Heaven's Light is Our Guide

Rajshahi University of Engineering & Technology

Department of Electronics & Telecommunication Engineering

ETE 4214: Sessional Based on Radio and TV Engineering

Project

Experimental Study of Radio Receiver

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Report	**(Teacher's Section)**	**Viva**
☐ Excellent		☐ Excellent
☐ Very Good		☐ Very Good
☐ Good	_____	☐ Good
☐ Moderate	Signature	☐ Moderate
☐ Poor		☐ Poor

Experiment 3

Experimental Study of Radio Receiver

Objectives

The main objectives of this experiment are:

- To design a radio receiver capable of receiving signals in the frequency range of interest.
- To implement the necessary components for signal demodulation.
- To achieve good signal quality and minimize interference.
- To provide a user-friendly interface for frequency tuning and signal selection.

3.1 Theory

Radio frequency (RF) receivers and transmitters are fundamental components in modern communication systems, enabling the wireless transmission and reception of information over various frequency bands. An RF receiver is a device designed to capture and process RF signals. An RF transmitter is a device responsible for generating and broadcasting RF signals.As technology evolves, radio receivers continue to benefit from advancements in electronic components, signal processing algorithms, and communication protocols, enabling improved performance and additional features.Good receivers exhibit high selectivity to isolate the desired signal from interference and high sensitivity to detect weak signals, ensuring optimal performance in varying signal conditions.

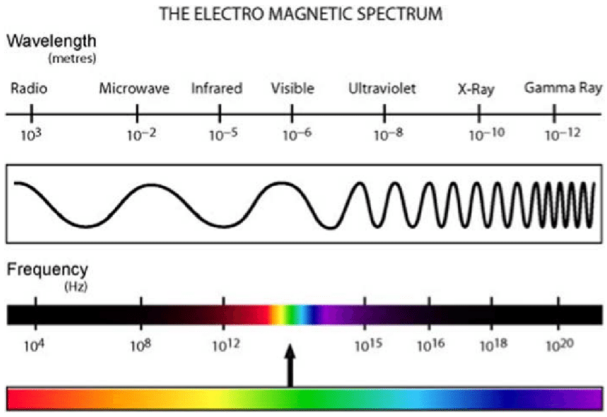

Figure 3.1: Radio Frequency Ranges.

The choice of frequency range for a particular application depends on factors such as signal propagation characteristics, bandwidth requirements, and regulatory considerations. Different frequency bands have varying properties, making them suitable for different types of communication and technologies.

3.2 Basics of Radio Frequency Communication

Electromagnetic Waves

Radio communication relies on the propagation of electromagnetic waves through the air. These waves, encompassing radio frequencies, travel at the speed of light and are characterized by wavelength and frequency.

Frequency Modulation (FM) and Amplitude Modulation (AM)

FM and AM are two primary modulation techniques used in radio communication. AM modulates the amplitude of the carrier wave, while FM modulates the frequency. AM is commonly used in medium-frequency (MF) bands for broadcasting.

3.3 Radio Receiver Architecture

Antenna

The antenna is the first component in the receiver chain, responsible for capturing RF signals. The design and positioning of the antenna are critical for effective signal reception.

3.3.1 RF Amplification

The RF amplifier boosts the weak incoming signal from the antenna, enhancing its strength for further processing. This stage is crucial for maintaining signal integrity and overcoming noise.

Mixer and Intermediate Frequency (IF)

The mixer combines the RF signal with a local oscillator signal to produce an intermediate frequency (IF). This step allows for easier signal processing and filtering.

IF Amplification

The IF amplifier further amplifies the signal at the intermediate frequency, preparing it for demodulation. This stage contributes to an improved signal-to-noise ratio.

Demodulation

Demodulation is extracting the original information signal from the modulated carrier wave. In the case of AM, demodulation involves rectification and filtering to recover the original audio signal.

Audio Amplification and Output

An audio amplifier then amplifies the demodulated audio signal before being sent to the speaker for output. This stage ensures that the recovered audio signal is of sufficient strength for clear reproduction.

3.4 Required Apparatus

- Antenna: Captures radio frequency signals.
- RF Amplifier: Boosts the weak incoming signal.
- Mixer: Converts the RF signal to an intermediate frequency (IF).
- IF Amplifier: Further amplifies the signal.
- Demodulator: Extracts the original signal from the modulated carrier.
- Audio Amplifier: Amplifies the demodulated audio signal.
- Speaker: Outputs the audio signal.

3.5 Block Diagram

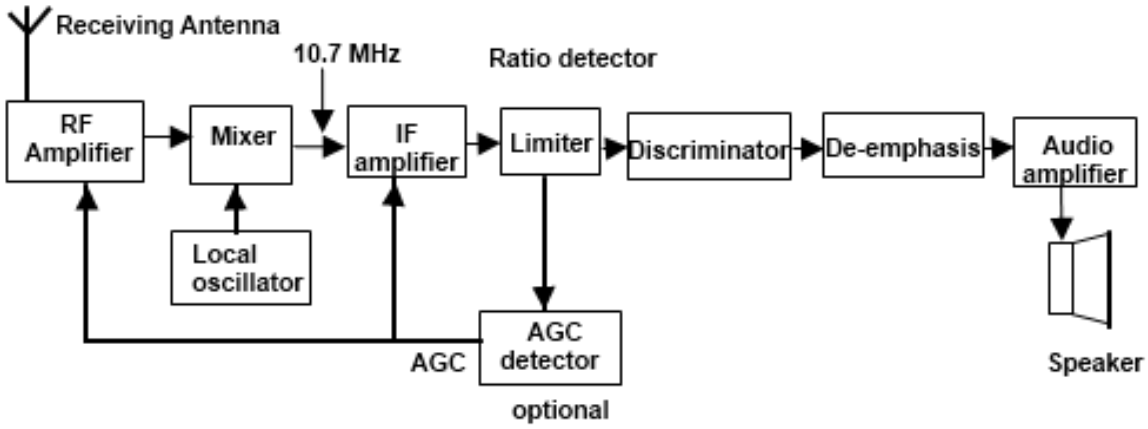

Figure 3.2: Block Diagram for Radio Receiver

3.6 Circuit Diagram with Experimental Setup

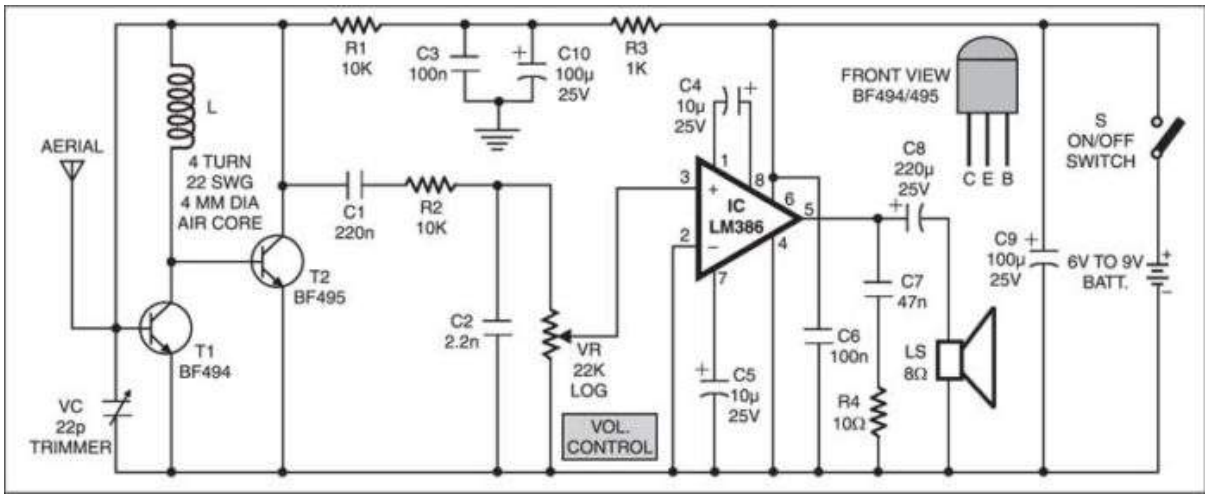

Figure 3.3: Circuit Diagram for Radio Receiver

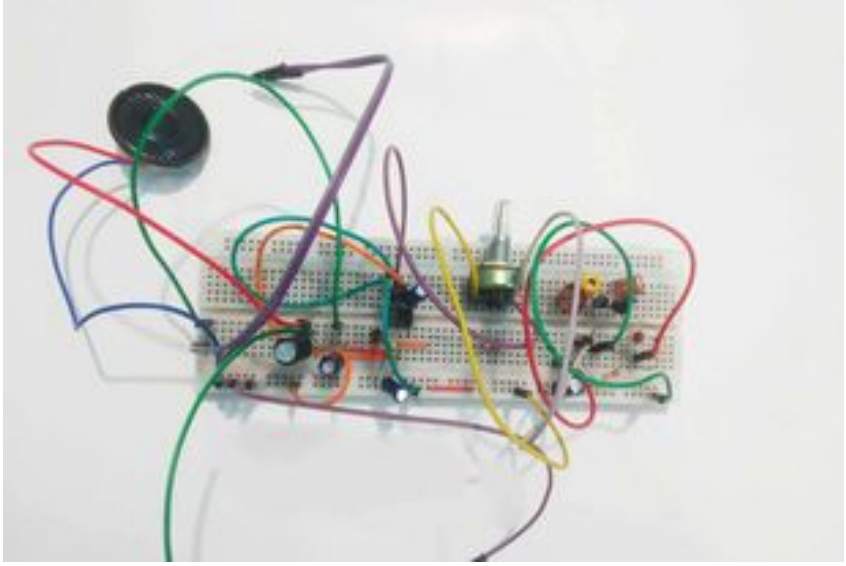

Figure 3.4: Experimental Setup for Radio Receiver

3.7 Output Result

Figure 3.5: Output Result of FM Receiver

3.8 Discussion and Conclusion

The design and implementation of the radio receiver involved a thorough exploration of radio frequency communication principles and electronic circuitry. The theoretical foundation covered electromagnetic wave propagation, modulation techniques (AM and FM), and the sequential stages of receiver architecture. The practical realization included meticulous circuit de-

sign, focusing on component selection for optimal signal processing. The project emphasized efficient capture, amplification, and demodulation of radio signals, particularly in medium-frequency (MF) bands used in AM broadcasting. Key components like the antenna, RF amplifier, mixer, and IF amplifier were carefully designed to extract the original audio signal successfully. Testing and calibration procedures were crucial for validating functionality and performance. Signal testing verified the receiver's ability to tune into specific frequencies and maintain signal quality, while calibration fine-tuned component values for optimal operation within defined parameters. In conclusion, the completed radio receiver project demonstrates the effective integration of theoretical principles with practical implementation. The receiver, showcasing a deep understanding of RF communication, modulation, and electronic circuitry, is a functional and reliable device capable of clear audio signal reception and reproduction. The foundational knowledge gained serves as a stepping stone for future advancements in radio communication and signal processing.