

9.22 Determine the effective area of a half-wave dipole antenna at 100 MHz, and compare it with its physical cross-section if the wire diameter is 2 cm.

Solution: At $f = 100$ MHz, $\lambda = c/f = (3 \times 10^8 \text{ m/s}) / (100 \times 10^6 \text{ Hz}) = 3 \text{ m}$. From Eq. (9.47), a half wave dipole has a directivity of $D = 1.64$. From Eq. (9.64), $A_e = \lambda^2 D / 4\pi = (3 \text{ m})^2 \times 1.64 / 4\pi = 1.17 \text{ m}^2$.

The physical cross section is: $A_p = ld = \frac{1}{2}\lambda d = \frac{1}{2}(3 \text{ m})(2 \times 10^{-2} \text{ m}) = 0.03 \text{ m}^2$. Hence, $A_e/A_p = 39$.
