Homework #12 Guide

Please note that these "Guides" are intended to go only part way toward a properly "presented" set of solutions. You should be able to fill in the blanks with drawings, equations, and additional explanation as necessary. If you can't, do *not* hesitate to come see me.

11.6 Same idea as 11.3. Show that, for the current *I* running through a resistance to dissipate the same power that the radiation carries away, we would have to have

$$\left\langle I^2 \right\rangle R = \frac{\mu_o m_o \omega^4}{12\pi c^3}$$

Recall how m_o is defined, and recall the relationship of ω to λ to show that the radiation resistance is given by

$$R_{rad} = \frac{8}{3}\pi^5 \sqrt{\frac{\mu_o}{\varepsilon_o}} \left(\frac{b}{\lambda}\right)^4 = 3\times 10^5\ \Omega \left(\frac{b}{\lambda}\right)^4$$

Note that, in this case, the radiation resistance rises *much* faster as the frequency increases. For the same size antenna and the same 1 MHz to 100 MHz frequency range that we looked at before, we find a radiation resistance between $20\ \text{p}\Omega$ and $20\ \text{m}\Omega$. (Note that, as the frequency approaches the value that violates approximation 2, the radiation resistances become comparable.)