

Introduction to Amateur Radio (HAM)



About this Presentation

- **NOT** designed to help you pass the Technician's license test
- You will learn the importance and theory surrounding communications (comms) using Amateur radio
- How to get your license
- Which radios to buy
- Radio accessories and use
- Limitations of Amateur Radio



What is Amateur Radio?

- Established in the early 20th century as a method of communication which bypassed paid telegraphs
- Use of a transmitter & receiver (combined: transceiver) to speak with other operators via Radio Frequency (RF) Radiation
- Most countries have licenses for operators (FCC) and there are international regulations on domestic & cross-country comms
- While considered a hobby HAM is critical during times of crisis
- Typically a “Handy Talky” (HT) is used for portable comms while mobile radios are common for use in vehicles
- Many different frequencies may be used and all carry strengths and weaknesses



What are benefits of HAM?

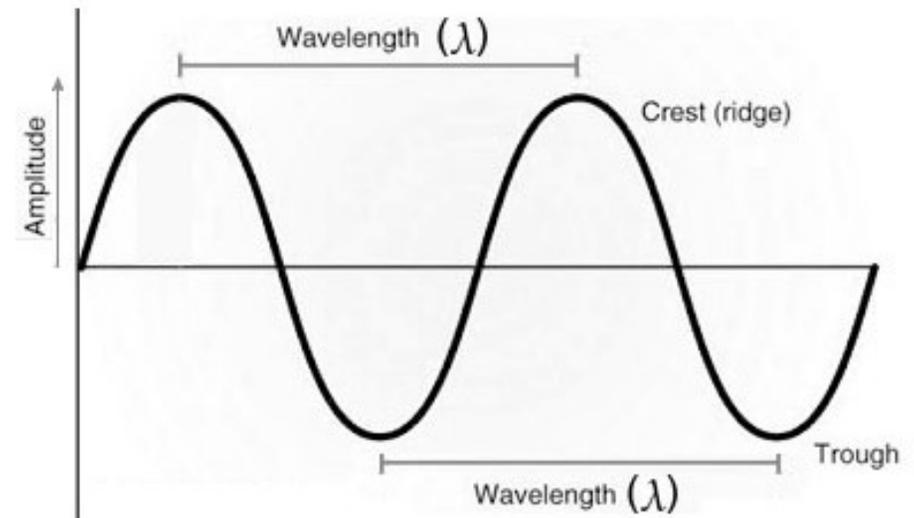
- Current tech is completely reliant on external communication systems and the electric grid
- Communications between individuals can be independently managed and do not require a separate service
- HAM gives you extra options for talking with others
- The barriers to entry is low
- Real time event updates
 - The Levee failures during Katrina (05) were first warned to others by HAM operators in the area



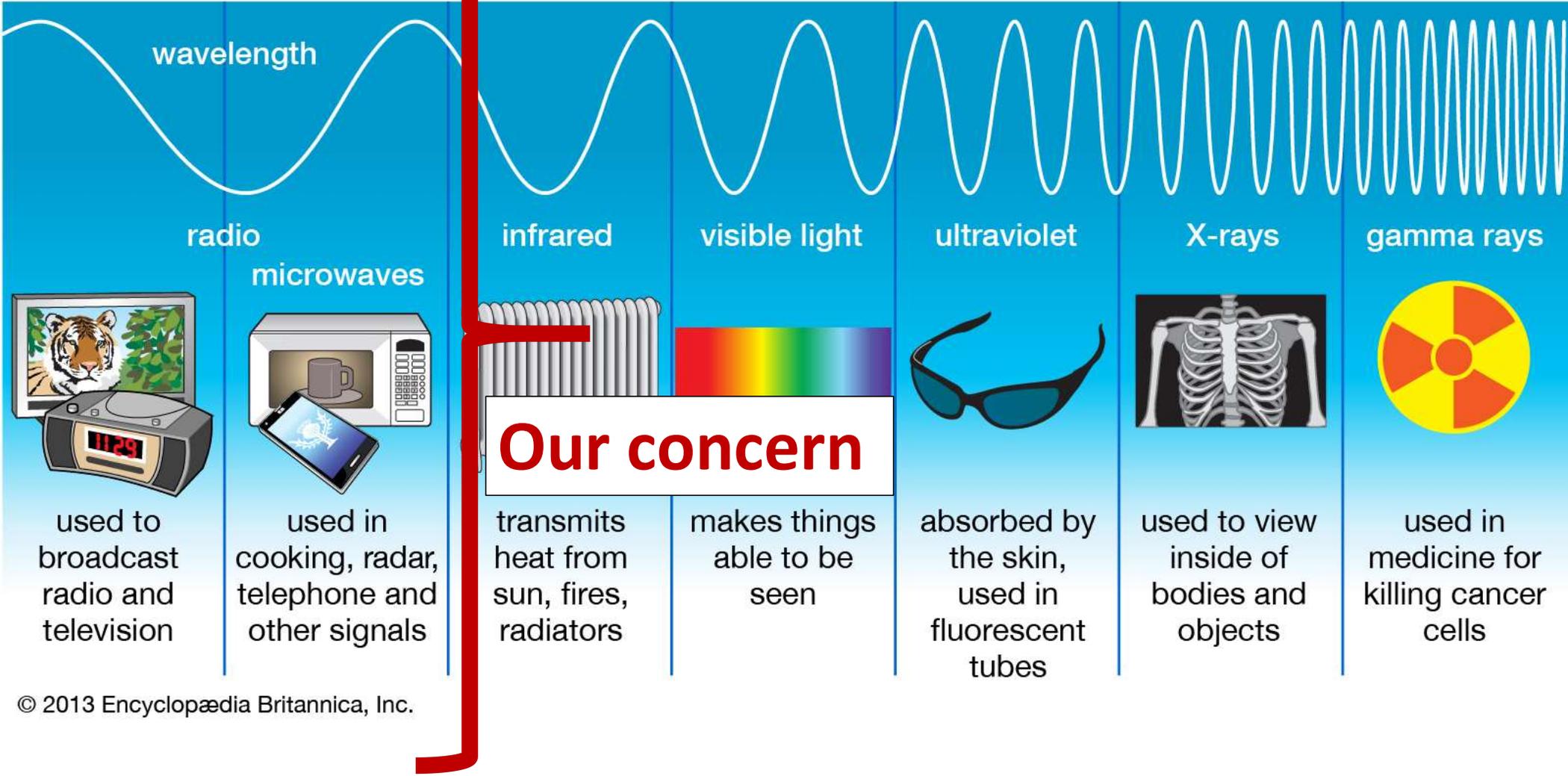
Radiation

- Simply: Electro-Magnetic (EM) waves which have different properties based on energy and wavelength
- Amateur radio uses non-ionizing (waves not energetic enough to damage DNA) radiation to transmit information
- The wavelength of an EM wave is measured from peak-to-peak, the number of times a whole wavelength is completed per second of transmission is the frequency (Hz)

$$\lambda = 300 \div f \text{ MHz}$$

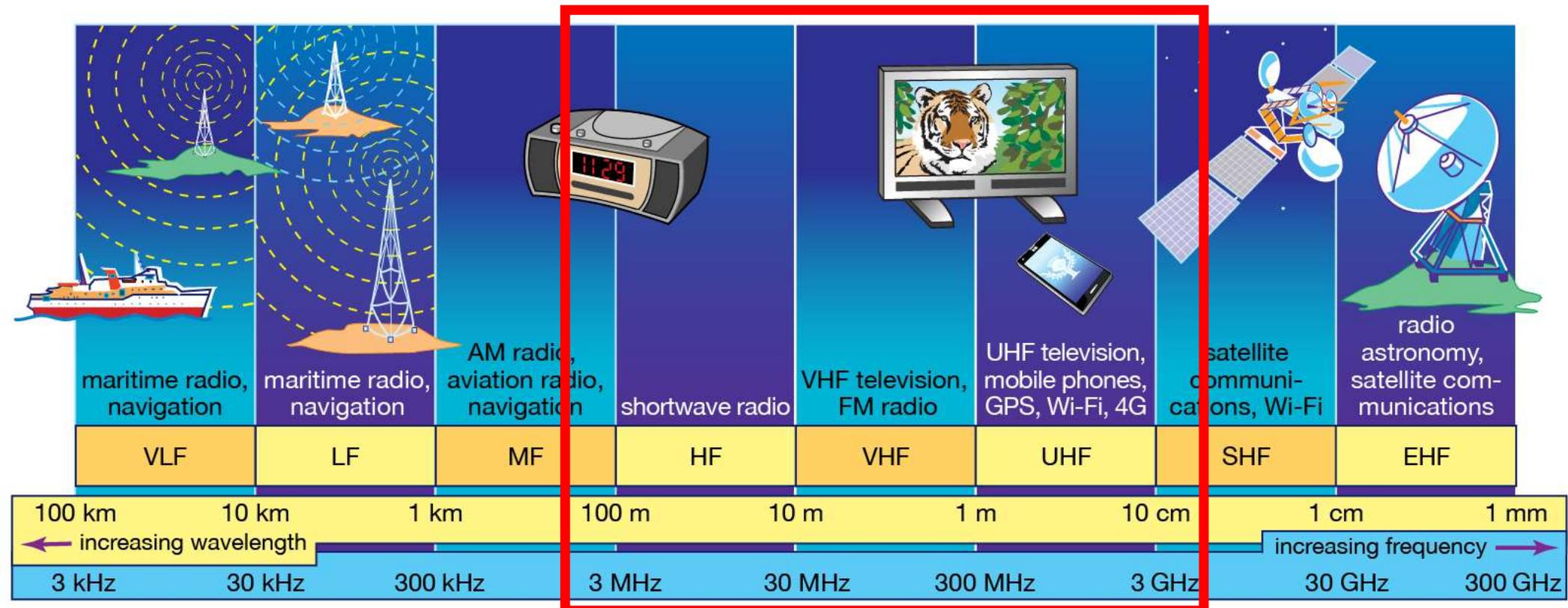


Types of Electromagnetic Radiation



The RF Spectrum

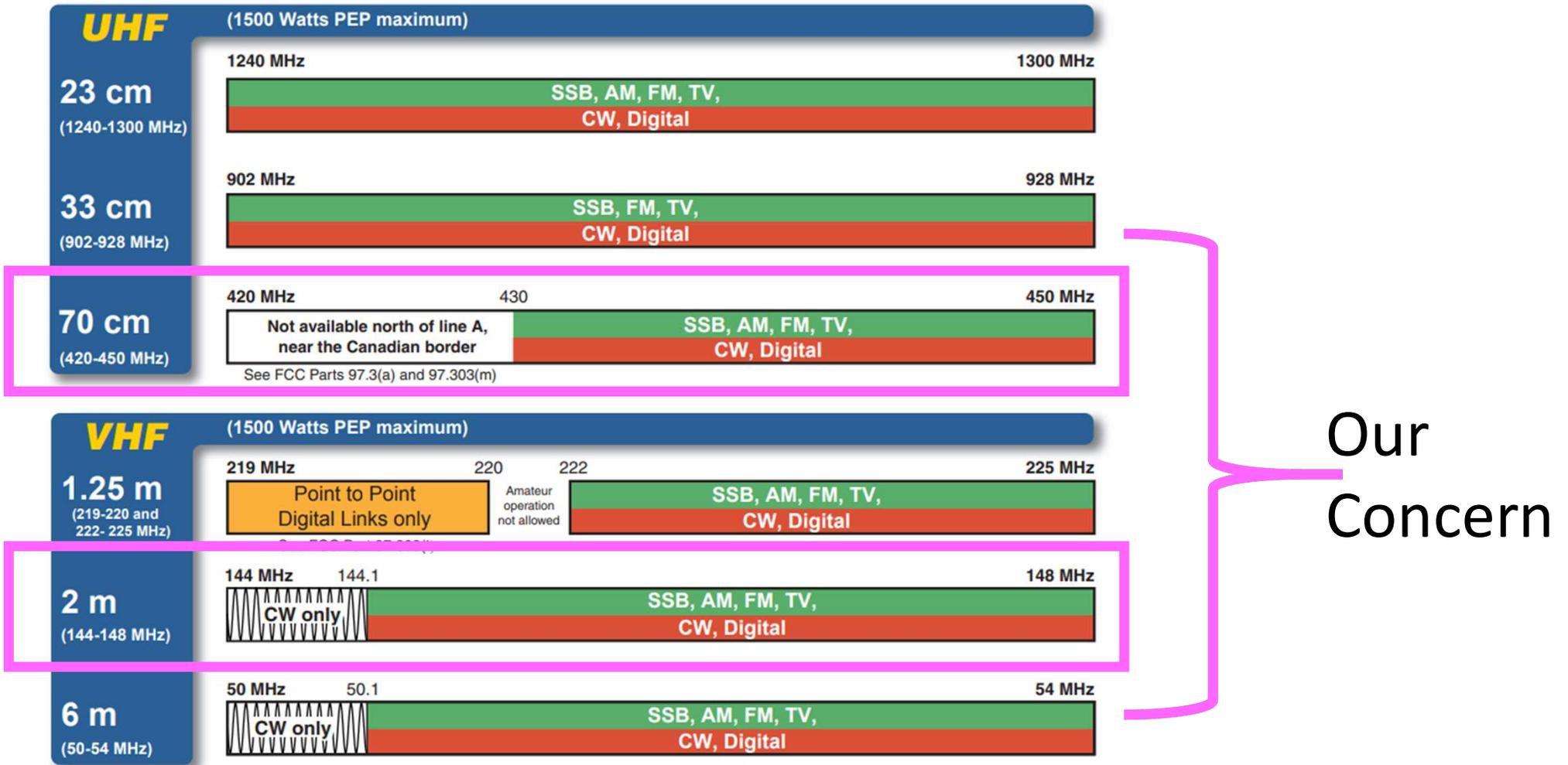
Our concern



Radio wave “band plans” – HF/VHF/UHF

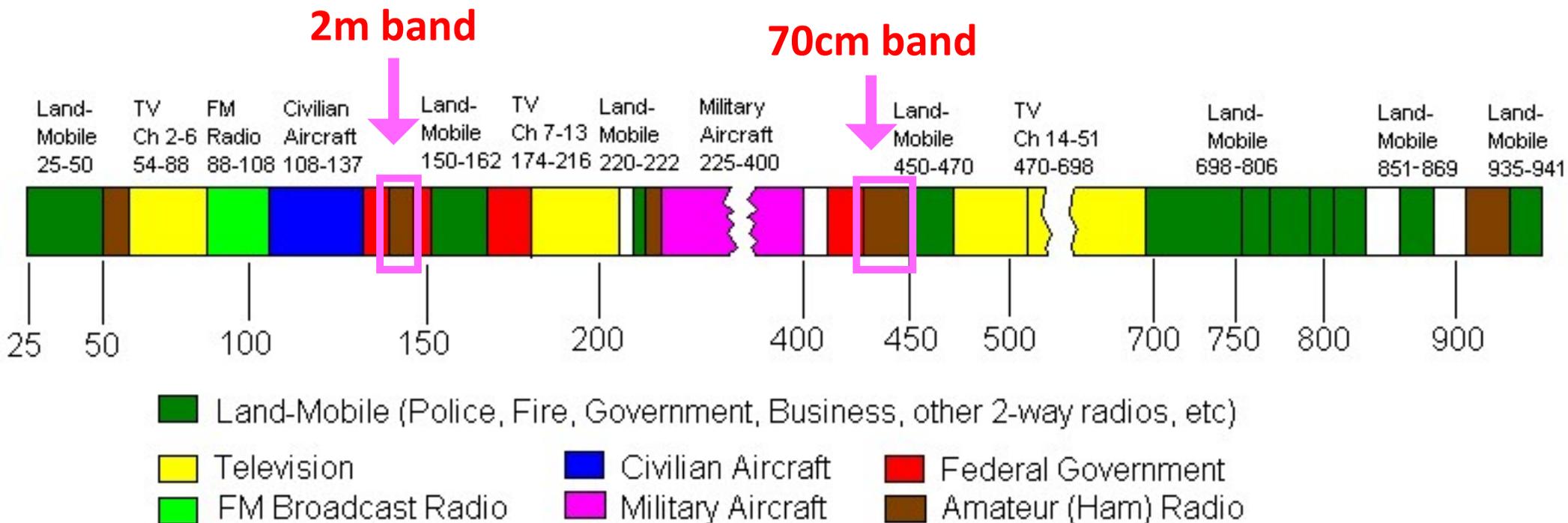
- In theory any radio frequency may be used for communications
- Regulatory agencies (FCC) established what range (bands) of frequencies an operator may use as an amateur, as some bands are reserved for aviation, public services, commercial, and military use
- Not all bands accessible for an amateur may use voice comms as some are restricted to data or morse code
- Most HTs can be used to at least listen to multiple band plans outside of the allowed range
- The amateur band is surprisingly limited in scope

Technician Band Plan



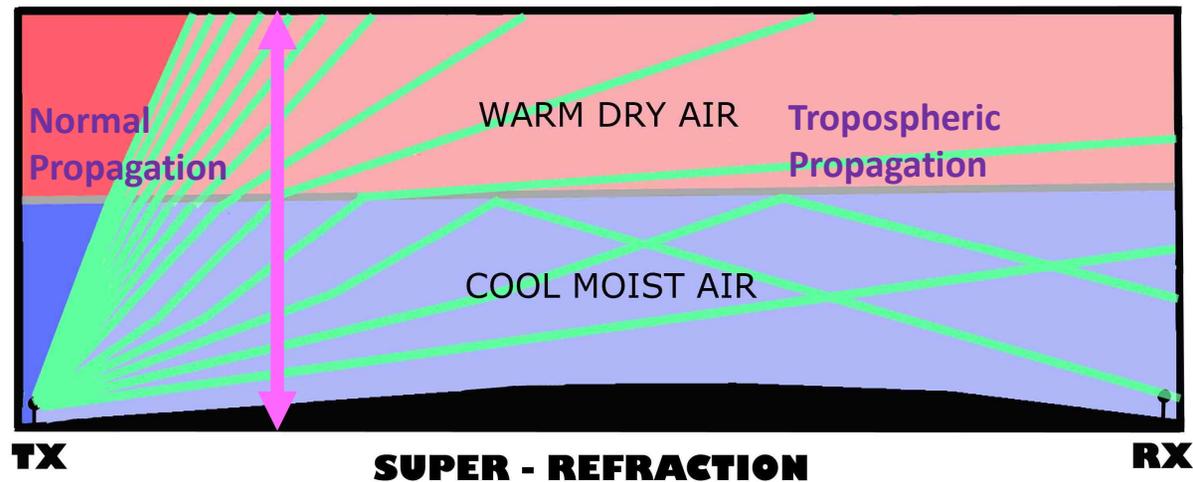
Amateur vs Land Mobile and other plans

- Not all VHF/UHF bands are available to us, some are reserved for aviation, GMRS, commercial & emergency services use (Land Mobile)
 - Emergency bands are even trickier as many are digitally encrypted and use various Land Mobile frequencies



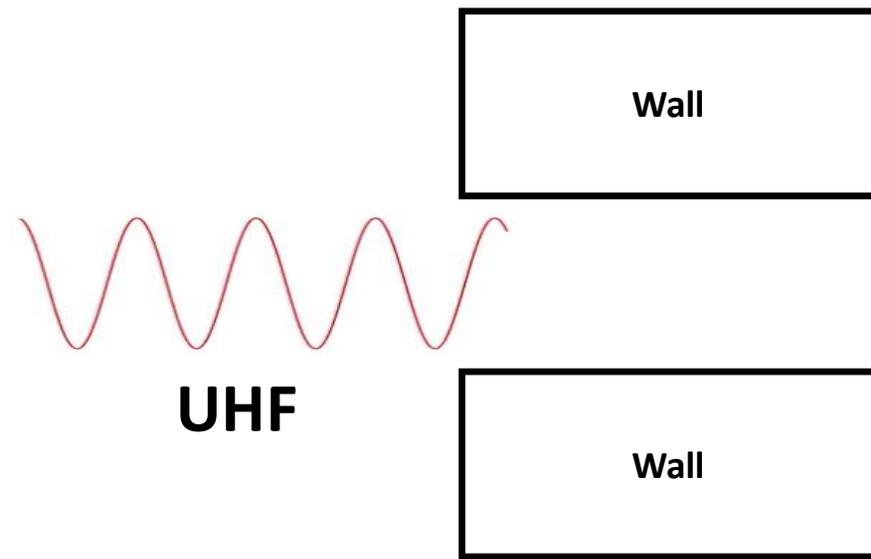
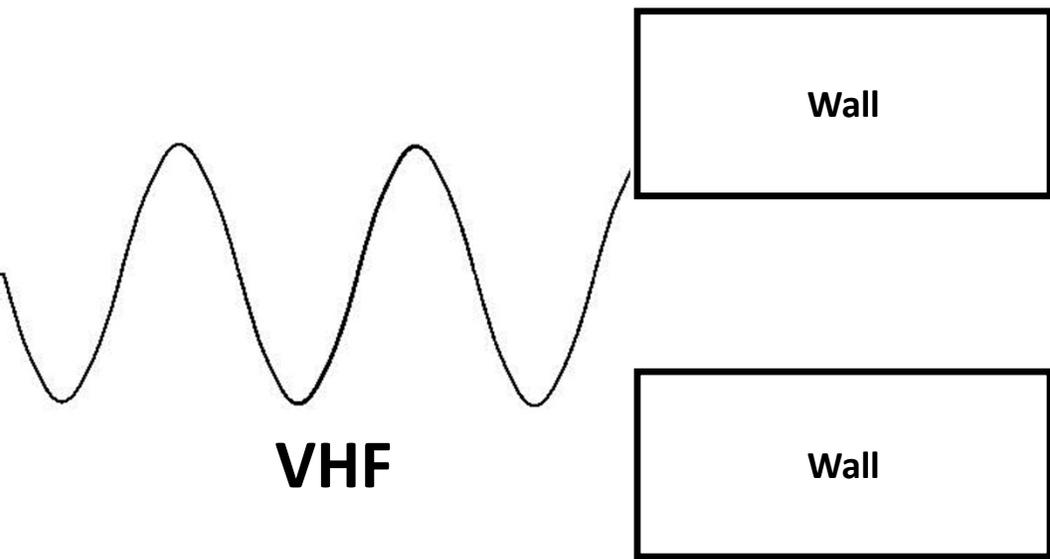
HF vs VHF/UHF

- Both VHF/UHF spectrums (Technician bands) have a few limitations
- HF can bounce off meteors, the ground, the ionosphere, etc. This allows comms up to hundreds of miles away
- HF requires a General license to use and only a handful of HT and Mobile radios exist to support it
- VHF/UHF is useful in local communications within the horizon (LOS)
- VHF Tropospheric Propagation may give much greater range



VHF (2m) vs UHF (70cm)

- Both bands are very common in HAM and have similar performance
- VHF is often used in rural areas as the signal suffers little in terms of losses (few obstructions) and has longer ranges
- UHF is great in urban areas and can transmit more through buildings



Why get a Technician HAM license?

- The Tech license gives you access to the 6m, 2m, 1.25m, & 70cm bands
- Only costs are your study time and a \$10-15 payment to take a test and get your certification
- FCC has been weighing the option of adding a fee to registering as a HAM (like the \$70 GMRS fee) so act soon
- You need to practice just as you would practice at the range
- You are not “registering yourself” any more than you would be by using a cellphone or submitting your taxes
- Everyone may use the same comms vs others trying to cheat with GMRS radios bought on Amazon
- Easily can listen in to other radio traffic

How to get your Technician License

- (1.) Register on the FCC CORES with your personal information
- (2.) Study for the Technician exam via YouTube videos and the online question bank
- (3.) Find a testing date and center (online is possible), usually by a local HAM club on the weekends
- (4.) Pass the test and wait for the FCC to issue you a call sign

<http://www.arrl.org/studying-for-a-technician-license>

https://youtube.com/playlist?list=PLZ_9BZQ8gpzhaGSV3CmTjNkPWFCDMe0xJ

- W4EEY's video series to learn the Technician Exam and radio



GMRS vs Amateur

- GMRS has set channels above 450 MHz with limited power and certain radio feature restrictions
- GMRS requires a license (\$70) but without a test and covers your whole family along with you
- GMRS is limited to UHF frequencies and they are all fixed: *inflexible*
- GMRS radios tend to have lesser quality, range, durability, etc.
- Very few repeaters for the frequencies



Recommended Radios

- Criteria for HT radio selection must include the following:
 - Dual-band (VHF/UHF) or Tri-band
 - Modifiable antennas and audio connection options
 - Programmable by computer
 - Easy to use interface (LCD display)
 - Good audio quality
 - **Optional:**
 - Digital modes
 - Waterproof



The Baofeng Question...

“Are Baofeng UV-5R radios a good option?”

- Short answer: **No.**
 - Audio quality is spotty and the signal range is less than similar HTs
 - Difficult to program, difficult to use
 - Many who buy them are clueless on how to use them
 - QC is inconsistent as some work great but others are terrible
 - Best used as an ad hoc simplex repeater or only for close range comms within a local block or building



Recommended Affordable Radios



Yaesu FT-65R



TYT TH-UV88



AnyTone AT-D878UV

Accessories

- The following accessories should be added to your HT HAM radio
 - Spare battery
 - Battery Charger
 - Programming cable
 - *These three at a minimum*
 - Speaker mic or some other type of connector
 - Wrist strap and/or belt clip
 - Spare/other type of antenna
 - Car power adapter (replaces battery)



Comms: Microphones & Receiving



Throat Mic & Covert Earpiece



Headset & PTT



Speaker Mic

Antennas

- Greater antenna length and gain make transmissions clearer and longer ranged
- 4 common antenna types: “Rubber Ducks”, Flexible, Whip, & Cat Tail
 - Each have advantages but generally whip and flexible antennas give the best signal, rubber ducks are the most durable, and whip & cat tail antennas work best with a kit



Rubber Duck



Flexible



Whip



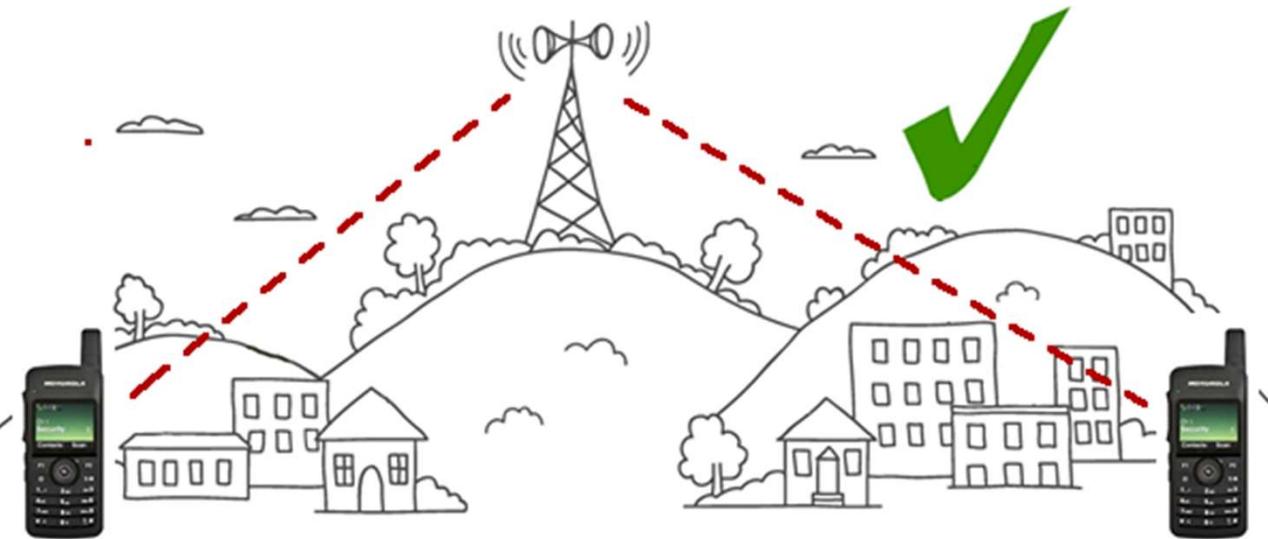
Cat Tail

General Radio Operation

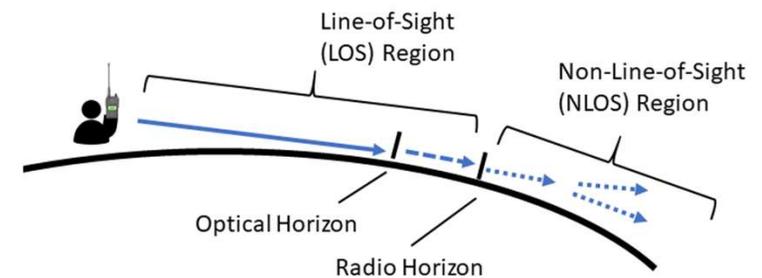
- Two-way radios work with a pause between transmitting and receiving a signal otherwise “hot mic” transmissions will block all other signals
 - Doing this intentionally is known as “jamming” and will only be resolved by stopping the jammer or switching frequencies/bands
- Repeaters help to greatly extend the range of your comms but only work with proper programming (CTCSS tones) and close enough range
- Normally comms are simplex and thus do not require anything more than everyone sharing the same frequency
- Be aware of terrain and vegetation as they can diminish signal strength
- **Radio messages are not private** → Transmit on the lowest possible power with the shortest messages and do not remain too stationary
 - Radio directional finding is a reliable way to home in on any operators

Repeaters

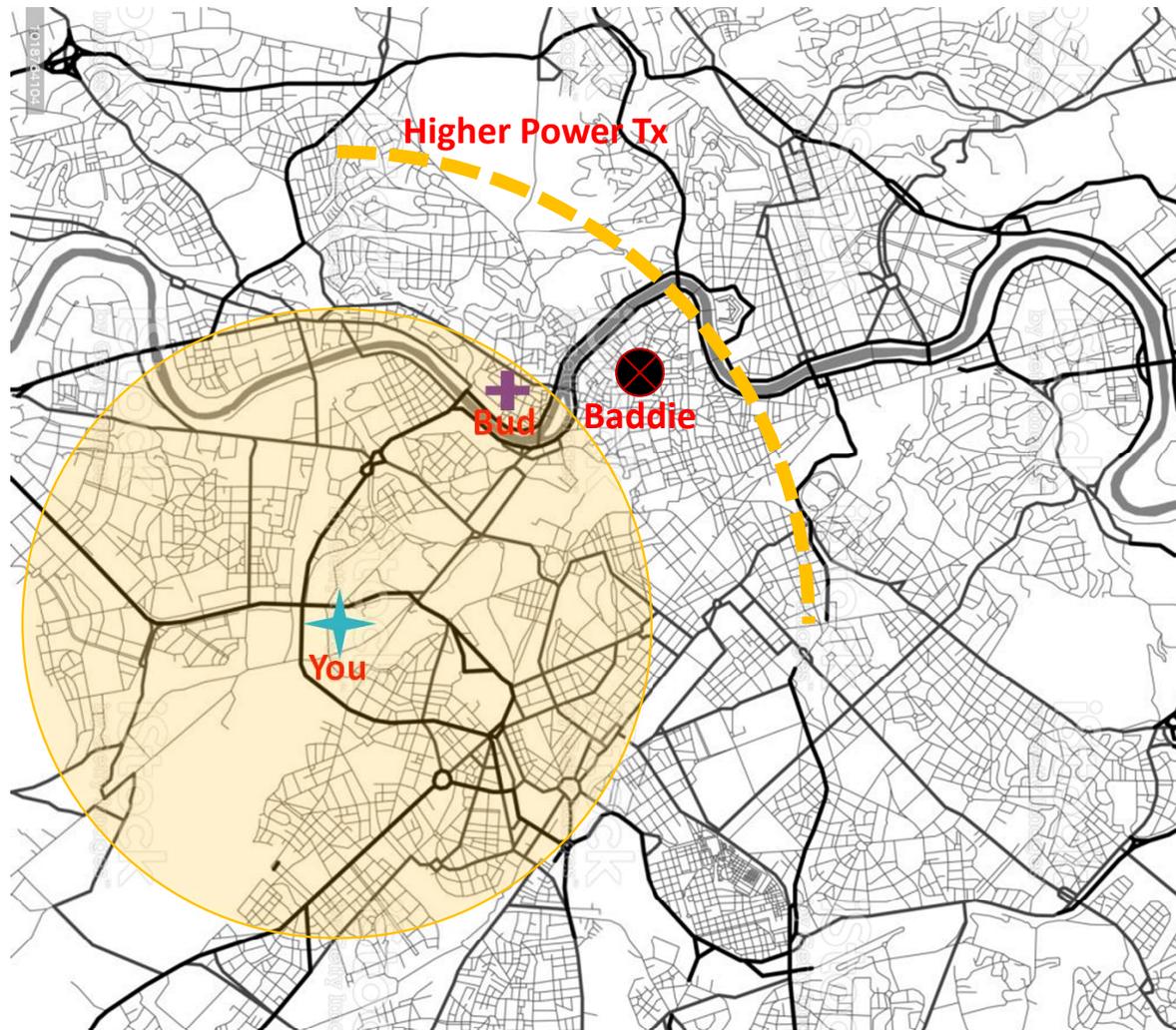
- Allow an RF signal to transmit much farther by repeating it
- Programmed ahead of time and occasionally require CTCSS tones to unlock and speak/hear transmissions from the repeater



Line-of-Sight Model



Simplex Comms: Avoid detection



Limitations of HAM

- Major Geomagnetic storm events may prevent reliable comms
- All comms are public and **trackable**
- Relying on repeaters to talk is no different than cell phone towers →
Electrical grid failure or tower destruction (wind, sabotage)
 - Most ARES repeaters use backup batteries/generators
- Relies on preparation: Proper coordination & frequency management
- Distance, weather, and terrain will always be a hindrance
- A hot mic or jam may easily disable comms thus frequency shifting must be expected
 - In a real emergency those with radios but little to no experience are expected to clog up the airwaves as well as repeaters

You are only as good as the effort you put in!

- Get a good quality HT and accessories
 - You are relying on these things for your protection
- Study and get your technician license
 - Easier than it looks, all questions are public, most clubs test monthly
 - This doesn't need to be immediate but shoot for Valentine's day at the latest
- Further lessons will provide more advanced comms including local repeaters to use, techniques, signal finding, additional radio features, etc.