EE 567

Homework 8 Solution

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Problem 1. A receiver front end has a noise figure of 8 dB and a gain of 60 dB and a bandwidth of 12 MHz. The input signal power is 10^{-11} W. The antenna temperature is 175 K. Find T_e, T_s, N_{out}, SNR_{in} and SNR_{out}.

Solution: Given $F = 10^{0.8}$, $G = 10^6$, $B_n = 1.2 \times 10^7$ Hz, $S_{in} = 10^{-11}$ W and $T_a = 175$ K, we can calculate the following quantities:

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\begin{aligned}
T_e &= (F-1)T_0 = 1539.8 \text{ K} \\
T_s &= T_a + T_e = 1714.8 \text{ K} \\
N_{in} &= kT_aB_n \\
N_{out} &= kT_sB_nG = 2.84 \times 10^{-7} \text{ W} \\
SNR_{in} &= \frac{S_{in}}{N_{in}} = \frac{10^{-11}}{1.38 \times 10^{-23} \times 175 \times 1.2 \times 10^7} = 345.07 = 25.38 \text{ (dB)} \\
SNR_{out} &= \frac{S_{in}G}{N_{out}} = \frac{10^{-11} \times 10^6}{2.84 \times 10^{-7}} = 35.21 = 15.47 \text{ (dB)}
\end{aligned}
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Problem 2, 3, and 4

Solution: Please look at midterm solution.