

# Physics Assignment

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## Problem Statement

A radio can tune over the frequency range of a portion of the MW broadcast band: (800 kHz to 1200 kHz). If its LC circuit has an effective inductance ( $L$ ) and a variable capacitor with capacitance ( $C$ ), what must be the range of  $C$ ?

## Solution

To find the range of the variable capacitor ( $C$ ) for a radio tuning over the frequency range of the MW broadcast band with an effective inductance ( $L$ ), we can use the formula for the resonant frequency ( $f$ ) of an LC circuit:

$$f = \frac{1}{2\pi\sqrt{LC}}$$

For this problem, we can rearrange the formula to solve for  $C$ :

$$C = \frac{1}{(2\pi f)^2 L}$$

Given the frequency range of 800 kHz to 1200 kHz, we can find the range of  $C$  by substituting these values into the formula:

$$C_1 = \frac{1}{(2\pi \times 800 \times 10^3)^2 \times L} \approx 198.1 \text{ pF}$$

$$C_2 = \frac{1}{(2\pi \times 1200 \times 10^3)^2 \times L} \approx 88.04 \text{ pF}$$

So, the variable capacitor should have a frequency range between 198.1pF and 88.04pF.

Table 1: Input Parameters given in the question

Symbol	Value	Description
$L$	$200\mu H$	Inductance of the circuit
$f_{\min}$	800 kHz	Minimum operating frequency
$f_{\max}$	1200 kHz	Maximum operating frequency
$C_1$		Maximum capacitance value
$C_2$		Minimum capacitance value

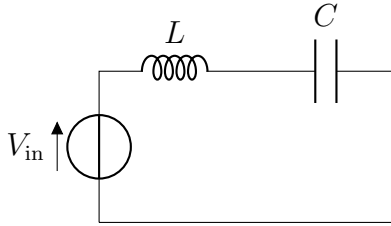


Figure 1: LC Circuit Diagram with Voltage Source (Time Domain)

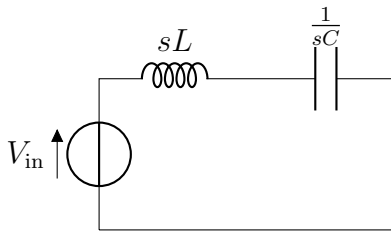


Figure 2: LC Circuit Diagram with Voltage Source (s Domain)

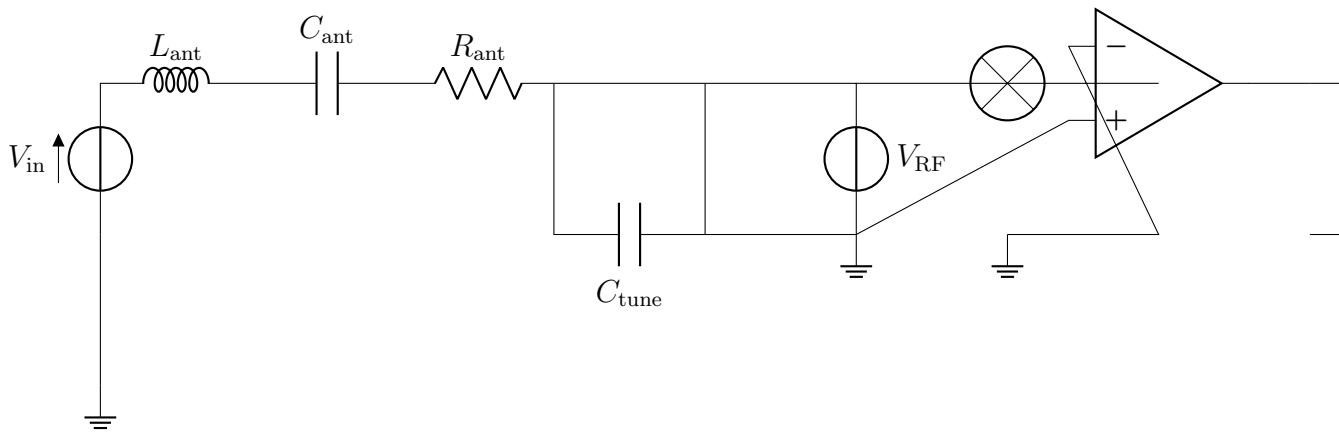


Figure 3: Circuit for Radio Transmission in the MW Band