

End of Chapter 14 Exercises

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14.12) A waveform travels in space at a rate of approximately 300 million meters per second. The wavelength of a sine wave is the actual distance in space that is used by one sine wave as it travels.

a) What is the wavelength of a 100-MHz sine wave?

b) What is the wavelength of a 500-MHz sine wave?

Antennas to send and receive electronic waves are often sized to be one-half of the wavelength of the particular wave being used. Compare your previous calculations to the size of VHF and UHF television antennas.

c) How large would a $\frac{1}{2}$ wavelength antenna have to be to transmit a 60 Hz wave?

Answer) a) Wavelength $\lambda = \frac{c}{f}$

where - $c = 3 \times 10^8 \text{ m/s}$ (speed of light)

$f = 100 \text{ MHz} = 100 \times 10^6 \text{ Hz}$

$$\lambda = \frac{c}{f} = \frac{3 \times 10^8 \text{ m/s}}{100 \times 10^6 \text{ Hz}} = 3 \text{ m}$$

b) Wavelength $\lambda = \frac{c}{f}$

where - $c = 3 \times 10^8 \text{ m/s}$ (speed of light)

$f = 500 \text{ MHz} = 500 \times 10^6 \text{ Hz}$

$$\lambda = \frac{c}{f} = \frac{3 \times 10^8 \text{ m/s}}{500 \times 10^6 \text{ Hz}} = 0.6 \text{ m}$$

→ VHF antennas: A wavelength is $\frac{1}{4}$ the length of the antenna: 1m - 10m

→ UHF antennas: UHF antennas are 12-24 inches

c) $\lambda = \frac{c}{f}$

where $c = 3 \times 10^8 \text{ m/s}$

$f = 60 \text{ Hz}$

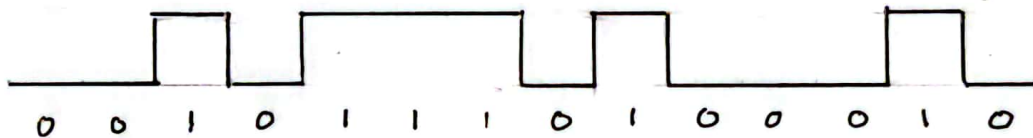
$\lambda = \frac{c}{f} = \frac{3 \times 10^8}{60 \text{ Hz}} = 5 \times 10^6 \text{ m}$

Size of antenna is $\frac{1}{2}$ of wave length

$d = \frac{\lambda}{2} = \frac{5 \times 10^6 \text{ m}}{2} = 2.5 \times 10^6 \text{ m} = 2500,000 \text{ m}$

14.17) Draw a diagram that represents 00101110100010. Below the original diagram draw the Manchester representation of the sequence.

Digital
Binary
Signal



Manchester
Encoding

