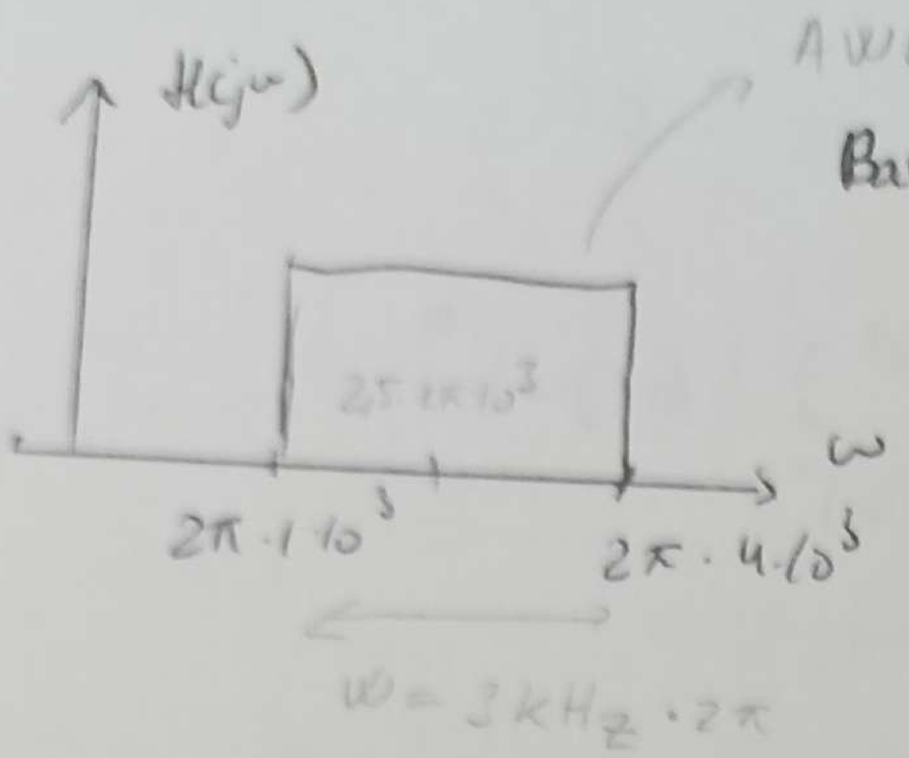
DEP $= \frac{2}{T}$

Problems

$\boxed{6}$



AWGN => entonces tengo un receiver llano

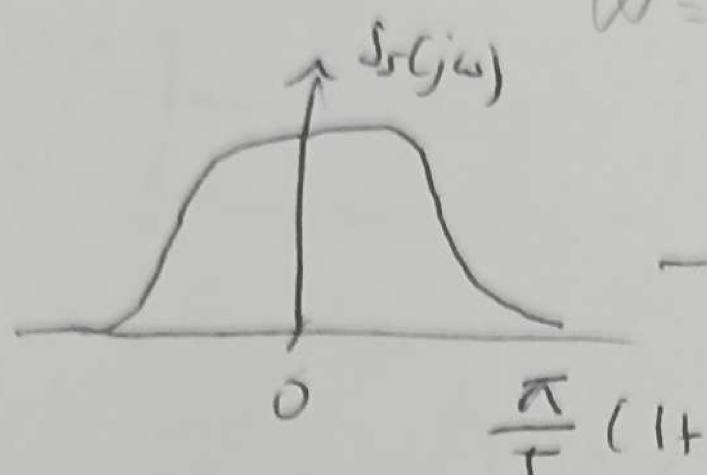
Bandpass problem

la mitad ; wc es $2,5 \cdot 2\pi \cdot 10^3$

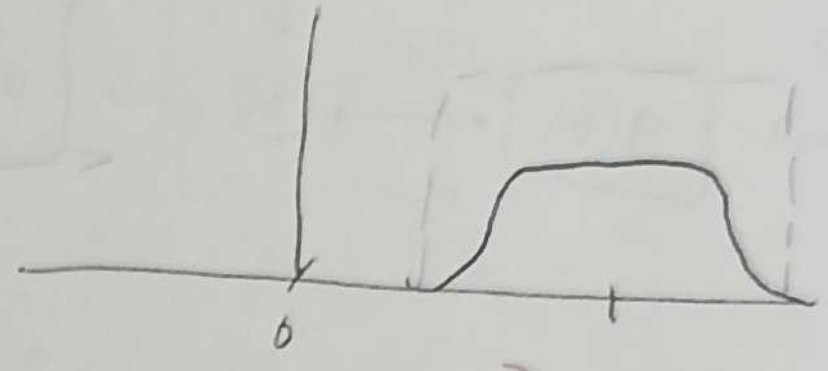
$W = 2\pi \cdot 10^3 \frac{rads}{s}$

g(t) -> SR-RCF

Para que sea mas facil



$S_S(j\omega) = \frac{1}{T} S_A(e^{j\omega T}) \, |G(j\omega)|^2$



choose the T so I use the whole bandwidth

$\frac{2\pi}{T}(1+\alpha)$

$W = 2\pi \cdot 3 \cdot 10^3 = 2\pi \cdot R_S \cdot (1+\alpha)$

$R_b = 9600 \frac{bits}{s}$ ← You need to provide that.

$R_S = \frac{R_b}{\log_2 M}$

but $\frac{1}{T} = R_S$

the R_b is always $> R_S$

$W = 2\pi \cdot 3 \cdot 10^3 = 2\pi \frac{9600}{\log_2 M}(1+\alpha)$ $\quad 0 \leq \alpha \leq 1$

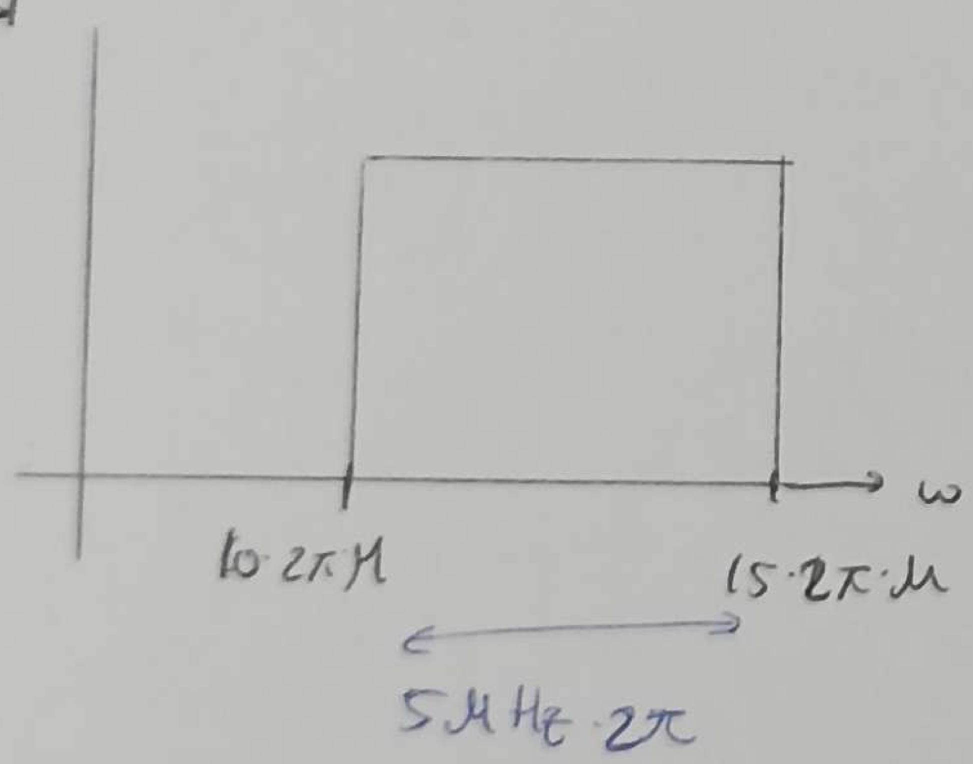
↳ the alpha must be positive.

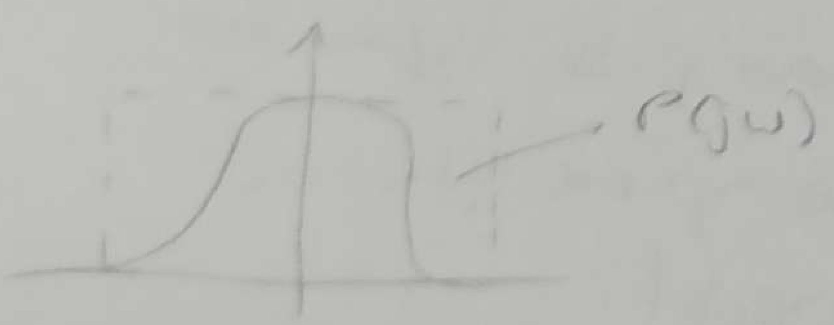
$M = 16 \rightarrow \alpha = 0'25$

QAM → $M=4$, $M=16$, 64 ...

$\boxed{15.}$

a)





$g(t) =$ SR-RCF

$f(t) = g(-t)$

$p(t)$? $\sum_k P(j\omega - j\frac{2\pi k}{T})$

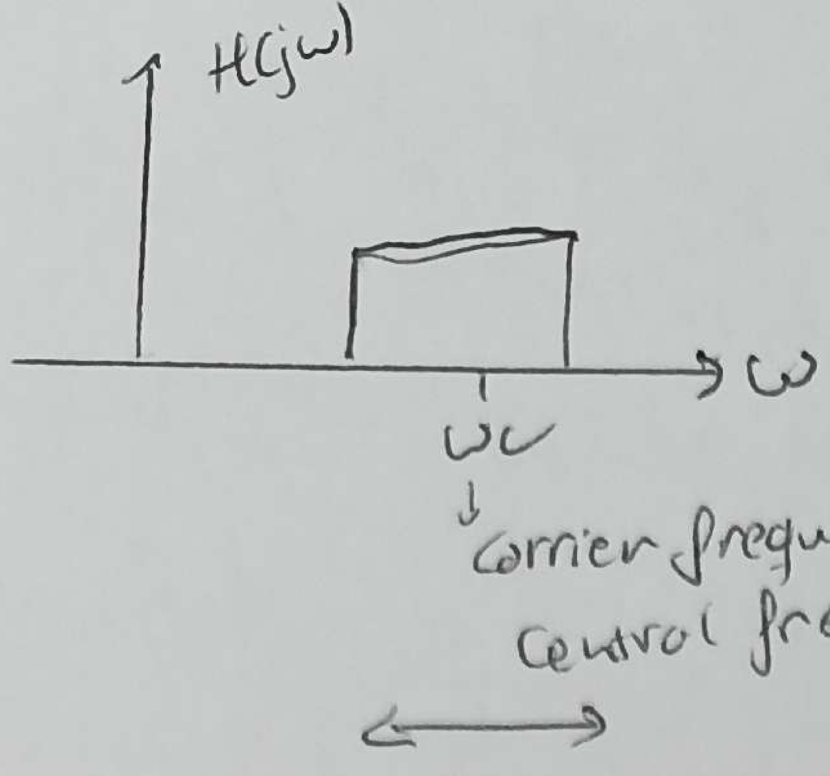
$p(t) = g(t) * h_{eq}(t) * g(-t)$

If your channel is flat & ~~Rc~~ SR-RCF you have a point of the SR-RCF there will be no ISI. Square of the ~~RC~~ - SR-RCF

$2\pi \, 5 \cdot 10^6 = 2\pi \, R_S \, (1 + 0'25)$

$R_S = 4M \frac{Sym}{s}$

channel Bandpass



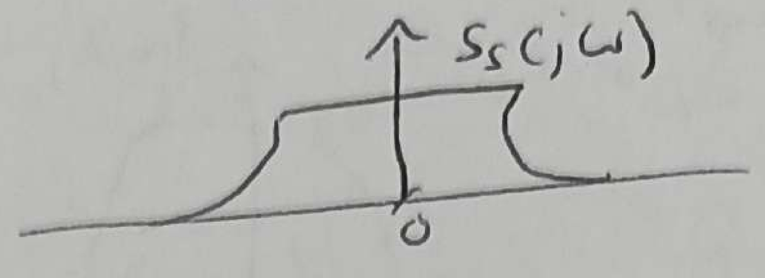
$A[n] \in \mathbb{C}$

$A[n] = A_I[n] + j A_Q[n]$ (inphase, quadrature)

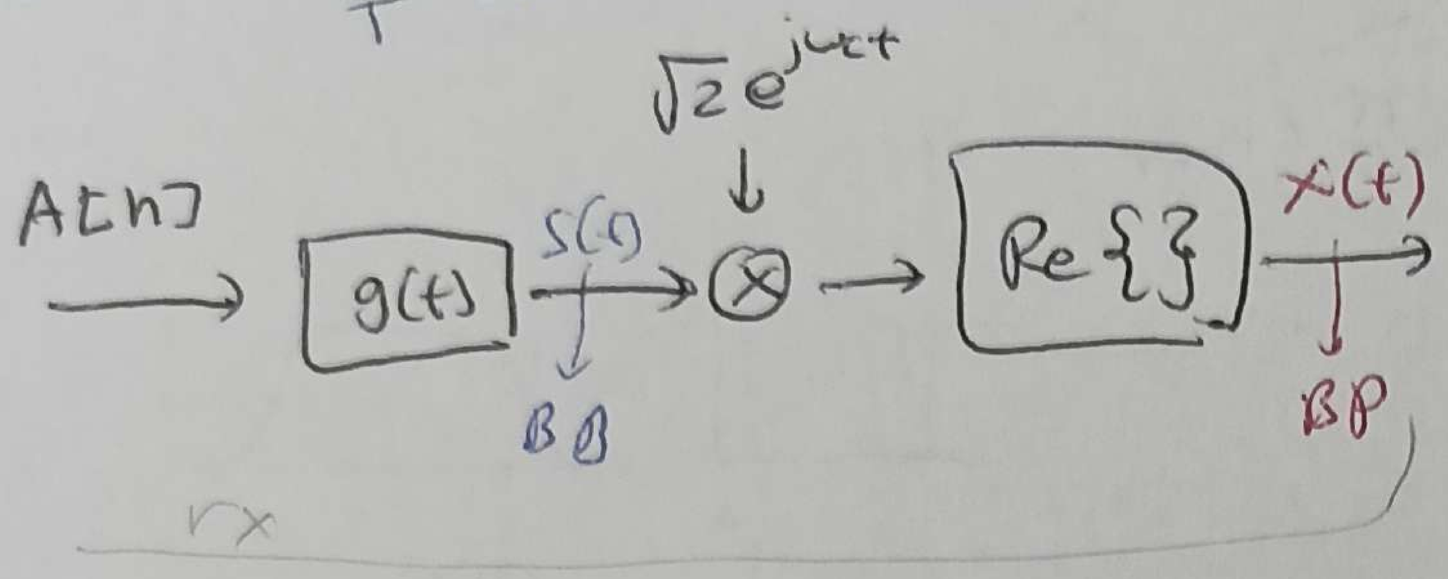
- QAM
- PSK

g(t) as in BB

$S_s(j\omega) = \frac{1}{T} S_A(e^{j\omega T}) \, |G(j\omega)|^2$

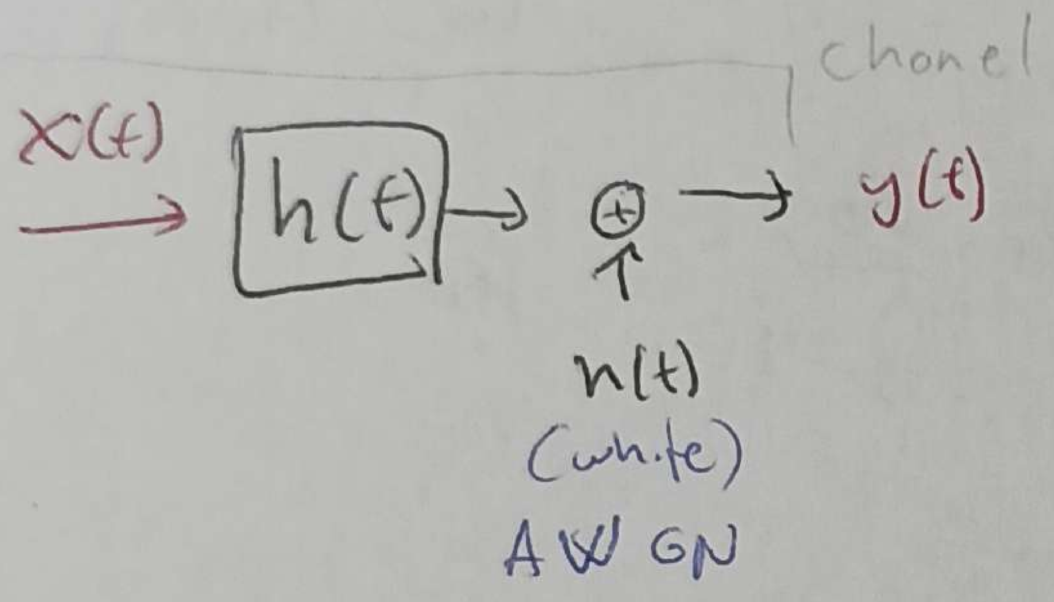


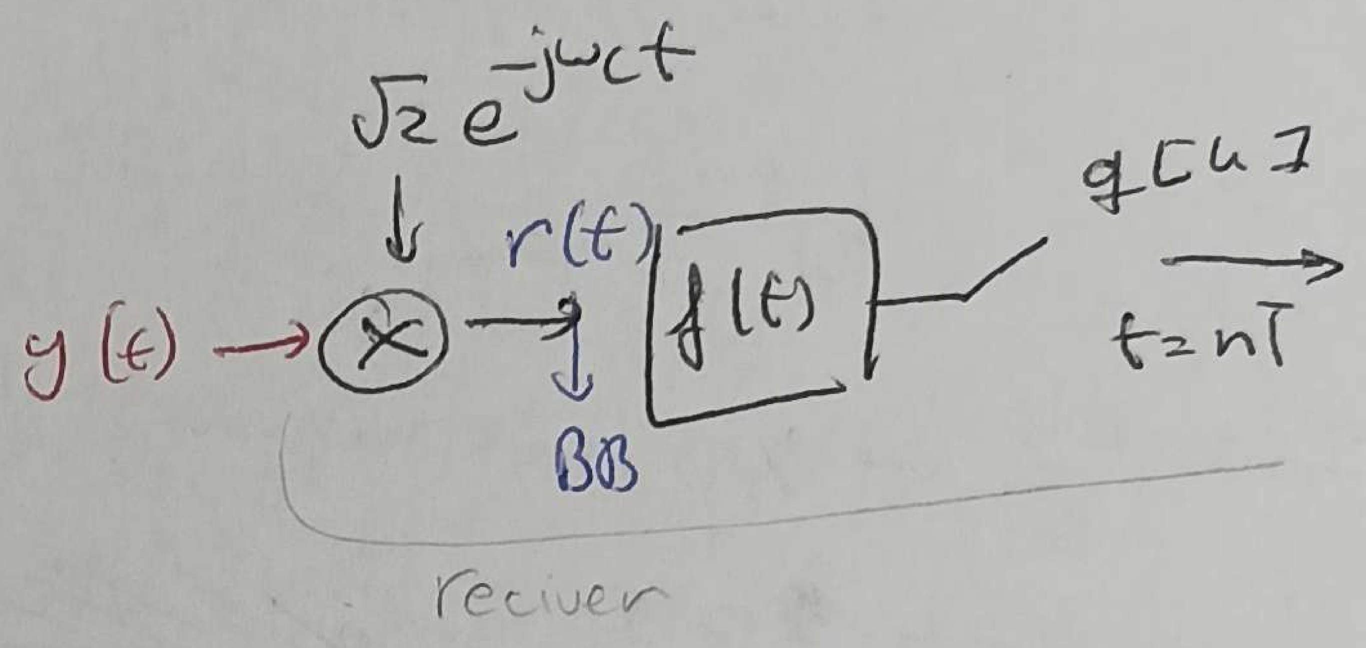
$W = 2\pi \frac{1}{T}(1+\alpha)$ new one



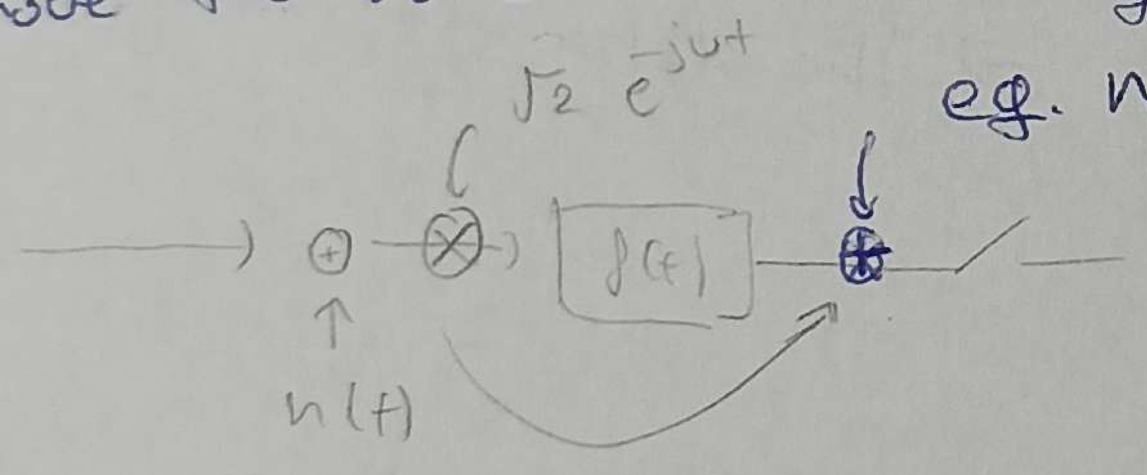
$S_x(j\omega) = \frac{1}{2}(S_s(j\omega - j\omega_c) + S_s(-j$

$S_s(j\omega) = \frac{1}{T} S_A(e^{j\omega T}) \, |G(j\omega)|^2$





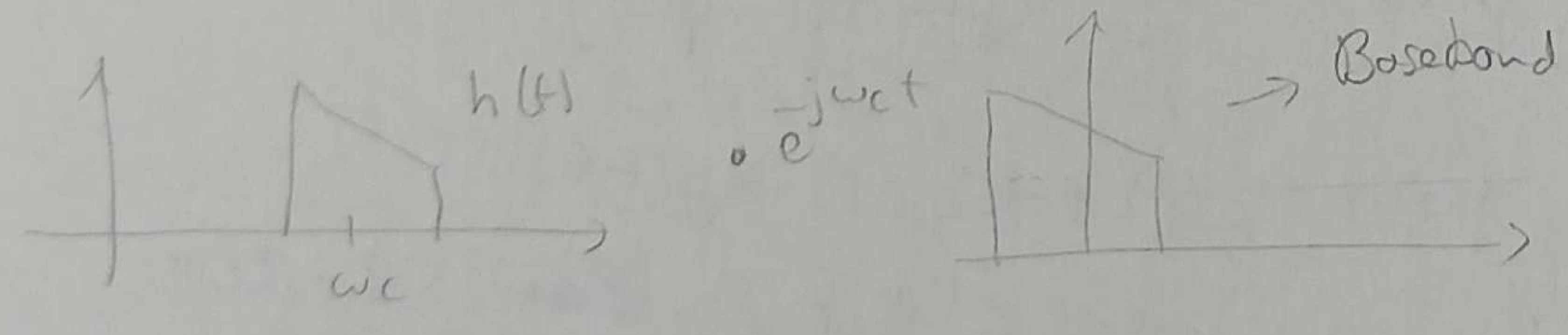
I move the noise to see the equivalent noise at the reciever

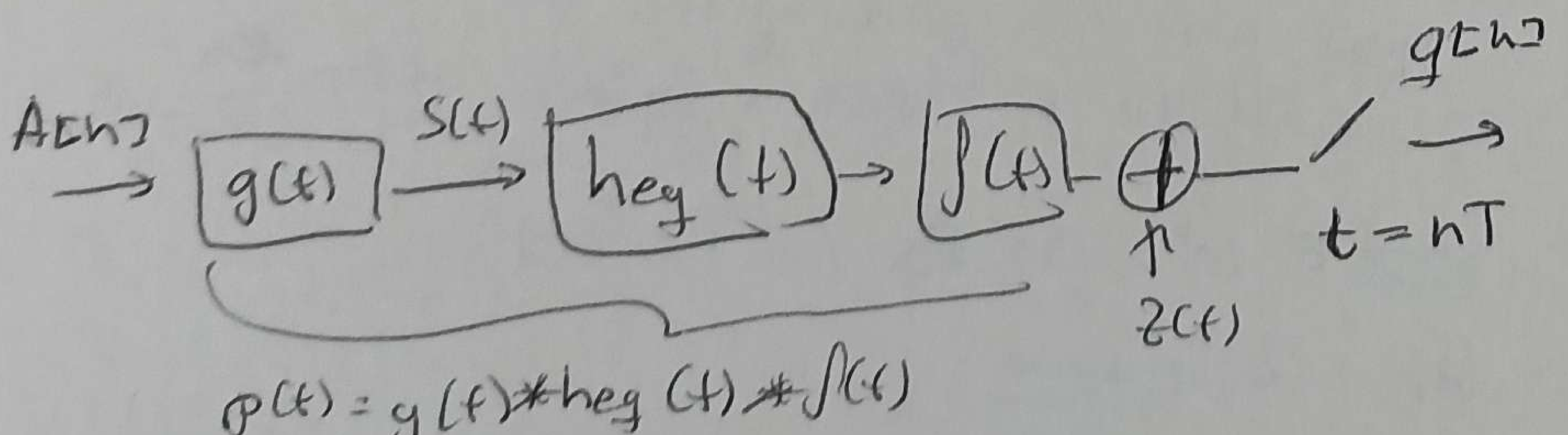


eg. noise is $z(t) = (\sqrt{2} \cdot n(t) \, e^{-j\omega_c t}) \, f(t)$

the white noise, when you shift it, it doesn't have any effect. The $e^{-j\omega_c t}$ doesn't have effect. If it is white.

then you move the expo before the channel → you shifted the response of the channel and the channel can be BB

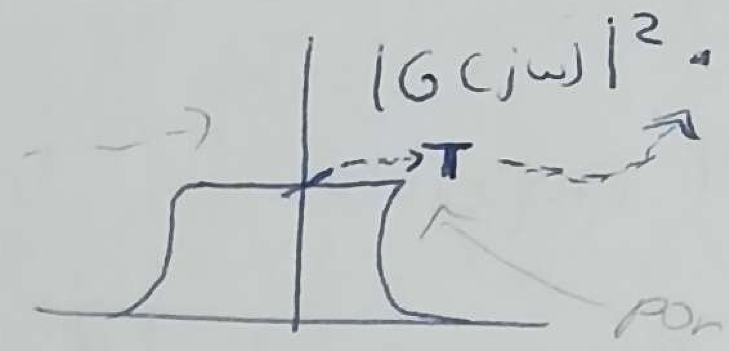




Low pass equivalent complex channel model.

$R_b = 4 \cdot M$ symbols $\cdot \log_2 M = 16\, M \frac{bit}{s}$

II) $S_X(j\omega) = \frac{1}{2}\left(S_S(j\omega - j\omega_c) + S^*(-j\omega - j\omega_c)\right)$



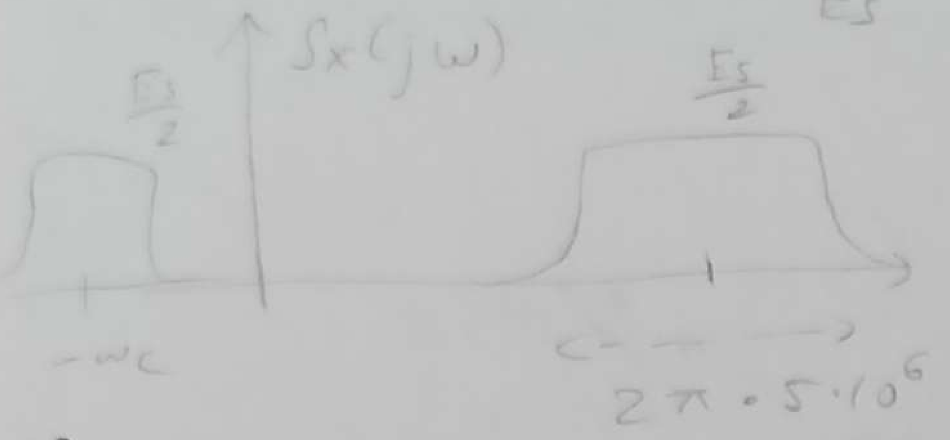
$|G(j\omega)|^2 \cdot \frac{E_s}{T} = E_s =$

$= S_S(j\omega)$

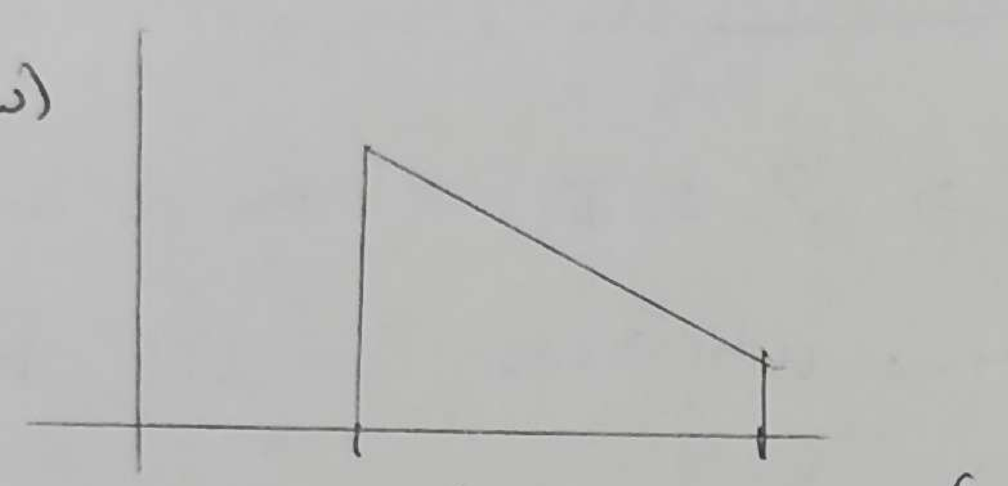
por el cuadrado $|\,|^2$

$\underbrace{\text{Secuence is white} \longrightarrow S_A(e^{j\omega T}) = E_s}$

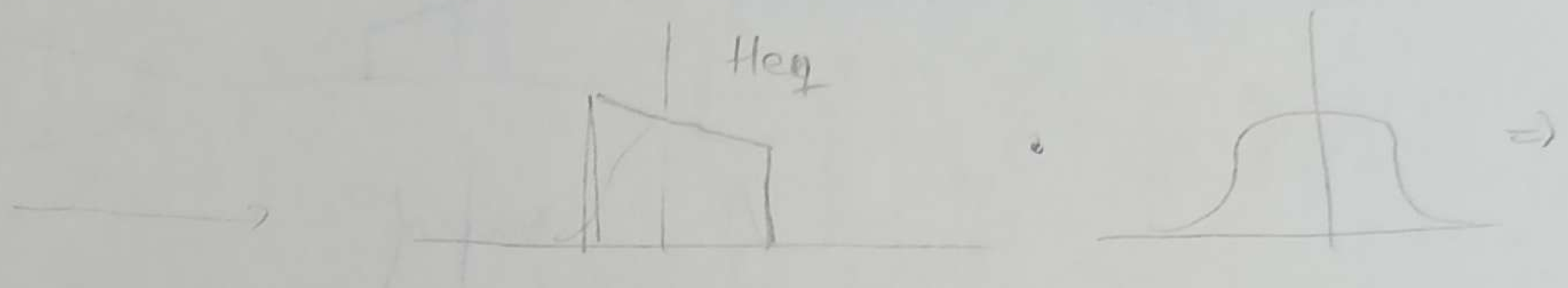
$S_S(j\omega) = \frac{1}{T} \underbrace{S_A(e^{j\omega T})}_{E_s} |G(j\omega)|^2$

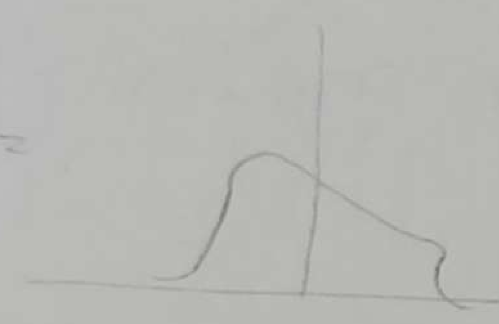


b)



I) $P(j\omega) = G(j\omega)\, H_{eq}(j\omega) \cdot G^*(j\omega) = |G(j\omega)|^2 H_{eq}(t)$





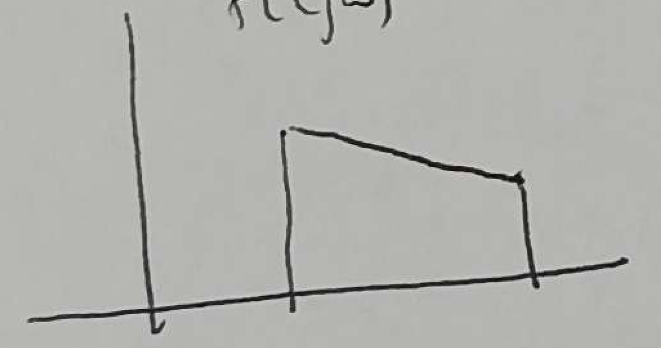
→ Como no puedo sumarlo y shiftearlo y que rede plano ⇒

will give a white noise.

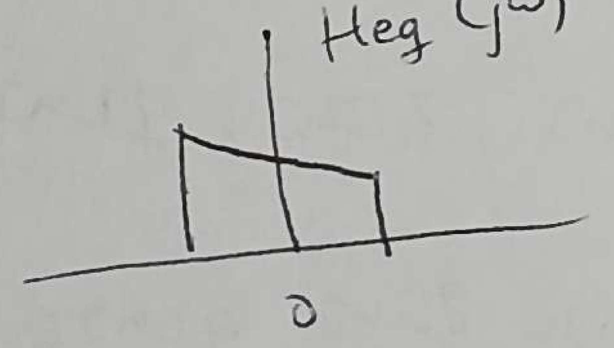
II) Since using a RS- Cosine ⇒

$S_Z(e^{j\omega}) = \frac{N_0}{2T} \cdot \sum_k \underbrace{\left|F\left(j\frac{\omega}{T} - j\frac{2\pi k}{T}\right)\right|^2}$ → noise is cte

c) $h(t)$



- - →



$g(t) \longrightarrow \nexists$ ISI

$f(t) = g(-t)$

$P(j\omega) = G(j\omega)\, H_{eq}(j\omega) \cdot F(j\omega) = \underbrace{G(j\omega)\, H_{eq}(j\omega)\, G^*(j\omega)}_{RCF}$

Look for de type of a Raised cosine filter.

$= P(j\omega) = \sqrt{\frac{RCF}{H_{eq}(j\omega)}} \cdot H_{eq}(j\omega) \cdot \sqrt{\frac{RCF}{H_{eq}(j\omega)}} = RCT$

↳ the noise will be not white since it is $H_{eq}(j\omega)$

II) $Z[n]$ is white $\longleftrightarrow R_Z[k] = \sigma_Z^2\, \delta[n]$

$\longleftrightarrow S_Z(e^{j\omega}) = cte.$ $\quad S_Z(e^{j\omega}) = \frac{N_0}{2T_0} \sum_k \underbrace{\left|F\left(\frac{\omega}{T} - j\frac{2\pi k}{T}\right)\right|^2}_{\neq\, cte\ \text{for}\ \sqrt{\frac{RCF}{H_{eq}(j\omega)}}}$