

Radio Merit Badge

Boy Scouts of America



Module 1 - Radio Basics

BSA National Radio Scouting Committee 2012

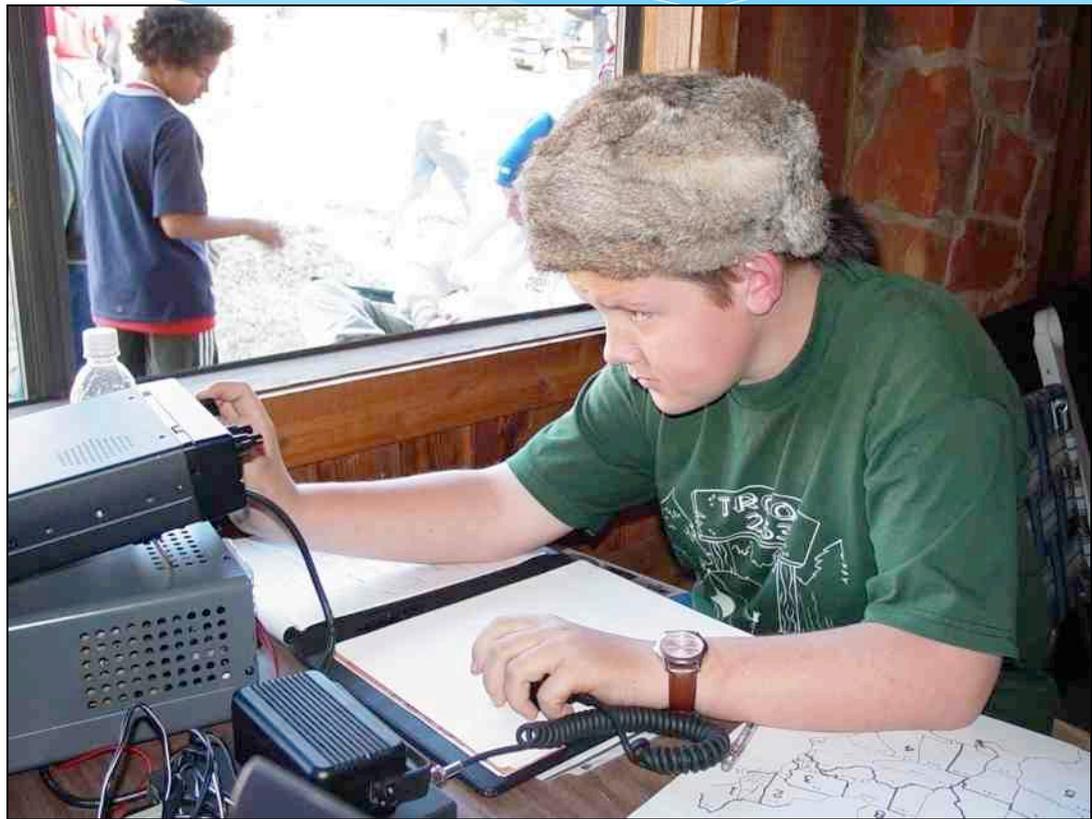


Purpose

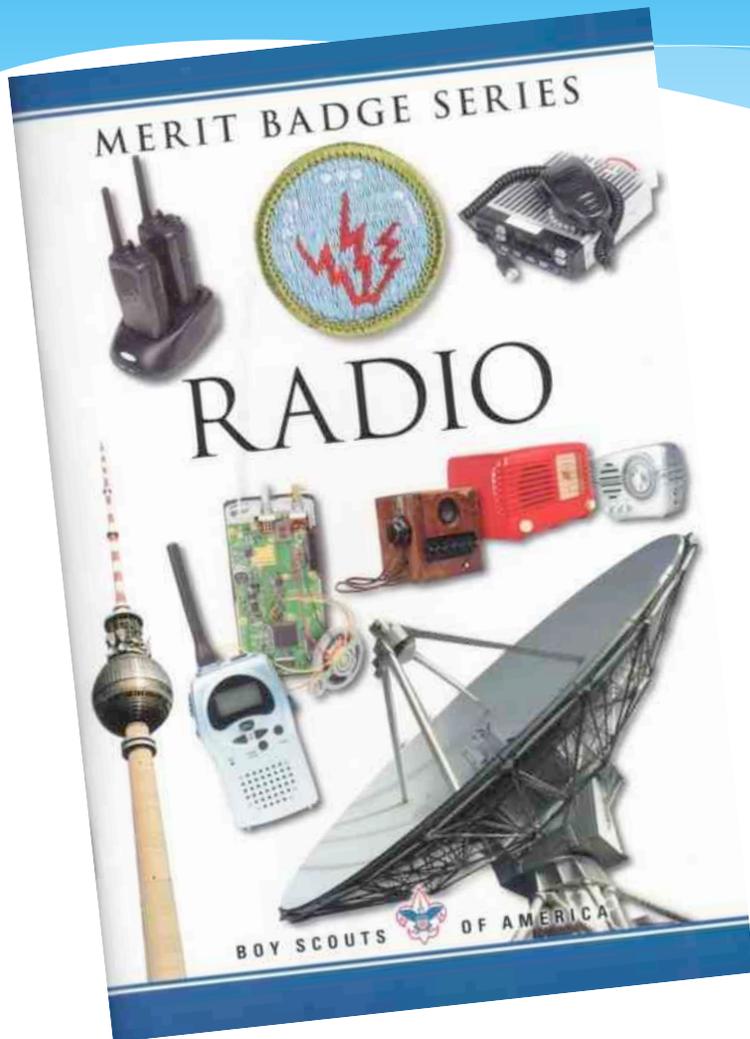
~~Make You a
Radio Expert~~

Basic
Familiarity
With Radio

Emergency
Preparedness

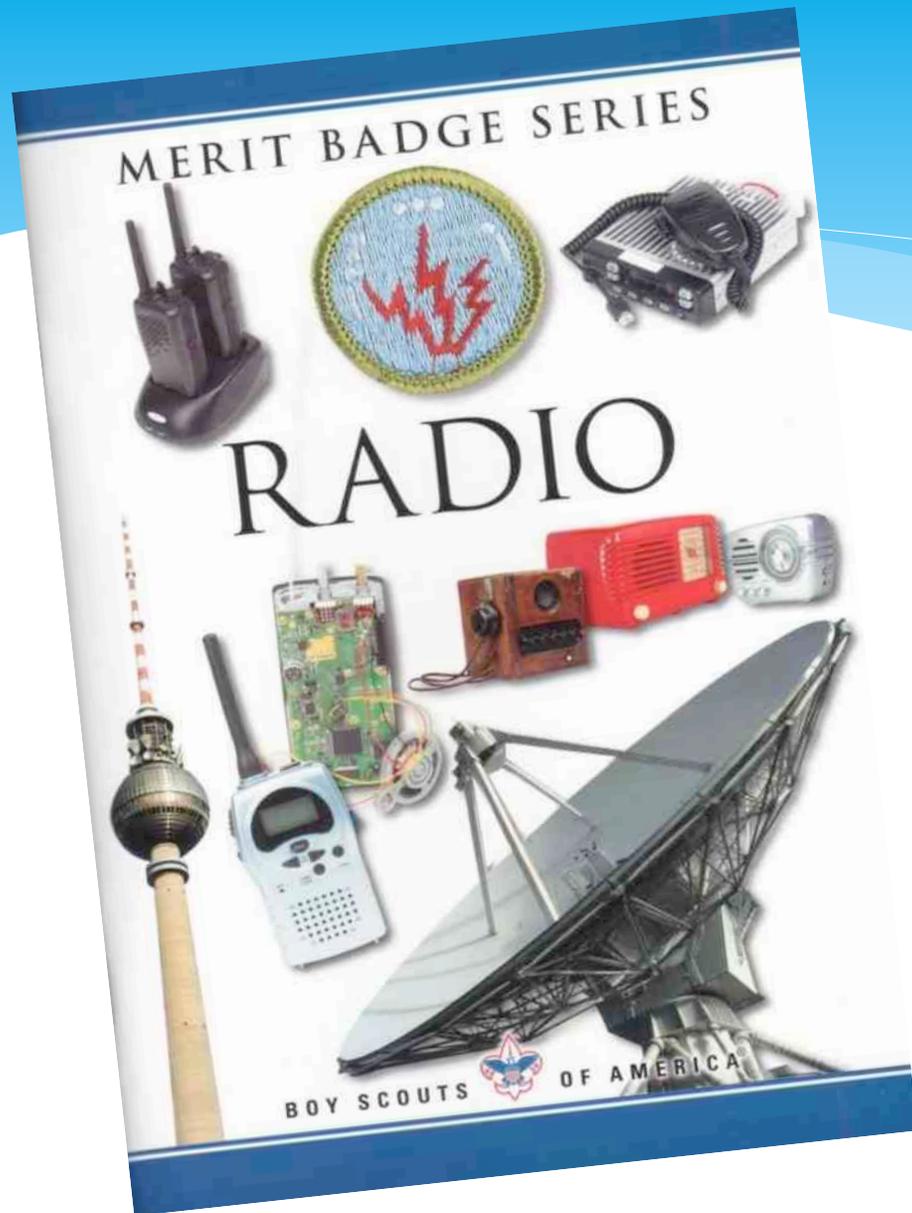


Class Format



- * **Three modules – any order**
- * **Module 1 – Intro To Radio**
- * **Module 2 – Electronic Components & Safety**
- * **Module 3 – Amateur Radio & Emergency Communications**

Module 1



Introduction To Radio

Key Topics in This Module

- * **1 - What is Radio?**
- * **1a,1b - Types of Radio Services**
- * **1c - Radio Call Signs & Identification**
- * **1d - The Phonetic Alphabet**
- * **2a - Radio Wave Propagation, WWV & WWVH**
- * **2b - The FCC & ITU**
- * **3a - The Electromagnetic Spectrum**

What Is Radio?

Electronic communication from one location to another without wires



1920s-era
Radio
Receiver

Where Radio is used



* **Radio** is used in:

- * broadcast receivers
- * two way radios
- * televisions
- * cellular telephones
- * wireless LANs
- * garage door openers
- * car locks
- * EZPass
- * satellites
- * pagers
- * radar
- * microwave ovens
- * etc, etc



Broadcast Radio

- * **Broadcast - One-way** transmissions to the public. Could be **commercial** (music, news, sports with advertisements) or **non-commercial** (National Public Radio, school radio stations, Voice of America)



**Three Types Of
Radio**

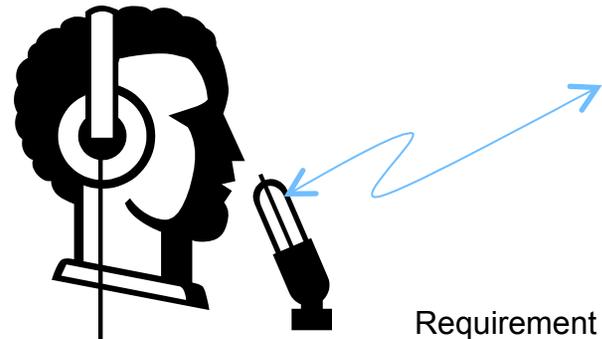
Broadcast Radio Towers

Examples of radio transmission towers you may see:



Two-Way Communications

- * **Two Way** Radios both send (transmit) and receive messages.
 - * walkie-talkies
 - * Amateur Radio
 - * cell phones
 - * fire and police
 - * aviation
 - * ships
 - * military, etc.



Requirement 1

Hobby Radio

- * **Use of the radio by the public to communicate with others or to control models.**
- * **Amateur radio is a licensed type of Hobby Radio**



Requirement 1

Three Types Of Radio

Amateur Radio

- * A volunteer non-commercial radio service devoted to educational, recreational and emergency purposes
- * “HAM” Radio
- * “Hobby” Radio



Why Amateur Radio?

- * A place to learn about radio!
- * Called the “*Amateur Radio Service*” because it can't be used for profit.
- * An important part of disaster response.
- * A lot of fun!



Technology In The Wilderness

From the BSA Field Book, page 436...



“Many SAR teams use ham radio technology, especially the two-meter band and the FCC Technician license, to facilitate communications.”

Radio Call Signs

- * **Call Signs** are identification. They **show you have a license** to transmit.
- * **Broadcast Call Signs**
 - * WHO, KDKA, KORA, WNBC
- * **Ham Call Signs**
 - * WW3Y, KB3BOY, VR2DK, 9N1MM, JA1ABC
 - * A92EB/OZ, G4RZC/MM
 - * All ham call signs contain a number

US Call Signs

- * Every US station has a call sign issued by the Federal Communications Commission (FCC)
- * Broadcast call signs begin with K or W

KXAS

WBAP

- * Amateur call signs begin with A, K, N or W

AB2SNKF5WT

NY8N

W3ZLP

Amateur Radio Call Signs



International Call Signs

* International call sign prefixes assigned by the International Telecommunications Union (ITU)

* Countries issue specific call signs

* Examples:

The World
POLITICAL

• XE – Mexico

• VE – Canada

• VK – Australia

• ZL – New Zealand

• PY – Brazil

* G – Great Britain

* F – France

* I – Italy

* 4X – Israel

* JA – Japan

4K,ZL5,CE9A,KC4

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Station Identification Rules

Broadcasters

- Once per **hour**.

Amateurs

- Every **ten minutes** and at end of a conversation.

Phonetic Alphabet

Alfa AL fah

Bravo BRAH VOH

Charlie CHAR lee

Delta DELL tah

Echo ECK oh

Foxtrot FOX trot

Golf GOLF

Hotel hoh TELL

India IN dee ah

Juliet JEW lee ETT

Kilo KEY loh

Lima LEE mah

Mike MIKE

November

no VEM ber

Oscar OSS cah

Papa pah pah

Quebec keh BECK

Romeo ROW me oh

Sierra see AIR rah

Tango TANG go

Uniform YOU nee form

Victor VIK ter

Whiskey WISS key

X-Ray ECKS RAY

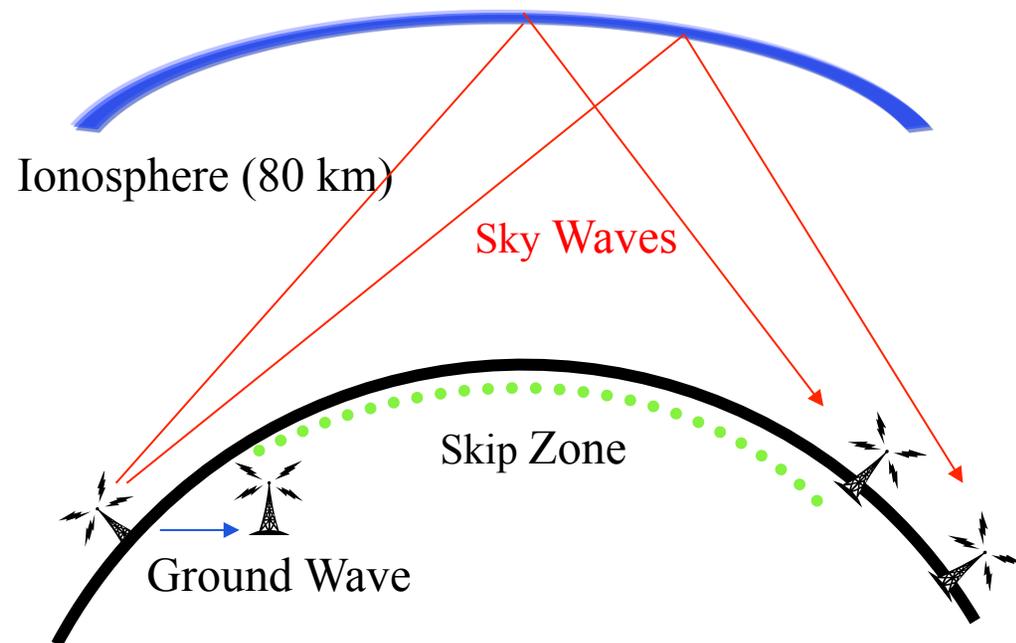
Yankee YANG kee

Zulu ZOO loo

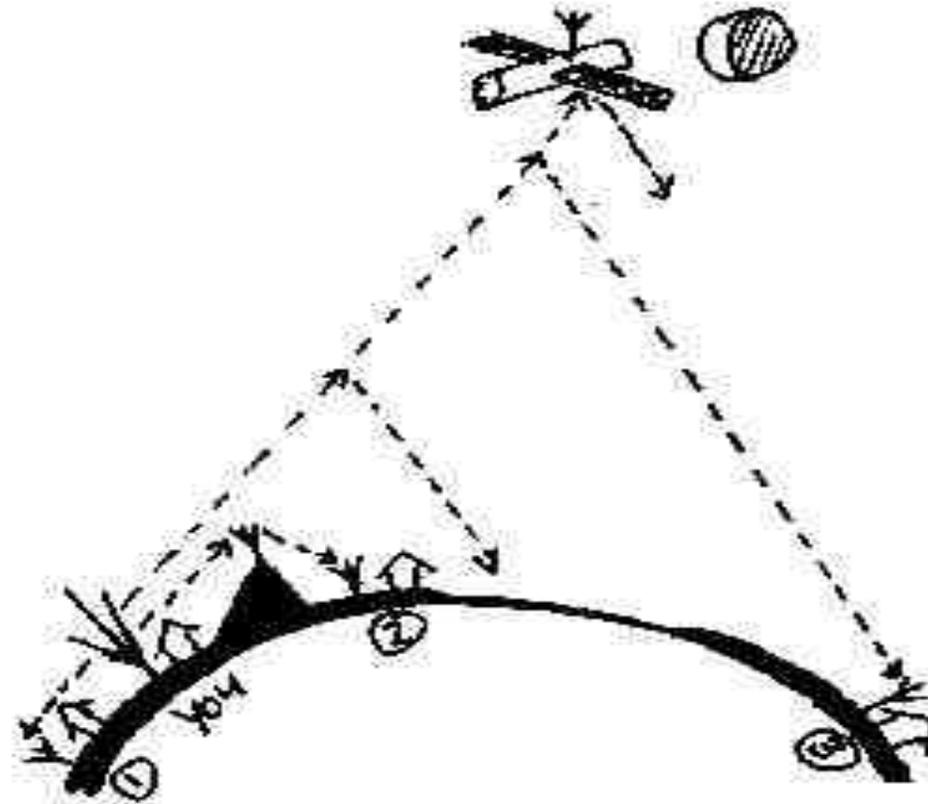
Example: “My name is Tom – *tango, oscar, mike* – Tom”

How High Frequency (HF) Radio Waves Travel (Propagation)

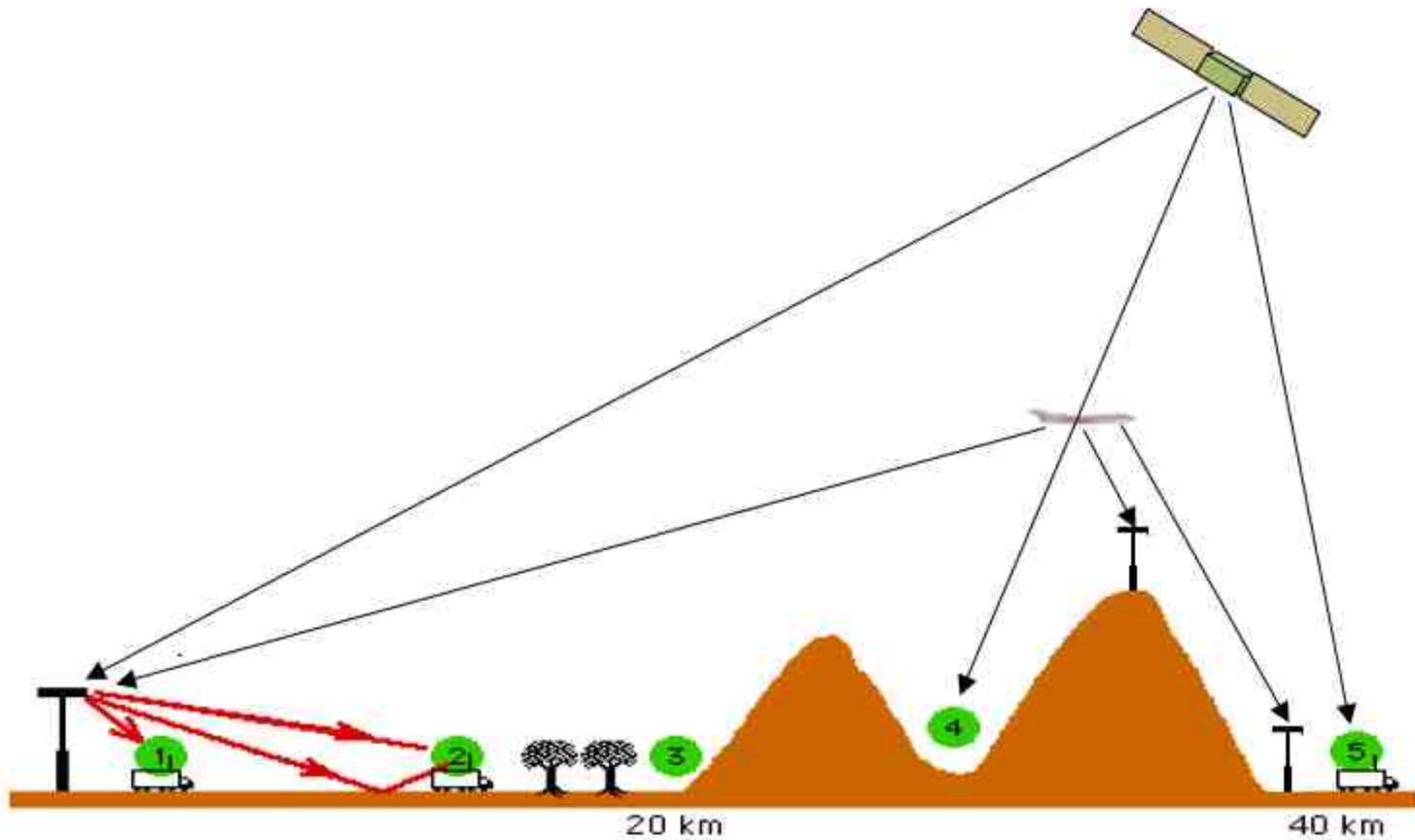
- * Ground Wave
- * Sky Wave
- * Ionosphere
- * Skip
- * Local
- * DX



How VHF & UHF Radio Waves Travel (1)



How VHF & UHF Radio Waves Travel (2)



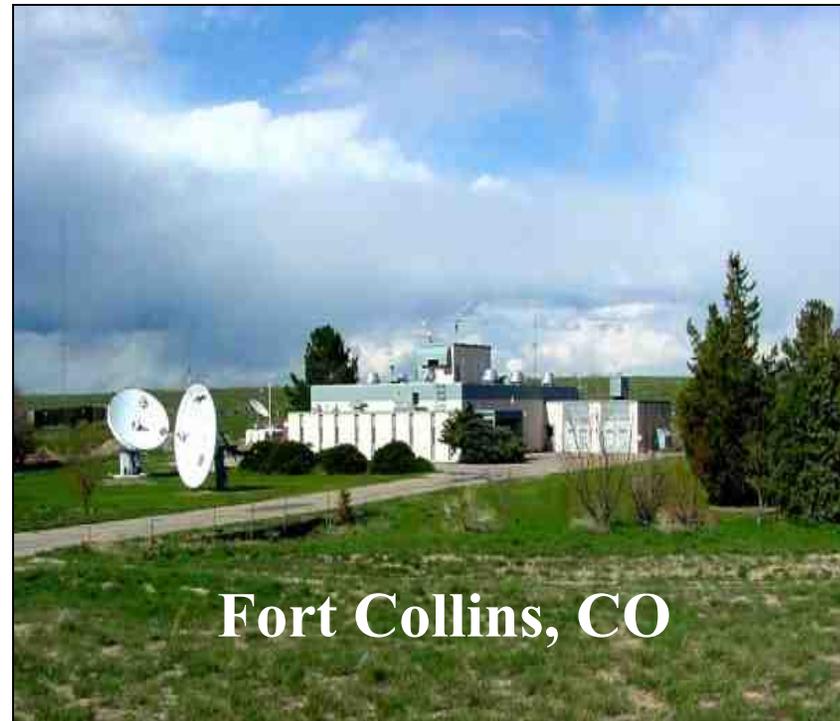
Radio Propagation Characteristics

- * **HF Wavelengths (160 – 10 meters)**
 - Generally utilizes skywave propagation
 - Affected by solar activity
- * **VHF Wavelengths (6 meters – 2 meters)**
 - Generally utilize line-of-sight
 - Affected very little by solar activity
- * **UHF Wavelengths (70cm and shorter)**
 - Generally utilize light-of-sight propagation
 - Affected much by terrain, buildings

Radio Station WWV

- * Transmits on standard frequencies
- * If you can hear WWV, the HF bands are open

2.5, 5, 10, 15 and 20 Mhz



Regulation of Radio

* ITU

- * **I**nternational **T**elecommunications **U**nion
- * Meets every few years.
- * Sets International Frequency assignments.
- * Assigns prefixes to countries.

* FCC

- * **F**ederal **C**ommunication **C**ommission
- * Set Frequency Assignments in US.
- * Issues Licenses & Call Signs in US.
- * Enforces Radio Laws in US.

Frequencies

(One Hertz is cycle per second)

- * DC Power
- * AC Power
- * Audio (Sound)
- * LF
- * MF
- * HF or Shortwave
- * VHF
- * UHF
- * Microwave
- * Visible Light
- * 0 Hertz (goes in one direction only)
- * 60 Hertz (Hz)
- * 100 Hz to 20 KHz (100 - 20,000 Hz)
- * 30-300 kHz (30,000-300,000)
- * .3-3 MHz (300,000-3,000,000)
- * 3-30 MHz (3,000,000-30,000,000)
- * 30-300 MHz (30,000,000-300,000,000)
- * 300-3,000 MHz (well, you get the idea)
- * Frequencies above 500 MHz
- * 400-800 THz (400,000,000- 800,000,000 MHz)

So, what frequencies are assigned to whom?

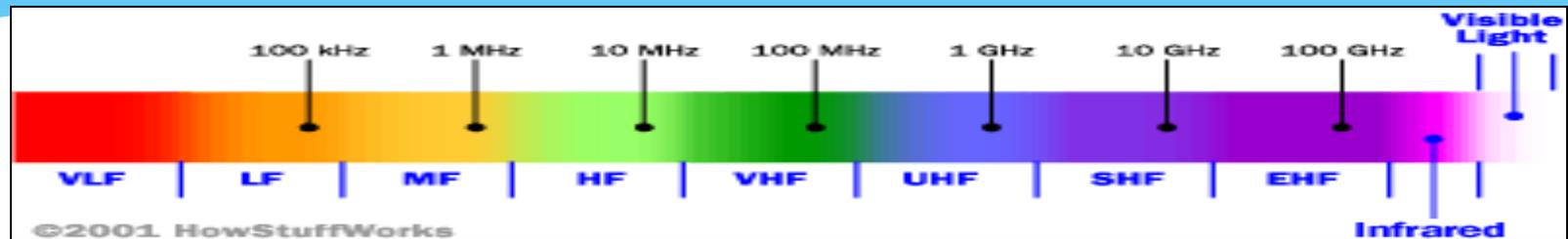
- * AM Broadcast Radio * 540 - 1600 kHz
- * FM Broadcast Radio * 88 - 108 MHz
- * Short Wave Broadcast * 5 - 22 MHz
- * Television Broadcast * Channel 2 = 54-60 MHz
- * CB Radio * 27 MHz
- * Police Radio * 450-470 MHz
- * **Amateur Radio** * **3.5, 7.5, 10, 15, 20, 30, 50, 150 MHz**
80, 40, 30, 20, 15, 10, 6, 2 meters

Freq=C/meters

C=300,000,000 or

Freq (MHz)= 300/meters

The Electromagnetic Spectrum



↑
Sound

↑
Long Radio
Wavelengths

↑
Short Radio
Wavelengths

↑
Microwaves

Frequency - Measured in Hertz (kilohertz, megahertz, gigahertz)

Wavelength – Measured in meters (cm)

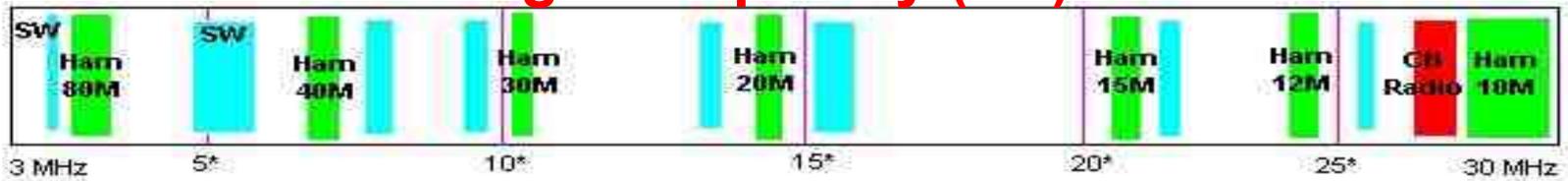
Electromagnetic Radiation Demonstration

The Electromagnetic Spectrum

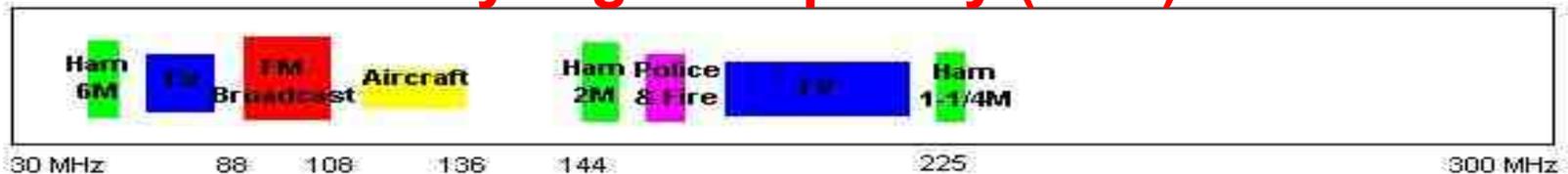
Medium Frequency (MF)



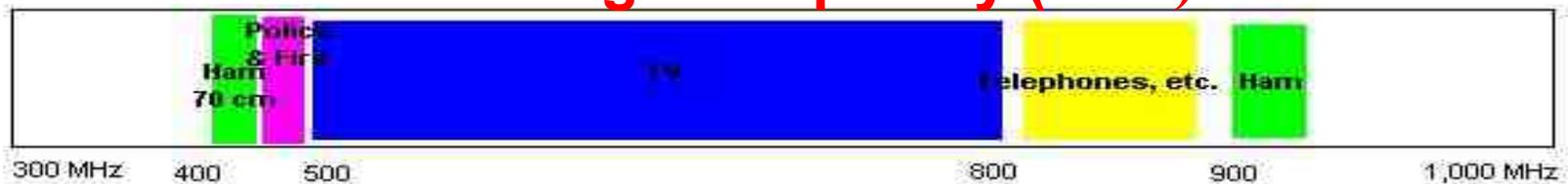
High Frequency (HF)



Very High Frequency (VHF)

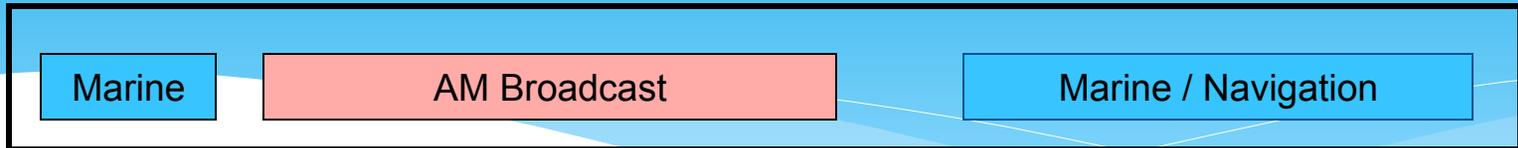


Ultra High Frequency (UHF)



DRAW the Electromagnetic Spectrum

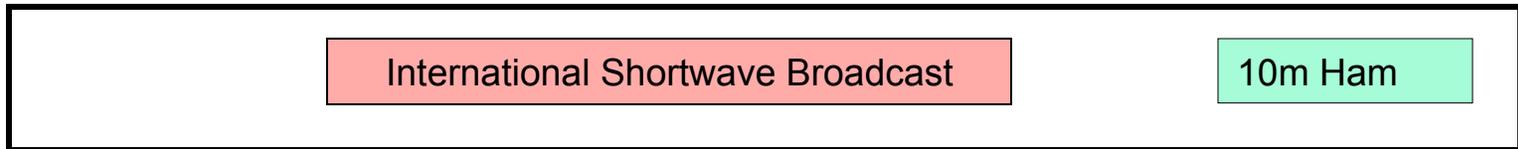
MF



300 KHz

3 Mhz

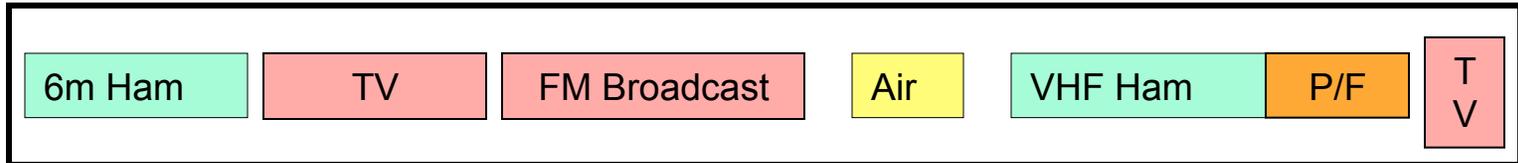
HF



3 Mhz

30 Mhz

VHF



30 Mhz

300 Mhz

UHF



300 Mhz

3 Ghz