastrant High-Visibility Support Rope

Mastrant released a new highly reflective Mastrant-O rope. It is bright orange with braided reflective tape based on a long-term proven polyester (Dacron) product line. It is designed for maximum visibility in public places such as ARRL Field Day and Parks on the Air activities. Like all Mastrant ropes, it is UV stable and resistant to all weather conditions. The rope is 5.8 millimeters in diameter and 102 feet long, and has a 1,190-pound strength. You can purchase the spool for \$35 from www.mastrant.com.



Volunteer Monitor Program Report

The Volunteer Monitor (VM) Program is a joint initiative between ARRL and the FCC to enhance compliance in the Amateur Radio Service. This is the July 2024 activity report of the VM Program.

◆ Two licensees in Michigan and Wisconsin received advisory notices to stay off local repeaters, both having received “stay off” directives from the repeater owners. The licensees were informed that further use of the repeaters would be considered deliberate interference and would be referred to the FCC for enforcement action.

◆ Technician-class licensees in Pennsylvania and Michigan received advisory notices for FT8 operation on 40 meters. Technicians have only CW privileges on 40 meters.

◆ A good operator commendation was issued to a licensee in Virginia for exemplary operation as net control of a daily net meeting on 7.251 MHz.

◆ A volunteer monitor alert was issued on July 20 for a pulsing noise on 20 meters. The VM Program Administrator participated in a nationwide online presentation to ARRL Section Managers and participated in one FCC meeting.

The totals for April monitoring were 1,908 hours on HF frequencies, and 2,801 hours on VHF frequencies and above, for a total of 4,709 hours. Totals for May monitoring were 890 hours on HF frequencies, and 1,918 hours on VHF frequencies and above, for a total of 2,808 hours. Totals for June monitoring were 1,210 hours on HF frequencies, and 1,413 hours on VHF frequencies and above, for a total of 2,623 hours.

— Thanks to Volunteer Monitor Program Administrator Riley Hollingsworth, K4ZDH

Congratulations

July 2024

QST Cover Plaque Award Winner

*Brian Karcher,
KG5GJT*

In his article, “Preparedness Paid Off Before, During, and After Hurricane Ida,” Brian explains how planning ahead and staying informed got his family safely through Hurricane Ida.

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

www.arrl.org/cover-plaque-poll

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

Preparedness Paid Off Before, During, and After Hurricane Ida

A firsthand account of how this Louisiana ham family stayed informed and connected during a catastrophic storm.



Damage is assessed in Hahnville, Louisiana, during the aftermath of Hurricane Ida. This was about 25 minutes away from Brian Karcher's, KG5GJT, home. [Photo courtesy of FEMA]

Brian Karcher, KG5GJT

On August 29, 2021, Hurricane Ida made landfall in Port Fourchon, Louisiana, as an “extremely dangerous” Category 4 hurricane that traveled on a path of destruction through the northeastern US and into the Atlantic Ocean on September 2. It was the second most damaging storm to hit Louisiana since Hurricane Katrina.

Geographical Demand for Emergency Preparedness

Residents of the New Orleans metropolitan area of southeast Louisiana experience a yearly threat of tropical systems and hurricanes from June to November. Because of this, I take emergency preparedness very seriously. I'm an active member of the Louisiana Ama-

teur Radio Emergency Service® (ARES®) Region 1. Checking in to our weekly ARES training net reminds me to stay prepared to keep improving upon my amateur radio capabilities.

I keep a 2-week supply of emergency food and water year-round. Between that and the normal supplies in the house, I always have enough to keep my family fed and hydrated for 4 weeks in case of an emergency. I also regularly ensure that all of my amateur radio equipment is operational and ready to go for any emergency. And when a storm is approaching, I double-check that all of my radio batteries and backup batteries are topped off.

Having been through many power outages, my station is equipped with a West Mountain Radio Epic



Certificate of Code Proficiency Recipients



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

February 2024

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

March 2024

Mark A. Jessing, N4OJE	10
Stephen M. Riley, WA9CWE	10
Kenneth F. Robinson, K8SCA	10
Steven L. Myers, A17OL	20
Bernard A. Poskus, KF0QS	20

April 2024

Joseph P. Kononchik, KS1I	10
Bill Durham, KG5ZCI	15
Joseph P. Kononchik, KS1I	15
Glenn R. Barr, Jr., WB0KFC	20
Daryl I. Hammond, W0BZ	20
Gabriel E. Donley, WN7JT	25

May 2024

Tom J. Zajdel, AA3TZ	10
Tom J. Zajdel, AA3TZ	15
John H. Orkney, KA1LHJ	20
Tom J. Zajdel, AA3TZ	20
Daryl I. Hammond, W0BZ	25

June 2024

Robin L. Zinsmaster, N6PHP	25
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July 2024

Theodore J. Jacobson, N6ZO	10
Jerry K. Nobles, N5MES	10
Charlene K. Lewis, K8XCO	15
David D. Koberstein, N9DK	20

August 2024

Jeanne Martin, KC1SPX	10
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Congratulations to all of the recipients.

October 2024 W1AW Qualifying Runs

W1AW, the Hiram Percy Maxim Memorial Station at ARRL Headquarters in Newington, Connecticut, transmits Morse code Qualifying Runs to assist ham radio operators in increasing and perfecting their proficiency in Morse code. Amateur radio operators can earn a Certificate of Code Proficiency or endorsements by listening to W1AW Qualifying Runs.

October Qualifying Runs will be transmitted by W1AW in Newington, Connecticut, at the times shown on 1.8025, 3.5815, 7.0475, 14.0475, 18.0975, 21.0675, 28.0675, 50.350, and 147.555 MHz. The West Coast Qualifying Runs will be transmitted by KH6TU on Wednesday, October 23, at 6 PM HST (0400 UTC on October 24) on 7047.5 and 14047.5 kHz. Unless indicated otherwise, sending speeds are from 40 to 10 WPM.

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

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

Include \$10 (check or money order) if this is a submission for your initial Code Proficiency certificate; \$7.50 if you are applying for an endorsement (available for speeds up to 40 WPM). Your text will be checked against the actual transmissions to determine if you have qualified.

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

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

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

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

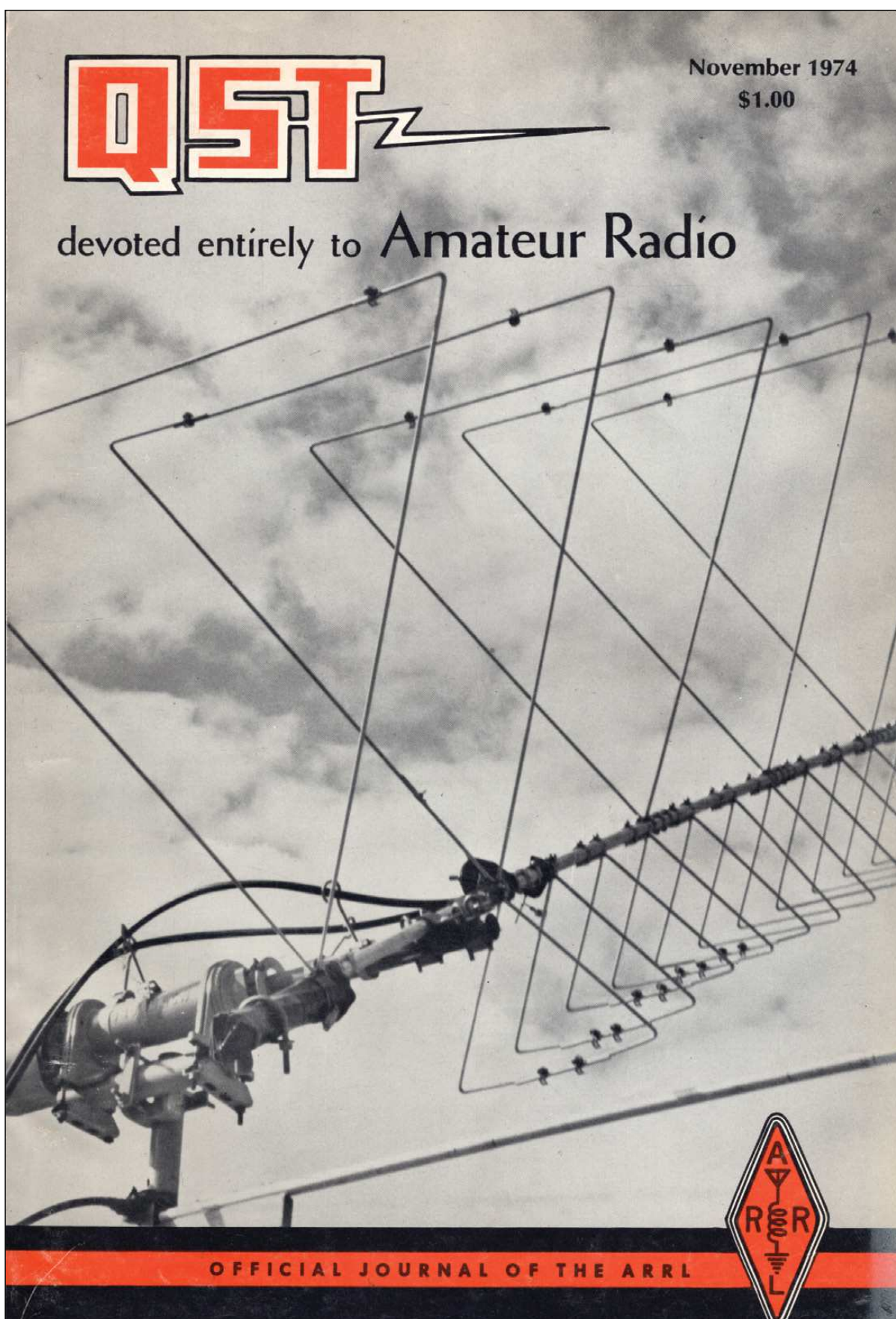


W1AW Qualifying Runs — October 2024

(All times are in Eastern Standard Time.)

Monday	Tuesday	Wednesday	Thursday	Friday
10/7 4 PM – 2000Z 35 – 10 WPM	10/8 7 PM – 2300Z 10 – 35 WPM		10/10 10 PM – 0200Z (10/11 – UTC) 10 – 40 WPM	10/11 9 AM – 1300Z 10 – 35 WPM
Columbus Day/ Indigenous Peoples' Day	10/15 4 PM – 2000Z 10 – 35 WPM		10/17 9 AM – 1300Z 35 – 10 WPM	10/18 10 PM – 0200Z (10/19 – UTC) 10 – 35 WPM
10/21 9 AM – 1300Z 10 – 35 WPM			10/24 7 PM – 2300Z 10 – 35 WPM	10/25 4 PM – 2000Z 10 – 40 WPM
10/28 10 PM – 0200Z (10/29 – UTC) 10 – 40 WPM	10/29 4 PM – 2000Z 35 – 10 WPM	10/30 9 AM – 1300Z 10 – 35 WPM		

A Look Back

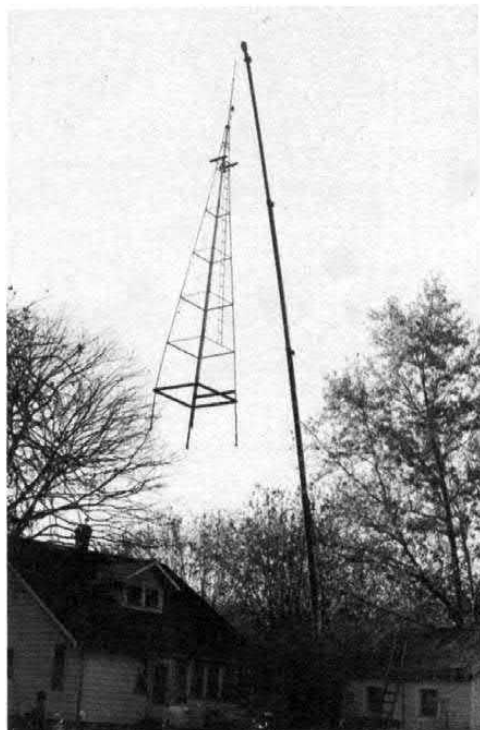


Strays

WB2HTJ displays the prize of his license plate collection: his call on a French plate!

A five-cent postage stamp honoring the nation's 250,000 amateur radio operators was first placed on sale at Anchorage, Alaska, on December 15, 1964. It was in Alaska that the 'hams' wrote another chapter in a long public service record by maintaining communications following the (then) recent earthquake. The commemorative stamp falls on the 50th anniversary of the founding of the American Radio Relay League. The purple vertical stamp was designed by Emil J. Willett of Hartford, Connecticut. His stylized design combines a radio broadcast wave (AM) with a portion of a radio dial.

From the U.S. Post Office Department's advertising literature, de K6YD.



Back in 1923, when Western Pennsylvania was part of the Eighth Call Area, the old FRC assigned my first call, W8IYI. When the districts were realigned we became part of the expanded Third District, and my call was changed to W3LEJ. While filling out a routine renewal in 1956, I checked the *Callbook* and found that W3IYI was unassigned, and asked FCC to issue that call to me.

On an evening in early May, while the XYL was preparing dinner, I fired up on 40 cw, using the call W3LEJ, and contacted a friend in New Jersey. During the QSO, the XYL put the FCC envelope on my desk and said, "This came in the mail today." I opened it, and found that FCC had granted my call request, and so advised the fellow on the other end. So I began the QSO with one call — and ended with another! — W3IYI

— . . . —

W8CNL was calling "CQ Dog Xray." So, some nut sent him 4 copies of a dog's Xray. — WA7RFH

Recently K4VZC moved to another section of the country and was faced with the problem of dismantling a 35 foot tower. It was located behind his house, which just happened to be surrounded by large trees. He contacted the local steeple construction company and arranged for the use of their hydraulic crane to assist in the move. It was necessary to pick up the tower and carry it over the 2 story house. The 3 element quad had to be taken off in order to transport it through the downtown area. — WA4ZXH



Gregory Lapin, WA1NUK, winner of an F.A.R. scholarship (see story in "Happenings of the Month"), also received an inscribed ARRL *Handbook* from New England director Robert York Chapman, W1QV, (far right) as a memento of the occasion. Greg's parents, Mr. and Mrs. Stanley Lapin of Westport, Conn., share the pleasure.

QST for

Celebrating Our Legacy

How Ham Radio Led to a High-Level Scientific Award

I owe a profound thank-you to ham radio for my success in life. Ham radio taught me how to build things that work! As a kid growing up in East Africa, I had a limited budget, so I had to put a long-wire homemade antenna up on the sixth floor of our apartment building. It worked great! I could copy the East African Net every Sunday on my shortwave AM radio. As a ham radio operator, I always made friends with anyone from anywhere.

When I was 20, I competed for a scholarship in America and won a spot studying engineering physics at Washington University in St. Louis (Wash U). It was like a door opening. When I saw the Wash U cyclotron — an atom smasher that creates a new kind of matter and even antimatter in the form of positrons — I was hooked. The engineers said there wasn't a job for me, but I didn't care; I didn't need to be paid. I was grateful when Rex Hill taught me how to use integrated circuits, even before they appeared in textbooks. It felt like I was back in the ham radio world, wiring circuits, and that cyclotron experience was just a warm-up for what came next.

Mike Phelps and Ed Hoffman wanted to build the first Wash U PET scanner and asked me to design the circuitry. Any ham radio operator would understand how we had to scrounge for parts for it. When we finished the prototype hexagonal PET scanner, it looked like a science fair project, but it had the critical elements of a modern PET scanner. When my lab chief, Michel Ter-Pogossian, saw our PET scanner, he got PET scan fever and wrote a proposal for the next one. The funds came through, and we no longer had to scrounge for the parts.

I helped build every one of the improved PET scanners, from PETT III in 1974 to PETT VI in 1980, pivoting from the hexagonal detector array to

the modern circular PET. For PETT IV, I needed to squeeze more performance out of the same number of detectors. My teenage tinkering experience with ham radio told me to divide each detector into segments and make it do the work of four!

In 1999, I met someone at a trade show who changed my life. He was a salesman like me. I was flogging a device I invented to find veins and minimize the pain of drawing blood. The guy next to me, John Bottjer, had an instrument he was selling, and he showed me its circuitry. His wiring was a mess, and it was easy for me to fix his device. Together, we invented a new cancer-detecting instrument, the DermLite, and dermatologists swear by it. They could find melanoma when just a tiny area was cancerous. People found new uses for the device, like discovering the cause of hair loss or distinguishing one kind of skin cancer from another. One of the dermatologists, William V. Stoecker, MD, became my lifelong friend. He received funding for cancer detection studies and bought many of my instruments. I discovered he liked to write, and we wrote some stuff together.

On June 25, 2023, the President of the Society of Nuclear Medicine and Molecular Imaging, Dr. Munir Ghesani, finished introducing me at the annual meeting with a brief history of my contributions to PET scanners. I stepped up to the podium, gave my acceptance speech, and joined the elite roster of George Charles de Hevesy Nuclear Medicine Pioneer Award winners. It was an incredible feeling to share this moment of recognition for my life's work.

I thought about how positive influences came to me at critical times in my life, like my parents, who nurtured and educated me; the Aga Khan, who told me to get an education; my employer in my home country, Tanzania, who fired me and told me



Nizar Mullani, KØNM, receiving the George Charles de Hevesy Nuclear Medicine Pioneer Award plaque. [Nizar Mullani, KØNM, photo]

to go back to school, and everyone after who played a role in my education, including Professor Jerry Cox, a guardian angel for everyone he knew at Wash U, and Michel Ter-Pogossian.

All the big changes in my life came when I made new friends, but that's the magic of ham radio. When we meet someone new, wherever they are, we help each other and learn new things. This little story shows my gratitude for all the ham radio operators I've met in my 80 years.

**Nizar Mullani, KØNM, and
William V. Stoecker, MD**
Sugar Land, Texas

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

Classic Radio

The Stunning National NC-270 Cosmic Blue Receiver

Radios in earlier years were often boring, dark, and severely functional. So, imagine the buzz when National Radio Company introduced a series of ham receivers in 1960 that used two different shades of blue, along with striking red accent colors, a glossy front-panel finish, shiny bright knobs, a unique flip-down bail, and a model number written out in a large stylish script. It even had shiny fins (think 1957 Chevy or Cadillac) around the slide rule dial and meter. National called it the NC-270 Cosmic Blue, and its styling was radically new and unlike anything on the market at that time. I've been told that hams either really liked the styling or were horrified. Personally, I liked it!



NC-270 Cosmic Blue receiver and matching NTS-3 speaker.

Cosmic Blue Shock

National advertised the NC-270 in the August 1960 issue of *QST* with a suggested price of \$249.95, which is equivalent to \$2,652.97 in today's dollars (www.usinflationcalculator.com). An equally stylish and matching NTS-3 speaker was offered for \$19.95. The NC-270 was designed to be a medium-grade communications receiver and was manufactured from 1960 through 1964.

According to National Radio Service Manager (from 1963 to 1969) Carl Huether, KM1H, National had assigned the NC-270 design to a completely new group. This explains the shift from National's traditionally stodgy or purely functional look and the shock of the Cosmic Blue styling. The front panel of the NC-270 was a deep shade of blue, while the cabinet, foot bail, and subpanel behind the S-meter were a lighter shade. The front-panel finish was glossy and bright.

Its 11 1/2 x 2 1/2-inch slide rule dial had black silk-screen lettering for frequency and red lettering for a logging scale, which were easy to read. Turning the main frequency tuning knob moved a bright red vertical slider or needle across the front of the slide rule dial to indicate frequency.

The main tuning knob was large, with a stainless-steel weighted dial skirt behind it that provided National's traditional, smooth tuning.

The cabinet was perforated with holes on all sides, reducing weight and providing convection cooling. A novel



Top view of the chassis and rear panel.



Scott Freeberg's, WA9WFA, vintage station.

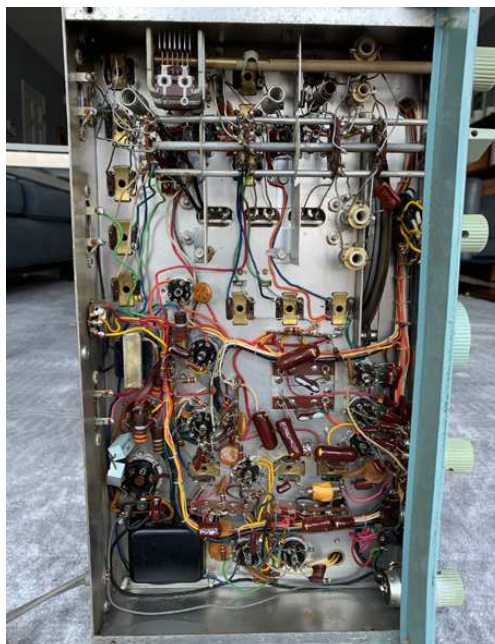
convenience was a flip-down stand, or bail, that angled the front of the radio up to face the operator. This was known as the "flip foot." When not in use, the flip foot would lay flat against the bottom of the chassis. The NTS-3 matching speaker also had a flip-foot mechanism, but instead of folding flat against the bottom, it folded all the way back around into the rear of the cabinet. The rear panel held the power cord, screw antenna terminal input, RCA antenna jack, speaker output terminal, S-meter adjust, and standby relay output.

The controls were standard, and you'd recognize almost everything. The RF and audio gain controls were labeled R.F.G. and A.F.G., respectively. Five different styles of knobs were used on the front panel.

The NC-270 was a 10-tube, double-conversion, six-band superheterodyne ham receiver that covered the traditional non-WARC bands from 6 through 80 meters. Modes included AM, SSB, and CW, although it appears it was designed to favor the AM mode more than the others. The NC-270 was $15\frac{3}{4} \times 9 \times 8\frac{3}{4}$ inches and weighed 28 pounds. The NTS-3 speaker was approximately $5\frac{1}{2} \times 8\frac{1}{2} \times 4\frac{1}{2}$ inches and weighed just over 3 pounds.

The receiver used a 2215 kHz first IF and a 230 kHz second IF for good image rejection. In the second IF chain, there was a unique super-high Q factor patented ferrite filter that provided good band-pass filtering. A front-panel switch provided five bandwidth selections, including 0.6 kHz, USB 2.5 kHz, LSB 2.5 kHz, 3 kHz, and 5 kHz. There was also a variable beat frequency oscillator for tuning in CW and SSB.

A 100 kHz crystal calibrator was included for calibrating the slide rule dial with the red vertical slider. Interestingly, the vertical slider wasn't adjusted to line up with the slide rule dial — it was the other way around. The entire mechanism moved right or left to line up with the vertical slider. The NC-270 also featured a notch filter, similar to the one used in today's modern transceivers. I wasn't that impressed with the notch filter performance, but it worked.



Chassis underside.

The receiver had plenty of sensitivity on my favorite bands (80, 40, and 20 meters) and heard almost everything my Drake 2-B could. Sensitivity started falling off on 15 meters and above.

While the NC-270 had an automatic gain control and S-meter, curiously, it operated only in the AM mode. When CW or SSB was selected, those features were disabled. With SSB popularity booming in the early 1960s, the missing functions in SSB and CW likely became a show-stopper, as competing receivers had them.

National added the missing features to the subsequent Cosmic Blue NC-155 model, but it didn't matter. The era of large and heavy receivers was ending abruptly, as newer, smaller, lighter, and better-performing receivers were on the market by then. Within a couple of years, National completely exited the ham radio tube receiver market and began focusing on their popular SSB transceivers.

An Overall Good Receiver

While initially drawn to the funky styling of the NC-270, I was later impressed with the high quality of the build and its excellent performance for a medium-grade receiver. I thoroughly enjoyed learning about the radio and its history, restoring it, and using it on the air! I have a vintage 1960s station set up in my shack that consists of the National NC-270 Cosmic Blue receiver and an E. F. Johnson Viking Ranger transmitter. The station is fun to use on the air, and I'm making contacts all around the US and Canada. If you hear me on the bands, be sure to give a call! For fun, I send out 1960s-era QSL cards to contacts made with this station.

100, 50, and 25 Years Ago

October 1924

- The cover shows an amateur silhouetted against his shack window as he sends a radiogram on his trusty hand key.
- With short waves having been granted to the amateur service, and experimentation successful, "Editorials: The Third Hoover Conference" speculates on the recommendations many broadcasting entities may bring to the conference.
- WWV is described by the man who has been most active in furthering the progress of this service in "The Standard-Frequency Set at WWV" by Hoy J. Walls.
- WNP and Don Mix will be home from a fifteen-month far north cruise on the *Bowdoin*. The ship's owner and captain, Donald MacMillan, will illustrate the journey with a lecture. An update is in "WNP Nearing Home" by F.H. Schnell, 1MO.
- A short study of operating characteristics of amplifiers employing the superheterodyne principle is presented in "A Study of Superheterodyne Amplification" by H.A. Snow.
- Spiderweb and cylindrical evils are discussed in "The Receiving Coil Problem" by Greenleaf W. Pickard.
- J.H. Turnbull presents "The Vacuum Tube Voltmeter," which will measure high voltage at any frequency.
- "Strays" announces Miss Harriet Ellsworth, 7SI, became the second young lady amateur in the seventh district.

October 1974

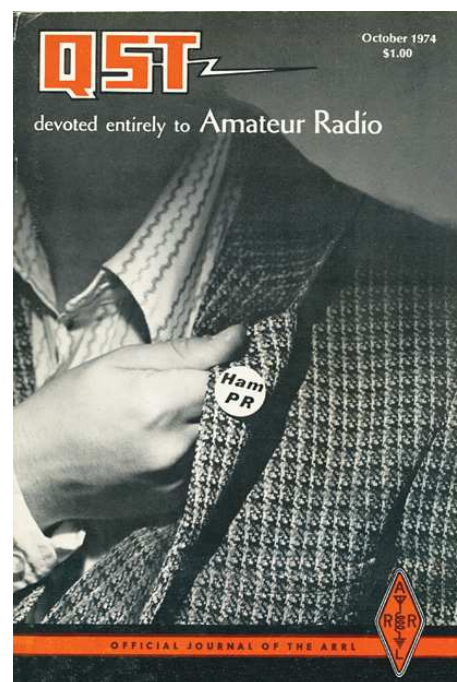
- The cover reminds us to not keep our public relations under cover. The story of one amateur radio club's efforts for improved public relations appears in "Getting the Story Told!" by Don Keith, WA4BDW.
- A new freedom, but also a new responsibility for US amateurs, is explained in "It Seems to Us...Logging Reregulated."
- Uncomplicated solid-state circuitry with no mechanical relays is discussed in "Solid-State Repeater Control" by Dave L. Moon, WA2SHD.
- Arthur J. Peterson, W7CZB, shares a limited-space antenna that works well for him in "Beginner and Novice: Apartment Dwellers' Slinky Jr. Antenna."
- The "Two-Toter Two" eliminates the shortcomings of the original Two-Toter (July 1971) as experienced by the author, E. Laird Campbell, W1CUT.
- An address by Armin H. Meyer, W3ACE, to the ARRL National Convention Banquet, "Amateur Radio In Our Interdependent Civilization," leaves us with this quote: "It is not likely that a Paradise will ever be fully achieved on this planet. But human satisfaction is derived by striving for it. That, in my view, is what amateur radio is all about."

October 1999

- The cover shows old and new technologies, comfortable side by side, in Dr. Jerry Svoboda's, KB2QIU, station. Jerry shares his passion for hardware, past and present, in "Regeneration and Crystal Control."
- David Sumner, K1ZZ, outlines ARRL and IARU issues of concern on the WRC-2000 agenda in "It Seems to Us...WRC-2000."
- An approach to matching a feed line to an antenna that uses the antenna itself as an impedance transformer is described in "Simple Offset Feeding of Wire-Element Beams" by Robert K. Zimmerman, NP4B.
- In the good old days, ham radio was a smelly business. Eric P. Nichols, KL7AJ, shares a story in "The Smell of Radio."
- A rotatable dipole that offers uniform performance on three fascinating HF bands is shown in "17-15-12 and Simple" by L.B. Cebik, W4RNL.
- It was not a typical storm. Michael Nie, KB8VMX, relates how "Cincinnati Hams Help Before and After Killer Tornado" in the "Public Service" column.
- Bernie McClenny, W3UR, suggests that operating practices of DXers and contesters should set examples for others to follow in "How's DX? Cleaning Up the Bands."

QST

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Silent Keys

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

♦W1ASY Blais, Roger W., Jay, ME
 K1AVE Rozea, Gene, Granite Falls, NC
 ♦KC1BNQ Hahn, Albert P., Granby, CT
 ♦W1DA Hitz, George E., Jr., Sudbury, MA
 K1GSU Weiss, Allen O., Laconia, NH
 WB1GZB Moran, Colin C., Plymouth, MA
 N1KPY Pachaly, Frederick A., Brookfield, CT
 N1LEU Carrasquillo, David M., Meriden, CT
 KC1MSN Lynch, Bernard J., Milton, MA
 K1RWK Knott, Robert W., Exeter, RI
 N1SYN Smith, Richard D., Pittsfield, MA
 ♦KA1TZR Hudson, Donald, Madison, CT
 ♦WA1UJU Rantala, Glen W., Chassell, MI
 ♦K1UQJ Smyth, Douglas S., Bridgewater, CT
 WA1VWA Millican, Donna L., Newtown, CT
 WA1WDN Marinoff, Robert J., West Haven, CT
 N1YQU Peary, Donald R., Washburn, ME
 K1ZDO Andrews, Bryant, Columbia, CT
 W2AR Mollica, Philip R., Jr., Vero Beach, FL
 ♦W2ARQ Gardina, Michael F., Broadalbin, NY
 KE2BG Talbott, Charles, Waverly, NY
 KG2D Poss, Donald E., Ballston Lake, NY
 ♦K2GCC Caward, Gerald C., Jr., Lansing, NY
 ♦WB2GMK Grambor, Greg, Brandon, FL
 AB2IX Zeffert, Adrian M., Worcester, MA
 N2JOK Wyatt, William D., Wappingers Falls, NY
 ♦KX2N Monahan, Anthony S., North Syracuse, NY
 ♦W2OKF Szachara, Walter S., Madison, AL
 AC2SV Fonseca, John J., Saylorburg, PA
 K2UYH Katz, Allen, Princeton Junction, NJ
 ♦N2YBG McCaw, Robert L., Mohawk, NY
 KC2YQF Pawlowski, Adam J., Tonawanda, NY
 ♦W2ZNS Bodeep, George E., Gainesville, GA
 ♦♦N3AO Craigie, Carter W., Blacksburg, VA
 ♦N3BAL Lepley, Bruce A., Gambrills, MD
 K3DLB Bokan, David L., La Plata, MD
 AI3EE Crowley, David, Towanda, PA
 ♦W3EOP Schneebeli, Robert C., Saylorburg, PA
 ♦AA3GF Pasqua, Salvatore G., Towson, MD
 KC3GOC Morrison, Michael, Fairview, PA
 AF3IF Fisher, Irving J., Frederick, PA
 ♦KB3JZX Brockett, Warren E., Adamstown, MD
 K3RR Johnson, Joseph M., Gettysburg, PA
 N3TN Cole, John F., Sr., Midland, PA
 NG3V Skinner, Thomas R., Alma, CO
 W3VYK Chauvin, Dewey A., Cheswick, PA
 ♦WA4AW Beals, Jeff, Loxahatchee, FL
 K4BGV Morris, James K., Church Hill, TN
 KG4BIN Morgan, David L., Athens, TN
 AF4BN Blankenship, Michael G., Elizabethtown, KY
 ♦KN4CCZ Jackson, Joseph Larry, Sevierville, TN
 ♦WB4CEG Thompson, David K., Greenville, TN
 ♦KA4CMO Adams, Albert L., Jr., Greensboro, NC
 N4DWU Woodard, Irene C., Landrum, SC
 W4EEA Magin, Gregory A., Ocala, FL
 ♦K4EQH Turner, Tom D., Waterloo, AL
 ♦K4FKJ Schoenfelder, Alfred W., North Augusta, SC
 WA4FMK Browne, Jack, Cameron, SC
 K04GGE Allen, John C., Bardstown, KY
 WA4IHH Rogers, Anthony D., Florence, AL

W4MII Metzler, Anthony, Port Murray, NJ
 ♦KX4NI Gradl, George J., Louisville, KY
 WB4OEF Turner, Paul A., Sadietville, KY
 W40XH Norris, Oscar W., Gastonia, NC
 K14PUA Cockram, Patric J., Punta Gorda, FL
 ♦KS4QN Baggett, Franklin M., Rome, GA
 ♦K4QZF May, Larry A., Memphis, TN
 ♦AB4RQ Stroud, Ernest K., Tarboro, NC
 ♦NK4T Hester, Wayne L., Semmes, AL
 ♦N4VOB Kelly, Walter D., Hopkinsville, KY
 ♦W4VZF Baber, Gerald P., Blountville, TN
 KS4WL Odom, Kenneth W., Hialeah, FL
 KG4YMJ Lane, Hermin H., Kingsport, TN
 ♦NW4Z Scofield, Jeffrey A., Cary, NC
 ♦K04ZEL Combs, Robert S., Dallas, NC
 W5AWE Fletcher, Richard E., Elephant Butte, NM
 ♦NT5CC Collins, Carl W., Centerville, TX
 ♦K5EWJ Cooke, Willis R., Santa Fe, TX
 KD5GQV Nutt, Herman A., Sparkman, AR
 ♦KG5HR Cope, George W., Shawnee, OK
 KF5KK Foster, Mary L., Boynton, OK
 ♦WN5KML Coleman, Joe E., Los Alamos, NM
 N5NCV Palmer, William S., Bryan, TX
 ♦W5RIQ Cecil, Joseph N., Austin, TX
 ♦K5SCO Pulkrabek, Frank S., League City, TX
 KG5SST Holden, Rodney D., Purcell, OK
 ♦KE5UFY Mason, Kent R., Oklahoma City, OK
 KD5UGO Sinnett, Philip M., Norman, OK
 ♦KE5USQ Henry, Donald A., Cleburne, TX
 W5XXX Byrd, Darrell J., Midland, TX
 K15ZKQ Hayter, Phillips B., Fort Worth, TX
 KC6AOH Fields, Robert Lee, West Chester, PA
 ♦K6BSB Darlington, Henry R., Nevada City, CA
 ♦N6BUU McCarrick, Henry R., Oakland, CA
 ♦KG6KRN Baird, Karl S., Camarillo, CA
 ♦WB6MVK Edler, Lawrence A., Santa Cruz, CA
 K6PF Kocisko, Robert J., Chino Valley, AZ
 ♦KK6PMC Butler, Karen E., Camarillo, CA
 ♦W6PPM Barry, Gerald E., Merced, CA
 ♦W6QM Eveland, Ronald D., Cerritos, CA
 ♦AE6SI Seitz, John L., Mission Viejo, CA
 WB6UUQ Carrillo, Thomas, Benicia, CA
 ♦K6ZMI Smith, Martin J., Rancho Palos Verdes, CA
 KA7BHL Hurley, Robert E., Phoenix, AZ
 KB7DNE Dinkelman, Diane M., Kent, WA
 ♦KB7HBA Poyas, Howard S., Spokane, WA
 ♦W7HXG Bates, Leroy A., Tolovana Park, OR
 ♦W7IBC Lenny, Albert T., Wenatchee, WA
 ♦W7ICB Westlund, Robert L., Enumclaw, WA
 W7JBU Bracher, Katherine, Walla Walla, WA
 ♦NW7K Richardson, Eric T., Twin Falls, ID
 ♦KF7KIZ Halvorson, Haans J., Sidney, MT
 ♦KG7KNQ Kennedy, Roger L., Marysville, WA
 K7QMI Schneebek, Timothy J., Seattle, WA
 ♦W7QR Passey, Rulon L., Ogden, UT
 ♦WB7RAH Guyer, Glenn W., Tualatin, OR
 KE7THN Smith, Joseph E., Rigby, ID
 ♦KK7XP Morgan, Suzann B., Mountain Home, ID
 KC8AZR Field, John M., White Cloud, MI
 ♦N8DE Havlicek, Donald J., Edmore, MI
 ♦N8DJD Bracken, Paul R., Massillon, OH
 K8DPD Walters, Jeffrey J., Findlay, OH
 K8DZR Huetter, John E., Cleveland, OH
 W8GUC Meeks, Reuben C., Jr., Dayton, OH
 ♦WQ8H Boccia, Gene A., Youngstown, OH

♦♦W8IYD Fugate, William M., Zelienople, PA
 ♦W8JVP Irish, Ken M., Jr., Kalamazoo, MI
 WA8KKT Goniam, Ronald L., Monroe, MI
 KA8KZY Molby, Guy E., Alden, MI
 W8LW Butters, Robert B., Dublin, OH
 ♦W8MHH Hoffman, Conrad R., Palm Coast, FL
 ♦KC8OYX Benzenhofer, Michel J., Struthers, OH
 ♦WD8QKJ Krueger, John C., Monroe, MI
 AB8RH Craft, Donald W., Jr., Sterling Heights, MI
 ♦K8RI Halstead, Roger D., Midland, MI
 K8RSD Stahl, Richard L., Cortland, OH
 K8TDA Archibald, Thomas D., Hillsboro, OH
 W8UJ Kozal, Lawrence J., Jr., Grand Rapids, MI
 ♦WB8VTT Swaim, Richard W., Cincinnati, OH
 ♦N8WSR Holley, Betty R., North Port, FL
 ♦K8YDV Vincent, Michael W., Tacoma, WA
 ♦WB8ZAX Allen, Albert L., Jr., Columbus, OH
 KF8ZH Montgomery, Herbert S., Lewisburg, WV
 WB8ZZR Gehringer, Paul W., Wilmington, OH
 ♦W9AMX Larimore, Alfred, Mokena, IL
 ♦W9FRY Fry, John A., La Porte, IN
 KB9HFJ Osborne, Robert E., Fort Worth, TX
 ♦W9JCD Davis, James C., Marion, IN
 N9JME Everts, James I., Hager City, WI
 KO9JOE Morton, Joseph W., Indianapolis, IN
 KB9KXV Brulez, Victor M., Mishawaka, IN
 ♦W9LDZ Kash, Bernard B., Chicago, IL
 KD9LIL Eide, Duane L., Spring Green, WI
 KD9LNY Wagner, Richard, Middleton, WI
 ♦K9LYA Collison, James A., Lafayette, IN
 ♦KD9MOL Grube, Timothy P., Corunna, IN
 ♦W9NJ Genova, Nicholas J., Arlington Heights, IL
 ♦N9RMI Lafferty, Aubrey R., Scottsburg, IN
 W9WQZ Ward, Barbara, Churubusco, IN
 ♦KØCSJ Umstead, Brice B., Knoxville, TN
 ♦KBØDLS Bell, Sandra J., Minot Air Force Base, ND
 ♦KAØDSH Lowe, Mary L., Big Lake, MN
 ADØEH Larson, Rodney K., Cedar Rapids, IA
 WØFHD Feigal, Ronald R., Seattle, WA
 ♦WØHEU Goetz, Wayne L., Siloam Springs, AR
 ♦NØHWU Ralston, Lee W., McCook, NE
 ♦WBØJJX Carlson, Randall K., Newark, DE
 KBØMSO Gibson, Alyce J., Baxter, MN
 ♦KØOAQ Baden, Brian J., Spring Lake Park, MN
 ♦WØPAN Shima, Larry J., Mesa, AZ
 ♦AGØU Short, James K., Jefferson City, MO
 KBØWNZ Schneider, Trygve, Denver, CO
 ♦WBØWCK Houg, Roger L., St. Cloud, MN
 AAØZR Wodening, Jane, Nederland, CO
 ♦VE3LVO Kyle, J. Fergus, Burlington, ON, Canada

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- ♦ Current Diamond Club
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- ♦ Veteran
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FTDX10 | HF/50MHz 100 W SDR Transceiver

- Narrow Band and Direct Sampling SDR • Down Conversion, 9MHz IF Roofing Filters Produce Excellent Shape Factor • 5" Full-Color Touch Panel w/3D Spectrum Stream • High Speed Auto Antenna Tuner • Microphone Amplifier w/3-Stage Parametric Equalizer • Remote Operation w/optional LAN Unit (SCU-LAN10)



FT-991A | HF/VHF/UHF All Mode Transceiver

- Real-time Spectrum Scope with Automatic Scope Control • Multi-color waterfall display • State of the art 32-bit Digital Signal Processing System • 3kHz Roofing Filter for enhanced performance • 3.5 Inch Full Color TFT USB Capable • Internal Automatic Antenna Tuner • High Accuracy TCXO



FTDX101D | HF + 6M Transceiver

- Narrow Band SDR & Direct Sampling SDR • Crystal Roofing Filters Phenomenal Multi-Signal Receiving Characteristics • Unparalleled - 70dB Maximum Attenuation VC-Tune • 15 Separate (HAM 10 + GEN 5) Powerful Band Pass Filters • New Generation Scope Displays 3-Dimensional Spectrum Stream



FT-710 Field version also available!

FT-710 Aess | HF/50MHz 100W SDR Transceiver

- Unmatched SDR Receiving Performance • Band Pass Filters Dedicated for the Amateur Bands • High Res 4.3-inch TFT Color Touch Display • AESS: Acoustic Enhanced Speaker System with SP-40 For High-Fidelity Audio • Built-in High Speed Auto Antenna Tuner



FT-891 | HF+50 MHz All Mode Mobile Transceiver

- Stable 100 Watt Output • 32-Bit IF DSP • Large Dot Matrix LCD Display with Quick Spectrum Scope • USB Port Allows Connection to a PC with a Single Cable • CAT Control, PTT/RTTY Control



FTM-300DR | C4FM/FM 144/430MHz Dual Band

- 50W Output Power • Real Dual Band Operation • Full Color TFT Display • Band Scope • Built-in Bluetooth • WiRES-X Portable Digital Node/Fixed Node with HRI-200



FT-2980R | Heavy-Duty 80W 2M FM Transceiver

- 80 watts of RF power • Large 6 digit backlit LCD display for excellent visibility • 200 memory channels for serious users



FTM-200DR | C4FM/FM 144/430MHz Dual Band

- 1200/9600bps APRS® Data Communications • 2" High-Res Full-Color TFT Display • High-Speed Band Scope • Advanced C4FM Digital Mode • Voice Recording Function for TX/RX



FTM-500DR | C4FM/FM 144/430MHz Dual Band Xcvr

- Front Firing Acoustically Enhanced Speaker System • True Dual Band Operation, C4FM/C4FM Digital D-D Dual Receive • 2.4" High-Resolution Full-Color Touch Panel Display • Built-in High Precision GPS Receiver • Wireless Operation Capability with Optional Bluetooth® Headset

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

- System Fusion Compatible • Large Front Speaker delivers 700 mW of Loud Audio Output • Automatic Mode Select detects C4FM or Fm Analog and Switches Accordingly • Huge 1,105 Channel Memory Capacity • External DC Jack for DC Supply and Battery Charging



FT-5DR C4FM/FM 144/430 MHz Dual Band

- High-Res Full-Color Touch Screen TFT LCD Display • Easy Hands-Free Operation w/Built-In Bluetooth® Unit • Built-In High Precision GPS Antenna • 1200/9600bps APRS Data Communications • Supports Simultaneous C4FM Digital • Micro SD Card Slot



FT-65R | 144/430 MHz Transceiver

- Compact Commercial Grade Rugged Design • Large Front Speaker Delivers 1W of Powerful Clear Audio • 5 Watts of Reliable RF Power Within a compact Body • 3.5-Hour Rapid Charger Included • Large White LED Flashlight, Alarm and Quick Home Channel Access



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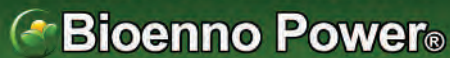
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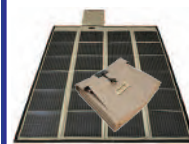
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In-Line Module connections

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- 3.5mm mono or stereo inputs
- Line level input/output
- 7 watts mono speaker output
- Headphone socket
- Easy to use controls

5W amplified DSP noise canceling In-Line module - 8 filter levels 8 to 40dB - Use in-line with a loudspeaker

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- Headphone socket - Audio input overload feature
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- Simple controls
- Use in-line with headphones or powered speakers
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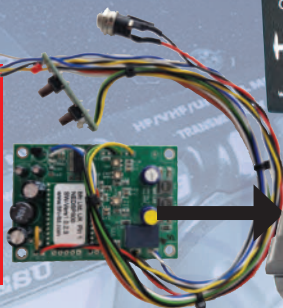
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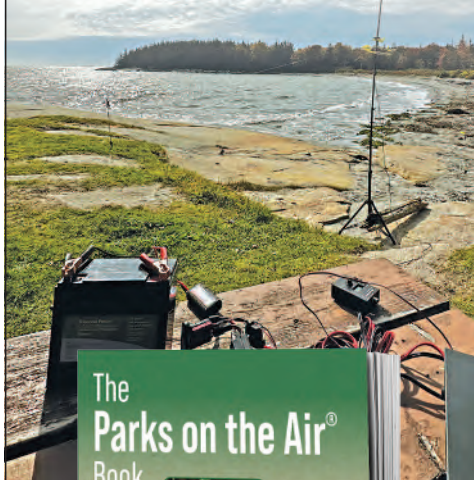
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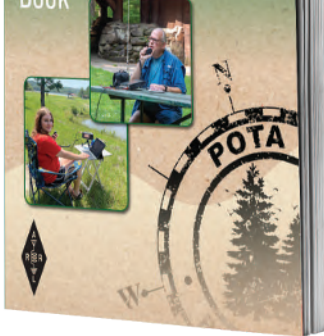
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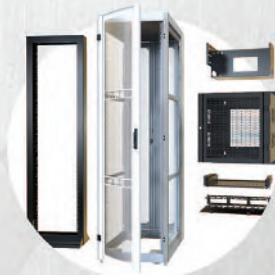
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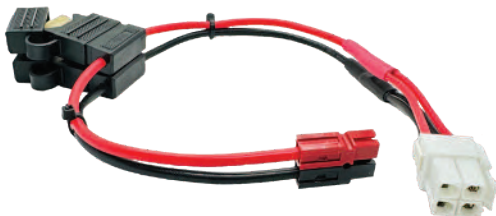
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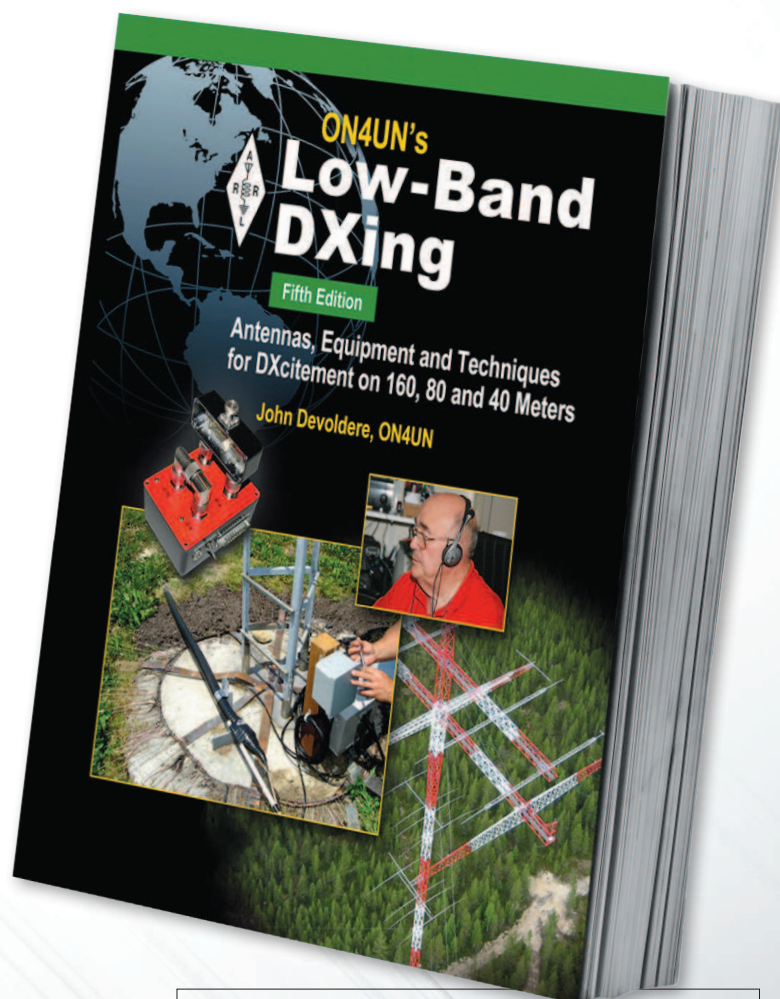
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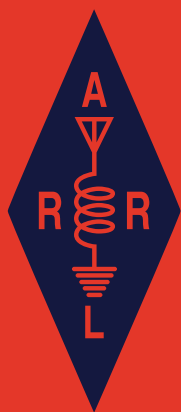
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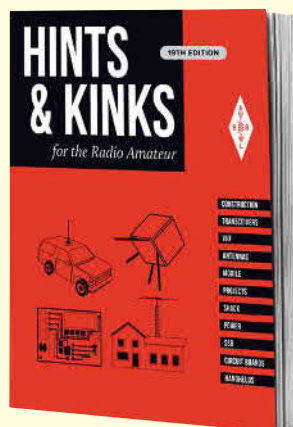


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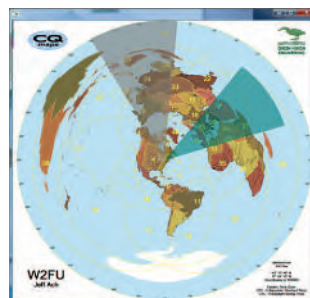
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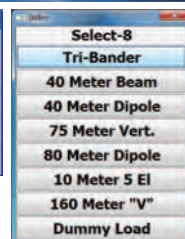
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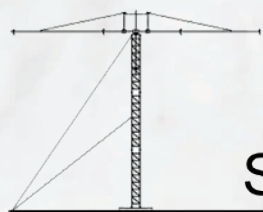
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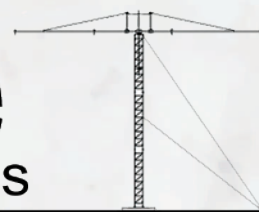


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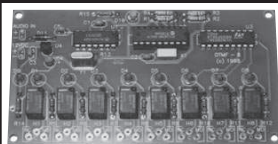


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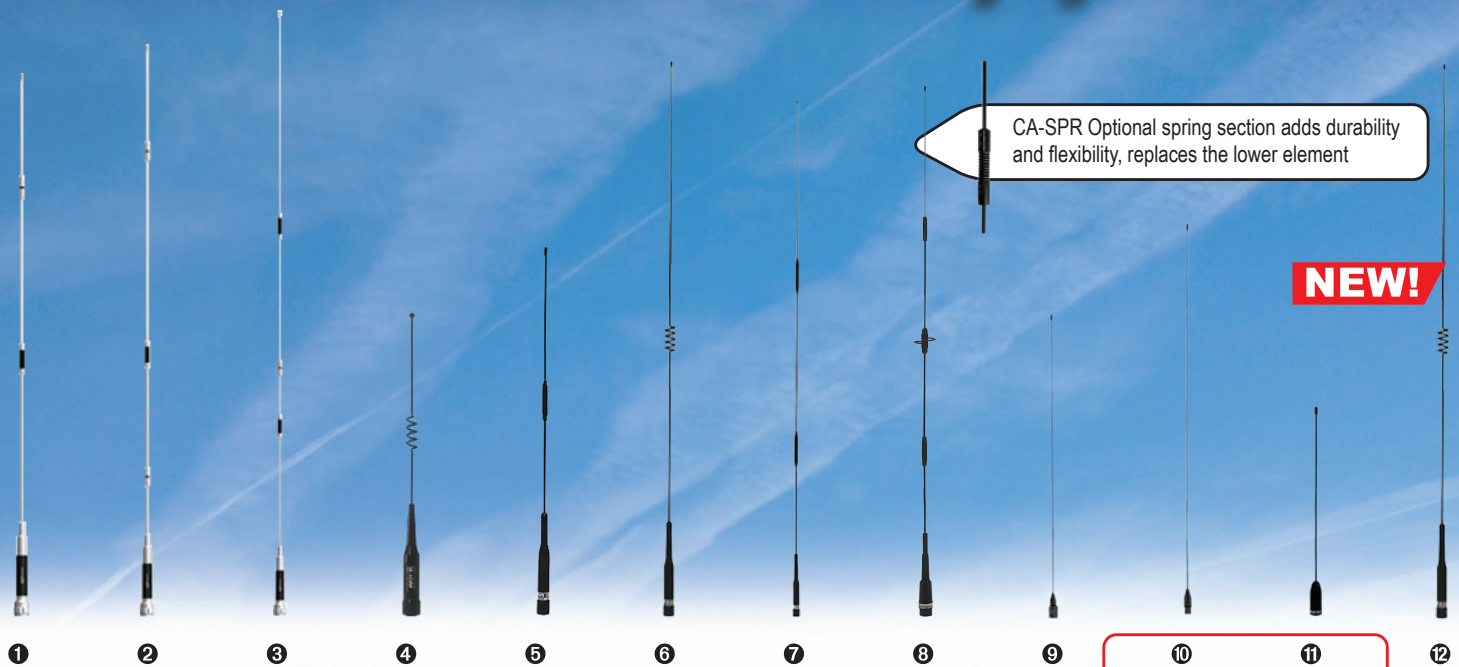
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Mobile Antennas

1 COMET CSB-750A DUAL-BAND 2M/440MHz w/FOLD-OVER

2M: 1/2 wave • 440MHz: 5/8 wave x 2 • VSWR: 1.5:1 or less • Length: 42" • Conn: PL-259 • Max. Pwr: 150W

2 COMET CSB-770A DUAL-BAND 2M/440MHz w/FOLD-OVER

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

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

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

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

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

5 COMET SBB-2/SBB-2NMO DUAL-BAND 2M/440MHz

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

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

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

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

2M: 6/8 wave • 440MHz: 5/8 wave x 3 • Length: 58" • Conn: SBB-7 PL-259, SBB-7NMO - NMO style • Max Pwr: 70W

8 COMET CA-2X4SR/CA-2X4SRNMO WIDE-BAND 140-160MHz 435-465MHz w/FOLD-OVER

2M: 5/8 wave • 440MHz: 5/8 wave x 3 • Length: 40" • Conn: CA-2x4S PL-259, CA-2x4SRNMO NMO style • Max Power: 150W

9 COMET BNC-24 DUAL BAND 2M/440MHz HT ANTENNA

RX range: 100-1200MHz • Length: 17" • SuperFlex featherweight whip • Conn: BNC

10 COMET SMA-24, SMA-24J DUAL BAND 2M/440MHz HT ANTENNA

RX range: 100-1200MHz • Length: 17" • SuperFlex featherweight whip • Conn: SMA-24: SMA-male / SMA-24J: SMA-female

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

RX range: 100-1200MHz • Length: 8.75" • Conn SMA-503: SMA-male, SMA-503J: SMA-female

12 COMET NEW! FC5/FC5NMO DUAL-BAND GMRS & MURS w/FOLD-OVER

MURS: 1/2 wave • GMRS: 5/8 wave x 2 • Length: 37" • Conn: FC5 PL-259 style, FC5NMO - NMO style • Max Pwr: 120W

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*2: D-STAR is a digital radio protocol developed by JARL (Japan Amateur Radio League).

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