**Emergency Communications: Handheld Radios** [Patrick McCarthy](https://www.offgridweb.com/author/pmccarthy/)

What is the key factor that has made humans the dominant species on Earth? Many would say it all comes down to our ability to use tools, dating back to the first time our cave-dwelling ancestors crafted a blade or smacked two rocks together to spark a fire. But that claim overlooks a much greater advantage: our ability to work together through sophisticated methods of communication. Enter the world of handheld radios.

As the English poet John Donne put it, “No man is an island entire of itself; every man is a piece of the continent, a part of the main.” We have succeeded through collaborating to build societies, and none of that would be possible if we had not developed spoken and written methods to communicate with each other. Although television shows and movies often portray the quintessential survivalist as a grizzled lone wolf, totally independent of the crumbling ruins of humanity, that could not be further from the truth. Alone, we are vulnerable; together, we can support one another.

It’s critical to have a plan for [emergency communication](https://www.offgridweb.com/survival/survival-scenarios-communication-breakdown/) if something goes wrong, especially for those of us who venture out into the wilderness and distance ourselves from society. We have all heard the stories of lost hikers who wandered off-course or got injured in a remote location, nearly dying because they were unable to call for help. The irony behind these stories is that long-range communication these days is easier than ever before — our ancestors would be astonished by the capabilities of the cell phones we carry in our pockets. However, those same cell phones can lull us into a false sense of security. If your phone’s battery dies, its screen is smashed, it is out of range of the nearest cell tower, or a widespread disaster has disabled or overloaded local infrastructure, is your only backup plan to start sending smoke signals?

Thankfully, there is an inexpensive, reliable, and highly capable alternative to cell phones. Despite claims to the contrary, handheld radios are anything but obsolete, and while there is certainly a learning curve involved, they are not as difficult to use as you might think. To get up to speed on how to effectively use a radio in a survival setting, we signed up for an Intro to Emergency Radio Communication course hosted by [Independence Training](https://www.independencetraining.com/) in Arizona. Guest instructor Ted Harden covered a huge range of topics, from the absolute basics of selecting a radio and making a distress call to more advanced techniques. Read on for an overview of some of the lessons we learned at this class.

**Before You Get Started**

We will begin with an important disclaimer — it is essential to understand your radio’s capabilities as well as local and federal laws before you begin transmitting.

Harden made it extremely clear that it is easy to inadvertently break the law with many common handheld radios (HTs), such as the Baofeng UV-5R used by most of the students in his classes. The Federal Communications Commission (FCC) has imposed fines of $25,000 or more on individuals who got caught breaking the rules, and serious offenses can even lead to jail time. Admittedly, the likelihood of getting caught by the FCC for a one-time infraction is minimal, since their investigators are primarily looking for corporations and “pirate” radio stations who illegally broadcast high-power signals daily. Improper use of your radio may also lead to contact from local law enforcement agencies — Harden says the [Department of Fish and Game](https://www.offgridweb.com/preparation/john-nores-spotlight-the-patron-saint-of-mother-nature/) might monitor the airwaves to track down poachers, especially outside hunting season.

*Above: Many handhelds come with a short “duck” antenna, like the one seen here. For an easy upgrade, replace it with a longer whip antenna.*

Aside from the financial and legal ramifications, misusing your radio can interfere with important emergency services. In April 2017, an unauthorized radio signal triggered the tornado warning network in Dallas, Texas, causing sirens throughout the suburbs to blare for 95 minutes until workers cut power to the system. On a smaller scale, broadcasting on the wrong frequency can interrupt communications between EMS, fire, and police agencies who may be responding to urgent calls.

If you are in a true life-and-death emergency, these rules can be bent or broken. In any other case, it is wise to exercise caution and read up on the laws in your area before you buy or use a radio.

**Understanding the Bands**

The class began by discussing common bands, or segments of the radio frequency spectrum, as well as the radio categories within those bands. There are three bands you should be aware of: HF, VHF, and UHF. See the sidebar for definitions of these and other key terms.

HF is primarily useful for intercontinental communications since it can bounce off the ionosphere to cross extremely long distances. This so-called skywave communication can be inconsistent due to changes in atmospheric conditions and is less useful for emergencies since someone on another continent probably will not be able to come to your aid.

VHF and UHF are our primary areas of operation, and each has its advantages. VHF’s longer wavelength is better at pushing through brush and trees in outdoor areas; UHF’s shorter wavelength is better at bouncing off buildings and other metallic obstructions in urban areas.

Traditional walkie-talkies feature fixed antennas and low power, so they are not ideal for long-range communication.

There are several important subcategories within VHF and UHF:

**Family Radio Service (FRS):** If you have ever used the walkie-talkies sold in blister packs at retail stores, you have probably used this service. FRS radios require no license but are limited to 2 watts of output power and cannot use a detachable antenna, so you will rarely see range beyond a mile.

**Multi-Use Radio Service (MURS):** Like FRS, this service does not require a license. It is slightly better due to the ability to use external antennas, but the FCC’s guidelines for MURS prohibit the use of repeaters to extend range.

**General Mobile Radio Service (GMRS):** This service is one step better for emergency communication purposes since it can be used with repeaters. It requires a $70 license, but there is no test required, the license lasts for 10 years, and it automatically applies to all members of your immediate family. However, power restrictions limit its range in comparison to ham radio.

**Ham/Amateur Radio:** Ham radio offers the most versatile capabilities and the most robust community of operators to communicate with. However, to legally use a ham radio, you will need to pass a test and get a license. There are three license categories: Technician, General, and Extra. The first is the most practical for general emergency preparedness; the associated 35-question multiple-choice test costs about $15 and can be passed easily after studying for about a week. The other two categories offer increasing levels of access to HF for intercontinental communication.

When you take a ham radio license test, you could find out immediately if you passed or failed. If you failed the test by only a few questions, you could often retake a slightly different version of it on the same day (you will need to get approval from the Volunteer Examiner who is proctoring the test and pay the fee again). After passing the test and waiting a week or two for processing, you will be assigned a six-character call sign. At that point, you are cleared to begin transmitting.

**Important Note:** To become a licensed ham radio operator, you must submit your full name and mailing address to the FCC, and this information is entered into a public online database. If someone knows your call sign, they can easily look you up. It is possible to use a P.O. box on your license to maintain some privacy, but keep in mind that this is an additional cost to consider.

*Above: A mobile radio in your vehicle can offer substantially more power than a handheld. Pair this with a tall, roof-mounted antenna to maximize range.*

**Range, Elevation, and Power**

Both VHF and UHF radios require line of sight between your antenna and the recipient’s antenna. This means that if you are holding a handheld radio (HT) with its antenna at head level and your friend is doing the same, assuming perfectly flat ground with no obstructions, your maximum range will be limited to roughly three miles due to the curvature of the Earth. Go to [hamuniverse.com/lineofsightcalculator.html](http://hamuniverse.com/lineofsightcalculator.html) for more examples and a range calculator. In the real world, you might see a maximum of one to two miles between two HTs on a good day.

If you are thinking that a mile or two probably is not enough range to call for rescue, you are right. The first way to extend that range is to get more elevation by physically moving to the top of a nearby hill or building and/or using a taller antenna. Most handheld radios come with a standard “rubber duck” antenna that is only a few inches long. This can be replaced with a flexible whip antenna for a slight improvement. For a larger improvement, a roll-up backpacking antenna can be connected to your handheld via a length of coaxial cable and hung from a tree or other tall object. This can provide a maximum range of 20 miles or more. Magnetic antennas mount to the roof of a vehicle or other flat metal surface, using it as a ground plane to extend range even further. Directional “Yagi” antennas are another worthwhile option but are less portable and must be aimed carefully. But above all, height is critical.

The second way to improve range is to use a radio that offers higher power output, measured in watts. Most handhelds are 5W or 8W, and Harden says the difference in that range is usually negligible in the real world — antenna quality and elevation are much more important for HTs. Power really comes into play when you can use a larger mobile or base station radio that is able to push 50W, 100W, or even more. That kind of power is not an option for handhelds, since it can cause RF burns on the skin on your hand (said to feel like something between a bee sting and a bad sunburn). After all, radio waves are a form of radiation.

**Gear Checklist**

Once you have a good understanding of the technical and legal aspects of radio communication, it is time to pick up some hardware. Thankfully, there is a thriving market for ham radios, and you can easily get an HT with the essentials for under $100. Many “starter kits” are available online but be cautious since some of these kits include low-quality accessories or items you will not need.

**Handheld radio(s):** Harden says that the Baofeng UV-5R (approx. $25) and other derivatives such as the BF-F8HP (approx. $40) are by far the most common HT choices for starters. Keep in mind that out of the box, these radios can illegally transmit on many frequencies they are not certified for. They should only be used for monitoring (listening to nearby transmissions) or transmitting on approved ham bands with the appropriate license. Get a few extra HTs for your friends or family members, if possible.

**Upgraded antenna:** The standard short antenna that comes with most inexpensive radios is a serious Achilles’ heel. Upgrade options include an extended whip (Harden recommends the Diamond brand), a magnet-mount for the roof of your car, or a roll-up backpacking antenna (Harden recommends the $25 Dual Band Slim Jim antenna available at [n9taxlabs.com](https://n9taxlabs.com/)). You might even want all the above.

**Coaxial cable and adapters:** Aside from a whip, connecting to an external antenna will require some coaxial cable. Do not use the cheap, stiff type made for TVs. Flexible RG-8 or RG-58 is ideal, but only use as much as you need since excess cable can diminish signal strength. You should also pick up some SMA to UHF connection adapters or buy a pre-terminated cable with those connectors built-in ([n9taxlabs.com](https://n9taxlabs.com/) offers those, too).

**Programming cable:** This allows your radio to connect to your computer via USB. Look for one that has “genuine FTDI” in the name, since those are truly plug-and-play. There are many knockoffs on the market that cause driver headaches with some PCs.

**Programming software: Good news:** You do not have to pay for this. CHIRP is an excellent open-source piece of software, and it is free to download for PC, Mac, or Linux at [chirp.danplanet.com](https://chirp.danplanet.com/projects/chirp/wiki/Home). It can be used to quickly find important frequencies, program them onto your radio, and duplicate that programming onto other radios you own (this is highly recommended).

**Extended battery:** Many options are available, including rechargeable packs or units that accept [AA alkaline batteries](https://www.offgridweb.com/gear/video-which-aa-batteries-are-the-best/). If you buy a rechargeable pack, get a USB charging cable so you can easily hook it up to a portable power bank, solar panel, or car charger. Never transmit while you are charging, as it may damage the radio.

**Hand mic:** This microphone/speaker combo clips onto your shirt, backpack strap, or plate carrier, and allows you to listen and transmit while you are on the move. Look for one with a 3.5mm output port, so you can connect it to an earbud for privacy or active ear protection for shooting.

**Radio pouch:** Do not trust the included belt clip to secure your radio. A purpose-built MOLLE-compatible pouch will protect it and offer easy access when you need it.

**Stand-alone scanner (optional):** Although most handheld radios can scan for nearby transmissions, a dedicated scanner will be far more efficient at this task. Many law enforcement and government agencies have transitioned away from analog comms, so a digital scanner will have the added advantage of being able to monitor these frequencies, if they are not encrypted.

**Prepping Your Radio**

Your ham radio can be used two ways: radio-to-radio (simplex) or radio-to-repeater (duplex). The former offers easy, direct communication within a typical range of a few miles. The latter uses a high-power repeater to extend your range by tens or hundreds of miles and is therefore much more useful for emergencies. Some repeaters are even linked together to bounce your signal across counties or states, and many are supported by generators or other emergency-ready backup power options.

Out of the box, your radio probably will not be programmed with any useful frequencies. You can always use the scan function to check for nearby transmissions, but that should be your last resort. Ideally, you will want to plan and add the ham repeaters in your area to the radio’s memory, either by entering them manually on its keypad (tedious) or by programming them via USB cable and CHIRP (fast and easy). To find repeaters in your area, check [RepeaterBook.com](https://repeaterbook.com/) or [RadioReference.com](https://www.radioreference.com/), or search online for “[your state/city] repeater directory.”

In addition to ham repeaters, Harden recommends programming your radio with NOAA weather advisory frequencies (see [weather.gov/nwr/maps](https://www.weather.gov/nwr/maps)) as well as the 22 standard FRS, GMRS, and MURS frequencies. If you are near the coast, you may also want to program in the marine VHF frequencies, which are used by watercraft. Lastly, you can look up any local police, fire, or EMS frequencies, since listening to these may provide useful information during a disaster. Note that your radio may not be authorized to transmit on any of the frequencies in this paragraph, and you certainly should not transmit on government frequencies, but it is perfectly legal to listen and gather information. A hand mic makes it easier to communicate on the move and to keep your radio safe inside a pouch or pack.

**Begin Transmission**

Under normal circumstances, there is a standard etiquette that should be followed when using a ham radio repeater. Rule number one is to listen before you transmit — you are sharing the airwaves with other people, and it is rude to cut someone off. Key up (press the transmit button) for a few seconds before you begin speaking and try to keep messages under a minute whenever possible. You are always required to identify yourself by your call sign before speaking. To get started, you might say “[call sign] is monitoring” to indicate you’re listening, or say “this is [call sign], can I please get a signal report?” to ask someone to report back if they can hear you clearly.

In an emergency, these niceties will get pushed aside for obvious reasons. You should say “break” if you’re interrupting an ongoing conversation, quickly identify yourself, and then state, “this is an emergency” and ask for someone who can help. Once someone responds and is ready to take down your information, provide the relevant details for that person to pass along to rescue personnel. Students in the class were trained to call in emergency information as concisely as possible using a civilian-oriented version of the standard military nine-line MEDEVAC format:

**1.** Location of pickup site (include decimal GPS coordinates, if possible)
**2.** Radio frequency and call sign
**3.** Number of patients by precedence/injury severity
**4.** Special equipment required (e.g., a stretcher)
**5.** Number of patients by type (e.g., ambulatory, or non-ambulatory)
**6.** Number and type of wound, injury, or illness
**7.** Method of marking pickup site
**8.** Patient description (e.g., teenage girl wearing a bright blue jacket)
**9.** Terrain description, including key landmarks.

End this emergency transmission with a “how copy?” to ask for confirmation or clarification. If possible, have a notepad and pen ready to write down important info such as times, frequencies, and call signs. These details will help you get in touch with the same person again in the future, if necessary.

*An extended battery pack is a wise purchase for any handheld radio, especially one you plan to use in emergencies. If possible, select one with an onboard port for a USB or car charger, as well as contacts for use with a charging cradle.*

**Advanced Capabilities**

Some ham radio repeaters offer capabilities that can greatly expand your emergency comms capabilities. We will briefly address a few of these below.

**Autopatch**
You can make local phone calls from your handheld radio through an autopatch-enabled repeater if you know the passcode. To start a call, key up, say “this is [call sign] requesting autopatch,” and listen for any objections. Then, key up again and dial the activation code, the 10-digit phone number, and finally the star key (\*) before unkeying. If it works, you will hear a message saying “autopatch enabled” and the call will begin. After the call, say your call sign again and enter the disconnect code followed by \*.

Unfortunately, autopatch has some drawbacks. You will need to know that the repeater you are connecting to is autopatch-enabled, and you will need the passcode, which is often only given out to radio club members (that rule may be waived in an emergency). Your call is also limited to 3 minutes, broadcasted to anyone listening on the repeater, and testing has revealed that many phone service providers will send autopatch calls straight to voicemail. Still, if you are trying to directly contact someone who does not have a radio, this may be your best bet. It can also be used to call 9-1-1 if no one else is active on the repeater.

**IRLP/Echolink**
The Internet Radio Linking Project (IRLP) is a service that transmits radio calls over the internet from one node to another, much like Skype or any other VoIP service. This is a great way to reach other radio operators who live in a different state or country, far beyond the reach of your local repeater network. See [IRLP.net](http://irlp.net/) for details and list of nodes in your area.

EchoLink is a functionally similar service, but it comes with the bonus of stand-alone functionality on PCs and smartphones. That means that even if you do not have a radio, you can download the app and use it to communicate with those who do.

Remember that unlike typical ham radio repeaters, both services are dependent on the internet, so they are likely to go offline if a major disaster wipes out infrastructure.

**AMSAT**
Did you know you can directly make a call to outer space from a ham radio? It is true. In fact, the International Space Station will send you a certificate if you call its onboard repeater. Refer to [ariss.org/contact-the-iss.html](https://www.ariss.org/contact-the-iss.html) for details.

Before you dismiss this as useless trivia, you should learn about the Amateur Radio Satellite Organization, also known as AMSAT. These low-orbit amateur satellites act as radio repeaters, and they can be reached using a ham radio and directional antenna. In 2017, a father and son successfully used it to call for rescue when they got stuck in Big Bend National Park, outside the range of cell towers or terrestrial repeaters. An audio recording of this call is available on [AMSAT.org](https://www.amsat.org/).

The catch to AMSAT is that you need a smartphone or computer app to determine the exact orbital path and timing of these satellites, which will provide a narrow window of 15 minutes or less to transmit as one passes overhead. You also need to hope that your transmission is heard by someone else who is willing to help.

*The Baofeng UV-5R was used by most students in the class. This $25 made-in-China HT is far from the best on the market but is a good starting point for beginners.*

**Over and Out**

Just like any other emergency preparedness skill, your ability to communicate is only as good as your training. You do not want the first time you test your radio to be at the bottom of a ravine with a broken leg, so get out there and practice with your gear. More importantly, practice in a realistic manner. If you go off-roading frequently in mountainous terrain, see how your radio setup copes with that exact scenario. If you selected a radio for use in an urban natural disaster, test it out next time a storm rolls in. These dry runs will quickly reveal flaws in your plan.

At the conclusion of the class, Harden recommended following the military’s PACE plan format to establish Primary, Alternate, Contingency, and Emergency options for communication. Your primary will almost certainly be your cell phone, whether you are using it to call, text, email, or reach out on social media. A handheld radio makes an excellent alternate tool, and a satellite phone or personal locator beacon might be a good contingency option. The emergency option is a last resort, such as attempting to find a nearby landline or pay phone (yes, they still exist in a few places).

You may never experience a day when you are desperately in need of help and your cell phone shows “No Signal.” We sincerely hope that is the case, but we live our lives by the mantra “hope for the best and plan for the worst.” If things go off the rails, you’d better have several reliable options to stay in touch.

*Above: A handheld ham radio makes a valuable addition to any emergency kit or bug-out bag, even if you only use it to check the weather forecast.*

**Terms to Know.**

**Ham** – Amateur radio. The term’s origins are debated, but some believe it was originally a derogatory term used by professionals to single out amateur (i.e., “ham-fisted”) operators.
**RX** – Receive
**TX** – Transmit
**Watts** – Used to measure radio transmission power
**Repeater** – Receives and retransmits a signal to extend its range.

**Simplex** – Transmits and receives on one frequency; used for direct radio-to-radio comms
**Duplex** – Transmits and receives on two different frequencies with a small offset between; used for radio-to-repeater comms.

**HT** – Handheld radio, aka handheld transceiver, or handie-talkie
**Mobile** – Non-handheld radio configured for use in a vehicle on 12V DC power
**Base Station** – Non-handheld radio configured for use on a wall power outlet.

**RF** – Radio frequency
**Band** – Section on the radio frequency spectrum
**HF** – High frequency, 3 to 30MHz
**VHF** – Very high frequency, 30 to 300MHz. For amateur radio communications, this typically means 144 to 148MHz, often referred to as “144” (the frequency) or “2-meter” (the wavelength).
**UHF** – Ultra high frequency, 300MHz to 3GHz. For amateur radio communications, this typically means 420 to 450MHz, often referred to as “440” or “70-centimeter.”
**Dual band** – Capable of using VHF and UHF.

**Make a Cheat Sheet**

Harden recommends printing out small cards that contain the following critical information. Laminate these cheat sheets and place one with each radio you distribute to your family, friends, or emergency preparedness group members.

**Important phone numbers**

**Regional ham radio repeater frequencies**

**Local PD/EMS/NOAA weather frequencies**

**Signal Operating Instructions (SOI):** A bare-bones guide on how to use the radio to call for help. Make it simple enough that a child can understand it.

**Communication windows:** Plan out daily time frames when the user should broadcast or listen for regular communications, so you do not end up missing a group member’s calls. Avoid exact hour or half-hour marks since prescheduled events may be occurring on the repeater at those times.

**Privacy key:** List a few vague terms for specific locations or instructions. For example, you might say “meet at the red building,” which the card indicates is the warehouse on the corner of Washington and 12th. This ensures any eavesdroppers will not know exactly where you are or what you are doing unless you want them to.