Technician License Course
Chapter 2

Lesson Plan Module 2 –
Radio Waves & Signals

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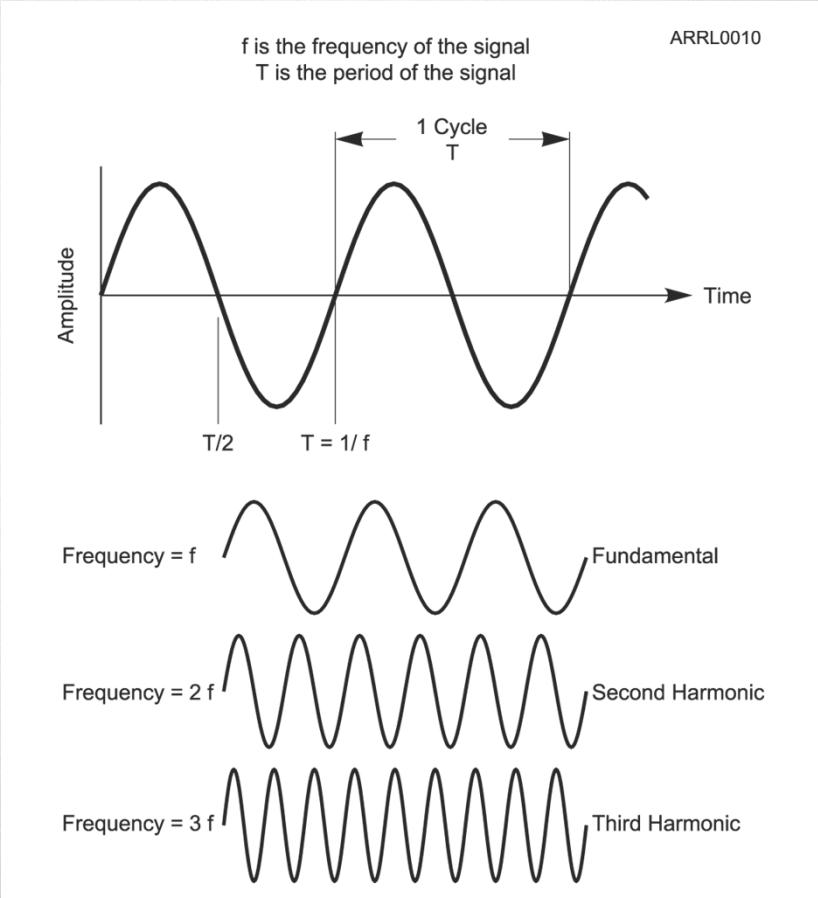
Wave Vocabulary

- 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.

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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*.

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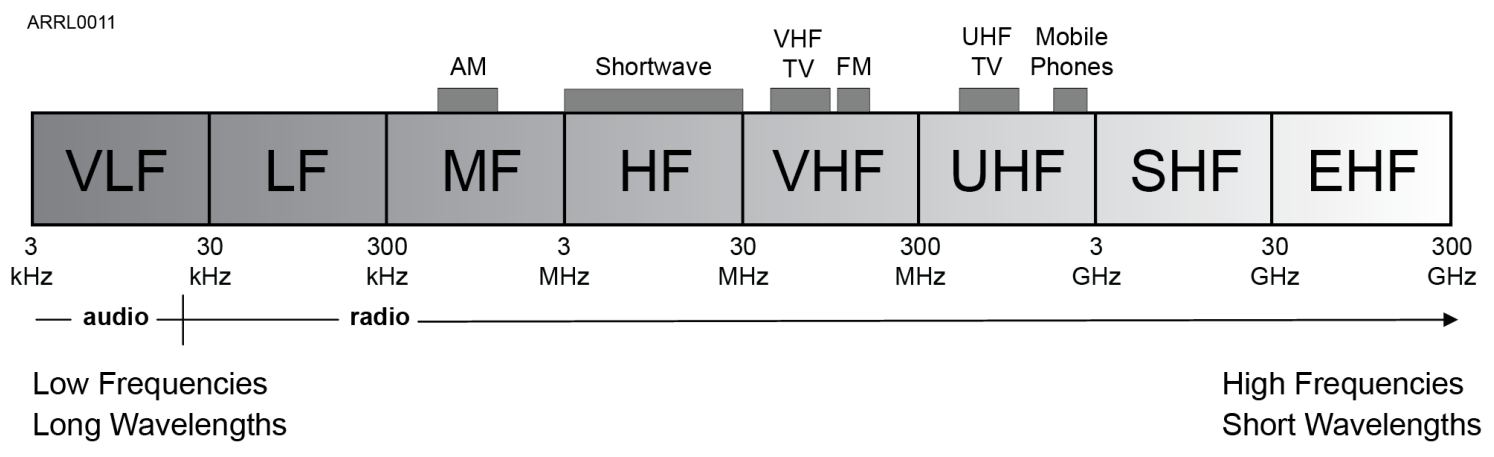
Radio Spectrum



- 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

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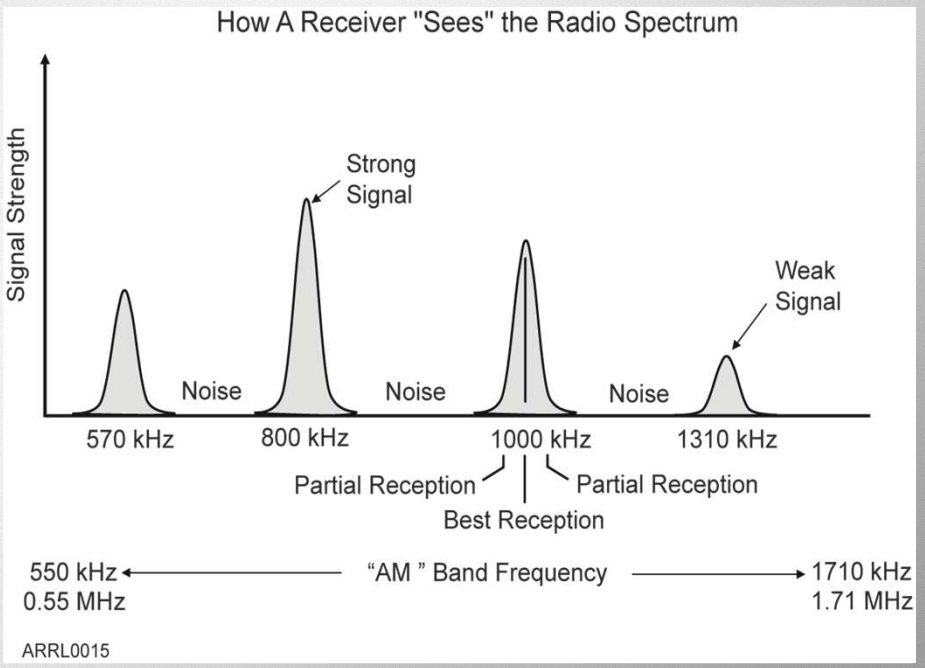
Radio Signals

- 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.



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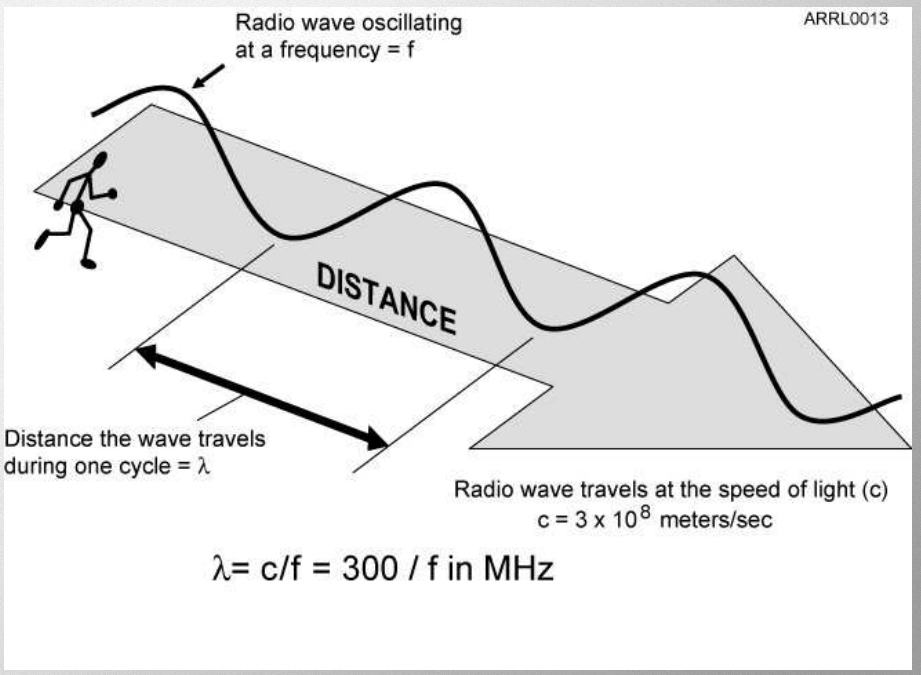
Wavelength

- *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 wave-length (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)

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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

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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)

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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

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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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T3B05 HRLM (2-5)

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

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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)

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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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)

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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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

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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

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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)

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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)

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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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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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What is the unit of frequency?

A. Hertz

B. Henry

C. Farad

D. Tesla

T5C05 HRLM (2-3)

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T5C05 HRLM (2-3)

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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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