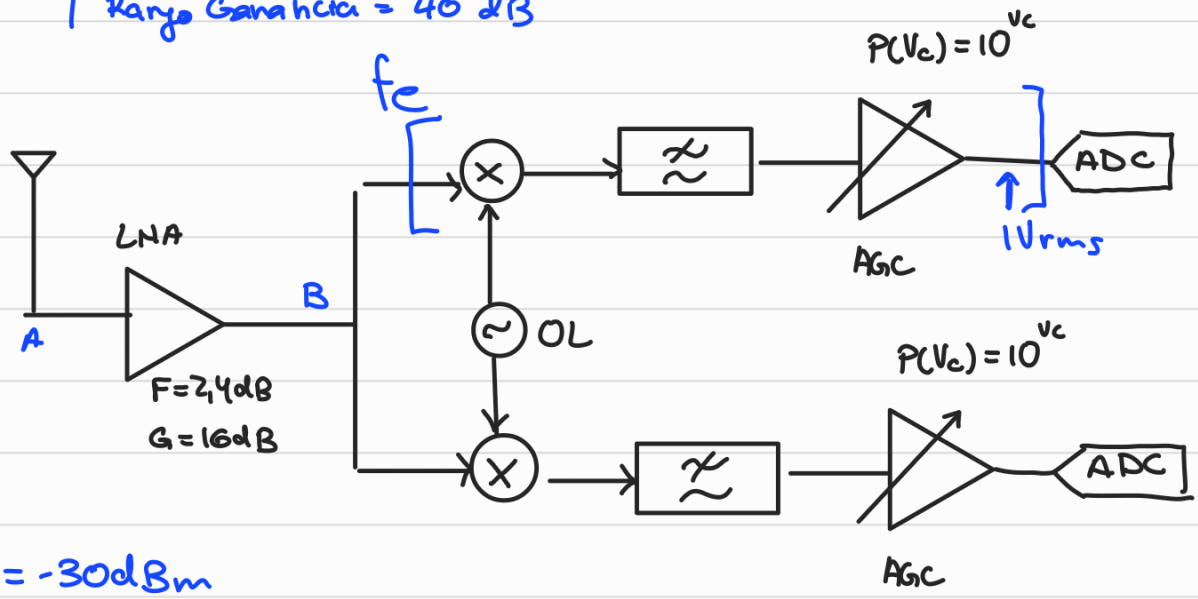
BLOQUE 2:

Receptor →
- LNA
- Mezclador → IF = 2,4 GHz; OL = 2,4 GHz
- Filtro paso bajo
- Control automático de Ganancia
- Convertidor A/C

LNA →
- F = 2,4 dB — Nivel máximo de entrada = -30 dBm
- G = 16 dB
- BW_N = 20 MHz

AGC →
- V_o = 1 Vrms
- Rango Ganancia = 40 dB



1) V_i = -30 dBm

$$SNR_{entrada} = 10 \log \left(\frac{(31,6\mu V)^2}{4 \cdot K \cdot T \cdot 50 \cdot 20M} \right) = 17,8 \text{ dB}$$

$$SNR_{salida} = SNR_{entrada} - \underset{(F)}{2,4} = 15,4 \text{ dB}$$

V_i = -70 dBm

$$SNR_{entrada} = 10 \log \left(\frac{(0,316\mu V)^2}{4KT \cdot 50 \cdot 20M} \right) = -22,2 \text{ dB}$$

$$SNR_{salida} = SNR_{entrada} - F = -24,6 \text{ dB}$$

2)

$$F_t = f_1 + \frac{f_e - 1}{g_1} = 10 \Rightarrow f_e = 10^{1'6}\left(10 - 10^{0,24}\right) + 1 = 329,92$$

$f_1 = 10^{\frac{2,4}{10}}$; $g_1 = 10^{\frac{16}{10}}$

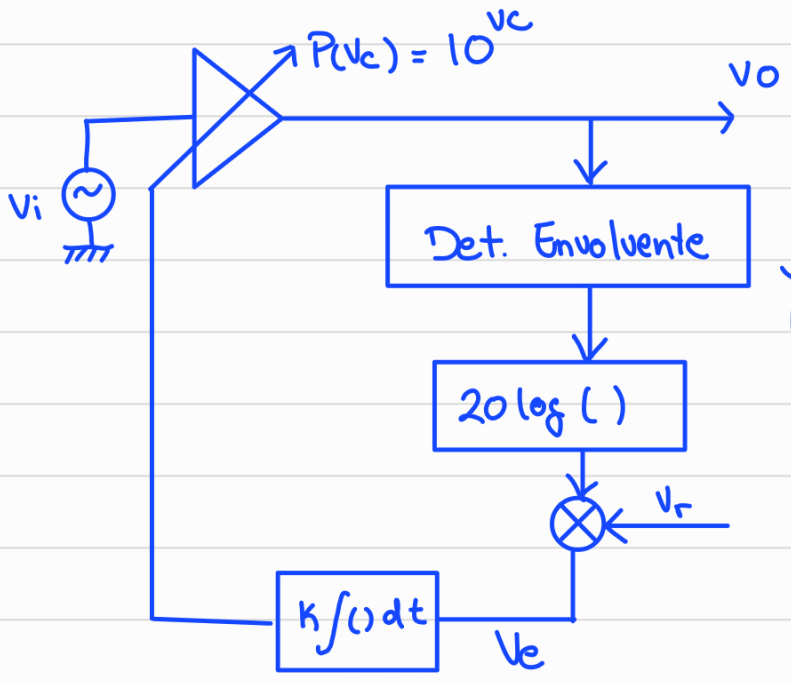
$$f_e \leq 25,18\ dB \text{ para mantener } F_t = 10\ dB$$

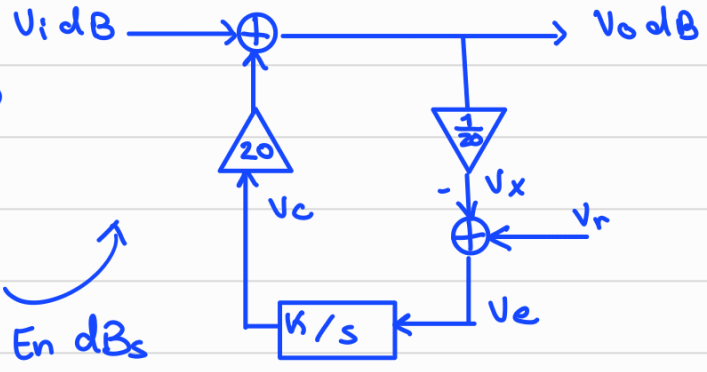
3)

$$V_o = V_i + G_{ACC} = 20 \cdot \log\left(\frac{1\,V_{rms}}{1\,mV_{rms}}\right) \Rightarrow 60\,dBm - (-70\,dBm) = G_{max\,AGC}$$

$$G_{max\,AGC} = 130\ dB \rightarrow G_{min\,AGC} = 90\ dB$$

4) Diagrama de Bloques en lineal





En dBs

$$V_{o(dB)} = V_{i(dB)} + 20\,V_{c\,(dB)}$$

$60\,dBm$

$$V_{orms} = V_{irms} \cdot 10^{V_c}$$

ley de control

$$P(V_c) = 10^{V_c}$$

$$\begin{cases} V_c = \frac{K}{s}\left(V_r - \frac{V_o}{20}\right) \\ \hookrightarrow V_o = V_i + 20\frac{K}{s} \cdot V_r - \frac{K}{s} \cdot V_o \end{cases}$$

$$V_o = V_i \frac{s}{s+r} + 20\,V_r \frac{K}{s+K}$$

Analizado en régimen permanente.

$$V_o\Big|_{s=0} = 20 \cdot V_r$$

$V_i\,dB = x$; $60\,dBm$

$$V_r = \frac{60}{20} = 3\,dB$$

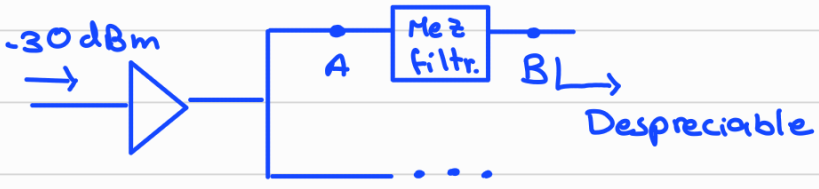
$$V_r = 10^{\frac{3}{20}} = 1,41\,V_{rms}$$

6)

Según la simulación, para una V_i de -30dBm

↳ El ruido → $V_{RMS} = 38,628 \mu V$

→ Analizando la figura de ruido:



(apartado b)

$SNR_A = 15,4 dB$

$P_{NB} = (38,628 \mu V)^2 W$

$P_{SB} = -30dBm + 16dB + 1dB = -13dBm$

(16dB: LNA; 1dB: mezc.)

$P_{SB} = (223,87 \mu V)^2 W$

$SNR_B = 10 \log\left(\frac{P_{SB}}{P_{NB}}\right) = 15,26 dB$

$F_{mez} = SNR_A - SNR_B$

$\boxed{F_{mez} = 0,14 dB}$

↳ Se cumple la condición