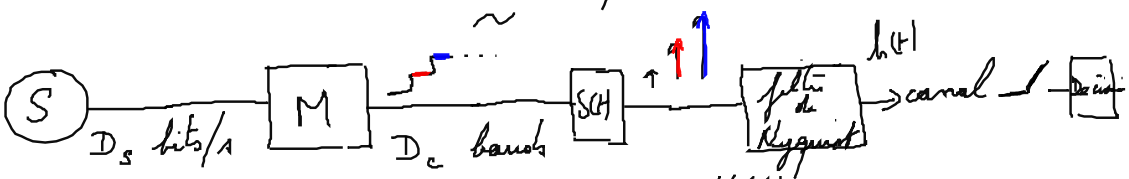
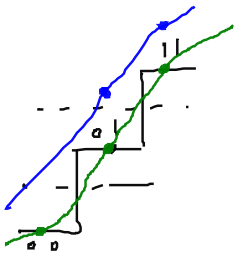
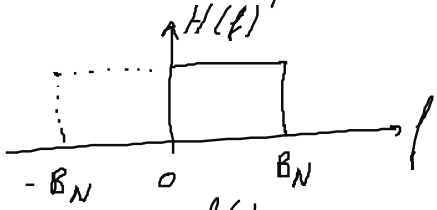
Le critère de Nyquist

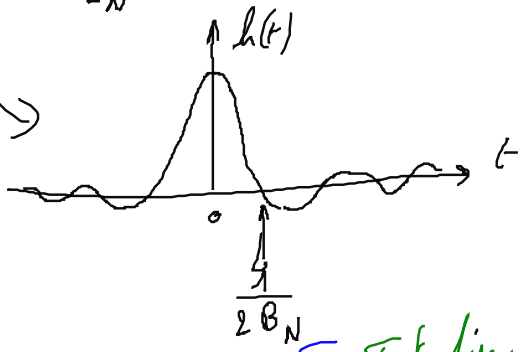


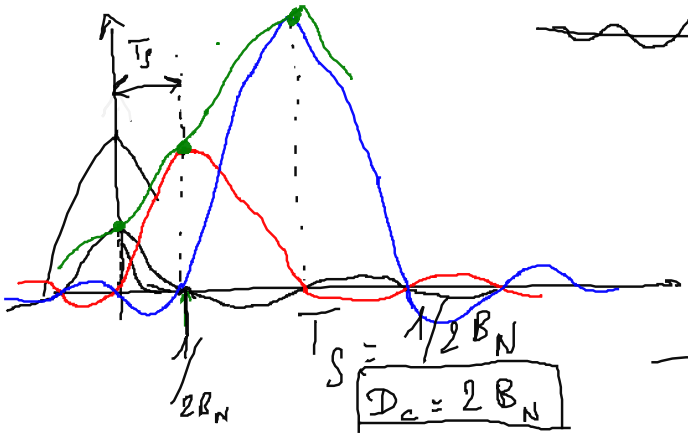
$$D_s = D_c \cdot \log_2 M$$





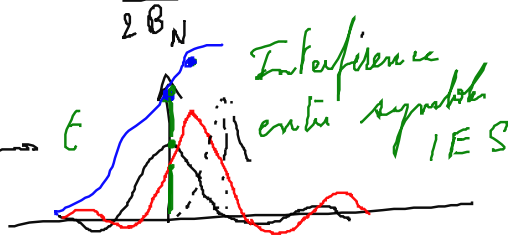
TF^{-1}





$$T_s = 1/2B_N$$

$$\boxed{D_c = 2B_N}$$

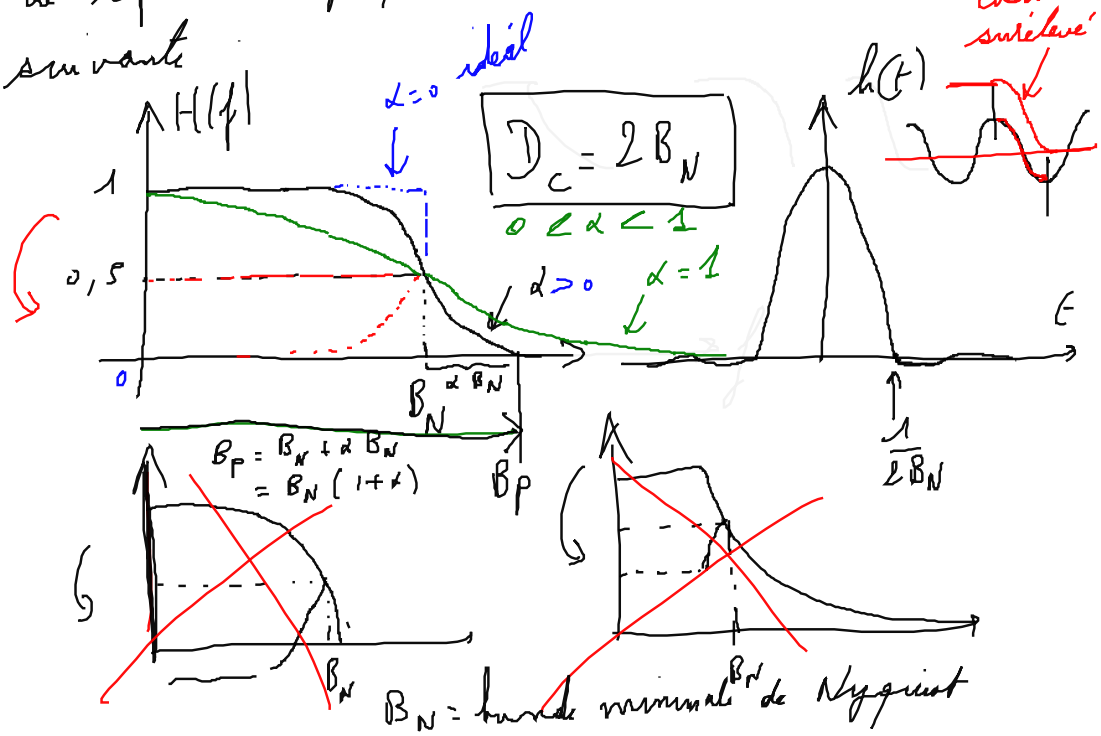


Interférence entre symboles IES

Un filtre rectangulaire n'est pas physique

On réalise un filtre "progressif", mais avec une réponse impulsionnelle proche d'un sinus cardinal.

La réponse en fréquence d'un tel filtre est la suivante

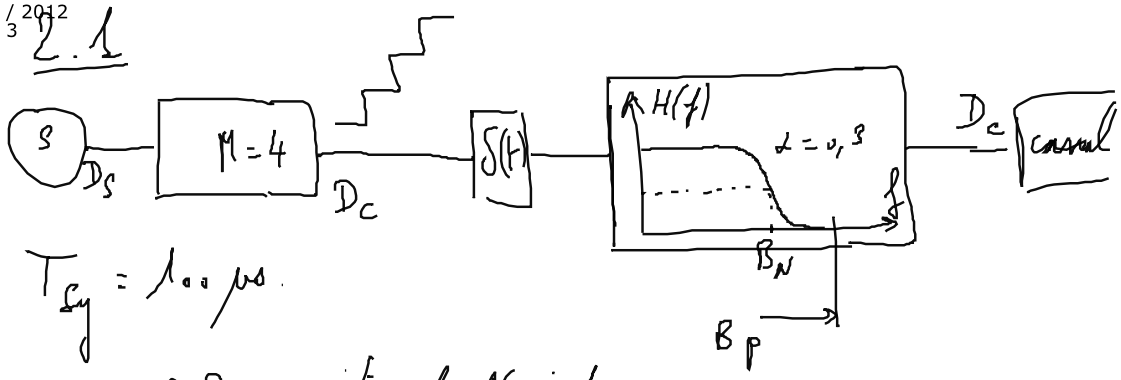


$$\boxed{D_c = 2B_N}$$

$0 < \alpha < 1$

B_N = bande minimale de Nyquist

2.1



$T_{sy} = 100\ \mu s$

$D_c = 2 B_N$ critère de Nyquist

$= \frac{1}{T_{sy}} = \frac{1}{100 \cdot 10^{-6}\ s} = \frac{1}{10^{-4}} = 10^4$ bauds.

$2 B_N = 10000\ Hz \longrightarrow B_N = 5000\ Hz$

$B_p = B_N (1+\alpha) = 5000(1+0,3) = 6500\ Hz$

$D_S = D_C \cdot \log_2 M = 10000 \cdot 2 = 20$ kbits/s

Temps pour 10^6 bits $= \frac{10^6}{2 \cdot 10^4} = \frac{1}{2} \cdot 10^2 = 50\ s$

La bande passante n'est pas modifiée
B_P et B_N constants

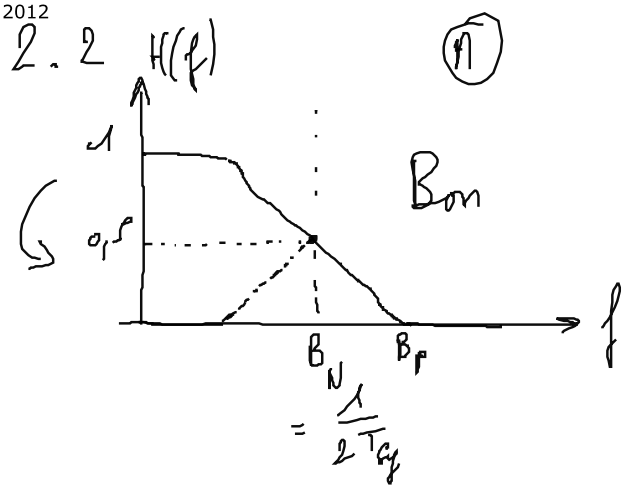
$$D_c = 2 B_N \longrightarrow D_c \text{ constant } (10^4 \text{ bauds})$$

On veut diviser par 2 le temps de transmission
Cela revient ~~recevent~~ à multiplier par 2 le
debit source D_S

$$\underset{\times 2}{D_S} = \underset{\text{const.}}{D_c} \cdot \log_2 \underset{\times 2}{M}$$

$$\log_2 M = \frac{D_S}{D_c} = 4 \longrightarrow M = 2^4 = 16.$$

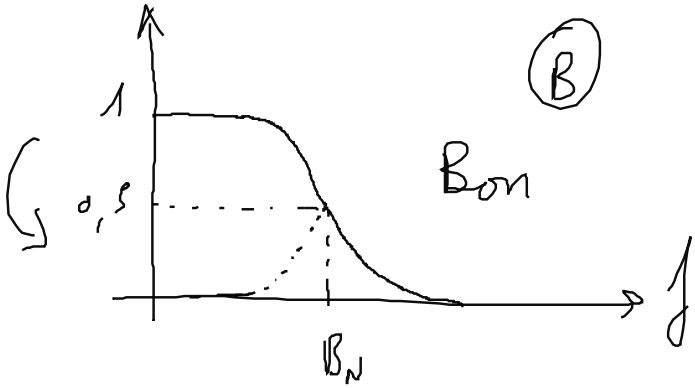
2.2

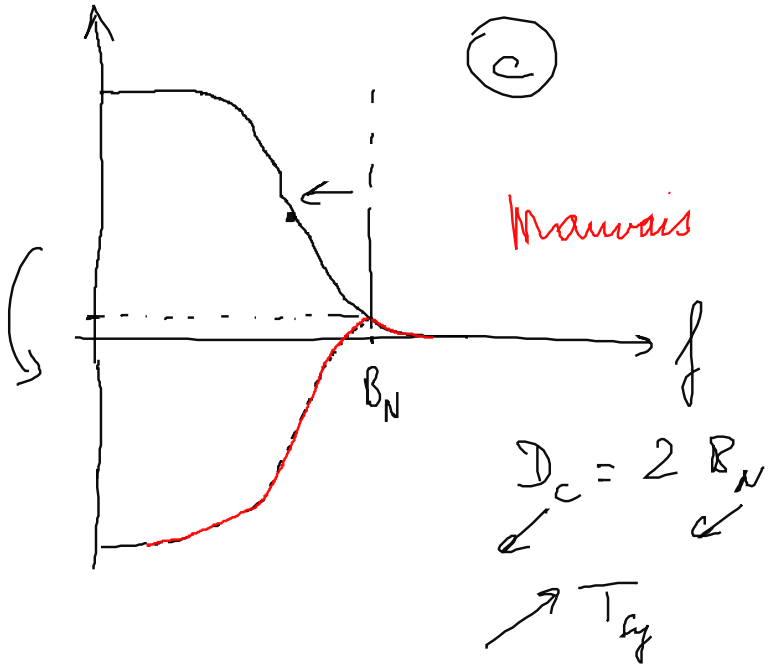


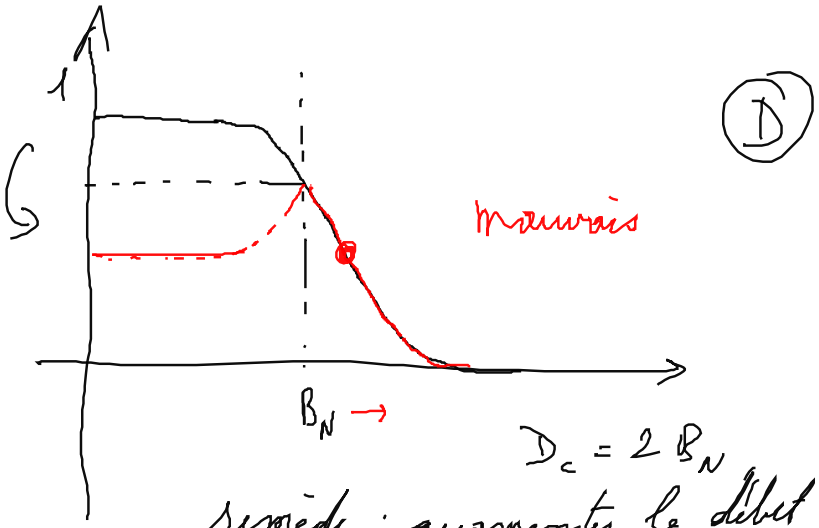
$$D_c = 2B_N$$

$$\frac{1}{T_{Sy}} = 2B_N$$

$$\frac{1}{2T_{Sy}} = B_N$$




c
Mauvais
f
B_N
$D_c = 2 B_N$
T_{fy}

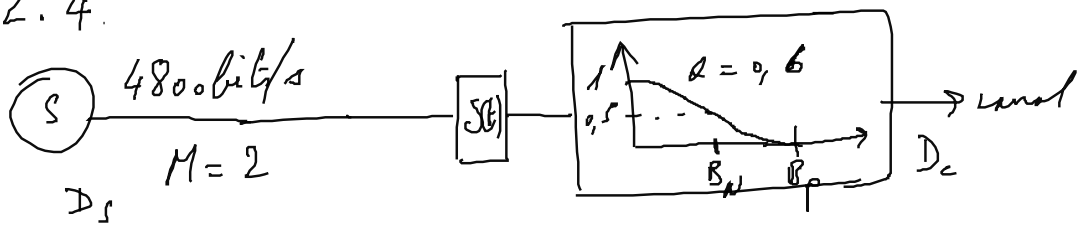


D

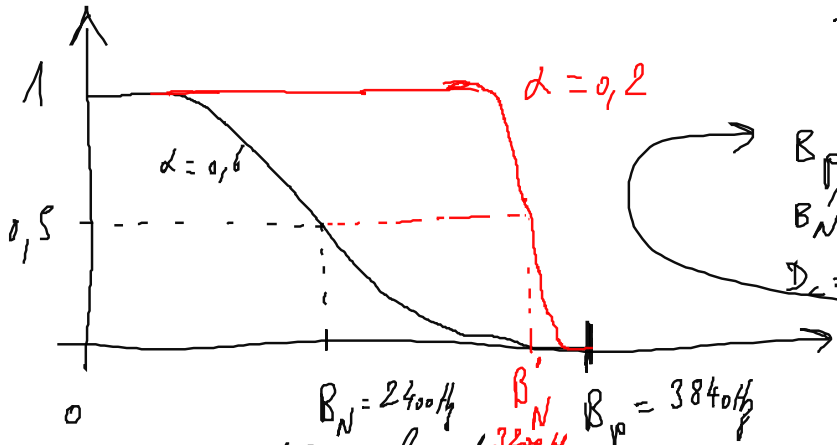
$D_c = 2 B_N$

remède : augmenter le débit symbole

2.4.



$$D_C = \frac{D_S}{\log_2 M} = D_S$$



$$D_C = 2B_N$$

$$D'_C = 2B'_N$$

$$B_P = B'_N(1+0,2)$$

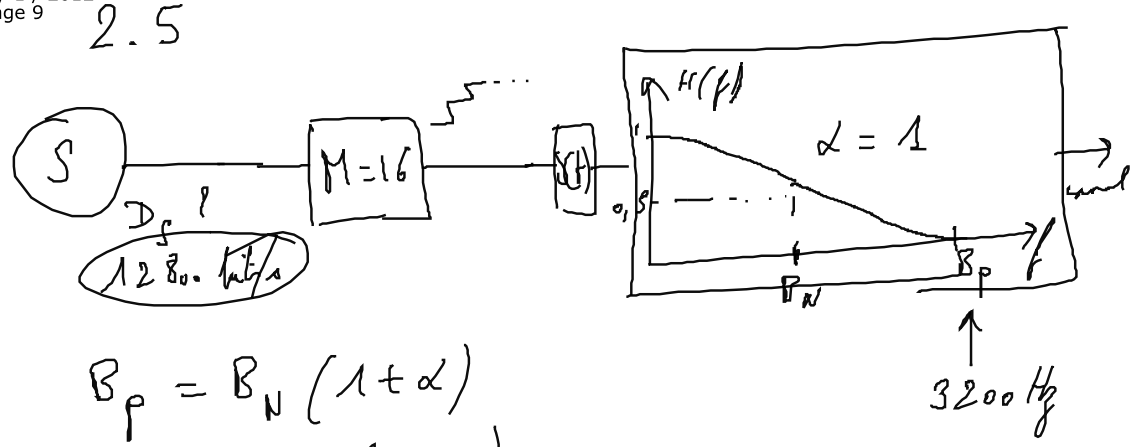
$$B'_N = \frac{3840}{1,2} = 3200 \text{ Hz}$$

$$D_C = D_S = 2B_N = 6400 \text{ bit/s}$$

$$D_C = D_S = 4800 \text{ bauds}$$

$$= 2B_N \rightarrow B_N = 2400 \text{ Hz} \rightarrow B_P = B_N(1+\alpha) = 2400 \cdot 1,6 = 3840 \text{ Hz}$$

2.5



$$B_p = B_N(1+\alpha)$$

$$3200 = B_N(1+1)$$

$$= 2B_N$$

$$D_c = 2B_N$$

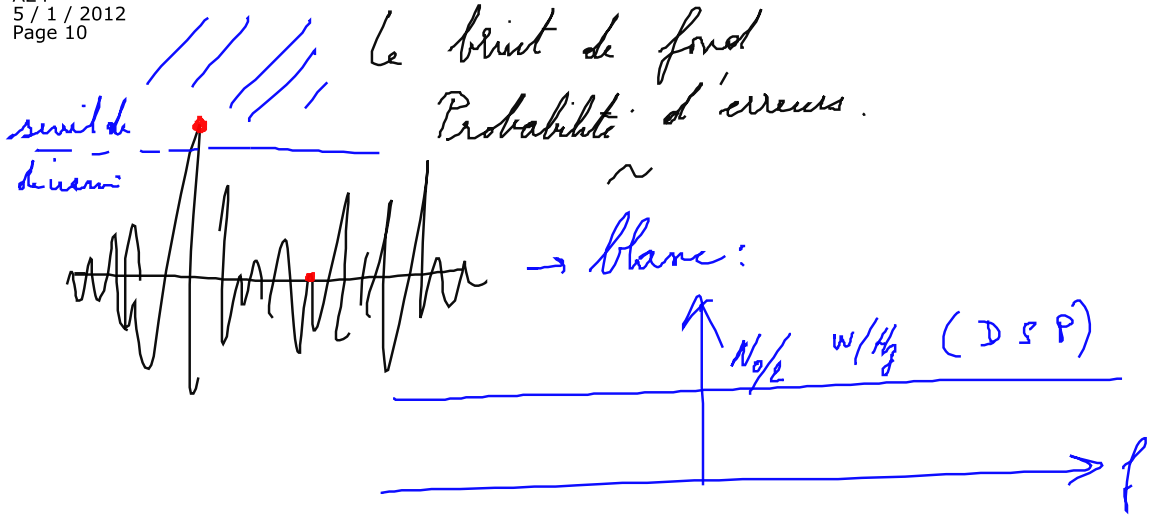
$$= 3200 \text{ bauds}$$

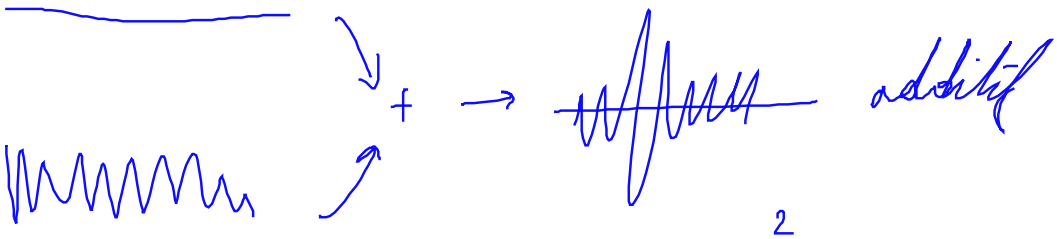
$$D_s = D_c \cdot \log_2 M = 3200 \log_2 16 = 3200 \cdot 4$$

$$= 12800 \text{ bits/s}$$

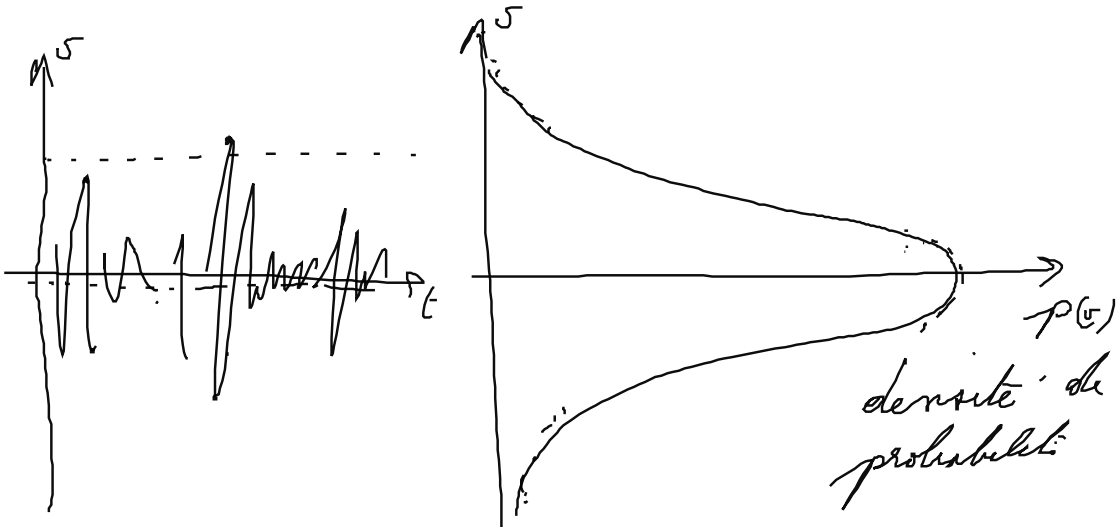
Le bruit de fond

Probabilité d'erreurs.





gaussien $p(v) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2}\frac{v^2}{\sigma^2}}$



origine : thermique : agitation thermique des porteurs de charge dans les matériaux.

→ souffle (AM)

→ neige ou brouillard en TV