Homework 1

Due: Wednesday, February 3, 2020, 11:59PM Central Time

- Homeworaks are due Wednesday at 11:59 p.m (Champaign local time). Late homework will not be accepted.
- Put name and NetID on the top of every sheet. Scan and submit your homework through Gradescope.
- Each student must submit individual solutions for each homework. You may discuss homework problems with other students registered in the course, but you may not copy their solutions.
- One problem is bonus problem for undergraduate student, but it is required if you are a graduate student.
- Penalties for cheating on homework: 0 points on that homework for first offense and an F on the course for any subsequent offense.

Recommended Reading: Paul: Lectures 1-2

1. Determine the wavelength at the following frequencies in metric and in English units:
   a) LORAN C long-range navigation 90Hz in km and mile.
   b) Submarine communication 1kHz in km and mile.
   c) GPS Satellite L1 (1575.42 MHz) in cm and in.
   d) 5G cell phone 28 GHz in mm and mil (1 mil = 0.001 inch).

2. Determine the following voltages in $dB\mu V$ and $dBm$.
   a) 0.3 $\mu V$.
   b) 300 mV.
   c) 0.3 V.
3. Determine a simple expression to convert (RMS) voltage $V_{RMS}$ to $dBm$ with 50 Ω of system impedance.

4. The radiated emissions from a product are measured at 50 MHz at 15 m away and are found to be 21 $\mu$V/m.
   a) Does the product comply with the FCC Class B limit?
   b) By how much does the product pass or fail at 15 m away?

5. **Bonus Problem for undergraduate student:**
   A 50 Ω source is connected to a 50 Ω receiver using 30 ft of RG58U coaxial cable. If the source output is 100 MHz and $-30$ dBm, determine the voltage at the receiver in mV and $dB\mu V$. 