

12.2 - /

DSB-SC system

$$\text{PSD} : S_n(\omega) = 10^{-10}$$

$$B = 4 \text{ kHz}$$

Need  $\frac{S}{N} = 30 \text{ dB}$  (1000 x power)

- (a) What  $S_i$  (input signal power) is needed?
- (b) Output noise  $N_o$ ?
- (c) Power needed if  $H_c(\omega) = 10^{-4}$

---

$$\text{PSD} = 10^{-10} \frac{\text{watts}}{\text{Hz}}$$

$$N_o = \left(10^{-10} \frac{\text{watts}}{\text{Hz}}\right) (4000 \text{ Hz})$$

(b)  $N_o = 4 \times 10^{-7} \text{ watts}$

(a)  $S_i = 4 \times 10^{-4} \text{ watts}$ .

Transmit power needed =  $\frac{S_i}{H_c(\omega)} = \frac{4 \times 10^{-4}}{10^{-4}} = 4 \text{ watts.}$  (c)

---

12.2 - 2 - Same for SSB-SC.

12.3-1 For FM,  $\beta=2$ ,  $S_n(\omega) = 10^{-10}$

We have  $SNR = 28 \text{ dB}$ .

$m(t)$  has  $B = 15 \text{ kHz}$

loading = 30 ] ? ignore this

demod constant =  $10^{-4}$  ← assume unit  $\frac{\text{Watts}}{\text{Hz}}$

Determine: (a) received signal pwr  $S_i$ :

(b) output signal power  $S_o$

(c) output noise power  $N_o$

$\beta=2$ ,  $B=15 \text{ kHz}$  means  $\Delta f = 30 \text{ kHz}$

$$28 \text{ dB} \rightarrow \frac{S}{N} \xrightarrow{\text{Power}} 631$$

(b) output signal power =  $(10^{-4} \frac{\text{W}}{\text{Hz}})(15000 \text{ Hz})$   
= 1.5 watts.

(c) output noise power =  $\frac{1.5}{631} = 2.38 \times 10^{-3}$  watts.

(a) input noise power =  $(10^{-10} \frac{\text{Watts}}{\text{Hz}})(15 \text{ kHz}) = 1.5 \times 10^{-6}$  watts.  
Equivalent baseband  
(not the actual noise ...).

$\beta=2$  means  $\frac{3}{2} \beta^2 = \frac{3}{2} (2)^2 = 6 \times \text{improvement}$

so Baseband  $\frac{S}{N} = 28 - 7.78 = 20.22 \text{ dB.} \Rightarrow 105 \times$

so  $S_i = (1.5 \times 10^{-6})(105) = 1.58 \times 10^{-4}$  watts