

Problem 9.11 Derive an expression for the post-detection signal-to-noise ratio of the coherent receiver of Fig. 9.6, assuming that the modulated signal $s(t)$ is produced by sinusoidal modulating wave

$$m(t) = A_m \cos(2\pi f_m t)$$

Perform your calculation for the following two receiver types:

- (a) Coherent DSB-SC receiver
- (b) Coherent SSB receiver.

Assume the message bandwidth is f_m . Evaluate these expressions if the received signal strength is 100 picowatts, the noise spectral density is 10^{-15} watts per hertz, and f_m is 3 kHz.

Solution

- (a) The post-detection SNR of the DSB detector is

$$\text{SNR}^{DSB} = \frac{A_c^2 P}{2N_0 W} = \frac{A_c^2 A_m^2}{4N_0 f_m}$$

- (b) The post-detection SNR of the SSB detector is

$$\text{SNR}^{SSB} = \frac{A_c^2 P}{4N_0 W} = \frac{A_c^2 A_m^2}{8N_0 f_m}$$

Although the SNR of the SSB system is half of the DSB-SC SNR, note that the SSB system only transmits half as much power.