Microwave Experiment and Radiation

Reading assignment

Experiment 1 - microwave demonstration of wave effects

The microwave experiment uses a 10.5 GHz source.

a. What is the wavelength in air at this frequency?

b. Determine the electric field direction of the source (i.e. its polarization). To do this, you need to figure out in which direction the polarizing plate will short out the electric field.

c. Determine which orientation of the source yields parallel polarization. Estimate the Brewster angle for reflection from a dielectric. Determine the dielectric constant for the material.

d. Calculate the distance between standing wave minima in free space. Then measure the standing wave pattern produced between the receiving antenna and a dielectric and compare with your prediction.

Experiment 2 - radiation

We will use simple wires as antennas in this experiment. The wires will be connected to other equipment using a coax to mini-grabber adapter. Work with a group at another experimental station across the room. One group should be the transmitting antenna. Connect your antenna to the output of the function generator. Set the frequency to 13.56 MHz. (This is a frequency at which the FCC allows general use). Turn the amplitude up to maximum. The second group is the receiving antenna. Connect your antenna to the oscilloscope and set the time scale to about 50 ns/div. (Autoscale will probably not be very useful here). What do you observe?

Play with settings and observe effects.

a. Vary amplitude and frequency of the source.

b. Switch which group transmits and receives.

Calculations

a. Compute the wavelength in air at 13.56 MHZ. An ideal radiation effect has distances > λ. Do we meet this criteria?

b. This experiment can be used to model radiation at 400 MHz if you multiply all distances by 13.56/400. Is noise pickup similar to what you observe an important consideration for computers?