## 99.9 - The Hawk

The radio station broadcasts at 99.9 MHz with a power of 50,000 Watts. What is the wavelength of the radio waves? What are the maximum electric and magnetic fields at a distance of 1.25 kilometers from the station? (Assume the power radiates evenly in all directions.)

(a) $\lambda = ?$

$$\lambda = \frac{c}{f} = \frac{3 \times 10^8 \, m/s}{99.9 \times 10^6 /s} \simeq 3.00 \, m$$

(b) what are the amplitudes of the electric and magnetic fields 1.25 km away? (assume power radiates in all directions)
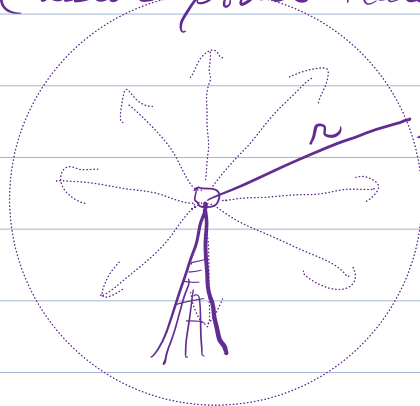
surface area $= 4\pi r^2$

$$I = \frac{P}{A} = \frac{50,000 \, W}{4\pi (1250m)^2}$$

$$I = 0.00255 \, W/m^2$$

$$I = \frac{1}{2} \epsilon_0 c E^2 \implies E = \sqrt{\frac{2I}{\epsilon_0 c}}$$

$$E = \sqrt{\frac{2 (0.00255 \, W/m^2)}{8.85 \times 10^{-12} \frac{C^2}{N \cdot m^2} \cdot 3 \times 10^8 \, m/s}} \simeq 1.39 \, V/m$$

$$B = \frac{E}{c} = \frac{1.39 \, V/m}{3 \times 10^8 m/s} = 4.62 \times 10^{-9} \, T$$