Quiz 4 (Chapter 5)

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Optic Commu (PAK)

Quiz 4

An InGaAs *pin* photodiode has the following parameters at 1550 nm: $I_D = 1.0$ nA, $\eta = 0.95$, $R_L = 500\ \Omega$, and the surface leakage current is negligible. The incident optical power is 500 nW (-33dBm) and the receiver bandwidth is 150 MHz. Find quantum noise.

Find quantum noise

formula: $\langle i_Q^2 \rangle = 2qI_pB$

let $B = 150$ MHz, $q = 1.6\times10^{-19}$ C, $I_p = ?$

formula: $I_p = \Re P_0 = \frac{\eta q \lambda}{hc} \cdot P_0 = 5.92\times10^{-7}\ A = 0.5927\mu A$

then, $\langle i_Q^2 \rangle = 2\times(1.6\times10^{-19}\ C)\times(0.5927\times10^{-6}\ A)\times(150\times10^{6}\ Hz)$

$\langle i_Q^2 \rangle = 2.84496\times10^{-17}\ A^2$

Hence $\langle i_Q^2 \rangle^{1/2}$ is $5.334\times10^{-9}\ A = 5.334\ nA$ //