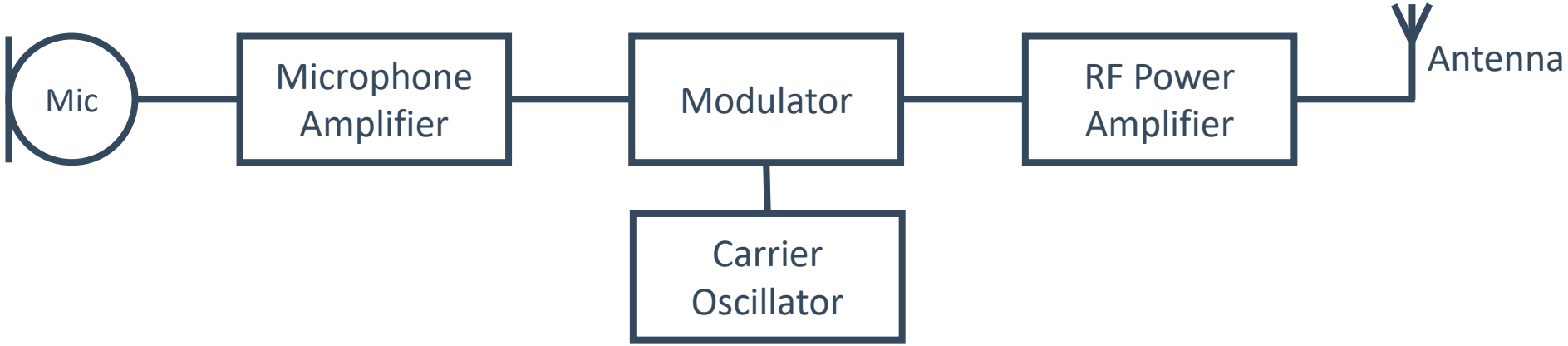
UK Foundation Amateur Radio License

Transmitters and Receivers

Purpose of a Transmitter

- To send information from one place to another wirelessly
- Requires taking an information signal and converting it to an RF signal

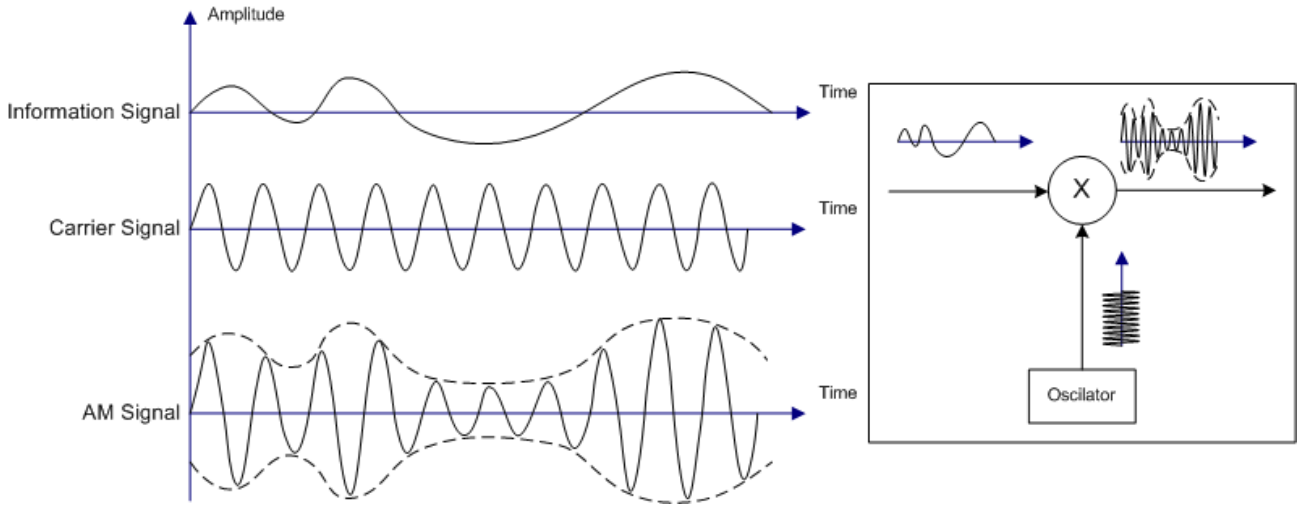


Modulation

- The process of adding information to a carrier signal
- Map the information to one (or more) of the properties of a wave
  - Frequency Modulation (FM)
  - Amplitude Modulation (AM)
  - Phase Modulation (PM)

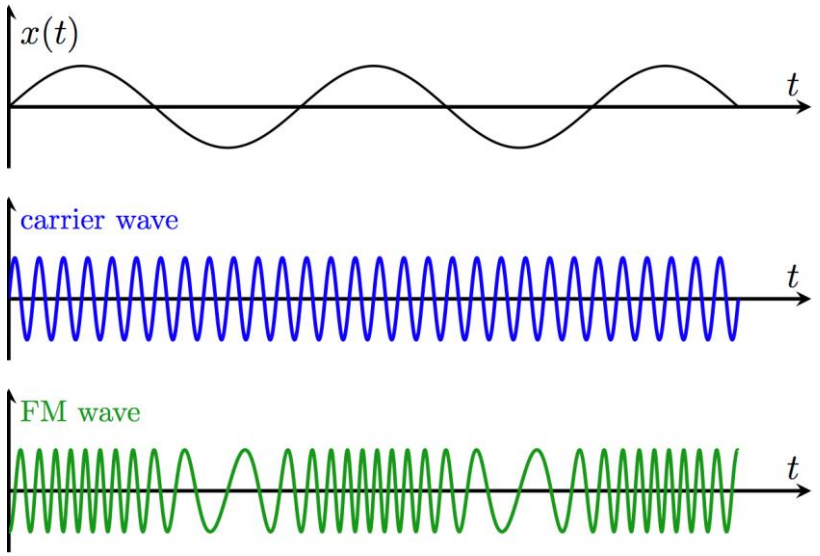
Amplitude Modulation

- Information (baseband) signal becomes an *envelope* on the carrier signal
- Changing amplitude, constant frequency, constant phase
- Having the envelope cross zero results in distortion
  - *Overmodulation*



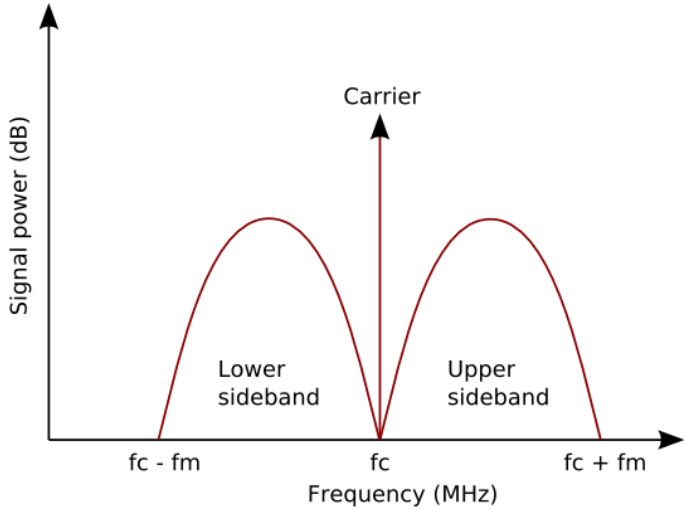
Frequency Modulation

- The information signal (baseband signal) scales the frequency
- Varying frequency, constant amplitude, constant phase



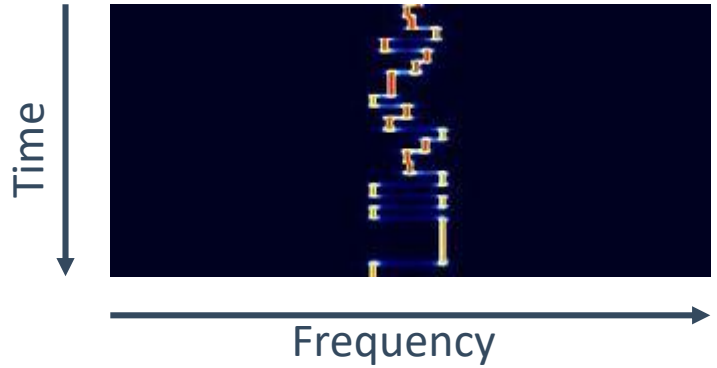
Sidebands

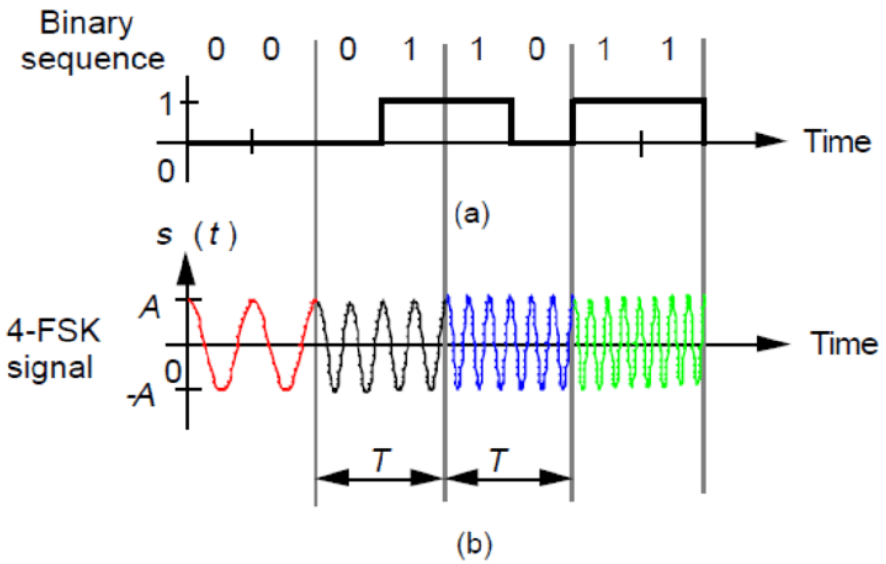
- When the baseband signal is shifted to the carrier frequency sidebands can be created
  - Upper Sideband (USB)
  - Lower Sideband (LSB)
- With AM, the sidebands are mirror images
  - No extra information, waste of bandwidth!
- Frequently transmitters will suppress one or the other sideband
  - Also more energy efficient! Can have a stronger signal
  - Transmitting both is called Double Sideband (DSB) or just AM, not common



Data Modulation

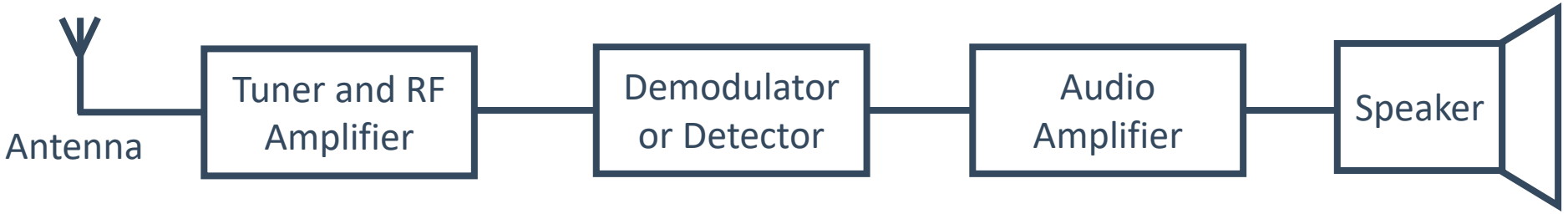
- Still doing AM, FM, PM, or a combination
- Information signal is digital rather than analog
- Frequency Shift Keying (FSK)
  - Group binary data into 1,2,… bit chunks
  - Map chunks to frequencies
- Can use microcontrollers or PCs





Receivers

- EM signal picked up by antenna, converted to voltage/current
- Tuned circuits (Filters) select the signal (frequencies) desired
  - Usually an RF amplifier to increase the weak signal
- Convert the modulated signal back to a baseband signal
  - Recovering the information signal by demodulating
- For an analog voice signal, amplify again and output to a speaker



Demodulators

- Must match the demodulator to the type of modulation used
  - AKA don’t try to decode an FM signal with an AM demodulator
- For the exam, questions assume that AM and FM signals are analog and are output to a speaker

Software Defined Radio

- Use digital signal processing to (de)modulate
- Moves hardware processing into software
  - Easier to change, Often simpler to implement