Vježba 2

1.) $R = 50\,\Omega$

$P_{p0} = 100\,W$

$P_{AM} = 118\,W$

$$P_{AM} = P_{p0}\left(1 + \frac{m_{aM}^2}{2}\right) \rightarrow m_a = \sqrt{2\left(\frac{P_{AM}}{P_{p0}} - 1\right)}$$

$$\underline{\underline{m_{a1} = 0.6}}$$

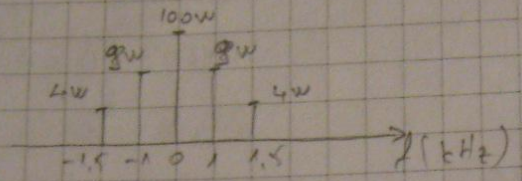
b) $P_{p0} = \frac{U_{pM}^2}{2R} \rightarrow U_{pM} = \sqrt{2 \cdot P_{p0} R} = 100\,V$

$$A_{max} = U_{pM}(1 + m_{a1}) = 160\,V$$

c) $$P_{AM1} = P_{p0}\left(1 + \frac{m_{a1}^2}{2} + \frac{m_{a2}^2}{2}\right) = 126\,W$$

d) $P_{BK1} = P_{P0} \frac{m_a^2}{2} = 18\,W$

1. bočne komponente $P_{BK2} = P_{P0} \cdot \frac{m_a^2}{2} = 8\,W$



2.) $2A_{min} = 80\,V_{pp}$

$2A_{max} = 160\,V_{pp}$

$f_p = 512\,kHz$

$f_m = 4\,kHz$

a) $\frac{A_{max}}{A_{min}} = \frac{U_{pm}(1+m_a)}{U_{pm}(1-m_a)} \Rightarrow m_a = \frac{A_{max} - A_{min}}{A_{max} + A_{min}} = 0.$

b) $A_{max} = U_{pm}(1+m_a) \Rightarrow U_{pm} = \frac{A_{max}}{1+m_a}$

$f_g = f_m + f_p = 516\,kHz$

$f_d = f_p - f_m = 508\,kHz$

$U_{gbk} = U_{dbk} = U_{pm} \cdot \frac{m_a}{2} = 1.0\,V$

c) $P_{AM} = \frac{U_{pm}^2}{2R}\left(1 + \frac{m_a^2}{2}\right) = 38\,W$

$P_{...}$

3.

$$\Theta_1 = \frac{U_{PMS}}{U_{Ptorisno}} = \frac{0.5}{\frac{A_{max}+A_{min}}{2}} = 0,025$$

(prijenosni omjer signala)

$$m_a = \frac{A_{max}-A_{min}}{A_{max}+A_{min}} = 0.8$$

$$(S/I)_{NF} = 10\log\frac{P_k}{P_S} = 10\log\left(\frac{m_{ak}}{a_S}\right)^2 = 30,1\,dB$$

4.

$$u_{AM}(t) = U_{PM}(1+m_a\cos\omega_m t)\cos\omega_p t\cdot\cos(\omega_p t+\varphi)$$

$$u_{dm}(t) = k\cdot u_M(t)\cdot\cos\varphi = C\cdot\frac{1}{2}\cdot U_{PM}$$ → padne za 6 dB $\left(-20\log\frac{1}{2}\right)$

5. $f_p = 100\,MHz$

5) $f_p = 1.00\,MHz$

$P_{FM} = 2.45\,kW$

$f_m = 15\,kHz$

$\Delta f_{FM} = 75\,kHz$

$\phi = \int \omega$

a) $u_{FM} = U_{pm}\cos(\omega_p t + m_f \cdot \sin\omega_m t)$

$m_f = \frac{\Delta\omega_{FM}}{\omega_m} = \frac{\Delta f_{FM}}{f_m} = 5$

$\omega(t) = \omega_p + \Delta\omega_{FM}\cdot\cos\omega_m t \quad / \int \Rightarrow \phi$

$u_{pm}(t) = U_{pm}\cos(\omega_p t + \omega_p \sin\omega_m t)$

$\Delta\phi$

$\Delta\omega = m_p \cdot \omega_m$

b) $B_{FM} = 2(\Delta f_{FM} + f_m) = 180\,kHz$

c) $P_{FM} = \frac{U_{ef}^2}{2R} \Rightarrow U_{ef} = \sqrt{2 P_{FM} \cdot R} = 350\,V$

d) $m_f \Rightarrow 0.4 \Rightarrow$ UZKOPOJASNA MODULACIJA (moće se prenositi više harmonika

6.

$B_{kanal} = 25\,kHz$

$B_G = 9\,kHz$

$f_{min} = 100\,Hz$

$f_{max} = 3\,kHz$

$\Delta = 2\,rad$

a) $B_{FM} = B_{kanal} - B_G = 16\,kHz$

$B_{FM} = 2[\Delta f_{FM} + f_{max}]$

$\rightarrow \Delta f_{FM} = \frac{B_{FM}}{2} - f_{max} = 5\,kHz$

b) $m_{f_{min}} = \frac{\Delta f_{FM}}{f_{min}} = 1.67$

$m_{f_{max}} = \frac{\Delta f_{FM}}{f_{min}} = 16.7$

c) $\Delta f_{FM} = \Delta\phi \cdot f_m$

$\Delta f_{min} = \Delta\phi \cdot f_{min} = 600\,Hz$

$\Delta f_{max} = \Delta\phi \cdot f_{max} = 6\,kHz$

7.

$\Delta f = 75\,kHz$

$f_{max} = 15\,kHz$

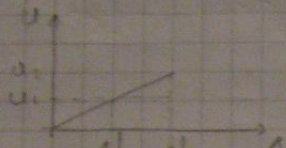
$\frac{(P_k/P_\Sigma)_{FM}}{(P_k/P_\Sigma)_{AM}} = 10\log\left[2 \cdot \left(\frac{\Delta f_k}{f_{max}}\right)^2 \cdot \frac{1}{m_a^2}\right] = 10\log\left[2 \cdot \left(\frac{75}{15}\right)^2 \cdot \frac{1}{1}\right] = 13\,dB$

ma nije zadan pa se pretpostavlja da je 1.
(najbolje za AM modulaciju)

8.

a) $B_{FM} = 2 \cdot (\Delta f + f_{max}) = 2 \cdot (6,75 + 5) = 23,5\,MHz$

b) $\Delta f = k \cdot U_{mm}$ → modulacijski



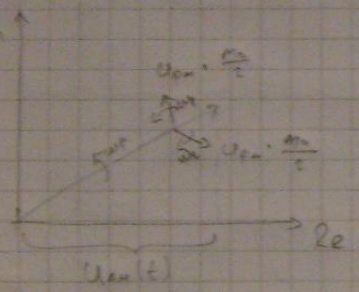
$A = 20 \log \frac{U_2}{U_1} = 20 \log \frac{\Delta f_{max}}{\Delta f}$

$\Rightarrow \Delta f_{max} = \Delta f \cdot 10^{\frac{A}{20}} \quad \left(A = 2_{znano}\right)$

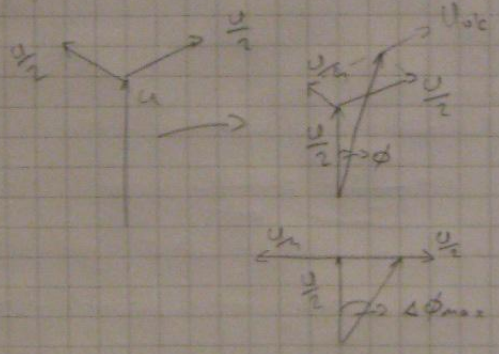
$\Delta f_{max} = 8,5\,MHz$

$B_{FM2} = B_{max} = 2(\Delta f_m + f_{max}) = 27\,MHz$

9.



$m_a = 1$



$\Delta\phi = tg^{-1}\left(\frac{U/4}{U/2}\right) = tg^{-1}\left(\frac{1}{2}\right) = 0,464$

$\Delta f = \Delta\phi \cdot f_m = 0,464 \cdot 2160 = 1\,kHz$

10.

$\rightarrow$ derivacija smetnje

$$\rho_{FM} = \frac{\Delta\omega_s}{\Delta\omega_k} = \frac{\omega_s \cdot a_s}{\Delta\omega_k}$$

$\rightarrow$ derivacija korisnog

$$= \frac{(l_s - l_k) \cdot \frac{U_{FMS}}{U_{FMK}}}{\Delta l_k} = \frac{8.1\cancel{0^{-3}} \cdot \frac{2}{40\pi}}{50 \cdot \cancel{10^{-3}}} = \frac{1}{125}$$

$$20 \log\left(\frac{1}{\rho_{FM}}\right) = -42\,dB$$