

**Problem 9.2** A 1-m-long dipole is excited by a 1-MHz current with an amplitude of 12 A. What is the average power density radiated by the dipole at a distance of 5 km in a direction that is  $45^\circ$  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),

$$\begin{aligned} S(R, \theta) &= \left( \frac{\eta_0 k^2 I_0^2 l^2}{32\pi^2 R^2} \right) \sin^2 \theta \\ &= \frac{120\pi \times (2\pi/300)^2 \times 12^2 \times 1^2}{32\pi^2 \times (5 \times 10^3)^2} \sin^2 45^\circ = 1.51 \times 10^{-9} \text{ (W/m}^2\text{)}. \end{aligned}$$

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