

On the Air

JUL/AUG 2023
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CHECK IN



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WITH CAUTION

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TRAFFIC
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Talking About Traffic

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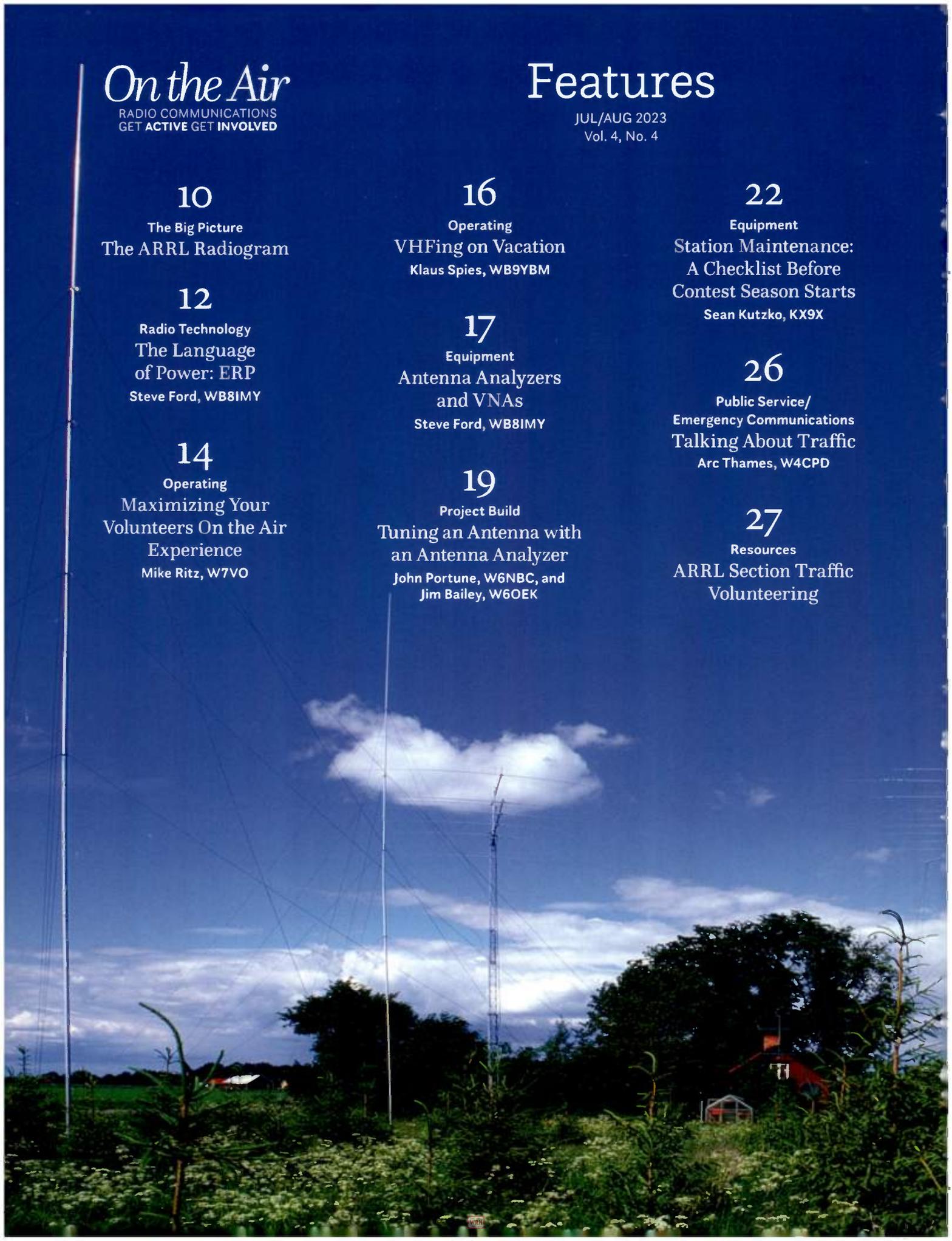
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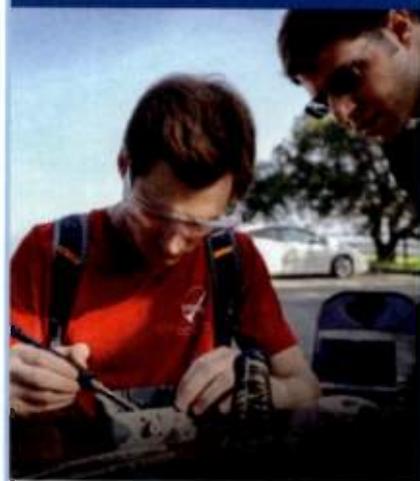
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On the Cover: The origins of traffic (message) handling are almost as old as amateur radio itself. In the days before telephones, every town had at least one radio operator who was willing to deliver messages to and from other members of the community. Due to the technological limitations of the time, radios were only good for a few hundred miles of reliable communications, so a universal system of message relaying and formatting was developed, and a version of that system is still used today. Read "Talking About Traffic" in this issue to learn more.

On this Page: Leif Lindberg's, SM5CEU, antennas stretch across this vista in southern Sweden. [Henryk Kotowski, SMØJHF, photo]

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From the Editor

Talking About Traffic

Much of this issue focuses on a ham radio topic that's nearly as old as ham radio itself: traffic. In the early days of the Amateur Radio Service and hobby, the passing of messages was ham radio's *raison d'être*. In the first half of the twentieth century, long-distance communication wasn't widely possible or available. Even when early hams stepped in to assist in their communities, the communication range available at that time made it necessary for a message to be relayed by several stations in order for it to reach its final destination. This necessity gave rise to the National Traffic System, a structure that assured a standard of efficiency and accuracy.

There are hams who assert that passing accurate, timely messages is a fundamental reason for amateur radio's existence, and their point is well taken. For starters, Part 97 of the FCC rules and regulations — the part that lays out the Basis and Purpose of the Amateur Radio Service — states that we are a “voluntary noncommercial communication service, particularly with respect to providing emergency communications.” It's hard to argue with that! And upon looking more closely at the things hams do, the need for accuracy is everywhere. It even underlies the fun and challenge of radiosport events via a contest's *exchange* (information that must be stated in every contest contact), which must be relayed, received, and recorded accurately, or the participants won't receive points for that contact. The long, elaborate exchange for the ARRL Sweepstakes (six pieces of information, including a sequential serial number that ticks upward with every contact you make) has its roots in traffic handling. Even casual, everyday contacts can't be confirmed if you haven't correctly copied and recorded the relatively simple information (call sign, date, time, band, mode, signal report) that makes the contact unique.

Clearly, accuracy is fundamental to ham radio, and passing traffic could be called the highest purpose for this accuracy, as we serve our communities during everything from triathlons to tornadoes. In this issue, you'll get background on a few kinds of ham radio traffic, meet some of the ARRL Field Organization volunteers who are committed to all things traffic-related, and get a walk-through of the ARRL radiogram form, all in service of helping you be of service When All Else Fails.®

73,

Becky W1BXy



Resources

On the Air Information and Archive
arrl.org/ota

Find the On the Air Podcast
app.stitcher.com
blubbry.com/arrlontheair
podcasts.apple.com

On the Air Blog
arrl.org/ota-blog

ARRL Learning Network
arrl.org/ARRL-Learning-Network

Technical Information Service
tis@arrl.org

New Ham Group
groups.arrl.org/g/ARRL-New-Hams

Manage Your ARRL Membership
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Join ARRL or Renew Your Membership
arrl.org/join

ARRL Member Benefits
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Find...

...a Licensing Class
arrl.org/class

...a License Exam Session
arrl.org/exam

...a Radio Club (ARRL-affiliated)
arrl.org/find-a-club

...a Hamfest or Convention
arrl.org/hamfests



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(((On Frequency)))

Lighthouses On the Air • Upcoming Contests and QSO Parties • Hamspeak • Crimper/Stripper Multi Tool

Light Up the Bands in August

Portable operating takes a specialized turn in August each year, with not one, but two operating events that focus on lighthouses.

The Amateur Radio Lighthouse Society (arlhs.com) sponsors US National Lighthouse-Lightship Weekend (NLLW), an annual event that coincides with US National Lighthouse Day, which is August 7. This year, August 7 is a Monday, so NLLW 2023 will be August 5 and 6.

Two weeks later, on August 19 and 20, operations for the International Lighthouse Lightship Weekend (ILLW, illw.net) will be on the bands. Held the third full weekend in August every year, ILLW attracts more than 500 lighthouse operations located in more than 40 countries.

As NLLW and ILLW are operating events and not contests, all amateur radio bands are eligible for use.

To get a taste of what it's like to operate from a historic lighthouse, check out "Activating the Loneliest Lighthouse in the World," in the August 2022 issue of QST, and "Following in Marconi's Footsteps: Portable Operation at the Navesink Twin Lights," in the August 2023 issue of QST.

In 1899, the Navesink "Twin Lights" Lighthouse in Highlands, NJ, was the site of Guglielmo Marconi's first public US demonstration of the wireless telegraph.

HAMSPEAK

Antenna analyzer

A test instrument designed to measure the impedance and/or standing wave ratio (SWR) of an antenna, an antenna and feed line combination, or other circuit element as a function of frequency.



Upcoming Contests, QSO Parties, and More

Date	Contest	Rules
July 8-9	IARU HF World Championship	arrl.org/iaru-hf-world-championship
July 15-16	North American QSO Party, RTTY	ncjweb.com/NAQP-Rules.pdf
July 15-16	CQ Worldwide VHF Contest	cqww-vhf.com/
August 5-6	ARRL 222 MHz and Up Distance Contest	arrl.org/222-mhz-and-up-distance-contest
August 5-6	North American QSO Party, CW	ncjweb.com/NAQP-Rules.pdf
August 12-13	Maryland-DC QSO Party	w3vpr.org/mdcqsop/
August 12	Kentucky State Parks On The Air	k4msu.com/kypota/
August 19-20	ARRL 10 GHz and Up Contest	arrl.org/10-ghz-up
August 19-20	North American QSO Party, SSB	ncjweb.com/NAQP-Rules.pdf
August 20	ARRL Rookie Roundup, RTTY	arrl.org/rookie-roundup
August 28-29	Kansas QSO Party	ksqsoparty.org/rules/KSQPRules2021.pdf?1
August 26-27	Ohio QSO Party	ohqp.org/index.php/rules/
August 25-27	Hawaii QSO Party	hawaiiqsoparty.org/
August 26-27	World Wide Digi DX Contest	ww-digi.com
September 3-4	Tennessee QSO Party	tnqp.org/rules/

Klein-Kurve 1019 Wire Stripper/Crimper/Cutter Multi Tool

This multi-use tool is rated to strip #10 to #26 AWG solid and #12 to #28 AWG stranded wire. The jaws include a section at the base for cutting wire, and the tips are serrated for use as gripping pliers. The tool can also be used as a crimper for insulated and non-insulated terminals. One additional feature is a built-in screw cutter for shortening #6-32 and #8-32 machine screws. The threaded holes for the cutter are located just below and to the side of the center jaw pivot. The Klein-Kurve 1019 weighs about 6 ounces, and the curved, padded handles are comfortable to use. kleintools.com, about \$20

Paul Danzer, N1II



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From Our Readers

Marshaling Support for an MS Ride

Soon after obtaining my ham license in 2019, I became involved with the communications team for the MS 150 bike ride, a fundraising event for the National MS Society. I found a rewarding and selfless purpose, using my license for a great cause by supporting the riders and event officials with various needs (medical, coordination, logistics, etc.).

At first my job as a volunteer ham was to set up a modest station at a designated area (i.e., rest stop) and serve as a communications relay to the command center, so they could coordinate needed resources. As years passed, I ventured into other jobs such as net control operator at the command center and repeater network support.

This past year I found another MS 150 volunteer opportunity with the “Motorcycle Marshal” group, in which hams on motorcycles serve the riders with route support as communication liaisons when needs arise between designated areas. However, one of the several requirements for participation is to have mobile radio comms installed on the motorcycle. With this challenge in mind, I began to research motorcycle mobile installs and came across a wide range of support from various motorcycle marshal groups.

I landed on the discontinued Yaesu FTM-10R, which was designed for such an application. The radio body was small,

“This has been a year-long journey, learning a new method of mobile operating. It’s been worth it, to increase my support of the wonderful folks who dedicate their time and resources to help those with MS.”

the radio head is waterproof and has I/O for audio and push-to-talk (PTT). I got a SENA SR10, which is an interface specifically made to convert the TX/RX into Bluetooth, which allows me to pair my helmet comms. It also has a PTT button that can be attached to the handlebars. For the antenna system, the antenna and coax were the easy part, but the mount proved to be the most challenging, as our regular manufacturers didn’t seem to have anything available for this application. I turned to the Motorcycle Marshals for help, and a member custom made a mount for my bike.

I participated in a motorcycle training class that enhanced my abilities as a rider. I learned emergency evasive actions and slow-speed maneuvering, which are skills I needed as a Motorcycle Marshal.

This has been a year-long journey, learning a new method of mobile operating. It’s been worth it, to increase my support of the wonderful folks who dedicate their time and resources to help those with MS.

Brian Wasson, WA5SON
Hockley, TX

Helping from Home

The April 2023 episode of the *On the Air* podcast, “Where Do Hams Fit Into the Incident Command System,” provided an excellent overview of ICS and how it incorporates the many aspects of emergency situations.

I recently founded an informal organization for ham radio operators like myself who are disabled and cannot trek into the woods, etc., in emergency situations. It uses a “hams from home” concept to tap into the vast numbers of amateur radio operators who are not affiliated with any formal group, yet want to help if and when called upon to assist formal groups and services.

The present thrust, in what I call Phase 1, is to raise awareness among the radio community and offer an alternative way to help if and when needed locally or regionally. There are many ways to help your local community, even if in your own town or from home.

Larry Baker, M7WDX
Cambridgeshire, England

“I recently founded an informal organization for ham radio operators like myself who are disabled and cannot trek into the woods, etc., in emergency situations.”



Taking a Precaution Launched a New Pursuit

Mike Brands, W4MBX
Age 61, Augusta, GA

Credentials: First licensed in 2018, currently a General.

Q: What led you to get licensed?

My wife suggested we get an emergency radio. I bought a Baofeng handheld, and the instruction manual said I needed to be licensed to use it. A quick internet search brought me to the ARRL website and the Technician licensing process. Reading about HF communication in the license manual got me hooked, and I got my General license 1 month later. The ability to contact people all over the world, completely independent from commercial communication services or power utilities, fascinated me.

Q: What were the first things you did after you got licensed?

I bought an Icom-7300 transceiver and Buckmaster seven-band off-center-fed dipole.

Q: What do you currently do with ham radio?

I love trying to contact European countries now that I have added a Mosley Mini 32A, two-element, tri-band antenna. I'm also close to confirming all states for my Worked All States award, and I like chasing Parks On the Air.

Q: What are your favorite resources for ham radio information and ideas?

At first, I searched the internet as my main resource, but now I have *The ARRL Antenna Book*, and I continue to find helpful information in *On the Air*, which explains radio equipment use, repair, and building at a level that I can understand and directly implement.



W4MBX's three must-have tools for ham radio.

A rotator for my tri-band antenna. My dipole is fantastic, but directing the tri-band antenna makes a huge difference in getting distant stations to pick out my call sign when I'm running just 100 watts.

An antenna switch. I built a 20-meter vertical antenna, and I enjoy comparing its performance with my commercial antennas.

A computer is essential for identifying and logging contacts and their locations.

Q: Favorite non-radio activities?

Bicycling, archery/shooting, and playing the drums.

Q: What does your day-to-day work entail?

I'm a Professor of Physiology. I do medical research and teach medical students. I am fortunate to love the job I have.

Q: What was the last book you read, or movie you saw?

I'm currently reading the *Malazan Book of the Fallen* series. The last movie I watched was *The Batman* (2022).

Q: Biggest ham-related embarrassment?

The white-knuckle Keystone Cops routine I put my family through when we were raising my 40-foot push-up pole and antenna, with everyone holding the guy wires as the pole swayed back and forth, close to the breaking point.

Q: Biggest ham-related success?

I broke the 5,000-mile barrier with a contact in Ukraine last year.

Q: Finish the sentence: "My family/friends think ham radio is..."

A strange hobby.

Q: People say you are...

Unusual.

Q: What do you, personally, get out of being an ARRL member?

Being a member of ARRL enables my casual use of radio, supported by years of structure and organization.

The ARRL Radiogram

This tried-and-true message form has gone through some changes over the decades, but it's still a standard in passing traffic. Here's a look at the various parts of the ARRL radiogram.

- Preamble:** Includes information used to prioritize and track the message and ensure its accuracy.
 - A Number.** Assigned by the Station of Origin and never changed. Begin with "1" each month or year.
 - B Precedence.** Determines the order in which traffic is passed. See "ARRL Message Precedences" on the next page.
 - C Handling Instructions (HX).** Optional, used only if a specific need is present. See "ARRL Message Handling Instructions" on the next page.
 - D Station of Origin.** The call sign of the station originating (creating) the message.
 - E Check.** The number of words or word groups in the message text. A word group is any group of one or more consecutive characters with no interrupting spaces.
 - F Place of Origin.** The location (city and state) of the party for whom the message was created, and not necessarily the location of the Station of Origin.
 - G Time Filed.** Optional, used only when the filing time has importance relative to the Precedence, Handling Instructions, or Text.
 - H Date.** The date the message was filed. If Time Filed is used, date and time must agree.
- Address:** Name, address, city, state, ZIP, and telephone number of the intended recipient, as complete as possible. Note that punctuation is not used in the Address section.
- Text:** Limited to 25 words or fewer. Punctuation characters are not used. A question mark is sent as "Query," while "Dash" is sent for a hyphen. The letter X is used as a period — but never after the last group of the text — and counts as a word when figuring the Check. The letter R is used in place of a decimal in mixed figure groups (example: 146R52 for 146.52).
- Signature:** The name of the party for whom the message was originated. May include additional information, such as call sign, title, address, phone number, and so on. The Signature is not included in the Check.

ARRL - The National Association for Amateur Radio

1A NUMBER: 1

1B PRECEDENCE: R

1C HX: HX

1D STATION OF ORIGIN: W1AW

1E CHECK: 8

1F AMATEUR STATION: NE JING CT

1G NAME: DIANA

1H STREET: FROM

2 TO: DONALD SMITH

3 HIGH EAST SIXTH AVE

4 NORTH RIVER CITY MO 64789

5 PHONE NUMBER: 555-1234

6 Email: example@arrl.net

7 HAPPY BIRTHDAY

8 X LOVE

9 DATE: DEC

10 SENT: DEC

REC'D

ARRL is the national association for amateur radio. It is a not-for-profit organization of public service communicators who share the values of the radio. The ARRL has organized the National Traffic System to help amateur radio operators.

This message was handled at no charge by a licensed amateur radio operator, whose address is shown in the box at right above. No compensation can be accepted by a radio operator. A return message may be filed with the ham delivering this message to the information on amateur radio may be obtained from ARRL Headquarters, 221 Main Street, Newington, CT 06111 or www.arrl.org

The Language of Power: ERP

Steve Ford, WB8IMY

In the May/June 2023 article “In Step with PEP,” we discussed *peak envelope power*, better known as *PEP*. Amateurs often use this acronym when discussing the output power levels at their stations, especially when they are operating SSB.

But there is another acronym associated with power that you will encounter almost as often: *ERP*, or *effective radiated power*.

ERP In Simple Terms

Effective radiated power (ERP) is a measure of the amount of power radiated by an antenna in a particular direction. You might recall from our March/April 2021 issue that *antenna gain* is the ability to focus power, much in the way that a lens focuses light. ERP takes antenna gain into account, along with the amount of power you are feeding into the system. The result is a number that can be used to help define the distance over which you can communicate. Just like PEP, ERP is expressed in watts.

Here are a few examples of how effective radiated power is used:

- In broadcast radio and television, ERP is used to describe the power of the signal transmitted by the antenna. The higher the ERP, the farther the signal can reach.
- In cellular networks, ERP is used to describe the power of the signal transmitted by the cell tower. The higher the ERP, the larger the coverage area of the cell tower.
- In a ham radio application, ERP is used to describe the power of the signal transmitted by the station. The higher the ERP, the greater the reliable range.

Figure 1: A hypothetical example of ERP. The radio is generating 100 watts output and the antenna is focusing this power in a particular direction for a gain of 6 dBd. Using the formula, the ERP of this station would be 600 watts.

What’s Your ERP?

You can calculate the ERP of any station by multiplying the power supplied to the antenna (in watts) by the antenna gain (in decibels) relative to a *reference antenna* (a dipole antenna cut to precise dimensions to match the desired frequency), and then converting the result to watts. The formula for calculating ERP is:

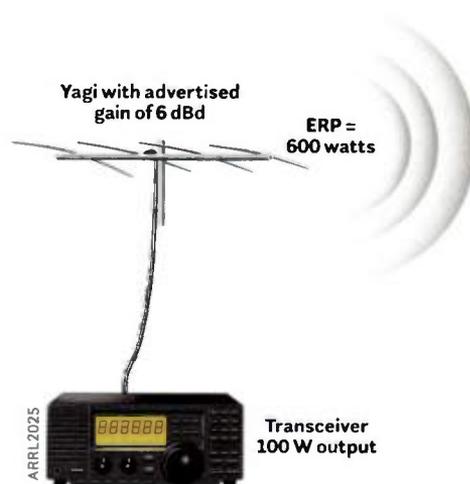
ERP = Power supplied to the antenna (in watts) x Antenna gain (in dBd)

...where *dBd* stands for *gain in decibels relative to a dipole antenna*, which is the smallest, least gain practical antenna that can be made. The dipole in this case is the reference antenna.

Let’s say you are generating 100 watts and feeding it to an antenna with a gain of 6 dBd. See Figure 1.

ERP = 100 x 6 = 600 watts

But hold on a minute! How do you know the gain of your antenna in dBd?



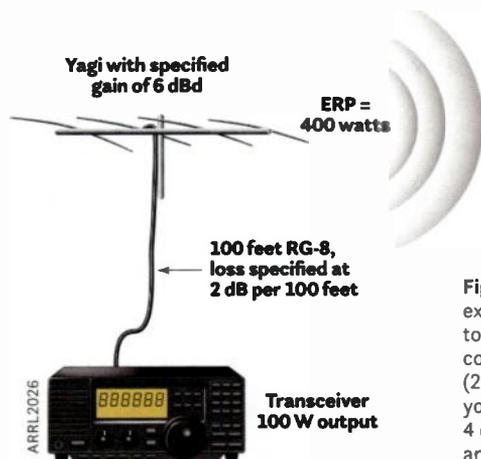


Figure 2: Let's bring feed line loss into the ERP picture. In this example, the Yagi antenna has 6 dBd gain and it is connected to a 100-watt output transceiver through 100 feet of RG8 coaxial cable and you are operating on the 10-meter band (28 MHz). At this frequency you will lose 2 dB in the cable, so you must subtract this from the antenna gain, reducing it to 4 dBd. Multiply this by the output power of your transceiver and you get an ERP of 400 watts.

The answer is you don't — not unless you go to great lengths to measure it using specialized equipment. Very few amateurs do this. Instead, they rely on data from the antenna manufacturer, data contained within an antenna's design specifications, or they calculate the gain using antenna modeling software.

Few manufacturers go to the trouble of directly measuring the gains of their antennas; most calculate these figures with software. The same is often true of authors who publish antenna designs.

You're probably thinking that these calculations amount to guesswork, and you are correct, but it is sophisticated guesswork that tends to be reasonably accurate. As the saying goes, amateur radio isn't rocket science, so calculated gain is perfectly adequate for our purposes.

Sharpening the Pencil

You can make your ERP calculation more accurate by subtracting any power losses that occur in the antenna system. For instance, you always lose a certain amount of power in the feed line between the transceiver and the antenna. The loss varies according to the type of feed line you are using, its length, and the frequency of your signal. Most feed line manufacturers specify loss in terms of decibels per 100 feet at a given frequency.

See Figure 2. Let's say you have a Yagi antenna with 6 dBd gain connected to a 100-watt output transceiver through 100 feet of RG8 coax cable and you are operating on the 10-meter band (28 MHz).

For the sake of simplicity, let's also assume that the impedance of the antenna system is perfectly matched to the radio, resulting in a standing wave ratio (SWR) of 1:1. Loss increases as SWR increases, but we'll set that issue aside for this article.

The manufacturer will likely specify that 100 feet of RG8 cable at 28 MHz will have a loss of about 2 dB. You'll need to subtract this loss from your antenna gain. So, 6 dBd minus 2 dB equals 4 dBd. Multiply this by the output power of your transceiver and you get an ERP of 400 watts. Here's the formula:

Transmitter power × (antenna gain – cable loss) = ERP

100 watts × (6 dBd – 2 dB) = 400 watts ERP

As you can see, excessive loss can have a serious impact on your station's ERP. Power can be lost not only in feed lines, but also in switches, antenna tuners, and even in the feed line connectors themselves. That's a discussion for a future article!



Maximizing Your Volunteers On the Air Experience

Mike Ritz, W7VO

There's still plenty of time to make contacts and rack up points in the year-long VOTA event. ARRL Northwestern Division Director and experienced contester W7VO offers inspiration and advice on where and how to operate.

ARRL is now halfway through the Year of the Volunteers and its accompanying year-long operating event, Volunteers On the Air (VOTA), which honors the many ARRL Field Organization volunteers that keep ARRL vibrant. This on-air event is exclusively driven by contacts uploaded to ARRL's Logbook of The World (LoTW), and as of this writing there have been some 13.3 million VOTA contacts uploaded. The W1AW portable operations from every state, which are a feature of this event, have contributed about 100,000 of those contacts thus far, and those numbers continue to mount daily as new states come on line. To say the 2023 VOTA event is a success would be an understatement!

Operators generate VOTA points by contacting ARRL volunteers or members on the air. If you hold *any* ARRL appointed or elected position, or are even just an ARRL member, you are worth VOTA points! ARRL Officers, Directors, Section Managers (and their appointees), staff, and domestic and DX ARRL members can all be contacted for points.

As one of the 15 ARRL Division Directors, each of my VOTA contacts is worth 225 points to anybody I contact. To take full advantage of this, I had a plan to maximize my VOTA activity for 2023.

One Station, Two Purposes

I am lucky to have a multioperator contest station in northwest Oregon. The station can run two HF transceivers at the same time, so my contest group decided that for each contest we operate this year, we would have one station position working that contest in the Multi-Operator/Single Transmitter category, while the second station position would be dedicated to VOTA, operating on a different band than the contest station to minimize interference (even in the same band during the RTTY contests). Whoever was on hand to operate and was not currently operating the contest would run the VOTA station to give out those valuable points. This setup certainly keeps everybody busy here!

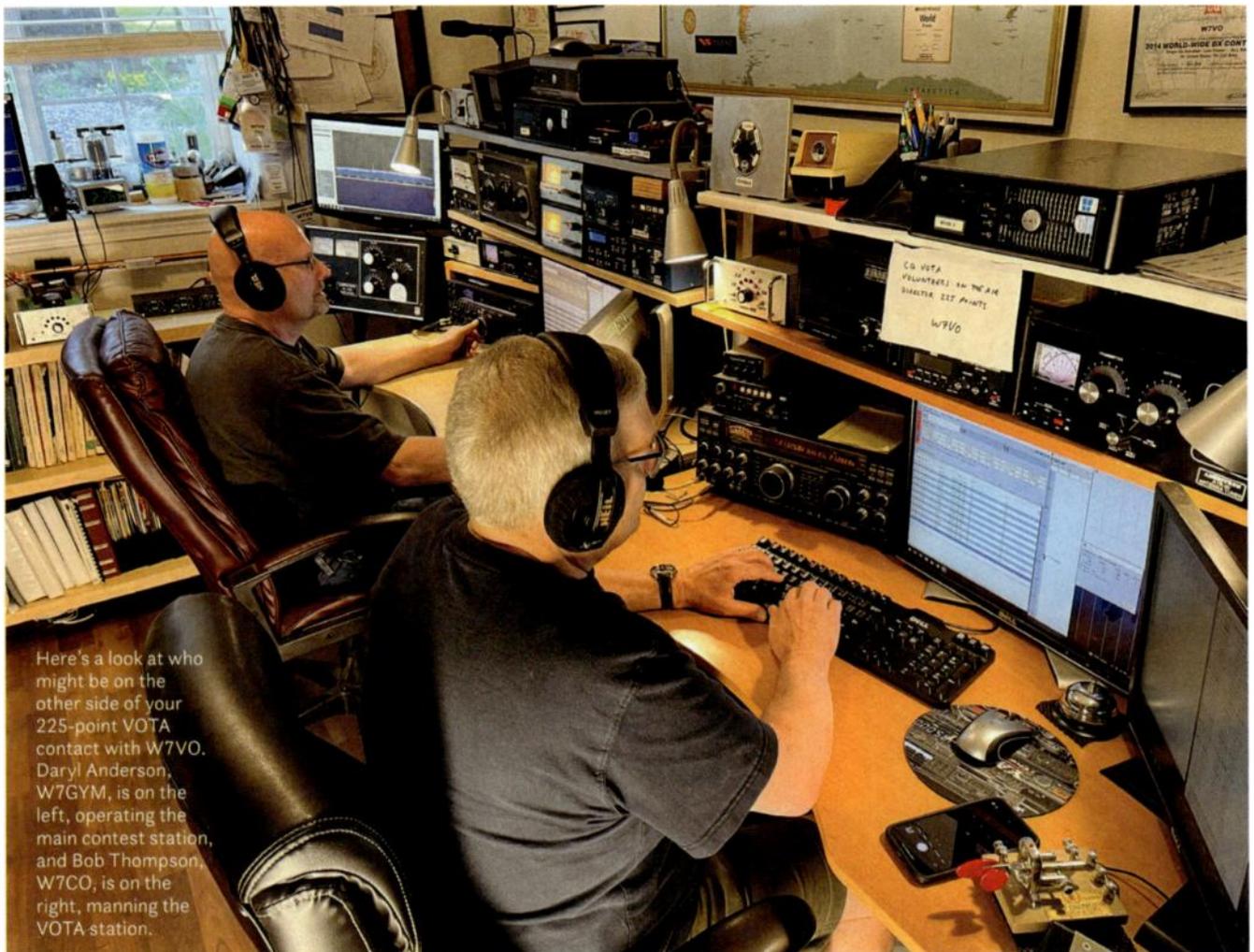
We started with the ARRL RTTY Roundup on January 7 – 8. The second HF station made VOTA SSB contacts on 10 meters through 20 meters, concentrating on the General and Technician portions of those bands. We ended up giving out some 347,000 VOTA points that weekend, and it was absolutely some of the most fun I've had recently on the air! That effort was followed by the CQ WPX RTTY contest in February, where we logged more than 725 contacts for VOTA using SSB, approximately 557 of which were on the

Technician subband of 10 meters. At this point in the year, after a few more contest weekends, we have now handed out more than 1.2 million VOTA points to 5,000 or so amateurs worldwide. (Remember that all contest contacts also count for VOTA points, as long as they are uploaded to LoTW.)

Gratitude and Good Behavior

It's interesting to compare the fervor of the contest station with the more mellow VOTA station activity only a few feet away in the same room. While the contest station is working feverishly to get as many contacts as possible logged as quickly as they can, the VOTA station is much more casual, with the operators taking time to thank hams for being ARRL members, and especially thanking those that volunteer for ARRL.

That said, I've noticed some of the pileups of amateurs calling us during our VOTA activity have been akin to what we might hear while operating on a remote Pacific Island DXpedition, with many callers at a time, for sometimes hours on end. The best behaved of the bunch are Technicians on 10 meters, as they haven't yet learned bad operating habits from experienced hams who may try to get away with less-than-courteous behavior!



Here's a look at who might be on the other side of your 225-point VOTA contact with W7VO. Daryl Anderson, W7GYM, is on the left, operating the main contest station, and Bob Thompson, W7CO, is on the right, manning the VOTA station.

Tips for VOTA Operating

There are several months left in the VOTA operating event. Here's how you can maximize your VOTA point totals for the rest of the year.

▪ Get on the air!

You can't collect or hand out VOTA points unless you are "radio active!" To find out how many VOTA points you are worth to others, or how many points somebody you contact is worth, check out vota.arrl.org/index.php, and click on the POINTS TABLE link.

▪ Call CQ!

Rather than tuning up and down the band to find VOTA stations to contact, try calling "CQ VOTA" on a clear frequency, especially if you are an ARRL volunteer and worth extra points. Amateurs are out there looking for you! (Always ask, "Is this frequency in use," before calling CQ!)

▪ Focus on Generals and Techs.

If you're calling CQ, (known as *running* in contesting lingo), concentrate on the General and Technician portions of the HF bands. Now that the sun has come to life with sunspots, the Technician phone portion of 10 meters (28.300 to 28.500 MHz) has lots of SSB activity and many eager Technician-class hams waiting to contact you.

▪ Use the DX spotting network to find VOTA activations.

If you're calling CQ, get your operation listed (or, in hamspeak, *spotted*) on the DX websites so other hams can easily find you. There are several spotting websites, such as dxwatch.com, qrz.com/dxcluster, or dxsummit.fi. I like to share my spot on these sites every half-hour or so. Just about every time we spot our operation on the network, activity increases significantly shortly thereafter. Make sure to note that you are a VOTA activation as part of the spot text.

▪ Contact W1AW/x.

Look for the weekly W1AW portable activations by checking the ARRL VOTA website at contests.arrl.org/docs/2023-VOTA-State-Activations-Schedule.pdf. Better yet, activate *your* station as W1AW by getting registered, which is easily done by contacting your state activation coordinator (their email addresses are available on the previously mentioned State Activations Schedule PDF). They may direct you to a website where you can enter what bands, modes, and times you would like to operate.

▪ Upload ALL your operating logs to LoTW.

Do it every time you are on the air, for all of 2023.

Just a reminder that VOTA activity is only allowed on 160, 80, 40, 20, 15, and 10 meters, and VHF/UHF ham bands. Now get out there and have some VOTA fun! The end of 2023 will be here before we know it, and it'll soon be time to print out your awards!

VHFing on Vacation

Klaus Spies, WB9YBM



Klaus's, WB9YBM, simple setup for his trip to Wisconsin, plus some postcards that feature a local attraction, to use as QSL cards.

On vacation, our main focus is to spend time with family and friends, and garner new experiences. This can make the focus on hamming secondary, but there are still simple, vacation-friendly ways to get on the air. Here's how to have a successful VHF operation on your vacation.

Planning and Programming

The first thing I do is check what activity is available at the destination. Two-meter operation is usually the best bet — that and 70 centimeters are the two most populated VHF/UHF bands no matter where I go. *The ARRL Repeater Directory* is usually my go-to resource for this, along with a good local area map, because nearby towns may also have repeater activity. If I'm going to operate mobile while traveling to or from the destination, programming my transceivers ahead of time with repeaters that will be in range along the way can help me gain insights about worthwhile stops en route. If you do this, make sure operating doesn't distract you from safe driving and paying attention to navigation!

Keep it Local

Since my focus is typically in and around our destination, I don't need HF equipment or antennas, or anything for VHF/UHF long-range work. The mobile setup I use while driving to and from work is all I need. At the destination, I can use either my mobile radios with a mag-mount antenna and power supply right in our motel room, or a handheld transceiver with a battery eliminator and small power supply, since most tourist towns are large enough to have a repeater within range of my handheld. This small setup helps keep the peace with my traveling companions, so they don't feel like ham radio is taking over their vacation. To complete my vacation station, I take along

a small notepad, vacation logbook, and a scanner for listening to non-ham radio traffic in the area. I've often gotten a chuckle from shenanigans indulged in by a hotel's housekeeping staff, come across golf course traffic, and so forth!

Vacation QSLs

Even though exchanging QSL cards is not typical in VHF/UHF operation, I do it anyway, for two reasons: as a thank you to locals for their advice on where to visit, and if I get a card in return, it's a unique addition to a vacation scrapbook. Sending a QSL card also provides a perk for the station I talked with, because they get to show off a QSL card from an out-of-state operator who talked to them on their local repeater. You can even customize a QSL card for your vacation, with a photo of your vacation setup, your operating location, or something unique you did on your vacation.

Small Station, Big Fun

A vacation involving ham radio does not need to be a burden on the operator or their travelling companions. You need only a small amount of radio gear in order to have fun operating! A small station also ensures fewer chances of complaints from housekeeping or motel management, and is easier to secure when you're not in your room. The ability to operate on vacation has not only provided travel tips from locals, but has also given me the opportunity to get invited to local club meetings and make friends all over the country.

Klaus Spies, WB9YBM, radio interests began in the early 1970s as a shortwave listener, including scanning, CB, and commercial operations. He received his ham license in 1975. He has been an author since 1988, with more than 65 articles published.

Antenna Analyzers and VNAs

Steve Ford, WB8IMY

There is no doubt that you've seen antenna analyzers advertised in amateur radio magazines and online, and you have likely wondered what they are. Here's a look at this useful piece of basic test equipment.

An antenna analyzer is used to measure the impedance (for more about impedance, see "Impedance — The Loyal Opposition" and "Impedance in the Real World," both in the November/December 2021 issue) and other properties of an antenna system. It can be a huge help in optimizing an antenna system's performance and identifying problems in its design or installation. A typical antenna analyzer is shown in Figure 1.

The first commercially available antenna analyzers for ham radio use were introduced in the late 1970s. These early analyzers were designed for specific frequency ranges and were often quite expensive.

In the years since then, the technology has advanced, and prices have come down. Today, there is a wide range of antenna analyzers available to hams at varying price points, from simple and affordable, to more sophisticated and expensive with advanced features.

How an Antenna Analyzer Works

An antenna analyzer operates by injecting a radio frequency (RF) signal into the antenna system. This signal travels to the antenna, and then a portion of it returns to the analyzer. The device analyzes the returned signal to determine the impedance of the antenna system at various frequencies. It will also calculate the standing wave ratio, or SWR (for more about SWR, see "Untangling SWR" in the January/February 2021 issue).

The most popular application of an antenna analyzer occurs when you're trying to tune an antenna for the lowest SWR. An analyzer can quickly display the frequency at which the lowest SWR currently exists, allowing you to adjust the antenna to move the low-SWR point to the desired frequency. You can also perform this adjustment with a simple SWR meter, but an analyzer makes the job much easier.

Some analyzers can "sweep" through a range of frequencies and instantly show the SWR results as a helpful graphical display. In addition to measuring SWR, most analyzers can also measure the RF loss in a length of coaxial cable. This can be helpful when you're trying to keep losses in a system to a minimum, or when you've purchased a length of cable, and you're not sure about its characteristics.

"Tuning an Antenna with an Antenna Analyzer," in this issue, walks you through how to tune an antenna for the lowest SWR at your desired frequency.



Figure 1: An antenna analyzer manufactured by MFJ Enterprises.

VNAs are designed for precision applications where measurement errors must be minimized.

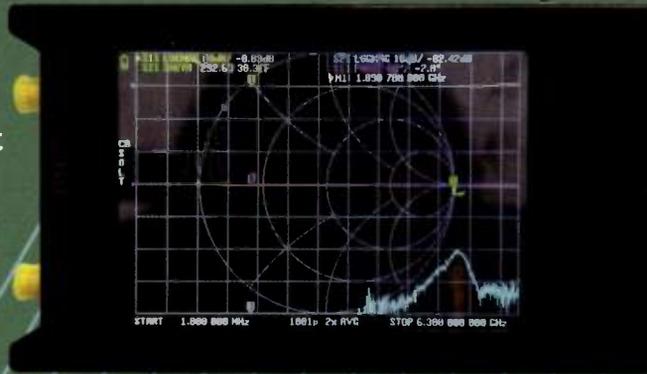


Figure 2: An affordable VNA. Models like these typically sell for less than \$100.

What is a VNA?

When hams discuss antenna analyzers, the topic of vector network analyzers (VNAs) will often arise as well.

A VNA works similarly to an antenna analyzer, and it can do most of the same tasks. Like an antenna analyzer, a VNA generates a signal that is applied to whatever is being tested, such as an antenna system, and it can display the SWR at a single frequency or through a range of frequencies.

Key differences between antenna analyzers and VNAs include:

- VNAs usually have a greater operating range, especially at microwave frequencies.
- VNAs typically have a higher measurement accuracy than antenna analyzers because VNAs use a more sophisticated measurement technique called *vector measurement*. This technique can accurately determine the amplitude and phase of the signal. Antenna analyzers are different in that they only measure the signal's amplitude. This difference isn't critical for most ham applications, but it becomes important for building antennas, filters, etc.
- Unlike an antenna analyzer, a VNA requires a well-controlled environment for optimum accuracy, including high-quality test fixtures with precision connectors and cables. Antenna analyzers are more forgiving and user-friendly.

Which is Best: Analyzer or VNA?

It depends; VNAs and antenna analyzers can be used to measure the electrical properties of RF circuits and systems. However, VNAs are typically used for more sophisticated, high-precision measurements, while antenna analyzers are primarily utilized for simpler measurements.

Within the last several years, small VNAs, as shown in Figure 2, have appeared that are substantially less expensive than most antenna analyzers. Some of these VNAs can be purchased for less than \$100. The low selling price has generated considerable interest among amateurs. Still, it is important to remember that VNAs are designed for precision applications where measurement errors must be minimized. For example, VNAs may require periodic calibration to maintain their accuracy. In this regard, VNAs are more like laboratory instruments where you must thoroughly understand the device to get the maximum benefit.

In contrast, an antenna analyzer is designed to operate directly out of the box with little setup and less knowledge necessary on the part of the user. With an antenna analyzer, you're paying for convenience and ease of operation. You simply load the batteries, attach the coaxial cable from your antenna, and turn on the unit.

An analyzer is likely to be less accurate than a VNA, but it is perfectly adequate for most ham applications. The choice between the two depends on what you hope to accomplish with the devices.

Tuning an Antenna with an Antenna Analyzer

Learn to match your antenna to your ham transceiver and adjust it to your operating frequency with one of the most basic ham radio tools.

John Portune, W6NBC, and Jim Bailey, W6OEK

Most ham antennas require adjustment to *efficiently* convert RF power into radio waves. Few work “right out of the box.” The reason for this is simple: all antennas are sensitive to the local environment — the antenna’s height above ground, nearby objects, the soil under the antenna — all of these exert strong influences that call for two basic antenna adjustments, *tuning* and *matching*.

Coarse tuning sets the band that you’re going to operate on — 2 meters, 10 meters, 6 meters, etc. *Fine tuning* sets the sub-segment of the band — the repeater segment, the phone (voice) segment, the digital segment, or the CW (Morse code) segment. With a few exceptions, most antennas, as built or manufactured, can cover all band segments.

Matching adjusts an antenna so that it will accept the greatest amount of power from your transmitter. Matching creates a low SWR (standing wave ratio) in the antenna/feed line combination, both on the band and in the sub-segment of the band.

The most common way to understand matching is to imagine that it causes a transmitter that’s expecting a 50 ohm load to “see” that 50 ohm load coming

from the antenna at the other end of the coax. This match is the optimum state for the transmitter-coax-antenna combination, because it allows maximum transmitter power to radiate from the antenna as radio waves. (For a fuller discussion of matching, see “Antenna Tuners: Making a Match” in the January/February 2021 issue.)

Consequently, hams need tools to perform these adjustments. Fortunately, the modern antenna analyzer makes them easy, as the steps of this article will show.

There are many good antenna analyzers to choose from, varying in price, features and frequency range. All, however, provide the needed features for basic tuning and matching. Low-cost VNAs (vector network analyzers) are also becoming popular for the same adjustments, although often with more experienced hams.

The most commonly used antenna analyzers are from MFJ Enterprises, Rig Expert, and Comet. For the purposes of this article, we will use the MFJ-259D, because it’s typical of other analyzer brands.



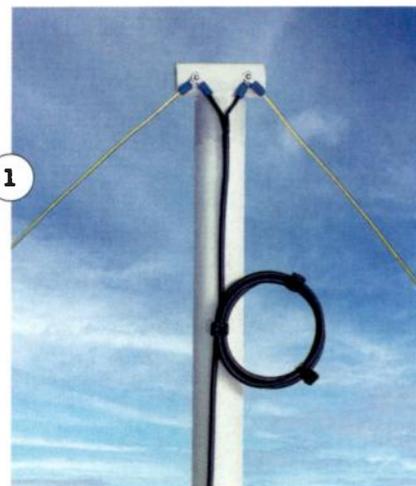
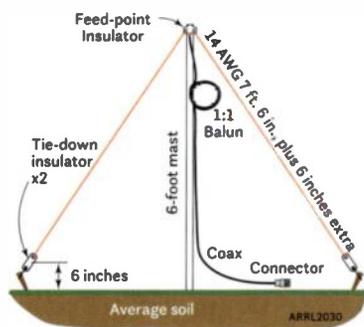
Some of the most commonly used antenna analyzers are made by Comet, RigExpert, and MFJ.

An Example Antenna

The antenna we'll use as an example is a simple inverted V antenna for 28 MHz, aka 10 meters (see the diagram and the lead photo), cut to a length that works for the middle of the Technician portion of the band. There is a feed-point insulator at the top of the mast for connecting the feed-line coax. The 14 AWG antenna wires (the antenna's *elements*) slope down on each side to an end insulator that is tied down with nylon cord.

Initially, the wires and mast were intentionally made somewhat longer, which is common practice when building a *homebrew*, or homemade, antenna.

If you are tuning up a commercially built antenna for the first time, the manufacturer will have sized the lengths of the elements for the desired band or will have provided cutting instructions for the wire elements.



The feed point of the antenna, showing the position of the three-turn 3-inch diameter coax balun.

Mounting an Antenna for Adjustment

You should also always mount an antenna for tune-up in an approximation of your final operating location. As mentioned previously, antennas are sensitive to surrounding objects and to the ground. The example antenna for this article was initially mounted on grass using a mast made of a 10-foot PVC pipe. It is not good practice to tune up an antenna indoors on a workbench, particularly a metal workbench, as the antenna will be significantly out of adjustment when it is moved to a permanent location. A wooden stepladder makes a good temporary mount. Also, when making adjustments, stand 2 or 3 feet away from the antenna, as your body will affect the adjustments.



The antenna analyzer's Frequency knob is set to cover a range of frequencies that includes the 10-meter band.

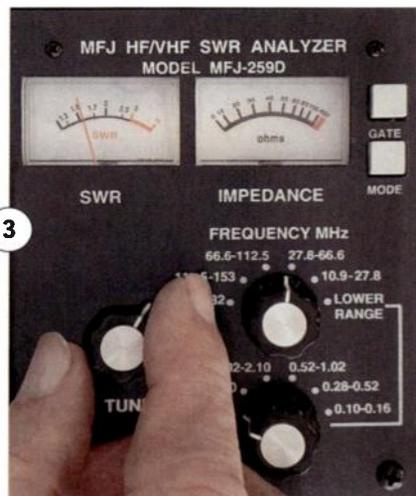
Tune-up Procedure

Step One

Connect the analyzer to the antenna via a short coax pigtail. *Note:* Include a 1:1 choke current balun in the pigtail near the antenna. It can be a few turns of the feed coax formed into a 3 – 4 in. diameter coax balun, held in place with zip ties (see ①), a commercial 1:1 choke current balun, or several snap-on ferrite split chokes of the type used on computer cables. A 1:1 current choke balun placed at the antenna is essential whenever you are using an antenna analyzer. Otherwise, RF current on the outside of the coax shield will adversely affect tuning and matching. See “Build a Balun” in the January/February 2023 issue for instructions on making a suitable balun.

Step Two

On this antenna analyzer, turn the the FREQUENCY selector switch to the frequency range that includes the band that the antenna is designed to operate on — in this case, the range 27.8 – 66.6 MHz (see ②). On other analyzers, you will enter the desired frequency range on a keypad.



Performing a frequency sweep. Note that in these images, some normal analyzer display data has been omitted. This data is for other, more advanced, functions of the analyzer, and does not concern our purposes here.

Step Three

Perform a *frequency sweep*. A frequency sweep on MFJ-259 series analyzers is performed by rotating the TUNE knob across the entire band, while observing the SWR meter on the left-hand side of the unit (see ③). On other analyzers, a frequency sweep is an automatic function that also draws an SWR graph on the display.

During the sweep, you should see a sharp reduction, or *dip*, in the level of the SWR — the needle on the SWR meter will swing noticeably to the left. The dip indicates the frequency to which the antenna is currently tuned. If you don't see a dip, change bands (or the frequency range/limits) and repeat the sweep until you locate the dip. The initial SWR at the dip may not be low, especially if the SWR (match) requires adjustment.

Step Four

Adjust the TUNE knob so that the SWR meter is at the dip, then read on the display the frequency to which the antenna is tuned (see ④). On other analyzers, read the dip frequency (which will be the frequency to which the antenna is tuned) directly from the SWR graph.

In ④, note that because the initial lengths of the antenna's wire elements are too long and the height of the antenna is too high, the initial frequency (the tune) is low at 27.872 MHz, and that the SWR is poor, at 3:1. A correctly matched antenna will have an SWR close to 1:1, and for the 10-meter band, the desired frequency will be near 28.4 MHz.

Step Five

Now that we know what frequency and SWR we're dealing with, we can tune the antenna.

It's recommended to tune the SWR (match) first, and the frequency second. This order is not mandatory, but it is practical. The SWR will change only a little when we adjust the frequency, but on most antennas the frequency will change much more when we adjust the SWR.

First then, we adjust the SWR. For this antenna, the easiest way is to lower the mast height to 6 feet, and the wire ends to a height of 6 inches. There are other ways to adjust the match of an antenna, such as changing the length of tuning stubs and adjusting tuning capacitors that a manufacturer has included in the design.

Notice, though, in ⑤, that the height change causes the SWR to drop to 1.1:1 (a good match) but that the frequency changes only slightly, to 26.685, emphasizing the advice to adjust SWR before frequency. Also note that the change in frequency to 26.685 requires a change of the frequency band switch on the analyzer and a new frequency sweep because 26.685 is lower than the frequency range we selected in ②.

Step Six

Second, adjust the frequency. For most antennas, the length of the wire or metal tubing elements adjusts the frequency. By shortening this antenna's wires to the lengths shown in the diagram on the previous page, a good final adjustment of frequency — in the center of the 10-meter band — and a good SWR (match) — below 1.2:1 — is obtained (see ⑥).

These, then, are the two simple steps that you will routinely perform with an antenna analyzer on commercially built or home-built antennas to tune them to the appropriate frequency and obtain a good SWR.

There are other useful secondary functions that an antenna analyzer can perform. Some models running specialized software can be connected to a computer for a more graphic display. But for achieving maximum performance from an antenna, most hams ultimately find the modern antenna analyzer an indispensable tool in their ham radio toolkit.

John Portune, W6NBC, was first licensed in 1965 as WB6ZCT. He also holds the call sign MØGCK, as well as a General Radiotelephone Operator License (GROL). He has published more than 30 articles in QST. He can be reached at w6nbcmail@gmail.com.

Jim Bailey, W6OEK, of Santa Maria, CA, is an ARRL member and has been a licensed amateur radio operator for over 65 years. He is retired from an electronics company, where he was an Engineer and Test Systems Maintenance Supervisor. You can reach him at w6oek@comcast.net.



After the initial tune-up, the frequency is too low and the SWR is too high.



The match has adjusted — in this case by lowering the antenna — achieving a low SWR.



The final tuning for frequency and SWR shows that the antenna is tuned to the center of the Technician portion of the 10-meter band, and also exhibits a reasonable 1.2:1 match.

Station Maintenance: A Checklist Before Contest Season Starts

Sean Kutzko, KX9X

Believe it or not, it's time to start thinking about fall. Fall means better conditions on HF, and it's also when contest season ramps up, with major competitive events several times a month from October to March. Here's how to get your station ready now, while the weather's on your side.

Whether you are a serious competitor or a casual participant, ham radio contest season allows you to have a lot of fun on the air in a short amount of time, and pursue operating achievements like DXCC and the Worked All States Award with great efficiency. With a large portion of the country subject to winter weather, now is the time to perform maintenance that will help your station function at its best, and reduce your chance of having to repair an antenna in a snowstorm.

Here is a checklist of things to review outside and inside your shack — including shack ergonomics.

Outside the Shack

Check all of your antenna feed lines, and replace anything that's worn or damaged. Pay close attention to anywhere there is a connector, such as a feed point or a junction between two coax runs.

Evaluate your feed lines with an eye toward keeping them as short as possible. Excess feed line spooled on the ground wastes RF energy and makes your station less efficient.

Check connectors and junctions for water. Undo the connector or junction, examine the outside and inside for water or signs of rust or corrosion, and make replacements where necessary. *The ARRL Antenna Book* shows how to properly seal feed points and junctions with tape and other sealants to keep water and corrosion out.

Evaluate your antenna systems to see if anything needs to be rehung or replaced. This is a good time to put up new antennas that offer better performance or more flexibility on the bands.

Determine whether your station is properly grounded and bonded. A well-grounded station offers protection from lightning strikes and can help with noise and interference issues. A trusted resource, such as Ward Silver's, NØAX, book, *Grounding and Bonding for the Radio Amateur*, can help.



Inside the Shack

Grounding and bonding is important indoors too. Take steps to ground the gear in your shack properly. It can reduce noise, help eliminate RF “hotspots” in your shack when transmitting, and make your shack a safer place.

If you have noise problems, take the time to track down the sources. The most common culprits are appliances, Wi-Fi equipment, and “wall wart” switching power supplies for numerous devices.

Tidy the cables on and around your operating desk. The cleaner look will be satisfying, and it can help with some noise and RF issues.

Evaluate how your feed lines enter your shack. Running cables through a poorly sealed window can lead to wasted electricity and heat, as well as other issues. Check *The ARRL Antenna Book* to discover more efficient ways to get feed lines into your shack.

Take the time to install or learn new software. Last-minute installations or updates rarely go as planned.

Evaluate your shack chair — it’s arguably the most important item in your shack besides the radio. The fanciest radios and best antennas will not help if sitting at your radio is painful or stressful. Find a good-quality chair that includes back/lumbar support, knee support, and several adjustment methods for maximum comfort. Consider computer gaming chairs, which are designed for a function similar to radio contesting.

Evaluate your operating desk. Make sure your desk is at the proper height — 29 – 30 inches above the floor is generally good. You want to be able to have your forearms resting on the desk with your elbows bent at a 90-degree angle. Make sure your desk is wide enough to hold all your gear. Many aren’t deep enough to hold radios and accessories and still offer enough space for keyboards, notepads, and other necessities. Consider building your own desk. There are a lot of DIY plans on the internet, and it doesn’t have to be expensive or complicated.

Set up your computer monitor at your eye level. Continuously bending your neck to view the screen leads to fatigue. Placing your monitor on top of a short shelf on your desk helps adjust it to the proper height, and provides a storage area for keyboards and small accessories underneath.

Optimize your microphone setup. Most of us have tried logging a contact while holding a microphone. It’s awkward and uncomfortable, especially if done for long periods. If you’re a phone operator, a boom-mic headset and a push-to-talk footswitch free up your hands for logging contacts and operating station accessories.

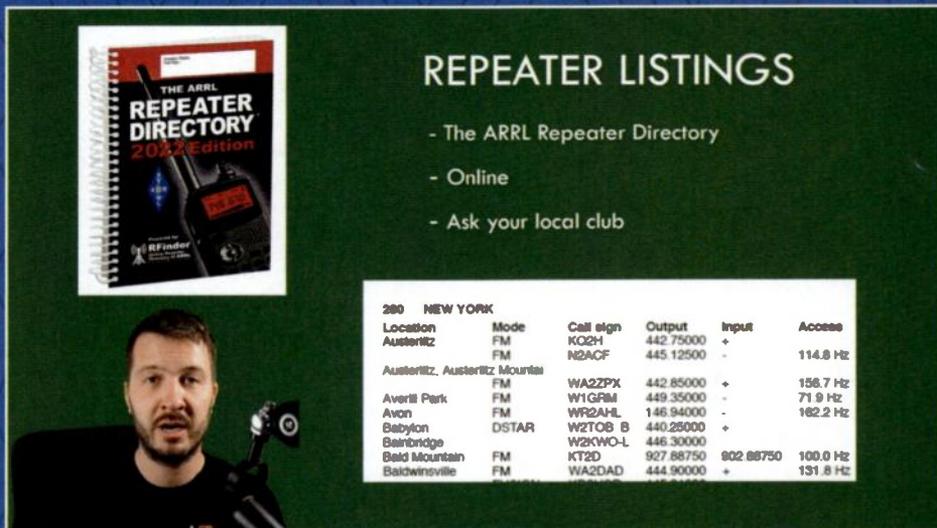
A thorough inspection and proper station maintenance should be conducted at least once a year. All things wear out and break, usually at the most inconvenient time. With careful planning this summer, you can avoid having to make a repair in the middle of winter, or running into a problem that takes you off the air until spring. Best of all, you can have a lot of fun on the air this fall!

Sean Kutzko, KX9X, is the former ARRL Contest Branch Manager and Media & Public Relations Manager. He spends his ham radio time mostly on satellites and operating portable in the Parks on the Air (POTA) and Summits on the Air (SOTA) programs. Follow him on Twitter @SeanKutzko.



From the Learning Center

The ARRL Learning Center, located at learn.arrl.org, is an online resource where ARRL members can undergo training and earn certificates. To access the Learning Center, simply log in using your ARRL.org member username and password.



REPEATER LISTINGS

- The ARRL Repeater Directory
- Online
- Ask your local club

280 NEW YORK					
Location	Mode	Call sign	Output	Input	Access
Austerlitz	FM	KO2H	442.75000	+	
	FM	N2ACF	445.12500	-	114.8 Hz
Austerlitz, Austerlitz Mountain					
	FM	W42ZPX	442.85000	+	156.7 Hz
Averill Park	FM	W1GFM	449.35000	-	71.9 Hz
Avon	FM	WR2AHL	146.94000	-	162.2 Hz
Babylon	DSTAR	W2TOB B	440.28000	+	
Bainbridge		W2KWO-L	446.30000		
Bald Mountain	FM	KT2D	927.88750	902.88750	100.0 Hz
Baldwinsville	FM	WA2DAD	444.90000	+	131.8 Hz

In the ARRL Learning Center course *Repeater Basics*, Hayden, VK7HH/KD9SSB, explains how to find repeaters to access.

Repeater Basics

One of the first things many new hams do after getting their license is make a contact on a repeater. There are thousands of repeaters in the US alone, yet most amateur radio operators don't truly understand what they are and how they work. The ARRL Learning Center's new three-part course, *Repeater Basics*, can help. It's geared toward teaching amateurs what repeaters are and how they function, and helps them to understand basic terms and etiquette, to help mitigate the all-too-common "mic fright" many new operators experience.

Once you're at the Learning Center (learn.arrl.org), click on "Courses," then navigate until you see the tile for *Repeater Basics*.

The What, Why, and How

In the first course module, "Basics of Repeaters," instructor Hayden Honeywood, VK7HH/KD9SSB, explains why repeaters are applicable to many new hams. Hayden explains the use of simplex communications, as well as the limitations of such methods, then explains how repeaters can help extend communications across a larger area, and potentially around obstacles that may block a signal.

Hayden then gives a basic explanation, with illustrations and diagrams, of how a repeater works. He also introduces the idea of linking repeaters and digital voice modes including AllStar, DMR, D-STAR, and YSF, as well as discussing links using dedicated radio linking hardware.

The first module also introduces common lingo used on repeaters, including definitions and examples of common usage. This is important for acclimating new repeater users.

Tones and Talk

In the second module, "Listings, Programming, and Etiquette," Hayden tackles the issue of how to find repeaters, naming resources that can be utilized, and explaining how to use them. He also explains what offset frequencies are, and why they exist. The module goes on to teach basics on programming repeater information into a radio. Hayden demonstrates how offset frequencies work, and explains that you can program custom offsets if needed.

Accessing a repeater often involves more than just setting the frequencies into the radio. Hayden explains what Continuous Tone Coded Squelch System (CTCSS) tones are, and why they may be used in repeater systems. He also introduces dual-tone multi-frequency tones (DTMF) and the purposes they serve.

Hayden demonstrates how to program tones into a radio — a process that's slightly different on every radio, so Hayden takes the time to give examples of what various manufacturers may call the tone settings on their radios.

Finally, it comes time to discuss talking on the repeater. While the basic etiquette Hayden goes over is not absolutely required, it generally makes the experience more enjoyable for everyone involved.

Hardware Matters

Module three, "Building Blocks of a Repeater," covers the actual hardware of the repeater. Hayden uses a block diagram and explains components represented in the diagram, then shows actual repeater components. He takes the time to explain the function of each one and shows the basic connections between the components. This module also delves into which feed lines are best to use, which ones to avoid using, and why.

Finally, Hayden explains some options for the most important part of the repeater system — the antenna. He discusses some basic requirements and options, and takes the time to explain some items that are often overlooked when installing an antenna.

Whether you are just curious about how repeaters work, or are planning to install or perform maintenance on an existing repeater, head to the ARRL Learning Center at learn.arrl.org and check out *Repeater Basics*.

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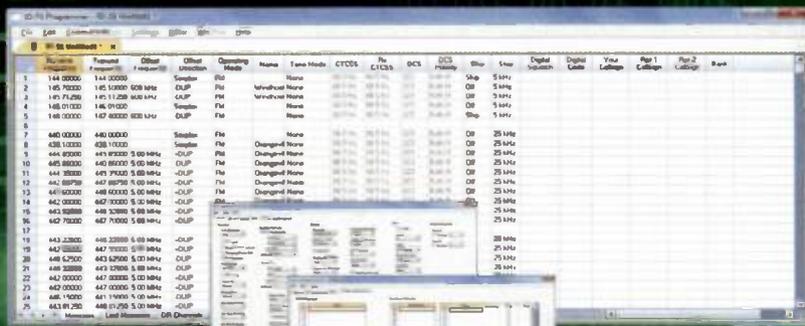
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If you've been on an amateur radio net, you've probably heard the phrase, "Does anyone have any traffic to be passed into or out of our local area?" The term *traffic* refers to messages of a more formal nature that are delivered using ham radio. These messages may be for another ham, or for someone who isn't a ham, and can range from well wishes such as "Happy Birthday," to health and welfare messaging after a disaster such as, "Wanted to let you know we made it through the hurricane."

Health and welfare messaging has long been one of the services we provide to the public when traditional methods such as internet, landline, and cellular communications are down in an area impacted by a disaster. Outside of disaster response, sending a message to a friend or family member using amateur radio can be a great way to introduce them to amateur radio, or just to say hello in a unique way.

Radiograms — Putting the "Form" in "Formal"

In most cases, the sender of the message uses a *radiogram form*. An ARRL radiogram has four main areas, which include:

The header, which contains

- A message number
- The *precedence*, or importance of the message
- *HX*, or handling instructions on how the delivering operator should handle the message
- The *station of origin*, which is the call sign of the amateur radio operator that generated the original radiogram form
- The *check*, or number of words or character groups in the message
- The *place of origin* of the message
- The *time filed* and the *date* the message was created

The "TO" area, which contains information about the message recipient, including

- The name of the person the message should be delivered to; if the person is a ham, their call sign should be included
- The recipient's address or, at minimum, their city and state so that the message can be routed to someone in their local area for delivery
- The recipient's phone number or email address; at least one must be provided to ensure delivery to the recipient, especially if no address is provided

The body, or text area, which includes the sender's message

- The ARRL radiogram form provides 25 spaces for words or mixed groups of characters; you can send more than that, but sticking to the limit is recommended, so as not to clog up the nets

A signature area for a salutation or signature from the sender

Depend On the NTS

Once a message has been generated, it's sent using the *National Traffic System* (NTS), which ARRL formed in 1914 for the purpose of passing formal messages around the country. When the Net Control Station of your local or sectional net asks for traffic that needs to be passed, these messages are presented. If the message is being delivered locally, it is passed around the appropriate local nets. If it needs to go farther than that, typically only official message stations will participate in the regional and area-wide nets, as they are used to pass message traffic quickly from one Section, region, or area to another.

There are numerous ways to inject a message into the NTS for delivery. While Morse code is still used to transmit formal messages, local or Section-based phone nets, also known as *voice nets*, occur weekly, or even daily. *Winlink*, software that sends digital messages over the air, has a built-in radiogram form that can be used to inject a message directly into the region in which the message recipient is located.

Once a message has reached an amateur radio net in the recipient's general area, any ham participating in that net can offer to deliver the message.

Traffic can also be utilized to pass messages relevant to disaster response. Emergency management and other served agencies use Incident Command System (ICS) forms, which are standardized nationwide so that they can be easily interpreted wherever they may be delivered. Two common forms are the ICS 213 general message form, and the ICS 213 RR resource request form. These forms are generally passed over the air or via *Winlink* directly from the originating station to the recipient station. However, they can also be sent using the NTS, if needed.

Preparing to Pass Traffic

If you're nervous about passing traffic, you can prepare by listening to the nets in your area as they pass traffic. Download a blank radiogram form from the ARRL website (arrl.org), print it out, and practice copying down the message as it's being passed. Your local club or ARRL Section website should have information about local nets that pass traffic. Once you're familiar with the process, and you'd like to become more involved with the NTS, locate your Section Traffic Manager to find out how to be of service.

There's only one way to learn the art of passing traffic, and that's to get on the air and pass some yourself, or take part in delivering a radiogram to someone in your area. Whether you're a new ham or a seasoned veteran, take time to utilize the NTS and generate traffic for your friends and family.

Arc Thames, W4CPD, serves as the Section Emergency Coordinator of ARRL's Northern Florida Section and Emergency Coordinator of Santa Rosa County, FL. He has been a licensed ham since 2016.

ARRL Section Traffic Volunteering

ARRL has designated 2023 as the Year of the Volunteers, and all year, *On the Air* will be highlighting the work that hundreds of volunteers do at the ARRL Section level to make ARRL's programs run, to keep information about ham radio and ARRL flowing to the members, and to help keep the ham radio hobby and service active, constructive, and satisfying for its practitioners.

In this issue, we'll look at Section-level traffic volunteers. Telephone and instant messaging are not always available when catastrophes strike, but the airwaves are — hence the Amateur Radio Emergency Service (ARES*) slogan, "When All Else Fails*." Here are some of the Section-level positions that help keep ARES at the ready.

Section Traffic Manager

Section Traffic Managers (STMs) oversee all *traffic nets* (on-air gatherings that pass messages via a network of other such gatherings) in their ARRL Sections. These nets, which meet on a regular schedule, are part of the National Traffic System (NTS), and they handle third-party messages called *radiograms* (similar to telegrams) throughout the US and Canada, as well as wherever third-party messages are legally permitted. The purpose of local or Section-wide nets is to train others in the skills of accurate and efficient message handling and net operation, which is a valuable asset in times of emergencies and disasters. (For more about nets and the NTS, see "Check In to Nets!" in the July/August 2021 issue.)

STMs ensure that each net has an appointed Net Manager responsible for training and overall net operation, including appointing qualified Net Control Stations and liaison stations. An STM sets the example of best practices for message handling, responds to queries from net managers, collects monthly activity reports from net participants, and communicates these — along with

comments on happenings, recognitions, and traffic tips — to ARRL Headquarters and the Section website.

Eastern Massachusetts STM Marcia Forde, KW1U, noted, "Most NTS nets operate 7 days a week, whether there are messages to pass or not. In today's world of internet and cell phones, there is less need on the part of the public for the use of these traffic nets. However, we realize the pitfalls of dependence on commercial services and keep our skills honed to be available when needed. Many hams gen-

erate messages for this purpose. It is a great way to meet and make new friends while learning a valuable skill."

As Assistant STM for the Eastern Massachusetts Section, Peter Doherty, KC1HHO, developed a training program for new relay stations that uses questions as the message in a radiogram. Peter said, "The methods and procedures that are used are vital to ensure the messages get transmitted and received exactly as written."

Net Manager

Net Managers (NMs) are appointed by the Section Manager (SM) for coordinating and supervising traffic-handling activities in the Section. The number of NMs appointed may depend on a Section's geographical size, the number of nets operating in the Section, and the way the Section is organized.

NMs are active members of the net. They accept and relay traffic, and are accessible to stations before, during, and after the net. NMs verify how the Net Control Operators are doing and where they need help, and provide training and assistance for all net check-ins. On a daily basis, NMs



The center of the Minute Man Repeater Association network. All repeaters in this network link through this setup. At the bottom is a battery backup power supply that can operate 30 to 60 minutes during a power outage. [Photo courtesy of Joe Weisse, W1HAI]



Official Relay Station Ethan Hansen, KC1OIP, uses the NTS to send POTA confirmations. [Photo courtesy of Ethan Hansen, KC1OIP]

receive the following information from Net Controls: the number of stations who checked in, the number of messages passed, and the duration of time the net took that day. At the end of the month, the NM totals the check-ins, traffic, and time, and passes that information to the SM. The NM works closely with the club and trustees of the host repeaters, attends their meetings, provides presentations on the NTS, and lends a hand where possible.

Eastern Massachusetts NM Joe Weisse, W1HAI, said, "In a long tradition of relaying messages through multiple nets across the country and beyond, this system provides a public service to those who receive the message, maintaining skills that may be needed in an emergency. My motivation is to have more hams trained [to] participate and take leadership positions in the National Traffic System and public service."

Official Relay Station

Some of the tasks of an Official Relay Station (ORS) include sending and receiving NTS-formatted traffic (i.e., radiograms) during ARES exercises, delivering birthday messages, sending and receiving confirmations for Parks on the Air (POTA), and picking up and delivering Priority traffic related to search-and-rescue efforts.

Ethan Hansen, KC1OIP, said that being an ORS has made him a better operator. He noted, "Passing training messages back and forth with the Net Manager helped me get over my mic fright as a new ham. Having to really slow down my talking speed and enunciate while passing traffic has helped me [be] heard right the first time. The experience of passing traffic during terrible band or repeater conditions has made me a better operator. If I can pick out the text of a radiogram when the wind is causing the repeater to go in and out, I can probably pick out a weak station getting back to me on HF voice."

Technical Coordinator

The ARRL Technical Coordinator (TC) is a Section-level official appointed by the SM to coordinate all technical activities within the Section. The TC reports to the SM and is expected to maintain contact with other Section-level appointees as appropriate to ensure a unified ARRL Field Organization within the Section.

TC for the Connecticut Section, Steve Simons, W1SMS, who says he enjoys mentoring others, is currently designing a monthly get-together at his location for the purpose of hands-on project assistance, troubleshooting, antenna assembly, and instructing others in using test

equipment. As TC, Steve has assisted with various technical problems involving communications between emergency operations centers. Additionally, he has given presentations at radio club meetings, on topics such as tower and antenna erection safety, proper station grounding and protecting against lightning events, and remote controlling a station.

Why You Should Volunteer

Volunteering in these capacities may be of special interest to hams looking to advance careers/education in communications, information services, and more. You'll gain practical experience, and you will also be faced with valuable networking opportunities among like-minded people. The alliances that volunteers inevitably make as an STM, NM, ORS, or TC can range from professional to casual, yet every connection is worth exploring. If you're looking to better yourself as a community member, an operator, and a communications asset, consider a volunteer position within your ARRL Section.



From the Podcast

Unique content to help you get more out of the magazine.

arrl.org/On-the-Air-Magazine

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Every month, the editors of *On the Air* release a companion podcast that extends the features, projects, and experiences presented in the magazine. Hosted by Becky Schoenfeld, W1BXY, and sponsored by Icom, the 15-minute podcast takes a deeper dive into an issue of *On the Air* to offer additional resources, techniques, and hints to help you get the most from the magazine's content.

The *On the Air* podcast is now available as a video! Visit ARRL's YouTube channel at youtube.com/ARRLHQ to watch the video version of our monthly podcast.

Here's an overview of recent episodes:



May 2023: Seasoned VHF operator Bob Witte, KØNR, expands upon his May/June article "A Mountaintop Trifecta: SOTA, POTA, and the ARRL VHF Contest," in terms of how to prepare yourself and your station to join in the fun of the beginner-friendly ARRL June VHF Contest.



June 2023: ARRL Radiosport & Regulatory Information Manager Bart Jahnke, W9JJ, and ARRL Contest Program Manager Paul Bourque, N1SFE, discuss a popular ARRL Field Day fixture known as the GOTA (Get On the Air) Station, which is a great way for a newer ham to try out ham radio, with expert guidance at hand.

You can subscribe to the *On the Air* podcast in Apple iTunes (podcasts.apple.com) or on Stitcher (app.stitcher.com). If you're using an RSS client, the feed URL is feeds.blubrry.com/feeds/arrlontheair.xml.



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This has proven to be a satisfactory solution to the abrasion problem, and has no effect on the performance of the feed line.

HACK

Protecting Ladder Line from Abrasion

I like using 450 ohm ladder line for wire antennas because it's lightweight and offers low loss, but I have a problem with abrasion of the plastic insulation where the ladder line runs over the edge of my roof. As the line moves up and down in the wind, eventually the Copperweld conductor of the line becomes exposed, the copper abrades, and the steel core rusts. I've had to replace my feed line twice due to this problem.

After several attempts to find a simple and inexpensive solution, I opted for the split, flexible tubing sold to contain wire harnesses. It's neat, inexpensive, widely available, and it can be replaced in minutes, should the need arise.



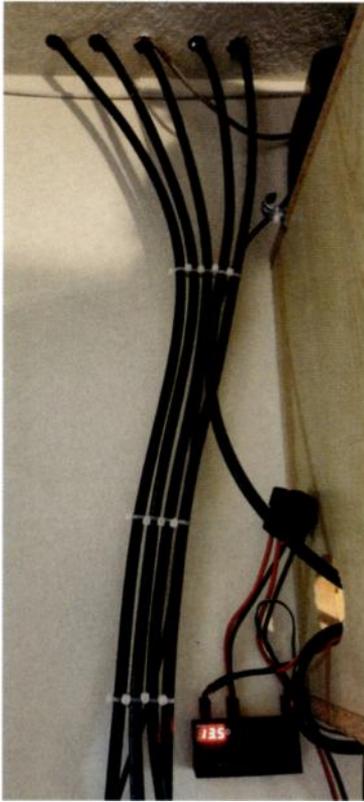
The split tubing installed on the ladder line with the plastic pen barrel "stopper" in place.

It's installed by inserting the ladder line through the longitudinal split in the tubing. The tubing should then be rotated to bring the split perpendicular to the plane of the ladder line, to prevent the line from exiting the tubing. If you're especially concerned about that, you can add cable ties around the tubing — one at each end, and one near the middle.

To prevent the tubing from sliding down the ladder line, I installed a piece of non-conductive material through the ladder line. I used the barrel of a discarded ballpoint pen, and held it in place with waxed nylon string typically used for securing wire bundles. Small cable ties or weather-resistant twine would work just as well.

This has proven to be a satisfactory solution to the abrasion problem, and has no effect on the performance of the feed line. I also used a cable tie around the tube, to anchor it to a gutter bracket. This stopped the tubing from making an annoying rasping sound when the wind caused it to move up and down against the edge of the gutter.

John Weatherley, AB4ET



Create a cable loom from zip ties to keep multiple runs of coax tidy.

HACK

Stay Organized with Cable Looms

An easy method for organizing multiple runs of coax in your shack is to craft cable looms out of zip ties. Loosely install a zip tie around the coax cables you want to loom together, then install a zip tie between each of those cables. Once all the zip ties are in place loosely, just tighten them and you'll have tidy loomed cables.

Brian Wasson, WA5SON

HACK

A Small Brush for Cleaning Connectors

When the sockets of female connectors get tarnished, dirty, or corroded, it's almost impossible to find a brush small enough to clean them. I solved this problem by using pipe cleaners — the kind actually used for cleaning tobacco pipes. I sprayed a pipe cleaner with electronic contact cleaner fluid until it was soaked, then twisted the pipe cleaner into each female socket.

Susan Meckley, W7KFI

HINT

Using Powerpole Connectors to Ground Ladder Line

In looking for a simple way to ground the ladder line that runs between my shack and tower, I've found Powerpole connectors to be an effective solution. I attached Powerpole connectors to the ladder line, and have the ladder line coming down the tower to a grounded Powerpole connector. When I'm not on the air, I store the line that comes from my shack about 6 feet away from my tower. When I want to operate, I disconnect the ladder line from the grounded connector, unroll the shack side of the line, and plug it into the antenna side of the line. The Powerpole connectors don't seem to cause any appreciable issues in the feed line.

Ron Wagner, WD8SBB

When I'm not on the air, I store the line that comes from my shack about 6 feet away from my tower. When I want to operate, I disconnect the ladder line from the grounded connector, unroll the shack side of the line, and plug it into the antenna side of the line.

US Amateur Radio Bands

Operator license classes: **E** = Amateur Extra **A** = Advanced **G** = General **T** = Technician **N** = Novice
 CW operation is permitted throughout all amateur bands. Except as noted, all frequencies are in megahertz (MHz).

■ = RTTY, data, phone, image
 ■ = USB phone, RTTY, data and CW
 ■ = RTTY and data
 ■ = phone and image
■ = SSB phone
 = CW only

LF – Low Frequency band

MF – Medium Frequency bands

2200 Meters (135 kHz) E,A,G
1 W EIRP maximum



630 Meters (472 kHz) E,A,G

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



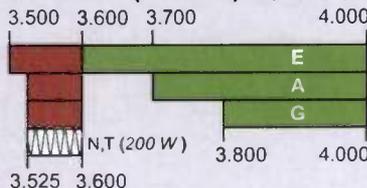
160 Meters (1.8 MHz) E,A,G



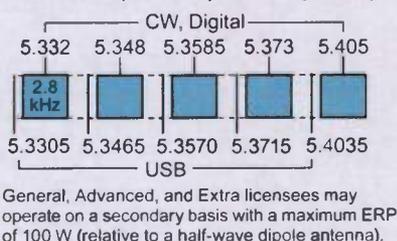
Amateurs wishing to operate on **2200 or 630 meters** must first register with the Utilities Technology Council online at <https://utc.org/plc-database-amateur-notification-process/>. You need only register once for each band.

HF – High Frequency bands

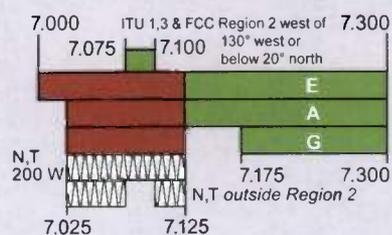
80 Meters (3.5 MHz) E,A,G,T,N



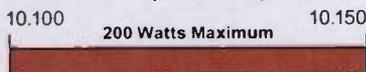
60 Meters (5.3 MHz) E, A, G (100 W)



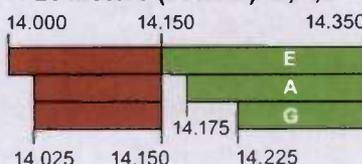
40 Meters (7 MHz) E,A,G,T,N



30 Meters (10.1 MHz) E,A,G



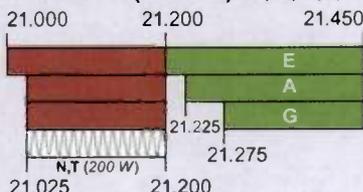
20 Meters (14 MHz) E,A,G



17 Meters (18 MHz) E,A,G



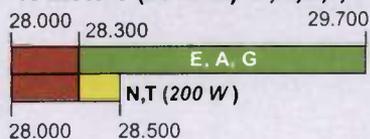
15 Meters (21 MHz) E,A,G,T,N



12 Meters (24 MHz) E,A,G



10 Meters (28 MHz) E,A,G,T,N



VHF – Very High Frequency bands

6 Meters (50 MHz) E,A,G,T



2 Meters (144 MHz) E,A,G,T



1.25 Meters (222 MHz) E,A,G,T,N



UHF – Ultra High Frequency bands

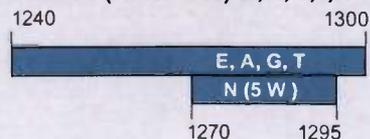
70 cm (420 MHz) E,A,G,T



33 cm (902 MHz) E,A,G,T



23 cm (1240 MHz) E,A,G,T,N



SHF&EHF – Super and Extremely High Frequency bands

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

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

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

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 OTAbands rev. 2-10-23

The Next Steps

Each month, *On the Air* presents practice questions from the upgrade exams. This month is special because as of July 1, 2023, the new General question pool is in effect! The General question presented here is from the new pool.

General

Question G4B13

Which of the following can be measured with an antenna analyzer?

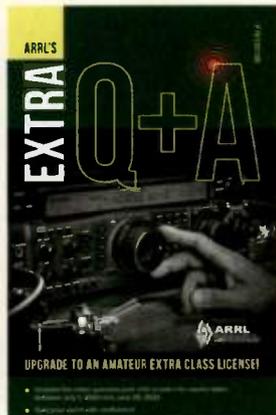
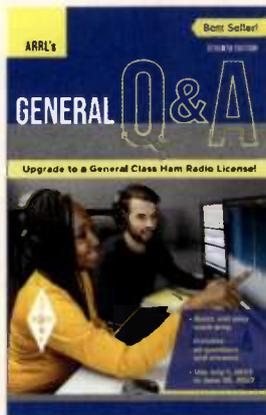
- A. Front-to-back ratio of an antenna.
- B. Power output from a transmitter.
- C. Impedance of coaxial cable.
- D. Gain of a directional antenna.

The correct answer is C. An antenna analyzer's manual will show how to make many useful measurements such as feed line characteristic impedance, velocity of propagation, electrical length, and so on. These are very flexible test instruments.

For Further Study

For the entire General or Amateur Extra question pools, along with simple answers like the ones shown here, pick up a copy of ARRL's *General Q&A* or *Extra Q&A*. For in-depth explanations of the answers, get a copy of *The ARRL General Class License Manual* or *Extra Class License Manual*. These resources are available from the ARRL online store (arrl.org/shop), Amazon, or your favorite ham radio dealer.

As you're studying, take free practice exams at arrl.org/exam-practice.



Amateur Extra

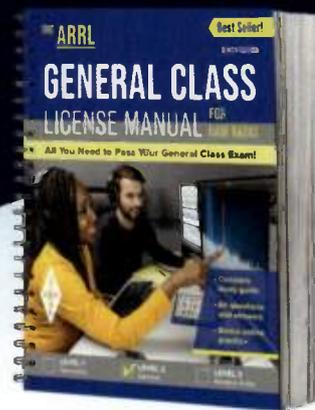
Question E4C13

How does a narrow-band roofing filter affect receiver performance?

- A. It improves sensitivity by reducing front end noise
- B. It improves intelligibility by using low Q circuitry to reduce ringing
- C. It improves dynamic range by attenuating strong signals near the receive frequency
- D. All these choices are correct

The correct answer is C. A roofing filter is applied to the signal path before the final filters that have bandwidths closer to that of the desired signal. The function of a roofing filter is to remove strong nearby signals that may overload the receiver circuits before being rejected by the narrower single-signal filters.

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73 LAST WORD

Scott Freeberg, WA9WFA

ARRL Life Member Scott Freeberg, WA9WFA, was first licensed in 1968 as WN9WFA and holds an Extra-class license. Scott has a BS in electrical engineering from the Milwaukee School of Engineering and recently retired after 41 years in the medical device industry and 6 years in the US Navy Reserve. He enjoys getting on the air, building ham radio gear, and sailing. Scott can be reached at wa9wfa@gmail.com.

Top left: The E.F. Johnson Viking Ranger transmitter, a lightweight at 45 pounds. Top right: WA9WFA's Johnson Viking Ranger and Drake 2-B from the early 1960s. Bottom left: Collins Radio boat anchor station at KB9R. This is heavyweight gear, at 940 pounds combined. You could say this shack is well anchored. [Photo courtesy of Joe Eide, KB9R]

Below right: WA9WFA's vintage QSL card, a replica of a 1960s style, sent for contacts made with his vintage station.

Weighing In on Boat Anchors

When I talk to newer hams about one of my favorite topics — boat anchors — they often look confused until I explain that “boat anchor” is a nickname for old, often heavy, vacuum tube ham radios. The joke is that these radios are so heavy, they could be used as boat anchors. My Viking Ranger weighs about 45 pounds, and is on the lighter side. The heaviest radio I’ve owned weighed 400 pounds. My friend Joe Eide, KB9R, regularly uses a boat anchor transmitter that weighs 600 pounds.

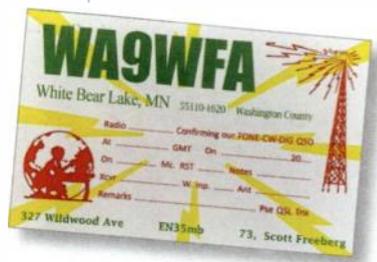
As recently as the 1960s, many American radio companies were still building and selling tube gear. Advertisements from R.L. Drake, Hammarlund, Hallicrafters, Heathkit, Swan, Collins, E.F. Johnson, Gonset, National, and others filled the pages of QST. Each manufacturer had a distinctive style. Many had snazzy styling, colorful silk screening and paints, stylish knobs, and colored lamps. Some radios had inspiring names. You could command the airwaves using an HF transceiver called the “Cyclone,” or “Hurricane,” a transmitter called a “Viking Navigator,” and a receiver called a “Sky Champion.” What fun!

Many older hams get a wonderful sense of nostalgia from collecting, restoring, and using radios from their earlier years.

Some younger and newer ham collectors are fascinated with tube technology, and the classy look and feel of vintage radios. One of the risks after buying your first boat anchor is you get the urge to buy another one, then another, and pretty soon your shack is filled with them.

I run a Johnson Viking Ranger transmitter, and Drake 2-B receiver for CW and voice. For morning chats on 75-meter SSB, I use a 1963 Heathkit tube SSB transceiver that I built from a kit last year. For me, these classic radios from the early 1960s are wonderful to look at, and so much fun to put on the air. I have modern stations as well — boat anchors are simply one part of my ham radio hobby.

I encourage you to take a look at this interesting aspect of amateur radio. And if you hear me on the air, please give me a call. I’ll have a vintage-style QSL card waiting for you.



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- QST Dec 2019 review "easy-to-use device that improves the audio clarity of amateur signals"*

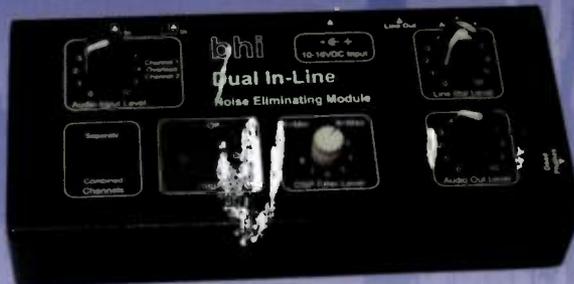
In-Line Module



Great review in Jan '23 QST!

- 5W amplified DSP noise canceling In-Line module
- 8 filter levels 8 to 40dB - Use in-line with a loudspeaker
- Audio bypass feature - 3.5mm mono inputs and outputs
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On the Air

RADIO COMMUNICATIONS
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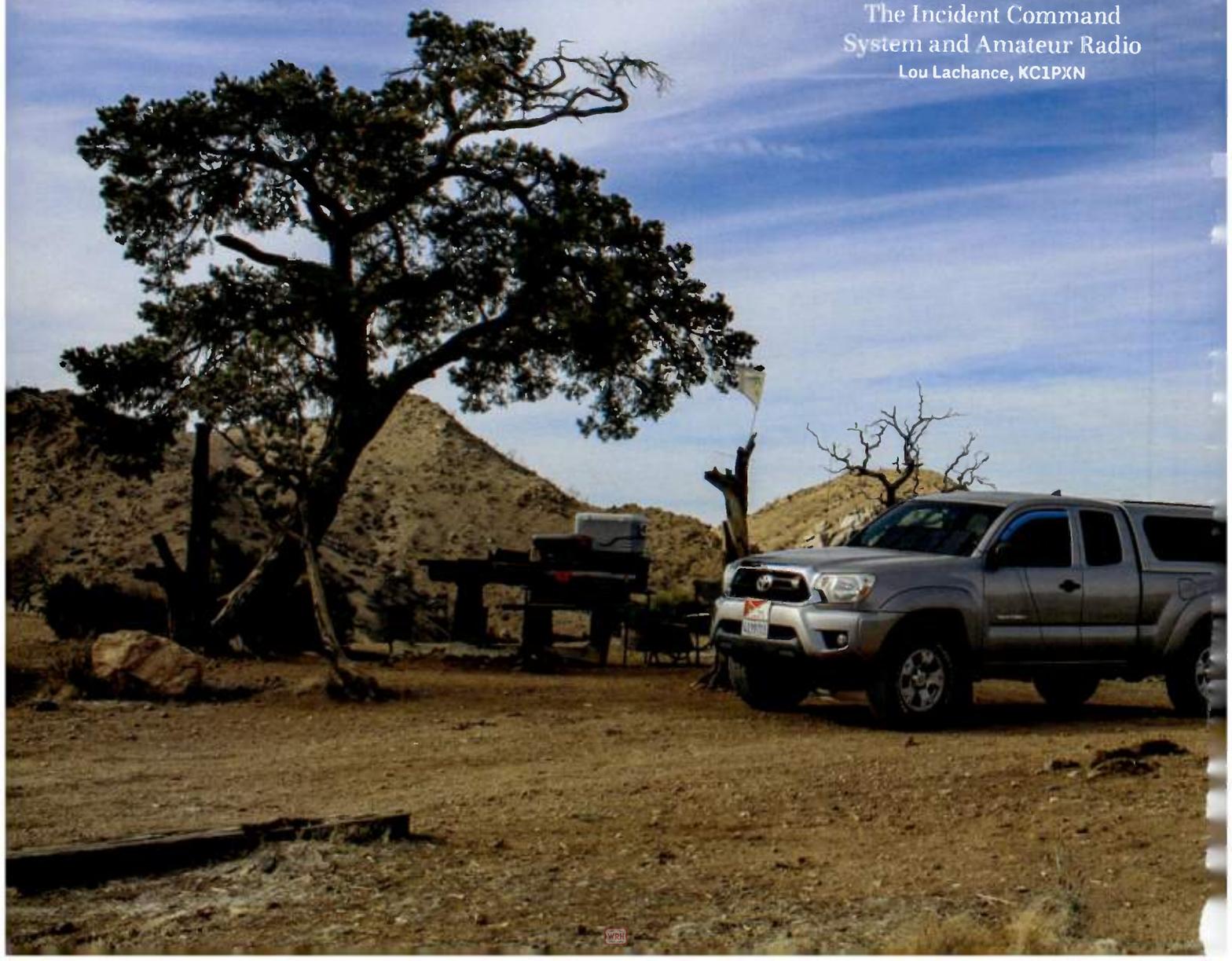
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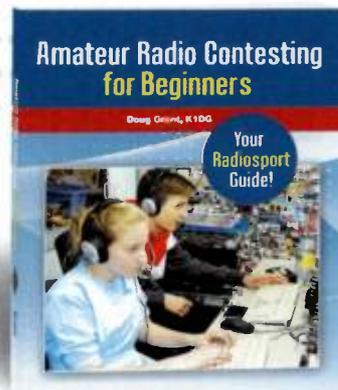
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On the Cover: Radiosport events are often fast paced, but perhaps none more so than radio orienteering, which involves sprinting through a designated area to search for transmitters. This unique sport offers a perfect way to include non-hams in your radio activities. Learn more in "Radio Orienteering: Using Sound to Find Your Way." [Vadim Afonkin, KB1RLI, photo]

On this Page: As the world warms up and spring returns, it's time to start planning ham radio adventures, like this one in the Mojave Desert's Owl Canyon. [Chuck Bunn, AI6OZ, photo]

New to radio contesting?



Amateur Radio Contesting for Beginners

by Doug Grant, K1DG

offers ideas to get you started in contesting or to build your skills if you're already active.

Three tips from the book to get you started:

- Get on the air as frequently as possible before the contest.
- Talk (or send code) at the same rate of speed as the station you're contacting.
- Use contest logging software to log your contacts.

Order Online at
arrrl.org/shop

From the Editor

The Thrill of the Chase

Hams often approach our hobby with a “collector” mindset. I don’t mean the hams who have recreated their dad’s (or their own!) Collins station from back in the day, or the folks who have enough handhelds to wear them in a bandolier. I’m referring to our practice of making on-air contacts, an activity that can lead to the pursuit of specialized “collections” — and an even more intense mindset.

For example, in this issue you’ll learn about “Getting on Six Meters and Having Fun Once You Get There,” courtesy of 6-meter aficionado Sean Kutzko, KX9X. The article discusses the use of Maidenhead grid squares, a system in which geographic locations are known by an alphanumeric identifier (ARRL Headquarters is in grid square FN31). You can hang a grid square map in your shack and color in the relevant square when you confirm a contact with a particular grid. It’s one of the fun parts of operating on 6 meters; it’s like playing bingo with the entire globe!

While some hams collect contacts with grid squares, others focus on making contacts with everything from countries to counties, from peaks to parks. Some do it to earn operating awards, such as the ARRL DX Century Club (DXCC) award for contacting 100 DX entities, or the ARRL Fred Fish Memorial Award for contacting all 488 grid squares in the continental US, but some do it just for the fun of it — the thrill of the chase.

And it is indeed a chase. Confirming contacts with 488 grid squares takes years of dedication, strategy, and planning. Earning DXCC for your first 100 entities is an achievement, but then you can’t resist trying for another 100, which takes a concerted effort, or maybe you decide to start over again at zero, but making contacts only on, say, 20 meters.

The pursuit of certain “collections” of contacts can lead us down many paths, keeping ham radio exciting for decades, and even becoming part of our identities, as we proudly declare ourselves a POTA chaser, grid chaser, county hunter, or DXer.

In this issue, we’ll hear about a different kind of “chaser,” the radio orienteer, who literally sprints, sometimes for miles, using a receiver to find a transmitter located somewhere on the course. Check out “Radio Orienteering: Using Sound to Find Your Way,” by Charles E. Scharlau, NZØI, for more about this uniquely athletic radio sport.

73,

Becky W1BXK



Resources

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(((On Frequency)))

Tracking Wildlife via Radio • Upcoming Contests • Hamspeak • CW Hotline Kit

Graduate student Galen Burrell conducts bat telemetry research in northeastern Indiana. [Deanne Jensen, photo]

Tracking Wildlife via Radio: A Different Kind of Foxhunt

Scientific researchers have used radio telemetry since the 1950s and '60s as a means of tracking radio-tagged wildlife. Wildlife radio telemetry allows scientists to trace or track the movements of an animal without needing to physically watch the animal.

The techniques and equipment used for wildlife radio telemetry are similar to those used for amateur radio foxhunts, or transmitter hunting. Many foxhunters use a signal in the 2-meter band. Similarly, many wildlife telemetry researchers use transmitters in the VHF or UHF region, with frequencies extending from just above the 2-meter band (~150 MHz) to past the 70-centimeter band. Both activities use similar antennas as well, with portable, light, directional Yagis being the antenna of choice.

In summer 2022, Jim Danielson, AC9EZ, a student at Purdue University Fort Wayne (PFW) conducted a wildlife telemetry research project with Jordan Marshall, NM9L, and Scott Bergeson, both faculty members of the Department of Biological Sciences at PFW. The project was inspired by Bergeson's academic work in using wildlife telemetry to study several species of bats in the Midwest region. As part of Bergeson's research, he attaches small transmitters (with transmit frequencies in 150 MHz range) to the backs of captured bats. After the bats are released, Bergeson and his students track them, identifying their habitats and areas of activity.

The tracking equipment consists of several commercially made portable Yagi antennas, as well as a commercial receiver. The signals transmitted by the wildlife transmitters usually consist of a simple carrier emitted at regular intervals.

Danielson's research goals included analyzing the performance of homemade Yagi antennas in receiving telemetry signals, as well as analyzing the performance of an inexpensive SDR (software-defined radio) dongle for possible use by wildlife telemetry researchers.

Results of the experiments were promising, indicating the possibility of professional researchers being able to use inexpensive homemade antennas and SDR technology. SDR may be particularly useful, as being able to visually detect signals with SDR receivers and software before audio detection methods are applied may extend the range in which researchers can receive telemetry signals.

Andrew "Jim" Danielson, AC9EZ; Jordan Marshall, NM9L, and Scott Bergeson



Upcoming Contests

Springtime QSO parties offer opportunities to hone your skills and just plain have fun!

Date	Contest	Rules
March 11-12	Idaho QSO Party	pocatelloarc.org/idahoqsoparty/
March 12	North American RTTY Sprint	ncjweb.com/Sprint-Rules.pdf
March 12-13	Wisconsin QSO Party	warac.org/wqp/wqp.htm
March 18-19	Virginia QSO Party	qsl.net/sterling/VA_QSO_Party/2021_VQP/2021_VQP_Main.html
March 25-26	CQ WPX SSB Contest	cqwp.com/rules.htm
April 23	North American SSB Sprint	ssbsprint.com/rules/
April 8-9	Georgia QSO Party	gaqsoparty.com/
April 15	Michigan QSO Party	miqp.org/Rules.htm
April 15-16	Ontario QSO Party	va3cco.com/oqp/rules.htm
April 16	ARRL Rookie Roundup – SSB	arrl.org/rookie-roundup

HAMSPEAK

E-skip

Slang for ionospheric propagation via the E layer.

Also called sporadic E or E_s, this type of propagation occurs when highly ionized regions in the E layer significantly enhance propagation.

E-skip is noticeable on 10 meters through the low UHF bands.

QST Product Review: CW Hotline Kit



Building the CW Hotline enables you to practice Morse code online with a simulator, or with other people who are also online and hoping to practice. If you build two CW Hotlines, you can link them without a computer and use the device to key a remote station — or send code to a friend. The \$50 kit contains all the parts to build either the straight key or paddle version; you can also build in a jack input for an external key. Read the complete review, "Ham Radio Solutions CW Hotline," by Sean Klechak, W9FFF, in the February 2023 issue of QST.

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From Our Readers

“Ugly” Turns Out to Be a Beauty

I was licensed in 2022, so my first antenna build ever is the “ugly” dual-band antenna from the July/August 2022 issue (see the photo). After a lot of trial and error, it came out quite well. I haven’t tried it on a mobile unit yet, but it outperforms *any* of my store-bought handheld antennas by a long shot!

To build it, I used 1/8” steel rod, an SO-239 panel-mount connector, four 12-gauge ring terminals for the radials, one 12-gauge fork terminal for the top radiators, and four nuts and bolts (with LocTite). I soldered the ring connectors to the ends of the radials, then bolted them to the holes in the SO-239. I soldered the fork terminal to the SO-239 pin, then bent the “forks” around the top radiator and soldered it in place. A little hot glue around the fork terminal at the SO-239 kept the top from rotating when I moved the antenna around.

To mount the antenna, I used a piece of 3/4” Schedule 40 PVC, spray-painted it silver, and used a small thumbscrew to hold the feed line in place at the connector (see inset photo). The setup is certainly not weatherproof, but it holds the antenna up when I want to use it.

I measured SWR with my NanoVNA H4 with an SMA-to-PL-259 adapter on the feed line. The 2-meter reading stabilized at 1.23:1 at 148.50MHz, and the 70-centimeter band bested at 1.07:1 at 433.50MHz.

I may mount it in the attic, use it for GMRS, or just play with it as a benchmarking antenna — whatever use case comes up!

Benjamin M. Pauly, KO4ZEW
Simpsonville, SC

Benjamin Pauly’s, KO4ZEW, build of the “ugly” dual-band antenna from the July/August 2022 issue.



Benjamin, KO4ZEW, used a thumbscrew on the antenna’s mount, to hold the feed line in place.

Getting the Feeling Back

I have been a ham since I was 15 years old. I was very active until my kids were born, we moved to the country, and I got a new job. At that time I became pretty much inactive except for a little 2-meter FM work. When I retired, I tried to pick it up again, but so much has changed in the hobby, it has been difficult. *On the Air* has been a big help to get the feel and fun of ham radio back, and I really appreciate your work. The access to the digital versions of ARRL’s magazines has been a real benefit also.

Steve Tobin, WAØODF
Hampton, MN

Simple, Not Scary

Accolades for the January/February issue. Not only does it explain, in simple terms, what a balun and common mode choke do, but later in the issue, it explains how to build a balun. There is so much misunderstanding of what a balun does, why they are needed, and even treating coax as a three-conductor cable. You treated a neglected subject so well, in very simple terms, with no math to scare away readers.

Dave Eckhardt, WØLEV
Berthoud, CO

When and Where to Get On the Air

Thank you for the January/February article, “Cycle 25 Has These Bands Hopping!” I am a relatively new op, and still learning about propagation. When I first got on the air, I stuck mostly to 20 meters, as it was quieter. Gradually I branched out to 40 meters and am learning to love that band — and when to use it, too. I’d like to explore other bands, but wasn’t aware of what to use, and when. This article is concise, laid out in an easy-to-follow format, and most useful. In fact, I pulled it out of the magazine and laminated it to keep by my station for reference.

Teri Beard, KO4WFP
Savannah, GA



Talk to us!
Send letters and other comments about *On the Air* to ota@arrl.org or On the Air, ARRL, 225 Main St., Newington, CT 06111.



Howard McLean, KE8STS

Age 78, Columbus, OH

Credentials: Received Technician license in 2021, upgraded to General in 2022.

Q: What led you to get licensed?

As a youngster, I was astounded that the gentleman down the street could talk to people around the world. Later in life, my interest was rekindled, and I purchased a scanner and monitored a repeater in another town. My goal was to talk to other countries. Also, I wanted to pursue the computer interface options.

Q: What were the first things you did after you got your license?

I talked on the repeater that I listened to for so many months. That was a true milestone.

Q: What kinds of things do you currently do with ham radio?

I'm looking at the various equipment options open to me now that I have my General, and plan to proceed from there. This may take a little time to decide.

Q: What's your favorite resource for ham radio information and ideas?

I relied solely on the ARRL publications to prepare for the exams. I will continue this trend, as ARRL seems to be a great resource for the hobby.

Q: What are you favorite non-radio activities?

Drawing and stained glass.

Q: What does your day-to-day work entail?

I am retired, so I can tackle all the household chores.

Q: What's your dream job?

I guess I had my dream job — drawing for a living. I was a graphic designer in my past life.

Q: What was the last book you read?

The ARRL General Class License Manual (I read it four times).

Q: Biggest ham-related embarrassment?

I unknowingly broke in on a weather net during an extremely long pause. I thought, "What am I doing here?"

Q: Biggest ham-related success?

My first contact.



Q: Finish the sentence: "My family/friends think ham radio is..."

A mystery. People don't know exactly what I'm doing. They find that their cell phones are a much easier way to communicate.

Q: What would you say is your best quality?

Setting a goal and, for the most part, achieving it.

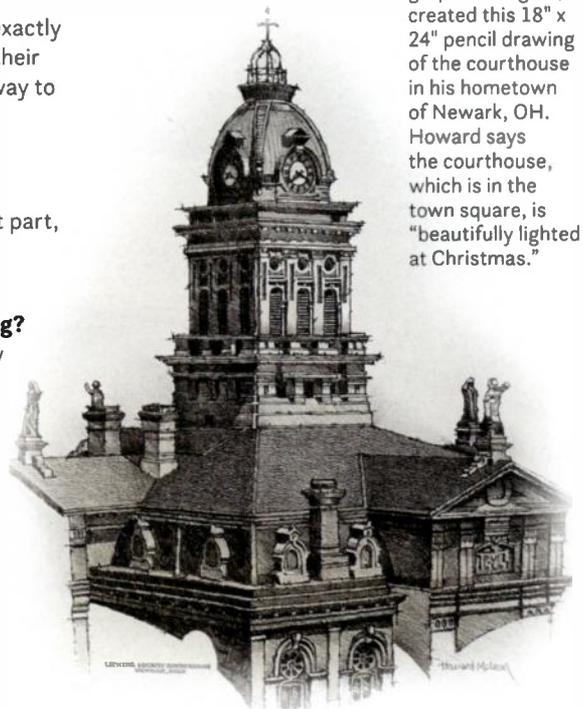
Q: Who or what inspires you to get out of bed in the morning?

A great wife! Every day is a new adventure if you approach life with this attitude.

Q: What do you, personally, get out of being an ARRL member?

Knowledge. With this hobby, there is always something new to learn.

Howard, a retired graphic designer, created this 18" x 24" pencil drawing of the courthouse in his hometown of Newark, OH. Howard says the courthouse, which is in the town square, is "beautifully lighted at Christmas."



Tropospheric Ducting

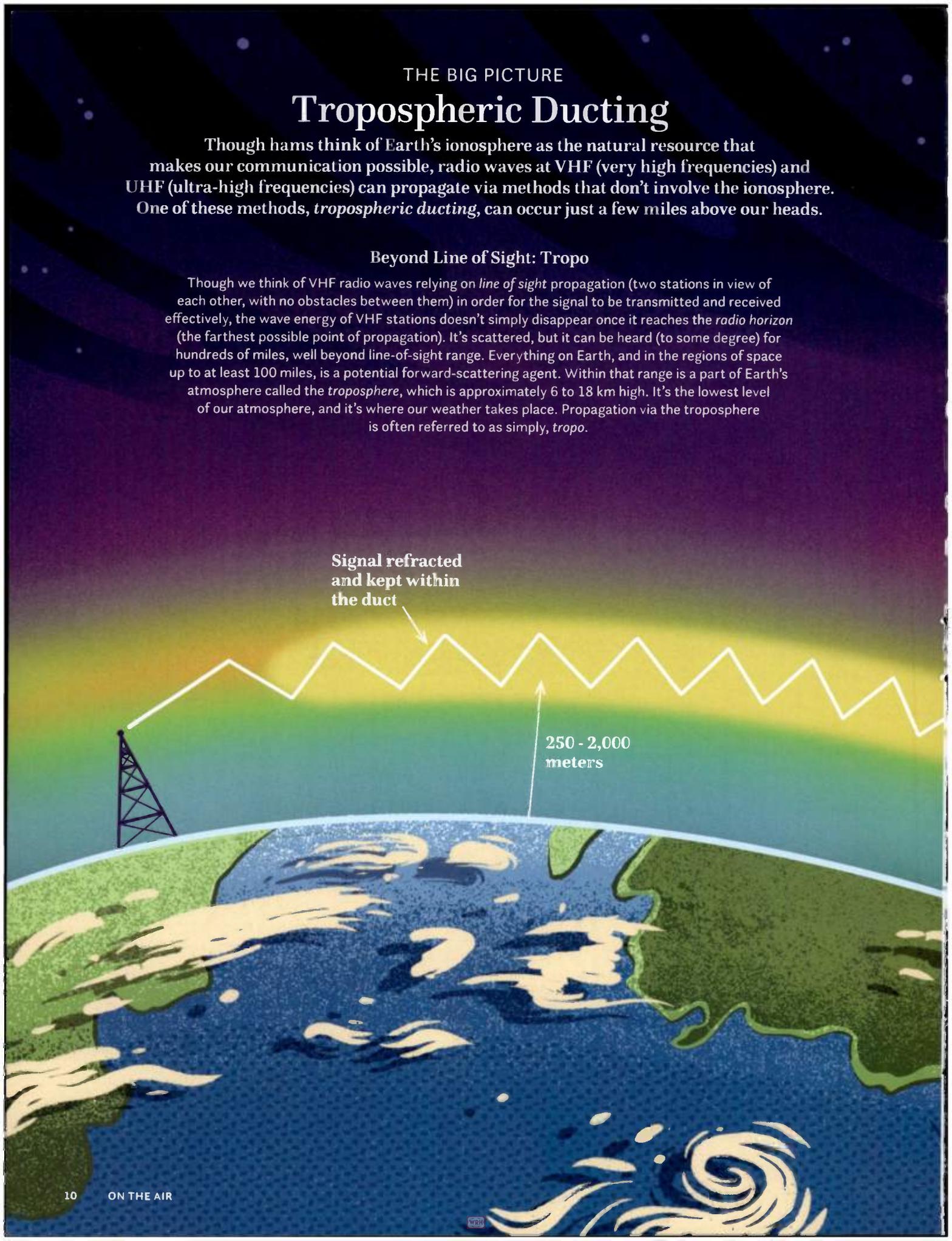
Though hams think of Earth's ionosphere as the natural resource that makes our communication possible, radio waves at VHF (very high frequencies) and UHF (ultra-high frequencies) can propagate via methods that don't involve the ionosphere. One of these methods, *tropospheric ducting*, can occur just a few miles above our heads.

Beyond Line of Sight: Tropo

Though we think of VHF radio waves relying on *line of sight* propagation (two stations in view of each other, with no obstacles between them) in order for the signal to be transmitted and received effectively, the wave energy of VHF stations doesn't simply disappear once it reaches the *radio horizon* (the farthest possible point of propagation). It's scattered, but it can be heard (to some degree) for hundreds of miles, well beyond line-of-sight range. Everything on Earth, and in the regions of space up to at least 100 miles, is a potential forward-scattering agent. Within that range is a part of Earth's atmosphere called the *troposphere*, which is approximately 6 to 18 km high. It's the lowest level of our atmosphere, and it's where our weather takes place. Propagation via the troposphere is often referred to as simply, *tropo*.

Signal refracted
and kept within
the duct

250 - 2,000
meters



Refraction, or bending, of radio waves under standard atmospheric conditions extends the radio horizon somewhat beyond the visual line of sight. But favorable weather conditions further enhance normal tropospheric refraction, lengthening the useful VHF and UHF range by several hundred kilometers and increasing signal strength. Higher frequencies are more sensitive to refraction, so its effects may be seen in the microwave bands before they are apparent at lower frequencies.

Ducting takes place when refraction is so great that radio waves are bent back to the surface of the Earth. When tropospheric ducting conditions exist over a wide geographic area, signals may remain very strong over distances of 1,500 kilometers (930 miles) or more. In order for ducting to occur, there needs to

be a sharp increase in temperature with altitude — quite the opposite of normal atmospheric conditions. A simultaneous drop in humidity contributes to increased refractivity.

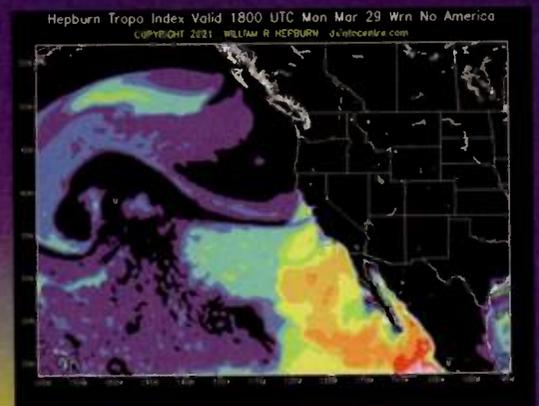
Normally, temperature steadily decreases with altitude, but at times there is a small portion of the troposphere in which the temperature increases, and then again begins decreasing normally. This is called a *temperature inversion*. Useful temperature inversions form between 250 and 2,000 meters (800 – 6,500 feet) above ground. The elevated inversion and the Earth's surface act like the boundaries of a natural, open-ended duct. Radio waves of the right frequency range will be caught inside the duct and be propagated for long distances with relatively low losses. Several common weather conditions can create temperature inversions that allow for tropospheric ducting.

To help decide if weather conditions may support tropospheric ducting, visit William Hepburn's Worldwide Tropospheric Ducting Forecasts at dxinfofocentre.com/tropo.html, which features tropospheric ducting forecast maps for virtually every region of the world. You can get a 6-day preview, as well as 42-hour preview (in 6-hour increments).

These maps display potential duct paths for VHF, UHF, and microwave signals, indicated by the color shading on the maps using the Hepburn Tropo Index, which indicates the degree of tropospheric bending that is forecast to occur over a particular area. Overall tropospheric radio signal strength is described on a linear scale from 0 to 10 (with 10 representing an "extremely intense opening" for propagation by ducting).

The maps also show predicted "unstable signal areas," where weather conditions could potentially disrupt signal paths and cause unusual and sometimes rapid variations in signal strengths.

Elevated region with high refractive index (highest around the center)



The color-coded maps at William Hepburn's Tropospheric Ducting Forecast page (dxinfofocentre.com/tropo.html) predict the probability of band openings that will propagate your signal via tropospheric ducting. You can use these maps to forecast as much as 6 days in advance.

10-meter CW Propagation Beacons — What Are They?

Scott Freeberg, WA9WFA

Ten meters is a fun and strange band. Propagation can be there one minute and gone the next, or it might only favor one part of the country. Often, when the band is quiet, it's because there is no propagation, but sometimes the band is quiet because everyone's sitting back, listening for a signal before calling CQ! While doing your own listening on 10 meters, you might have tuned across a portion of the band that was full of chirping CW signals that repeated non-stop, and wondered what was going on. Surely, there couldn't be someone sitting at their station, pounding out the same dits and dahs over and over (and over!) again. Well, no, there isn't. These are automated CW *beacons*, put on the air for the purpose of evaluating 10-meter propagation, and they can be useful, and even fun.

CW beacons sit on 10 meters and transmit 24 hours a day, 7 days a week. They send out their messages, waiting to be heard by someone. Listening for beacons is a quick way to tell if 10 meters has useful propagation, and what direction it may favor. Sometimes these beacons are your first clue to the fact that 10 meters is *open* (or has viable propagation), even if you don't hear any contacts.

Legal Beacons

Automated beacons are legal on 10 meters. Part 97.203 of the Federal Communications Commission (FCC) regulations gives special allowance for one-way transmissions, with just a few rules that need to be followed.

For example, Technician-, General-, Advanced-, and Extra-class licensees can operate and be a control operator of a beacon. A beacon can only transmit on one channel in the same band, and must operate within the 28.2 – 28.3 MHz segment of the 10-meter band. A beacon's transmit power is limited to 100 watts, but even so, most beacons use low power, in the range of 2 – 5 watts. In fact, many of the beacon transmitters are low-power converted CB radios or RadioShack 10-meter AM radios. Often, a beacon's antenna is omnidirectional, so the signal transmits in all directions.

The International Amateur Radio Union (IARU) coordinates the beacon frequencies (see iaru.org/on-the-air/beacons/), and Jerry Moyer, AC5JM, is the *beacon coordinator* for IARU Region 2, handling all matters relating to beacons in Region 2, which comprises the Americas. Most beacons are coordinated.

Beacons Around the World

Ten-meter beacons operate from other countries around the world as well. Some of them operate on frequencies outside of the US beacon band, so you might hear a DX beacon from Brazil as far down as 28.115 MHz. Recently I copied OE3XAC/B from Vienna, Austria on 28.188 MHz, and DLØIGI/B from Germany on 28.205 MHz. There is an informal list of 10-meter beacons at wi5v.net/beacon-list-table-version. All of the beacons that I copied over the course of several days were on that list, and it's a huge list with hundreds of stations.

What's In a Beacon's Message

There's no official format for beacon messages, so you'll hear many different ones. Some beacons start out transmitting a series of the letter "V" in Morse code, as in "VVV VVV de [the beacon's call sign]" ("de" is a Morse code abbreviation that means "from" or "this is"). Some beacons start out with 5 or 10 seconds of slow Morse code dits or dahs, preceded by the beacon's call

Beacon QSL Cards

Beacon owners encourage you to mail or email signal reports, so they can find out how far away the beacon's signal is being heard. Many beacon owners are happy to send you a QSL card. You can check their page on the popular qrz.com website to find out if they send QSLs, and the specific details for getting one.

Below is a QSL card from W2MQO/B, a beacon in Grand Island, FL.





No Code? No Problem!

You can still use CW beacons, even if you don't know Morse code.

Decoding software such as *CW Skimmer* or *CW Decoder* can help, as can larger software packages like *Ham Radio Deluxe* and *fldigi* that include decoding capability.

sign. Other beacons simply send their call sign. Some beacons start out at full power, and then reduce power in 6 dB steps, ending in milliwatt power levels. These stations are particularly fun to listen to as the signal decreases to the milliwatt levels. After sending its call sign, a beacon often sends its location in the format of a *Maidenhead grid square* (arrl.org/grid-squares) and/or the city or state where the beacon is located. Sometimes it sends the transmit power and the antenna type as well.

Beacons Just for Fun

Sometimes I listen to beacons for the fun of it. I'll do some "beacon DXing," and try to see if I can hear any beacons that are especially far from my location. When I hear a beacon, I'll copy down its message to find its location, transmit power, and an-

tenna, and I'll send the beacon coordinator one of my QSL cards and ask for one in return. It's another fun aspect of our amateur radio hobby. The next time you think 10 meters is dead, tune into the 28.2 – 28.3 MHz portion of the band, and listen for the distant beacons chirping away. They may be telling you there is some 10-meter propagation somewhere.

Scott Freeberg, WA9WFA, was first licensed in 1968 as WN9WFA and holds an Extra-class license. He is an ARRL Life Member. Scott has a BS in Electrical Engineering from the Milwaukee School of Engineering, and recently retired after 41 years in the medical device industry and 6 years in the US Navy Reserve. Now in retirement, he enjoys getting on the air, building ham radio gear, and sailing. Scott can be reached at wa9wfa@gmail.com.



Getting on Six Meters and Having Fun Once You Get There

Sean Kutzko, KX9X

Technicians are often besieged with messaging from the ham radio community about the need to upgrade. Don't sell that Tech license short; you have access to a ton of great operating, including one of the most exciting bands in the spectrum: 6 meters. Now is a good time to acquaint yourself with 6 meters. The summer conditions will be starting soon, so read on to prepare yourself for the excitement.

Six meters (50 MHz) is often referred to as "the Magic Band," because amazing things can happen there. The summer months between May and August are when the band gets hot, due to *sporadic-E propagation* (also called *E-skip*). Thanks to patches of ionized gas that form in the E-layer of Earth's ionosphere and act like mirrors, radio signals get reflected over great distances, making contacts possible from a few hundred miles to several thousand miles, if conditions are right. (For more about how sporadic E works, see "The Big Picture: The 6-Meter Band" in the July/August 2020 issue.)

More Than Just Sporadic E

There are several other modes of propagation available to 6-meter operators. They can help you make your own magic on the Magic Band.

F2: We are currently in an upswing of the 11-year solar cycle, which is predicted to peak in July 2025. This means the higher bands will be open in the F layer of the ionosphere, which facilitates long-haul contacts. If you've been able to make long-distance contacts on 10 meters, 6 meters can sound the same if the solar peak is high enough.

Tropospheric Ducting: During periods of stable, high pressure, warm air blends with a cool air mass and creates a duct similar to a "wormhole" between the two masses, and the signal travels within that duct. This happens most frequently during early morning and late afternoon hours, and can occur any time of year.

Aurora: When the earth gets hit with a big shot of solar radiation after a coronal mass ejection from the sun, it can overwhelm the ionosphere (and trigger the Northern Lights). While this disrupts the HF bands, the aurora becomes just dense enough to refract radio signals, although they become quite distorted. Point your antennas straight north and listen carefully!

Meteor Scatter: Meteors enter the atmosphere every day, mostly in the morning. As they burn up, the trail they create becomes dense enough to bounce radio signals off of, but only for a second or two. Using MSK144 software (part of the WSJT-X suite of programs) in 15-second transmission sequences, you can contact stations on 6 meters (and other VHF bands) using this form of propagation. Tune to 50.260 about an hour before sunrise, and monitor the frequency using MSK144; you may be surprised at what you decode.

Equipment Needed

Like other bands, 6 meters works best when you have a good station and antenna. Most modern HF radios also work on 6 meters, and a minimum of 100 watts and a *directional antenna* (that will allow you to orient your signal in a certain direction) such as a Yagi or Moxon will work best. However, when there is a very strong opening, many operators have good success running *QRP* (low) power and simple antennas. If you're just getting started, building a dipole out of spare wire is easy; they're only 9.4 feet long. Get it up in the



The author installing a four-element 6 meter Yagi on a 20-foot push-up mast bracketed to the side of his house. Small Yagi antennas for 6 meters can weigh less than 10 pounds, be less than 12 feet long, and offer several decibels of gain and directivity. A directional antenna and a 100 watt transceiver is a very good station on 6 meters. [Sean Kutzko, KX9X, photo]

air as high as you can, and use good-quality coax, such as 9913 or better, to account for greater feed line losses on 50 MHz, compared to HF.

A horizontally polarized antenna, such as a Yagi, quad, or even a dipole, will function better than a vertical. Your antenna will start showing directivity when it's as little as 10 feet off the ground, but higher is better.

Popular Modes for 6 Meters

For better or worse, most activity on 6 meters is now conducted via FT8. FT8 definitely comes in handy, as some openings on 6 meters can be very weak. However, do not ignore SSB or CW, as many old-school ops — or those who don't like FT8 — still frequent those modes. During strong openings, you'll be able to make many more contacts with them than with FT8.

The 6-Meter Band Plan

It's important to know the band plan, so you know where to transmit, and where not to.

50.000-50.080: CW propagation beacons
50.080-50.100: CW contacts
50.100-50.125: DX window (international contacts only)
50.125: SSB Calling frequency
50.125-50.200 (or higher): SSB contacts
50.260: Meteor scatter calling frequency
50.313: FT8 calling frequency
52.525: FM calling frequency

Monitoring for Openings

There are a couple of websites you can monitor to see if 6 meters is open:

DXMaps.com: This site will show you all contacts being reported within the last hour or so. You can adjust it for band and continent, so focusing on 6 meters in North America is easy.

PSKReporter: If your focus is on digital modes, PSKReporter can show you what is being heard on specific bands. If you configure your *WSJT* software to share data to the site, it will also tell you who is hearing you within a specified period.

Awards

While lots of people collect states and even DXCC entities on 6 meters, the main geographic unit on 6 meters is the *Maidenhead grid square*, a chunk of

territory 2 degrees of longitude wide by 1 degree of latitude high, or about 60 x 120 miles. There are well over 30,000 grid squares worldwide. ARRL offers the VUCC Award for confirming contacts with 100 different grid squares on 6 meters (and other VHF/UHF bands), and the ARRL Fred Fish Memorial Award for confirming contacts with all 488 grids in the continental US — this is an extraordinary feat; only 40 hams have accomplished this as of December 2022.

Six meters is a tremendous amount of fun. It's available to Technician-class operators and offers even modest stations long-distance contacts during strong openings, and true DX possibilities with a decent station. Operating on 50 MHz has become an obsession for many radio amateurs; see if the Magic Band bug bites you, too!



DXMaps.com will show you when 6 meters is open and the path of contacts made within the past hour. If you see a map with this many lines on it, it's time to get on the Magic Band!

A person's hand is visible on the right side of the image, holding a blue circular antenna with a thin wire extending upwards. The background is a dense, green forest with many trees and bushes. The lighting is natural, suggesting an outdoor setting.

Radio Orienteering: Using Sound to Find Your Way

Charles E. Scharlau, NZØ1

Your radio orienteering journey begins with a weak signal and a general direction. Then, by following the waves along trails, past streams, and through the woods, the signal grows stronger, confirming your deductions. Suddenly, among the trees, you spot the transmitter and its antenna sequestered in an improbable spot amid some ferns. Only those who can track its signal could ever find it. This is the magic of radio orienteering.

Radio orienteering (aka Amateur Radio Direction Finding, or ARDF) involves radios, maps, compasses, and navigating on foot outdoors. The sport combines radio direction finding with map and compass skills, requiring participants to locate transmitters placed in parks or forests. Winners are determined by the number of transmitters (called *foxes*) they find, and the time spent completing their course. In radio orienteering, radio waves provide clues to a location, instead of facilitating an exchange of information.

I sometimes call radio orienteering the only *athletic* radio sport. Elite radio athletes sprint, sometimes for miles, over rough, hilly terrain to search out as many as five transmitters. But one needn't be an athlete: the pace can be dropped into low gear for weekend warriors' enjoyment. One variety of the sport shrinks the playing field to the size of a city park, and another stretches it to cover a good-sized forest. Fast or slow, large or small, what is common



2023 USA Radio Orienteering Championships

The 2023 championships on April 19 – 23 near Dallas, Texas, will feature courses in all four radio orienteering formats: sprint, foxoring, classic 80-meter, and classic 2-meter. In addition to the competition, beginner training will be available in the days leading up to the championships! The championships are also a great place to get your direction-finding questions answered and to see first-hand the best equipment for traveling light and quickly through the woods. And, if you feel ready, you can take a crack at finding some “regulation” foxes at the site of the premier foxhunting event in the USA. Participants compete in up to four competition formats against others of their gender and age group. Registration is required. Visit radioorienteeing.us.



Above: A variety of 80-meter radio orienteering receivers. [Photo courtesy of Charles Scharlau, NZØ1]

Left: USA Competitor Liza Afonkin, W19 category, competing in 80 meters at the 2022 World Championships. [Photo courtesy of Vadim Afonkin, KB1RLI]

to all radio orienteering varieties is they are played outdoors, on foot, using a direction-finding receiver to locate transmitters secretly stashed out of sight.

Radio orienteering foxes are not disguised. When you find one, you will know it by its prominent orange-and-white flag. Unlike mobile transmitter hunting, or informal transmitter hunts (or *T-hunts*), which often involve trickery, radio orienteering is governed by a set of rules designed to keep competitors focused on their radio navigation skills and physical fitness.

Essential Gear: The Receiver

The most important piece of equipment for radio orienteering is the direction-finding receiver. At first glance, a receiver’s few buttons and switches seem familiar, but on closer inspection, they have unfamiliar labels such as “Sense,” “Tone,” “Attenuation,”

and hand-drawn symbols and doodles. Like a 2-meter handheld, these receivers are lightweight and designed to be held and operated in one hand, but they’re definitely not typical handhelds. For one thing, they have a small loop or a portable Yagi antenna integrated with the receiver, so it is difficult to determine where the receiver ends and the antenna begins. And they don’t have audio speakers built in; the user wears earphones or headphones that seal out outside noises.

The most important skill a radio orienteer must have is familiarity with their receiver. It isn’t enough to know what the buttons and switches do. What is needed is a level of skill I call “becoming one” with the receiver: understanding and trusting what the equipment is telling you so well that the receiver becomes an extension of your senses. Once a competitor has reached that skill level, they no longer need to think about how to operate the receiver, and instead they can concentrate on the signal.



EQUIPMENT RESOURCES

Jiří Mareček, OK2BWN
ok2bwn.cz

Joe Moell, KØOV, 2m Equipment ideas
homingin.com/equipment.html

Joe Moell, KØOV, 80m Equipment ideas
homingin.com/joemoell/80intro.html

ARDF IARU Region 2
ardf-r2.org/equipment

Open ARDF
openardf.org

ACTIVITY RESOURCES

New Mexico:
Jerry Boyd, WB8WFK
wb8wfk@icloud.com

North Carolina:
Backwoods Orienteering Klub
backwoodsok.org

Southern California:
Joe Moell, KØOV
homingin.com/joemoell/ardfinla.html

Texas:
Texas ARDF
texasardf.org

USA Radio Orienteering/
ARDF Event Calendar
bit.ly/radio-o

ARDF USA Email List
groups.google.com/g/ardf-usa

ARRL Affiliated Clubs
arrl.org/find-a-club

Orienteering USA Clubs
orienteeringusa.org/events/clubs



The orange-and-white flags on a radio orienteering transmitter is a sure indication that a participant has found their quarry.

Interpreting Signal Strength and Direction

A signal's strength is key to locating the fox. Louder means closer, of course, but signal strength *changes* provide more clues. The signal strength increases faster and faster as you approach a fox. So observing how rapidly the signal strength increases with the distance traveled provides an accurate and "eyes-free" gauge of proximity to the fox's lair.

A signal's direction measured at a particular map location, called a *bearing*, is another key to finding foxes. Bearing directions are indicated by a compass attached to a directional antenna. A bearing shows which direction you should head in, but determining where bearings cross by drawing them on a map can provide a good indication of precisely where you need to go. And, *parallax* (how quickly the bearings change as one moves) provides more clues to the fox's proximity. Developing skills to interpret signal strength and direction while on the move is all part of becoming one with your receiver.

Getting Started

The easiest and most effective introduction to radio orienteering is having a knowledgeable instructor provide a beginner's class with all equipment provided. Check with amateur radio and orienteering clubs in your area (see the sidebar, "Activity Resources") and inquire about any radio orienteering instruction they might offer.

If no organized radio orienteering is going on in your area, then it is possible to acquire minimal equipment and work with a partner. One of you can set out a transmitter, and the other can hunt for it. No amateur radio license is required (because you're only receiving, and not transmitting), so this is an ideal activity for involving non-hams. Tracking down a few transmitters will provide a sense of the sport. Obtaining the requisite radio orienteering accoutrements can require some searching and ingenuity. See the sidebar, "Equipment Resources."



This map of a radio orienteering event shows the contours of the course's landscape.



A Sport for Everyone

The USA Radio Orienteering Championships offer a unique opportunity for newcomers to the sport. Don't let the event's name fool you: it isn't just for elite competitors. In the days leading up to the championships, you will find beginner classes and loaner equipment available at the event. Experienced, knowledgeable instructors will be on hand to help you locate your first transmitters and become familiar with the basics. The championships are held at different venues every year, so when they come to your area, don't miss them! Those living in the vicinity of Dallas, Texas, will have this unique opportunity in April 2023. Contact the organizers for registration information and class offerings. See the sidebar, "2023 USA Radio Orienteering Championships," for more information.

There is more to the sport of radio orienteering than competition. It offers opportunities to design, build, and maintain sophisticated radio transmitters and antennas. Challenging courses must be designed and deployed. Competitions and practices require multiple foxes and flags to be set in the woods. Whether you enjoy spending time at the workbench, the drafting table, or hiking in the woods, radio orienteering offers something to enjoy.

Radio orienteering brings together science, technology, nature, and sport. Its pace and challenge can be adapted to match the skills and abilities of the participants. Regardless of one's age, physical fitness, or experience level, radio orienteering offers lifelong fun and learning. We can all experience it! Find out more at arrl.org/radio-orienteering.

Charles E. Scharlau, NZØ1, was first licensed in 1974 as WN5MIY, and currently serves as USA ARDF Co-coordinator. He has been active in Amateur Radio Direction Finding since 2000. He represented the USA at the ARDF World Championships from 2004 – 2010. He spent 26 years in both hardware and software positions in the aviation, maritime, and cellular communications industries. Charles can be reached at nz0i@openardf.org. Thanks to Gerald Boyd, WB8WFK, USA ARDF Co-coordinator, for his help reviewing this article.



Top left: Gheorghe Fala and Norbert Linke wait for their 80-meter classic start times. [Photo courtesy of Imre Polik, KX4SO]

Top right: Kelly Sears, KN4PAE, and Patrick Sears, AK4JE, head down the start corridor at the USA ARDF Championships 2019.

Above: Marcus Enochs competing in 80-meter foxoring at the 2019 USA ARDF Championships.

Below: Alexandra Bondarenco competing in 2-meter classic at the 2019 USA ARDF Championships.

[Photos courtesy of Charles Scharlau, NZØ1]



Build a Simple 10-Meter Half-Square Wire Antenna

John Portune, W6NBC

High on the list of simplicity and performance for a new ham's first venture into HF (high-frequency) ham radio, is the half-square wire antenna. You don't need much more than 35 feet of wire, a length of coaxial cable, and a simple balun made from coax. Attach the finished antenna to a tree limb and perhaps the edge of a roof for support, hook it up to an HF transceiver and you're on the air.

Think back to the questions in the Technician exam about wavelength and frequency, and you'll remember that 300 divided by the frequency in MHz equals wavelength. The half-square antenna is a two-wavelength square loop of wire on 10 meters cut in half, and suspended a few inches or more above ground (see ①). The flat top portion of the antenna is a half a wavelength long, and the vertical sides are a quarter wavelength. With the feed line at a corner, this shape of antenna will give you close to a natural match to 50 ohm coax without having to use an antenna tuner.



The half-square antenna, deployed at the author's home.

Materials and Tools

- (35 ft.) 14-16 AWG stranded insulated wire
- (5 in.) ½-in. Schedule 40 PVC pipe
- (2) 8-32 × 1¼ in. stainless or brass screws and nuts
- (4) Ring terminals for #8 lug, solder or crimp type
- ⅜ in. plastic spiral wire/cable wrap
- (2) ¾ in. or ⅝ in. eye bolts
- Light braided nylon or polypropylene line
- (2) End supports (see Step One)
- (As needed) RG-58 or RG Mini-8 coax
- Wire cutter and stripper
- Terminal crimper or soldering iron and solder
- Electric drill and bits

Step One

Select a location for your half-square antenna. One of the supports might be your house or your shack. The second could be a tree, a pole, or another building. The separation between the two supports should be at least 20 feet. In ①, one support is a house, and the second support is a 12-foot free-standing aluminum mast in a buried ground tube made of 2½-inch PVC conduit. The flat top portion of the antenna needs to be at least 9 feet above ground. A small amount higher is okay.

Step Two

Install an eye bolt at the top of each support, to create a place to pass light-duty nylon or polypropylene line through the bolts, enabling you to raise and lower the finished antenna.

Step Three

There are several options for creating the antenna's feed point. The method shown here is simple and easy to build. Drill a 5 in. length of common ½-inch Schedule 40 PVC pipe according to the diagram below.

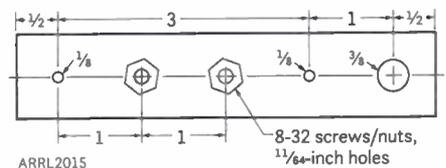
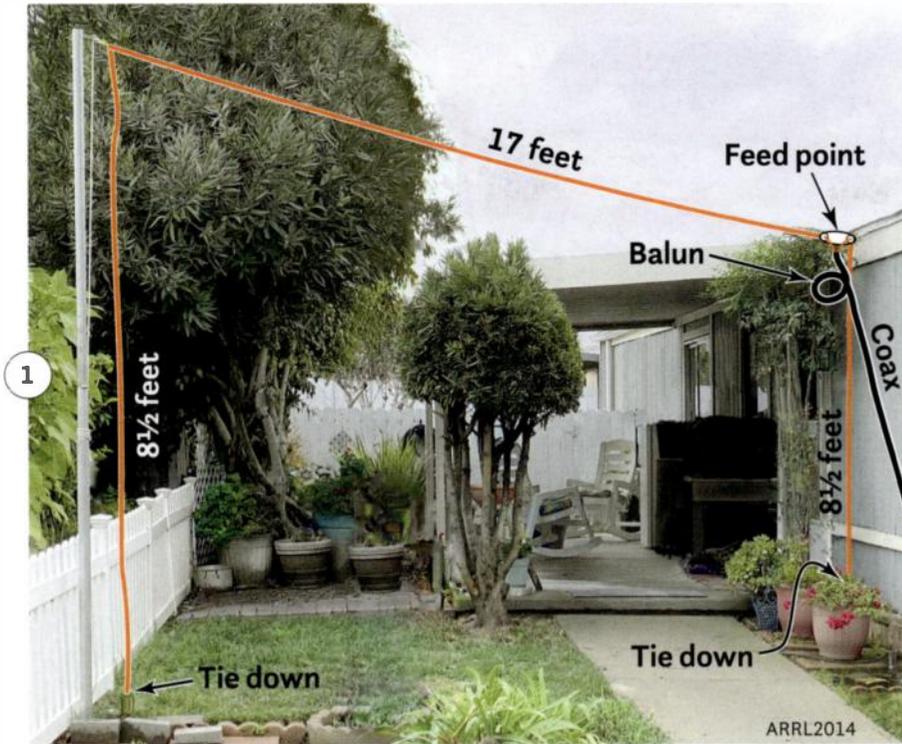


Diagram for drilling holes in the feed-point insulator. The ⅜-*inch* hole at the right-hand end is the tie point for the poly-line you'll use to raise the antenna.



Step Four

Install two 8-32 × 1¼ inch feed point screws and nuts in the feed-point insulator. Cut a 9-foot length of the antenna wire, and push it through the ¼-inch hole that's closest to the ¼-inch hole. Fold the wire back, wrap it around itself twice, trim it to reach to the screw closest to the ¼-inch hole, and add a crimp- or solder-on #8 ring terminal. Attach the wire to the screw as shown in (2).

Similarly, cut and attach a 27-foot antenna wire to the ¼-inch hole at the end of the feed-point insulator, as shown in (2). At 17 ft. in the longer wire, twist a small loop in the wire to create a way for attaching the other support poly-line.

Step Five

Prepare a coax *pigtail* of small-diameter coax — RG-58 or RG Mini-8 — of a length that will reach from the antenna's feed point to ground level or just inside your house. Include an additional 18 inches of coax in your pigtail, which will be used to wind a balun in the pigtail.

Carefully remove 2 inches of the plastic coax jacket from one end of the coax, being careful not to nick the shield (see the first image in (3)). Unbraid the shield of the coax into individual fine wires (see the second image in (3)). Twist the fine wires together into a single separate conductor (see the third image in (3)).

For weatherproofing, wrap the two ends protruding from the coax in heat-shrink tubing or plastic electrical tape (see the fourth image in (3)). Crimp or solder on #8 ring terminals (see the fifth image in (3)). Add a suitable coax connector to the other end of the pigtail.

For the remainder of the coax leading to your transceiver, use a coax barrel connector to adapt the pigtail to larger-diameter coax. Weatherproof this connection with heat-shrink tubing, plastic electrical tape, or clear silicone sealant. Using larger coax, such as RG-8 or LMR-400, is important when you need a length of coax that's longer than roughly 15 feet. With small coax, much of a transmitter's power will not reach the antenna, even if your antenna analyzer or SWR bridge shows a low SWR.



Feed-point insulator with antenna wires (yellow) and support poly-line (white).



Steps in preparing the feed-point ends of the coax pigtail.



Step Six

There are two ways to create a balun in your coax pigtail.

Method 1: Torus knot coax balun

About 6 inches from the separated ends of your coax pigtail, form a loop that's roughly 2 inches in diameter. Pass the long end of the coax over the loop, and bring it back through the middle of the small loop to form a relaxed knot (see the first image in ④). Then make another turn of the coax. Again, pass the end over, then bring it back through the middle, placing it adjacent to the previous turn. Add a third turn in the same manner. You have just formed a three-turn torus knot, which will function as the balun for your antenna.

Method 2: Plastic spiral wrap coax balun

About 6 inches from the separated ends of your coax pigtail, form a three-turn loop bundle that's roughly 2 inches in diameter. Cut 14 inches of $\frac{3}{8}$ -inch plastic spiral wire/cable wrap, and begin wrapping it around the three-turn coax bundle, starting at the bottom. Wrap your way around the bundle. When you get to the top, bring the coax out of the wrap for two turns of the spiral wrap. Then complete the wrapping and trim the spiral wrap (see ⑤). Secure the balun with a zip-tie at the top.

No matter which method you use, the inductance of the balun's three turns will prevent antenna RF from getting onto the outside of the shield of the coax and disrupting the operation of the antenna.

Step Seven

Twist a small loop in the bottom ends of the two vertical antenna wires, and attach a short length of poly-line cord to the loops, to create a way of tying the antenna down. For a permanent installation, use a wooden stake, a tent stake, or perhaps a corkscrew pet anchor. For portable applications, use a large fishing sinker, a convenient stone, a beanbag, or other heavy object.



Steps in winding a three-turn torus knot coax balun.



A completed spiral-wrap coax balun.

Step Eight

Attach 10 – 15 feet of poly-line to end of the feed-point insulator that has the $\frac{3}{8}$ -inch hole, and a second similar length to the small twisted loop you made at 17 feet in the longer antenna wire. Pass both lines through the eye bolts at the top of your supports, and pull the antenna up to height. The bottom of the vertical wires should be at least 6 inches off the ground. Higher is okay.

Step Nine

Your half square, if constructed similar to the one shown, will not likely require frequency or SWR adjustment. However, the SWR may be adjusted by removing or adding equal small segments of wire at the ends of both wires — when you remove wire from one end, add wire to the other end to keep the total antenna length the same.

To raise the frequency, shorten the total length of the antenna, again by changing both ends of the antenna. Make sure to keep the proportion in the lengths of the two antenna wires the same. In other words, remove proportionately more from the long end and less from the shorter end. To lower the frequency, add wire proportionately to both ends.

Even though the half-square antenna is inexpensive and easy to build, it is an exemplary performer. It works well on all HF ham bands by simply scaling it to frequency. For example, the dimensions of a 20-meter half square are merely double those of a 10-meter half square.

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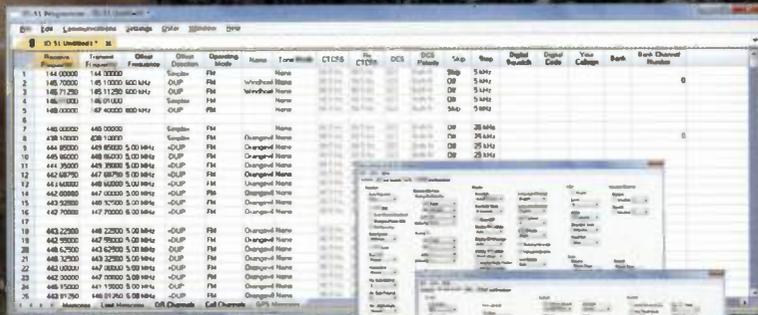
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YEAR of the VOLUNTEERS



Section-level Superstars

ARRL has designated 2023 as the Year of the Volunteers, and all year, *On the Air* will be highlighting the work that hundreds of volunteers do at the ARRL Section level to make ARRL's programs run, to keep information about ham radio and ARRL flowing to the members, and to help keep the ham radio hobby and service active, constructive, and satisfying for its practitioners.

If you don't know what ARRL Section you live in (there are 71 of them!), check the map on the next page. You can also visit arrl.org/sections to find your Section's web page and learn who's serving in the positions described here.

Section Manager

The Section Manager (SM) is the leader of ARRL programs for an entire Section, and is the first resource for the Section's members. The SM recruits ARRL volunteers to staff various crucial program areas, and provides that Section-level staff with guidance to ensure that they act in the best interests of Amateur Radio and in accordance with ARRL policy.

SMs also make periodic reports to the Division Director regarding the status of Section activities, and communicate with ARRL members and affiliated clubs in the Section, including making visits to clubs, hamfests, and conventions, and responding to ARRL members' questions and concerns. Section Manager is an elected position, with the membership in each ARRL Section electing an SM once every 2 years. The SM appoints qualified hams to the other positions described here.

Section Emergency Coordinator

The Section Emergency Coordinator (SEC) is the assistant to the SM for emergency preparedness and administers all matters pertaining to emergency communications and the Amateur Radio Emergency Service® (ARES®) on a Section-wide basis. In order to be an SEC, a ham must be a full ARRL member with a Technician-class license or higher, and must have achieved Level 3 qualifications in the ARES Standardized Training Plan.

The SEC advises the SM on all Section emergency policy and planning, including the development of a Section emergency communications plan; promotes and encourages the development

of local ARES groups, serves as liaison at the Section level with all agencies served in the public interest. The SEC also supports local Emergency Coordinators during a communications emergency, and maintains contact with other communication services.

Section Traffic Manager

The Section Traffic Manager (STM) coordinates all *traffic* efforts (hamspeak for "passing messages") within the Section, so that message routings within the Section, as well as connections with other networks and digital traffic nodes, will be orderly and efficient. The STM is called upon to develop and implement effective training programs to address the needs of traditional and digital modes of traffic handling. The STM also ensures that all traffic nets within the Section are properly and adequately staffed, with appropriate direction to Net Managers, which results in coverage of all Net Control and liaison functions.

Public Information Coordinator

The ARRL Public Information Coordinator (PIC) is the Section's expert on public information and public relations matters. A background in professional public relations, journalism experience, or dealing with the public media is preferred. The PIC is responsible for recruiting, organizing, training, and coordinating the activities of the Public Information Officers (PIOs) within the Section. A successful PIC effectively conveys a story and generates the desired results, with goals ranging from recruiting potential hams for a licensing course, to improving public awareness of amateurs' service to the community. The PIC maintains contact with other Section-level officials, particularly

the Section Manager, on matters appropriate for their attention and to help assure and promote a coordinated, cohesive ARRL Field Organization. The PIC works with PIOs to establish and coordinate a Section-wide Speakers Bureau of knowledgeable and effective speakers who can address community groups about amateur radio; create a comprehensive list of local media outlets and contacts for use in Section-wide or nationwide mailings; prepare PR kits containing information on amateur radio and local clubs, to distribute in advance to Emergency Coordinators and District Emergency Coordinators for use in dealing with the media during emergencies; and encourage activities that place amateur radio in the public eye, including demonstrations, Field Day activities, etc.

Technical Coordinator

The Technical Coordinator (TC) coordinates all technical activities within the Section, including the work of the Section's Technical Specialists (TS). The TC promotes technical advances and experimentation at VHF/UHF and with specialized modes, and works closely with enthusiasts in these fields within the Section. The TC also serves as an advisor, in cooperation with the Affiliated Club Coordinator, to radio clubs that sponsor licensing programs, and encourages clubs to develop (and TS to serve on) RFI and TVI committees in the Section for the purpose of rendering technical assistance as needed. In preparation for times of emergency or disaster, the TC coordinates the establishment of an array of equipment for communications use and, in cooperation with the Section Emergency Coordinator, is available to supply technical expertise to government and relief agencies in setting up emergency communications networks. The TC also assists with arranging suitable technical programs for ARRL hamfests and conventions and is available to give technical talks at club meetings, hamfests, and conventions in the Section.

Affiliated Club Coordinator

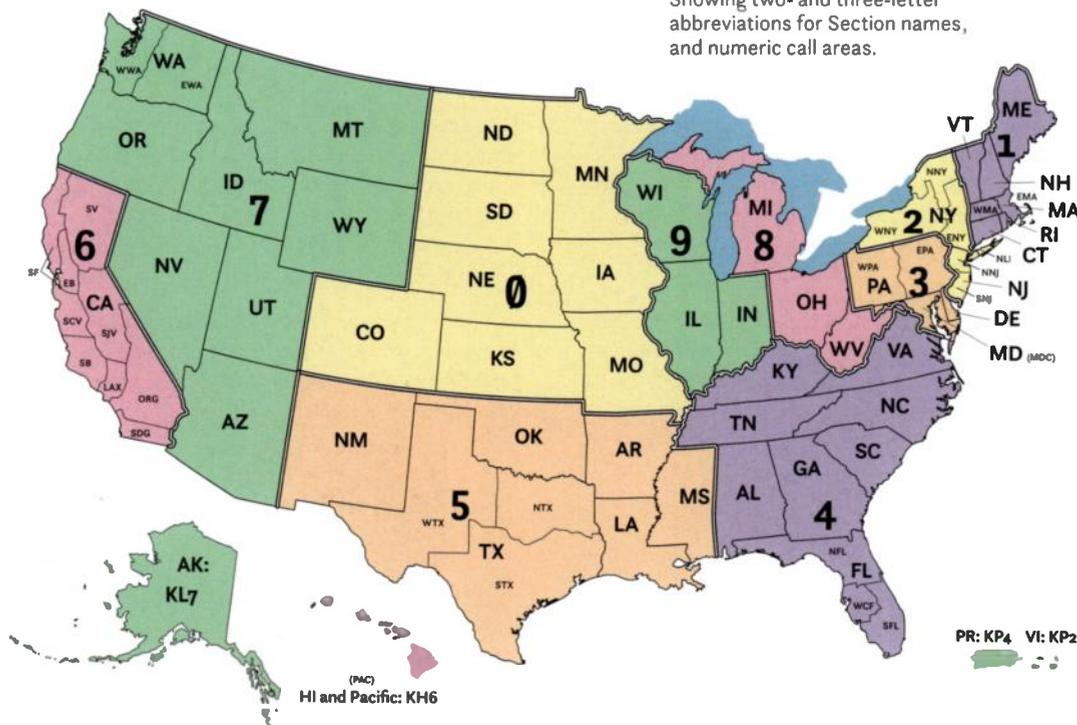
The Affiliated Club Coordinator (ACC) is the primary contact and resource for each amateur radio club in the Section, specializing in motivating and providing assistance to clubs, as well as coordinating joint club activities. The ACC develops relationships with the Section's clubs' officers and members to learn their needs, strengths, and interests, and works with them to make the clubs more enjoyable for members, as well as effective resources in their communities. The ACC encourages new clubs to become ARRL affiliated, and encourages effective affiliated clubs to apply as a Special Service Club (SSC). The ACC works with other Section leadership officials to ensure that clubs are involved in ARRL Field Organization activities.

Section Youth Coordinator

An aspiring Section Youth Coordinator (SYC) must have been licensed for at least 2 years, and hold a General-class license or higher. The appointee should be a youth, or an adult who works with youth regularly. The SYC is called upon to maintain a current assessment of active young hams in the Section, including those involved with clubs, Scouting and other youth organizations, and schools, and provide youth-related ideas and resources to amateur radio clubs and individuals within the Section. The SYC and Affiliated Club Coordinator collaborate to assess youth activity with ARRL-affiliated clubs; provide resources, ideas, and encouragement as needed. The SYC also promotes youth-related on-air activities including ARRL Kids Day, Jamboree on the Air (JOTA), ARRL Field Day, and School Club Roundup, and exchanges ideas with Section Youth Coordinators in other ARRL Sections.

ARRL Section Map

Showing two- and three-letter abbreviations for Section names, and numeric call areas.



From the Learning Center

The ARRL Learning Center, located at learn.arrl.org, is an online resource where ARRL members can undergo training and earn certificates. To access the Learning Center, simply log in using your ARRL.org member username and password.



In the four-module course, *Getting Started with Summits on the Air*, experienced SOTA activator Adam Kimmerly, K6ARK, covers everything a beginning SOTA activator needs to know, and offers information for how to be an effective SOTA chaser as well.

Getting Started with Summits on the Air

Portable operating has been growing in popularity, and Summits on the Air, or SOTA, has grown right along with it. Starting out in SOTA requires a bit more knowledge than just setting up a radio, antenna, and battery in the field somewhere, so let's take a look at the ARRL Learning Center course, *Getting Started with Summits on the Air (SOTA)*, by experienced SOTA activator Adam Kimmerly, K6ARK.

Once you're at the Learning Center (learn.arrl.org), click on "Courses," then navigate until you see the tile for *Getting Started with Summits on the Air (SOTA)*.

Basics and Chasing

Adam, K6ARK, begins the course with an 11-minute "Intro to Summits on the Air," where he gives an overview of the program, a little insight into what you will learn in the course, and some reasons why you might want to get involved in SOTA.

If you don't have mountains in your area, or you're not physically able to make the trek up to a summit, no worries. The second module of Adam's course, "How to Chase Summits," discusses how to participate in SOTA as a *chaser*. Chasers are the ham radio operators who are at home or some other location, but not on a summit. Chasers are important in the SOTA program, as a successful activation requires a certain number of contacts. This module steps you through everything you need to know to have fun and be successful as a SOTA chaser.

Planning and Activating

The third module, titled "SOTA Planning and Preparation," is full of tips and resources to help you find a summit to activate. Adam shares websites he uses for mapping SOTA sites and clues you in on how to use them to gather information about summits. He also gives advice on how to assess the climb and gather information from others who have accessed the summit.

The third module also discusses critical equipment and gear. Adam steps through his "Ten Essentials" and why each is an

important component of his kit. He also explains what radio equipment he brings on an activation, and gives advice about how to make sure you don't miss any critical components. This module also includes a discussion of the importance of safety.

The fourth module, "Activating a Summit," shows an actual activation. Adam shows how to find other SOTA activators who are on the air when you are, so you can make *summit to summit* contacts, and offers general operating tips using CW and SSB. Adam also demonstrates how to *spot* your activation using a variety of methods. Creating spots that let chasers know that your activation is progress can help you make enough contacts to qualify your activation so you earn points toward SOTA awards. In this part of the course, you will learn about a variety of spotting methods and tools, some of which require an internet connection, and some that don't.

First-time activators are often a little nervous about making their first contacts. Adam takes the time to walk viewers through the entire exchange so you'll know ahead of time what to expect to hear, and what to be prepared to send back. Adam also takes the time to express the importance of good operating practice and etiquette.

Whether you're working up to making a go at your first SOTA activation, or you've activated before and are just looking for tips, *Getting Started with Summits on the Air* has a wealth of information for you.



In the course's third module, "SOTA Planning and Preparation," Adam discusses important gear for activators.

The Incident Command System and Amateur Radio

Lou Lachance, KC1PXN

An understanding of the Incident Command System (ICS) is crucial for hams who want to be of service to the community. The ICS is a proven emergency management system that's effective when responding to anything from small incidents to large-scale disasters. Read on to learn the basics.

The Incident Command System (ICS) was designed to assist public safety agencies with mitigation efforts for emergencies. The ICS came about because of many large wildfires in California during the 1970s. The fires consumed thousands of acres of land, destroyed homes, and took life. Responding to these incidents often involved local, state, and federal agencies and crossed disciplines such as fire, police, Emergency Medical Services (EMS), volunteer organizations like the American Red Cross, and other non-governmental organizations (NGOs).

I have more than 30 years of experience in the fire service, and when the fire service suffers a Line of Duty Death (LODD), the National Institute for Occupational Safety & Health (NIOSH) investigates to determine what factors led to the LODD. More often than not, similar factors contributed to each death, including lack of accountability, no risk-versus-benefit analysis, a lack of command and control, and lack of communications. Clearly, there needed to be better incident organization, communication, and accountability. This led to the development of the ICS.

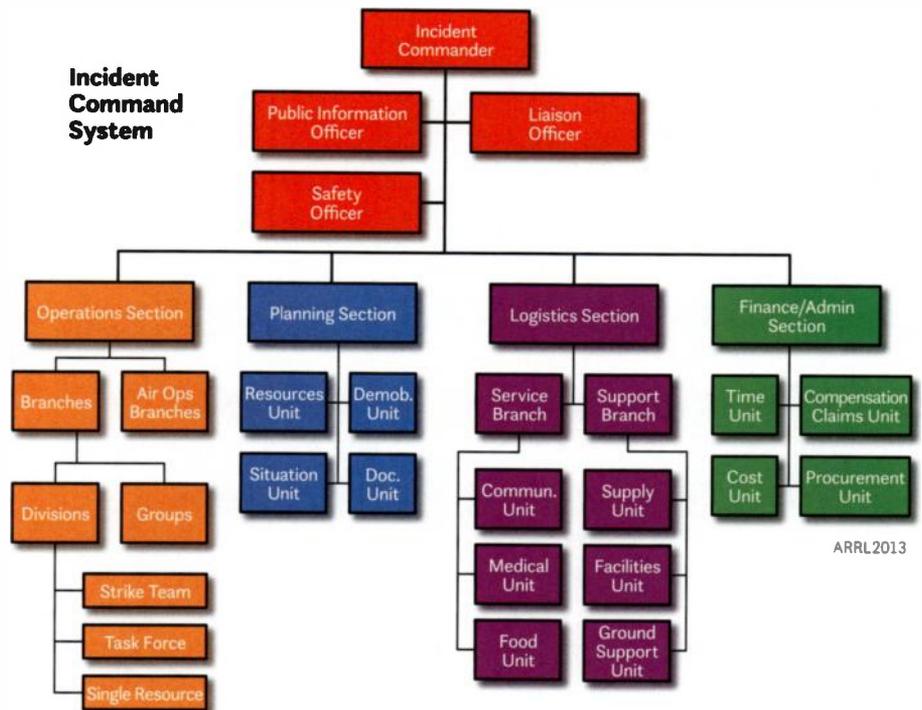
As a new ham operator, I have minimal experience with amateur radio, but through my decades in the fire service, I have gained valuable training and experience with the ICS, Command & Control of emergencies, pre-planned events, and developing Incident Action Plans (IAPs). I have been fortunate to have worked with some fantastic Incident Commanders in the volunteer, military, and career departments I have served. I believe that fire service leaders who doubt the effectiveness of ICS simply do not understand it. Therefore, it's important to understand the basic principles of the ICS, and how public safety and hams can interact.

Building Relationships, Building Understanding

For ham radio operators to effectively interact with and support public safety agencies during a disaster or a pre-planned event, hams must understand the ICS, as well as speak its language. The time to learn this not during the emergency but, ideally, beforehand. Meetings, training sessions, and tabletop drills are the perfect opportunities for amateur radio operators and public safety officials to interact and build relationships; emergencies run much smoother when a level of trust has already been established.

A Modular, Adaptable System

ICS is developed in a modular fashion and can adapt based on the size and complexity of the incident. Most incidents will not look like the organizational chart seen here; most of us will never see an incident that is this complex. You only need to fill the boxes that need to be filled in order to respond effectively to the incident you've been called to respond to. A minor incident may only require the Incident Commanders (IC) and Safety Officer functions to be filled, leaving room to expand as needed if the incident grows. That's the great thing about ICS; it is adaptable to change. As



ARRL 2013

The Incident Command System organizational chart is flexible and can adjust to the specific needs of a specific incident. Planning for where and how to use amateur radio operators would take place in the Logistics Section, and that planning may result in hams being asked to serve in other areas of the chart.



From the Podcast

Unique content to help you get more out of the magazine.

arrrl.org/On-the-Air-Magazine

arrrl.org/On-the-Air-Podcast

Every month, the editors of *On the Air* release a companion podcast that extends the features, projects, and experiences presented in the magazine. Hosted by Becky Schoenfeld, W1BXY, and sponsored by Icom, the 15-minute podcast takes a deeper dive into an issue of *On the Air* to offer additional resources, techniques, and hints to help you get the most from the magazine's content.

Here's an overview of recent episodes:



January 2023: ARRL has designated 2023 The Year of the Volunteers, and we're kicking it off in the first podcast episode of the year by focusing on "The ARRL Field Organization." ARRL Field Services Manager Mike Walters, W8ZY, discusses this network of ARRL member-volunteers who are positioned in the various ARRL Sections to offer technical advice, liaise with government contacts, work with young hams, and much more.



February 2023: The Volunteers On the Air operating event promises to make The Year of the Volunteers fun for everyone. ARRL Director of Operations Bob Naumann, W5OV, and ARRL Radiosport Manager Bart Jahnke, W9JJ, join us to talk about the event's structure and rules — and why you're going to want to contact every W1AW portable station!

You can subscribe to the *On the Air* podcast in Apple iTunes (podcasts.apple.com) or on Stitcher (app.stitcher.com). If you're using an RSS client, the feed URL is feeds.blubrry.com/feeds/arrrlontheair.xml.



Morse: the final frontier

These are the exploits of Star Fleet PreppComm. Mission Parameters are:

explore
new technology
and develop
new innovations,

taking Morse
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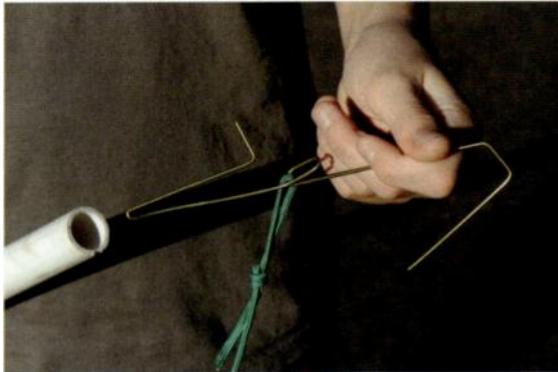


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On Planet Earth, visit us at
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Hints & Hacks

Share your hints (or hacks) with fellow hams by sending them to ota@arrl.org or *On the Air*, ARRL, 225 Main St., Newington, CT 06111.



Above: The finished loop and hook tool, with "V pin" at left to be inserted into the PVC pipe that will lift the tool to the desired antenna attachment point.

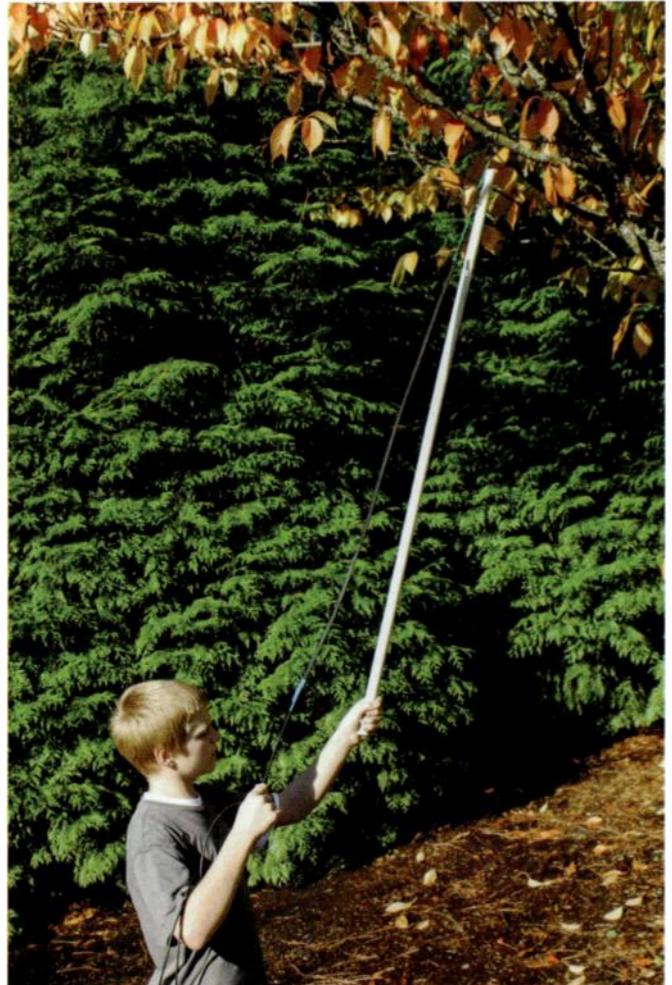
Right: The tool in use. Keeping tension on the antenna wire that's tied to the loop will keep the tool seated in the PVC pipe.

HACK

Loop and Hook Skyhook

It's good to have a wire antenna that can extend the performance of your handheld, especially on deployments, but it seems that the best attachment point for hanging the antenna is always just out of reach. This simple hook made from a coat hanger makes it easy to hang and retrieve the antenna.

Using about 18 inches of coat hanger wire, bend a hook that matches the curve of the desired attachment point. Below the hook, form a loop to which you'll tie the line you're using to raise your antenna. Below the loop, bend a downward-pointing V-shaped "pin," and bend the end of the wire at a right angle to prevent the pin from slipping completely inside the tube you'll be using to lift the hook and the antenna.



You'll need a section of PVC pipe. Place the V-shaped pin into the hole in the end of the pipe, and lift the hook to the attachment point. Tension on the antenna wire keeps the pin in the tube until the antenna has been placed. You can remove the antenna by catching the V-shaped pin in the end of the pipe and lifting the hook up and off of the attachment point.

I keep one of these hooks and a short section of PVC pipe in my emergency kit. I also include tape, so I can attach the pipe to a tree branch or broom handle to make a lifting pole of whatever length is necessary.

Randy Quinton, WQ7Q

Be sure to use fans that have the same current drain, otherwise the one with the larger drain won't get enough current.

HACK

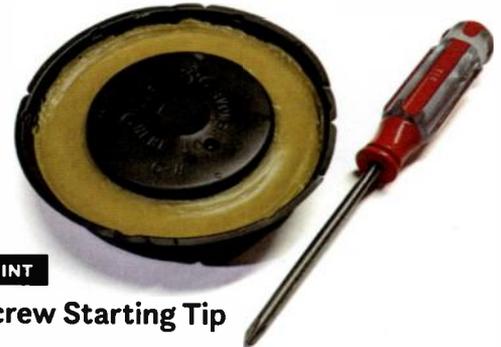
Keeping Power Supplies Cool

While operating in a digital contest, I noticed that the heatsink of my power supply was hot to the touch. While the supply was still operating fine, I know that heat is bad for electronics, so I decided to mount a couple of small muffin fans to the heatsink. These are typically available at hamfests, inexpensive, and they draw just a watt or two. Here are a couple of points that might be of interest.

First, I used two fans and connected them in series. (Be sure to use fans that have the same current drain, otherwise the one with the larger drain won't get enough current.) Connecting them in series kept the noise down and still allowed for plenty of cooling. I chose to mount them blowing over the heatsink, but I suppose you would get equal results if you blew the air away from the power supply. Be sure to purchase and install the small metal protective grills for safety.

Second, I gave some thought to how I would mount the fans on the heatsink. I didn't want to drill any holes, so I tried hot-melt glue, and it worked perfectly. (Careful, the hot-melt glue sets up immediately — you're mounting it to a heatsink, after all!) Everything seemed fine until I bumped one of the fans, causing it to pop off. I reattached the fans using a combination of GOOP household adhesive (eclecticproducts.com) for strength, and the hot-melt glue. The final result is, the fans are working perfectly and the power supply stays cool.

Mark Klocks, WA9IVH



HINT

Screw Starting Tip

If you need help starting a screw in a difficult spot, rub the tip of your screwdriver on a wax ring gasket used to seal a toilet bowl to the floor. You can buy these at a hardware store for under \$5. The wax is sticky, like soft beeswax, and wipes off easily. You'll find numerous uses for the wax any time you want to hold something light in position.

Robert Barnes, W8SEB



US Amateur Radio Bands

Operator license classes: **E** = Amateur Extra **A** = Advanced **G** = General **T** = Technician **N** = Novice
 CW operation is permitted throughout all amateur bands. Except as noted, all frequencies are in megahertz (MHz).

= RTTY, data, phone, image
 = USB phone, RTTY, data and CW
 = RTTY and data
 = phone and image
 = SSB phone
 = CW only

LF – Low Frequency band

2200 Meters (135 kHz) E,A,G
 1 W EIRP maximum



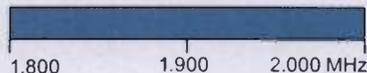
MF – Medium Frequency bands

630 Meters (472 kHz) E,A,G

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



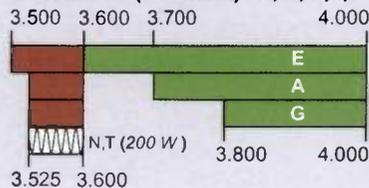
160 Meters (1.8 MHz) E,A,G



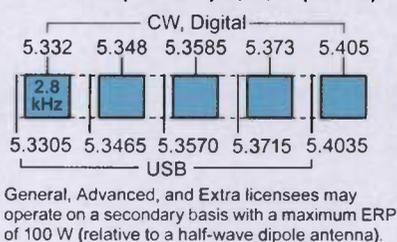
Amateurs wishing to operate on 2200 or 630 meters must first register with the Utilities Technology Council online at <https://utc.org/plc-database-amateur-notification-process/>. You need only register once for each band.

HF – High Frequency bands

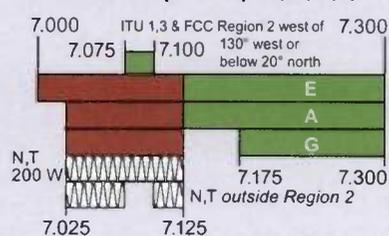
80 Meters (3.5 MHz) E,A,G,T,N



60 Meters (5.3 MHz) E, A, G (100 W)



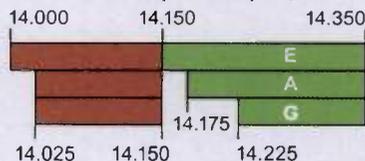
40 Meters (7 MHz) E,A,G,T,N



30 Meters (10.1 MHz) E,A,G



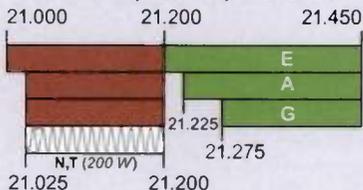
20 Meters (14 MHz) E,A,G



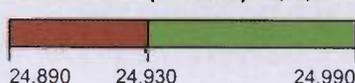
17 Meters (18 MHz) E,A,G



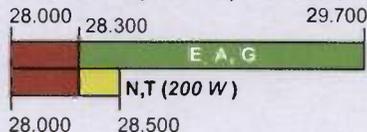
15 Meters (21 MHz) E,A,G,T,N



12 Meters (24 MHz) E,A,G



10 Meters (28 MHz) E,A,G,T,N

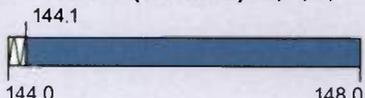


VHF – Very High Frequency bands

6 Meters (50 MHz) E,A,G,T



2 Meters (144 MHz) E,A,G,T



1.25 Meters (222 MHz) E,A,G,T,N



UHF – Ultra High Frequency bands

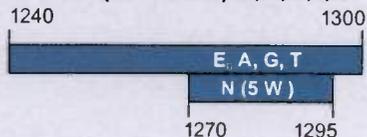
70 cm (420 MHz) E,A,G,T



33 cm (902 MHz) E,A,G,T



23 cm (1240 MHz) E,A,G,T,N



SHF&EHF – Super and Extremely High Frequency bands

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

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

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

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 OTAbands rev. 2-10-23

The Next Steps

If you're thinking about upgrading your amateur radio privileges, try your hand at a couple of questions you may encounter on your next exam. These questions and answers appear in the current official question pools from the National Conference of Volunteer Examiner Coordinators.

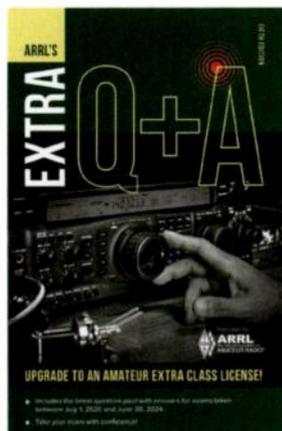
General

Question G2C06

What does the term “zero beat” mean in CW operation?

- A. Matching the speed of the transmitting station.
- B. Operating split to avoid interference on frequency.
- C. Sending without error.
- D. Matching the transmit frequency to the frequency of a received signal.

The correct answer is D. “Zero beat” means to match the frequency of the transmitting station. When separate receivers and transmitters were the norm, a transmitter’s frequency had to be adjusted to match the received signal’s frequency. This was done by spotting — turning on the transmitter’s low power stages and listening for that signal in the receiver. When the beat frequency between the desired signal and the transmitter’s spotting signal reached zero frequency, or zero beat, the transmitter signal and the received signal were on the same frequency.



Amateur Extra

Question E8D01

Why are received spread spectrum signals resistant to interference?

- A. Signals not using the spread spectrum algorithm are suppressed in the receiver.
- B. The high power used by a spread spectrum transmitter keeps its signal from being easily overpowered.
- C. The receiver is always equipped with a digital blanker.
- D. If interference is detected by the receiver, it will signal the transmitter to change frequencies.

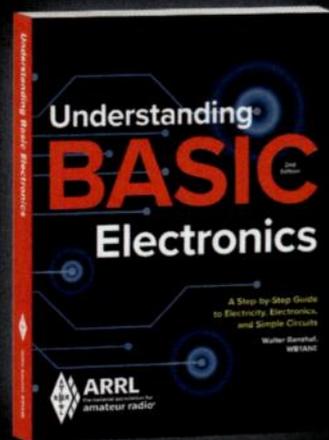
The correct answer is A. Because the spread spectrum signal changes frequencies rapidly, interference or noise on a single frequency affects it only briefly. To interfere with a spread spectrum signal, interference would have to follow the changing frequency exactly or cover a significant fraction of the band it occupies.

For Further Study

For the entire General or Amateur Extra question pools, along with simple answers like the ones shown here, pick up a copy of ARRL's *General Q&A* or *Extra Q&A*. For in-depth explanations of the answers, get a copy of *The ARRL General Class License Manual* or *Extra Class License Manual*. These resources are available from the ARRL online store (arrl.org/shop), Amazon, or your favorite ham radio dealer.

As you're studying, take free practice exams at arrl.org/exam-practice.

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Hams Say the Darnedest Things

73 LAST WORD

Ward Silver, NØAX



Ward Silver, NØAX, licensed in 1972, is working on his third quarter century of associating with wireless. Just when he thinks he has heard it all, there is something new and interesting going on in ham radio that will need some jargon! He is enjoying the solar antics of late, and contemplating which of many projects to start next.

Headed on the repeater: “Let’s sked to have a cold 807, hi hi.” Say what? Translated: “Let’s plan to have a beer, ha ha.” “Sked” is short for “schedule,” and “hi” is the “telegrapher’s laugh” shared between Morse operators for more than a century, even during voice contacts!

As for that “cold 807,” an 807 was a once-popular beer-bottle-sized vacuum tube with a brown plastic base. Back then, hams didn’t say “beer” on the air (things have changed), thus this clever euphemism. The last 807 was made decades ago, but we still click the long-obsolete floppy disk symbol to save files, don’t we? These little flourishes are not about being accurate. They’re fun, and they are part of what makes the “Tribe of Hamster” who we are!

Like any hobby, ham radio has a jargon all its own that creates a shared “in-joke” experience. But if you’re not “in,” you feel “out,” until someone shares the secret knock and — you’re in! Here are a few favorite ham-isms:

Armstrong rotator — Turn antennas manually (with strong arms — get it?).

Magic smoke — What makes components work, so when it escapes, gear stops working!

Boat anchor — Heavy old gear that makes a better anchor than a radio.

Pull the Big Switch — Go off the air. From the days when stations had a big master power switch.

Shack — Early ham spark transmitters were dangerous and literally built in a shack.

Barefoot — Not using an amp.

There are plenty more where these came from. *Kerchunk* describes the sound of an FM repeater being activated by an unmodulated signal for a few seconds. *Kerchunking* is the (frowned on) practice of making short, unidentified transmissions to see if you can *hit* (turn on) the repeater. Similarly, *picket fence* describes FM’s mobile flutter while driving through an area of multipath propagation.

We haven’t even touched upon the world of Morse abbreviations, pro-signs, and Q-signals that are even used on voice and digital modes! Take a look at lists of them via “The Morse Code” link at kent-engineers.com.

Did this help you understand a few odd ham-isms? If so, I’m glad to be your *Elmer* (mentor). After I *work* (contact) you, I’ll see you *down the log* (later). *BCNU!* (Be seein’ you!)

Enjoy a "noise free" listening with..
 ..a bhi DSP noise canceling product!

bhi

ParaPro EQ20 Audio range with parametric equalisation



- 20W audio and parametric equalisation on all units
 - Greatly improved audio for those with hearing loss
 - Simple control of all DSP functions
 - Two separate mono inputs or one stereo input
 - Basic 20W EQ units: EQ20, EQ20B* (use with your Dual In-Line or Compact In-Line unit)
 - 20W DSP noise canceling EQ versions: EQ20-DSP and EQ20B*-DSP * Denotes Bluetooth on input
- EQ20B-DSP QST Dec 2019 review "easy-to-use device that improves the audio clarity of amateur signals"

New In-Line Module

Dual In-Line



Fully featured flexible dual channel DSP noise canceling unit

- 8 Filter levels 9 to 40dB
- 3.5mm mono or stereo inputs
- Line level input/output
- 7 watts mono speaker output
- Separate headphone socket
- Easy to use controls

Enjoy clear "noise-free" speech



- 8 filter levels 8 to 40dB - Tone reduction up to 65dB
- 5W audio with latest bhi DSP noise cancelation
- Audio bypass feature - 3.5mm mono inputs and outputs
- Headphone socket - Audio input overload feature
- DC power 10 to 16V DC - Dims 135mm x 65mm x 46mm
- Replacement for bhi ANEM MKII and NEIM1031MKII

Compact In-Line



- Powerful audio processor
- Unique DSP noise canceling technology
- Low latency of 32mS
- Remove noise and interference
- Hear weak signals clearly
- Rotary encoders perform all functions
- Easy to use with "real time" adjustment
- Use with headphones or a loudspeaker
- 3.5mm line level and speaker level inputs

NES10-2MK4

5W Compact rugged amplified DSP noise canceling speaker

- 8 filter levels 8 to 40dB
- Three position switch for off/audio bypass mode, power on and DSP filter on
- LEDs for power on, filter on and audio overload
- 3.5mm Headphone socket - Supplied with integrated 2M audio lead, fused DC power lead and user manual



DESKTOP MKII

Latest bhi DSP noise canceling technology for even better receive audio

- 10W Amplified DSP noise canceling base station speaker
- "Real-time" control of all functions
- 8 filter levels 9-40dB
- Speaker level and line level input sockets
- Suitable for all radios incl' SDR, Elecraft and FlexRadio products



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