

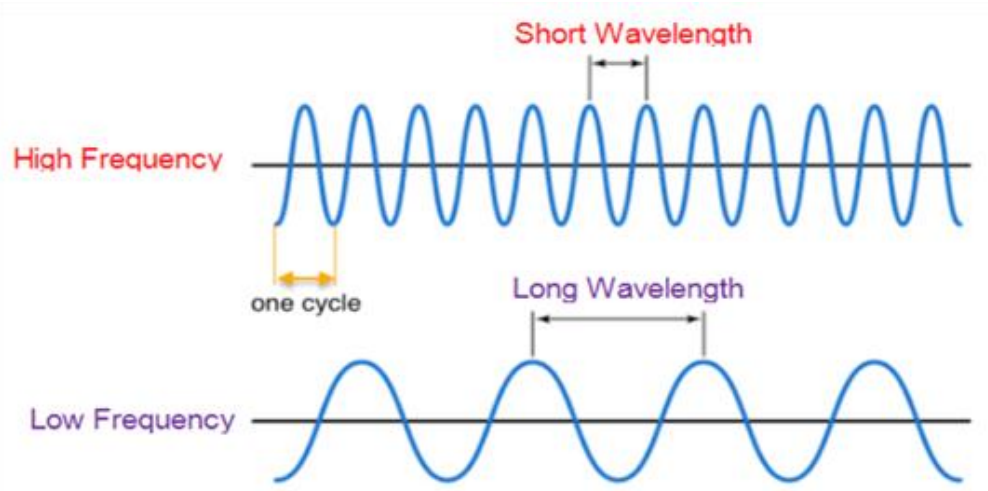
This is a basic review of Radio Communication capabilities.

Before deciding on your communications plan you should first know some basic terminology that helps you understand the capabilities of different types of radios and the various radio services.

How Radio Works

- **Radios** put electrical signals on an antenna at specific frequencies which create electromagnetic waves that radiate through the atmosphere.
- **The Radio Spectrum** is the range of **Frequencies** used for telecommunications. (sometimes referred to as channels or stations)

Ways to describe the Radio Spectrum



Frequency - **Wavelength** - **Band** are just different ways of saying the same thing.

- **Frequency** is measured in Hertz (Hz) or “cycles per second”.
- **Wavelength** is the distance between cycle peaks measured in meters. $\text{Wavelength} = \text{speed of light} / \text{frequency}$
Ex: $\text{speed of light} \approx 300\text{M m/s} \div 150\text{MHz} = 2 \text{ meters}$.
- **Band** is a small section of the radio spectrum. The 2 meter band is a section around 150MHz.

3 Most Important Parts of the Radio Spectrum



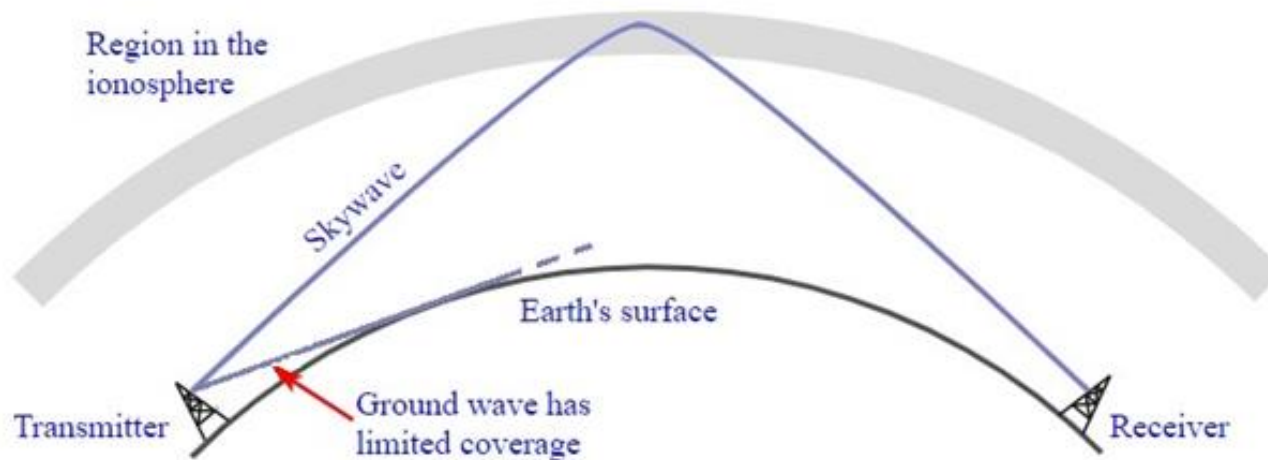
- **HF** (High Frequency) up to 30MHz
Ex: AM Radio, Shortwave radio, CB radio
- **VHF** (Very-High Frequency) 30MHz to 300MHz
Ex: FM radio, older TV, Police, Fire
- **UHF** (Ultra-High Frequency) above 300MHz
Ex: UHF TV, GPS, WiFi, satellite, cell phones

Communication Range

- Radio signals do not travel well through objects, especially conductive ones like metals, the earth, or even trees.
- Radio signals travel in straight lines so the basic communications range is only about 5 miles due to the curvature of the earth.
- One way to extend range is by increasing the power to help overcome some of the attenuation by trees and buildings.
- A second way to extend range is to elevate the antenna above obstacles and above the earth curvature.
- A third way to extend range is by **reflection** of the signal off the ionosphere. Often called **“skip”**.
- A fourth way to extend range is by use of **repeaters** that receive and retransmit your signal.

What is SKIP ?

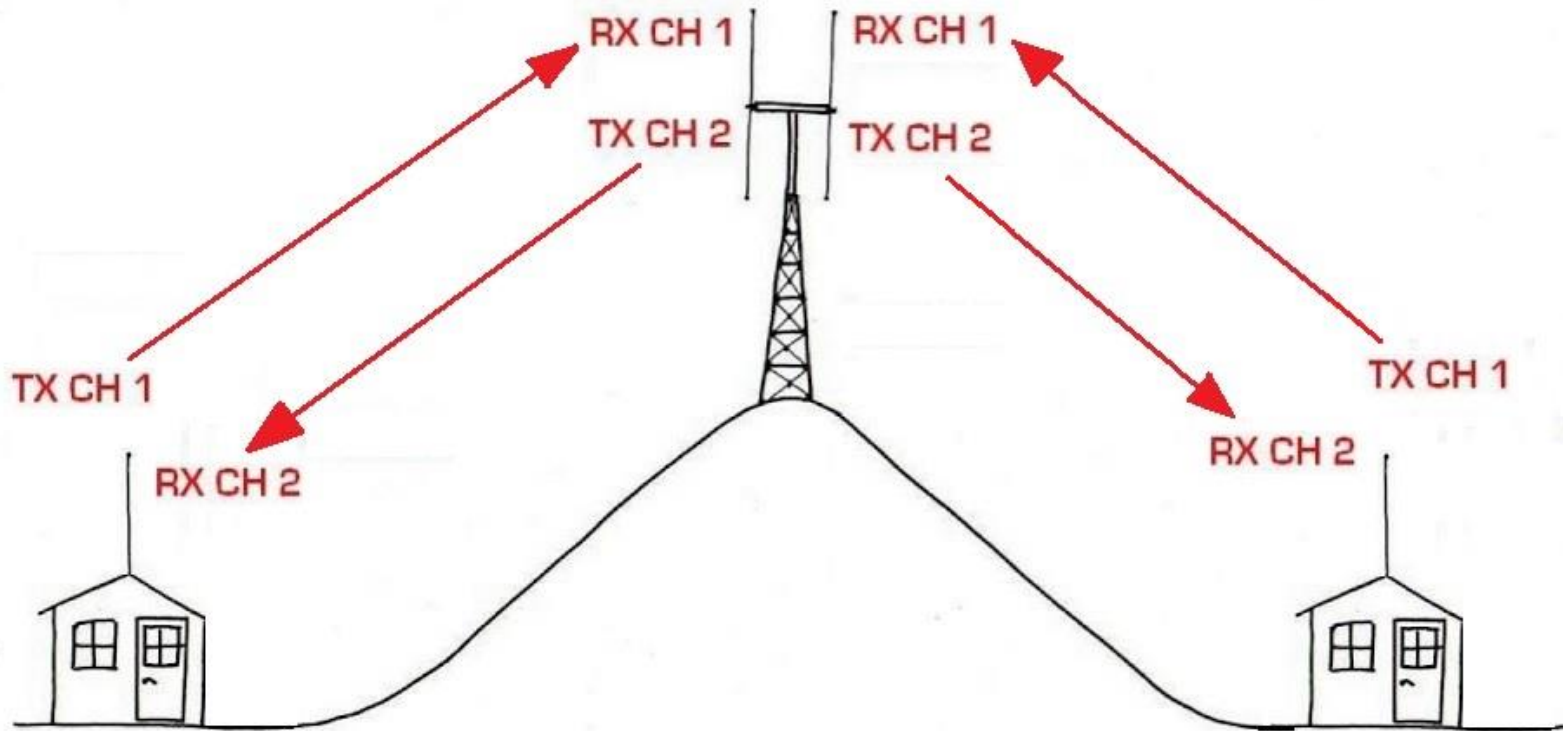
- **Skip** is the ability of the radio signal to **reflect** off the ionosphere and return to a spot beyond the horizon.
- **Skip** varies with solar radiation and weather, but mostly by frequency.



- **HF** is the most likely to skip. 30 MHz and below
- **VHF** skips some at the low end and not at the high end. 30 MHz to 300 MHz
- **UHF** does not skip but it is more effective at penetrating walls, etc.

What are Repeaters ?

- **Repeaters** are radios that enable two stations to communicate when there is not a direct line between stations. Repeaters are most often used in VHF and UHF.

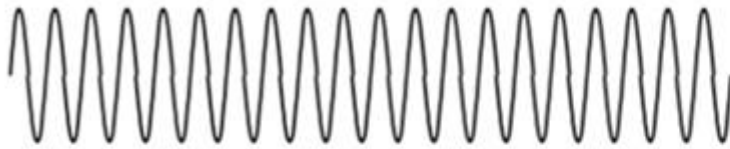


Transmission Modes

Transmission Modes are the way information is embedded in the radio signal.

– These are the basic ones.

- **CW** - Continuous Wave or Morse code
- **AM** - Amplitude Modulation (includes **SSB** - Single Side Band)
- **FM** - Frequency Modulation



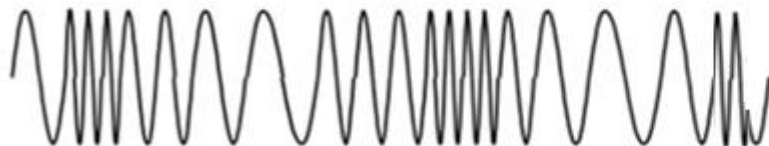
Carrier Frequency



Continuous Wave - CW



AM Signal



FM Signal

Radio Services

Radio Services are the FCC regulated frequencies and radios used for communications.

- The following four no-test-required services have limited power and are limited to specific frequencies and modes.
 - **CB** - Citizens Band Radio service
 - no license
 - 27 MHz HF, AM, SSB
 - AM 4 watt maximum
 - SSB 12 watt maximum
 - 40 channels
 - **FRS** - Family Radio Service
 - no license
 - 460 MHz UHF, FM
 - 4 watt maximum
 - 22 channels
 - **MURS** - Multi-Use Radio Service
 - no license
 - 152 MHz VHF, FM
 - 4 watt maximum
 - 5 channels
 - **GMRS** - General Mobile Radio Service
 - Same as FRS except:
 - license \$35 / 10 years
 - 8 watt maximum
 - repeaters allowed

What is the Amateur Radio Service?

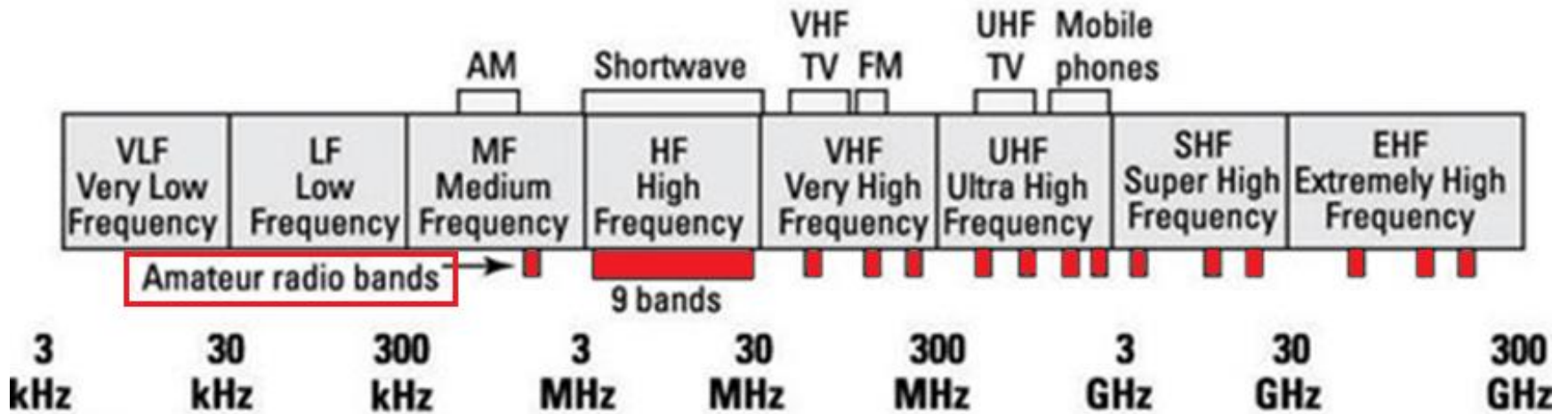
The Amateur Radio Service was established world-wide as a non-commercial radio service for personal enjoyment, experimentation, and voluntary services.

- Intended to provide a resource of knowledgeable people able to use radio communications, develop and test technologies, and assist during disasters.
- You must pass a technical and regulatory knowledge test, and get a license to transmit. No license is required to own a radio as long as you only listen.
- A non-technical person can pass the test with studying and memorization.
- \$35 fee for 10 years. No retesting if renewed on time.

Amateur Radio Service

- **Benefits of this radio service:**
 - Many more frequencies equivalent to tens of thousands of channels.
 - More modes.
 - Modifications allowed (interface between services)
 - Power allowed up to 1,500 Watts
 - Fairly reliable interstate communications

Amateur Radio Service



- Large number of frequency bands to utilize.
- From below HF to above UHF.
- Each frequency band has its own unique benefits.

3 License Levels for Ham radio.

<1MHz, 1.8, 3.5, 7, 10, 14, 18, 21, 24, 28, 50, 144, 222, 420, 902 MHz, 1.24 GHz

|-----HAM bands for **General** Class-----|

|-----HAM bands for **Technician** Class-----|

- **Technician** class licensees are limited to 200 watts on HF.
- **Technicians** can only use a small part of the HF bands using Morse code.
- **General** class licensee can transmit with up to 1,500 watts on the HF bands.
- **General** class license provides about three times the number of bands as the Technician class license.
- **General** class test is only a little more difficult than the Technician class test.
- **Extra** class license is the top level. It is mostly a status symbol license as the privileges provide only slight increases in the frequency available on four HF bands.

I recommend going with the General class license.

HAM Recommendations

- First get your license.
 - You don't need a radio to do this.
 - The license is free but the test administrator is allowed to charge a fee to cover their expenses. This may be around \$15 but should never exceed \$50.
- Learn the phonetic alphabet.
 - Alpha, Bravo, Charlie ...
- Then invest in HAM level radios and equipment.

Morse Code

- No longer required for any amateur radio license; however it can be beneficial to know.
- Most reliable mode of communication (CW) and the signal can get through when other modes are unintelligible due to interference or noise.
- Useful for communicating with people who speak a different language due to the use of special “Q” codes for passing information. Q codes are similar to “10” codes.
- Even knowing a few characters of Morse code can allow you to send special instructions that are not easily interpreted by others, especially those who don’t know Morse code.

E I S H T M O

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Radio Operation that does not require taking tests

- A **CB** radio, preferably one that has single sideband (**SSB**).
- A couple of handheld radios that cover **GMRS**, **FRS**, and **MURS**.
- A multi-band, multi-mode “**short-wave**” radio receiver that can operate from battery. These radios are for listening only and can have many features like scanning and programmed memory.
- A **scanner** for local fire, police, and EMS.

For Amateur Radio Operation

- A handheld or mobile radio that covers HAM bands in the **VHF/UHF** range.
 - You can get inexpensive **VHF/UHF** radios like the Baofeng for \$50 but these are considered marginal for signal quality.
 - You should consider a better quality radio for the HAM bands. These radios are in the \$200 to \$500 range.
- An **HF** multimode, multiband radio that can operate from 12V or from a power supply in your home, and has transmit power up to 100W.
 - Covers the HF band.
 - Can be used as both a base station and a mobile station.
 - This is going to be in the \$1,000 and up range for a quality radio.
 - You may also want additional equipment like an antenna tuner if you are making wire antennas, \$100 to \$200.

Considerations for preppers

- “go to” frequencies for your group.
- Coded messages for your group.
- Radio plan with others to listen every so often for a certain period of time on a specific channel. This can be any way you want such as 8-5-22
 - every **8** hours listen for **5** minutes on channel **22**.
- Variety of radios and antennas to cover all the frequencies you wish to operate.
- Alternate power sources and emergency power for your radios. Solar cells, battery chargers, spare batteries, Inverter/Generator. The inverter styles have best output regulation whereas a cheap generator may damage some electronics.
- All the manuals and accessories for your radios. Most new radios have advanced features that you don't use every day. Make sure you aren't stuck unable to use your radio when you need to input a new frequency, etc.

I have a website:

www.kepoco.com

All of the below information plus this Presentation is there under the “Radio Communications” section.

- Online Amateur Radio Test study guides
- Amateur Radio Testing Online and Local
- Licensing
- GMRS, FRS, MURS
- Software Defined Radio – SDR
- Antennas
- List of radio frequencies in use by area and other information
- Repeaters
- Commercial Sources for equipment
- Misc links and information for preppers