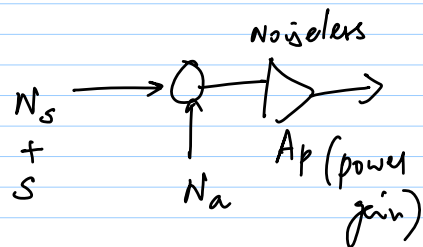
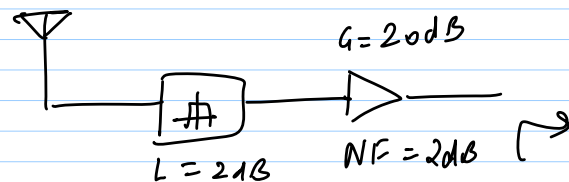


3-9-13

Lec 14

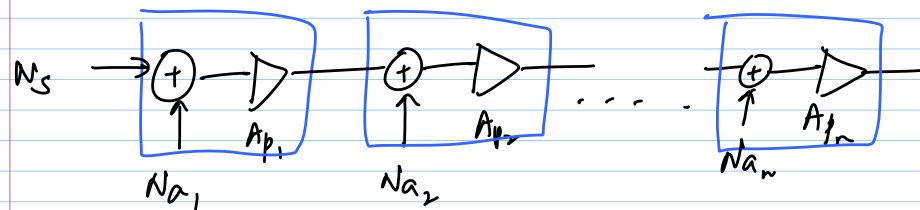


$$F = \frac{A_p (N_a + N_s)}{A_p \cdot N_s} = 1 + \frac{N_a}{N_s}$$

let signal power @ input = S

$$SNR_{in} = \frac{S}{N_s} ; SNR_{out} = \frac{A_p \cdot S}{A_p \cdot (N_a + N_s)}$$

$$\frac{SNR_{in}}{SNR_{out}} = \frac{S/N_s}{A_p \cdot S / A_p (N_a + N_s)} = 1 + \frac{N_a}{N_s} = F$$



$$N_{out} = (N_s + N_a) \cdot \prod_{i=1}^n A_{p_i} + (N_{a_2}) \prod_{i=2}^n A_{p_i} + \dots$$

$$N_{out}(N_s) = N_s \cdot \prod_{i=1}^n A_{p_i} + N_{a_n} \cdot A_{p_n}$$

$$F = \frac{N_{out}}{N_{out}(N_s)} = 1 + \frac{N_{a_1}}{N_s} + \frac{N_{a_2}}{A_{p_1} N_s} + \dots + \frac{N_{a_n}}{\prod_{i=1}^{n-1} A_{p_i} \cdot N_s}$$

$$F = 1 + (F_1 - 1) + \frac{F_2 - 1}{A_{p_1}} + \frac{F_3 - 1}{A_{p_1} A_{p_2}} + \dots + \frac{F_n - 1}{\prod_{i=1}^{n-1} A_{p_i}}$$

* Sensitivity $\equiv$ minimum signal power level that can be detected by Rx with desired SNR

- ties in with range of system

* Available noise power @ Rx = kTB watts

$$SNR_{in} = \frac{P_s}{kTB} \rightarrow \text{received signal power (available)}$$

$$F = \frac{P_s / kTB}{SNR_{out}}$$

$$P_s = (kTB) \cdot (F) \cdot (SNR_{out})$$

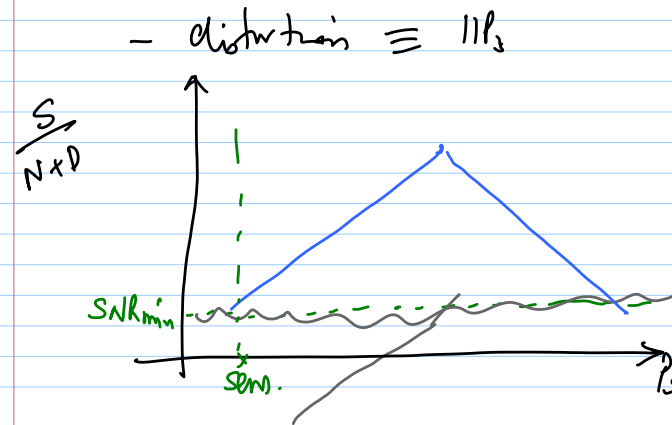
$$P_s|_{dB} = 10 \log(kT) + NF_{dB} + SNR_{dB} + 10 \log(B)$$

$$P_{in,min}|_{dBm} = -174 \text{ dBm/Hz} + NF + SNR_{min} + 10 \log(B)$$

Noise Floor

Dynamic Range

$$DR \equiv \frac{\text{max input level tolerated (distort.)}}{\text{min. input level meeting SNR requirements}}$$



SFDR $\equiv$ Spurious free dynamic range

$$P_{11P_3} = P_{in} + \frac{P_{out} - P_{1Mont}}{2}$$

$$= P_{in} + \frac{P_{in} - P_{1min}}{2}$$

$$= \frac{3P_{in} - P_{1min}}{2}$$

$$P_{in} = \frac{2P_{11P_3} + P_{1min}}{3}$$

$$NFL = -174 + NF + 10 \log B$$

$$P_{in,max} = \frac{2P_{11P_3} + NFL}{3}$$

$$P_{in,min} = NFL + SNR_{min}$$

$$SFDR = P_{in,max} - P_{in,min}$$

$$= \frac{2P_{11P_3} + NFL}{3} - (NFL + SNR_{min})$$

$$SFDR = \frac{2(P_{11P_3} - NFL)}{3} - SNR_{min}$$