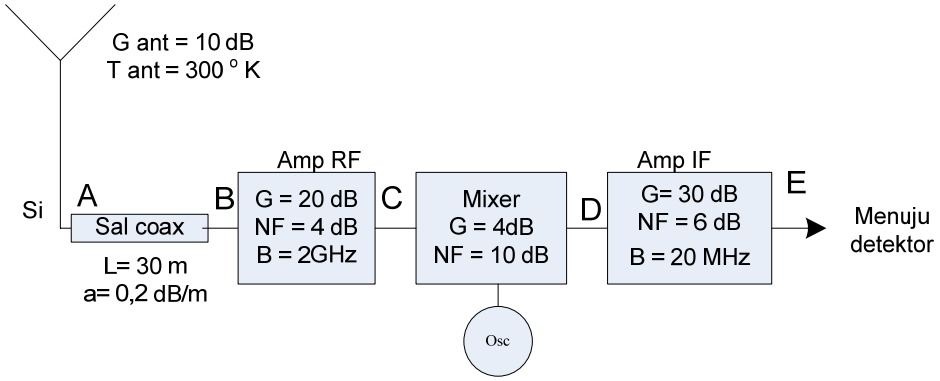
Solusi Soal No.1

1. Suatu sistem pradeteksi sebagai berikut:



Jika diinginkan S/N pada output system adalah 40 dB maka, tentukanlah:

a. Daya terima Si (dBm)

b. S/N (dB) pada masukan Mixer (titik C)

c. Bila saluran kabel coaxial dipotong jadi 2 bagian serba sama dan potongan kedua ditempatkan antara Amp RF dan Mixer. Hitung kembali pertanyaan point a) . Susunan mana yang paling baik .

Solusi :

a).

Total Loss koax = 30 x 0,2 dB = 6 dB = 4 , maka T_e koax = (4-1) x 290 = **870 ° K**

NF_{RF} = 4 dB = **2,512** , maka $\mathbf{T_{e\text{-}RF}}$ = (2,512 -1) x 290 = **438,4 ° K** ; G_{RF} = 20 dB = **100 kali**

BN_{RF} = 1 GHz

NF_{MIXER} = 10 dB = **10** ; $\mathbf{T_{MIX}}$ = (10 -1) x 290 = **2610 ° K** ; G_{MIXER} = 4 dB = 2,512 kali

NF_{IF} = 6 dB = 4 , maka $\mathbf{T_{e\text{-}IF}}$ = (4 -1) x 290 = **870 ° K** ; G_{IF} = 30 dB = 1000 kali

BN_{IF} = 20 MHz

$$\mathbf{T_{eP}} = T_{e-koax} + \frac{T_{e-RF}}{G_{koax}} + \frac{T_{e-MIX}}{G_{koax}\ G_{RF}} + \frac{T_{e-IF}}{G_{koax}\ G_{RF}\ G_{MIX}}$$

$$\mathbf{T_{eP}} = 870 + \frac{438{,}4}{\frac{1}{4}} + \frac{2610}{\frac{1}{4} \times 100} + \frac{870}{\frac{1}{4} \times 100 \times 2{,}512} = \mathbf{2741{,}85\ ^{o}K}$$

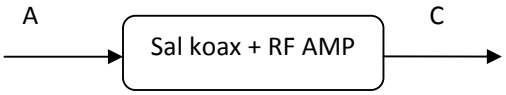
$\mathbf{G_P} = \frac{1}{4} \times 100 \times 2{,}512 \times 1000 = \mathbf{62.800}$ **kali** ; BN_P = 20 MHz

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

Maka : $S_i = 10.000 \times k\,[T_{Ant} + T_{eP}]\; BN_{IF}$

$\boldsymbol{S_i} = 10.000 \times 1{,}38 \times 10^{-23}\ [\ 300 + 2741{,}85\ ] \times 20.000 = \boldsymbol{8{,}4 \times 10^{-12}\ W}$

b).



$\mathbf{T_{eA\text{-}C}} = T_{e-koax} + \frac{T_{e-RF}}{G_{koax}}$

$\mathbf{T_{eA\text{-}C}} = 870 + \frac{438{,}4}{\frac{1}{4}} = 2623{,}6\ ^{o}K$

$\mathbf{G_{A\text{-}C}} = \frac{1}{4} \times 100 = 25$ kali ; BN $_{\mathbf{A\text{-}C}}$ = 2 GHz

$$\frac{\boldsymbol{S_c}}{\boldsymbol{N_c}} = \frac{S_i}{k\,[T_{Ant} + T_{eA-C}]\,BN_{A-C}} = \frac{8{,}13 \times 10^{-12}}{1{,}38 \times 10^{-23} \times [300 + 2623{,}6] \times 1 \times 10^{9}}$$

$$= \boldsymbol{0{,}2 = -7\ dB}$$

c). Susunan Pradeteksi diubah menjadi :

(sal koax) --(RF AMP)—(sal koax)—(MIXER)—(IF AMP)

Kabel koax dipotong jadi 2 sama panjang maka panjang tiap potong = 15 meter

Loss tiap saluran koax = 0,2 x 15 = 3 dB = 2 kali ;

maka T_e koax = (2-1) x 290 = **290 ^{o} K**

$$\mathbf{T_{eP}} = T_{e-koax} + \frac{T_{e-RF}}{G_{koax}} + \frac{T_{e-koax}}{G_{koax}\,G_{RF}} + \frac{T_{e-MIX}}{G_{koax}\;G_{RF}\;G_{koax}} + \frac{T_{e-IF}}{G_{koax}\;G_{RF}\;G_{koax}\,G_{MIX}}$$

$$\mathbf{T_{eP}} = 290 + \frac{438{,}4}{\frac{1}{2}} + \frac{290}{\frac{1}{2} \times 100} + \frac{2610}{\frac{1}{2} \times 100 \times \frac{1}{2}} + \frac{870}{\frac{1}{2} \times 100 \times \frac{1}{2} \times 2{,}512} = 1290{,}85\ ^{o}K$$

$\mathbf{G_P} = \frac{1}{4} \times 100 \times 2{,}512 \times 1000 = 62.800$ kali ; BN $_{\mathbf{P}}$ = 20 MHz

Maka : $S_i = 10.000 \times k\,[T_{Ant} + T_{eP}]\; BN_{IF}$

$\boldsymbol{S_i} = 10.000 \times 1{,}38 \times 10^{-23}\ [\ 300 + 1290{,}85\ ] \times 20.000 = \boldsymbol{4{,}4 \times 10^{-12}\ W}$

Pada susunan point a) diperoleh :

$\mathbf{T_{eP}} = 2741{,}85\ ^{o}K$, sedangkan hasil point c) dipeoleh : $\mathbf{T_{eP}} = 1290{,}85\ ^{o}K$

Jadi susunan paling baik adalah yang susunan sesuai point c) yaitu :

(sal koax) --(RF AMP)—(sal koax)—(MIXER)—(IF AMP)