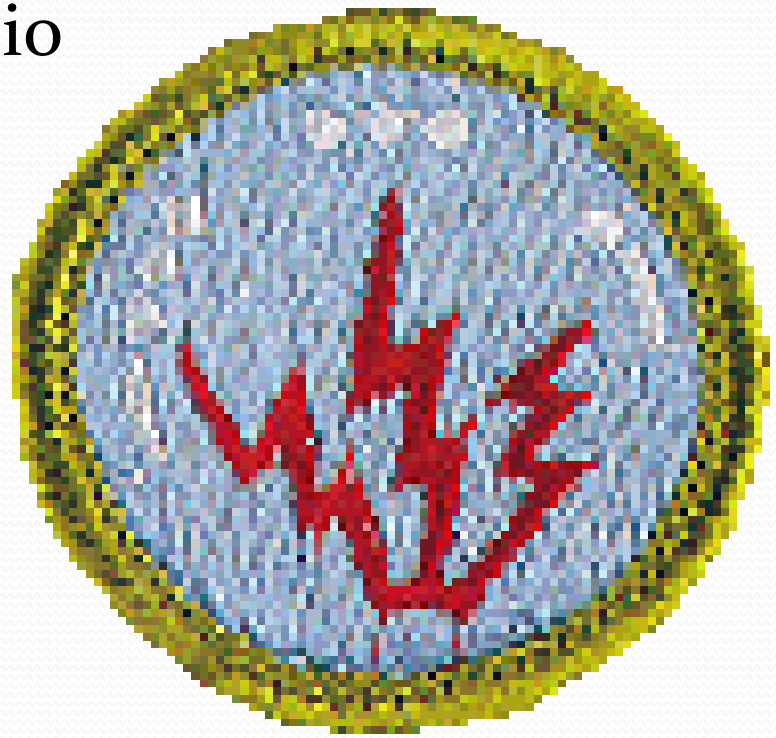

20 Aug 2022
ADXA
Albuquerque DX Association
Good DX
Good Luck in the Contest!
https://groups.io/g/adxa

Who Am I?

- Bill Mader, K8TE
- Former Boy & Explorer Scout
- Licensed 62+ Years as an Amateur Radio Operator
- Commercial Broadcast License 40+ Years
- American Radio Relay League Section Manager
- College Instructor
- Enthusiastic, Experienced Ham Radio Operator
- Still Learning for Fun!

Radio Merit Badge

- What is Radio?
- Radio Services
- Commercial vs. Amateur Radio
- Antennas
- Using Diagrams
- Signals and Modes
- Governing Agencies



What is Radio?

- Electromagnetic Waves Propagating
- Transmitters & Receivers or Transceivers
- Antennas & Accessories
- Communicates Information
- Many Radio Services Including
  Broadcasting
  Amateur Radio
  Family Radio
  Land Mobile Radio

Cellular Systems

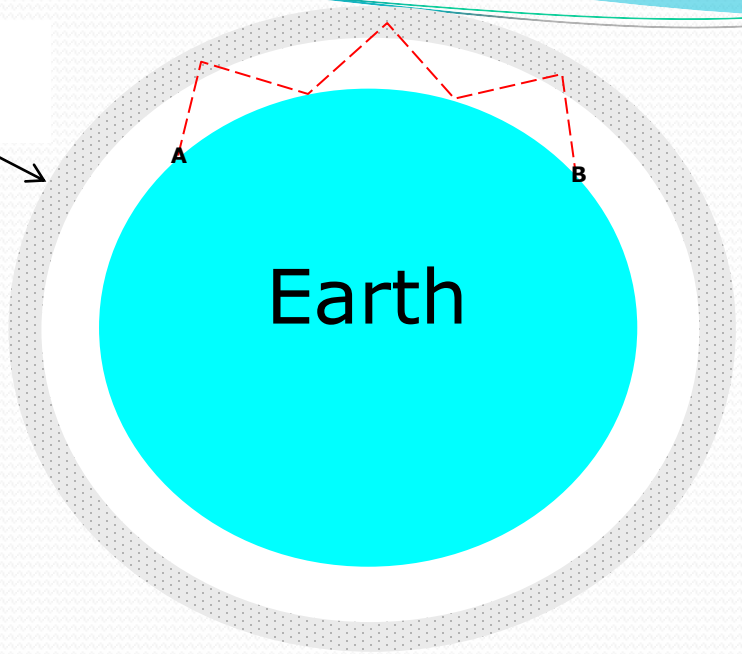
- Big, Big Systems (Nation-Wide Coverage)
- Many “Local” sites (cover under 20 miles each)
- Sites are Linked Together
- Handoff Calls to the Next Site
- Cellphones Are Radio Transceivers (and More!)

Cellular Systems

- **Advantages**
  - Simple to Operate
  - Minimal User Training/Knowledge

- **Disadvantages**
  - Limited Battery Capacity at Sites
  - Subject to Commercial Power Failures
  - Concept Only 10% of Users at Any Time
  - Often Useless in an Emergency (Ham Radio)

How Radio Waves Travel



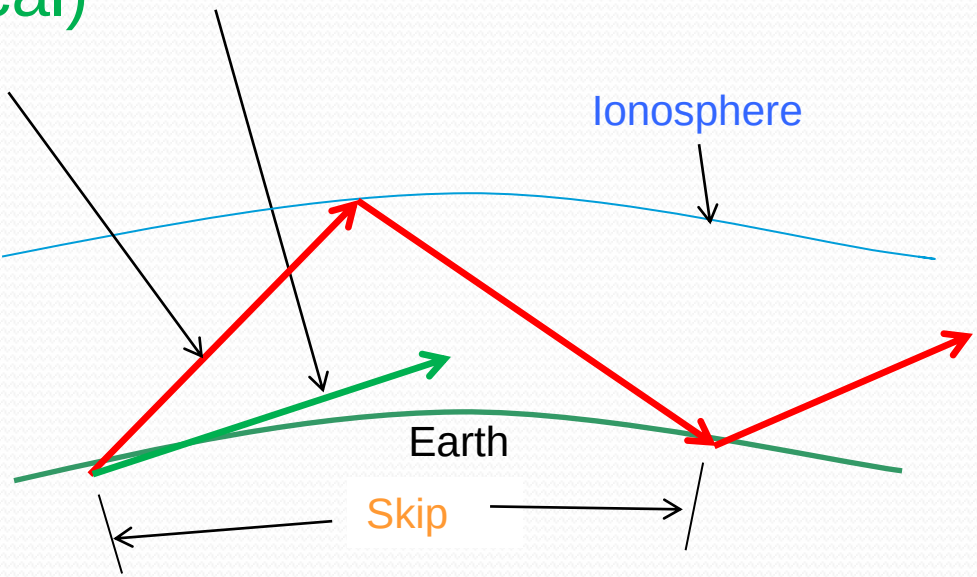
Around the World

Local

Earth

High Frequency (HF) Radio Waves Propagation

- Ionosphere
- Direct Wave (Local)
- Sky Wave (DX)
- Skip
- Local
- DX



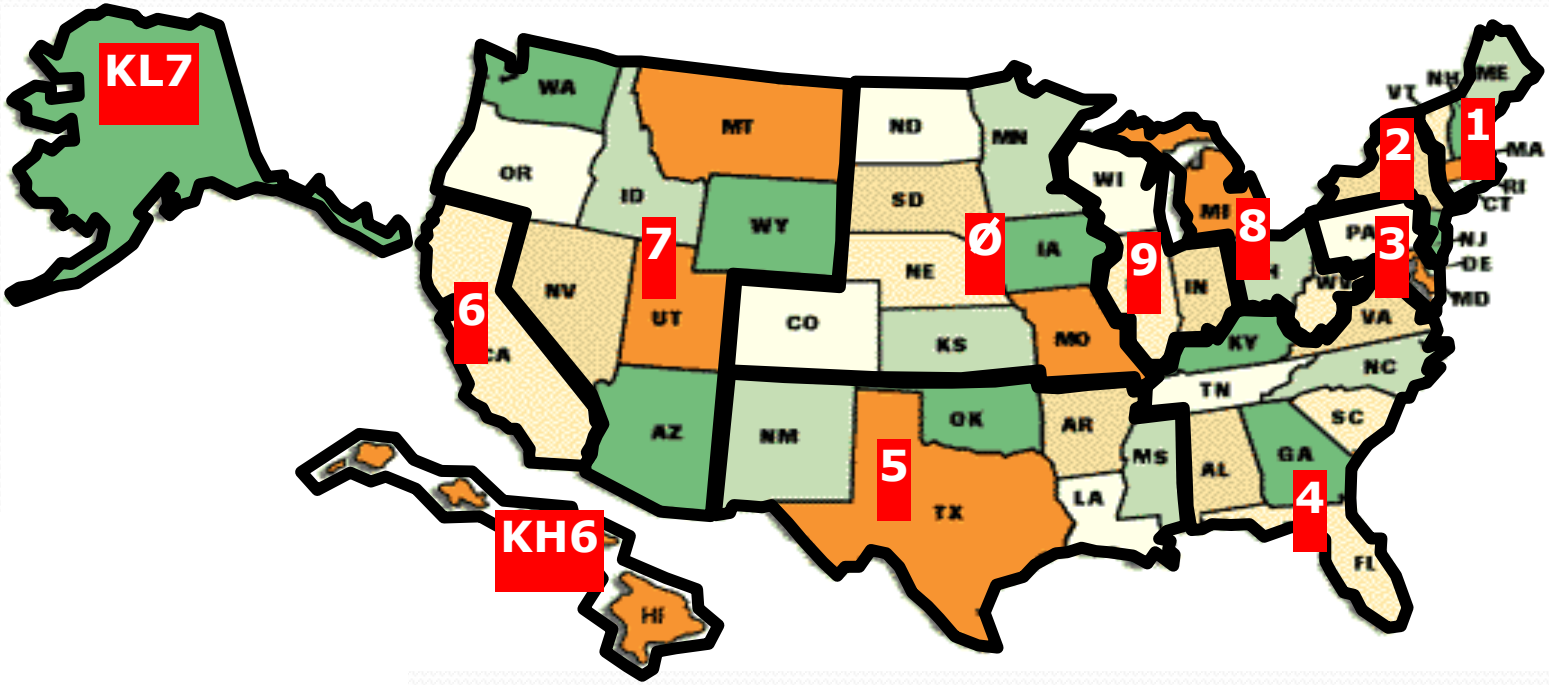
NOAA Weather Radio

- Computer Voice Broadcasting Weather Information
- Transmitters on Towers or Mountains
- Alert Tones Turn On Receiver Audio
- 24/7 Coverage
- Not All Areas Covered

Callsigns

- Unique Identifiers
- National Assignments of Letters
- Commercial Broadcasting: KKOB, KRQE, KOAT
- Amateur Radio Beginning A, K, N, W
  AA5B, K8TE, N6SIK, W1AW

2
ORIGINAL CALL SIGN DISTRICT

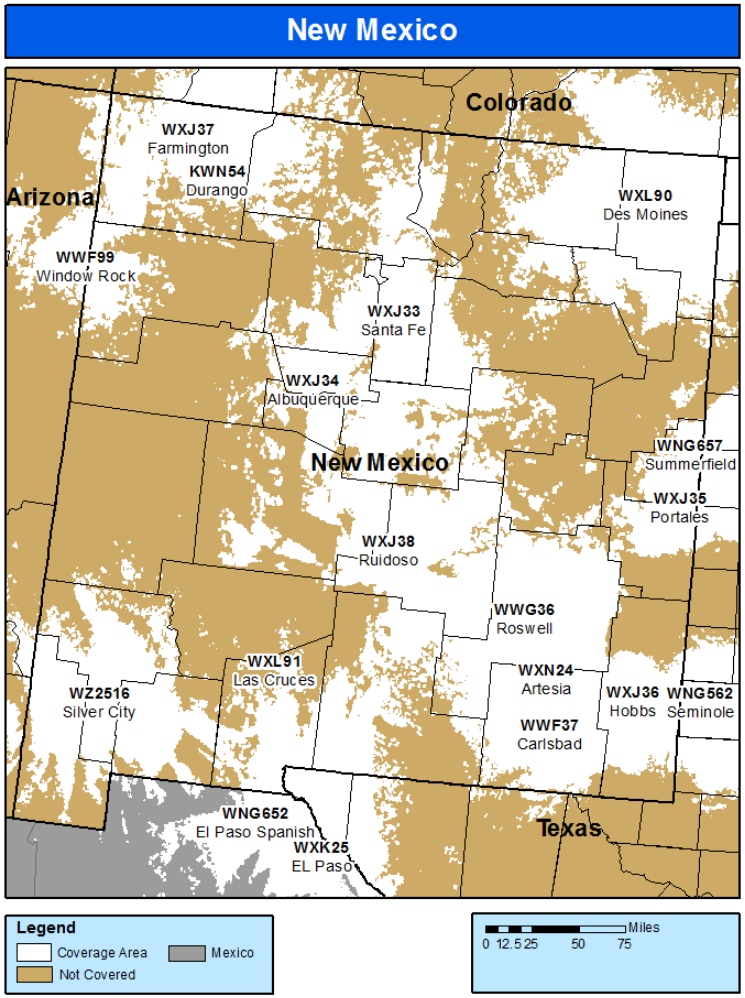


Phonetic Alphabet

- Avoids Ambiguity Like F&S B&V M&N T&P
- Weak or Noisy Signals
- Helpful for Non-English Speakers
- ICAO Alphabet (Standard)
  International Civilian Aviation Organization
- Foxtrot vs. Sierra
- Bravo vs. Victor
- Mike vs. November
- Tango vs. Papa

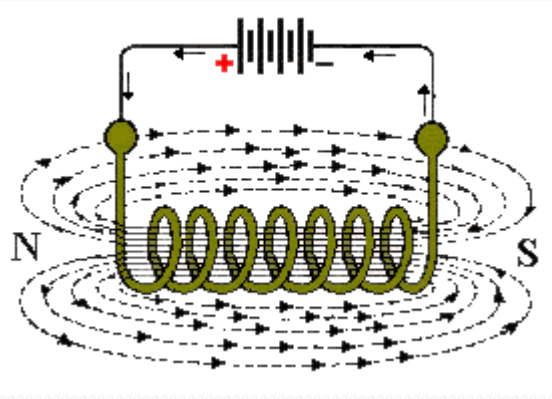
NM NWR Coverage

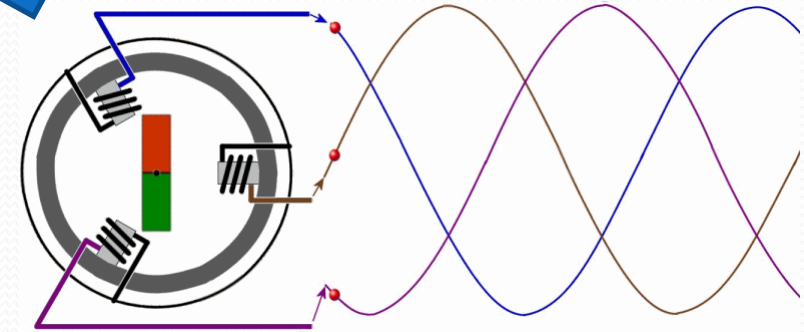
- Brown Area
  No Coverage
- Some Transmitters
  Out of Service
- Mora County Burn Scars
  NOT Covered
- Flash Floods Prevalent
- Apps Available but
  Require Cell Coverage
- Portable Lightning Detectors

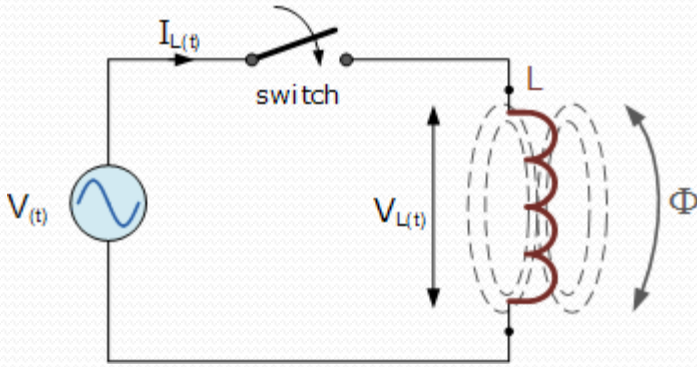


Electromagnetism

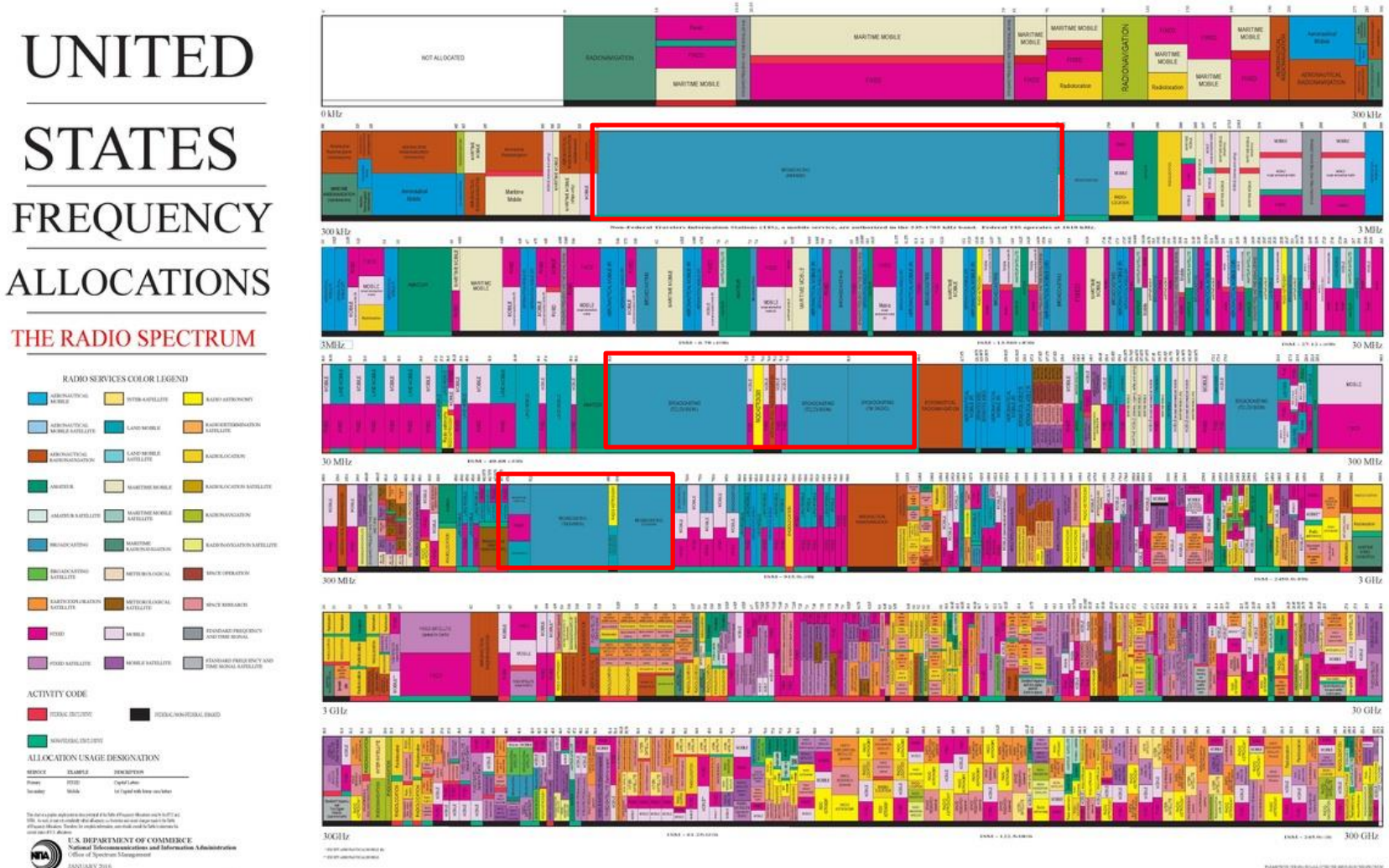
- Electron Flow through Conductor
- Generates an Electromagnetic Field
- Direct Current Example
- Alternating Current



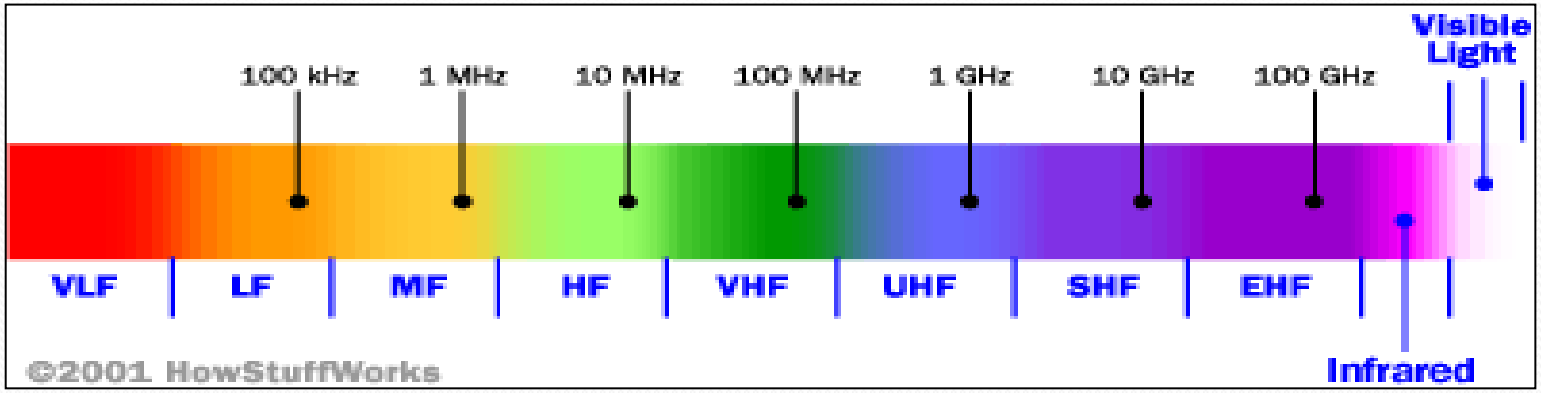




Radio Frequency Spectrum



The Electromagnetic Spectrum



Sound

Long Radio Wavelengths

Short Radio Wavelengths

Microwaves

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

Wavelength – Measured in meters (cm)

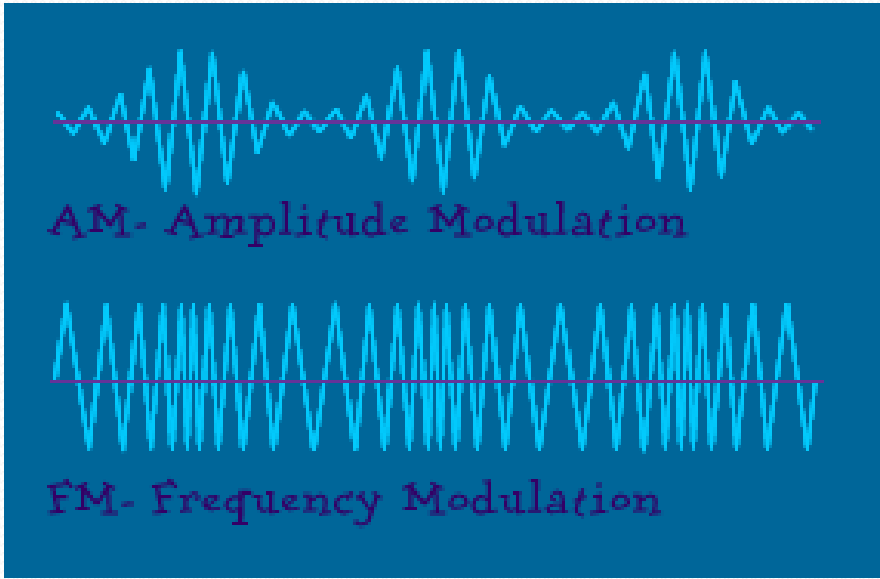
Inverse relationship between frequency and wavelength

AM vs. FM Signals

- Modulation: Information Added to The Carrier
- Demodulation: Separating the Information for Use

- Amplitude Modulation

- Frequency Modulation



Common Equipment

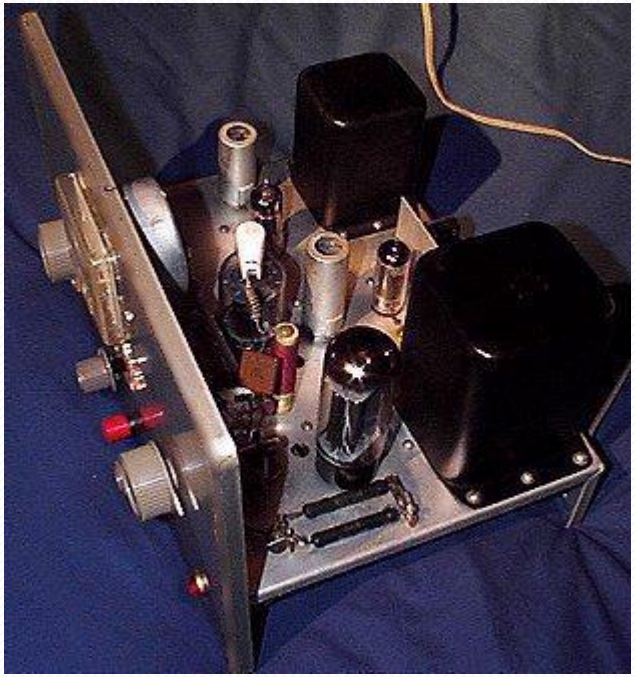
- Transceiver (Combination of TX & RX)
- Transmitter
- Receiver
- Amplifier Increases Transmitter Power Output
- Antenna Radiates RF Energy into the Ether

Transceiver

- Icom IC-7300

Transmitter

- Heathkit DX-40



- Crystal Controlled (no Tuning Dial)

Receiver

- Hallicrafters S-38D
- 1955 Model $49.95 $535 in 2022 Dollars!
- AM Broadcast to 30 MHz

Today's Receiver

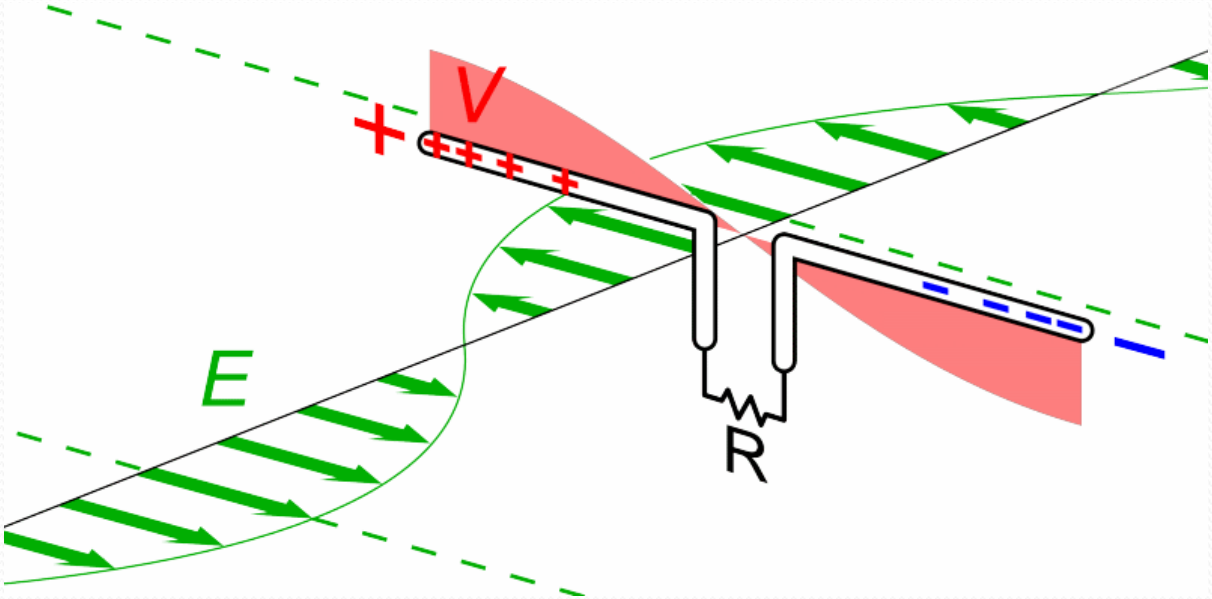
- SDRPlay RSP-1A $125 $9.35 in 1955 Dollars!
- A Little Hardware
- Lots of Software!
- No Earphone Jack
- Requires a Computer

VHF/UHF Transceiver Examples

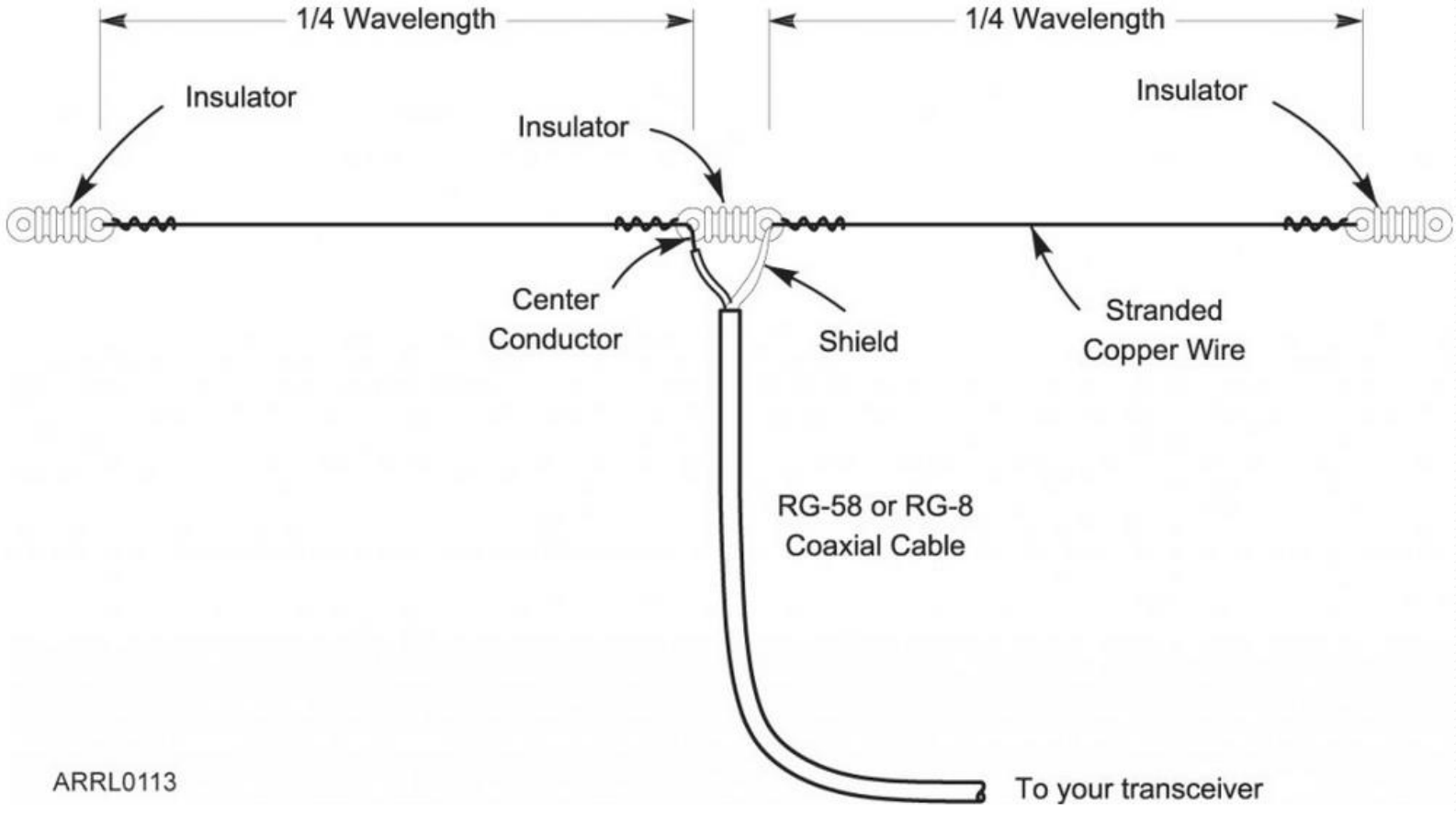
- Mobile Rig Often Used at Home
- Shiny Aluminum on a Tower
- HT—Complete Station

Antenna

- Half Wave Dipole
- L=468/f Length in Feet Frequency in MHz
- Electromagnetic Radiation
- Simple and Effective

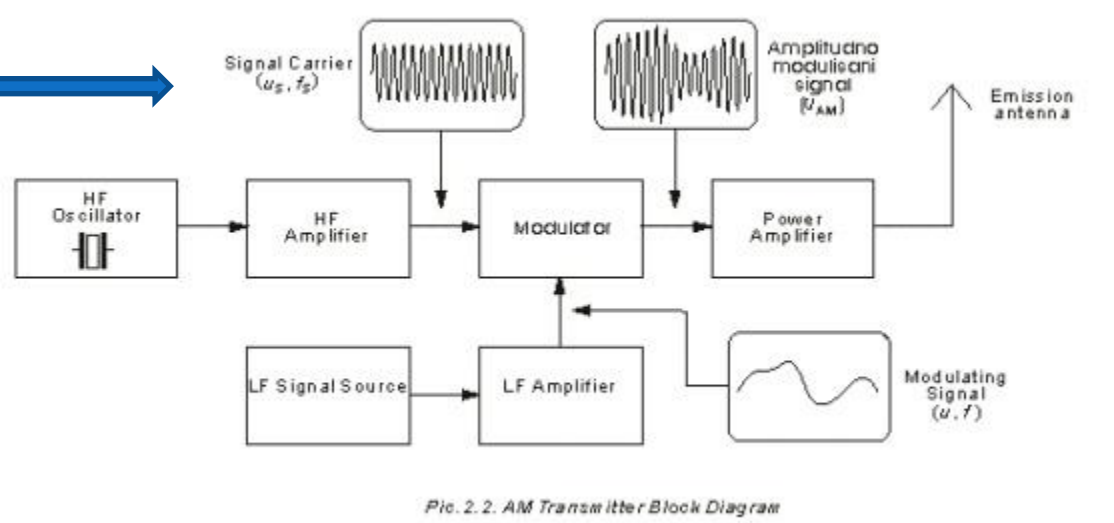


Practical Half Wave Dipole

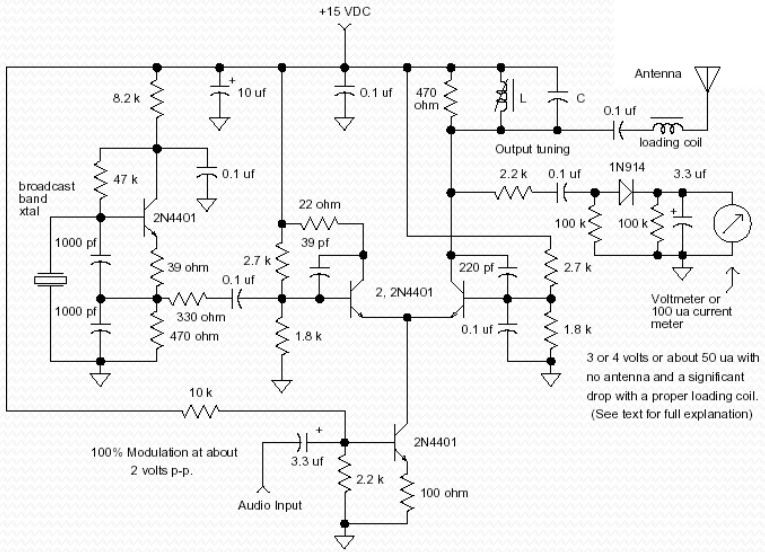


Radio Diagrams

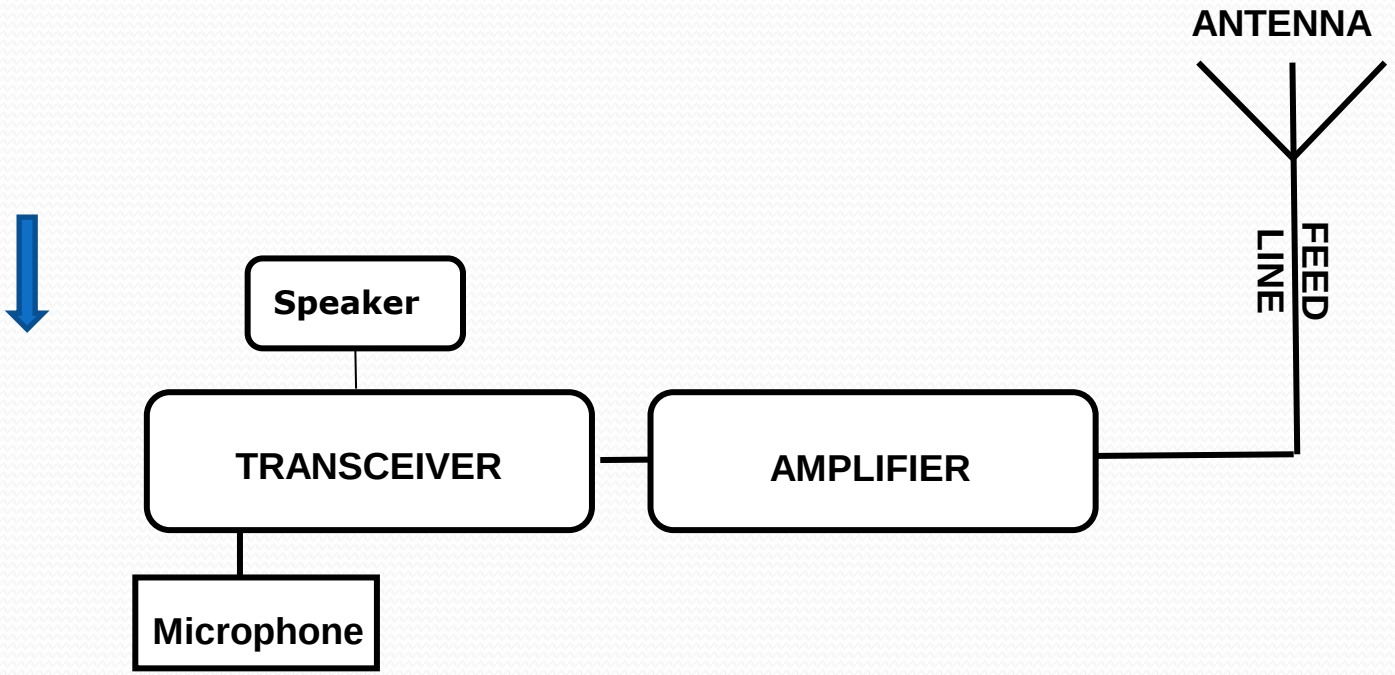
- Block Diagram
- Schematic



Pic. 2. 2. AM Transmitter Block Diagram

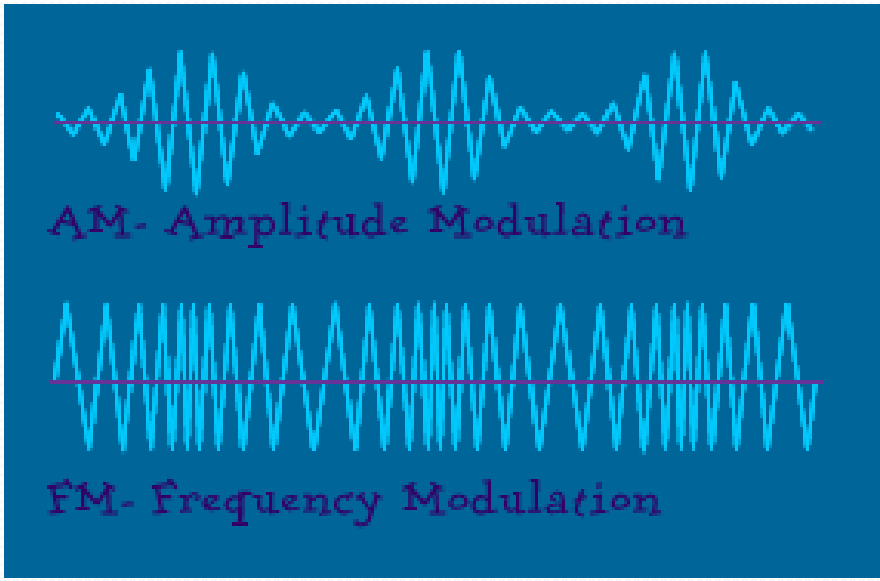


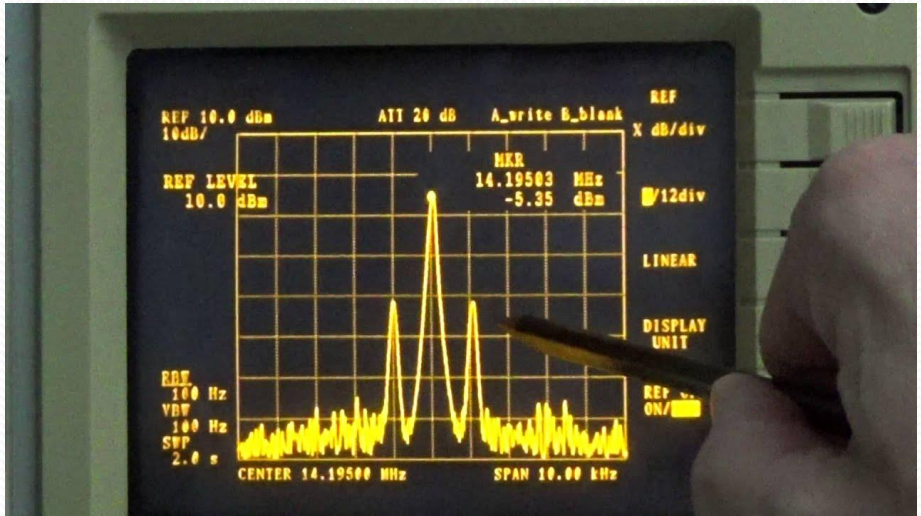
Station Block Diagram



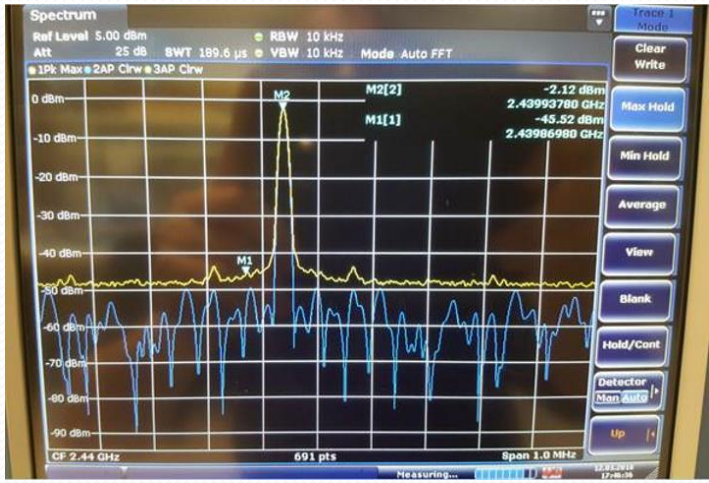
Amateur Radio Comm Modes

- AM & FM
- SSB
  Eliminates 1 Sideband
  & Carrier

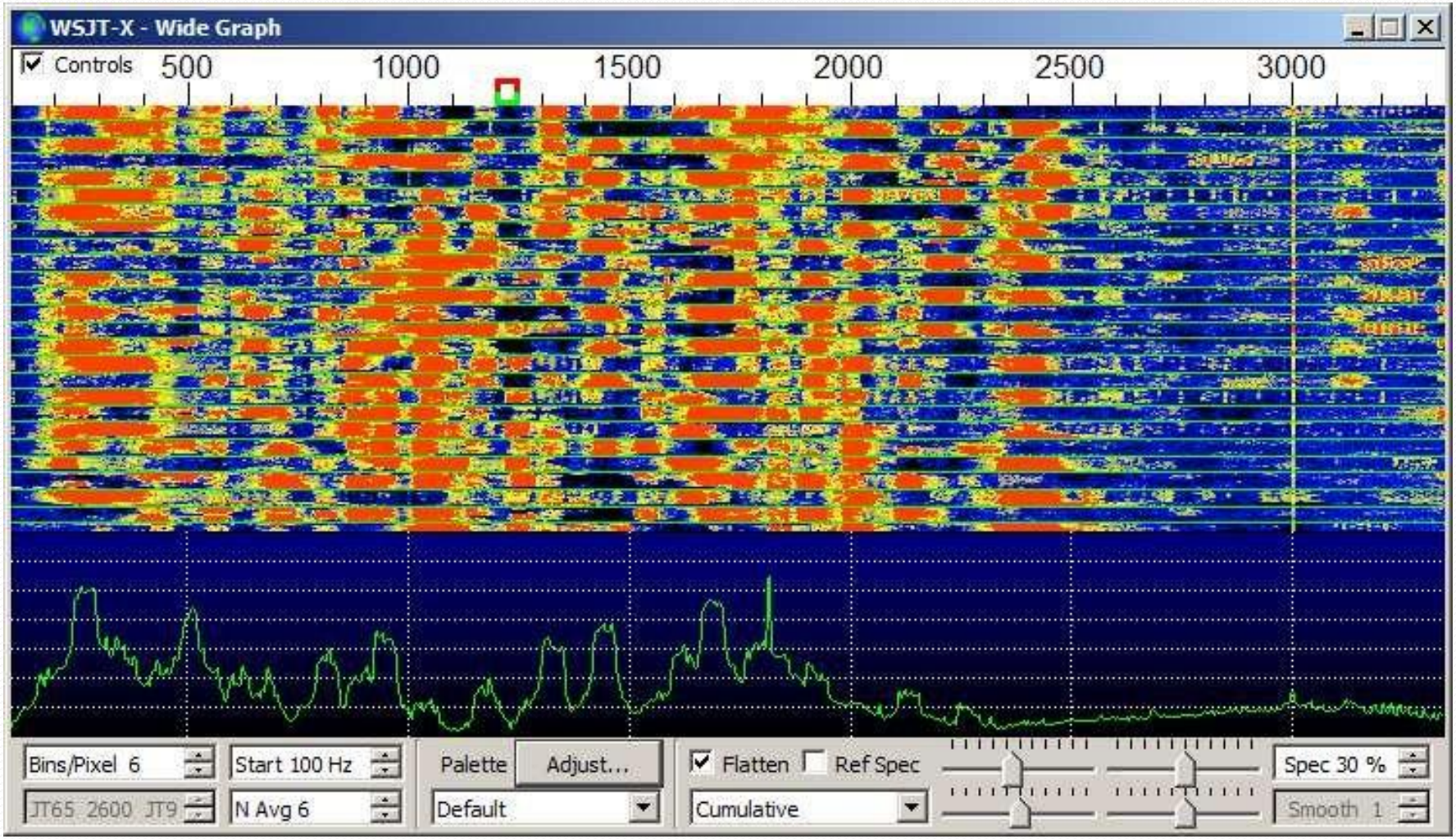




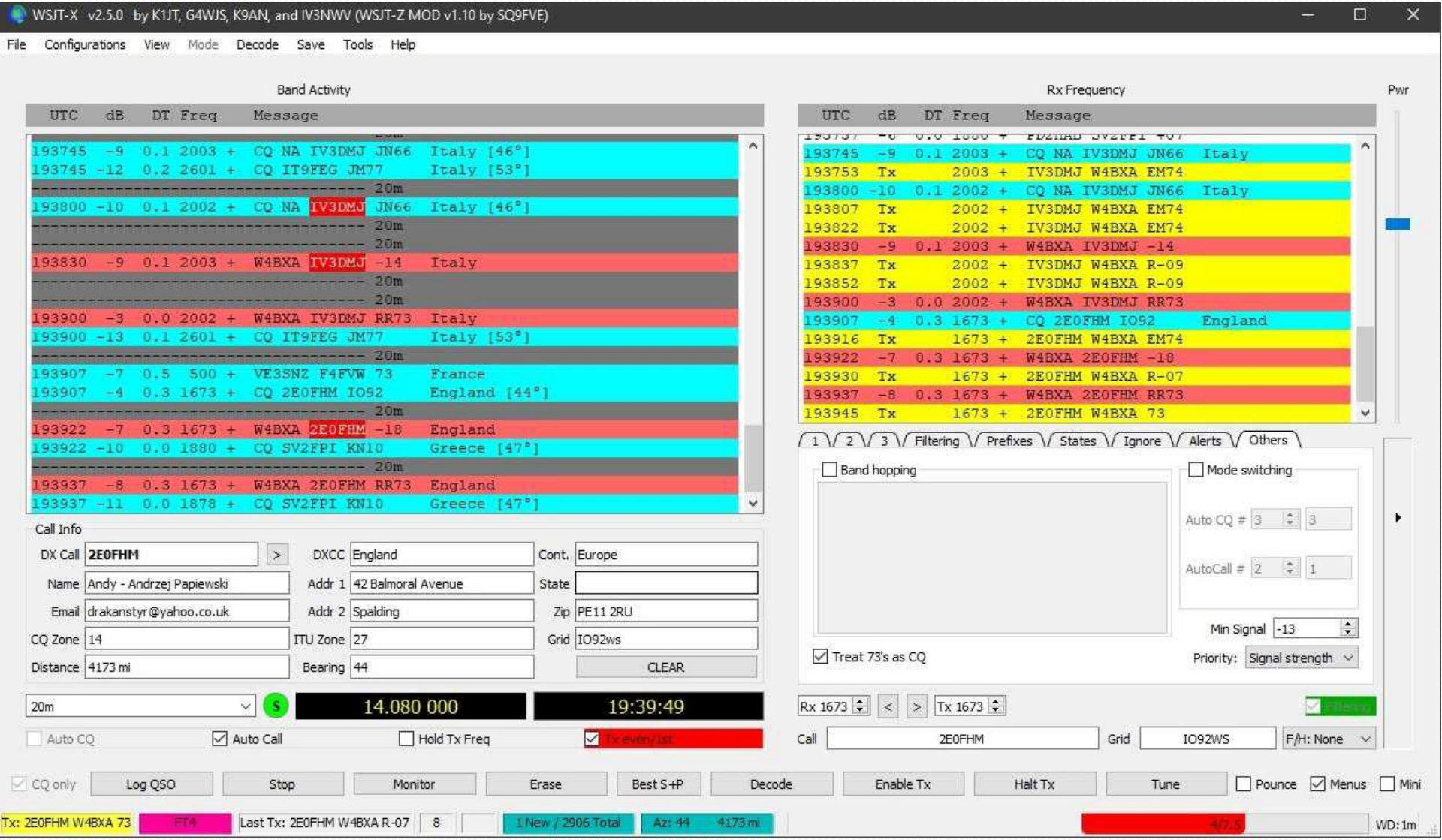
CW
Carrier
Only



Digital Mode FT8



FT8 Main Window



Radio Safety Precautions

- Electricity Can Kill (30 mA Current)
- Bonding & Grounding for Safety (N0AX Book)
- NEVER Take Safety Shortcuts!
- Don't Know? Don't Do!
- Antennas Attract Lightning
  Unplug & Disconnect
  "It's never happened to me."
- High Power Non-Ionizing Radiation is Dangerous
- Guidelines for Prevention

Radio Professions

- Bill, K8TE, Experience
- Electronics Retailing
- USAF Communications
- Electronics/Computer Service
- Radio & TV Broadcasting Engineer
- Servicing Radio & TV Towers
- Networking with Other Professionals
  Oil Rigs/Platforms/Vessels in Gulf of Mexico

Governing Agencies

- Federal Communications Commission
- Commercial Broadcasting Service
- Amateur Radio Service

- International Telecommunications Union
- Rule Making Among All Nations
- Radio Sees No Borders

WWV and WWVH

- National Institute of Standards and Technology NIST
- Time and Frequency
- Ionospheric Research
- HamSCI Research
- 24/7 Operations and Specific Schedule
- Fort Collins Colorado

Amateur Radio Basis & Purpose

- Voluntary, Noncommercial Communications
- "Particularly Emergency Communications
- Contribution to Advancement of the Radio Art
- Advancing Skills both Communications & Technical
- Expand the Reserve of Trained Operators, Technicians, and Electronics Experts
- Enhance International Good Will

Albert Schweitzer

I do not know what your destiny will be.

But one thing I know:

the only ones among you, who will be truly happy,

are those who have sought, and found, how to serve - -

The Amateur Radio Service

Summary

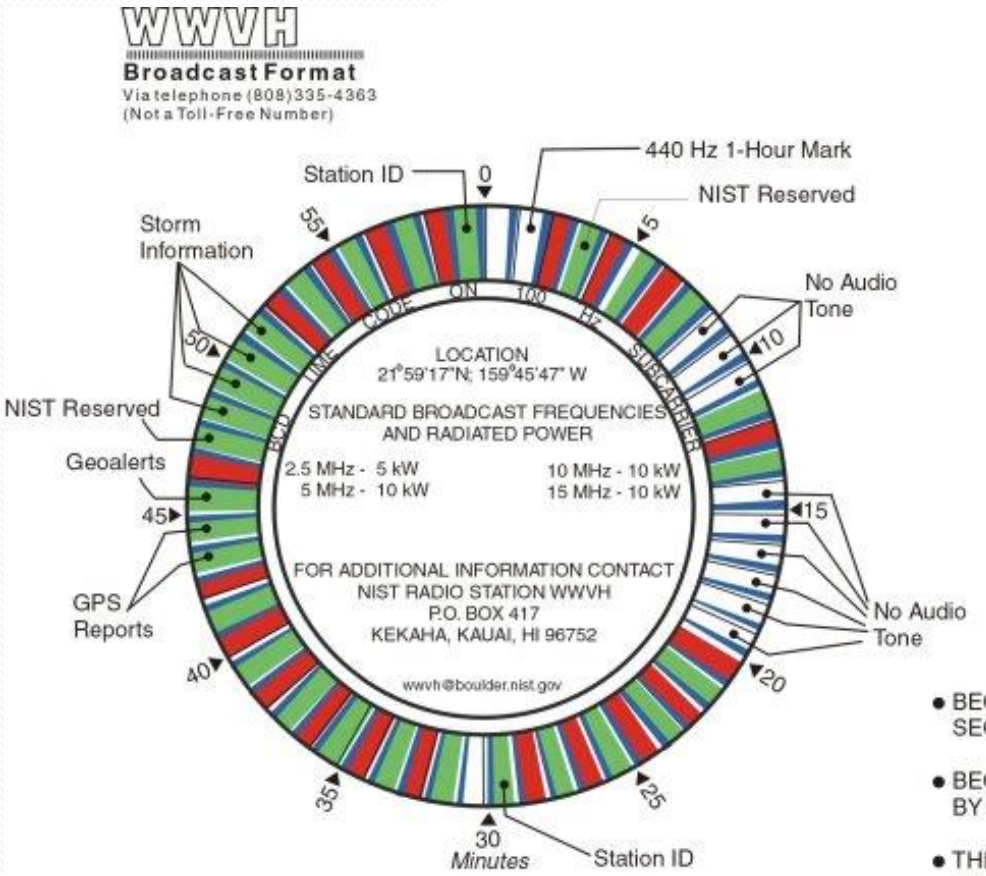
- What is Radio?
- Radio Services
- Commercial vs. Amateur Radio
- Antennas
- Using Diagrams
- Signals and Modes
- Governing Agencies

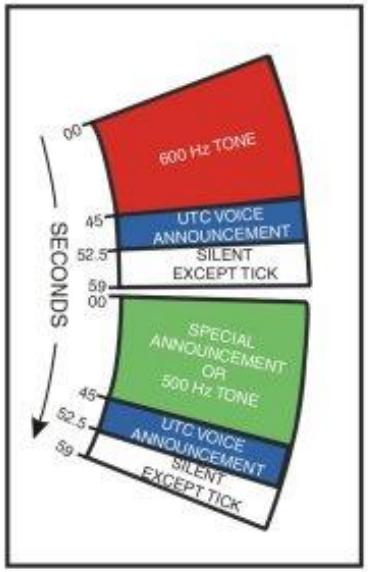
- Questions?
- Additional Slides for Further Study

References

- https://www.ntia.doc.gov/files/ntia/publications/2003-allochrt.pdf
- https://live365.com/blog/glossary-of-radio-terms/
- https://www.hamradio.com/detail.cfm?pid=H0-015965 SDRPlay RSP1A
- www.arrl.org
- http://www.arrl.org/grounding-and-bonding-for-the-amateur
- https://www.ecfr.gov/current/title-47/chapter-I/subchapter-D/part-97
- https://www.weather.gov/nwr/newmexico
- https://www.itu.int/
- https://physics.princeton.edu/pulsar/k1jt/ WSJT/FT8
- https://www.nist.gov/pml/time-and-frequency-division/time-services/wwvwwvh-scientific-modulation-working-group
- https://hamsci.org/

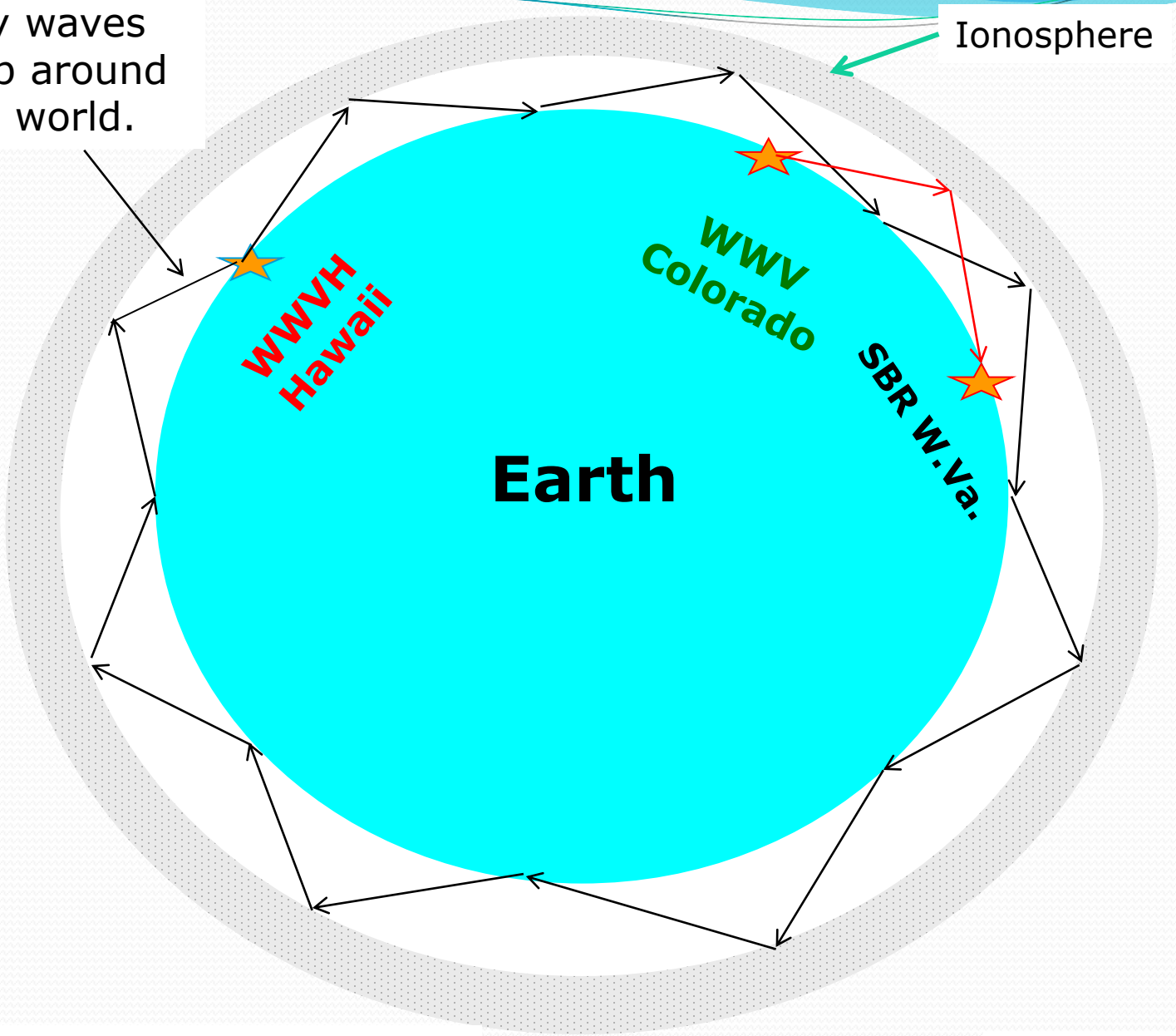
WWV and WWVH



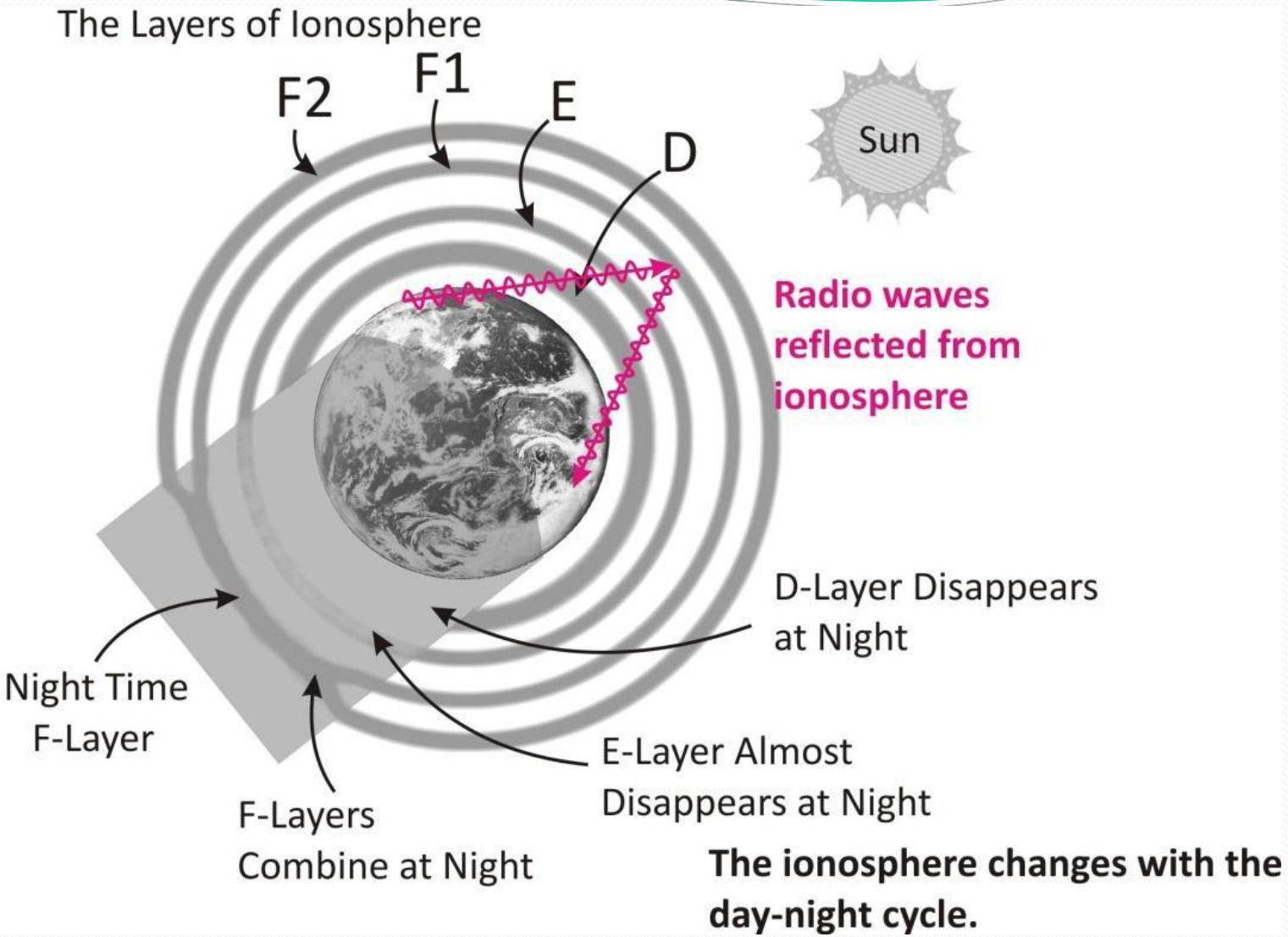


- BEGINNING OF EACH HOUR IS IDENTIFIED BY 0.8 SECOND LONG, 1500 Hz TONE.
- BEGINNING OF EACH MINUTE IDENTIFIED BY 0.8 SECOND LONG, 1200 Hz TONE.
- THE 29TH AND 59TH SECOND PULSES OF EACH MINUTE ARE OMITTED.
- 440 Hz TONE IS OMITTED DURING FIRST HOUR OF EACH DAY.

WWV and WWVH


Sky waves skip around the world.
Ionosphere
WWVH Hawaii
WWV Colorado
SBR W.Va.
Earth

How Radio Waves Travel



Drawing from WØSTU

Radio Safety Precautions

- Unplug equipment before working on it.
- Never let anyone turn the power on and off for you.
- Don’t work on a radio when you are tired.
- Don’t use your bare hands to adjust components.
- Don’t let your body be a ground path by touching grounded metal or standing in water.
- Never wear headphones while working on a radio.
- “Keep one hand in your pocket” so electricity can’t travel through your chest.
- Tell your family how to turn off the power.
- Be careful; death is permanent.

Radio Frequency (RF) Energy

- Exposure to high levels of radio frequency (RF) energy can be unhealthy. Direct contact can cause burns; human eyes are sensitive to RF energy.
- Don't use a radio when it is not completely assembled as the cabinet shields the RF radiation.
- Keep antennas out of reach.

Power Outlet Grounding

- Electric power enters a house through a box of circuit breakers. A metal ground rod is driven into the earth near where power enters the house to establish a Ground.
- Power Outlets are connected to the circuit breaker box with three wire cable and one of the wires is connected to Ground.
- Equipment is connected to Power Outlets with three prong plugs and one prong is connected to the Ground.
  - The equipment case is then grounded to prevent electric shock.

Antenna System Grounding

- Antenna systems often include tall towers or objects that might be struck by lightning.
- Antenna systems include transmission lines connecting the antenna to radio equipment.
- Lightning arrestors are devices inserted into transmission line with a spark gap or gaseous discharge to ground.
- Antenna system grounding should include both a ground connection for the antenna tower and a lightning arrestor in the transmission line where it enters the house.
- The lightning arrestor may discharge static electricity but likely offers little protection from a direct strike.

Antennas and Towers

- Never install an antenna over, under, or very near a power line.
- Avoid the possibility of the antenna falling on the power line or the power line falling on the antenna.

Antennas and Towers

- Never install an antenna where a person could touch the antenna.
- Be careful working on towers and roofs.
  - Protect yourself from falling.
  - Protect people below you from falling objects.
  - Use safety harnesses, belts, tethers, and hard-hats.

Lightning Protection

- Antenna support poles and towers should be connected to a ground rod.
- Disconnect radios if lightning is in the area.
- Lightning could strike your antenna and travel down the transmission line to the radio.
- Make sure your antenna and radio are grounded to a good earth ground.
- Never operate your radio in thunderstorms.

Amateur Radio Activities

- Jamboree On The Air (JOTA)
  - The third weekend every October.
  - Scouts all over the world talk to each other on ham radio. Largest annual scouting event.
- DX (Long Distance Communication)
  - Talk to other hams around the world.
  - Collect QSL cards (postcards) to prove contact (Collect countries!).
  - Great way to have fun and learn geography.
- Contests
  - Held many weekends to contact as many people as possible from a certain place or in a certain way.

Amateur Radio Activities

- Skywarn
  - National Weather Service uses Hams to report severe weather
- "Fox" hunting (Radio Direction Finding)
  - Hidden transmitters
  - Tagged wildlife
  - Downed aircraft
  - Life rafts
- Packet radio
  - Sending electronic messages (e-mail, text) via radio

Amateur Radio Activities

- Public Service.
  - Parades & special events from small carnivals to the Rose Bowl Parade.
  - Help with communication at large community events, marathons, bike-a-thons, etc.

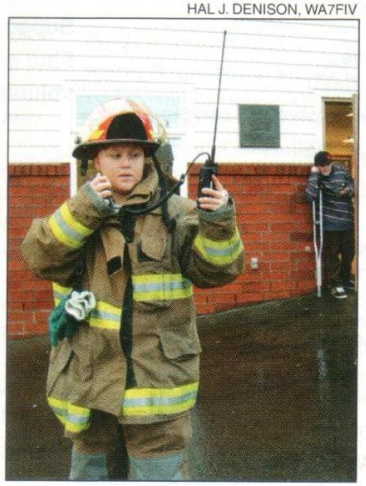
Amateur Radio Activities

- Disaster Communication
  - — Hams help during fires, floods, earthquakes, and other disasters.
  - — At these times, telephone lines and cell phone sites are often damaged or overloaded.
  - — Ham radio is the only reliable form of communication.

Oregon Hams of all Ages Respond to Devastating Windstorm

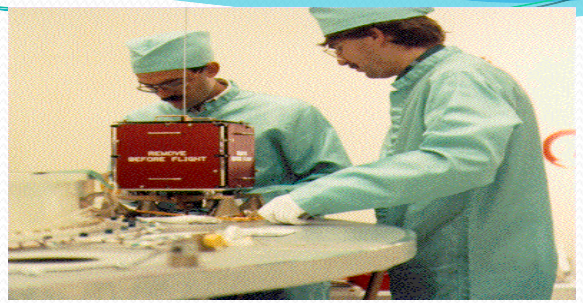
HAL J. DENISON, WA7FIV

Among the 60 or so local hams who responded to a December windstorm that had peak gusts of 147 mph two young men stood out as heroes. They convinced their parents to deliver them, early in the storm's heavy wind, to the Seaside Fire Department where they took up positions ready to pass all communications from the Fire Department to the County EOC. Nick, KE7NIT, and his friend Tommy, KE7OUD, both 12 years old, ran out in the wind and rain to find the best spot to reach the County EOC on their handhelds. They both passed messages, and provided help to Senior Citizens at the nearby Chisolm Senior Center.



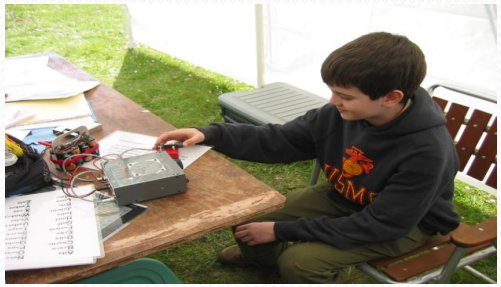
In Seaside, Oregon, Nick, KE7NIT, provides communications support with Tommy, KE7OUD, monitoring.

Both boys are members of the newly formed STARS (Seaside Tsunami Amateur Radio Society, WA7VE) in Seaside. — *Hal J. Denison, WA7FIV*



OSCAR

Foxhunting



Morse Code

Bicycle Station

Q Signals and Abbreviations

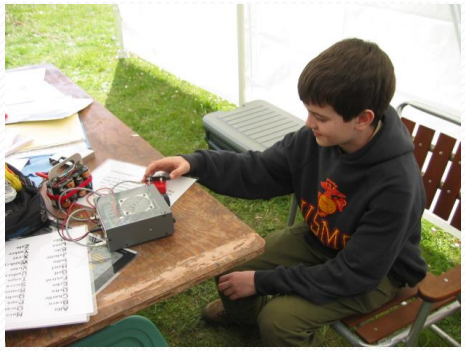
QRM	Interference (Your radio signal is being interfered with.)
QRN	Static (Your radio signal is being interfered with by static.)
QRP	Low power radio operation
QRS	Send your Morse code more slowly.
QRT	Leaving the air (I'm stopping my radio activity.)
QRX	Wait a few minutes.
QRZ?	Who is calling?
QSB	Your signals are fading.
QSL	A card sent to indicate you've talked to or heard a radio station; also, as a Q signal that means (Received OK)
QSO	A conversation.
QSY	I am moving to another radio frequency. . .
QTH	My location is. . .
73	Best regards
RST	Readability, Strength, Tone (Signal report)
CQ	I am calling…

Frequency Assignments

- 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, 10, 14, 21, 28, 50, 144 MHz
  80, 40, 30, 20, 15, 10, 6, 2 meters
- Mobile Telephone 850 - 900 MHz, 1800 – 1900 MHz
- Wi-Fi 2400 – 2470 MHz

How Radio Waves Carry Information

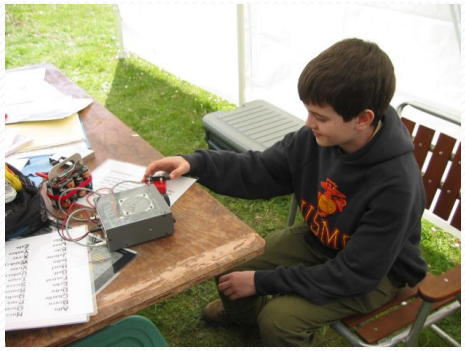
- A pure radio wave does not convey information.
- Radio waves carry information when they are changed by a process called modulation.
- Modulation
  - Continuous wave (CW)
  - Amplitude (AM)
  - Frequency (FM)



How Radio Waves Carry Information

Radio signals are modulated(changed) with information.

- Morse Code uses dots and dashes
- Voice, images – AM, FM, TV
- Digital modes – 1s and 0s



Continuous Wave (CW)

The Oldest Digital Mode

Works by simply turning the transmitter on and off in a pattern called Morse Code

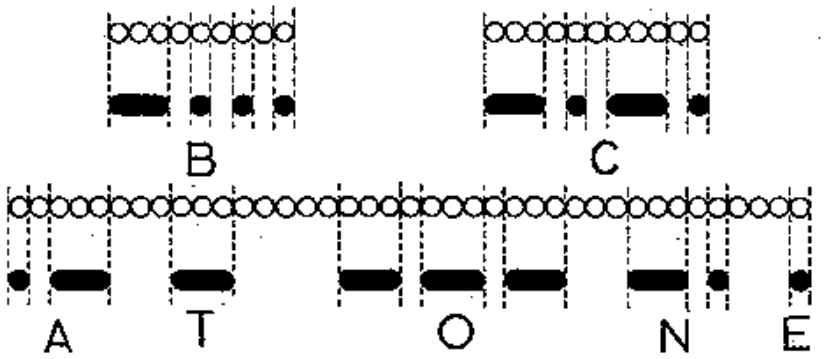


Diagram illustrating relative lengths of dashes and spaces referred to the duration of a dot. A dash is exactly equal in duration to three dots; spaces between parts of a letter equal one dot; those between letters, three dots; space between words, five dots. Note that a slight increase between two parts of a letter will make it sound like two letters.