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EE441 HW2

1 $\tau_0 = 25\ ns$ ← LOS

$\tau_1 = 50\ ns$ ← MP1

$\tau_2 = 69\ ns$ ← MP2

per τ_0

$T = \tau_2 - \tau_0 = 69 - 25 = \boxed{44\ ns}$

per τ_1

$T = \tau_2 - \tau_1 = 69 - 50 = \boxed{19\ ns}$

2 $Z_0^2 = -85\ dBm$

$P_0 = -97\ dBm,\ -100\ dBm$

$P_r = 1 - e^{-(P_0/Z_0^2)}$

per $P_0 = -97\ dBm$

$\frac{P_0}{P_{avg}} = -97 + 85 = -12\ dBm = 10^{-12/10} = 0.0631$

$1 - e^{-0.0631} = 0.06114 = \boxed{6.114\%}$

per $P_0 = -100\ dBm$

$\frac{P_0}{P_{avg}} = -100 + 85 = -15\ dBm = 10^{-15/10} = 0.0316$

$1 - e^{-0.036} = 0.03112 = \boxed{3.112\%}$

3 $P_r = 0.015$ $P_{avg} = ?$

$P_0 = -85\ dBm$

$P_r = 1 - e^{-P_r/P_{avg}} \Rightarrow 0.015 = 1 - e^{-P_r/P_{avg}}$

$0.9850 = e^{-P_r/P_{avg}}$

$-\frac{P_r}{P_{avg}} = \ln(0.9850) = -.0151$

$P_r/P_{avg} = .0151$

log scale (1) low scale

$\frac{P_r}{P_{avg}} = \frac{151}{10000} \Rightarrow P_{avg} = P_r\left(\frac{10000}{151}\right)$

$\Rightarrow P_{avg}(dBm) = 10\log_{10}\left(\frac{10000}{151}\right) + (-85) = \boxed{-66.7898\ dBm}$