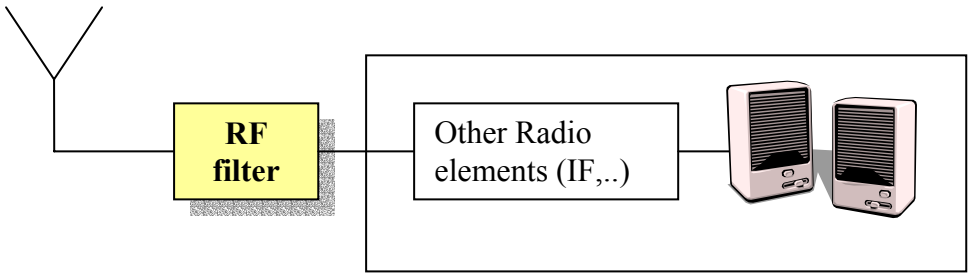
**King Fahd University of Petroleum & Minerals**
**Department of Electrical Engineering**
EE205 Electrical Circuits II
**Project II: RF filter Design**

**Due: Sat., Jan 3, 2003**

Our objective is to design two RLC filters tuned to the 882 kHz AM radio channel (Holy Quran Station) . The filter should suppress the adjacent channels. Let us assume that every channel occupies 8 kHz bandwidth and there is a 1 kHz gab between every two channels to reduce the interference. The total spacing between adjacent channels is 9 kHz. The two filters are to be compared. Both hand analysis and PSPICE simulation should support your design and evaluation. The following steps highlight the major tasks:




1. Draw a sketch showing the frequency axis, and the spectrum occupied by the required channel and the adjacent channels. Find the parameters ($\omega_0, \omega_{c1}, \omega_{c2}, \beta, Q$) of the ideal filter that will perform the required filtering function?
2. Suggest two different RLC circuit configurations and find the proper values of *R*, *L* & *C*, for the two filters.
3. Find the transfer functions $H(j\omega)$, magnitude and phase, and draw the Bode plot (four plots)
4. Simulate the two circuits using PS-PICE (or any other circuit simulation software that allows AC analysis). Plot the magnitude and phase of the two circuits for comparison.
5. Which of the two filters would you select? Compare the two and make a decision. (Hint: consider the attenuation at the edge of the channel and the suppression of the adjacent channels).
6. Based on your answer to question (5) you might find that both filters are not suppressing the adjacent channels effectively and that their performance are far from being ideal. Find out what kind of filters are used to get close to the ideal filter performance?
7. **The effect of loading the filter and source impedance:** let's assume the antenna can be modeled as an ideal voltage source with a 50 ohm resistance in series and the rest of the loading circuit is modeled as 50 ohm. Derive the new transfer function for the selected filter. Draw a comparative plot with the original filter. Simulate the circuit to verify your hand calculation. What is the effect of loading the circuit ($\omega_0, \omega_{c1}, \omega_{c2}, \beta, Q$)?

Hints:

1. Your report should be self contained. The reader should not feel that you are answering questions !
2. Writing style and organization are very important (Quality not Quantity!)

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Good luck, **Dr. Ali Muqaibel**