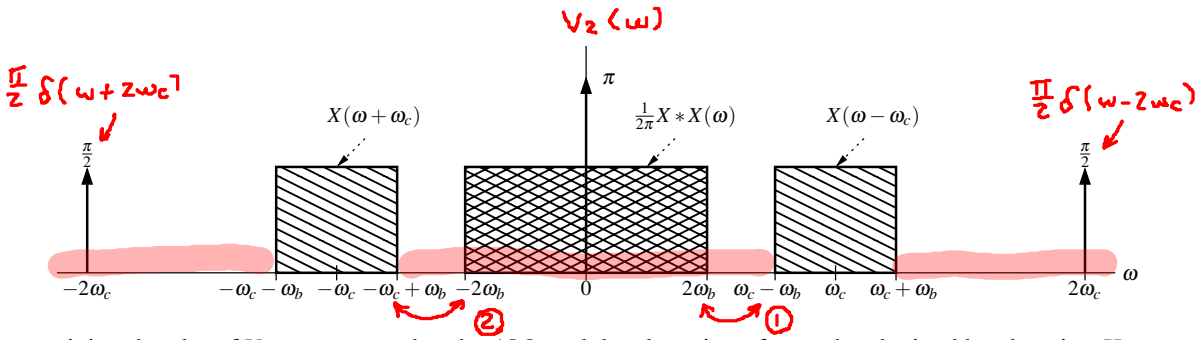
Exercise 6.22

L Answer (b).

Since $X(\omega) = 0$ if $\omega \notin [-\omega_b, \omega_b]$, $\frac{1}{2\pi} X * X(\omega) = 0$ if $\omega \notin [-2\omega_b, 2\omega_b]$. (This can be shown using a special case of the result proven in Exercise 4.8.) A plot of V_2 has the form shown in the figure.



By examining the plot of V_2, we can see that the AM modulated version of x can be obtained by choosing H to be the frequency response of a bandpass filter with the passband $\omega_c - \omega_b \leq |\omega| \leq \omega_c + \omega_b$ and a passband gain of $\frac{1}{2}$. That is,

$$H(\omega) = \begin{cases} \frac{1}{2} & \omega_c - \omega_b \leq |\omega| \leq \omega_c + \omega_b \\ 0 & \text{otherwise.} \end{cases}$$

This system will only work if $2\omega_b < \omega_c - \omega_b$ (1) and $-2\omega_b > -\omega_c + \omega_b$ (2) which implies that $\omega_c > 3\omega_b$.