M Rayan Ur Rehman Khan 2023281, Mohammad Abdullah 2023324, Mian Abdul Moiez 2023314

FM Radio Receiver

We aim through this project to make an electronic radio receiver that takes the modulated frequency form the radio tower to an audible frequency. The primary objective of this project is to make communication easier and more efficient. The project will use an antenna, Op-amp, transistors to catch, then filter and then amplify the signal then to transfer it to the speaker that will convert the signal into sound. This is a cost-effective and a very simple project focusing on practicality and common usage

Keywords—Basic circuit elements, Transistor, radio, cost-effectiveness.

I. Introduction

A radio receiver is used to capture radio waves transmitted through the air and convert them into usable audio signals. It operates by selecting a specific frequency from a range of electromagnetic waves using a tuner, amplifying the weak signal through an amplifier, and decoding it using a demodulator to retrieve the original information.

II. Schematic Design

Circuit Design:

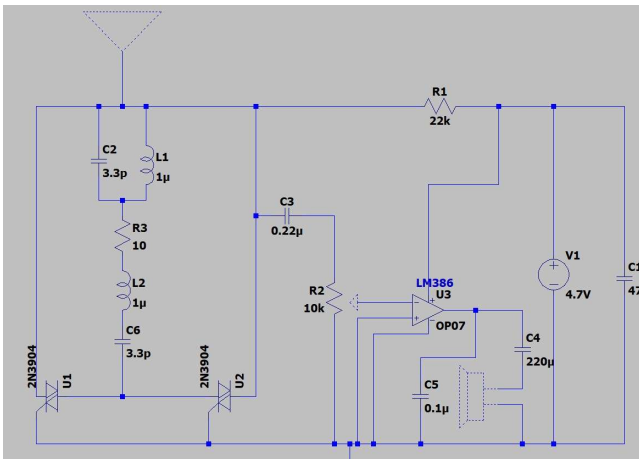

Fig. 1. Schematic Diagram of the receiver

Tunner circuit is used to select a specific channel and a Filter is used to filter out unnecessary noise two transistors and Op-amp to amplify frequency and a potentiometer to increase or decrease volume. A capacitor between Op-amp and speaker to remove dc signals and a capacitor between +ve and -ve terminal of voltage source to regulate voltage.

TABLE I
UNITS

Symbol	Quantity	
HZ	Frequency	Base unit

III. Methodology

Materials Used: Two Transistors(2N3904), capacitors multiple(22pF,0.22uF,220uF,0.1uF,0.470uF,221uF), Resistors (22k, 10k), LM386 IC(Audio Amplifier),Inductor, antenna and a speaker(5 Watt). Methodology: The project is designed in three parts the first part is the receiver which contains an antenna, inductor and a capacitor. The second part is the frequency filter that filters the frequency to suppress other frequency and has a RLC series filter which is used to implement this. The third part is the audio output part that has transistors and an Op-amp to amplify the frequency which is then outputted through a speaker. The calculations needed to determine the radio frequency the radio was tuning into is

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

$$f = \frac{1}{2\pi(\sqrt{3.3 \times 10^{-12} \times 1 \times 10^{-6}})} = 87.6\ Mega\ HZ \quad (1)$$

IV. Results and Discussion

Expected Frequency	Experimental
87.6 MZ	88.4 Mega HZ

Results: The circuit is tested by setting up the power supply and areal on a relatively higher ground and the circuit produced and audible signal with some noise and static in between the audio of the radio station's transmitter.

Discussion: The results of this experiment through the audible sound showed the project worked but with a slight discrepancy in the frequency as we tested it against another reliable receiver the frequency was 88.4 Mega Hz instead of the calculated 87.6 Mega Hz —this is relatively small and can be explained by the combined effects of component tolerances.

V. Conclusion

The project aimed to design a radio receiver using an LC circuit to tune to a specific frequency. The calculated resonant frequency was 87.6 MHz, while the actual frequency received

was 88.4 MHz, with the slight difference due to component tolerances and parasitic effects. The results show that the radio receiver performed effectively, closely matching the calculated frequency. This confirms that the design successfully solved the problem of building a functional radio receiver.

For future improvements, using more precise components with lower tolerances could reduce discrepancies. Additionally, digital tuning or frequency synthesizers could enhance accuracy and range, while signal processing techniques could improve the receiver's reliability.

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