



# *Chelmsford Amateur Radio Society*

# **Foundation Course**

# **Transmitters & Receivers**

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Chelmsford Amateur Radio Society  
Foundation Licence Course

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(4) Transmitters & Receivers



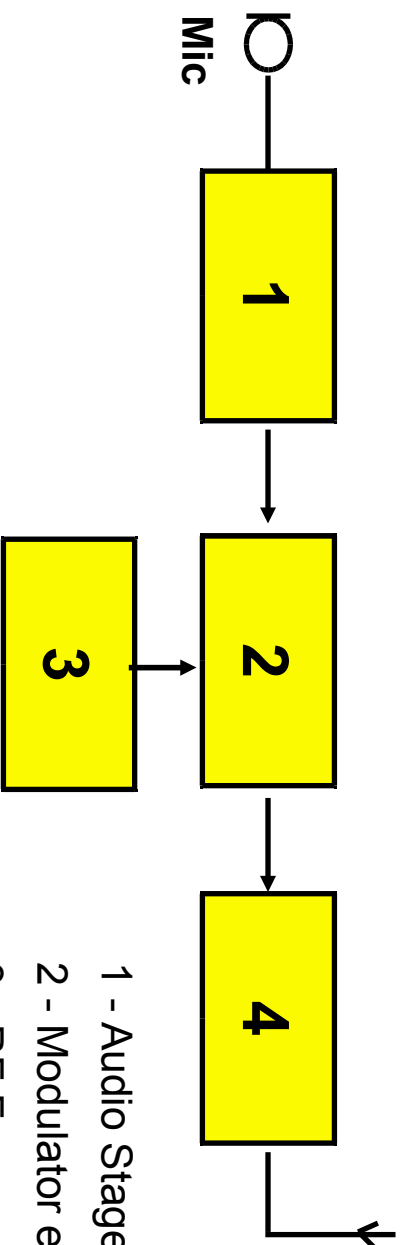
# Tuned Circuits

- Radios depend on the concept of tuned circuits.
- Tuned circuits are built from combinations of Inductors and Capacitors which have a self-resonant frequency.
- Tuned circuits are thus able to selectively pass or block frequencies in transmitters and receivers.
- They are the basis of tuners, filters, oscillators, ATUs etc.



# Transmitters

- Transmitter concept is in the block diagram below:-
- Foundation Licence only permits use of commercial equipment to minimise the risk of interference and/or out-of-band operation.
- Avoid over-deviating, and operating PAs into poor matches !!

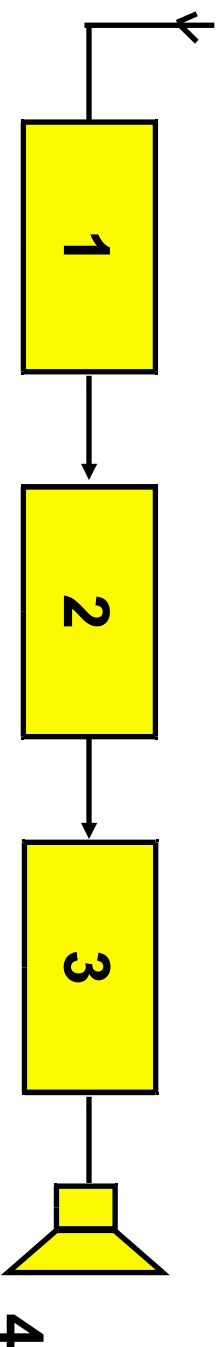


- 1 - Audio Stage
- 2 - Modulator eg AM, FM, SSB
- 3 - RF Frequency Generator
- 4 - RF Power Amplifier



# Receivers

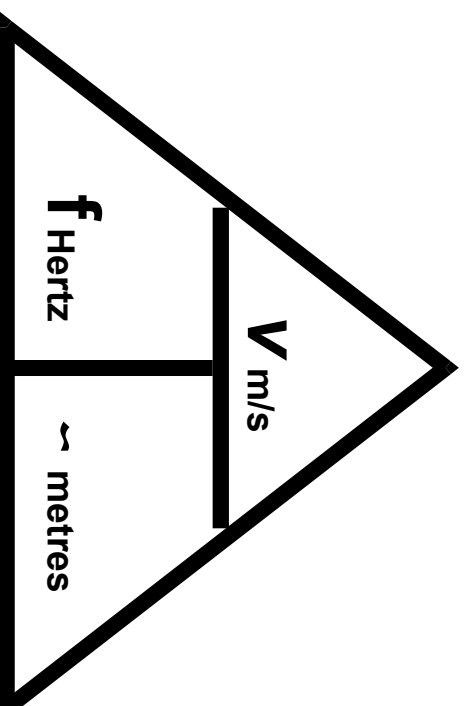
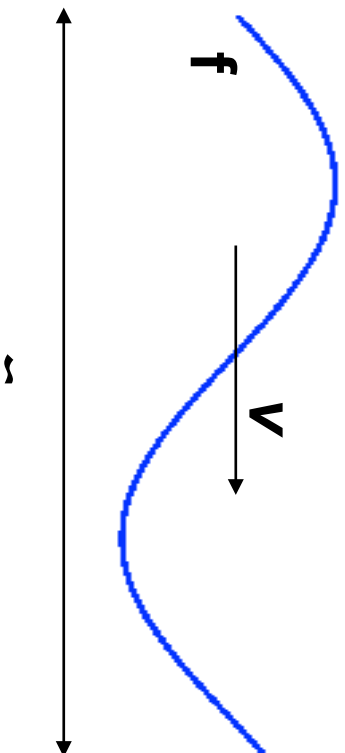
- Receiver concept is in the block diagram below:-
- RF Front-end is critical to performance. Inductors and capacitors create selectively tuned circuits.
- RF Amplifier stage dominates the Noise performance
- Detection circuits for decoding AM, FM etc are different





# Modulation

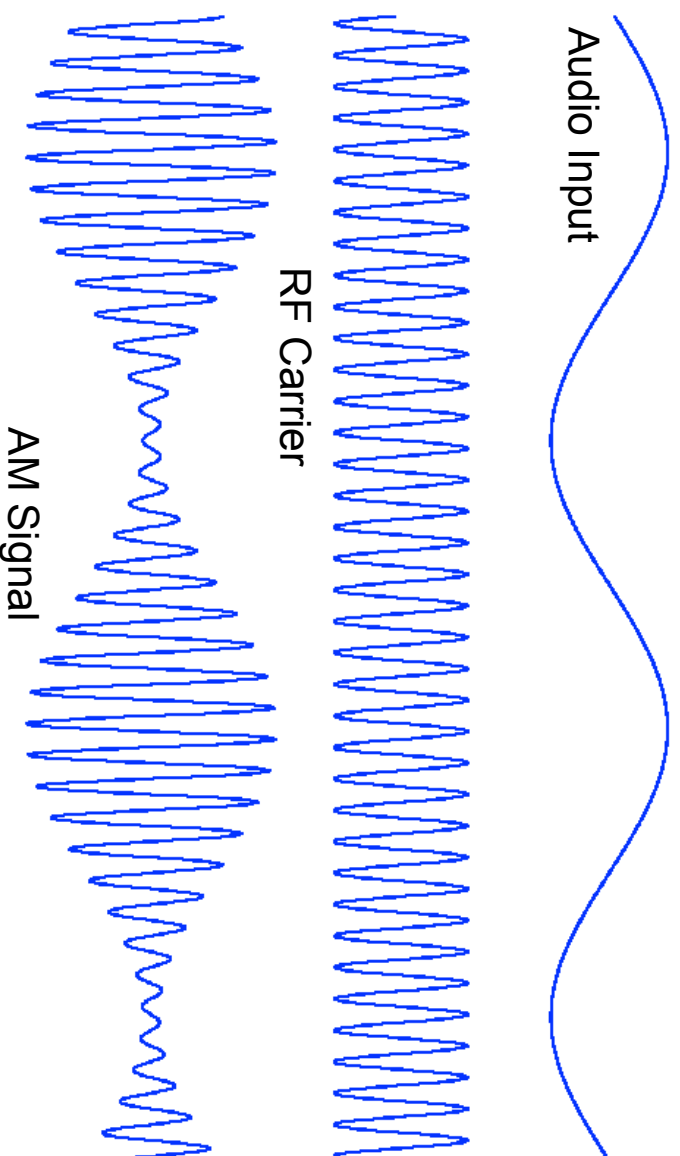
- Modulation (or Mode) refers to how audio or data information is superimposed onto an RF 'Carrier' frequency
- Remember - the RF Carrier is a sine wave:-





# AM Modulation

- **AMPLITUDE MODULATION (AM)** - The audio signal varies the amplitude of the RF Carrier

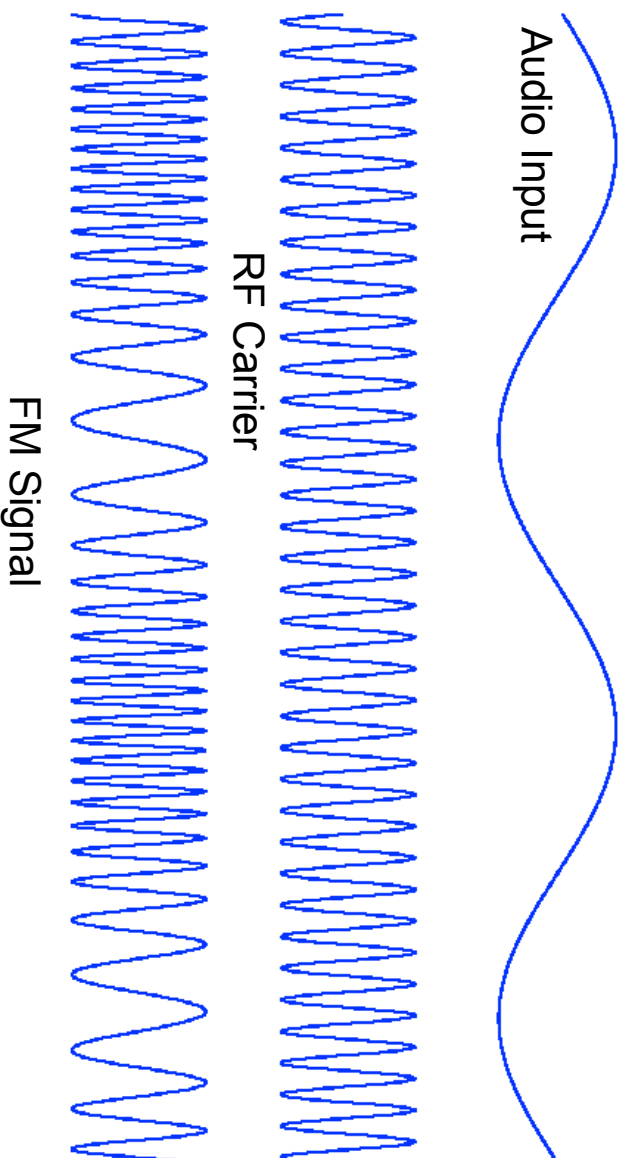


- Note if Audio is too strong, clipping and distortion occurs
- Simple AM gives carrier with lower and upper sidebands



# FM Modulation

- **FREQUENCY MODULATION (FM)** - The audio signal varies the Frequency of the RF Carrier - its Amplitude stays constant

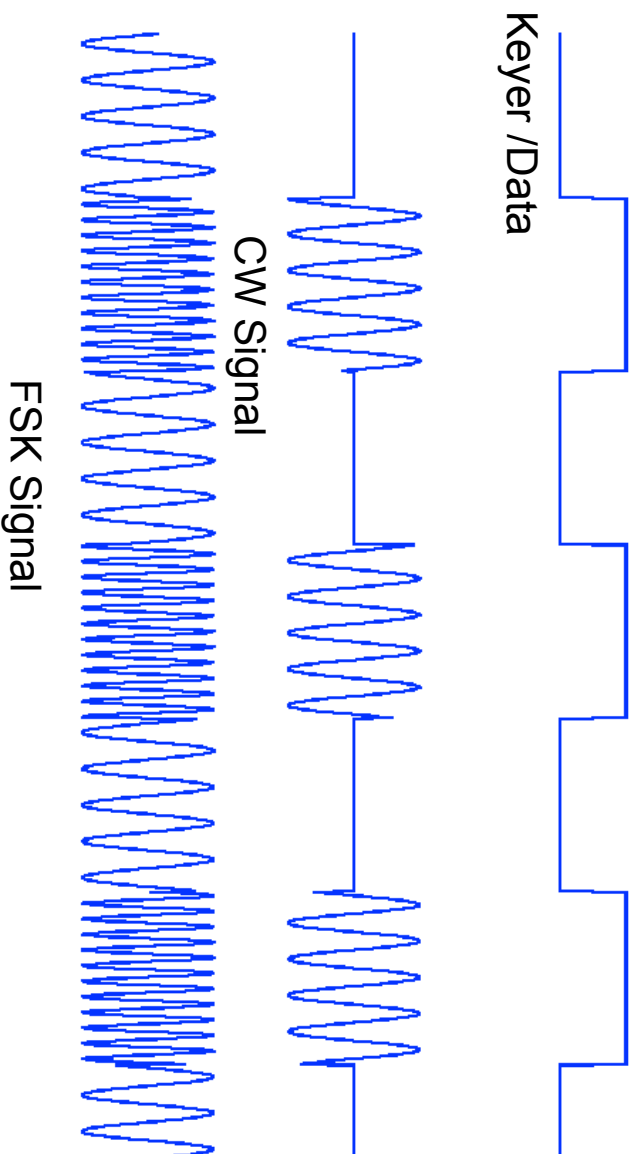


- Actual amount of variation is small & called **Deviation**
- **Signal Amplitude is constant and doesn't carry info. It's therefore less prone to interference**



# CW & FSK Modulation

- **Morse, also called CW, is the simplest form of digital mode.**
- **FSK, Frequency Shift Keying, is used for higher speed 'Packet' data**



- **Poor Edges can give ringing or key clicks**
- **Don't overdrive if TNCs used for Packet Data**
- **Data rates are limited by available Bandwidth**





# Earthing / EMC

- Good reception especially on HF, as well as EMC performance, depends on good earthing.
- Ensure shack equipment is run from a common mains earth to prevent earth loops - use filtered mains boards and ferrite rings correctly.
- RF Earths for antennas are often separate - consider earth stakes etc.
- Modern Gas & Water Pipes can give high resistance earth.
- AM/SSB can be rectified/detected easily, so is most prone to cause interference - Operate in a responsible manner!



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# Operating Precautions

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- **Ensure Transmitter frequencies/modes are setup correctly so emissions are always in band, and conform to bandplans.**
- **RF power amplifier outputs must be connected to a correctly matched antenna to work properly. Use of the wrong antenna can result in damage to the transmitter.**
- **Excessive AM modulation or FM deviation will cause distorted outputs, and interference on adjacent channels**
- **Ensure that Microphone Gain (where fitted) is correctly adjusted**