ECEn 665
Antennas and Propagation for Wireless Communication

Homework #4
Due Jan. 25, 2023 at the beginning of class (may be turned in late for half credit)

1. (a) A Hertzian dipole antenna of length $\ell = 4\,\text{cm}$ is driven by a source of phasor voltage $V_g = 1\,\text{V}$ with impedance $R_g = 50\,\Omega$. Another dipole of the same length a distance $r = 500\,\text{m}$ away receives the signal and drives a load $R_L = 50\,\Omega$.

   Using a circuit model for the transmitting antenna, find the input current. Neglect the reactive part of the input impedance (what does this mean physically?). Find the electric field radiated by the transmitting antenna at the location of the receiving antenna.

   From the electric field at the receiving antenna, find the open circuit voltage induced by the incident wave. Use a circuit model for the Hertzian dipole to find the power dissipated in the load. Assume that there is no polarization loss and that the receive dipole is at the radiation pattern peak of the transmitter. It may be helpful to use matlab for the analysis.

   What is the power received at 2 GHz? Give your answer in dBm.

   (b) Now find the received power using the Friis transmission formula. Set the transmit power equal to the available power from the source. How do the results compare for the two methods?

2. Redo the previous problem at a frequency of 100 MHz. How do the results compare at this frequency?