Opto-Electronics Q_9.2

$R := 0.5$ $\quad \lambda := 0.85 \cdot 10^{-6}$ $\quad h := 6.626 \times 10^{-34}$

$BER := 10^{-7}$ $\quad e := 1.602 \cdot 10^{-19}$

$B_T := 35 \cdot 10^{6}\,ts/s$ $\quad c := 2.99 \cdot 10^{8}$

Determine the minimum incident optical power required in order to maintain the required BER

Probability of error:

$P(e) := \exp(-z_m)$

$P(e) := BER$ $\quad f := \frac{c}{\lambda}$ $\quad f = 3.518 \times 10^{14}$

Average numer of photons detected in a time period τ for BER

$z_m := -\ln(P(e))$

$z_m = 16.118$

$\tau := \frac{1}{B_T}$

$\tau = 2.857 \times 10^{-8}$

$\eta := \frac{R \cdot h \cdot c}{e \cdot \lambda}$

$\eta = 0.727$

$Power := \frac{z_m \cdot h \cdot f}{\eta \cdot 2 \cdot \tau}$

$Power = 9.037 \times 10^{-11}$

$P_0 := 10 \log\left(\frac{Power}{1 \cdot 10^{-3}}\right)$

$P_0 = -70.44$ dBm