

9.38 A 94 GHz automobile collision-avoidance radar uses a rectangular-aperture antenna placed above the car's bumper. If the antenna is 1 m in length and 10 cm in height, determine the following:

- (a) Its elevation and azimuth beamwidths.
- (b) The horizontal extent of the beam at a distance of 300 m.

Solution:

(a) At 94 GHz, $\lambda = 3 \times 10^8 / (94 \times 10^9) = 3.2$ mm. The elevation beamwidth is $\beta_e = \lambda / 0.1 \text{ m} = 3.2 \times 10^{-2} \text{ rad} = 1.8^\circ$. The azimuth beamwidth is $\beta_a = \lambda / 1 \text{ m} = 3.2 \times 10^{-3} \text{ rad} = 0.18^\circ$.

(b) At a distance of 300 m, the horizontal extent of the beam is

$$\Delta y = \beta_a R = 3.2 \times 10^{-3} \times 300 = 0.96 \text{ m}.$$
