$$P_{qnoise} = \int_0^{f_B} \frac{\Delta^2}{12} \cdot \frac{2}{f_s} \cdot \left[2\sin\left(\pi \frac{f}{f_s}\right)\right]^{2L} df$$

$$\cong \int_0^{f_B} \frac{\Delta^2}{12} \cdot \frac{2}{f_s} \cdot \left[2\pi \frac{f}{f_s}\right]^{2L} df$$

$$\cong \frac{\Delta^2}{12} \cdot \frac{\pi^{2L}}{2L+1} \left[\frac{2f_B}{f_s}\right]^{2L+1}$$

$$\cong \frac{\Delta^2}{12} \cdot \frac{\pi^{2L}}{2L+1} \left(\frac{1}{M}\right)^{2L+1}$$