Problem 10.8 Show that the integral of the high frequency term in Eq. (10.53) is approximately zero.

<u>Solution</u>
Consider the integral over the period from 0 to T of the high frequency term in Eq. (10.53):

$$\int_0^T \frac{A_C^2}{2} \cos\left(4\pi f_c t + 2\phi(t)\right) dt = \frac{A_c^2}{8\pi f_c} \sin\left(4\pi f_c t + 2\phi(t)\right)\Big|_0^T$$

$$= \frac{A_c^2}{8\pi f_c}\left[\sin\left(4\pi f_c T + 2\phi(T)\right) - \sin\left(2\phi(0)\right)\right]$$

$$< \frac{A_c^2}{4\pi f_c}$$

where the first line follows since $\phi(t)$ is constant over a symbol interval. By the bandpass assumption $f_c \gg 1$, so this last line is small.