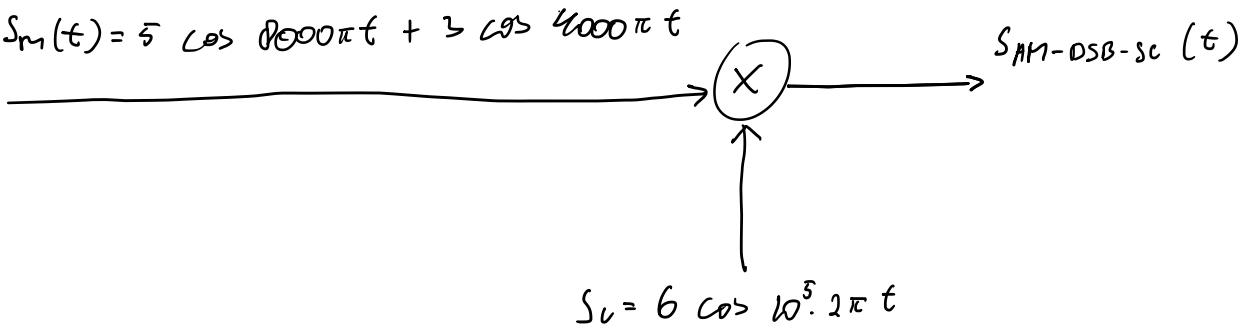
M. Hasyim Abdillah P. 1101191095 TT-43-11

1. $S_m(t) = 5\cos 8000\pi t + 3\cos 4000\pi t$

$S_c(t) = 6\cos 10^5.2\pi t$

Sistem : AM-DSB-SC

a.



$$S_{AM}(t) = S_m(t).\ S_c(t)$$

$$= (5\cos 8000\pi t + 3\cos 4000\pi t)\ 6\cos 10^5.2\pi t$$

$$= 30\cos(8000\pi t)\cos(10^5.2\pi t) + 18\cos(4000\pi t)\cos(10^5.2\pi t)$$

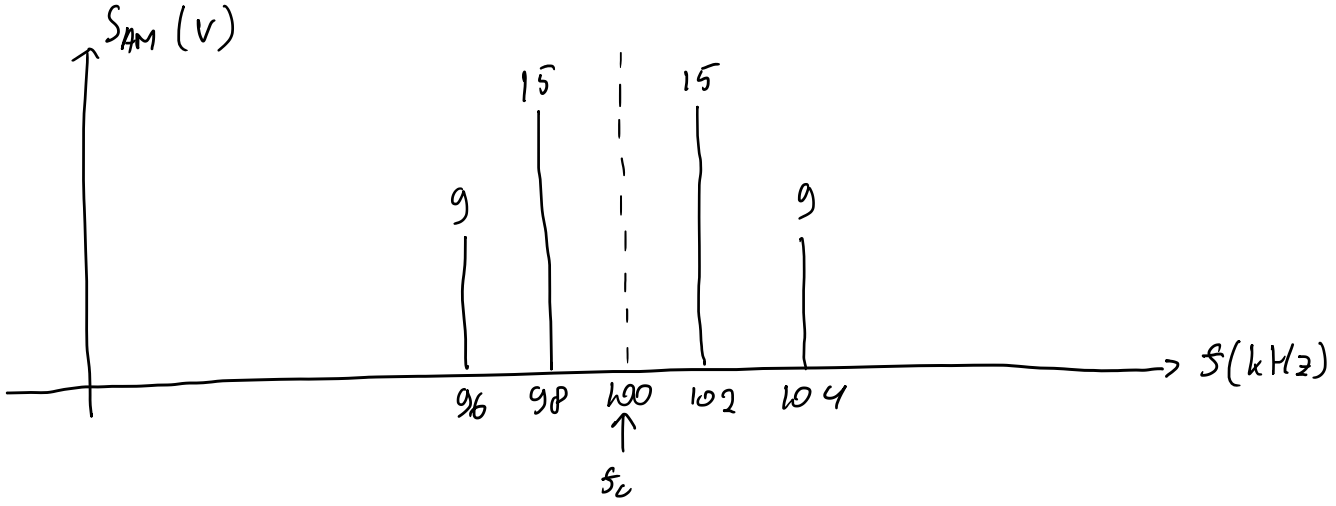
$$= 30\left[\frac{1}{2}\left(\cos(8000\pi t + 10^5.2\pi t) + \cos(8000\pi t - 10^5.2\pi t)\right)\right]$$

$$+ 18\left[\frac{1}{2}\left(\cos(4000\pi t + 10^5.2\pi t) + \cos(4000\pi t - 10^5.2\pi t)\right)\right]$$

$$= 15\cos 2\pi(104.10^3 t) + 15\cos 2\pi(96.10^3 t)$$

$$+ 9\cos 2\pi(102.10^3 t) + 9\cos 2\pi(98.10^3 t)$$

b.



$BW = 104\ kHz - 96\ kHz = 8\ kHz$

c. $P = 2\left(\frac{A_1^2}{2} + \frac{A_2^2}{2}\right) = 2\left(\frac{15^2}{2} + \frac{9^2}{2}\right) = 2(112,5 + 40,5)$

$= 2.153$

$= 306\ W/\Omega$

2. $V_c(t) = 10 \cos(2\pi . 100.10^6 t) \rightarrow f_c = 100\ MHz = 100.000\ kHz$

$V_s(t) = 2 \cos(10000\pi t) \rightarrow f_{s1} = 5000\ Hz = 5\ kHz$

Null carrier pertama $\rightarrow \beta_1 = 2,4$

a. $V_{s2}(t) = 4 \cos(20000\pi t) \rightarrow f_{s2} = 10.000\ Hz$

$$k_f = \frac{\beta_1 . f_{s1}}{A_{s1}} = \frac{2,4 . 5000}{2} = 6000\ Hz/volt = 6\ kHz/volt$$

$$\beta_2 = \frac{k_f . A_{s2}}{f_{s2}} = \frac{6.kHz/volt . 4V}{10.000\ Hz} = 2,4$$

$\Delta f_2 = \beta_2 . f_{s2} = 2,4 . 10\ kHz = 24\ kHz$

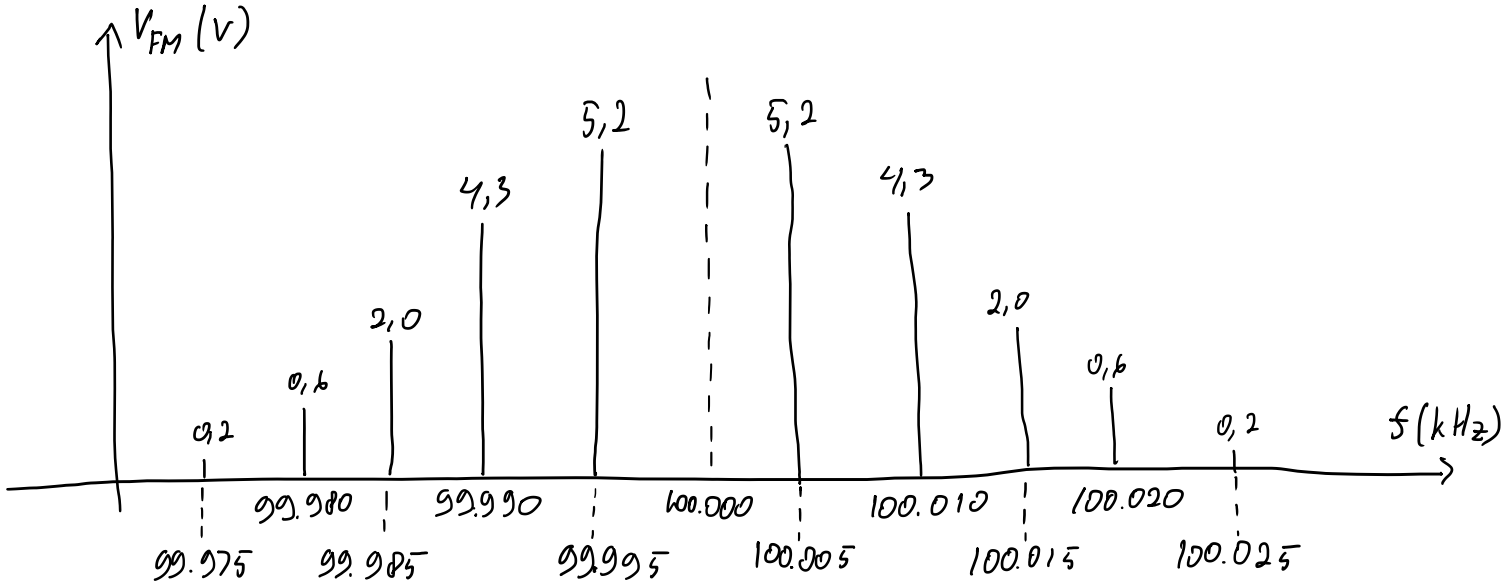
$BW_c = 2(\Delta f_2 + f_{s2}) = 2(24kHz + 10kHz)$

$BW_c = 68\ kHz$

b. $\beta_1 = 2,4$

$J_0(\beta) = 0$; $J_1(\beta) = 0,52$; $J_2(\beta) = 0,43$

$J_3(\beta) = 0,2$; $J_4(\beta) = 0,06$; $J_5(\beta) = 0,02$



$P_1 \left(f=(10^5 \pm 5)\,kHz\right) = \frac{A_1^2}{2} = \frac{6,2^2}{2} = 13,52\ W/\Omega$

$P_2 \left(f=(10^5 \pm 10)\,kHz\right) = \frac{A_2^2}{2} = \frac{4,3^2}{2} = 9,245\ W/\Omega$

$P_3 \left(f=(10^5 \pm 15)\,kHz\right) = \frac{A_3^2}{2} = \frac{2^2}{2} = 2\ W/\Omega$

$P_4 \left(f=(10^5 \pm 20)\,kHz\right) = \frac{A_4^2}{2} = \frac{0,6^2}{2} = 0,18\ W/\Omega$

$P_5 \left(f=(10^5 \pm 25)\,kHz\right) = \frac{A_5^2}{2} = \frac{0,2^2}{2} = 0,02\ W/\Omega$

3. a. $G_T = G_{RF} + G_{mixer} + G_{IF}$

$= 13\ dB + 6\ dB + 20\ dB$

$= 39\ dB$

$= 30\ dB + 3\ dB + 3\ dB + 3\ dB$

$= 1000 \times 2 \times 2 \times 2 = 8000$ kali

b. $Te_{RF} = 1000\ k$

$F_{mixer} = 6\ dB = 3\ dB + 3\ dB = 2 \times 2 = 4$

$$Te_{mixer} = (4-1)\,290\,k = 870\,K$$

$$F_{IF} = 9\,dB = 3\,dB + 3\,dB + 3\,dB = 2 \times 2 \times 2 = 8$$

$$Te_{IF} = (8-1).\,290\,k = 2030\,k$$

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

$$= 1000 + \frac{870}{13\,dB} + \frac{2030}{13dB + 6dB}$$

$$= 1000 + \frac{870}{20} + \frac{2030}{20 \times 4}$$

$$= 1000 + 43,5 + 25,375$$

$$= 1068,875\,k$$

c. $Te = (F_{RF} - 1).\,290\,k$

$$\frac{1000}{290} = F_{RF} - 1$$

$$F_{RF} = \frac{1000}{290} + 1 = 4,45$$

$$F_{mixer} = 4$$

$$F_{IF} = 8$$

$$F_{Total} = F_{RF} + \frac{F_{mixer} - 1}{G_{RF}} + \frac{F_{IF} - 1}{G_{RF} \cdot G_{mixer}}$$

$$= 4,45 + \frac{4-1}{20} + \frac{8-1}{20 \times 4}$$

$$= 4,45 + 0,15 + 0,0875 = 4,6875$$

$$NF_{Total} = 10.\ ^{10}\log(F_{Total})$$

$$= 10.\ ^{10}\log(4,6875)$$

$$= 6,7\ dB$$

d. $$\frac{S_{oE}}{N_{oE}} = \frac{S_i}{k(Te_B + Te_{total}).B_N}$$

$$= \frac{1 \times 10^{-6}}{1,38 \times 10^{-23}(1000 + 1068,875).\ 200 \times 10^3}$$

$$= 175.128.434,8$$

$$\frac{S_{oE}}{N_{oE}} = 10.\ ^{10}\log(175.128.434,8)$$

$$= 82,43\ dB$$