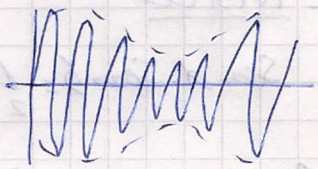
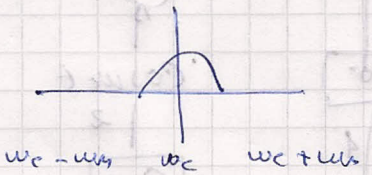
Resolución Guía Nº 3.

3.1

$$\phi(t) = [A + f(t)] \cos \omega_c t$$

AM con portadora

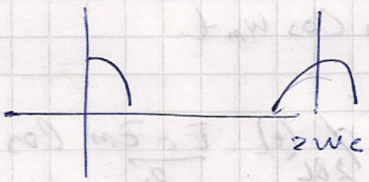




3.2

$$\phi(t) = \{[A + f(t)] \cos \omega_m t\} \cos \omega_c t.$$

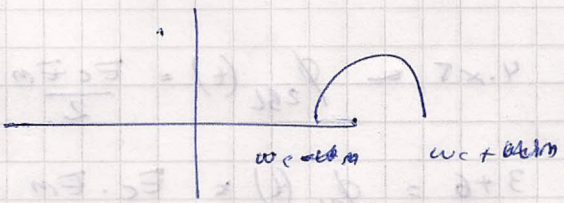
Detección por inyección de portadora.



3.3

$$\phi(t) = f(t) \cdot \cos \omega_c t.$$

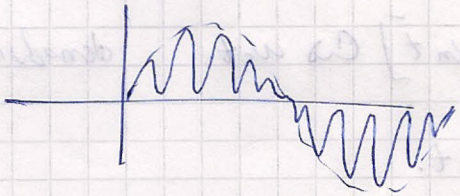
Modulación con portadora.

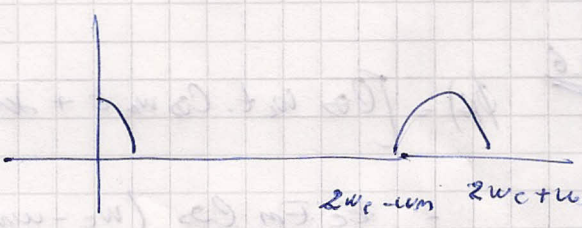


3.4

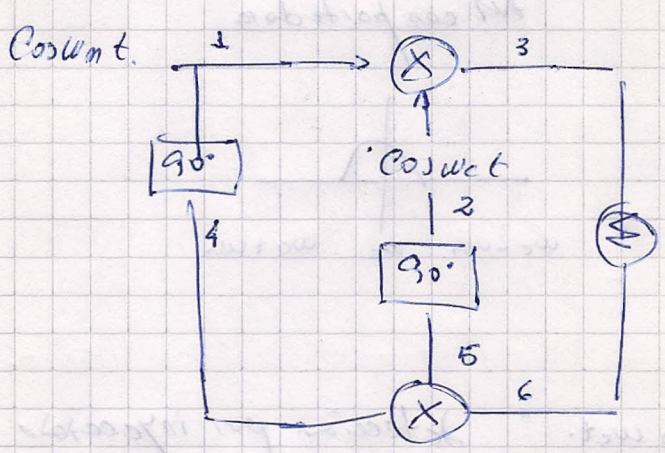
$$\phi(t) = [f(t) \cdot \cos \omega_m t] \cdot \cos \omega_c t.$$

doble banda lateral sin portadora





3.5 $\phi(t) = [\cos w_c t \cdot \cos w_m t + \operatorname{sen} w_c t \operatorname{sen} w_m t]$ ϕ_{BLU} cancelación de fase.



recordar

$\operatorname{Sen}\alpha \cdot \operatorname{Sen}\beta = \frac{1}{2}\cos(\alpha-\beta) - \frac{1}{2}\cos(\alpha+\beta)$

$\cos\alpha \cdot \cos\beta = \frac{1}{2}\cos(\alpha+\beta) + \frac{1}{2}\cos(\alpha-\beta)$

① $e_m(t) = E_m \cos w_m t.$ ② $e_c(t) = E_c \cos w_c t.$

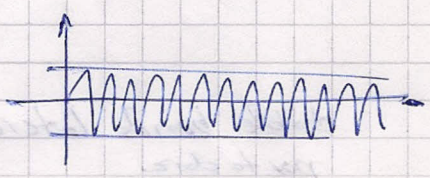
③ $1 \times 2 = \phi_{2BL}(t) = \frac{E_c E_m}{2}\cos(w_c + w_m)t + \frac{E_c E_m}{2}\cos(w_c - w_m)t.$

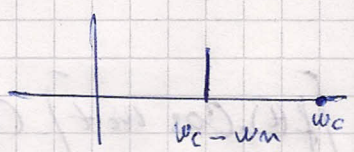
④ $e_m(t) = E_m \operatorname{Sen} w_m t.$

⑤ $e_c(t) = E_c \operatorname{Sen} w_c t.$

⑥ $4 \times 5 = \phi_{2BL}(t) = \frac{E_c E_m}{2}\cos(w_c - w_m)t - \frac{E_c E_m}{2}\cos(w_c + w_m)t.$

⑦ $3 + 6 = \phi_{BLU}(t) = E_c \cdot E_m \cos(w_c - w_m)t.$

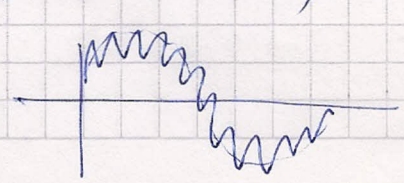


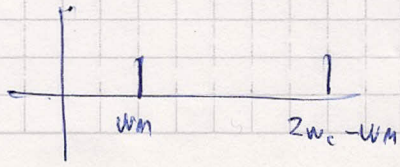


3.6 $\phi(t) = [\cos w_c t \cdot \cos w_m t + \operatorname{sen} w_c t \cdot \operatorname{sen} w_m t]\cos w_c t.$ demodulación de BLU.

$= E_c E_m \cos(w_c - w_m)t \cdot \cos w_c t.$

$= \frac{E_c E_m}{2}\cos(2w_c - w_m)t + \frac{E_c E_m}{2}\cos w_m t.$





3.7 $E_c = 10V$ $f_c = 1MHz$; $E_m = 10V$ $f_m = 100kHz$

A) - $e_m(t) = 10V \cdot \cos 2\pi \cdot 10^5 t$.

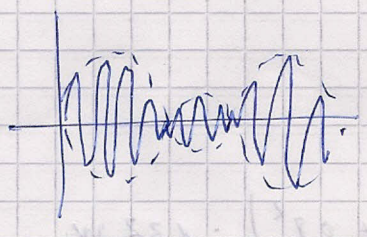
B) - $e_c(t) = 10V \cdot \cos 2\pi \cdot 10^6 t$.

C) $\phi_{AM} = [10 + 10\cos 2\pi 10^5 t] \cdot \cos 2\pi \cdot 10^6 t$.

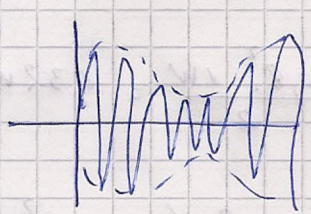
$= 10 \cdot \cos 2\pi 10^6 t + 5\cos 2\pi 1,1 10^6 t + 5\cos 2\pi \cdot 0,9 \cdot 10^6 t$.

↑ porte dore ↑ BLS ↑ BLI

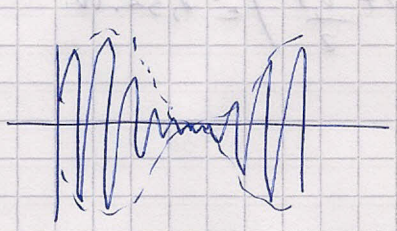
3.8



$m > 1$



$m < 1$



$m = 1$

3.9 $E_c = 10V$ $f_c = 100kHz$ - $f_m = 10kHz$. - $m = 80\%$. $Z_L = 50\Omega$

A) $e_c(t) = 10 \cdot \cos 2\pi \cdot 10^5 t$

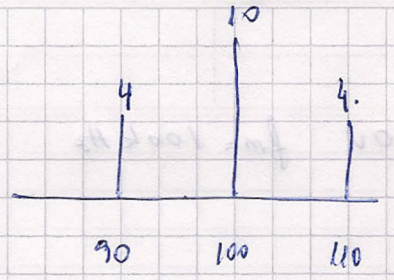
B) $m = \frac{E_m}{E_c} \Rightarrow E_m = m \cdot E_c = 0,8 \cdot 10 = 8V$.

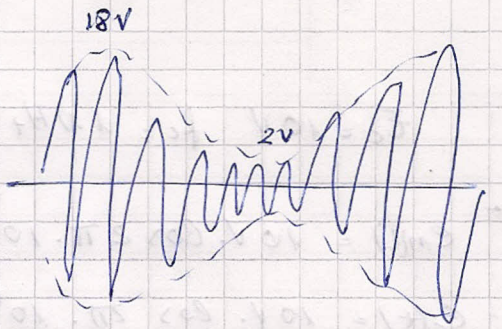
C) $e_m(t) = 8 \cdot \cos 2\pi 10^4 t$.

D) $\phi_{AM} = [10 + 8\cos 2\pi 10^4 t] \cos 2\pi 10^5 t$.

$= 10\cos 2\pi \cdot 10^5 t + 4\cos 2\pi 110\, 10^3 t + 4 \cdot \cos 2\pi \cdot 90\, 10^3 t$.

e)





f) $P_c = \frac{E_c^2}{2 R_L} = \frac{10^2}{2 \cdot 50\Omega} = 1\,W$

$E_{ef} = \frac{E_a}{\sqrt{2}}$

$P_c = \frac{(E_a/\sqrt{2})^2}{R_L} = \frac{E_a^2}{2 \cdot R_L}$

g) $P_{2BL} = \left(\frac{E_m}{\sqrt{2}}\right)^2 \cdot \frac{1}{R_L} = \left(\frac{m E_c}{\sqrt{2}} \frac{1}{2}\right)^2 \cdot \frac{1}{R_L} = \frac{m^2 E_c^2}{2} \cdot \frac{1}{4} \cdot \frac{1}{R_L} = \frac{m^2 E_c^2}{8} \cdot \frac{1}{R_L}$

$P_{2BL} = \frac{m^2}{2} \cdot P_c = \frac{0,8^2 \cdot 1W}{2} = 0,32\,W$

H) $P_T = P_c + P_{2BL} = P_c\left(1 + \frac{m^2}{2}\right) = 1\,W\left(1 + \frac{0,8^2}{2}\right) = 1,32\,W$

I) $\eta = \frac{P_{2BL}}{P_T} = \frac{0,32}{1,32} = 0,24$

$\eta = \frac{\frac{m^2}{2} P_c}{P_c\left(1 + \frac{m^2}{2}\right)} = \frac{m^2}{2 + m^2} = \frac{0,8^2}{2 + 0,8^2} = 0,24$

Resolución

3.10

$E_{max} = E_c + E_M$ ① $\longrightarrow$ $E_c = E_{max} - E_M$ ↘ en 2

$E_{min} = E_c - E_M$ ②

$E_{min} = E_{max} - E_M - E_M$

$2E_M = E_{max} - E_{min}$

$$\boxed{E_M = \frac{E_{max} - E_{min}}{2}}$$

de ② $E_M = E_c - E_{min}$ en ①

$E_{max} = E_c + E_c - E_{min}$

$$\boxed{E_c = \frac{E_{max} + E_{min}}{2}}$$

$$m = \frac{E_M}{E_c} = \frac{\frac{E_{max} - E_{min}}{2}}{\frac{E_{max} + E_{min}}{2}}$$

$$\boxed{m = \frac{E_{max} - E_{min}}{E_{max} + E_{min}}}$$

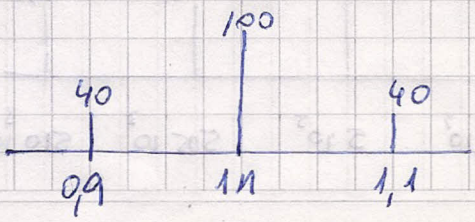
A) $m = \frac{180 - 20}{180 + 20} = 0{,}8$

B) $\phi_{AM} = (E_c + E_M \cos w_c t) \cdot \cos w_c t$

$E_M = \frac{180 - 20}{2} = 80$ $\qquad E_c = \frac{180 + 20}{2} = 100$

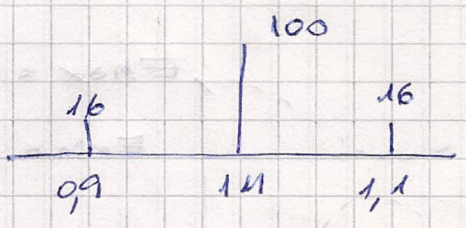
$\phi_{AM} = [100 + 80 \cos 2\pi \cdot 10^5 t] \cos 2\pi 10^6 t$

C)



D) $P_T = P_c\left(1 + \frac{M^2}{2}\right) = 100\left(1 + \frac{0,8^2}{2}\right) = 132\ W$

$P_c = \frac{E_c^2}{2R_L} = \frac{100^2}{2.50} = 100\ W$



3.11 $e(t) = 25\,(1 + \cos 5000t + 0,3 \cos 10000t).\cos 5\,10^5 t.$

$\phi_{AM} = [E_c + E_m \cos \omega_m t] \cos \omega_c t$

$= E_c\,(1 + m \cos \omega_m t) \cos \omega_c t$

A) $\phi_{AM} = 25 \cos 5.10^5 t + 12,5 \cos 505\,10^3 t + 12,5 \cos 495\,10^3 t$
$+ 3,75 \cos 510\,10^3 t + 3,75 \cos 490\,10^3 t$

B) portadora $5\,10^5$ rad/s.

$BB_1 = 5000$ rad/s.

$BB_2 = 10000$ rad/s.

en Hz % $\approx 2\pi$.

C) Portadora 25 V

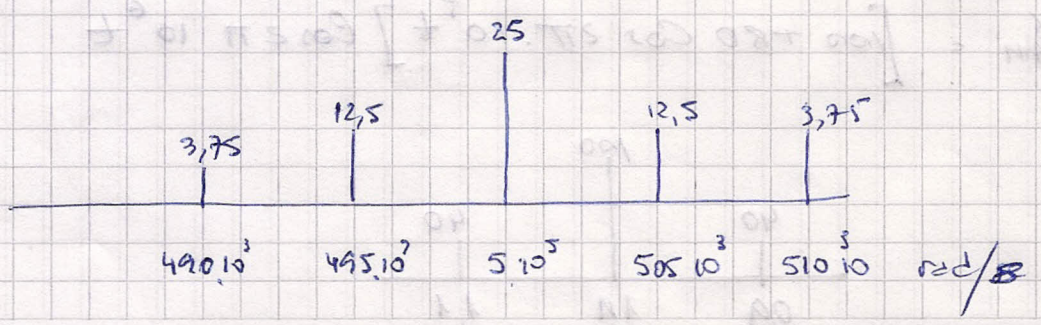
$BB_1 = 25$ V

$BB_2 = 7,5$ V

D) $m_1 = 1$

$m_2 = 0,3$

E)



NOTA

3.12

a) $P_T = P_c \left(1 + \frac{m^2}{2}\right)$

$150\,kW = P_c \left(1 + \frac{1}{2}\right) \Rightarrow P_c = 150\,kW$

b) $P_T = 100kW \left(1 + \frac{0,8^2}{2}\right) = 132\,kW$

c) $P_{2BL} = P_c \frac{m^2}{2} = 100k \cdot \frac{0,6^2}{2} = 18\,kW$

d) $P_c = 100\,kW$

$P_{2BL} = 100k \cdot \frac{0,9^2}{2} = 40,5\,kW$ $\quad P_T = 10 + 40,5\,kW$

$P_{1BL} = 20,25\,kW$ $\quad P_T = 50,5\,kW$

P_c: 100 k. se redujo a 10 dB = 10 kW

Alternativa

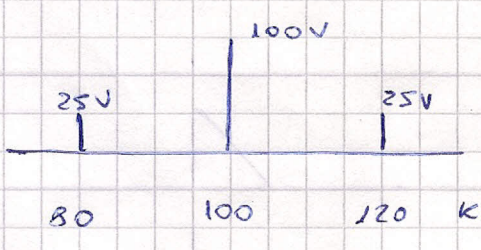
suponer que la P_c se redujo antes $\Rightarrow \frac{10k}{10} = 10\,kW$

$P_{2BL} = 10k \cdot \frac{0,9^2}{2} = 4,05\,kW$

$P_{1BL} = 2,025\,kW$

$P_T = 10 + 2,025 = 12,025\,kW$

3.13



Del grafico

$E_M = 50V$

$E_c = 100V$

NOTA

A) $e_m(t) = 50V \cdot \cos 2\pi\, 20\,10^3 t$

B) $e_c(t) = 100V \cdot \cos 2\pi\, 10^5 t$

C) $M = \frac{E_M}{E_C} = \frac{50V}{100V} = 0,5.$

D) $g_{AM} = \left[100 + 50 \cos 2\pi\, 20\,10^3 t\right] \cos 2\pi\, 10^5 t$

$g_{AM} = 100 \cos 2\pi\, 10^5 t + 40 \cos 2\pi\, 120\,10^3 t + 40 \cos 2\pi \cdot 8010^3 t.$

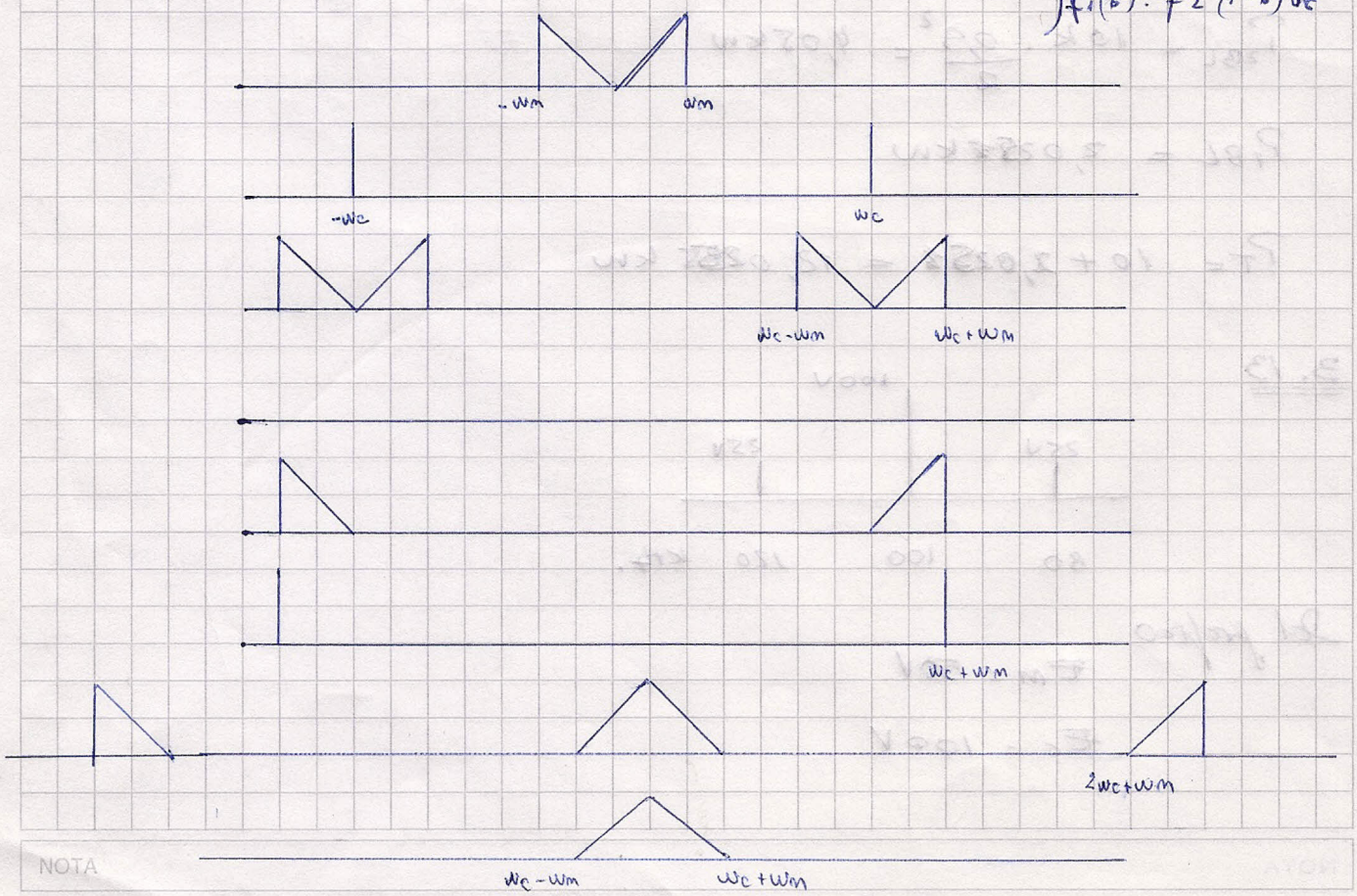
E) $P_C = \frac{E_C^2}{2 R_L} = \frac{100^2}{2 \cdot 50\Omega} = 100\,W$

F) $P_T = P_C \left(1 + \frac{M^2}{2}\right) = 100\left(1 + \frac{0,5^2}{2}\right) = 112,5\,W$

G) $\eta = \frac{P_{2BL}}{P_T} = \frac{m^2}{2+m^2} = \frac{0,5^2}{2+0,5^2} = 0,11 = 11\%$

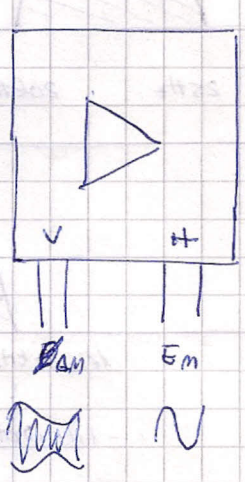
3.14

$\int f_1(z) \cdot f_2(1-z)\, dz$

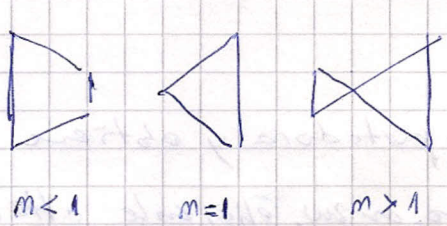


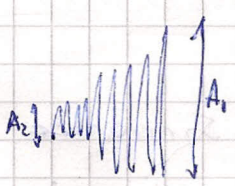
3.17

A)



B)





C) $m = \dfrac{E_{max} - E_{min}}{E_{max} + E_{min}}$ $\qquad m = \dfrac{A_1 - A_2}{A_1 + A_2}$

D) despejo E_c y E_m y obtengo la Φ_{AM} (ver 3.10)

3.18

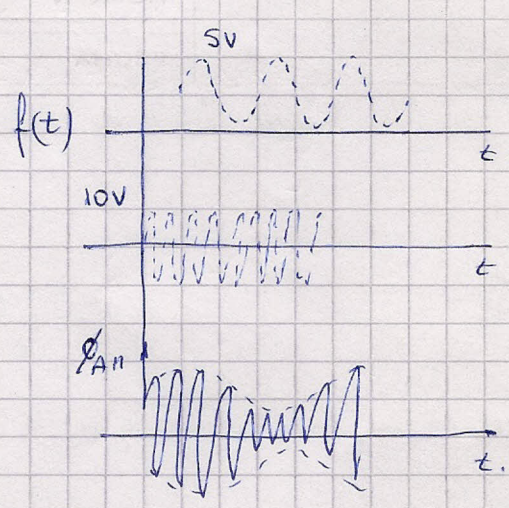
$$P_T = P_c \left(1 + \frac{m^2}{2}\right)$$

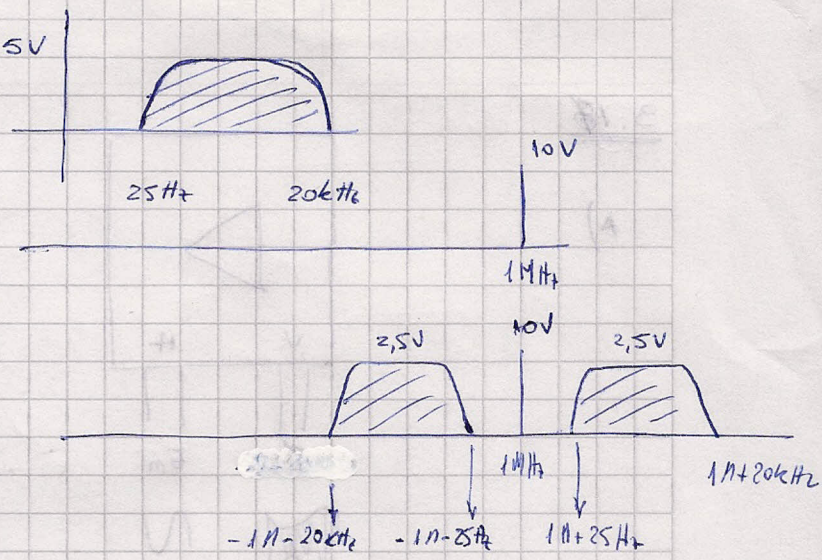
$$I_T^2 \cdot \cancel{Z_L} = I_c^2 \cancel{Z_L} \left(1 + \frac{m^2}{2}\right)$$

$$\frac{I_T^2}{I_c^2} = 1 + \frac{m^2}{2} \Rightarrow m = \sqrt{\left(\frac{I_T^2}{I_c^2} - 1\right) 2} = \sqrt{\left(\frac{17^2}{13^2} - 1\right)^2} = \underline{0,75}$$

NOTA

3.19



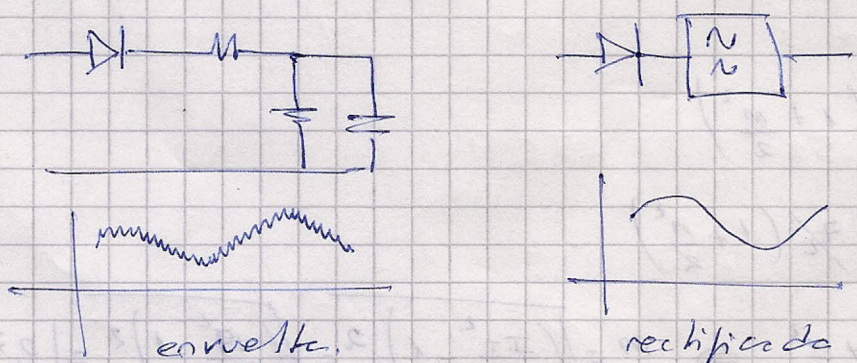


$$n = \frac{5V}{10V} = 0,5$$

3.20

A) Deteccion Sincronica: inyecta portadora y obtiene continua banda base y la misma tecnica en 2w, ejemplo, otro randimiento en banda base.

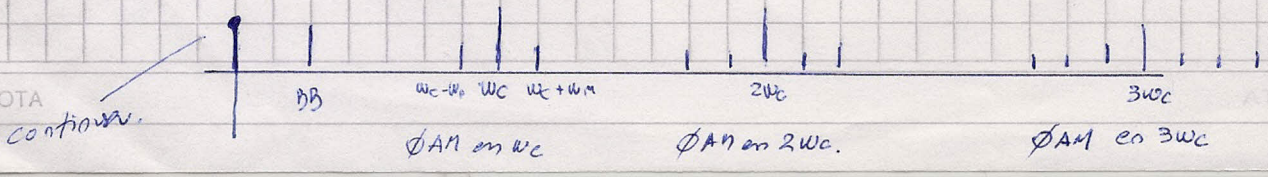
B) Deteccion de envuelta: se rectifica y filtra, barata pero poca amplitud en banda base porque se obtienen muchos armonicos.



3.21.

$$\phi_{AM} = E_c(1 + n \operatorname{Sen} w_m t).\operatorname{Sen} w_c t.$$

$$\frac{E_c}{\pi} + \frac{n E_c}{\pi} \operatorname{Sen} w_m t + \frac{E_c}{2} \operatorname{Sen} w_c t + \frac{n E_c}{2} \operatorname{Sen} w_c t \operatorname{Sen} w_m t + \dots$$

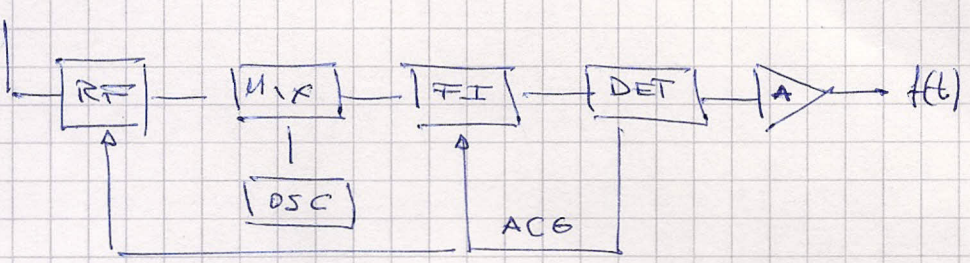


3.22

ver 3.20

3.23 → ver en simulación

3.24



superheterodino → $f_{osc} = f_{sintonia} + 1\,FI$

3.25

$F_{cia\ imagen} = F_{cia\ sintonia} \pm 1\ F.Intemedia$

3.26

El Amp de RF mejora la selectividad

Eleccion correcta FI

$FI_{min} = \frac{f_{max} - f_{min}}{2}$

$FI = FI_{min} + K$ ← se fija por Norma

88 - 108 $\qquad \frac{108 + 88}{2} = 10 + K = 10,7$ (0,7 Norma)

3.27

Mal elegida

3.28

$FI = \frac{1600 - 520}{2} = 540 + K. = 545,4\ KHz.$

NOTA