

Technician Class Course

Session 5



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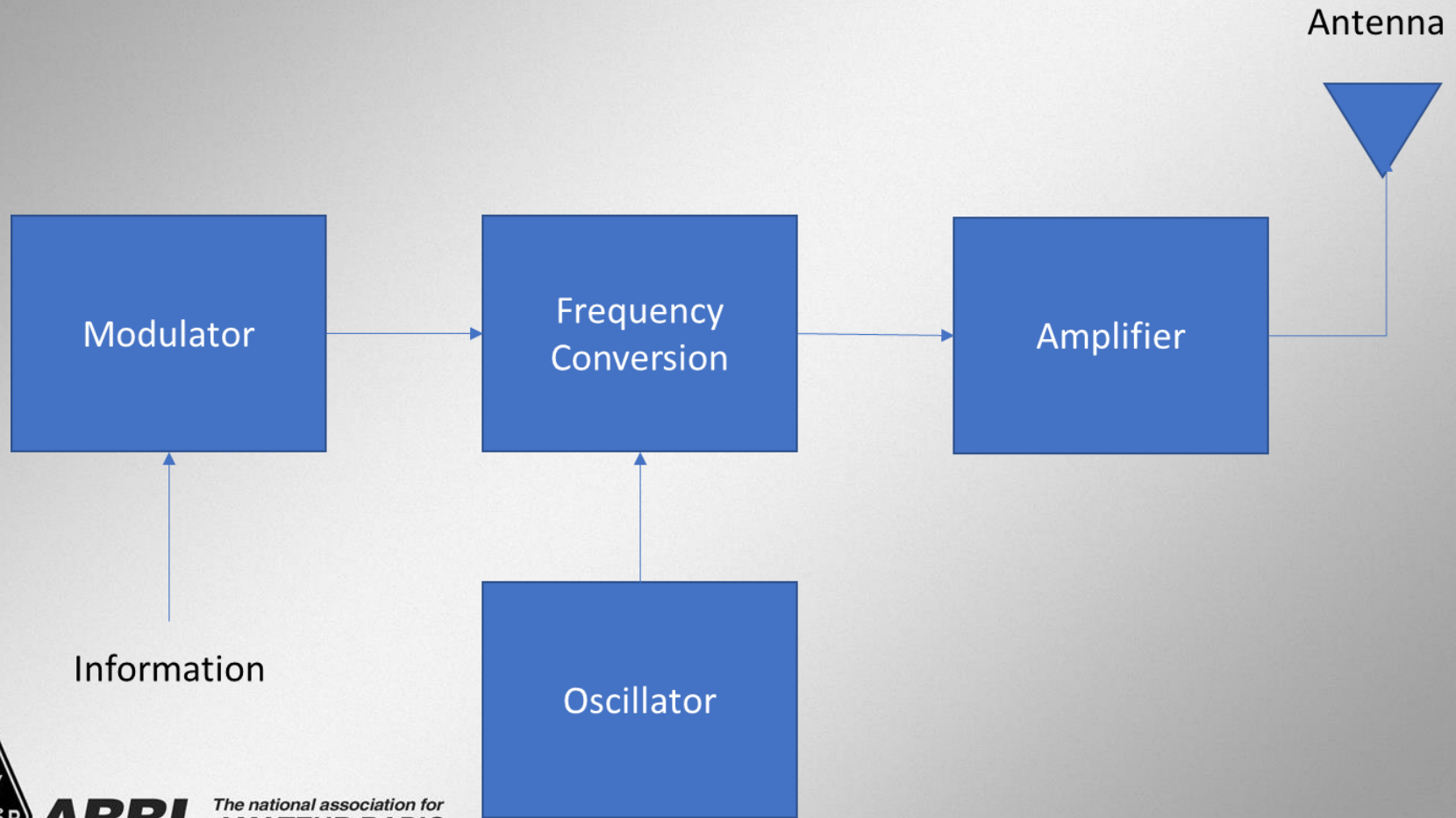
TRANSMITTERS, RECEIVERS AND TRANSCEIVERS



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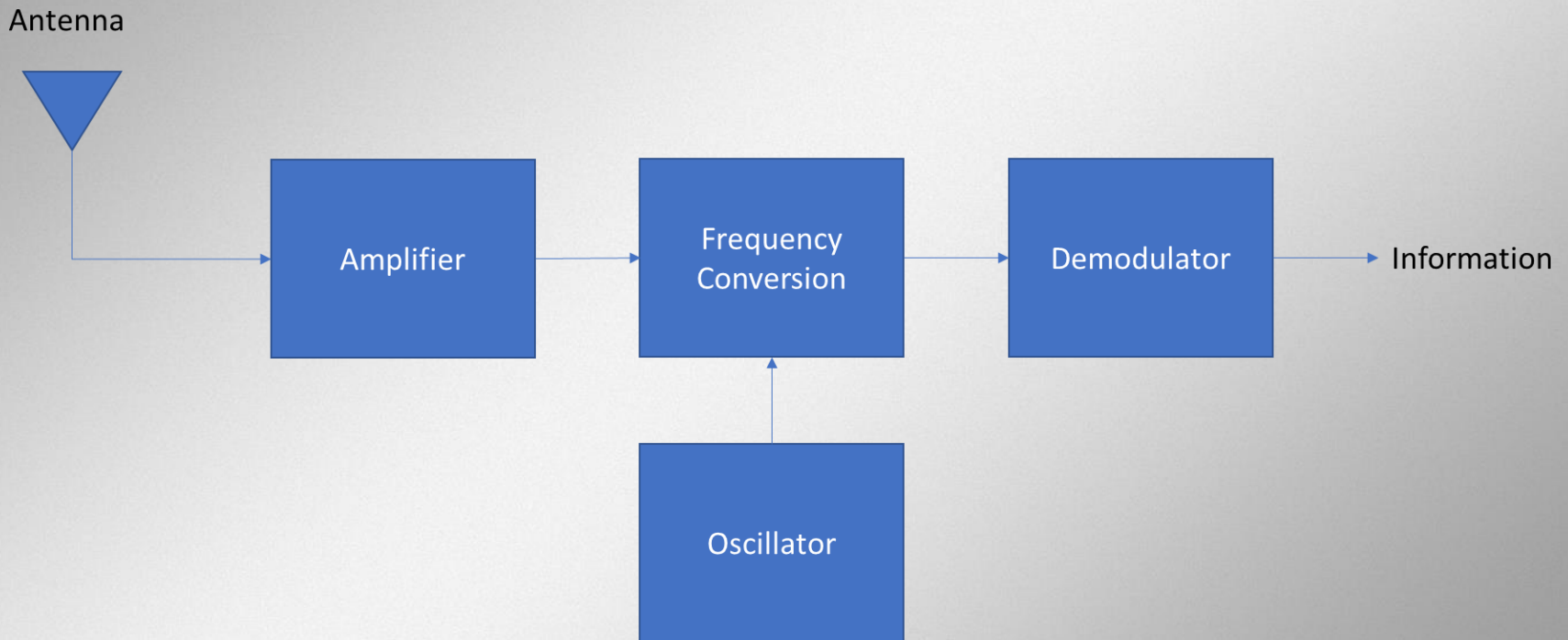
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Basic Transmitter Block Diagram



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Basic Receiver Block Diagram



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Generalized Transceiver Categories

Transceiver Operation	Typical Bands	Typical Modes
Single-band handheld or mobile	VHF or UHF	FM or Digital Voice
Dual-band handheld or mobile	VHF or UHF	FM or Digital Voice, Packet
Multi-band, multi-mode mobile or fixed	HF, VHF and UHF	AM, FM, SSB, CW, Data

“Rig” Vocabulary

- We will now go through some jargon and vocabulary specific to the functions and controls of a transmitter and receiver.
 - This is a way to discuss how to operate a transceiver.
- These controls, though separate, are combined in a transceiver.

Transmitter Controls and Functions

- Main tuning dial (both TX and RX):
 - Controls the frequency selection via the Variable Frequency Oscillator (VFO).
 - Could be an actual dial or key pad or programmed channels.
 - Variable frequency step size (tuning rate, resolution).
 - Could have more than one VFO (control more than one frequency at a time).



Typical Controls

<http://www.icomamerica.com/en/products/amateur/hf/718/default.aspx>



Keypad

Audio Gain (inside)
RF Gain (outside)

Main Tuning Knob



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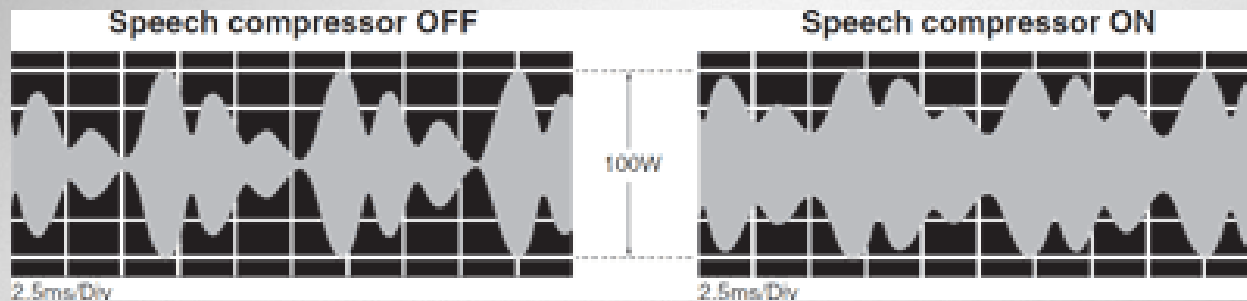
Transmitter Controls and Functions

- Mode selector (both TX and RX multi-mode rigs).
 - AM/FM/SSB (LSB or USB)
 - CW
 - Data (RTTY)
- Could be automatic based on recognized band plan.

Transmitter Controls and Functions

- Microphone controls
 - Gain
 - How loudly you need to talk to be heard.
 - Speech Compressor or Speech Processor
 - Compacting your speech into a narrow amplitude/frequency range to enhance “punch.”
 - Too much gain or compression can cause problems.
 - Splatter
 - Over-deviation
 - Over-modulation

Speech Compression Example



<http://www.icomamerica.com/en/products/746pro/img5.gif>

- Reduce dynamic range
- Increase average power

Transmitter Controls and Functions

- Automatic Level Control (ALC).
 - Automatically limits transmitter drive (output level) to prevent problems associated with too much gain or compression.
- Also can control external power amplifier operation.

Transmitter Controls and Functions

- Transmitter on/off
 - Push-to-Talk (PTT)
 - Voice-Operated Transmission (VOX)
 - VOX Gain
 - VOX Delay
 - Anti-VOX
 - Key jack

Transmitter Controls and Functions

- Microphones (Mic)
 - Hand mics
 - Desk mics
 - Pre-amplified desk mikes
 - Speaker-mics
 - Headsets or boom-sets
 - Internal mikes
- Speak across the mic, not into the mic.



Transmitter Controls and Functions

- Morse Keys
 - Straight
 - Semi-automatic (Bug)
 - Electronic keyer, paddle



Receiver Controls and Functions

- AF Gain or Volume
 - Controls the audio level to the speaker or headphones.
- RF Gain
 - Controls the strength of radio signal entering the receiver.
 - Used to limit (attenuate) very strong local signals.
 - Usually operated in the full-open position.

Receiver Controls and Functions

- Automatic Gain Control (AGC)
 - Automatically limits the incoming signals during signal (voice) peaks.
 - Prevents peaks from capturing the receiver and limiting reception of lower level portions of the incoming signal.
 - Fast setting for CW.
 - Slow settings for SSB and AM.
 - Not used in FM because of the type of signal used in FM.



Receiver Controls and Functions

- Squelch
 - Turns off audio to speaker when signal is not present.
- Used in FM primarily
 - Open – allows very weak signals to pass through (along with noise).
 - Tight – allows only the strongest signals to pass through.
- Advance the squelch control until the noise just disappears.

Receiver Controls and Functions

- Filters
 - Band-pass filter
 - Used to narrow the width of signal that is passed.
 - Can attenuate adjacent interference.
 - Notch filter
 - Very narrow filter that can be moved over an interfering signal to attenuate it.
 - Noise blanker or limiter
 - Limits signal spikes that are frequently associated with random naturally generated noise.

Receiver Controls and Functions

- Reception and Transmission Meter.
 - In transmit, indicates output power or ALC or other functions as selected by switch setting.
- In receive - indicates signal strength.
 - In “S” units S1 through S9 – S9 is strongest.
 - Also have dB over S9 to cover very strong signals.

Receiver Controls and Functions

- Receivers can be limited to ham bands or can cover other parts of the spectrum.
- General coverage receivers cover a wide area of the spectrum and can be used for shortwave listening (SWL).

Metering

Multi-purpose Metering

- Transmit
 - Output Power
 - ALC
 - SWR
- Receive
 - Signal Strength ("S units")



Mode and Filter Indication



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RADIO SIGNALS AND WAVES



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Radio Waves are AC

- You have already learned that in an alternating current (AC) the electrons flow in one direction one moment and then the opposite direction the next moment.
- Radio waves (electromagnetic radiation) are AC waves.
- Radio waves are used to carry the information you want to convey to someone else.



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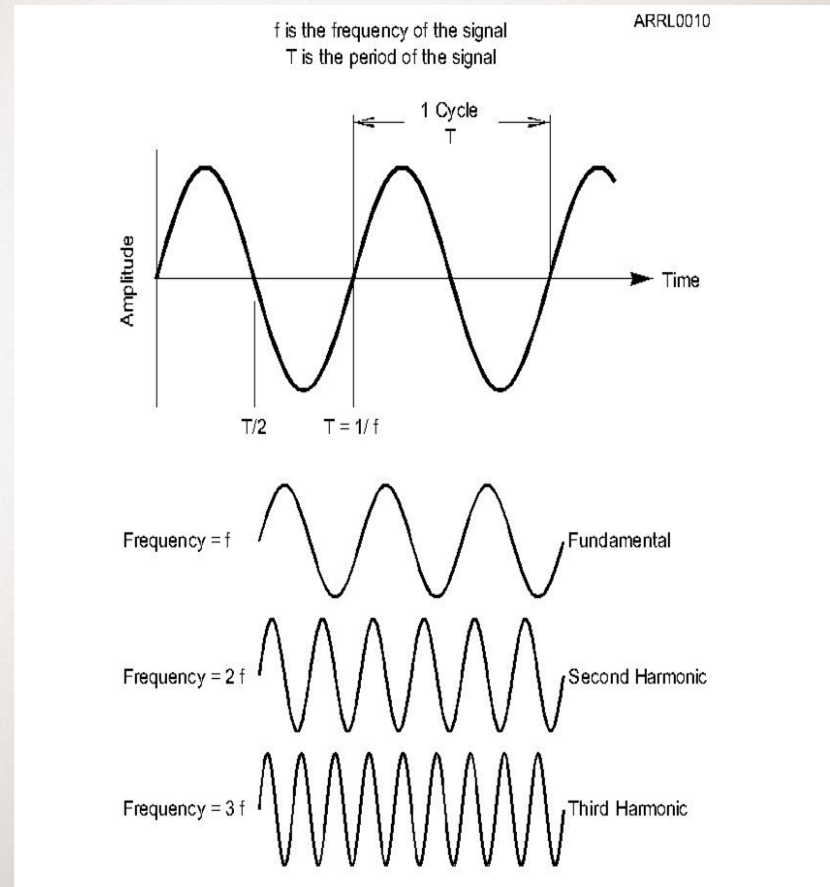
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Wave Vocabulary

- Before we study radio waves, we need to learn some wave vocabulary.
 - Amplitude
 - Frequency
 - Period
 - Wavelength
 - Harmonics



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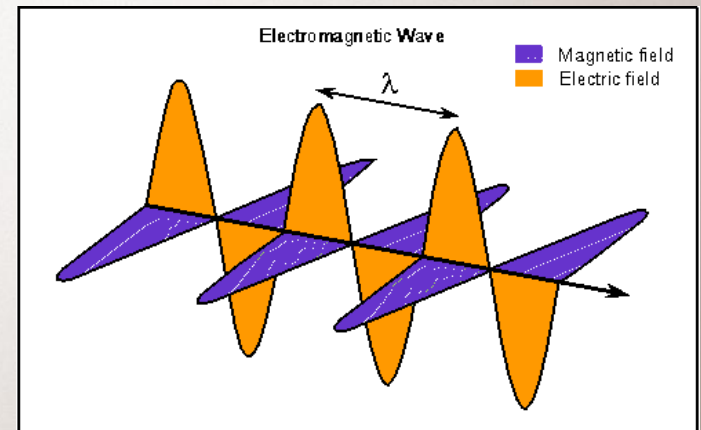
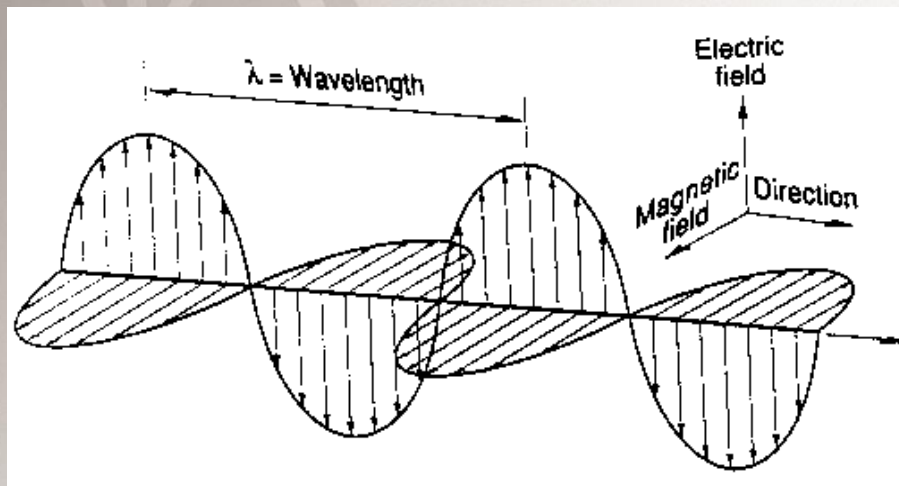
Electromagnetic Waves

- E-plane and H-plane
 - E-plane refers to the electric field
 - H-plane refers to the magnetic field
- H-plane is always at right angles to the E-plane
- Polarization is the E-plane orientation relative to the surface of the Earth



Electromagnetic Waves

- Electric and magnetic fields are at right angles to each other



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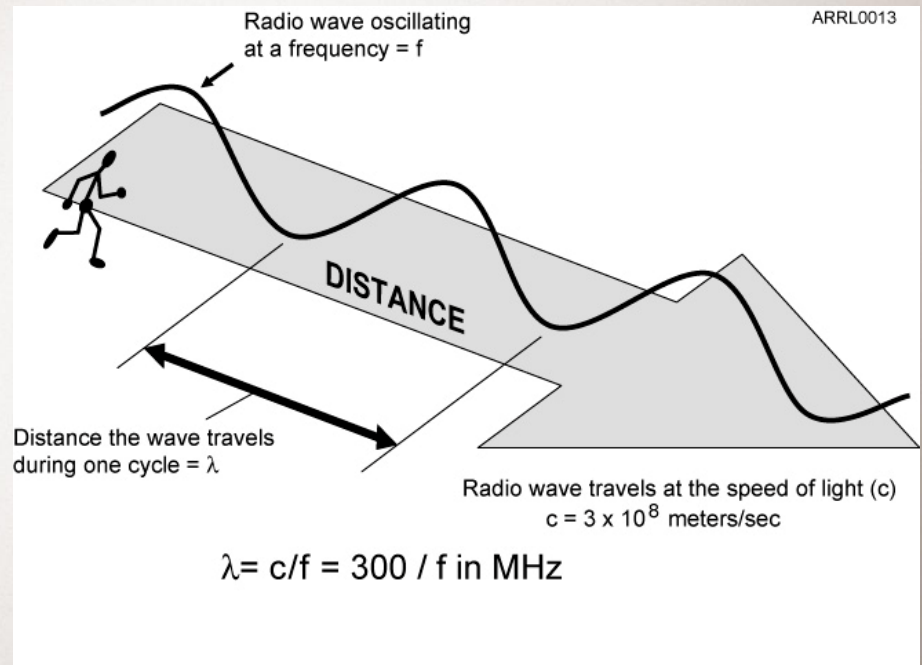


Wavelength

- The distance a radio wave travels during one cycle.
- One complete change between magnetic and electric fields.

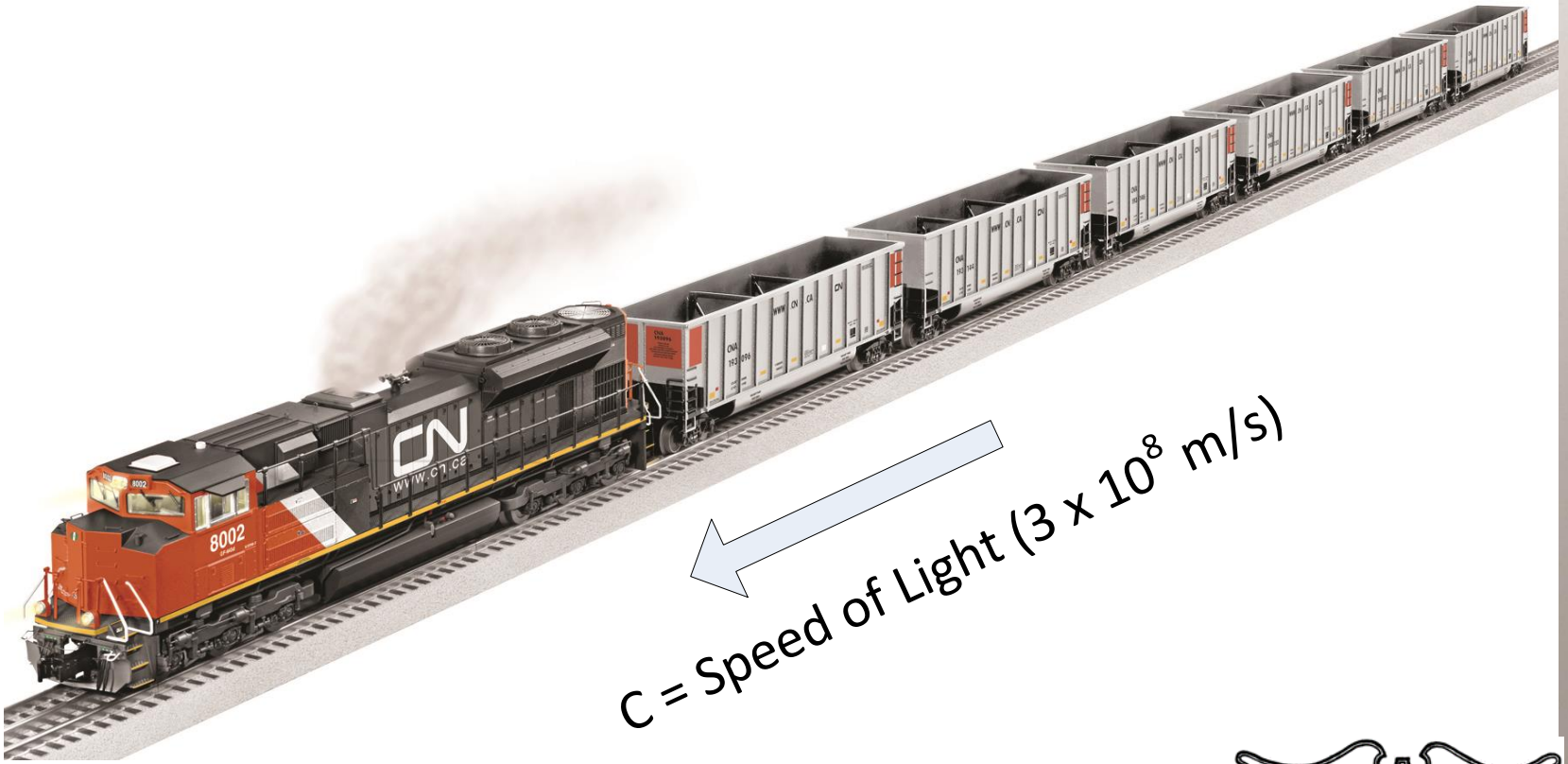


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(this is the figure in your book...)

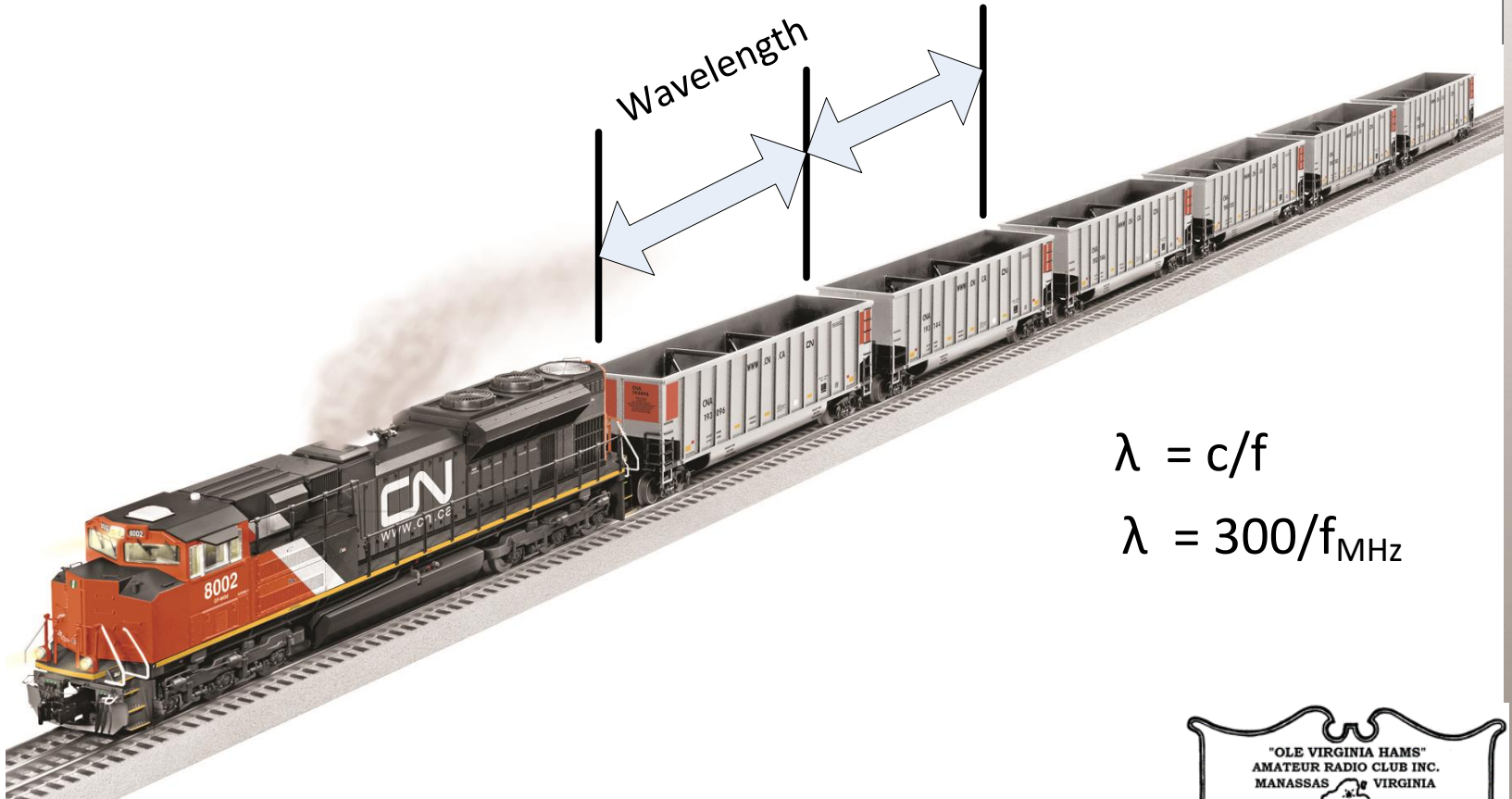
Electromagnetic Waves



$c = \text{Speed of Light } (3 \times 10^8 \text{ m/s})$



Electromagnetic Waves

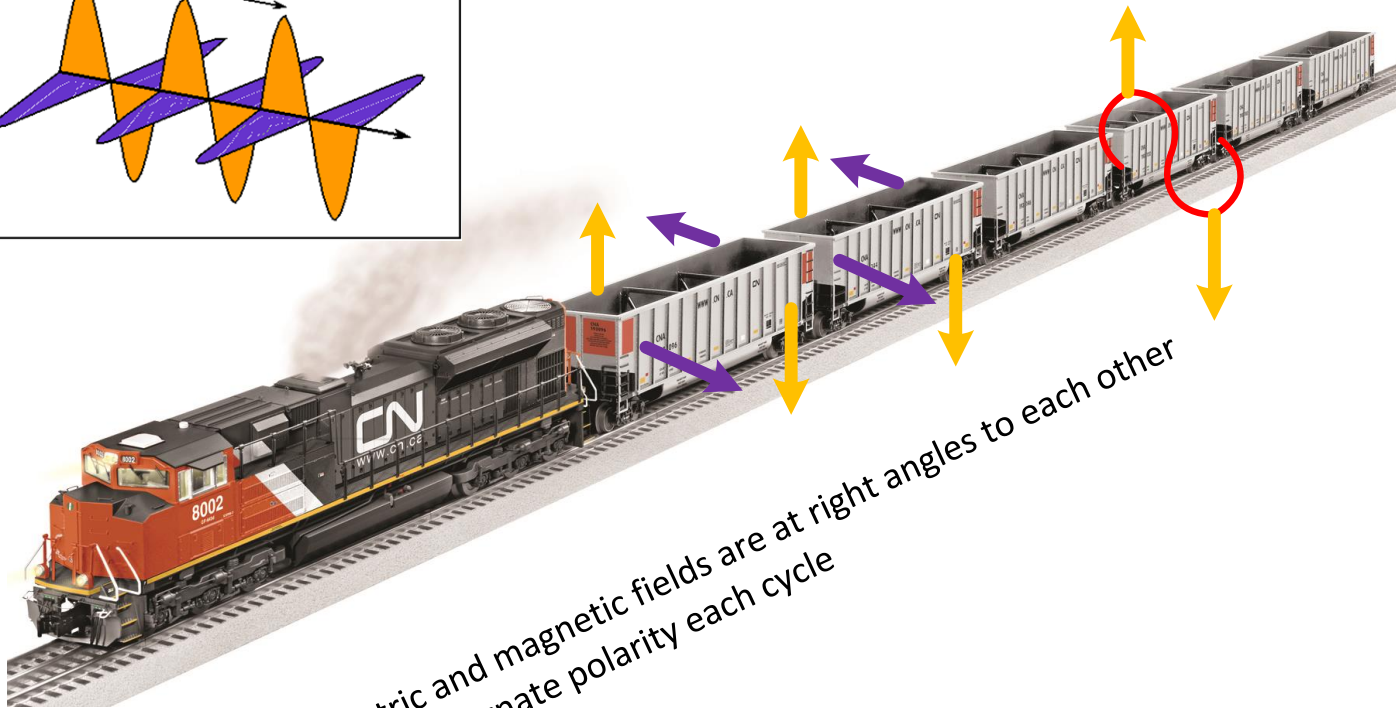
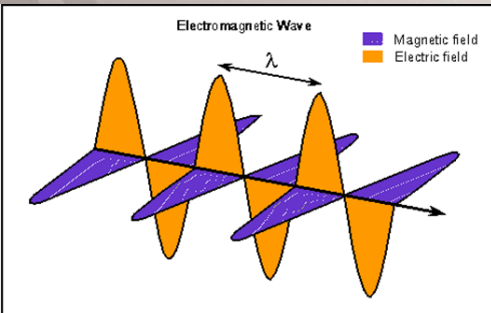


$$\lambda = c/f$$

$$\lambda = 300/f_{\text{MHz}}$$



Electromagnetic Waves



- Electric and magnetic fields are at right angles to each other
- Fields alternate polarity each cycle



Finding Where You are on the Radio Dial

- There are two ways to tell someone where to meet you on the radio dial (spectrum).
 - Band segment (2 meter simplex)
 - Frequency (e.g., 146.52 MHz)



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Radio Frequency (RF) Spectrum

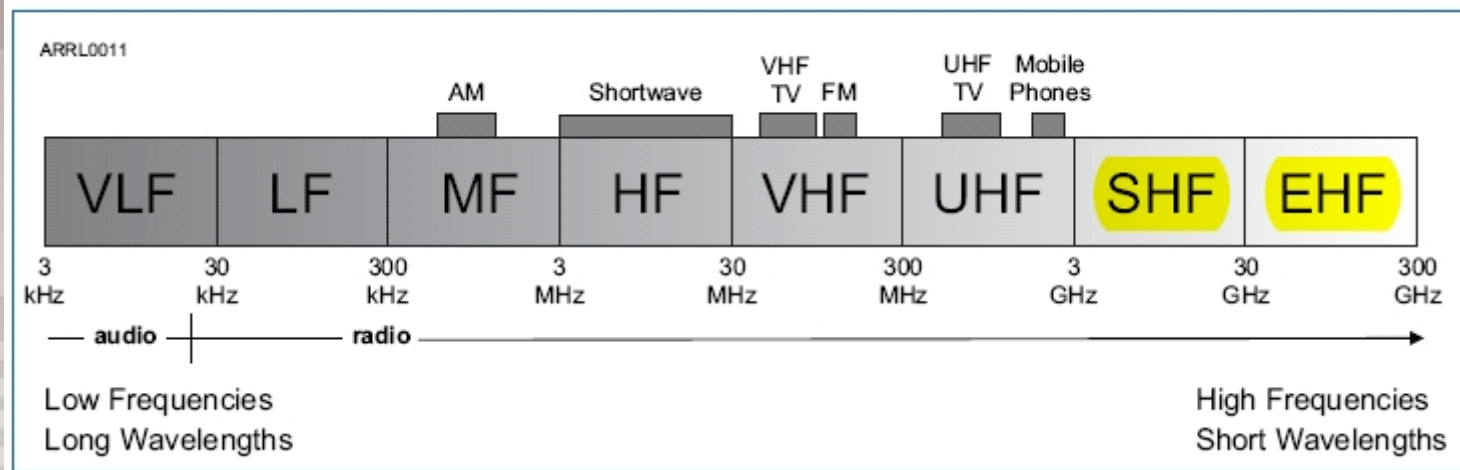
- The RF spectrum is the range of wave frequencies which will leave an antenna and travel through space.
- The RF spectrum is divided into segments of frequencies that basically have unique behavior.



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Radio Frequency (RF) Spectrum



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