

Problem 9.8 An FM system has a pre-detection SNR of 15 dB. If the transmission bandwidth is 30 MHz and the message bandwidth is 6 MHz, what is the post-detection SNR? Suppose the system includes pre-emphasis and de-emphasis filters as described by Eqs. (9.63) and (9.64). What is the post-detection SNR if the $f_{3\text{dB}}$ of the de-emphasis filter is 800 kHz?

Solution

From Eq. (9.59), (see Problem 9.7), the post-detection SNR without pre-emphasis is

$$\begin{aligned} \text{SNR}_{\text{post}}^{\text{FM}} &= \text{SNR}_{\text{pre}}^{\text{FM}} \frac{3}{4} \left(\frac{B_T}{W} \right)^3 \\ &\sim 15 \text{ dB} + 19.7 \text{ dB} \\ &= 34.7 \text{ dB} \end{aligned}$$

From Eq. (9.65), the pre-emphasis improvement is

$$\begin{aligned} I &= \frac{(6/0.8)^3}{3 \left[(6/0.8) - \tan^{-1}(6/0.8) \right]} \\ &= 23.2 \\ &\sim 13.6 \text{ dB} \end{aligned}$$

With this improvement the post-detection SNR with pre-emphasis is 48.3 dB.