ECEN 638: Antenna Engineering
Spring 2015 – Prof. Huff
Assignment 1

Literature Review # 1
Be prepared to summarize key points and discuss the contribution of these manuscripts.

[1] J. A. Stratton and L. J. Chu, "Diffraction Theory of Electromagnetic Waves," Phys. Rev. Vol. 56, pp. 99-107, Jul. 1939.
[2] A. Schelkunoff, "Some Equivalence Theorems of Electromagnetics and their Application to Radiation Problems," Bell System Tech. Jour., Vol. 15, pp. 92-112, Jan. 1936.

Homework Set #1
1. Calculate the attenuation in dB for the transmission schemes a-f for f_0 = 2.45 GHz and plot them together versus path length from 1 km to 10,000 km; normalize each plot to its value at 1 km such that all curves will start at a value of 0 dB (see Pozar's Microw. Eng., Ch. 12, Fig. 12.5), and use a logarithmic scale for the abscissa:

a. Free-space propagation in air
b. RG-60/U coaxial cable
c. Fundamental mode of a circular waveguide (aluminum) w/ radius a = 4.4 cm
d. Fundamental mode of a WR-340 rectangular waveguide (aluminum)
e. Fiber optic cable with α = 0.35 dB/km
f. 50 Ω stripline on 1 mm thick Duroid 5880 substrate w/ copper conductors

2. Given the previous scenarios, determine the approximate distance at which it becomes advantageous to rely on wave propagation in free-space.

3. Calculate the delay (in [s]) for the transmission schemes a, b, d, and f for Problem 1 for f_0 = 2.45 GHz and plot them together versus path length from 1 km to 10,000 km.

4. Calculate and plot the maximum power density as a function of distance from 0.1 λ to 100 λ for a Hertzian dipole ($L = 0.1\lambda$, wire radius $r = 0.001\lambda$) with an excitation of 1 A antenna; calculate this quantity both with and without the far-field approximation and plot the percent difference between the two calculations as a function of distance.