Sol. TESTO Ottobre 2007

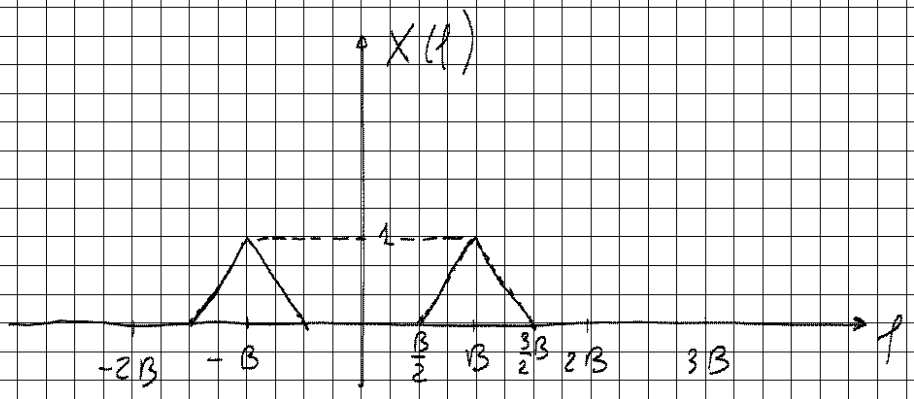
$$P(f) = \text{rect}\left(\frac{f}{4B}\right)$$

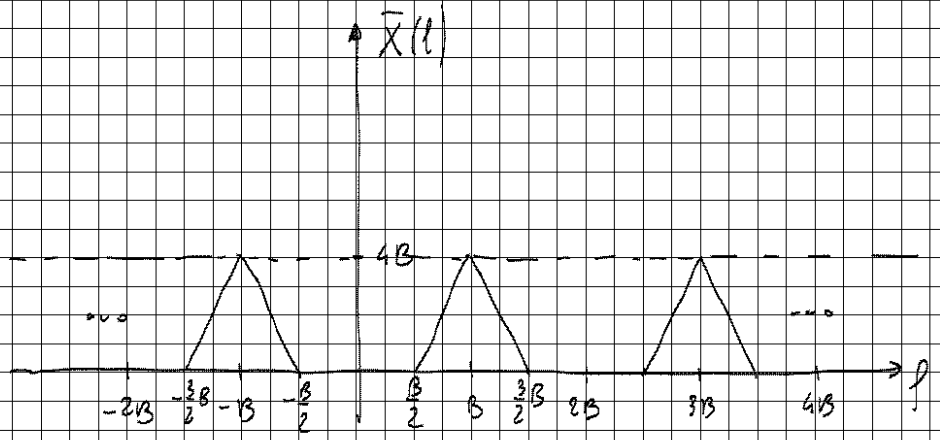
$$H(f) = \text{rect}\left(\frac{f}{B}\right)$$

1) $$\bar{X}(f) = \frac{1}{T}\sum_n X\left(f - \frac{n}{T}\right) = 2B \sum_n X(f - 2Bn)$$

$$X(f) = 2\left(1 - \frac{|f|}{B/2}\right)\text{rect}\left(\frac{f}{B}\right) \otimes \frac{1}{2}\left[\delta(f-B) + \delta(f+B)\right]$$

$$= \left(1 - \frac{|f-B|}{B/2}\right)\text{rect}\left(\frac{f-B}{B}\right) + \left(1 - \frac{|f+B|}{B/2}\right)\text{rect}\left(\frac{f+B}{B}\right)$$

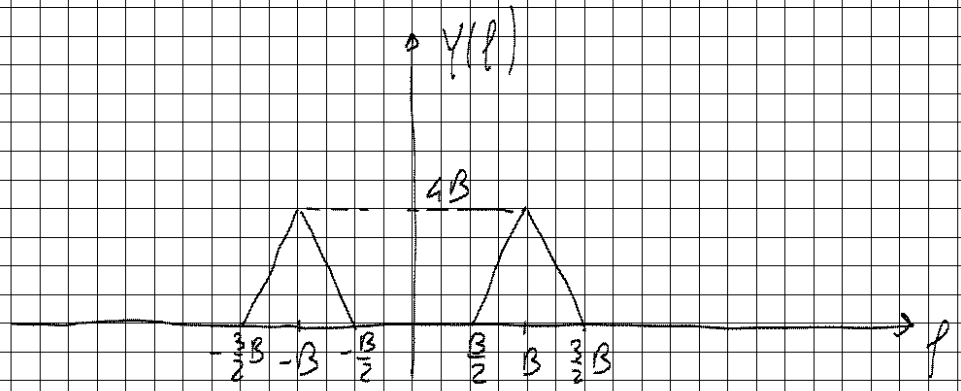




$$\overline{X}(f) = 4B \sum_n \left(1 - \frac{|f - B - 4Bn|}{B/2}\right) \text{rect}\left(\frac{f - B - 4Bn}{B}\right) +$$

$$+ \left(1 - \frac{|f + B - 4Bn|}{B/2}\right) \text{rect}\left(\frac{f + B - 4Bn}{B}\right)$$

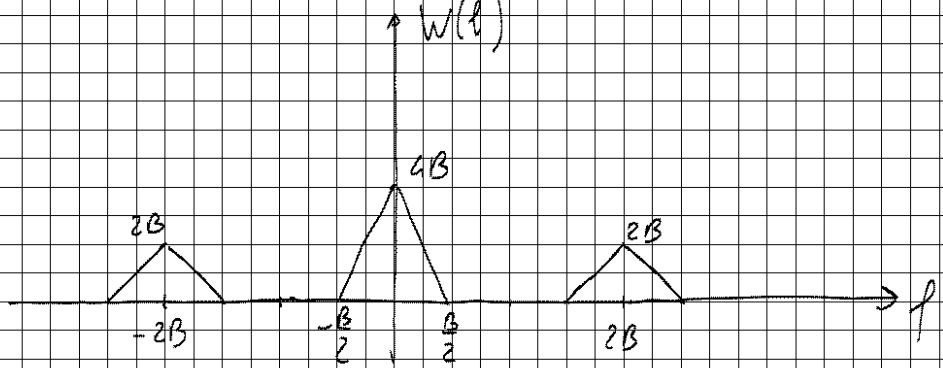
2) $Y(f) = \overline{X}(f)\, P(f)$



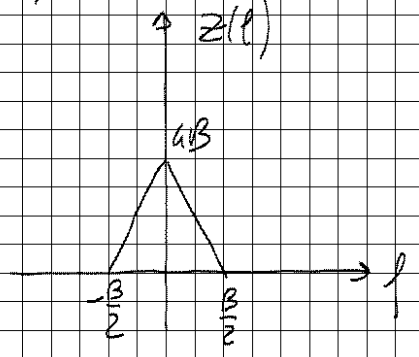
$$Y(f) = 4B\left(1 - \frac{|f|}{B/2}\right) \text{rect}\left(\frac{f}{B}\right) \circledast \left[\delta(f - B) + \delta(f + B)\right]$$

$$y(t) = 4B \frac{B}{2} \text{sinc}^2\left(\frac{B}{2}t\right) \cdot 2\cos(2\pi B t) =$$

$$= 4B^2 \text{sinc}^2\left(\frac{B}{2}t\right) \cos(2\pi B t)$$



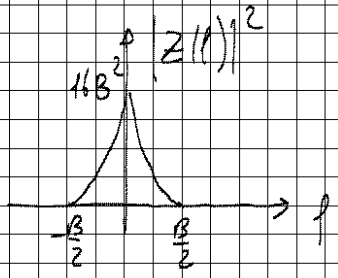
$$Z(f) = W(f)\, H(f)$$



$$Z(f) = 4B\left(1 - \frac{|f|}{B/2}\right) \mathrm{rect}\left(\frac{f}{B}\right)$$

$$z(t) = 4B\,\frac{B}{2}\,\mathrm{sinc}^2\left(\frac{B}{2}t\right) = 2B^2\,\mathrm{sinc}^2\left(\frac{B}{2}t\right)$$

$$3)\quad E_z = \int_{-\infty}^{+\infty} |z(t)|^2\,dt = \int_{-\infty}^{+\infty} |Z(f)|^2\,df$$



$$E_z = \frac{2}{3}\,16B^2 \cdot \frac{B}{2} = \frac{16}{3}B^3$$