EMERGENCY COMMUNICATIONS PREPAREDNESS GUIDE

Ukko Sirkelmaa, for PrepperDisk - 2025

INTRODUCTION

Although food, water and shelter are critical to survival, there's one specific thing that has set our species apart from all the others on Earth— **the very thing that makes us the top of the food chain.** That is, our ability to communicate using language. **Civilization, society, trade, development,** all of these things are ultimately only possible because of our unique knack for complex communication.

When we are kicked and backed into a corner, when we are threatened by lack of food, water, or when we suffer the risk of being exposed to the elements because of a large crisis or natural disaster, **communication** should be one of your top priorities along with **immediate survival**.

There's a myriad of stories of humans surviving the impossible, just as there are tales of people perishing in zones of war or disaster, or in acts of nature such as landslides, cave-ins and blizzards. **More often than not, the main thing that sets apart those who survived and those who perished was communication.**

The practice of **emergency communications** contains an extremely wide array of subjects and use cases. The apocalypse does not need to come to pass for you to need to learn about these, either.

For example, during the chaos of the **Columbine shooting in 1999**, so many people tried to call for help and contact loved ones that **the lines were completely flooded**, disabling cell phone coverage within the district. The only way 911 dispatchers were able to actually learn about the situation were through **radio transceivers owned by school officials**, who happened to be trained in emergency communications.

You also have the more low-technical applications. In the 2010 Copiapó mining accident in Chile, 33 miners were trapped for 70 days within a collapsed mine. **Seventeen days after the accident, a note was found taped to a rescue drill bit pulled back to the surface:** "Estamos bien en el refugio los 33" ("We are well in the shelter, the 33 of us").

Even outside disasters, **the authorities often have the authority and initiative to suspend cell phone and internet service**. Some examples of this include: the Myanmar 2021 military coup, the Hong Kong 2019-2020 protests, the Russian 2022 anti-war protests in Moscow and St. Petersburg, the Iranian 2019 fuel price protests, the George Floyd protests in 2020 in Portland, Oregon, the 2016 Dakota Access pipeline protests, the 2019-2020 Catalonian protests in Spain, the 2024 UK riots, and many, many more. These operations attacking communication services **lasted days, weeks, and some stretched into months,** leaving hundreds or thousands without access to any internet or cell phone service.

In these situations, very few options remain for the average person to hear about recent events. **Isolation can mean missing orders on evacuation, updates on roads and hazards, or opportunities for aid and assistance.** In a small town or isolated community, a single person with access to long-range communications can become the single, only link between important resources and their community.

The information in this guide will be largely US-centric. If you reside outside of the US, you should research your local laws and customs regarding the contents of this document. Emergency radio frequencies and laws may vary, but the broad strokes largely remain the same.

This is not meant to be a complete technical manual about these technologies. **You will not learn to repair a radio in this guide.** It is however our intention for you to **have learned, for example, how to contact somebody who can, even in an emergency or long-term collapse of infrastructure**.

While emergency comms training can be so specific depending on your situation that it would be impossible for us to write about it with much authority, this guide will serve as a rough guide to not be caught unprepared— or rather, disconnected, and what your options are if that does come to pass.

PREPAREDNESS

Preparedness is an incredibly deep and comprehensive topic, that involves developing contingencies for food, shelter, transportation, clothing, sanitation, entertainment and communication all based on **a threat model**. Depending on where you live and what your situation is, you may be looking at different hazards or problems, such as blizzards, disease outbreaks, radiation, earthquakes, wildfires, political violence, floods, government collapse, heat waves, cold snaps, hurricanes, typhoons, war and many, many more possibilities.

THREAT MODELING

'Threat modeling' is the methodology through which somebody can **estimate the possibility of bad outcomes** that would disrupt the normal, ideal functioning of their daily life, and **prepare contingencies to counteract it**, and then apply further contingencies to what they already have.

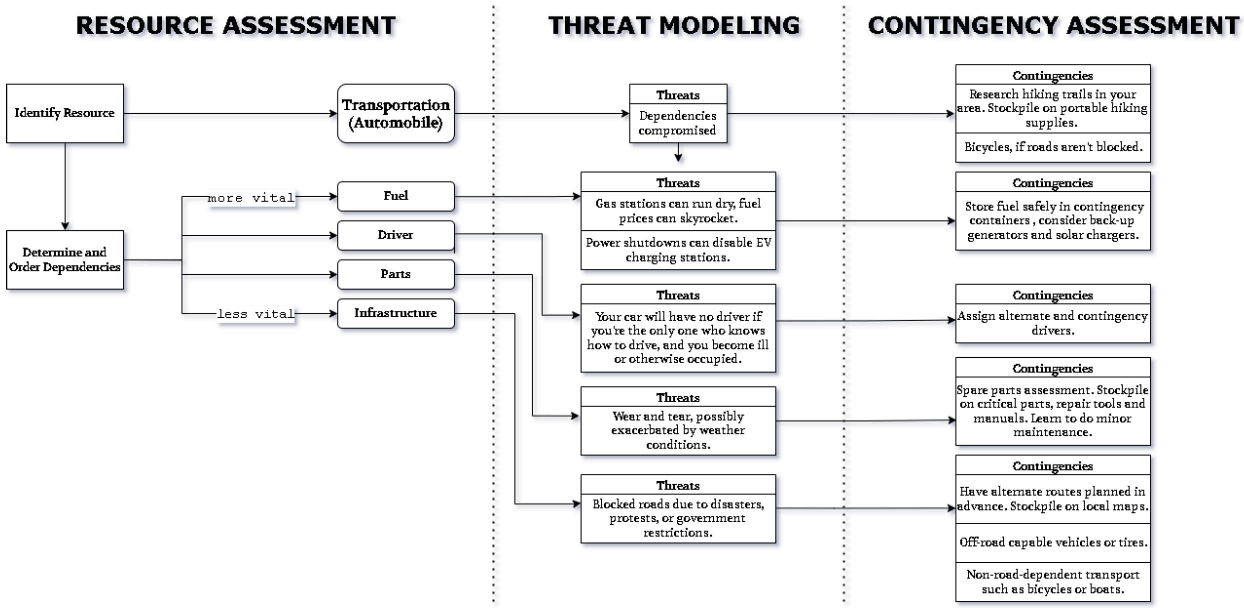
This is something most of us do in our daily lives without realizing it. If you feel the natural pressure to have a spare tire in the trunk to have a solution to a blown tire, or if you've downloaded maps of your city in the case that you take the wrong bus and get lost, then you have already practiced preparedness before. **You were capable of doing it before, and you are still capable now.**

CONTINGENCY THEORY

A contingency is defined as "a provision for a possible event or circumstance". **A good contingency not only adequately replaces one of your resources, but it does so at *exponential* value.** What this means is that they should not depend on the same services and infrastructures, **so that their collapse does not compromise several of your options at once.**

For instance, if you rely on your car for transportation, having a motorcycle as a backup is useful to a degree but not a reliable contingency. If gasoline becomes a valuable resource, you'll ultimately have to choose between the two, or even be unable to use either of them entirely. **The ideal solution would be creating a contingency for the resource that powers your car (gasoline), creating a contingency for the car itself, or both.**

This same methodology applies to everything else you may need a contingency for, and it's something you should always weigh and think about when creating contingencies.



Knowing which things your resources depend on is an important part in creating contingencies. **An ideal and exponential-value contingency plan gives you options to replace not only your resources, but also alternatives for the secondary resources those very things depend on.**

PACE SYSTEM

The **PACE** system is a framework for developing contingency plans, which should be your go-to for knowing your options when it comes to the breakdown of information infrastructure.

PACE stands for **Primary, Alternate, Contingency and Emergency.** In the case of an emergency, you should stick to going from top to bottom on the list:

- **Primary:** Your **Primary** recourse is the best available, and the intended method for everyday communication. It should be the most widely applicable method of communication in your area. This will most often take the form of **social media, e-mail, or phone calls and texts**.
- **Alternate:** Your **Alternate** recourse should be a widely-used but less optimal method of communication. Your alternate recourse is not only what you will use when your Primary device fails, but also when the infrastructure supporting that device fails. It should ideally run on completely different systems, on top of being

a completely different device. In the case where local cell phone coverage might be down, good options include **satellite internet services such as Hughesnet, Viasat and Starlink, and satellite phones such as Iridium, Inreach Messenger or SPOT.**

- **Contingency:** Your **Contingency** recourse is less convenient, but more reliable. Your contingency should not rely on any pre-existing infrastructure, but it should also be something that's not necessarily always on standby, yet that you know how to deploy and use.
  The most obvious case for contingency communications is **radio communications,** which are robust and impossible to dismantle. You're recommended to set up a small mini-PACE priority system of priorities, ranging from common radio stations down to emergency frequencies, before resorting to broadcasting and transmitting out of your own initiative to establish combat.

- **Emergency:** It's worth it to keep at least one **Emergency** recourse on hand, which will work even when your contingency device is compromised. These are not built to carry long, casual conversations— they should be a last resort to carry vital information to those who need it. These include **distress beacons, flashing lights in morse and written messages.**

PRIMARY COMMUNICATIONS

1. **Maintain emergency contacts.** Create a list of emergency phone numbers, including emergency services, a family contact sheet, and "In Case of Emergency" (ICE) contacts, and put them into your cell phone.

2. **If you have a life-threatening emergency, call 911.** If you do not have a **life-threatening** emergency, then don't call 911— phone lines are surprisingly easy to clog up in a disaster. Call the police or fire department instead, in these cases. 911 is mostly reserved for life-threatening or limb-threatening emergencies, and violent crimes actively in progress. Contributing to clogging up the line can cost lives.

3. **Use social media instead of making voice calls.** Data-based services like texts and emails are less likely to experience network congestion. You can also use social media to post your status to let family and friends know you are okay.

4. If you are unsuccessful in completing a call using your cell phone, **wait ten seconds** before redialing to help reduce network congestion.

5. **Conserve your cell phone battery** by reducing the brightness of your screen, placing your phone in airplane mode, and closing apps you are not using that draw power, unless you need to use the phone.

6. If you lose power, **you can charge your cell phone in your car.** Just be sure your car is in a well ventilated place (remove it from the garage). You can also listen to your car radio for important news and alerts.

ASCERTAIN - Do You Need Radio?

A radio should always be in your disaster kit. However, it's important to understand the time and place to use it. Before you hop into a radio and start hooking up an antenna, **try out other modes of communication first.** While this guide contains information that will help you listen and transmit over radio if you are forced to, **refer back to PACE. There is no reason to use radio, if you have not yet tried a satellite phone.**

Only if your primary recourse fails, should you switch to your alternate. Only if your alternate fails should you switch over to contingency.

If you're in the wilderness, the likelihood of there being someone listening nearby to spread your signal over a longer range is unlikely. Even if you were to find someone, how would someone find you after contact?

After you've exhausted your options that rely on internet and satellite communication is it time to switch over to your contingency device— **almost always, a radio.**

CONTINGENCY COMMUNICATIONS

INTRODUCTION TO HAM RADIO

Ham Radio (or just ham) is what most people will immediately default to, given a large-scale shutdown of things like internet connection and cell phone service. Ham is more than just talking to truckers with a walkie-talkie— it's barely even that. There are so many different aspects to ham that can focus on:

- There are modes of communication that allow you to talk with people on the opposite side of the planet using less power than a half-dead AA battery (**FT8, JS8Call, Fldigi**)
- Hams were sending email over radio network before the Internet even existed (**Winlink**)
- Slow Scan Television (**SSTV**) allows you to send entire images through tones over radio
- It can let you track the positions of airplanes and other vehicles (**APRS, Automated Packet Reporting System**)
- You can talk to people on both Earth and aboard the ISS using the repeat aboard the station, along with other amateur radio Low Earth Orbit satellites (**AMSAT**).

Ham is not only extremely long-distance, but is also incredibly resilient, and most importantly, decentralized. It's completely legal to listen to any radio communication. You only run into legal problems when you try to transmit through a non-consumer band, for which you need a license.

LEGAL INFORMATION

Transmitting over most radio bands without a license is generally illegal. Operating without a license or broadcasting outside of the authorized frequencies can result in significant penalties, including fines and equipment confiscation.

With that said, **FCC Rule 97.405** states the following:

§ 97.405 Station in distress
(a) No provision of these rules prevents the use by an amateur station in distress of any means at its disposal to attract attention, make known its condition and location, and obtain assistance.

(b) No provision of these rules prevents the use by a station, in the exceptional circumstances described in paragraph (a) of this section, of any means of radiocommunications at its disposal to assist a station in distress.

What this means is that not only is **listening to any radio communications completely legal, but it is also legal to transmit during an emergency**. As such, owning radio transceivers and antennas, only listening through them, and communicating with them during an emergency breaks no laws in the United States. **If you intend for radio to be your fallback communication system in times of crisis, this should be your modus operandi.**

If you plan to use a ham radio regularly, it's essential to obtain a license to avoid legal complications. **The process is relatively straightforward**, and provides you with the means to not only legally transmit for leisure, but also **gives you the skill set to efficiently transmit during an emergency**, respond to civilian distress calls and relay them to the authorities, and assist with getting your community on a communication grid again.

GETTING A HAM LICENSE

Some things you should know about Ham licenses, if you intend to get one:

- **The FCC license database is public.** It includes government names and addresses and is relatively easy to search. If you're keen on remaining hard to trace, we highly suggest that you use a P.O Box or an address that is not yours, but that you can still check. The FCC doesn't really care where you live, just that they can contact you by mail.
- There are three tiers of Ham licenses: **Technician, General, and Extra.** The Tech license is 35 multiple-choice questions chosen out of a pool of 428 questions, and you pass with a score of 74% or higher. **The questions and answers are all public.** https://hamstudy.org includes a Study Mode to answer questions one right after the other, to help you memorize them. The site keeps track of your

average score, before giving you practice tests. If you take the test multiple times and can consistently get an 80%, you're ready to take the real test.

Traditionally, you would have to be tested in person by volunteer examiners (VEs) and coordinators (VECs) with at least General class licenses. However, because of the COVID-19 pandemic, most testing has moved online, through things like Zoom or Google Meets. **As of April 19, 2022, the FCC charges a $35 application fee.** Nevertheless, VECs usually waive the $15 exam fee they used to charge before this rule took effect.

LICENSE-FREE RADIO

CB RADIO

Before cell phones, CB (Citizen's Band) radios were popular in rural areas. Houses and tractors would both have CB radios so that relatives could keep in touch with each other during the work day. School buses would also have CBs to let families know when buses were arriving.

CB is a set of 40 designated channels within the 11 metre band, **between 26.965 MHz and 27.405 MHz,** that are free for anyone to use without a license. The band has a **legal power limit of 4 watts**. With an antenna mounted on the roof of a car, you can expect a range of about **10 miles** in this band.

Its main modern uses include **communication between truck drivers** on hazards and status and emergency communications in the case of hurricanes, to detour trucks and cars from flooded interstates and other hazardous areas.

CB contains a **dedicated emergency channel** at **27.065 MHz**, protected by Title 47, CFR 95.931 Paragraph a:

> *"Operators of CBRS stations must, at all times and on all channels, give priority to emergency communications. CBRS Channel 9 may be used only for emergency communications or traveler assistance. It must not be used for any other purpose."*

MURS

The **Multi-Use Radio Service** is similar to CB radio, where anybody can use it without a license. MURS consists of 5 channels within the VHF (Very High Frequency) band. With a power limit of 2 watts, depending on antenna size and placement, **these can expect a range of 10 miles.**

FRS

The Family Radio Service is a set of 22 UHF frequencies **between 462.5625 MHz and 462.725 MHz.** FRS radios are very common, and are the most likely type of radio you'll see in stores. **Their unlicensed use is legal— as long as your radio is FRS-compliant**. They can't operate at higher than 2 watts, and can't have a detachable antenna. If you have a walkie-talkie with an antenna that can't be easily screwed off or detached, then you probably have an FRS-compliant radio.

GMRS

The **General Mobile Radio Service** is a set of 30 frequencies on the UHF band **between 462.5625 MHz and 467.725 MHz.** 22 of those frequencies are shared with FRS, but an FRS radio is only allowed to operate at up to 0.5 watts, as opposed to up to 50 watts with a GMRS license. A GMRS license costs $35 USD, and applies to every immediate family member. You don't have to take a test, you just need to file an application with the FCC.

MESHTASTIC/LORA

Meshtastic is an open-source communication system that utilizes **LoRa** (Long-range Radio Protocol) which does not require additional licenses or certifications. It uses an **application in your browser, desktop or phone**, encrypts it and relays it to a radio through Bluetooth, Wi-Fi/Ethernet or serial connection. The message you typed in is then **broadcasted by a connected radio** at 902 to 928 MHz.

Although any radio can catch this broadcast, only devices with Meshtastic firmware can decrypt it and know what was broadcasted. Using this protocol, Meshtastic becomes a **messaging app that's completely off the grid**, and does not depend on internet connection, instead depending on a radio of your choosing. Instead of your message travelling directly from your radio to another, **it uses every Meshtastic radio in the area (or every "node") as a repeater that re-broadcasts your message to increase range**.

Meshtastic/LoRa is very dependable. However, it's designed to be for confidential and off-the grid communication rather than emergency situations. **Meshtastic is not designed as a disaster comms method unless you've set yourself up with a family and friends**, since users remain relatively rare compared to radio hams, and Meshtastic intentionally limits how many nodes the app can remember at once.

BASICS OF RADIO

Radios and antennas work by transmitting, receiving and interpreting electromagnetic waves. The specifics on how information goes from sound to waves is wonderfully intricate, but we won't be exploring that in this guide. **Its basic principles can be broken into three stages:**

1. **Transmission**: A radio transmitter (ham radio, walkie talkie, etc) converts electrical signals (such as recordings of your voice) into waves.
2. **Propagation:** The waves travel through the air or space at the speed of light, reflecting and refracting depending on obstacles and atmospheric conditions.
3. **Reception:** A radio receiver with an antenna captures these waves, and converts them back into electrical signals.

Through these stages, we can isolate the components necessary for radio communication as only two: **a transmitting device and a receiving device**, both which need **an antenna** to transmit and receive.

CHOOSING A RADIO

If you want to create a radio setup for the purposes of receiving instructions and information in the event of an infrastructure collapse, we would recommend finding one or both of 2 items:

1. **RTL-SDR**, or other SDR. SDR stands for "Software Defined Radio". It's a USB device that you plug into your computer and tune using a program like SDR# ("SDR sharp") or GQRX, among others, to listen to various frequencies.

   You can find RTL-SDRs online for fairly cheap, often sold as "**TV tuners**" because people use them to watch over-the-air television on their computers.

Some SDRs can transmit, such as the HackRF One, but they are considerably more expensive. The HackRF One is currently $350 USD.

2. **Baofeng UV-5R, Quansheng UV-K5, or other VHF/UHF transceivers.** These can transmit, but keep in mind that it is illegal to transmit on amateur bands without a license, unless there's an emergency.

PUBLIC ALERTS: NOAA NWR All Hazards and SAME

You're going to want to look for logos on radios tagged with "**Public Alert**" or "**NOAA NWR All Hazards**". These two standards compete with each other but they mean essentially the same thing— that the radio meets specific technical standards that make it capable of receiving area specific alerts, along with extra capabilities to be used by the hearing-impaired or visually-impaired.

These radios are compatible with a technology called SAME (Specific Alert Message Encoding). **SAME transmissions deliver specific information to devices from a specified county or area**, and some radios that feature SAME (specifically weather/all-hazards receivers) allow users to program specific SAME codes for their device. For example, a person living in Irving, Texas, could program a code for Dallas County and **get easy access to the weather and alerts in that county**. However, if there is a need to know of severe weather from the west and northwest ahead of time, the user would program additional codes for Denton and Tarrant Counties.

POWER SOURCES AND EXTRA FEATURES

Battery operated radios are the most convenient, as long as you stock additional batteries. Emergency radios are built to sip power and use the minimum amount to run, but radios with extra features will drain more power. Some of these extra features come in very handy, such as flashlights, solar panels or speakers, but they'll make the system less efficient if you're going the minimal power usage route.

Even if you already have a radio, it's not a bad idea to keep a "listening-only" emergency radio built for the toughest of times. **A hand-cranked radio is not necessarily more efficient than simply carrying more batteries on a low power radio.**

AM AND FM

Most people will want an AM/FM radio that will deliver NOAA alerts and other warnings to them. **NOAA, along with many other emergency alerts, are broadcasted through AM (300 kHz - 3 MHz) rather than FM (30 - 300 MHz)**.

The difference between AM and FM is very simple. AM (Amplitude Modulation) and FM (Frequency Modulation) are simply two different ways to tune and interpret radio transmissions. **AM is more stable over long distances and uses lower frequency bands**, so it's often used for emergency alerts and services. **FM stores information differently, transmitting with better sound quality but with shorter range and in higher frequency bands**.

FREQUENCY

We're going to encounter this word quite often when talking about radio. You likely already know what the function of a frequency is, but to recap— radio waves have an attribute called **frequency**, measured in **Hertz(Hz) and its magnitudes, most often Kilohertz (kHz) and Megahertz (MHz)**. A tuner inside the radio isolates what frequencies your radio actually converts back into sound for you to hear, **creating a system of channels** However, what that tuner can exactly tune into is decided by the manufacturer. This is the reason why you can't just tune into military or police communications, but it's also a good reason to get a good radio with a wide array of frequencies that at least include HF and VHF— **a tuner locked into a tiny range of frequencies cannot be simply modified to cover more frequencies.**

Frequencies lower than VLF are often used for seismology and AC power, so they're not necessarily relevant. Frequencies higher than SHF are mostly used for radar technology, 5G, short range wireless networks, so you won't really be using them either.

The gap between 3.5MHz and 450 MHz is what will be the most useful to keep an ear on, although it's handy to remember what's just beyond the usual frequencies.

Abbreviation	Name	Frequency	Used for
VLF	"Very Low Frequency"	3-30kHz	Navigation, timekeeping, navy communications
LF	"Low Frequency"	30-300kHz	Broadcasting
MF	"Medium Frequency"	300kHz-3MHz	AM radio broadcasts, air traffic control
HF	"High Frequency"	3-30mHz	Shortwave radio, international broadcasts, weather, amateur radio, Citizen's Band
VHF	"Very High Frequency"	30-300MHz	Digital audio, FM radio broadcasts, TV broadcasts
UHF	"Ultra High Frequency"	300MHz-3GHz	Cellphones, satellite communications, GPS, Wi-Fi, Bluetooth, walkie-talkies, garage door openers, car door locks.
SHF	"Super High Frequency"	3GHz-30GHz	Radar, wireless LANs, microwave radio relay links.

WHICH FREQUENCIES TO USE

RULE OF THREES: 3-3-3 SURVIVALIST RADIO PLAN

The rule of threes in survival is also commonly used within survivalist/prepper radio circles. 3-3-3 is the "When, Where and How" to make radio contact with each other. Versions of 3-3-3 are used by survivalist, prepper and emergency communications groups worldwide.

The 3-3-3 radio plan is simple: **Turn on your radio every 3 hours. Tune to channel 3. Listen for 3 minutes.**

WHEN: EVERY 3 HOURS

Always use your Local Time for local area communications with the 3-3-3 radio plan, at the "**top of the hour**", each 3 hours:

Noon, 3pm, 6pm, 9pm. Midnight, 3am, 6am, 9am.

HOW LONG: FOR 3 MINUTES

At the top of every 3rd hour, turn on your radio. **Even if you don't need to make a call yourself, always turn on the radio and listen for calls for at least 3 minutes.** This is because you never know if someone may be trying to reach out for help. If you need to check in, make a short transmission, saying you're just checking in. If you have sufficient battery power, or if you have not connected in for a while, then you should listen for 15 minutes.

WHERE: CHANNEL 3

Channel 3 applies to CB, FRS or MURS, the most common types of civilian radios.

ACCURATE TIME KEEPING

Synchronize your watch with others whenever possible if there's no internet or cell phone connection. If you doubt your watch accuracy, compensate by keeping your radio on for a longer duration, before and after every 3rd hour. If you don't have a watch, **try listening to an AM broadcast radio station— they always identify their call letters at the top of each hour.**

FREQUENCY SCANNING

Some radios will have an option called Scan, Signal Stalker or CTCSS Scan. **This option will make the radio automatically cycle through a range of frequencies, stopping when it detects an active signal coming through.** If you need help but don't know which frequency to use, scanning helps you automatically find the most active ones given a smaller frequency.

OFFICIAL EMERGENCY FREQUENCIES

- **CB (26.965 - 27.405 MHz)** has an **official emergency use channel**, which is **channel 9 at 27.065 MHz.**
- **MURS (462.5625 - 462.725 MHz)** has an **official emergency use channel**, which is **channel 3 at 151.9400 MHz.**
- **146.520 MHz and 145.500 MHz.** These are the national simplex calling frequencies in the US, **sometimes used for emergencies**.
- **146.000 MHz - 148.000 MHz.** Common frequencies for **local police, fire, and emergency medical services (EMS)**.
- **162.400 - 162.550 MHz. NOAA weather radio**, provides continuous broadcasts of weather information, and is sometimes used to broadcast emergency messages to the public.
- If all of these are quiet for too long, it may be time to try your luck with the amateur frequencies.

ANTENNAS AND AMPLITUDE

Radio waves have the longest wavelengths (the difference between two peaks in a wave) in the electromagnetic spectrum, with their amplitudes ranging from one centimeter (0.3in) to greater than 100 meters (109 yds)

The length of an antenna is usually equal to 1/4 wavelength because of resonance. It's usually the most efficient in terms of material and overall effectiveness.

When we talk about something like “the 2 metre band”, this refers to the wavelength being equal to two metres, for example.

When trying to receive, you have a lot of leeway with what can be used as an antenna. **When you're transmitting, however, your antenna has to be tuned in resonance with the frequencies you're trying to transmit on**.

If your antenna is made out of **improper material** or is the **incorrect length** for the signal going through it, power will be reflected back into the transmitter instead of being radiated out of the antenna. This can at best make your signal noisy and garbled, and at worst, **permanently burn out your radio.**

Different types of antennas have different propagation, and are useful in different situations. **Most radio systems are connected to the antenna they come with through a coaxial cable**, which you can detach and connect into your antenna of your own choosing, if you want to transmit or receive in a different frequency than your radio was intended for.

The height of your antenna is substantially more important than the power it’s running on. VHF/UHF radio communication is considered “Line of Sight” because, at frequencies above 30MHz, radio waves are unable to pass through large buildings, mountains or the curvature of the Earth. Unless you’re at an urban center full of buildings or an extremely mountainous area, the curvature of the Earth, or **the horizon**, will be your biggest bottleneck for range— which means that **by increasing your antenna’s height, you increase your distance to the horizon, and therefore your range.**

You can calculate the distance (in miles) from the tip of your antenna to the horizon with the following formulas:

$$\sqrt{(1.5 \cdot antenna's\ height\ in\ feet)}$$

$$\sqrt{(13 \cdot antenna's\ height\ in\ meters)}$$

For example, if you’re holding up a walkie-talkie to your ear and are about 6 feet tall, your effective range should be about 3 miles, as long as there’s no large buildings between you and the receiver. If you can put the antenna on top of a 2 story house (25ft), your range’s around 6 miles. Put that antenna on top of a 10 ft mast, and you’re looking at 7 miles of range, so on and so forth.

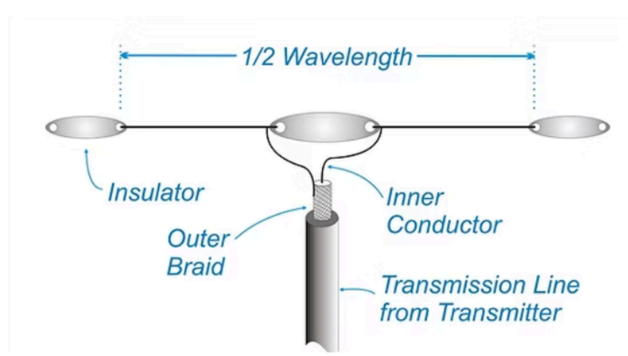
CHOOSING AN ANTENNA

WHIPS AND MONOPOLES

An **extremely common** type, used in cars, HTs and walkie talkies. These include **"rubber ducks"**, tiny antennas covered in rubber that come with your handheld radio. These are usually not very good, but **do their job well enough** for short-range communication.

DIPOLES

Two wires of the same length extended from the end of a piece of coaxial cable. **One wire is attached to the center wire of the coaxial cable, while the other is attached to the outer shield of the cable.** You may recognize these as the **"rabbit ears"** antennas that appear in **older TVs**. Their signals are more evenly distributed and they do not need grounding. However, dipole antennas can be more finicky with how many frequencies they can tune into (meaning they have lower bandwidth).

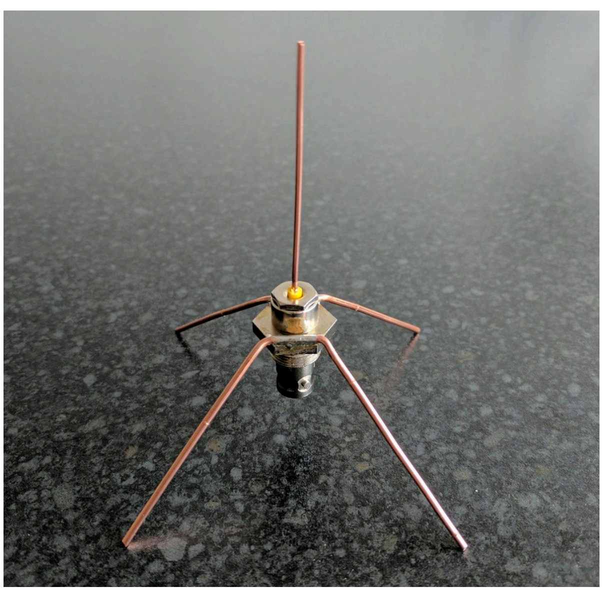


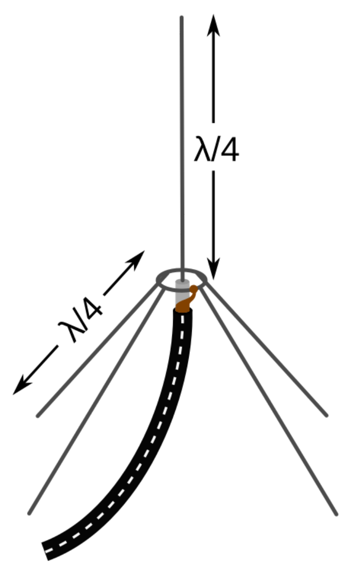
GROUND PLANES

5 wires of the same length, equal to 1/4 the wavelength you intend to transmit in (i.e. if it's intended for the 2 meter band, the wires will be approximately 50 Centimeters). **One wire is attached to the center conductor of the coax cable, and the other 4 are connected to the ground shield.**

They function at a similar profile to monopoles and whips. **Strictly speaking, all monopole antennas need a "grounding element" below them**— a conductive element, such as some copper wire in the case of walkie talkies, or your car's roof in the case of lower frequency car antennas— creating a **faux-dipole antenna** between the antenna and the conductive element.

Antennas release electromagnetic waves **radially** (which gives radio its name), which means some waves are going to be thrown downwards, where they're unlikely to reach anything. A conductor at the bottom can reflect these back and onto the horizon, with varying degrees of success. **A ground plane antenna is purpose-built to efficiently spread within the frequency it's built for, giving it more range and signal strength.**

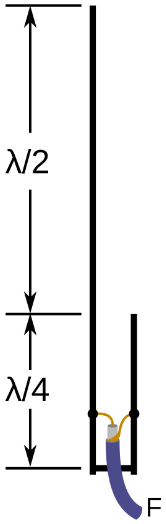




J-POLES

Usually made from copper and pipe, it's popular because of its durability and high gain. The long section is **3/4 the wavelength**, and the short section is **1/4 the wavelength**, assembling a shape that roughly **resembles the letter J**.

J-Poles uniquely **do not require a separate ground plane**, as the short section sufficiently helps to spread the signal towards the horizon. This makes it **easier to mount on a roof or pole** and makes it **resistant to strong winds**. The J-pole feed point is also at DC ground, which gives it minimal noise from its surroundings and does an excellent job of receiving signals.



SLIM JIMS

Often made from "ladder line" which can be rolled up and carried in a backpack. To use the antenna, attach to a rope and throw it into a tree or high location for better altitude. Much like a J-Pole, except they're portable.

If you have time to prepare, these are by far **the most adaptable for emergency situations.** You won't get a stellar audio quality, but you can get onto the top of any tall supermarket, other building or structure, or even a tree.

EXTENDING YOUR RANGE

Outside of increasing the height of your antenna, another way of increasing your range is increasing the power of your radio. However, it has so many factors involved that it would require formal radio technician training. There's no easy formula for this one, and **jury-rigging your radios for more wattage is ill-advised**— transmitting over the signal strength guidelines for each band is illegal (even for those with a license) since **it can interfere and jam other communication devices.**

Beyond this, **your only recourse to increase your range is using repeaters**. Repeaters are radios that receive signals and re-transmit them to cover longer ranges, or get around large obstacles such as a mountain. Most cities with at least a thousand people will have at least one repeater.

HOW TO USE A REPEATER

1. **Find a repeater.** People often find out about nearby repeaters either through online sites such as repeaterbook.com, or by word of mouth. You'll need to find out the following data about the repeater:

    a. Its **input frequency** (the frequency the repeater expects information to come in through),

    b. its **output frequency** (the frequency at which the repeater outputs your signal through),

c. its **frequency offset** (the difference between input and output frequencies. For example, if the input is listed at 146.200 MHz and its output at 146.800 MHz, the repeater has a frequency offset of -0.6 MHz) and

d. its access tone (a special tone needed to use the repeater).

2. **Tune your radio.** Change your listening frequency to the output frequency of the repeater. If anybody's speaking through it, you can listen on.
   If your radio is able to transmit, you'll need to **tune your offset.** Find a setting called **Offset** or **Duplex Mode** and set the offset to the one you have written down.
   Finally, set the access tone. Your radio should have a setting called **Tone** or **CTCSS** for this. For example, if an entry has the access tone "123.0", then you have to set the tone to 123.0 Hz.

3. **Transmit.** Your signal should now pass from the input frequency, into the repeater and broadcasted out through the output frequency you're listening on.

HOW AND WHAT TO COMMUNICATE

Radio signals are finicky, **varying with things like the wind, time of day, humidity, or simply just the whims of the medium (the air).** To keep exchanges useful and direct, radio communicators will often use specific procedures. These are designed to make letters, numbers and messages more distinct from each other, and make messages easier to understand, even without the best signal.

1. If your radio has a "push-to-talk" PTT button, **pause for a moment after pressing it and before speaking.**

2. **Start your first message with "Emergency, emergency, emergency".** Stating the purpose of your message three times is common procedure (see: Rule of Threes), but also generally a good habit to make sure you're intelligible.

3. **Be short.** Don't hold your PTT for longer than 30-45 seconds.

4. **Do not transmit while the other person is transmitting.** Even if you're being quiet, keep your PTT off if they're transmitting.

5. **Speak clearly, and directly.** Take your time to relay your information. Repeat it if needed or prompted to.

6. Bad signal can swallow up a few seconds of your message. **Use the NATO phonetic alphabet for spelling out addresses, names, license plates, etc.**

RADIO EXCHANGE EXAMPLE

— "Emergency, emergency, emergency. This is Brandon on repeater frequency 145.1100. I need medical assistance."

Pause and listen for response. If no response, repeat with more details. Relay your location first, then the nature of the emergency. Do not add superfluous details.

— "Emergency, emergency, emergency. My name is Brandon. I am located at 601 Zennia St. Somebody's unconscious. Is anyone able to assist?"

— "Hey Brandon, this is W5STX. I hear your emergency call. I can contact emergency services for you. Stay on this frequency and remain as calm as possible. Can you spell your address?"

Somebody having a callsign (such as W5STX) will mean they're licensed. If asked to spell, utilize the NATO phonetic alphabet. If you don't remember it, try to speak as clearly as possible before confirming that the correct information was relayed.

— "601 Zennia Street. Six-zero-one, Zulu Echo November November India Alpha, street."

CONCLUSION AND REVIEW

The body of this text mostly contains **basics** on radio functioning and protocols—a pragmatic rundown of ham radio and similar technologies. There's always more to learn, and more ways to stay connected that go beyond what was covered in this document. The rest of this paper will be references and tables for different frequencies. Emergency frequencies will be **highlighted**.

Stay safe, stay prepared, and most importantly—stay in touch.

PUBLIC USE FREQUENCY CHARTS

CB RADIO FREQUENCIES		
CHANNEL NAME	**FREQUENCY**	**USAGE**
CB Channel 1	26.965 MHz	Open to everyone
CB Channel 2	26.975 MHz	Open to everyone
CB Channel 3	26.985 MHz	Open to everyone
CB Channel 4	27.005 MHz	Default 4x4s/offroading frequency
CB Channel 5	27.015 MHz	Open to everyone
CB Channel 6	27.025 MHz	Open to everyone
CB Channel 7	27.035 MHz	Open to everyone
CB Channel 8	27.055 MHz	Open to everyone
CB Channel 9	**27.065 MHz**	**Emergencies Only**
CB Channel 10	27.075 MHz	Open to everyone, often used by truckers
CB Channel 11	27.085 MHz	Open to everyone
CB Channel 12	27.105 MHz	Open to everyone
CB Channel 13	27.115 MHz	Open to everyone, often used by civilian boats and RVs
CB Channel 14	27.125 MHz	Open to everyone, often used by walkie-talkies
CB Channel 15	27.135 MHz	Open to everyone
CB Channel 16	27.155 MHz	Open to everyone, used for SSB radio
CB Channel 17	27.165 MHz	Open to everyone, often used by truckers
CB Channel 18	27.175 MHz	Open to everyone
CB Channel 19	27.185 MHz	Trucker east-west highway traffic
CB Channel 20	27.205 MHz	Open to everyone
CB Channel 21	27.215 MHz	Open to everyone, often used by truckers
CB Channel 22	27.225 MHz	Open to everyone
CB Channel 23	27.255 MHz	Open to everyone
CB Channel 24	27.235 MHz	Open to everyone
CB Channel 25	27.245 MHz	Open to everyone
CB Channel 26	27.265 MHz	Open to everyone

CB RADIO FREQUENCIES		
CB Channel 27	27.275 MHz	Open to everyone
CB Channel 28	27.285 MHz	Open to everyone
CB Channel 29	27.295 MHz	Open to everyone
CB Channel 30	27.305 MHz	Open to everyone
CB Channel 31	27.315 MHz	Open to everyone
CB Channel 32	27.325 MHz	Open to everyone
CB Channel 33	27.335 MHz	Open to everyone
CB Channel 34	27.345 MHz	Open to everyone
CB Channel 35	27.355 MHz	Open to everyone
CB Channel 36	27.365 MHz	Open to everyone, used for SSB radio
CB Channel 37	27.375 MHz	Open to everyone, used for SSB and LSB radio
CB Channel 38	27.385 MHz	Open to everyone, used for SSB radio
CB Channel 39	27.395 MHz	Open to everyone, used for SSB radio
CB Channel 40	27.405 MHz	Open to everyone, used for SSB radio

FRS/GMRS FREQUENCIES				
CHANNEL NAME	**FREQUENCY**	**MAX. POWER (FRS)**	**MAX. POWER (GMRS)**	**USAGE**
FRS Channel 1	462.5625 MHz	2 W	5 W	Shared FRS/GMRS public use
FRS Channel 2	462.5875 MHz	2 W	5 W	Shared FRS/GMRS public use
FRS Channel 3	462.6125 MHz	2 W	5 W	Shared FRS/GMRS public use
FRS Channel 4	462.6375 MHz	2 W	5 W	Shared FRS/GMRS public use
FRS Channel 5	462.6625 MHz	2 W	5 W	Shared FRS/GMRS public use
FRS Channel 6	462.6875 MHz	2 W	5 W	Shared FRS/GMRS public use
FRS Channel 7	462.7125 MHz	2 W	5 W	Shared FRS/GMRS public use
FRS Channel 8	467.5625 MHz	0.5 W	0.5 W	Shared FRS/GMRS public use
FRS Channel 9	467.5875 MHz	0.5 W	0.5 W	Shared FRS/GMRS public use
FRS Channel 10	467.6125 MHz	0.5 W	0.5 W	Shared FRS/GMRS public use
FRS Channel 11	467.6375 MHz	0.5 W	0.5 W	Shared FRS/GMRS public use
FRS Channel 12	467.6625 MHz	0.5 W	0.5 W	Shared FRS/GMRS public use
FRS Channel 13	467.6875 MHz	0.5 W	0.5 W	Shared FRS/GMRS public use
FRS Channel 14	467.7125 MHz	0.5 W	0.5 W	FRS public use, GMRS repeater output
FRS Channel 15	462.5500 MHz	2 W	50 W	FRS public use, GMRS repeater output
FRS Channel 16	462.5750 MHz	2 W	50 W	FRS public use, GMRS repeater output
FRS Channel 17	462.6000 MHz	2 W	50 W	FRS public use, GMRS repeater output
FRS Channel 18	462.6250 MHz	2 W	50 W	FRS public use, GMRS repeater output
FRS Channel 19	462.6500 MHz	2 W	50 W	FRS public use, GMRS repeater output
FRS Channel 20	462.6750 MHz	2 W	50 W	FRS public use, GMRS repeater output
FRS Channel 21	462.7000 MHz	2 W	50 W	FRS public use, GMRS repeater output
FRS Channel 22	462.7250 MHz	2 W	50 W	FRS public use, GMRS repeater output
GMRS Channel 1	467.5500 MHz	N/A	50 W	GMRS repeater input only
GMRS Channel 2	467.5750 MHz	N/A	50 W	GMRS repeater input only

GMRS Channel 3	467.6000 MHz	N/A	50 W	GMRS repeater input only
GMRS Channel 4	467.6250 MHz	N/A	50 W	GMRS repeater input only
GMRS Channel 5	467.6500 MHz	N/A	50 W	GMRS repeater input only
GMRS Channel 6	467.6750 MHz	N/A	50 W	GMRS repeater input only
GMRS Channel 7	467.7000 MHz	N/A	50 W	GMRS repeater input only
GMRS Channel 8	467.7250 MHz	N/A	50 W	GMRS repeater input only

MURS FREQUENCIES

CHANNEL NAME	FREQUENCY	USAGE
MURS Channel 1 / “Calling”	151.8200 MHz	Unofficial MURS calling channel
MURS Channel 2 / “Safety”	151.8800 MHz	Recommended simplex repeater/crossband repeater channel (156.7 Hz CTCSS tone) and SAFETY channel - TX 210.7 Hz CTCSS 210.7 PL
MURS Channel 3 / “Emergency”	**151.9400 MHz**	**Recommended prepper/emergency management, disaster response calling and working channel - TX 88.5 Hz CTCSS or 141.3 Hz CTCSS 141.3 PL**
MURS Channel 4 “Blue Dot”	154.5700 MHz	Old Business Radio Service frequency, heavily used by stores, construction sites, etc.
MURS Channel 5 “Green Dot”	154.6000 MHz	Old Business Radio Service frequency, heavily used by stores, construction sites, etc.

AMATEUR RADIO FREQUENCY CHART

BAND NAME	FREQUENCY RANGE	USAGE
80 Metre Band	3.5 - 3.9 MHz	Regional (long-range) communication, especially at night time due to its strong propagation.
60 Metre Band	5.351.5 - 5.366.5 MHz	Emergency broadcasts, intermediate-range casual contact.
40 Metre Band	7.0 - 7.3 MHz	One of the most popular HF bands. Good for regional and international communication, effective both day and night.
30 Metre Band	10.1 - 10.15 MHz	Unwieldy propagation. Can be good for long-range, but very fickle and time-dependent.
20 Metre Band	14 - 14.35 MHz	Best all-around HF band, reliable during daytime and still usable at night. The most crowded one when it comes to amateur radio.
17 Metre Band	18.068 - 18.168 MHz	Almost as serviceable as the 20 metre band. Used when 20 metre band is too crowded.
15 Metre Band	21 - 21.45 MHz	Amateur long-distance communication. Most useful during the day. Harmonically related to the 40 metre band, which means that an antenna tuned for that band can also easily use this band. We are currently at a solar maximum[1], which makes this band more efficient and powerful during daylight hours.
12 Metre Band	24.89 - 24.99 MHz	Similar to 10 metre band, but used when that band is too crowded.
10 Metre Band	28 - 29.7 MHz	Most efficient during daylight hours. Long-distance opportunities via 10 metre seem to follow the sun across the globe. In North America, for instance, it might bring Europe and western Asia in the morning, the Americas during midday, and the Pacific and East Asia in late afternoon and early evening.
6 Metre Band	50 - 54 MHz	Called the "Magic Band" due to unpredictable propagation. Unreliable and not recommended for emergency communications.
2 Metre Band	144 - 148 MHz	Very popular for being local, reliable and accessible by short monopole antennas. The most used band for local emergency communications efforts, such as providing communications between Red Cross shelters and local authorities. **2 metre should always be your first choice when randomly roaming amateur bands.**
70 Centimetre Band	420- 450 MHz	Better building penetration than VHF bands. Popular ham band due to the ready availability of equipment.

1- Due to quirks with how radio waves interact with the atmosphere, some frequencies are more efficient during solar maximums when used in daylight hours. The next maximum will be in mid-to-late 2025, ending in early 2027, and declining from 2027 to 2031, down to the minimum in 2031-2032. These predictions aren't definitive— solar cycles are notoriously difficult to track and predict.