# FM Transmitter

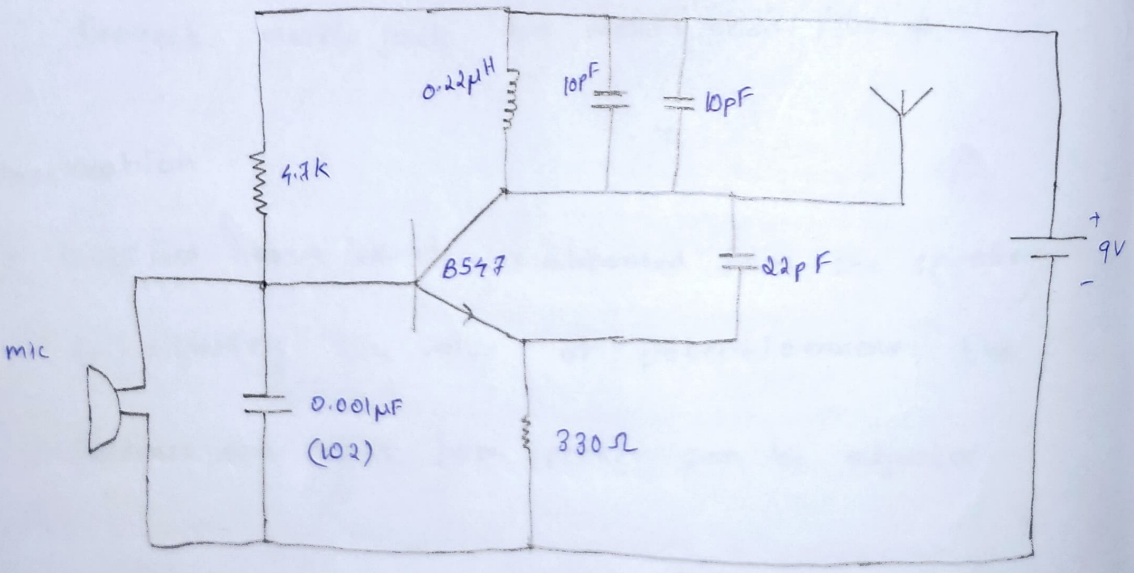
## Aim:

To build an FM transmitter which takes in an input audio signal through microphone and emits a specific frequency with 9V power supply.

## Materials Required

- Transistor B547
- Capacitors - 0.001μF (1nF) ($C_1$), 10pF ($C_2$, $C_3$), 22pF ($C_4$)
- Resistors - 4.7kΩ, 330Ω
- Inductor - 0.22μH
- Microphone
- Antenna

## Circuit diagram



## Theory

### . B547

B547 is a general purpose NPN bipolar junction transistor (BJT) that is widely available and inexpensive. It is suitable for a variety of low power applications, including amplification and switching, making it a popular choice for hobbyist projects and simple electronic circuits like FM transmitters.

### · Microphone

A mic is used as input device to capture audio signals such as human speech or other sound sources, and convert them into electrical signals.

### · Antenna

When a wire is used as an antenna, it exploits the principles of electromagnetism to transmit or receive radio frequency signals.

## Working

· The audio signal is being input by a microphone. The microphone contains a diaphragm that vibrates in response to sound waves. These vibrations cause changes in the electrical resistance of microphones

internal components, generating an electrical signal that represents the variations in air pressure caused by the sound waves.

- Now, this input passes through capacitor $C_1$. It serves the purpose of AC coupling and filtering.

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The capacitor blocks the DC voltage from the input which prevents any DC bias from interfering with the transmitter.

Filtering: It acts as high pass filter because the low frequency components contains noise

- This input is then fed into the base of transistor.
- Now comes the function of resistors (4.7kΩ & 330Ω)

Both the resistors are used for biasing the transistor as forward bias, setting up base and emitter voltages respectively and limiting the corresponding currents.

- The LC circuit is used for providing an oscillatory circuit which is used in generating carrier wave using transistor. $C_3$ (22pF) acts as positive feedback.

- ~~The collector of the transistor~~
- Amplification: The input is amplified by transistor to a level sufficient to modulate carrier wave effectively

- Modulation: This amplified wave is modulated with carrier wave. The frequency of carrier wave is directly proportional to amplitude of input.

- Generation of modulated signal: The modulated signal ie carrier wave which is modulated is then ready to be transmitted after amplification.

- The collector of the transistor experience voltage variations. By collecting the antenna to collector, it effectively "rides" on these variations, allowing transmitted signal to be radiated into space.

- **Calculations**

The frequency emitted can be calculated by

$$f_{emitted} = f_{carrier} + \Delta f$$

$$f_{carrier} = \frac{1}{2\pi\sqrt{LC}} \approx 75.9\,MHz$$

$\Delta f \rightarrow$ frequency caused by modulation, which is proportional to the amplitude of audio signal

Observed $f_{emitted} = 97.7\,MHz$

- **Testing / Observation**

→ First setup your device to scan the frequency that is emitted by the fm transmitter.

→ Tap test : As you tap the mic, you can identify the frequency corresponding to your fm transmitter.

→ As you play a song through the mic, you should be able to hear it.

→ Noise can be changed as you change the orientation of mic.

· Conclusion

We successfully designed an fm transmitter which emits a frequency of 99.1MHz