

The Tx Power Requirement

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PAM4 SNR Requirement for symbol error rate $P_e = 1e-5$

$$\text{erfc}(x) = 2Q(x\sqrt{2}) , \quad (1)$$

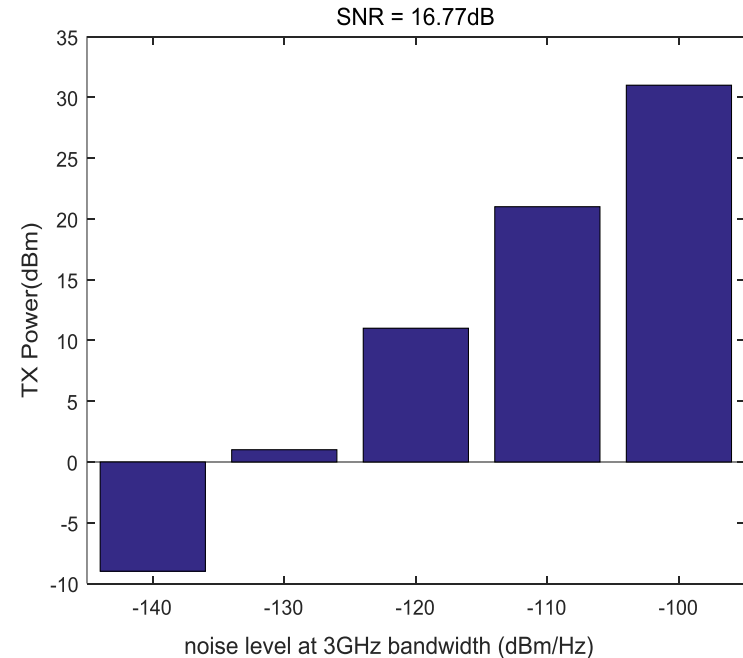
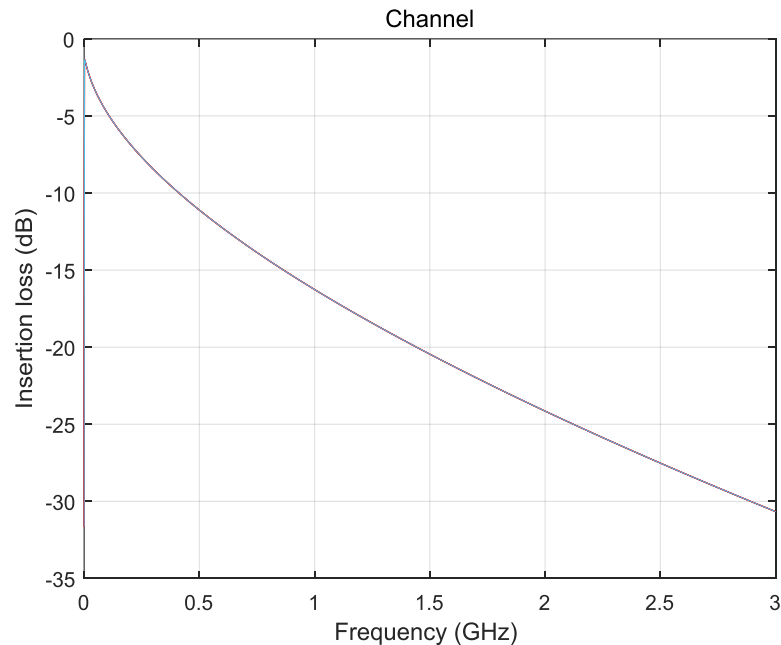
$$P_e = \frac{M-1}{M} \text{erfc}\left(\sqrt{\frac{3}{M^2-1}} \text{SNR}\right) .$$

M	SNR [dB]	E_b/N_0 [dB]
2	9.59	9.59
4	16.77	13.76
8	23.05	18.28
16	29.17	23.15

The PAM4 SNR requirement for $P_e = 1e-5$ is 16.77dB

*(1) Philip Edward McIllree, B.Eng. CHANNEL CAPACITY CALCULATIONS FOR M-ARY N-DIMENSIONAL SIGNAL SETS, 1995.

The Tx Power Requirement at Different Noise Level



1. Channel is the insertion loss defined in 802.3ch that each 10GBASE-T1 link segment shall meet.
2. $\text{TX Power (dBm)} = \text{Noise Power (dBm)} + \text{SNR (dB)} - \text{Avg_Channel (dB)}$.

$$\text{Noise Power [dBm]} = 10 \lg \left(\int_0^{3\text{GHz}} 10^{\frac{\text{Noise_level [dBm/Hz]}}{10}} df \right)$$

Thank you!