Sharif University of Technology

Communication Circuits

Problem set 2

Due Date: sunday, 7 Aban

You may submit your solutions in class or in the box.

1. A monostatic radar detects a 10 m^2 target at arange of 266.4 km. it transmits 100kW at a frequency of 3 GHz. The antenna gain is 40 dB and recived power is -10dBm. At what range would a stealthy target with an RCS of –30dBsm(10^{-3} m^2) be detected?

The power intercepted by the target is proportional to incident power desity, so $P^i = \sigma S^i$.σ is the radar cross section(RCS).

2. A lossy line at temperatute T feeds an amplifier with noise fiqure F. if an impedance mismatch is present at input of the amplifier, find the overall noise figure of system.
3. Consider the scenario shown in fig.1 where ω_3-ω_2= ω_2-ω_1 and the bandpass filter provides an attenution.

a) Compue the IIP_3 of te amplifier such that that the intermodulation product falling at ω_1 is 20dB below the desired signal.

b) Suppose an amplifier with a voltage gain of 10dB and IIP_3=500mV_P precedes te band-pass filter. Calculate

the IIP_3 of the overall chain.(neglect second order nonlinearities.)

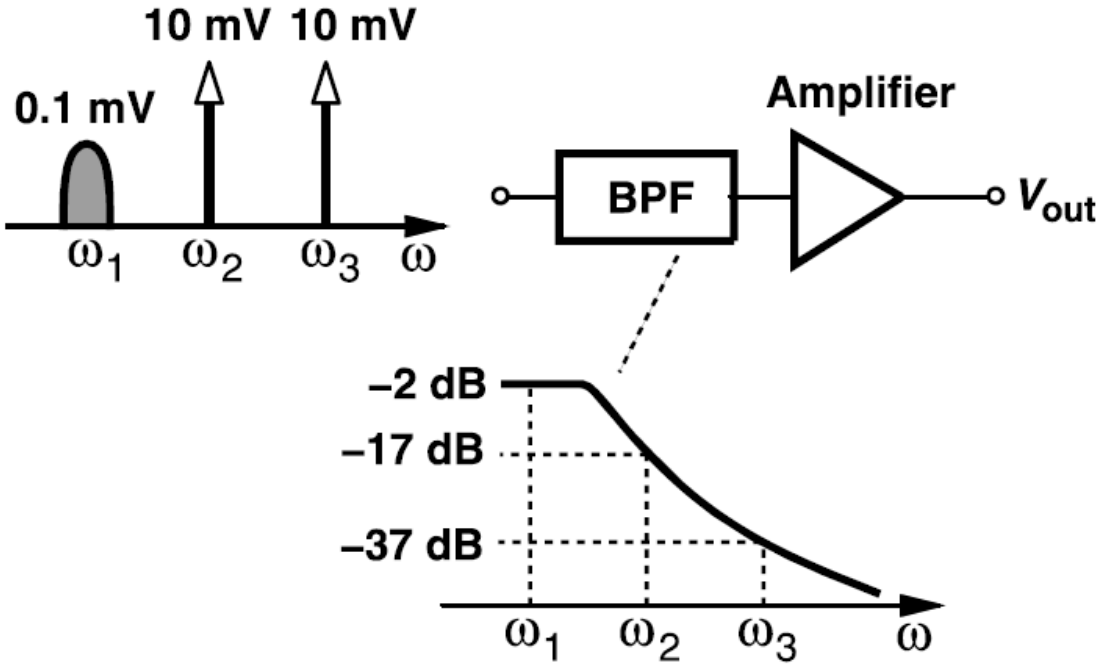

Figure 1 cascade of BPF and amplifier.

4. Prove that in fig 2, the noise power delivered by R_1 to R_2 is equal to that delivered by if the resistor reside at the same temperature. What happens if they do not?

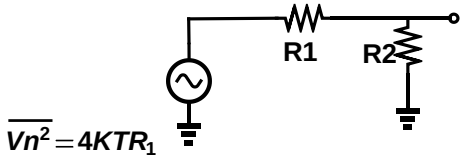

Figure 2 Transfer of noise from one resistor to another.

5. A 900-MHz GSM transmitter delivers a power of 1 W to antenna. By much must the second harmonic of signal be suppressed (filtered) so that it does not desensitize a 1.8-GHz reciever having P_{1db}=-25dBm? Assume the reciver is 1m away and the 1.8-GHz

signal is attenuated by 10dB as it propagates across this distance.