S-26.3392 Electromagnetic compatibility
Exam spring 2011

Part A. "Close book"

1. Explain shortly the following notions: (2 p each)

   a) OATS
   b) Common-mode choke
   c) Transfer impedance

2. Describe the radiation from an electrically small simple circuit which consists of a source and a load. What is the difference between the cases of small and large load impedances? Compared to which value one can say in this case the load impedance is small or large? (5p)

3. Describe the physical phenomena which can lead to signal coupling between two metal wires? How the wires should be properly shielded and grounded to minimize coupling? (5p)

Part B. "Open book"

4. Determine the necessary transmitter power for the following two cases, if we plan to test some equipment at the field strength of 10 V/m (RMS).

a) Using an anechoic chamber and a transmit antenna with gain G = 9 dB, and the equipment under test (EUT) at the distance of 6 m from the transmit antenna location. The attenuation of the antenna cable is 2.5 dB (5p).

b) Using a GTEM cell, in which the distance between the center conductor and the cell floor at the location of the EUT is 1.2 m. The characteristic impedance of the GTEM cell is 50 Ω. Attenuation along the cell length is 0.9 dB (5p).

5. Calculate how much power is needed to drive enough current through a short wire length to exceed Class A limits at 30 m (37 dBμV/m). The frequency is f = 1 GHz and the length of the wire is λ/30 at this frequency. (5p)

6. Consider a device, which consist of a PCB inside a shield. The PCB is shown in Fig. 1 and has the dimensions of 5 x 5 cm^2. The shield has the size of 20 cm x 20 cm x 20 cm and n = 100 holes with the diameter d = 0.5 cm on top of the PCB. The device is operating at the clock frequency of 100 MHz. The clock signal is shown in Fig. 2 and has parameters T_p/p = 0.5 and t_r/T_p = 0.1. The current level in the PCB is 100 mA. According to the standards the radiation of the device at the distance of 3 m must be less than 43 dBμV/m at 88 – 216 MHz range and 46 dBμV/m at 216 – 1000 MHz range. Will the device pass the test? (5p)

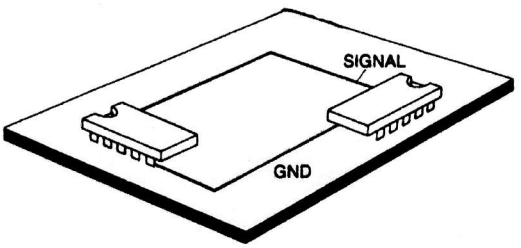

Fig. 1. A PCB.

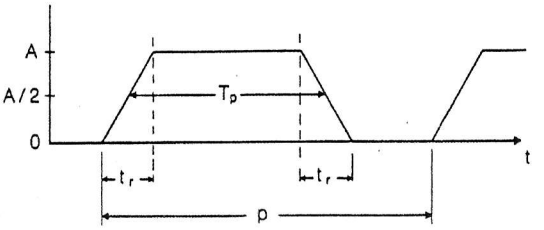

Fig. 2. Trapezoidal signal.