EE 483/583 Antennas for Wireless Communications (Spring 2022)
Homework 8
Monday, March 7, 2022

1) Design a six-element Yagi-Uda antenna for VHF television channel 10 using a copper-pipe boom with an outer diameter of 7/8 inch and brass elements with an outer diameter of 3/8 inch. **Note:** Assume $c = 2.998\times10^8$ m/s.

   a) Tabulate design specifications (assume 50 Ω feeding transmission line)

   b) Show complete design procedure (i.e., include design figures, spreadsheets, …) in a fashion similar to example given in class. **No matching network is required.**

   c) Make a scale drawing of the final Yagi-Uda antenna design including boom (transmission line may be omitted) that a machinist could take and use to build the antenna (use centimeters for all dimensions). Assume boom will extend 26" past the reflector to allow antenna to be attached to an antenna mast, and 2" past the last director for mechanical strength.

2) In free space, a PEC folded dipole has length $\ell = 0.454\lambda$, wire spacing $s = 0.04\lambda$, and wire diameter $2a = 0.003\lambda$ operating at wavelength $\lambda = 150$ cm ($f_c \approx 200$ MHz). Assume $c = 2.998\times10^8$ m/s. Compute the characteristic impedance of the transmission line mode and effective radius (cm) of the equivalent dipole. Given a 300 Ω feeding twin-lead transmission line made with the same wire, find its spacing s_{300} (cm). Make scale drawing of the folded dipole (all dimensions in cm). Then, find and **tabulate** the transmission line mode input impedance Z_t, antenna mode input impedance Z_a, and overall input impedance Z_{in} at frequencies f_c, f_c - 5%, and f_c + 5%. [**EE 583 only:** Also, find and **tabulate** the input reflection coefficient (polar form w/ angle in degrees) and VSWR on the 300 Ω feeding twin-lead transmission line at frequencies f_c, f_c - 5%, and f_c + 5%.] Show all work including NEC-2 input file(s) and relevant excerpts of output file(s).

Due Friday, March 11, 2022.