OPT 462: Homework Set 12 — Due on May 2, 2001

1 Emission from a truncated waveguide

Consider the fields emerging from a truncated quadratic hollow metal waveguide with ideally conducting walls. The side length a_o is chosen in a way that only the lowest order TE_{10} mode polarized in x-direction is supported. The field distribution of this mode is given by

$$E_x = -i\omega\mu_o\mu \frac{a_o}{\pi} E_{01} \cos\left(\frac{\pi}{a_o} y\right) \mathrm{rect}\left[\frac{x}{a_o}\right] \mathrm{rect}\left[\frac{y}{a_o}\right] \mathrm{e}^{ik_z z} \quad (1)$$

$$E_y = 0 \quad (2)$$

$$E_z = 0$$

Assume that the fields are not influenced by the edges of the truncated side walls.

- Calculate the Fourier spectrum of the electric field in the exit plane ($z=0$).
- Determine the field for arbitrary distance z.
- Calculate and plot the corresponding farfield.

2 Farfield of a radiating dipole

Consider a dipole aligned with the z-axis and located at $z=0$. Use the Weyl representation (see notes) to find the angular spectrum representation.

- Derive the farfields and show that they are identical to the familiar formula expressed in spherical coordinates.