

Technician License Course

Chapter 2

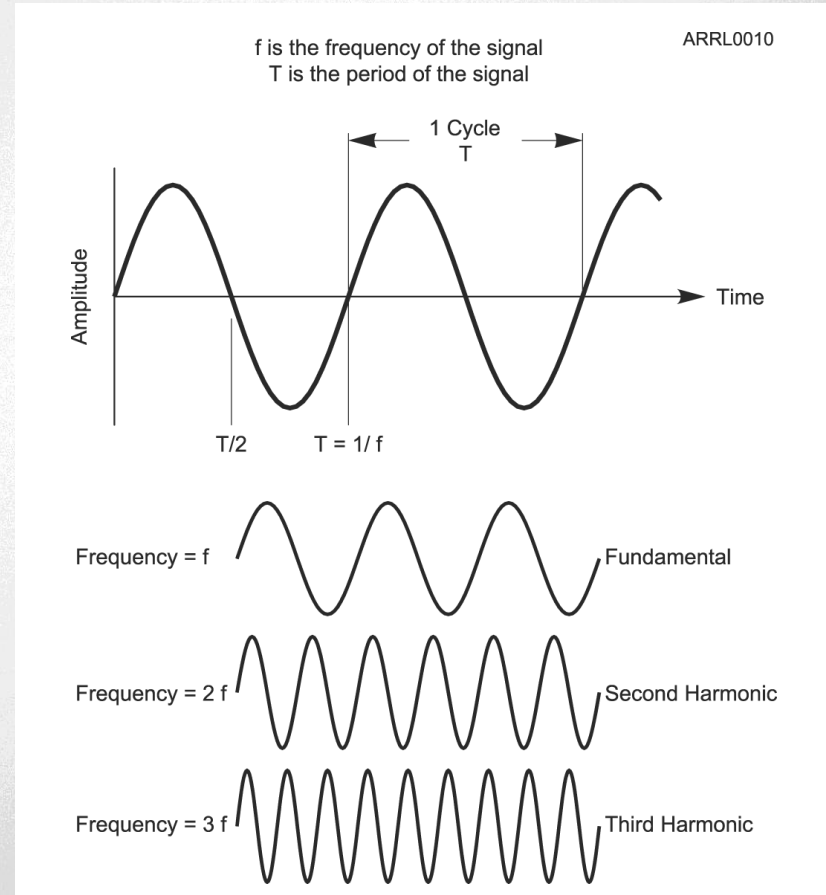
Lesson Plan Module 2 – Radio Waves & Signals



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Wave Vocabulary

- Before we study radio, we need to learn some wave vocabulary.
 - *Amplitude*
 - *Frequency (hertz, Hz)*
 - *Period (seconds, s)*
 - *Fundamental*
 - *Harmonics*



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Electromagnetic Waves

- *Electromagnetic waves* are made up of electric and magnetic energy (*fields*).
- The electric and magnetic fields vary in the pattern of a sine wave.
- Electromagnetic waves travel at the speed of light.

Electromagnetic Energy

A Demonstration

- What happens when you drop a magnet through a pipe made of non-magnetic conductive material, such as copper?

Electromagnetic Waves

- You observed electromagnetic energy being exchanged between the magnet and electrons in the pipe:
 - The falling magnet creates a moving magnetic field, in turn causing electrons in the pipe to move.
 - The moving electrons create a magnetic field that opposes the magnet's motion.

Electromagnetic Waves

- If the magnet was moved back and forth repeatedly, the varying electric and magnetic fields would create a sustained *electromagnetic wave* spreading into space like a water ripple.
- Moving electrons in an antenna take the place of the moving magnet.
- A signal from a transmitter can make the electrons in an antenna move, transferring energy from the signal to electromagnetic waves.

Electromagnetic Waves

- The same process works “backward,” too!
- Electromagnetic waves encountering an antenna make its electrons move in sync with the wave.
- Electromagnetic energy is transferred from the wave to the electrons.
- The moving electrons create a signal that can be detected by a receiver.



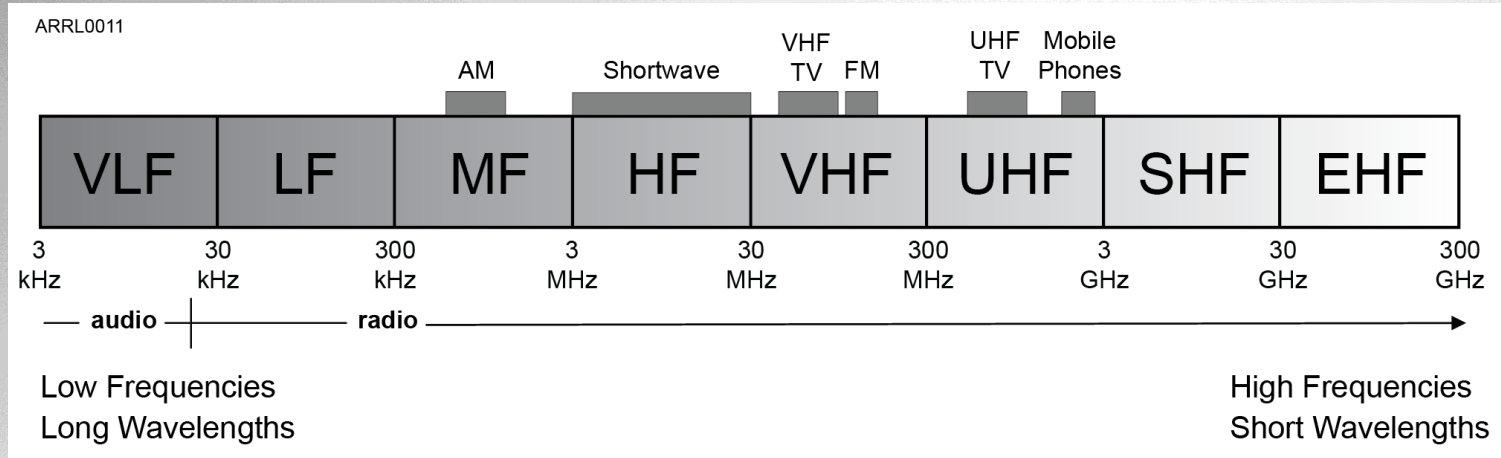
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Electromagnetic Spectrum

- The electromagnetic *spectrum* is divided into ranges of frequencies in which electromagnetic waves behave similarly.
- Each range or segment has a different name.
- Waves with a certain range of frequencies that can be used for communication are called *radio waves*.



Radio Spectrum



- The part of the electromagnetic spectrum composed of radio waves is called the *radio frequency* or *RF* spectrum.



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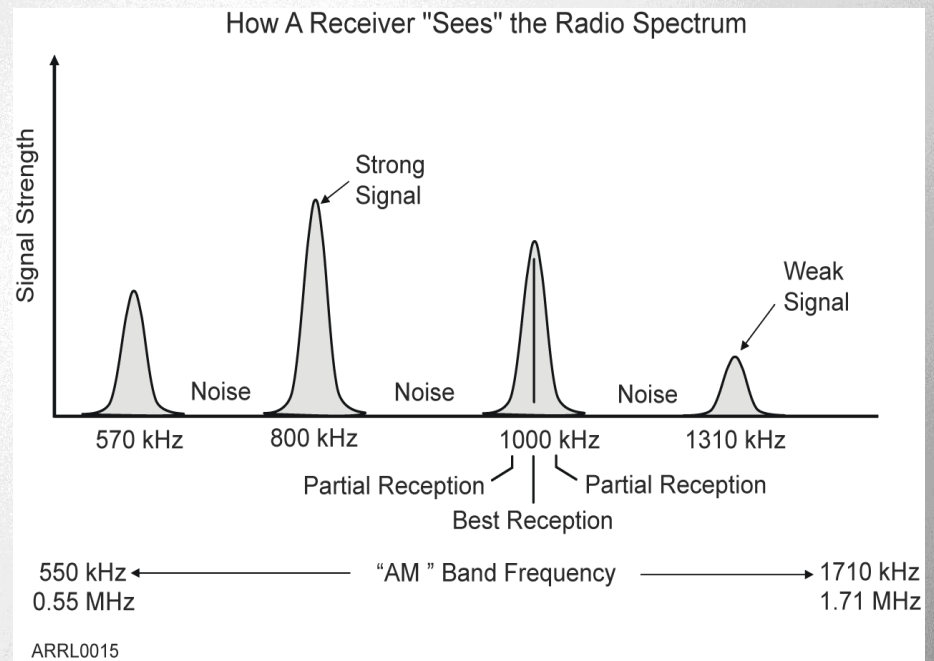
Radio Spectrum

- Parts of the spectrum allocated for a common purpose are called a *band*, such as the “AM band” or “CB band.”
- Signals in these bands are usually of the same type for commercial services
- Hams share the band across many signals of different types



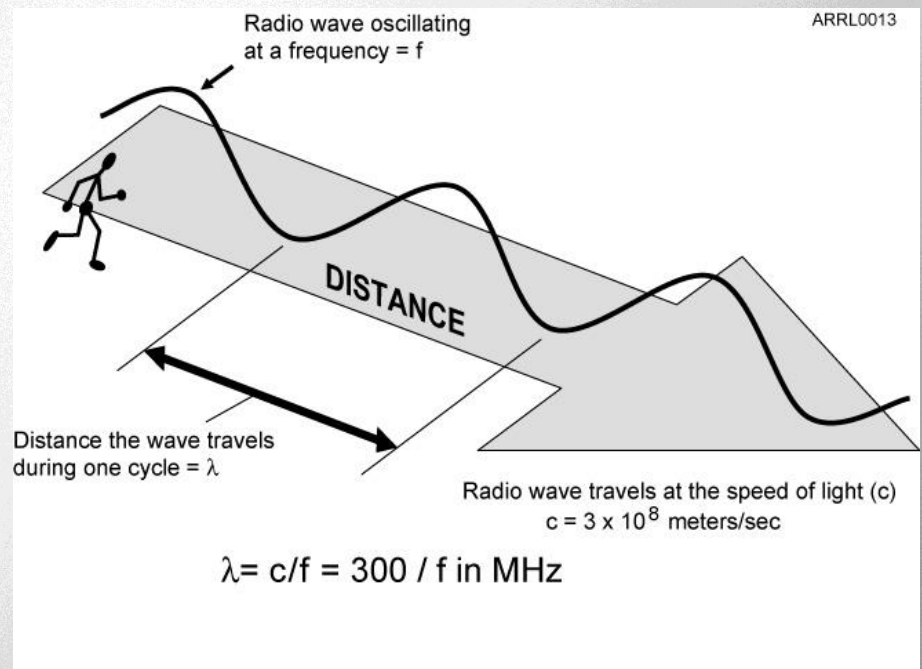
Radio Signals

- A radio wave carrying information is a *radio signal*.
- Each signal occupies a range of frequencies.
- Receivers “tune in” a signal by listening at the signal’s frequency.



Wavelength

- *Wavelength* is the distance a radio wave travels during one cycle of the wave's electric and magnetic fields.
 - λ (lambda) is the symbol for wavelength
 - Waves travel at the speed of light, c .
 - Hams can refer to bands by frequency (50 MHz) or by wavelength (6 meters)



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Practice Questions



What is the name for the distance a radio wave travels during one complete cycle?

- A. Wave speed
- B. Waveform
- C. Wavelength
- D. Wave spread

T3B01 HRLM (2-5)



What is the name for the distance a radio wave travels during one complete cycle?

- A. Wave speed
- B. Waveform
- C. Wavelength**
- D. Wave spread

T3B01 HRLM (2-5)



How fast does a radio wave travel through free space?

- A. At the speed of light
- B. At the speed of sound
- C. Its speed is inversely proportional to its wavelength
- D. Its speed increases as the frequency increases

T3B04 HRLM (2-5)



How fast does a radio wave travel through free space?

- A. At the speed of light
- B. At the speed of sound
- C. Its speed is inversely proportional to its wavelength
- D. Its speed increases as the frequency increases

T3B04 HRLM (2-5)

How does the wavelength of a radio wave relate to its frequency?

- A. The wavelength gets longer as the frequency increases
- B. The wavelength gets shorter as the frequency increases
- C. There is no relationship between wavelength and frequency
- D. The wavelength depends on the bandwidth of the signal

T3B05 HRLM (2-5)



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- A. The wavelength gets longer as the frequency increases
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- C. There is no relationship between wavelength and frequency
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T3B05 HRLM (2-5)

What is the formula for converting frequency to approximate wavelength in meters?

- A. Wavelength in meters equals frequency in hertz multiplied by 300
- B. Wavelength in meters equals frequency in hertz divided by 300
- C. Wavelength in meters equals frequency in megahertz divided by 300
- D. Wavelength in meters equals 300 divided by frequency in megahertz

T3B06 HRLM (2-6)



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T3B06 HRLM (2-6)



What property of radio waves is often used to identify the different frequency bands?

- A. The approximate wavelength
- B. The magnetic intensity of waves
- C. The time it takes for waves to travel one mile
- D. The voltage standing wave ratio of waves

T3B07 HRLM (2-5)



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T3B07 HRLM (2-5)



What are the frequency limits of the VHF spectrum?

- A. 30 to 300 kHz
- B. 30 to 300 MHz
- C. 300 to 3000 kHz
- D. 300 to 3000 MHz

T3B08 HRLM (2-3)

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- A. 30 to 300 kHz
- B. 30 to 300 MHz**
- C. 300 to 3000 kHz
- D. 300 to 3000 MHz

T3B08 HRLM (2-3)

What are the frequency limits of the UHF spectrum?

- A. 30 to 300 kHz
- B. 30 to 300 MHz
- C. 300 to 3000 kHz
- D. 300 to 3000 MHz

T3B09 HRLM (2-3)

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- A. 30 to 300 kHz
- B. 30 to 300 MHz
- C. 300 to 3000 kHz
- D. 300 to 3000 MHz**

T3B09 HRLM (2-3)

What frequency range is referred to as HF?

- A. 300 to 3000 MHz
- B. 30 to 300 MHz
- C. 3 to 30 MHz
- D. 300 to 3000 kHz

T3B10 HRLM (2-3)



What frequency range is referred to as HF?

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- B. 30 to 300 MHz
- C. 3 to 30 MHz**
- D. 300 to 3000 kHz

T3B10 HRLM (2-3)



What is the approximate velocity of a radio wave as it travels through free space?

- A. 3000 kilometers per second
- B. 300,000,000 meters per second
- C. 300,000 miles per hour
- D. 186,000 miles per hour

T3B11 HRLM (2-5)



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- B. 300,000,000 meters per second**
- C. 300,000 miles per hour
- D. 186,000 miles per hour

T3B11 HRLM (2-5)



What is the unit of frequency?

- A. Hertz
- B. Henry
- C. Farad
- D. Tesla

T5C05 HRLM (2-3)



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- A. Hertz
- B. Henry
- C. Farad
- D. Tesla

T5C05 HRLM (2-3)



What does the abbreviation “RF” refer to?

- A. Radio frequency signals of all types
- B. The resonant frequency of a tuned circuit
- C. The real frequency transmitted as opposed to the apparent frequency
- D. Reflective force in antenna transmission lines

T5C06 HRLM (2-3)



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T5C06 HRLM (2-3)

