EECE 598, Homework 06, SOULTIONS

8.1 SYSTEM 1: From Eq. (8.2) the total optical power loss allowed between the light source and the photodetector is

$P_T = P_S - P_R = 0$ dBm - (-50 dBm) = 50 dB

$= 2(l_c) + \alpha_f L$ + system margin = 2(1 dB) + (3.5 dB/km)L + 6 dB

which gives L = 12 km for the maximum transmission distance.

SYSTEM 2: Similarly, from Eq. (8.2)

P_T = -13 dBm - (-38 dBm) = 25 dB = 2(1 dB) + (1.5 dB/km)L + 6 dB

which gives L = 11.3 km for the maximum transmission distance.

8.2 (a) Use Eq. (8.2) to analyze the link power budget. (a) For the *pin* photodiode, with 11 joints

$P_T = P_S - P_R = 11(l_c) + \alpha_f L$ + system margin

= 0 dBm - (-45 dBm) = 11(2 dB) + (4 dB/km)L + 6 dB

which gives L = 4.25 km. The transmission distance cannot be met with these components.

(b) For the APD

0 dBm - (-56 dBm) = 11(2 dB) + (4 dB/km)L + 6 dB

which gives L = 7.0 km. The transmission distance can be met with these components.

8.9 The margin can be found from

$P_S - P_R = l_c + 49(l_{sp}) + 50\alpha_f$ + noise penalty + system margin

-13 - (-39) = 0.5 + 49(.1) + 50(.35) + 1.5 + system margin

from which we have

system margin = 1.6 dB