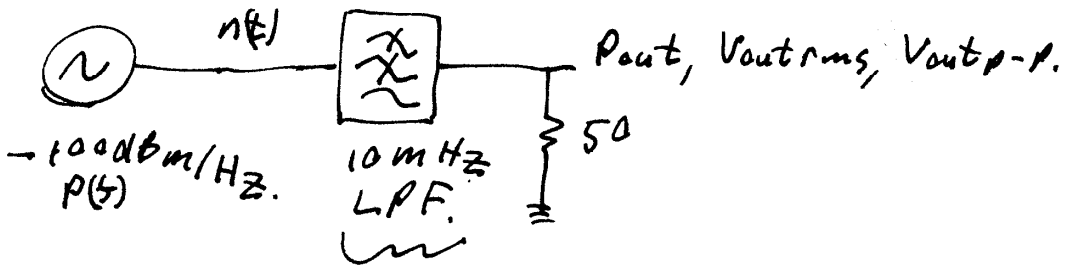
2/3/2014 Problem Lect 11

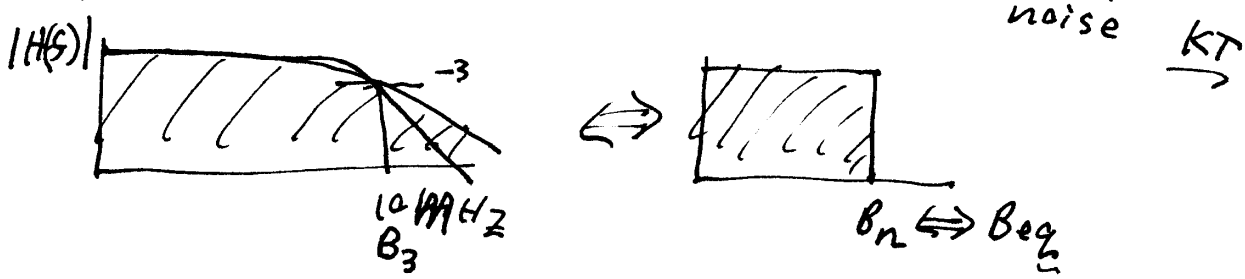


- what PSD in watts/Hz?

$-100\,dBm \Rightarrow 10^{\frac{-100}{10}} = 10^{-10}\ mW/Hz \Rightarrow 10^{-13}\ W/Hz$ ∴

(Thea $10^{-20.4}$ W/Hz. Thermal noise KT)

- LPF



$B_{eq} = B_3 \cdot \frac{\pi}{2} = 15.7\ mHz$

$L_{n=1}$

n		
1	1.57	⇒ π/2
2	1.11	11%
3	1.047	

- $P_{out} = \int_0^\infty P(f)\,|H(f)|^2\,df$

$P(f) = N_0 = 10^{-13}\ W/Hz$

$= N_0 \int_0^\infty |H(f)|^2\,df = N_0 B_{eq}$

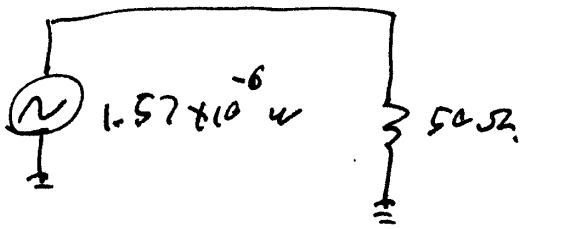
$= N_0 B_3 \frac{\pi}{2}$ rc filter

$\int_0^\infty \frac{1}{1+f^{4=2n}}\,df = 1.11$

1

$$= N_o \int_0^\infty \frac{1}{1+\left(\frac{f}{f_3}\right)^2} df \Rightarrow N_o f_3 \underbrace{\pi/2}_{B_3} = N_o B_3 \frac{\pi}{2}$$

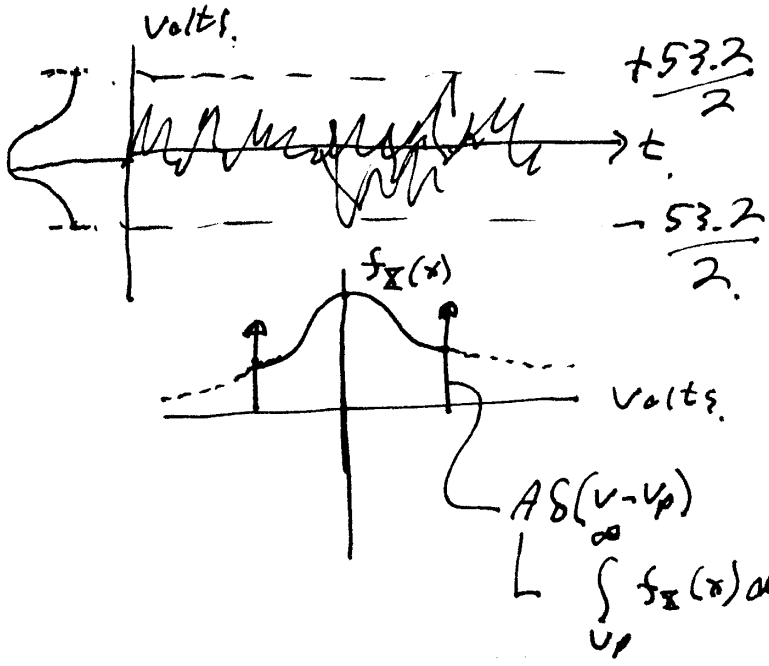
$$P_n = N_o B_{eq} = 10^{-13}\ w/Hz \cdot 10^7\ Hz \cdot \pi/2 = 15.7 \times 10^{-5}$$
$$1.57 = 1.57\ \mu W$$

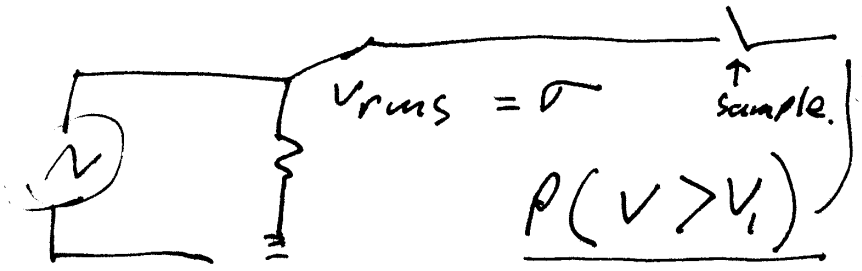


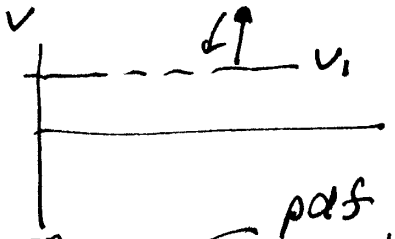
$$V_{rms} = \sqrt{(50 \cdot 1.57 \times 10^{-6})} \quad P = \frac{V_{rms}^2}{50}$$
$$= .00886\ V$$
$$= 8.86\ mV_{rms}$$

V_{p-p} given 6σ noise?

$$\sigma = V_{rms}$$
$$V_{pp} = 6 \cdot V_{rms} = 6 \cdot 8.86\ mV = 53.2\ mV_{p-p}$$



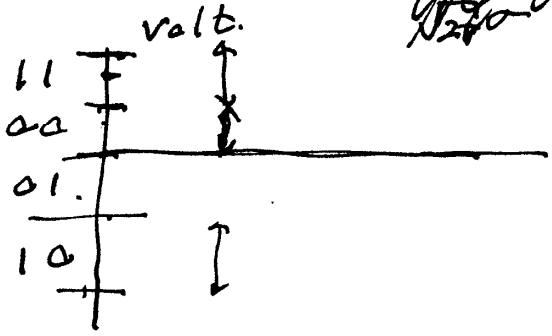




$$\int_{V_1}^{\infty} \frac{1}{\sqrt{2\pi}\,V_{rms}} e^{-\frac{V^2}{2V_{rms}^2}} dV = P(V > V_1)$$

$$\int_{V_1}^{\infty} f_X(x)\,dx$$ pdf

tail probability



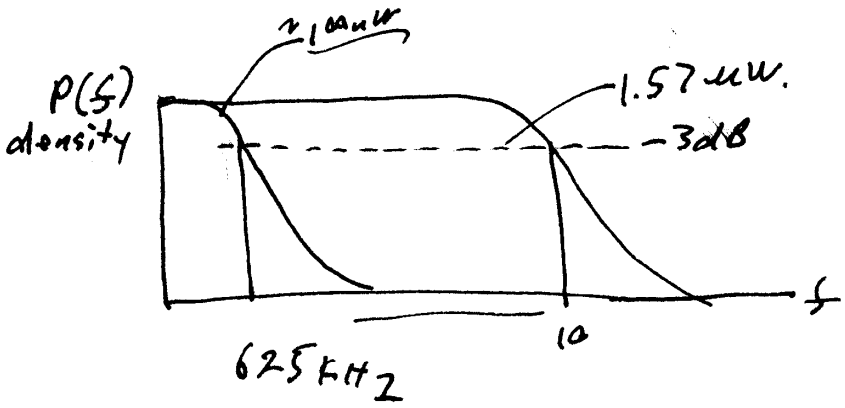
$P_n = N_0 B_{eq} = N_0 B_3 \frac{\pi}{2} \Rightarrow 1.57\mu W = P_2$

find B_3 if P_n is 12dB Lower $\Rightarrow \frac{P_1}{P_2} = 10^{\frac{-12}{10}} = 10^{-1.2}$ =

$$\frac{P_1}{P_2} = V_{16} = \frac{N_0 B_3 \frac{\pi}{2}}{N_0 B \frac{\pi}{2}}$$

$$\frac{1}{16} = \frac{B_3}{10} \qquad B_3 = \frac{10^{MHz}}{16} = 625 kHz$$

3 1/2 12 1/16
6 1/4
9 1/8


≈100mW
P(f)
density
1.57 mW.
-3dB
f
10
625 KHz