

9.3 A 1 m long dipole is excited by a 1 MHz current with an amplitude of 24 A. What is the average power density radiated by the dipole at a distance of 5 km in a direction that is 45° from the dipole axis?

Solution: At 1 MHz, $\lambda = c/f = 3 \times 10^8/10^6 = 300$ m. Hence $l/\lambda = 1/300$, and therefore the antenna is a Hertzian dipole. From Eq. (9.12),

$$\begin{aligned} S(R, \theta) &= \left(\frac{\eta_0 k^2 I_0^2 l^2}{32\pi^2 R^2} \right) \sin^2 \theta \\ &= \frac{120\pi \times (2\pi/300)^2 \times 24^2 \times 1^2}{32\pi^2 \times (5 \times 10^3)^2} \sin^2 45^\circ = 6 \times 10^{-9} \quad (\text{W/m}^2). \end{aligned}$$
