Lossless antenna $\eta = 1$

$$P_N' = G \cdot \Delta f \cdot k_B \cdot (T_A + T_{RX})$$

Amplifier

Bandpass filter Δf

$$P_S' = G \cdot P_S$$

P_S

$$\left(\frac{S}{N}\right)_{input} = \frac{P_S}{P_N}$$

G

T_{RX}

F

$\approx$

$$\left(\frac{S}{N}\right)_{output} = \frac{P_S'}{P_N'}$$

T_A

$$P_N = \Delta f \cdot k_B \cdot T_A$$

Nonsense definition of the noise figure:

$$F = \frac{\left(\dfrac{S}{N}\right)_{input}}{\left(\dfrac{S}{N}\right)_{output}} = \frac{\dfrac{P_S}{\Delta f \, k_B \, T_A}}{\dfrac{G \, P_S}{G \, \Delta f \, k_B (T_A + T_{RX})}} = \frac{T_A + T_{RX}}{T_A} = 1 + \frac{T_{RX}}{T_A}$$

A property of an amplifier can not be a function of T_A!

Sensible definition $\qquad F = 1 + \dfrac{T_{RX}}{T_0} \qquad @ \qquad T_0 = 290K \qquad \leftrightarrow \qquad T_{RX} = T_0 (F - 1)$

Logarithmic units $\qquad F_{dB} = 10 \log_{10} F = 10 \log_{10}\left(1 + \dfrac{T_{RX}}{T_0}\right) \qquad \leftrightarrow \qquad T_{RX} = T_0\left(10^{\frac{F_{dB}}{10}} - 1\right)$