EE579A

Electromagnetic Compatibility

HW1

Q1 [10 pts]: An antenna measures the radiated emissions at 220 MHz from a product as shown in Figure 1. If the receiver measures a level of –93.5 dBm at 220 MHz, (a) determine the voltage at the base of the antenna in dBmV. The cable loss at 220 MHz is 8 dB/100 ft. If the product providing these emissions is located a distance of 20 m and the antenna provides 1.5 V for every V/m of incident electric field at 220 MHz, (b) determine whether the emissions comply with the CISPR 32 Class B and FCC Class B limits and by how much.

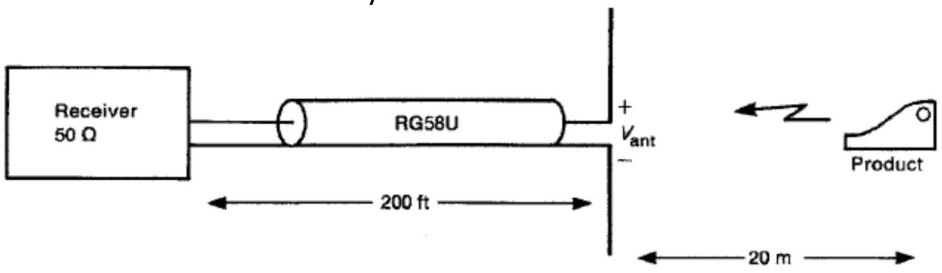

Figure 1

Q2 [10 pts]: A 50-Ω source is tuned to 100 MHz and attached to a 50-Ω spectrum analyzer with 200 ft of 50-Ω coaxial cable that has a loss of 4.5dB/100 ft at 100 MHz. The spectrum analyzer reads a level of signal at 100 MHz of 56.5 dBμV. If the cable is removed and the signal source is attached directly to a 100-Ω load,
(a) determine the voltage across this load in dBμV.
(b) Determine the reading on the meter of the source in dBm.

Q3 [10 pts]: Model the FCC/CISPR 32 LISN (on slide 27, Lecture 2) using LTSPICE. Then,

(a) plot the impedance seen by the EUT looking into the LISN over the frequency range of 100KHz and 30 MHz (with input impedance looking into the power source represented as an open circuit).
[**Hint**: use AC analysis for a frequency sweep.]

(b) Plot the time domain output at the 50 ohm load if the input signal coming from the EUT is a 1Vp-p 60Hz signal

(c) Repeat (b) with an input signal from the EUT of 50 mVp-p and 1MHz frequency, and plot the signals at the 50 ohm load as well as the AC power line input node.
[**Hint**: for (b) and (c) use transient analysis, and plot at least 10 cycles]

Attach the LTSPICE model schematic, and ALL plots and calculations for this question.

Q4 [10 pts]: For the waveform shown in Figure 2, find its Fourier Series coefficients **analytically**. Then, develop a **MATLAB** program to calculate the first 10 harmonics of this signal (and for any generic other signal, make the input waveform generic) and compare with the analytical expression. Assume that the amplitude is A = 1V, 50% duty cycle ($\tau = 0.5$) and 10MHz frequency.

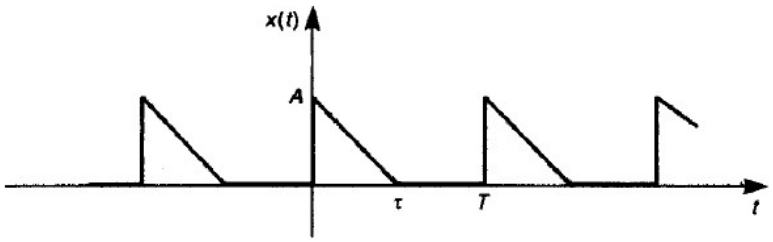

Figure 2

Q5 [10 pts]: **Sketch** the load voltage V(L,t) ante the input current to the line I(0,t) for the circuit shown in Figure 3 for 0 < t < 10 nsec. What should these plots converge to in steady-state. **Verify** your hand sketches with an **LTSPICE** model. Attach all your graphs and label all amplitudes and times on the hand sketches. Be organized and tidy.

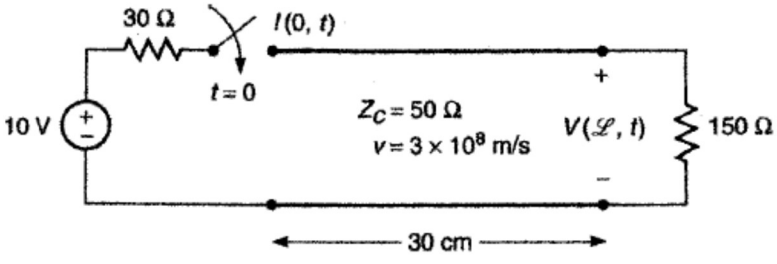

Figure 3

Submission Notes:

You need to submit the following items via email to the class TA Mr. Yannan Liu (liuy78@uw.edu) , and CC me at (msharawi@uw.edu)

(1) submit a very clear and readable PDF file for your solutions including ALL figures, plots, circuit models, etc, in 1 complete and organized FILE (i.e. make plots within file and corresponding to each problem).

(2) Attach the MATLAB code file, and LTSPICE files as separate files for each problem that asks for such a solution/model/file.

(3) Send the PDF file along with the individual circuit and MATLAB files in ONE EMAIL as Multiple Attachments (no links, actual files).