CRS: FM mode of transmission, its reach and advantage

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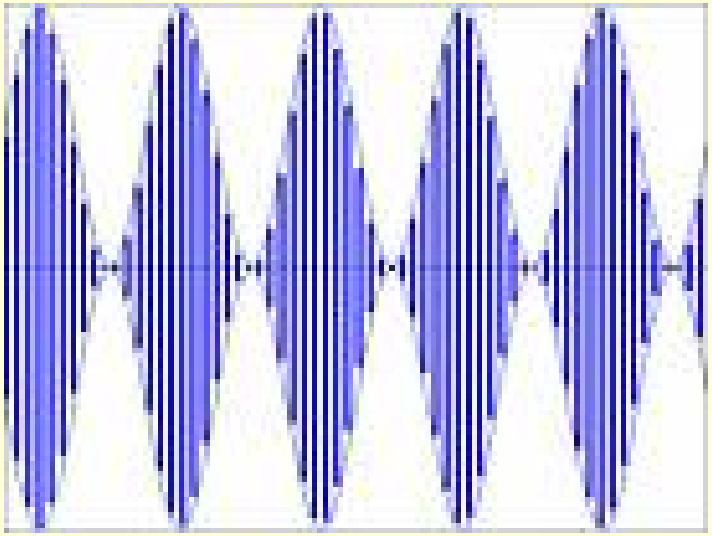
Basic idea of radio

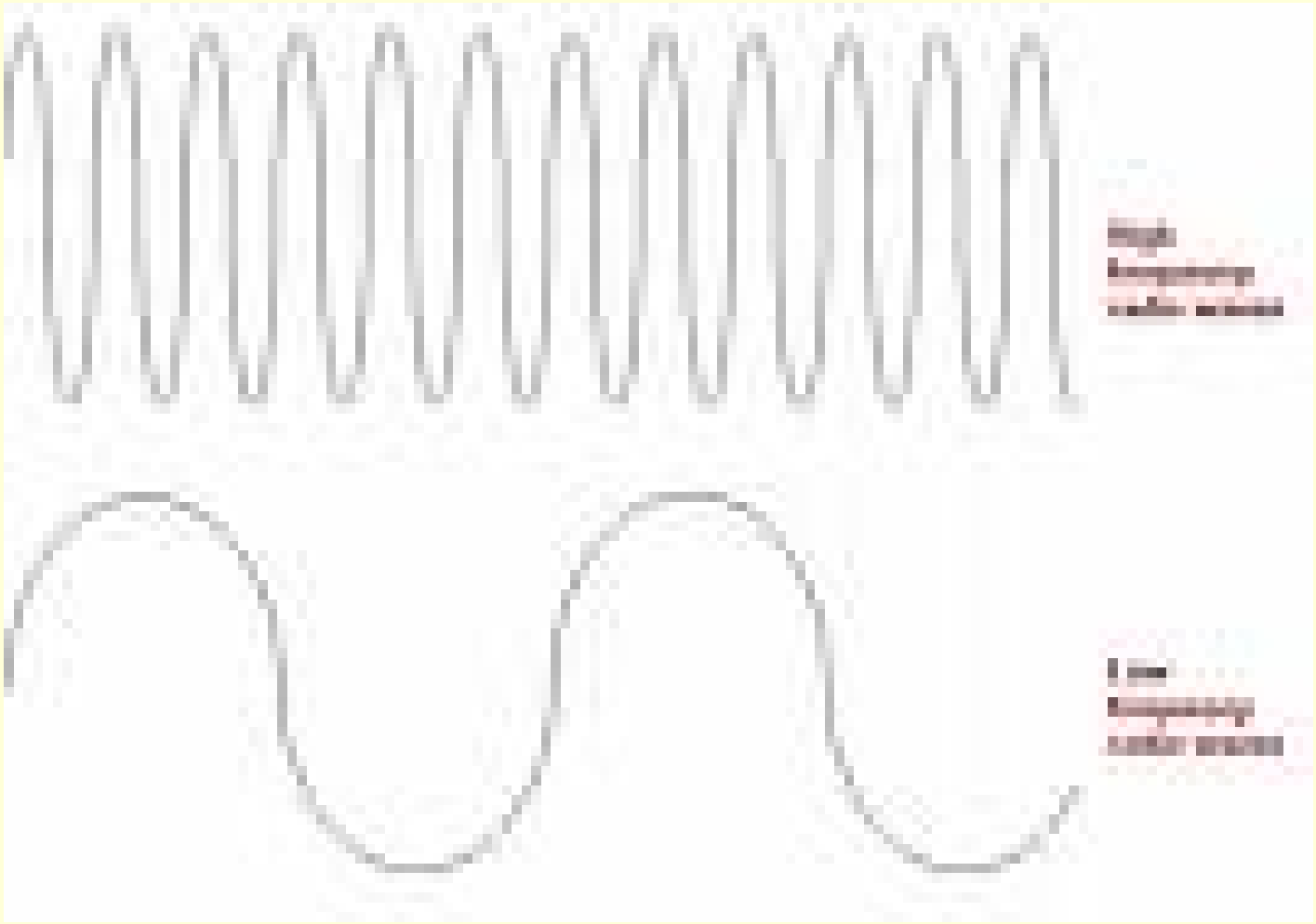
- Radio is a way of sending electrical energy between two places without using wires. That's why it's often called **wireless**.
- The piece of equipment that sends a radio wave is called a **transmitter**
- Radio wave ends its journey at another piece of equipment called a **receiver**.

- When you pull up the antenna (aerial) on an ordinary radio receiver, it catches some of the electromagnetic energy passing by.
- Tune the radio into a station and an electronic circuit inside the radio selects only the program you want
- The electromagnetic energy, which is a mixture of electricity and magnetism, travels in **waves** like those on the surface of the ocean.
- These are called radio waves. Like ocean waves, radio waves have a certain speed, length, and frequency. The speed is simply how fast the wave travels between two places

Radio Waves



Radio Waves -- contd

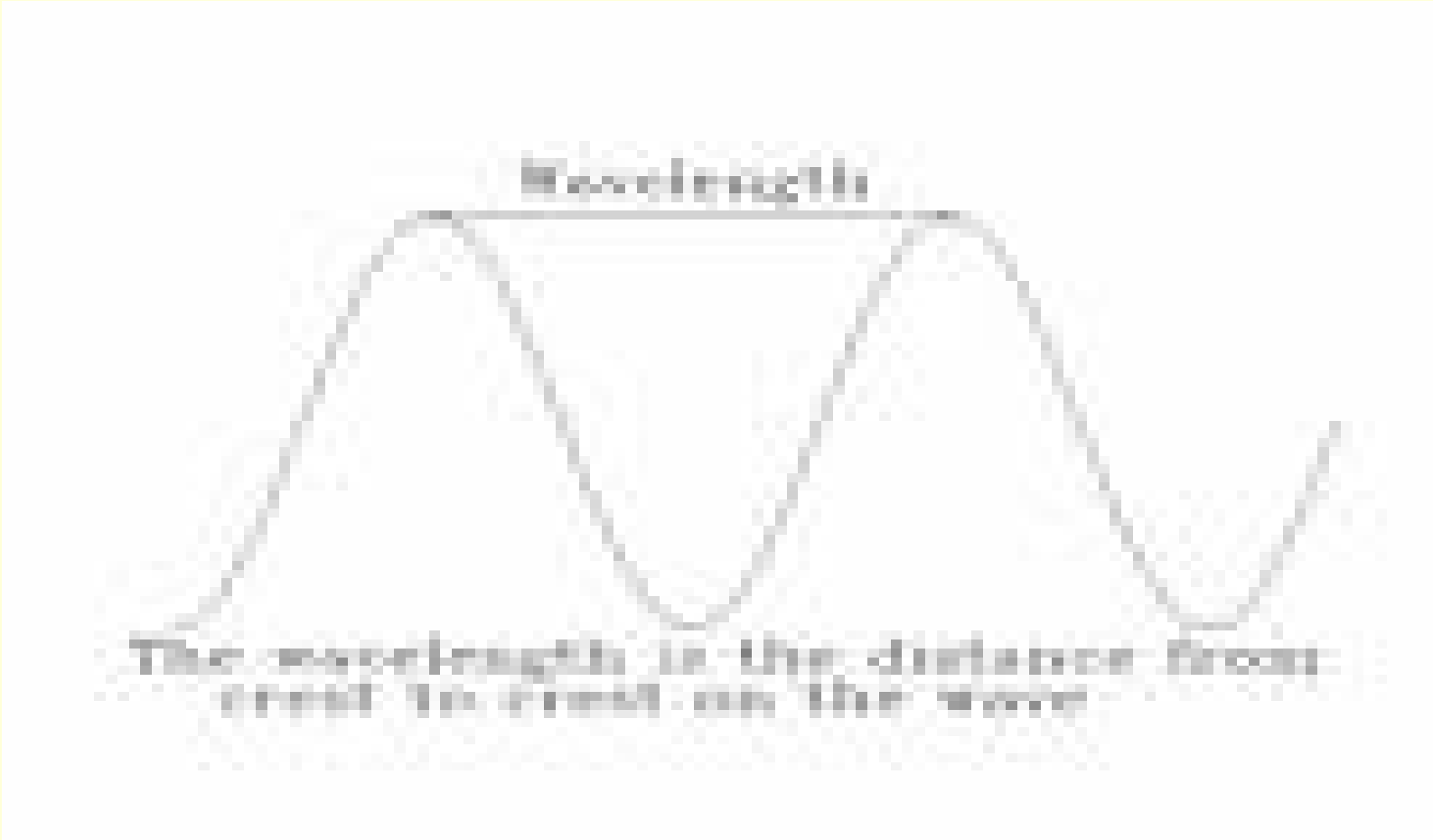


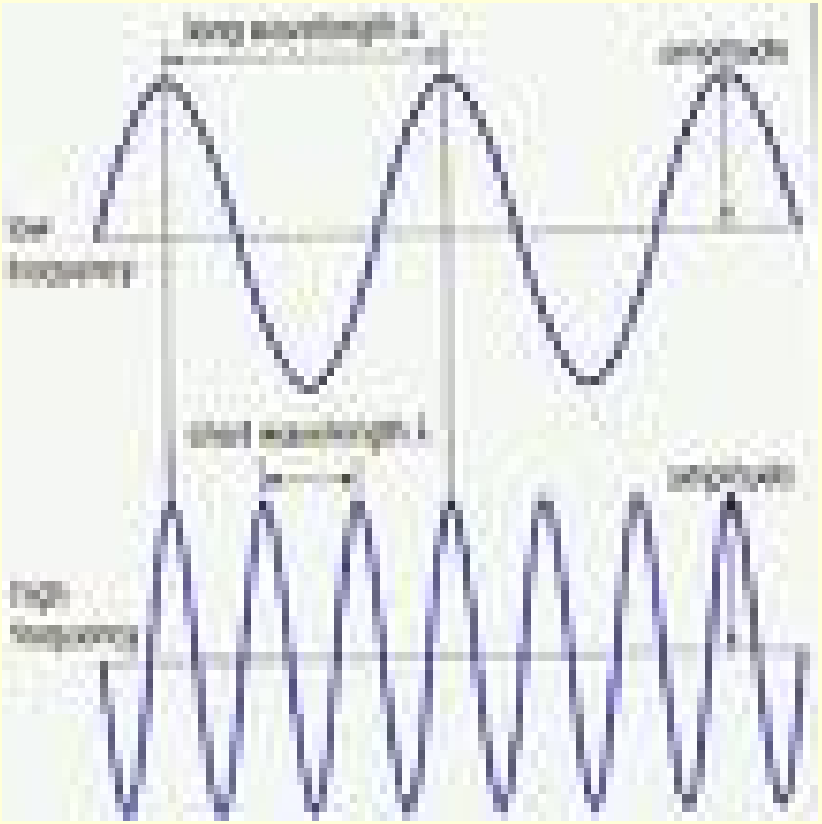
Wavelength , Amplitude and Frequency

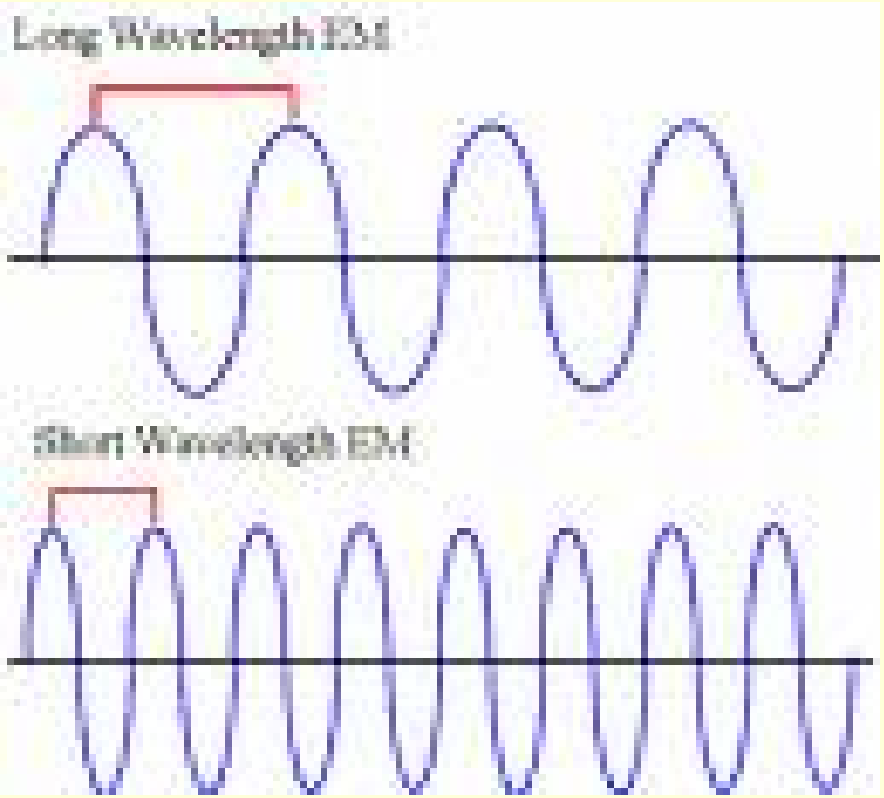
- The **wavelength** is the distance between one crest (wave peak) and the next, while the **frequency** is the number of waves that arrive each second.
- Frequency is measured with a unit called H**ertz**, so if seven thousand waves arrive in a second, we call that seven kHertz (7000 Hz).
- If you've ever watched ocean waves rolling in to the beach, you'll know they travel with a speed of maybe one meter (three feet) per second or so.

- The wavelength of ocean waves tends to be tens of meters or feet, and the frequency is about one wave every few seconds.
- Radio waves are much faster, longer, and more frequent than ocean waves, however.
- Their wavelength is typically hundreds of meters—so that's the distance between one wave crest and the next.
- **Amplitude** is the height of the peak of wave measured from base

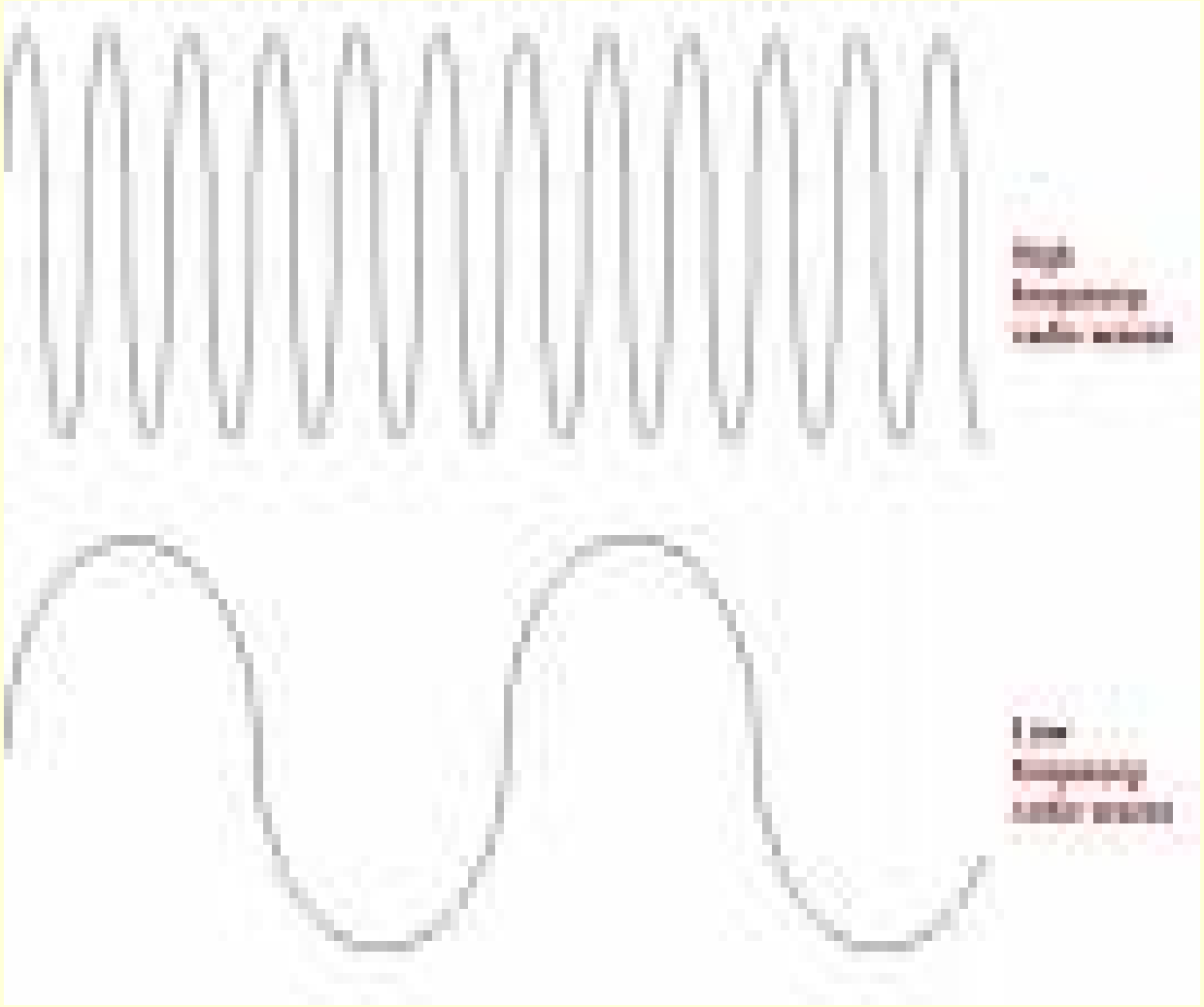
Wavelength


Wavelength
The wavelength is the distance from
crest to crest on the wave




Long Wavelength EM
Short Wavelength EM

Frequency



- But their frequency can be in the millions of hertz—so millions of these waves arrive each second.
- If the waves are hundreds of meters long, how can millions of them arrive so often?
- Radio waves travel *unbelievably* fast—at the speed of light (300,000 km or 186,000 miles per second).

How analog radio works?

- Ocean waves carry energy by making the water move up and down.
- In much the same way, radio waves carry energy as an invisible, up-and-down movement of electricity and magnetism.
- This carries program signals from huge transmitter antennas, which are connected to the radio station in all directions

Modulation

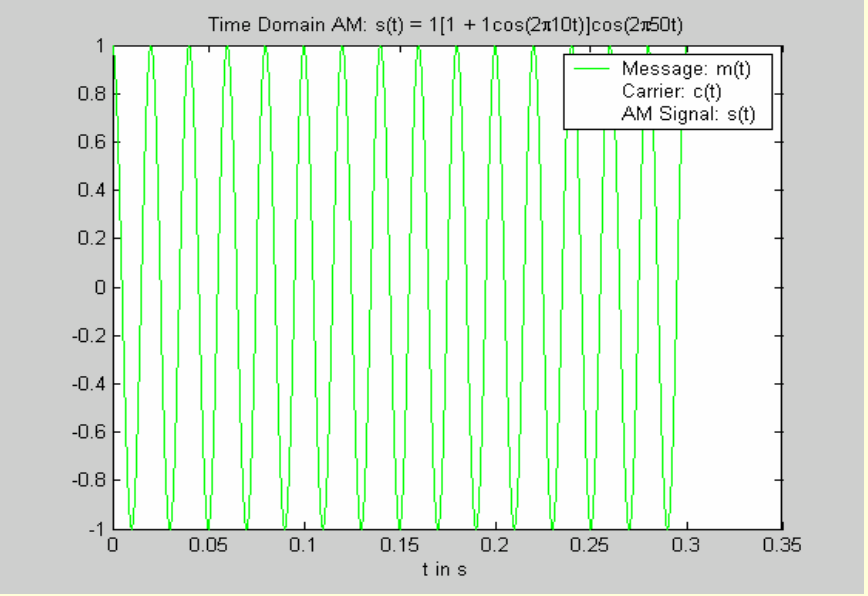
- A program is transmitted by adding it to a radio wave called a **carrier.**
- This process is called **modulation**.
- One way of sending a radio signal is to make the peaks of the carrier wave bigger or smaller.
- Since the size of a wave is called its amplitude, this process is known as **amplitude modulation (AM)**.

Frequency Modulation

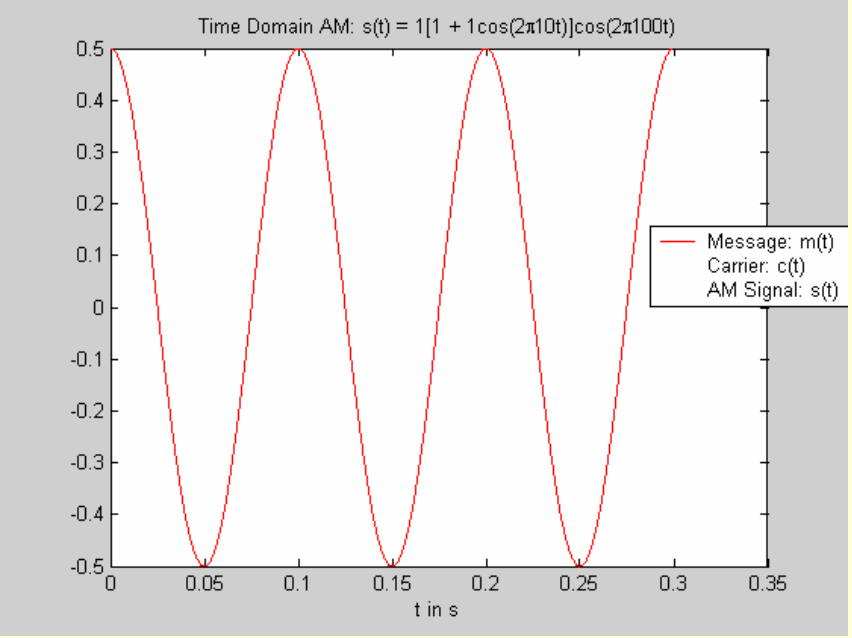
- Sometimes a radio program is added to the carrier in such a way that the program signal causes fluctuations in the carrier's frequency. This is called **frequency modulation (FM)**.
- Frequency modulation is how FM radio is broadcast; amplitude modulation is the technique used by AM radio stations.

1 . AMPLITUDE MODULATION

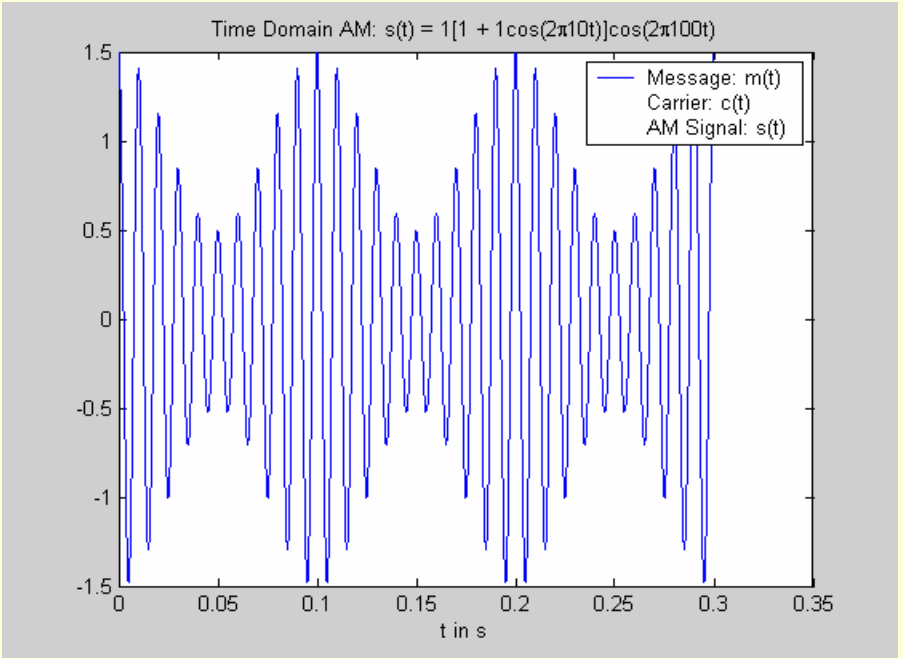
- PROCESS OF VARYING AMPLITUDE OF CARRIER ACCORDING TO INSTANTANEOUS AMPLITUDE OF MODULATING SIGNAL
- FREQUENCY OF CARRIER IS MUCH HIGHER THAN THAT OF MODULATING SIGNAL
- IN RADIO BROADCASTING , CARRIER MAY BE MW , HF or VHF RANGE



Carrier Signal



Modulating Signal



Amplitude Modulated Signal

2 . FREQUENCY MODULATION

- PROCESS OF VARYING THE INSTANTANEOUS FREQUENCY OF A CARRIER ACCORDING TO THE **AMPLITUDE** OF THE MODULATING SIGNAL
- WAVEFORM OF FM SIGNAL IS SHOWN IN FIG

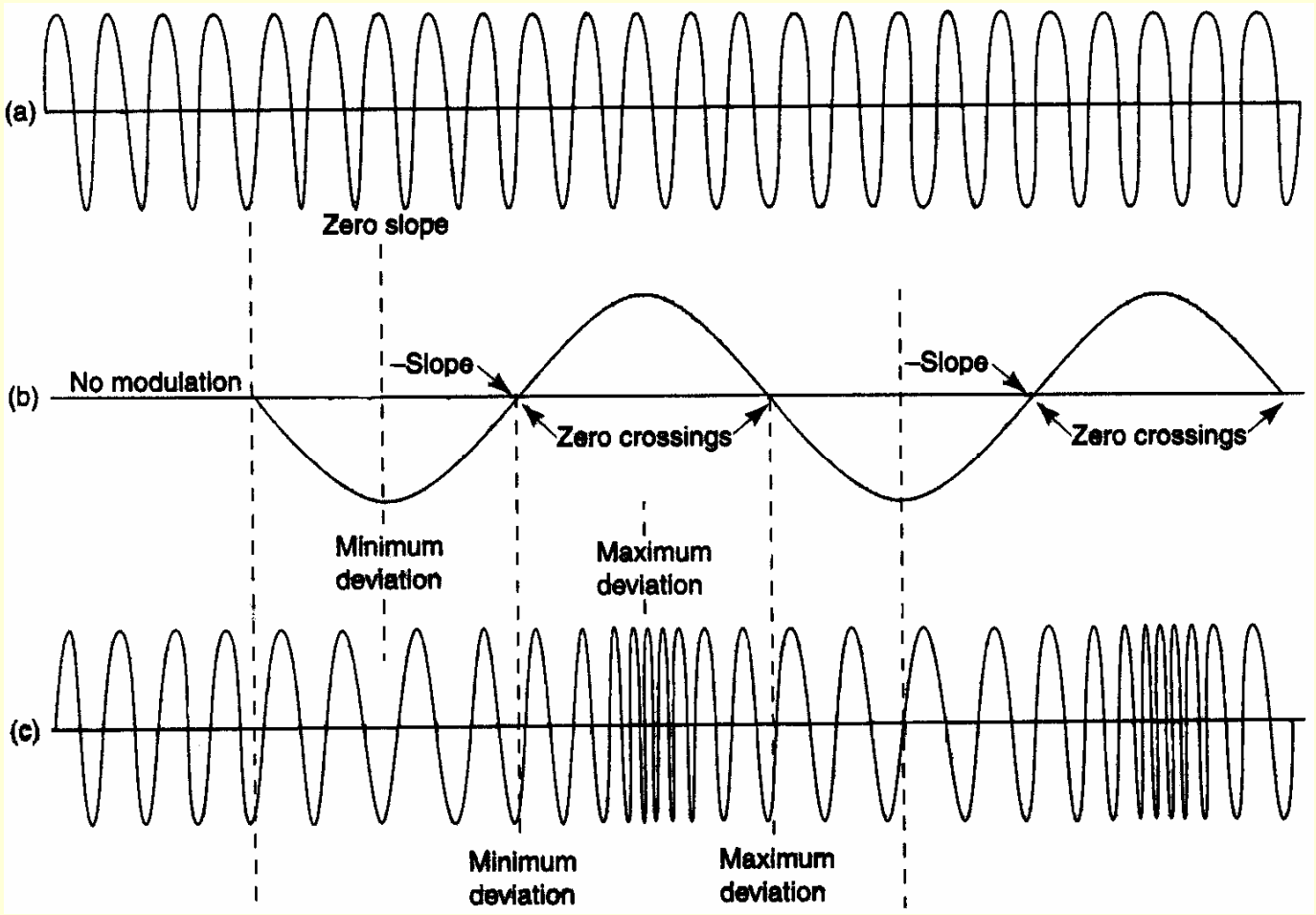


Fig 2. FM SIGNAL WAVEFORM

LIMITATIONS OF AM

- AM IS NOT BANDWIDTH EFFICIENT
- AM IS LESS ECONOMICAL
- AM IS PRONE TO NOISE AND INTERFERENCE

ADVANTAGES OF FM

- Much more energy efficient than AM
- Inherent ability to suppress noise and interference
- Uses bandwidth more effectively
- Additional information can be transmitted

BASIC COMMUNICATION SYSTEM

BROADCASTING IS A ONE-WAY COMMUNICATION SYSTEM COMPRISING OF :

- TRANSMITTER
- CHANNEL
- RECEIVER

BLOCK DIAGRAM OF ONE-WAY COMMUNICATION SYSTEM

TRANSMITTER

- In a transmitter,the information to be transmitted modulates the carrier .
- In other words , information is superimposed on a high

  frequency sine wave

Thus the transmitter performs two functions:

- Generates carrier wave
- Modulates the carrier with audio signal

FM for Community Radio

- Transmitter power requirement to serve the community is low say up to 100 W which can easily cover 10-12 km radius
- Due to its advantages over AM, FM mode has become popular in India during the last two decades and is also suitable for CRS
- Transmitting antenna is also much simpler and smaller for FM than AM

Mono or Stereo ?

- FM Transmission can be in mono or stereo mode
- Stereo transmission is compatible with mono and is received by the mono receivers also
- A stereo transmitter has a shorter range than a mono transmitter but is more costly than the later

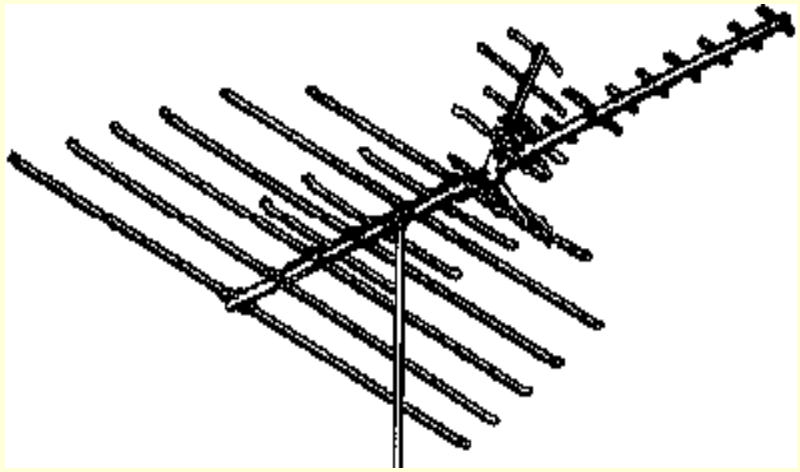
FM on Cell Phones

- Most of the modern cell phones are FM enabled
- So a careful decision has to be taken whether to go in for mono or stereo FM transmission
- Of course stereo offers more lively audio quality

Antenna

- Antenna is a metallic radiator which sends out radio waves in all directions
- Antenna can be
- Directional --- radiates more in a particular direction
- Omni-directional --- radiates equally in all directions

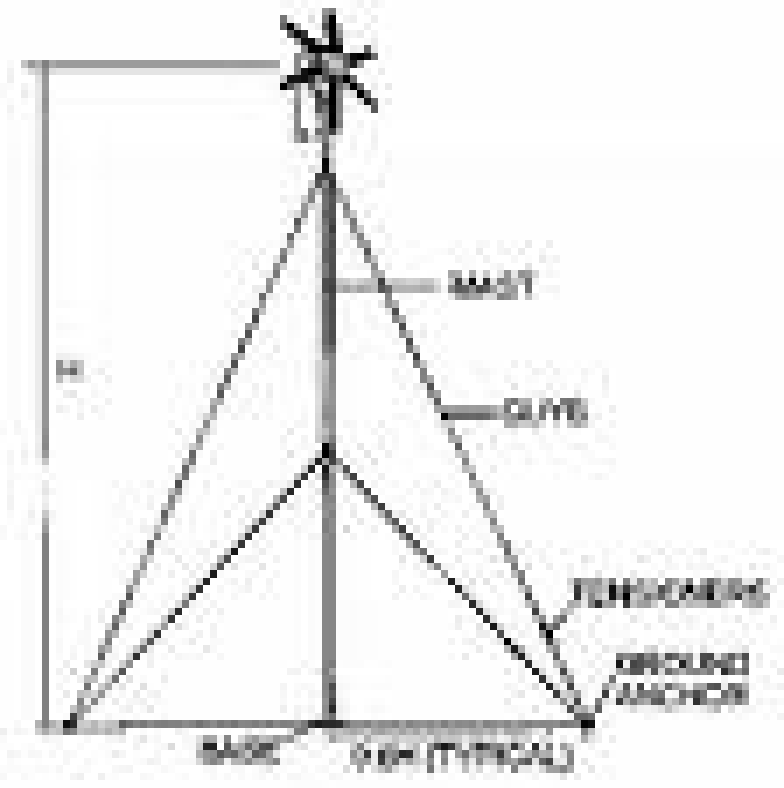
Different FM Broadcast Antennas



Antenna Height

- Antenna has to be mounted at a suitable height to optimize the coverage area
- A high rise building or a guyed mast can be used for the purpose
- Recommended height of antenna for CRS is from 15 to 30 meters
- Normally dipole antenna is used in FM broadcasting

Guyed Masts



FM antenna on a Building

Conclusion

- FM is the most suitable method of broadcasting for community radio stations because of its noise suppression, good reach in the vicinity, line of sight propagation , high fidelity and stereo capability.

Thank You