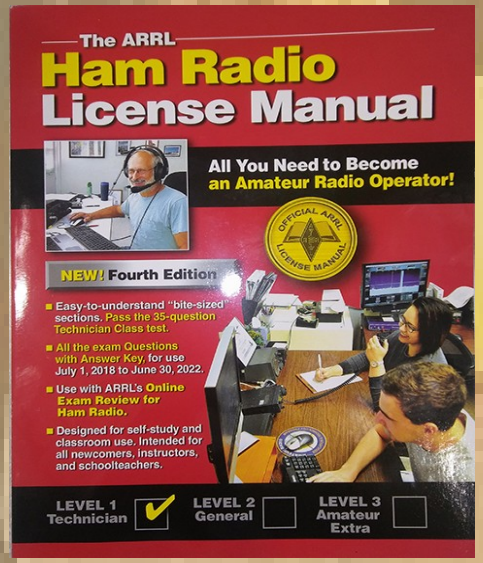
FCC Technician License Course



2018-2022 FCC Element 2 Technician Class Question Pool

Presented by:

Tamiami Amateur Radio Club (TARC)

Tamiami Amateur Radio Club
Venice, Florida

Meet Your Instructors

Andy Durette

KB1HIP

Extra Class

Paul Nienaber

KN4BAR

Extra Class

Steve Phillips

NS4P

Extra Class

What is Our Goal ?

Our goal during this class is for each of you to achieve the Technician Class Amateur Radio License!

- The license will authorize you to operate an Amateur Radio (Ham Radio) transmitter.

Steps to Get Your License

- Study the material in the *Ham Radio License Manual.*
- Review the questions in the back of the book
- Take interactive practice exams.
- Pass a proctored 35-question multiple choice test.
  - Questions pulled directly from the question pool.
  - Need to answer 26 questions correctly.

2018- 2022 Question Pool

35 of 428 Questions on the Test. Changes Every 4 Years on July 1st

T1 FCC Rules (6)
T2 Operating Procedures (3)
T3 Propagation (3)
T4 Ham Radio Practices (2)
T5 Electrical Principles (4)
T6 Circuit Components (4)
T7 Practical Circuits (4)
T8 Signals and Emissions (4)
T9 Antennas & Feedlines (2)
T0 RF Safety (3)

Passing Score is 75 %. You can miss 9 questions and still pass!

Only 3 Classes of License

- ~~Novice~~
- Technician
- General
- ~~Advanced~~
- Extra

Morse Code ???

NONE!

Feb 23, 2007

FCC has eliminated

Morse Code!

Find your License:

http://wireless.fcc.gov/uls

Why Be a HAM ?

There are many unlicensed radio services available. (Family Radio Service or FRS, Citizens Band or CB)

Ham radio is authorized:

- Fewer restrictions.
- More frequencies (channels or bands to utilize).
- More power (to improve range and quality).
- More ways to communicate.

What Hams Do

- Communicate
- Participate
- Experiment
- Build
- Compete
- Serve their communities
- Life-long learning

Which of the following is a purpose of the Amateur Radio Service as stated in FCC rules & regs? (T1A01)

A. Providing personal radio communications for as many citizens as possible
B. Providing communications for international non-profit organizations
C. Advancing skills in the technical and communication phases of the radio art
D. All of these choices are correct

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What is the FCC Part 97 definition of a ”space station”? (T1A07)

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What agency regulates and enforces the rules for the Amateur Radio Service ? (T1A02)

A. FEMA
B. The ITU
C. The FCC
D. Homeland Security

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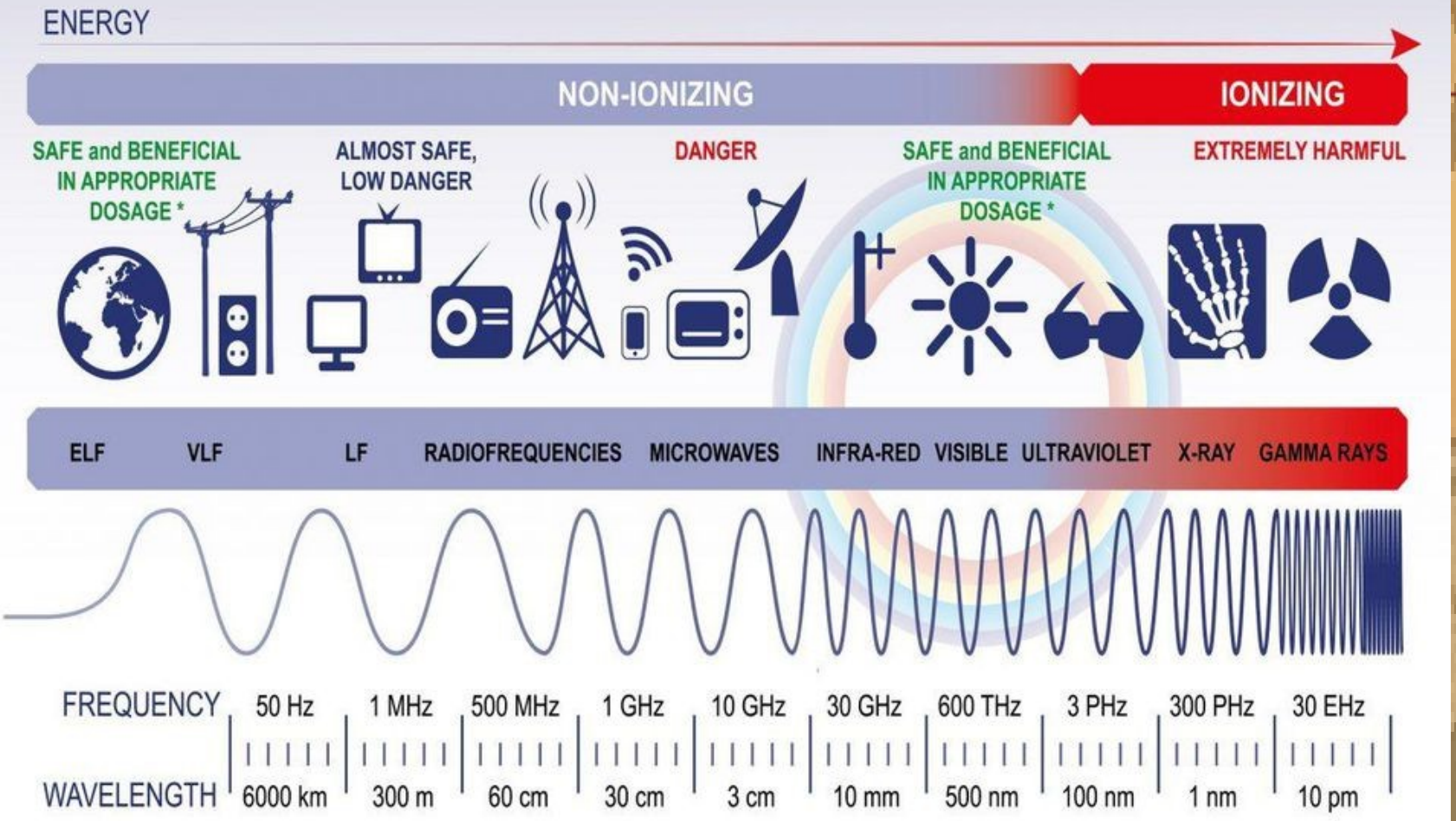
B. The ITU
C. **The FCC**
D. Homeland Security

Radio Signals and Waves

- **In alternating current (sine wave) the electrons flow in one direction one moment and then the opposite direction the next moment (a cycle)**
- **Radio waves (electromagnetic radiation) are sine waves. Also called EMR or RF**
- **Radio waves are used to carry the information you want to convey to someone else (modulation)**

THE ELECTROMAGNETIC SPECTRUM



Technician Band Plan

- Full privileges on 2M and 70cm (VHF and UHF)
- VERY restricted on the HF bands (10M to 80M)
- **SO...what can you do?**
  - Repeaters
  - SARNET
  - Digital radio (new)

Wave Vocabulary

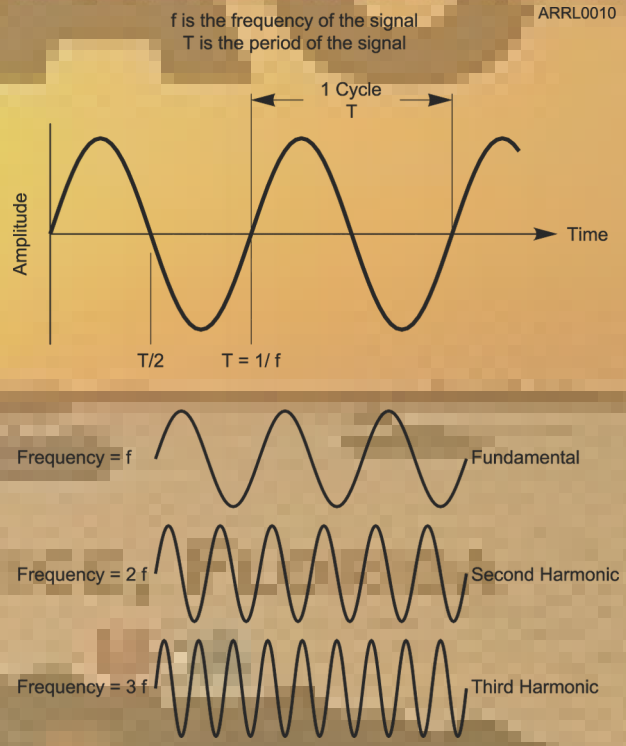
As we study radio waves, we will learn some new terms

- **Amplitude**
- **Frequency (Hertz)**
- **Period**
- **Wavelength (Meters)**
- **Harmonic**

f is the signal frequency

T is the period of the signal

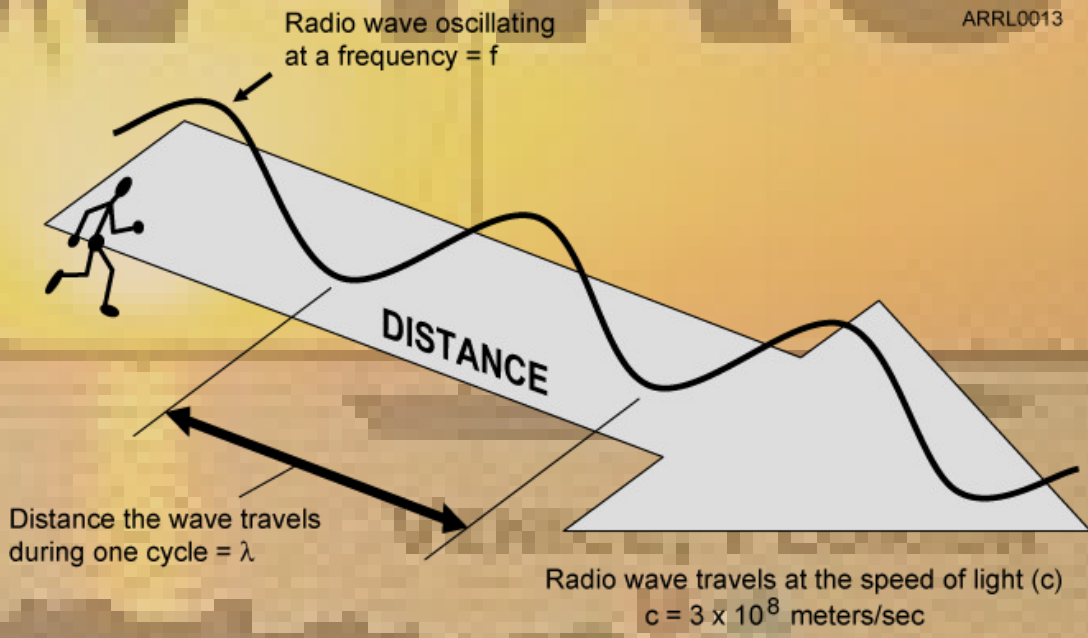
T = 1/f



Wave Length or λ

The distance a radio wave travels during one cycle

One complete change between magnetic and electric fields



$\lambda = c/f = 300 / f$ in MHz

Radio Signals and Waves

- Radio waves travel at the speed of light
  c = 300,000,000 m/sec (meters per second)

- **$\lambda = c/f$** SO a 1 MHz signal has a wave length of:

- 300,000,000 / 1,000,000 OR $300 \times 10^6 / 1 \times 10^6$
- Simplified to 300 / 1 OR 300 meters

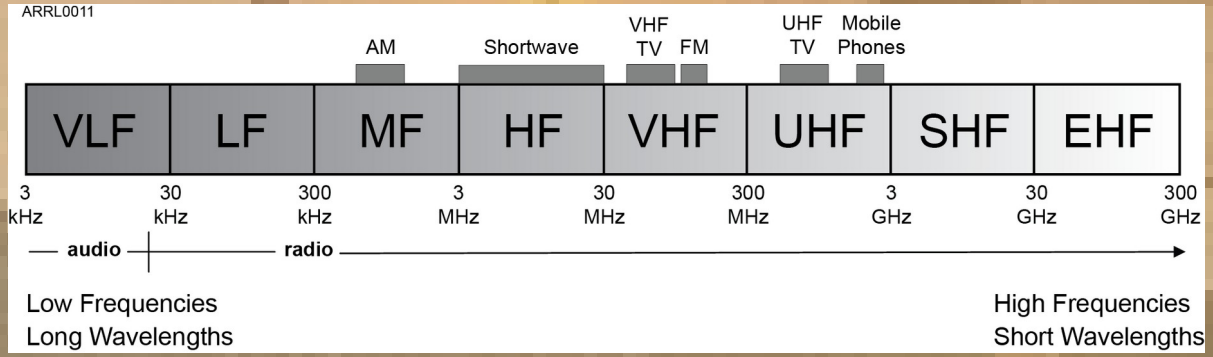
- Hence **$\lambda = 300 / f$ in MHz**

Wave Length & Frequency Band

Frequency	λ = 300/ f in MHz	HAM BAND
146.730 MHz (VHF)	300/146.73 = 2.045 M	2 meter band
7.240 MHz (HF)	300/7.240 = 41.436 M	40 meter band
14.225 MHz (HF)	300/14.225 = 21.090 M	20 meter band
436.000 MHz (UHF)	300/436.000 = 0.688 M	70 centimeter band

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 have a unique behavior**

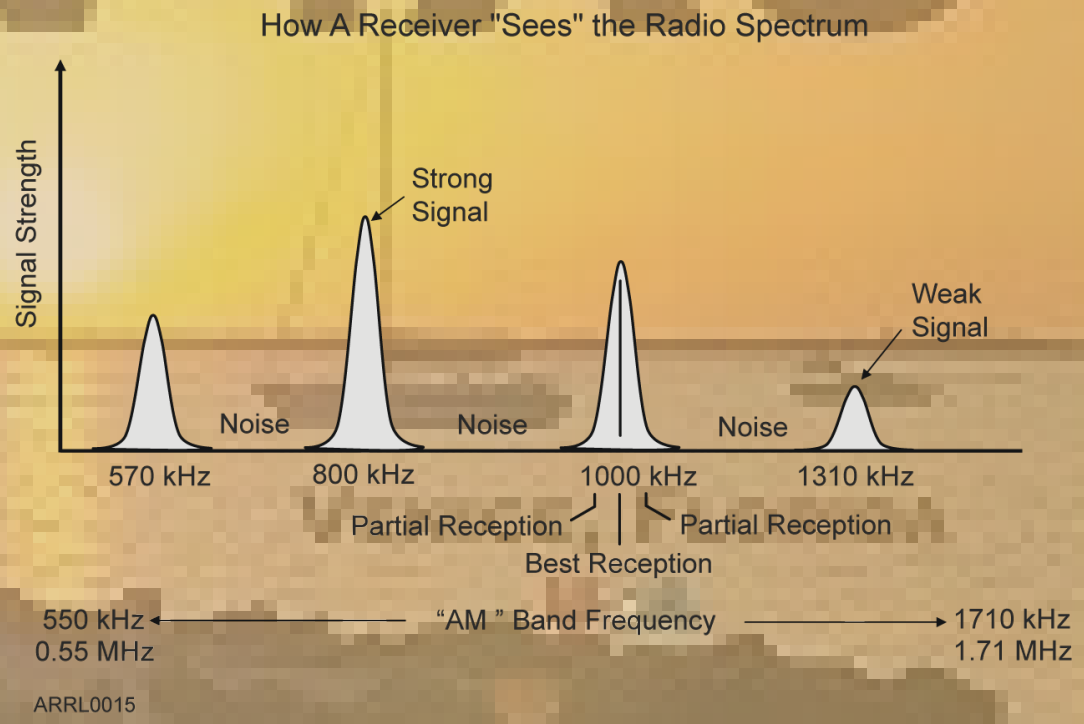


RF Spectrum Ranges

Range Name	Abbreviation	Frequency Range
Very Low Frequency	VLF	3 kHZ – 30 kHZ
Low Frequency	LF	30 kHz – 300 kHz
Medium Frequency	MF	300 kHz – 3 MHz
High Frequency	HF	3 MHz – 30 MHz
Very High Frequency	VHF	30 MHz – 300 MHz
Ultra High Frequency	UHF	300 MHz – 3 GHz
Super High Frequency	SHF	3 GHz – 30 GHz
Extremely High Frequency	EHF	30 GHz – 300 GHz

What a Radio Receiver Sees

- Signals received at some frequency and amplitude
- Strong signals have high amplitude
- A signal has a "**center frequency**" and some partial signal strength on either side of the center frequency



Signal Strength – Decibel (dB)

- **The “Bell” is a unit of measure of sound intensity.**
- **A decibel is 1/10 of a Bell**
- **Very wide range, from a whisper to an explosion!**
- **Measured on a logarithmic scale as 10 log (p_1 / p_0)**

Signal Strength – Decibel (dB)

- **dB is the ratio of two quantities as a power of 10**
  - **- 3 dB is half power**
  - **+ 3 dB is twice power**

Signal Strength – Decibel (dB)

- **T5B9 The approximate amount of change, measured in decibels (dB), of a power increase from 5 watts to 10 watts is 3dB.**
- **T5B10 The approximate amount of change, measured in decibels (dB), of a power decrease from 12 watts to 3 watts is -6dB.**
- **T5B11 The approximate amount of change, measured in decibels (dB), of a power increase from 20 watts to 200 watts is 10 dB.**

Numbers and the Metric System

- **Dealing with Very Big and Very Small Numeric Values**
- **In electronics we deal with large and small numbers**
- **The international metric system provides a method of dealing with the wide range of values**

International System of Units (SI)

- Giga- 1,000,000,000
- Mega- 1,000,000
- Kilo- 1,000
- deci- 1/10
- centi- 1/100
- milli- 1/1000
- micro- 1/1,000,000
- nano- 1/1,000,000,000
- pico- 1/1,000,000,000,000

How many milliamperes is the same as 1.5 amperes? (T5B01)

A. 15 milliamperes
B. 150 milliamperes
C. 1500 milliamperes
D. 15000 milliamperes

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How many volts are equal to one microvolt? (T5B04)

A. One one-millionth of a volt
B. One million volts
C. One thousand volts
D. One one-thousandth of a volt

How many volts are equal to one microvolt? (T5B04)

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How many volts are equal to one kilovolt? (T5B03)

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B. One hundred volts
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D. One million volts

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Add Information - Modulation

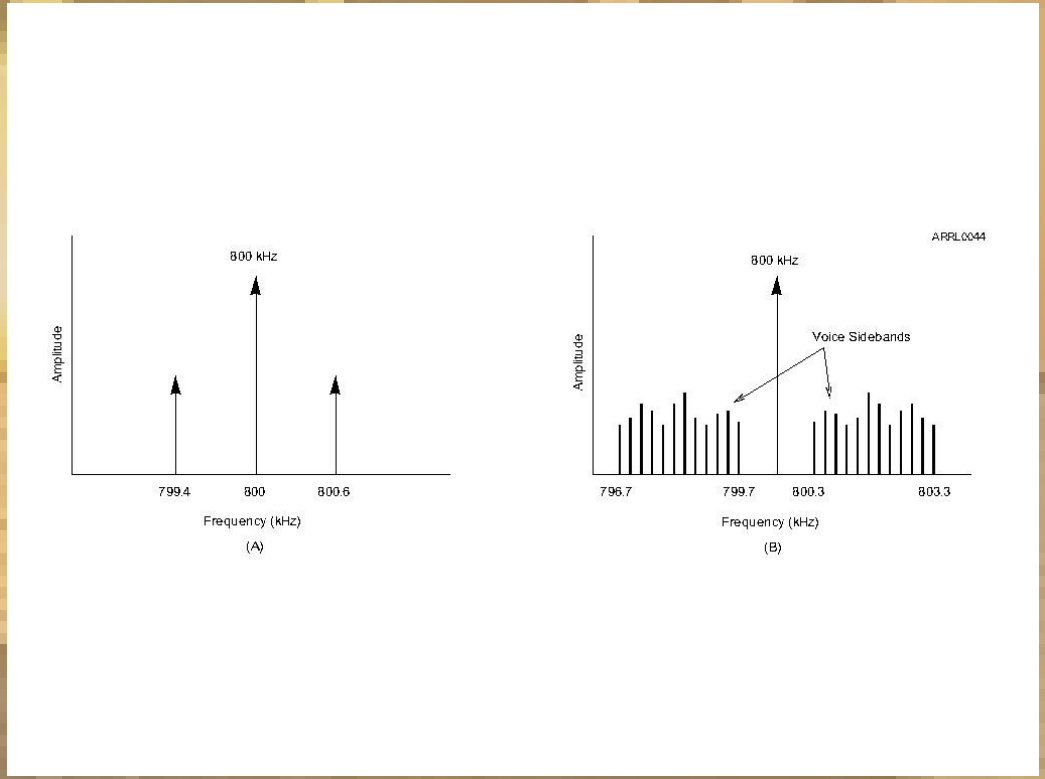
- When we imprint some information on the radio wave, we **modulate** the wave
  - Turn the wave on and off with CW modulation
  - Voice AM, Sideband (SSB), and FM, or Data modulation
- Different modulation techniques are called **modes**
  - CW continuous wave or Morse code
  - Phone or voice communications (AM, FM, SSB)
  - RTTY (radio teletype)
  - PSK (phase shift keying)
  - FT8 (newest and very popular)

Amplitude Modulation (AM)

- In AM, the amplitude of the carrier wave is modified in step with the waveform of the information (voice)
- Combining Voice with an RF carrier produces 2 identical sidebands
- Most voices range from 300 hertz to about 3000 Hz
- Our hearing range goes to about 20 kHz

AM Voice Modulation

- Center frequency or “carrier” and two sidebands, upper and lower (USB and LSB)
- Both sidebands have information (voice)
- Earliest Voice Mode Used
- Note AM mode band width of 6 kHz 803 – 797 = 6 kHz
- CW bandwidth is only 150 Hz

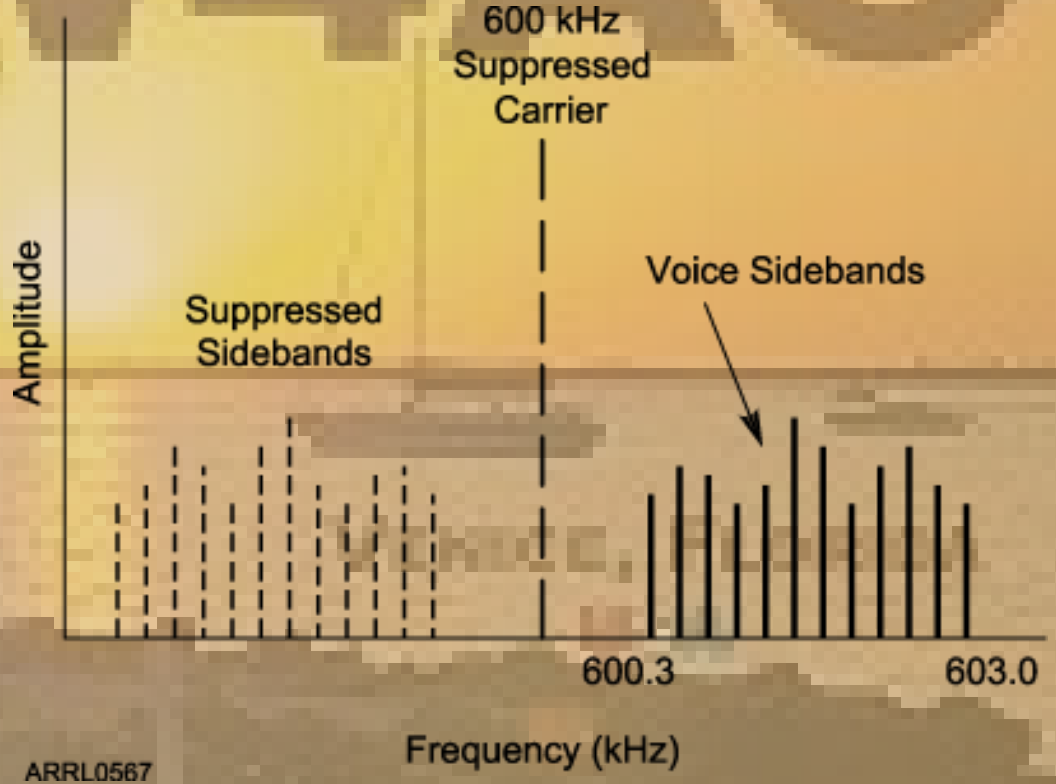


Single Sideband Modulation (SSB)

- Combining Voice with an RF carrier produces 2 identical sidebands (UPPER and LOWER)
- We can improve efficiency of transmission by transmitting only one sideband and then reconstruct the missing sideband at the receiver
- More efficient than AM modulation
- Cleaner more powerful audio signal
- Only uses 3 kHz of bandwidth, half of AM!

Single Sideband Modulation (SSB)

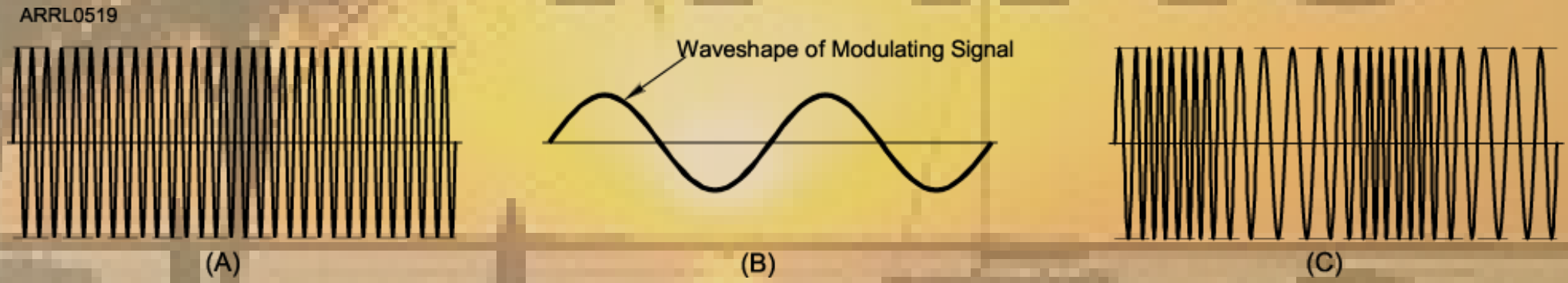
- 10 MHz and up uses USB
- Below 10 MHz uses LSB
- No “Rule” for this, just by convention
- There are some exceptions



Frequency Modulation (FM)

- Instead of varying amplitude, if we vary the frequency in step with the information waveform – FM is produced
- We shift the frequency of the transmitter up and down to carry information
- The amount of frequency variation is called carrier deviation or just plain "**deviation**".
- Speaking too loud can increase bandwidth to 15 kHZ or more.
- Excessive deviation can:
  - Cause interference to adjacent signals
  - Exceed band limits when operating near edge of a band

Frequency Modulation (FM)

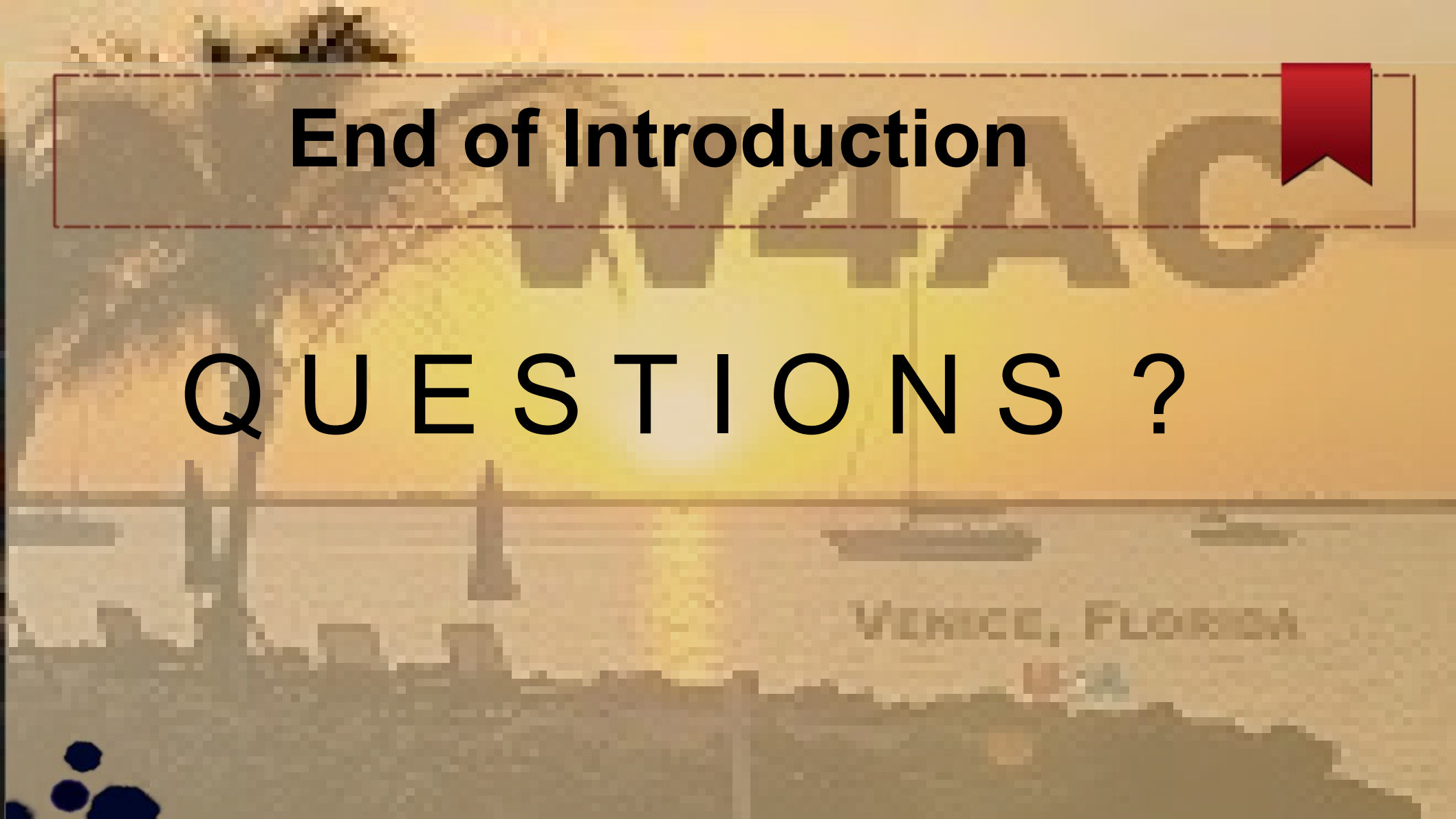


- FM can be used for data transmissions as audio tones
- An acoustic modem with an RF signal
- **Everything old is new again!**

Signal Bandwidth Summary

Type of Signal	Typical Bandwidth
AM voice	6 kHz
AM broadcast	10 kHz
SSB voice	2 to 3 kHz
SSB digital	500 to 3000 Hz
CW	150 Hz
FM voice	10 to 15 kHz
FM broadcast	150 kHz

End of Introduction



Q U E S T I O N S ?