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1. $L = 30\ m$
   $a = 0{,}2\ dB/m$
   $\frac{S}{N} = 40\ dB$

a. Total loss koax $= 30 \cdot 0{,}2 = 6\ dB = 4$

Te koax $= (4-1) \cdot 290K = 870\ K$

$NF_{RF} = 4\ dB = 2{,}512$

$Te_{RF} = (2{,}512 - 1) \cdot 290\ k = 438{,}4\ K$

$G_{RF} = 20\ dB = 100$ kali

$BN_{RF} = 2\ GHz$

$NF_{mixer} = 10\ dB = 10$

$Te_{mixer} = (10-1) \cdot 290\ k = 2610$

$G_{mixer} = 4\ dB = 2{,}512$ kali

$NF_{IF} = 6\ dB = 4$

$Te_{IF} = (4-1) \cdot 290\ k = 870\ k$

$G_{IF} = 30\ dB = 1000$ kali

$BN_{IF} = 20\ MHz$

$$Te_p = Te_{koax} + \frac{Te_{RF}}{G_{koax}} + \frac{Te_{mixer}}{G_{koax} \cdot G_{RF}} + \frac{Te_{IF}}{G_{koax} \cdot G_{RF} \cdot G_{mixer}}$$

$$= 870 + \frac{438{,}4}{\frac{1}{4}} + \frac{2610}{\frac{1}{4} \cdot 100} + \frac{870}{\frac{1}{4} \cdot 100 \cdot 2{,}512} = 2741{,}85\ K$$

$G_p = \frac{1}{4} \times 100 \times 2{,}512 \times 1000 = 62.800$ kali

$$\frac{S_o}{N_o} = 40\,dB = 10.000 = \frac{S_i}{k[T_{Ant} + T_{ep}]\,BN_{IF}}$$

$$S_i = 10.000 \times k[T_{Ant} + T_{ep}]\,BN_{IF}$$

$$S_i = 10.000 \times 1,38 \times 10^{-23}\,[300 + 2741,85] \times 20.000$$

$$S_i = 8,4 \times 10^{-12}\ W$$

b. $$Te_{A-C} = Te_{koax} + \frac{Te_{RF}}{G_{koax}}$$

$$= 870 + \frac{438,4}{\frac{1}{4}} = 2623,6\ K$$

$$G_{A-C} = \frac{1}{4} \times 100 = 25\ kali$$

$$BN_{A-C} = 2\ GHz$$

$$\frac{S_c}{N_c} = \frac{S_i}{k[T_{Ant} + Te_{A-C}]\,BN_{RF}} = \frac{8,4 \times 10^{-12}}{1,38 \times 10^{-23}[300 + 2636,6] \cdot 2 \times 10^{9}}$$

$$= 0,1 = -10\,dB$$

c. Loss tiap satuan koax $= 15 \cdot 0,2 = 3\,dB = 2$ kali

$$Te_{koax} = (2-1) \cdot 290\ K = 290\ K$$

$$Te_p = Te_{koax} + \frac{Te_{RF}}{G_{koax}} + \frac{Te_{koax}}{G_{koax}\,G_{RF}} + \frac{Te_{mix}}{G_{koax} \cdot G_{RF} \cdot G_{koax}} + \frac{Te_{IF}}{G_{koax}^2 \cdot G_{RF} \cdot G_{mix}}$$

$$= 290 + \frac{438,4}{\frac{1}{2}} + \frac{290}{\frac{1}{2} \times 100} + \frac{2610}{\frac{1}{2} \cdot 100 \cdot \frac{1}{2}} + \frac{820}{\frac{1}{2} \cdot 100 \cdot \frac{1}{2} \cdot 2,512}$$

$$= 1290,85\ K$$

$$S_I = 10.000 \times k[T_{Ant} + T_{ep}] \cdot BN_{IF} = 10.000 \times 1,38 \times 10^{-23}[300 + 1290,85] \times 20.000$$

$$= 4,4 \times 10^{-12}\ W$$

Karena T_{ep} pada point c. (T_{ep} = 1290,85 k) lebih kecil dari point a. (T_{ep} = 2741,85 k), maka susunan yang lebih baik sesuai point c.

Sal. koax -> RF AMP -> Sal. koax -> Mixer -> IF AMP