

A Project report on
RADIO TRANSMITTER
Submitted in partial fulfillment of the award of the
BACHELOR OF SCIENCE
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BONAFIDE CERTIFICATE

This is to certify that project report titled **“RADIO TRANSMITTER”**, is a bonafide record of work carried out by Miss VAISHNAVI BARMASE during the final semester from **February 2021** to **May 2021** under my guidance, in partial fulfillment of the requirements for the award of **Bachelor of Science in Aeronautics (Avionics)**.

Prof. Mr. SURESH KUMAR

Principal

DECLARATION

I declare that this written submission represents my ideas in my own words and where others' ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

VAISHNAVI BHOJRAJ BARMASE
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VAISHNAVI BARMASE
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ABSTRACT

At the end of fifth semester when there was announcement about the final year projects, I decided to make something that is related to our real life, something that is interesting and different. Firstly I thought about different projects like landing gear, Radio antennas, Aircraft light etc. But finally, I decided to make RADIO TRANSMITTER.

The early transmitter for radio broadcasting is so big and bulky that they do occupy numerous spaces. The circuits are mainly designed with valves, which are big in sizes. With the advent of semiconductor materials such as transistors, electronic equipment is now becoming miniaturized such that small transmitters are now handy and compact. In line with this, we choose to design a complete radio broadcasting equipment that is compact. The system units are of two categories, namely: audio console for the processing and mixing of musicals which is basically a condenser microphone. The transmitter unit is where the center frequency is provided. All these were designed to be in compact form. This project is aimed at serving a community using a small radio broadcasting equipment with a power rating of 20 watts. A community of 10meters in radius should be covered comfortably. The study was to design and construct a power rating of 20-watt Frequency Modulation (FM) transmitter to be received at a range of 100 meters.

Introduction and Objective

INTRODUCTION

In electronics and telecommunications a transmitter or radio transmitter is an electronic device which produces radio waves with an antenna. The transmitter itself generates a radio frequency alternating current, which is applied to the antenna. When excited by this alternating current, the antenna radiates radio waves.



Figure 1.1 TELECOMMUNICATION SYSTEMS

Commercial FM broadcasting transmitter at radio station WDET-FM, Wayne State University, Detroit, USA. It broadcasts at 101.9 MHz with a radiated power of 48 kW. Transmitters are necessary component parts of all electronic devices that communicate by radio, such as radio and television broadcasting stations, cell phones, walkie-talkies, wireless computer networks, Bluetooth enabled devices, garage door openers, two-way radios in aircraft, ships, spacecraft, radar sets and navigational beacons. The term transmitter is usually limited to equipment that generates radio waves for communication purposes; or radiolocation, such as radar and navigational transmitters. Generators of radio waves for heating or industrial purposes, such as microwave ovens or diathermy equipment, are not usually called transmitters, even though they often have similar circuits. The term is popularly used more specifically to refer to a broadcast transmitter, a transmitter used in broadcasting, as in FM radio transmitter or television transmitter. This usage typically includes both the transmitter proper, the antenna, and often the building it is housed .

- **ADVANTAGES OF RADIO TRANSMITTER**

Following are the **advantages of RF**:

- ➔ It has different penetration through the walls of the buildings or houses based on the frequency. Hence used for radio and television transmission and for cellular mobile phone service.
- ➔ Used in various medical applications. It is used in Diathermy instrument for surgery. It is used in MRI for taking images of human body. It is also used for skin tightening.
- ➔ It is used in radar for object detection.
- ➔ It is used for satellite communication.
- ➔ It is used in microwave line of sight communication system.

- **DISADVANTAGES OF RADIO TRANSMITTER**

Following are the **disadvantages of RF**:

- ➔ Uncontrolled radiation of RF affects pre-adolescent children's, pregnant women, elderly humans, patients with pace makers, small birds, flora and fauna, small insects etc.
- ➔ The areas near RF cellular towers have been observed with more lightening compare to other areas.
- ➔ It also affects some of the fruits grown near the RF tower areas.
- ➔ As RF waves are available both in LOS and non LOS regions of transmitter, it can be easily intruded by the hackers and crucial personal/official data can be decoded for malicious motives. In order to avoid this situation, radio frequency wave based transmission is used with highly secured algorithms such as AES, WEP, WPA etc. RF signal can also be modulated either using frequency hopping or spread spectrum techniques to avoid this kind of dropping.

METHODOLOGY

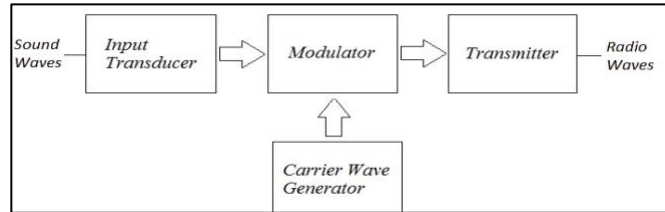


Figure 2.1. Block Diagram of FM Transmitter

Each Of These Sections Is Explained Below:

Audio Signal -An audio signal is a representation of sound, typically using a level of electrical voltage for analog signals, and a series of binary numbers for digital signals. Audio signals have frequencies in the audio frequency range of roughly 20 to 20,000 Hz, which corresponds to the lower and upper limits of human hearing.

Pre- amplifier-Is an electronic amplifier that converts a weak electrical signal into an output signal strong enough to be noise-tolerant and strong enough for further processing, or for sending to a power amplifier and a loudspeaker. Without this, the final signal would be noisy or distorted.

Modulator- A modulator is a device that performs modulation. A demodulator (sometimes detector or demod) is a device that performs demodulation, the inverse of modulation. A modem (from modulator–demodulator) can perform both operations.

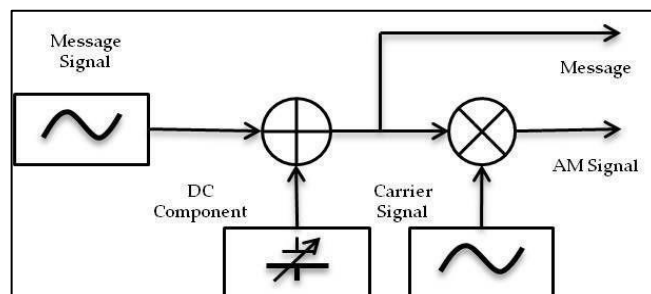


Figure .2.2 Diagram of a Modulator

Oscillator-An oscillator is a circuit which produces a continuous, repeated, alternating waveform without any input. Oscillators basically convert unidirectional current flow from a DC source into an alternating waveform which is of the desired frequency, as decided by its circuit components.

RF-Amplifier- A radio frequency power amplifier (RF power amplifier) is a type of electronic amplifier that converts a low-power radio-frequency signal into a higher power signal typically, RF power amplifiers drive the antenna of a transmitter.

Antenna-An antenna is the interface between radio waves propagating through space and electric currents moving in metal conductors, used with a transmitter or receiver. An antenna is an array of conductors (elements), electrically connected to the receiver or transmitter. to the carrier in several different ways, in different types of transmitter.

THE PROJECT WORK DIVIDED IN TWO PART AS

- THEROTICAL WORK:
 - **Theoretical study of FM Transmitter**
- ACTUAL WORK:-
 - **Design of unit**
 - **Development of setup**
 - **Actual working of setup**

A] Theoretical work:- The purpose of most transmitters is radio communication of information over a distance. The information is provided to the transmitter in the form of an electronic signal, such as an audio (sound) signal from a microphone. The transmitter combines the information signal to be carried with the radio frequency signal which generates the radio waves, which is often called the carrier. This process is called modulation. The information can be

- 1) In a frequency modulation (FM) transmitter, it is added by varying the radio signal's frequency slightly. Many other types of modulation are used.
- 2) The antenna may be enclosed inside the case or attached to the outside of the transmitter.

cell phones, walkie-talkies, and garage door openers. More powerful transmitters, the antenna may be located on top of a building or on a separate tower, and connected to the transmitter by a feed line, that is a transmission line (Jerry, 1991).

- **Construction of circuit**

- Project Board: This is a white electronic kit, which is used to test and construct electronic circuit without soldering the components. It provides room for circuit modification if need be.
- Connecting Wires: These are tiny pieces of copper wire about 0.2mm in diameter.
- Battery: The source dc supply is 9volts high watt battery.
- Cutter: This is to cut connecting wires and components to size.
- Digital Multi-meter: This is a multi-purpose electrical measuring instrument use to test for various parameters in an electrical circuit.
- Insulation Tape
- Complete Pliers Set
- Screwdriver

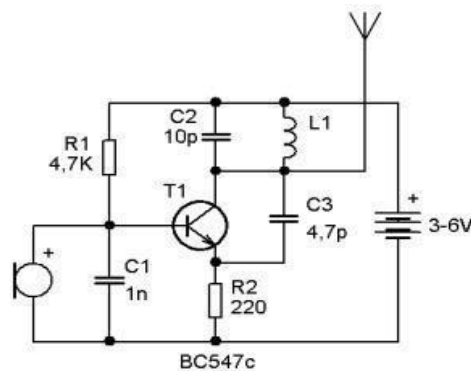


Figure 3.A.1 Overall Circuit Diagram

- **Design Construction**

The actual realization of the design was carried out in adherence to circuit schematics. Assembled first on bread board before transferring to a Copper Clad board (CCB). The choice of electronic materials and components used were done with the objective of achieving low cost.

- **Design Procedure**

The design procedure for the project hinged on an existing frequency modulation (FM) transmitter circuit. This transmitter circuit, which the researchers constructed and tested, showed some desirable characteristics. Operating efficiently on a low-power 9 V DC (Direct Current) which process minimal safety problem. However, the transmitter incorporates a low power ($2.52 \times 10^{-5}mw$) output stage using transistor 2N3904 which produces a range too short for practical application

B] Actual work :

DESIGN OF UNIT

3.B.1



ATmega328P Microcontroller

3.B.2



9V Battery (Hi-Watt)

3.B.3



**LM7805 - 5V Positive Voltage
Regulator**

3.B.4



**1000uF 50V Electrolytic
Capacitor**

3.B.5



- **Working of FM Transmitter Circuit**

The following circuit diagram shows the FM transmitter circuit and the required electrical and electronic components for this circuit is the power supply of 9V, resistor, capacitor, trimmer capacitor, inductor, mic, transmitter, and antenna. Let us consider the microphone to understand the sound signals and inside the mic, there is a presence of the capacitive sensor. It produces according to the vibration to the change of air pressure and the AC signal.

The formation of the oscillating tank circuit can be done through the transistor of 2N3904 by using the inductor and variable capacitor. The transistor used in this circuit is an NPN transistor used for general purpose amplification. If the current is passed at the inductor L1 and variable capacitor then the tank circuit will oscillate at the resonant carrier frequency of the FM modulation. The negative feedback will be the capacitor C2 to the oscillating tank circuit.

To generate the radio frequency carrier waves the FM transmitter circuit requires an oscillator. The tank circuit is derived from the LC circuit to store the energy for oscillations. The input audio signal from the mic penetrated to the base of the transistor, which **modulates the LC tank circuit** carrier frequency in FM format. The variable capacitor is used to change the resonant frequency for fine modification to the FM

frequency band. The modulated signal from the antenna is radiated as radio waves at the FM frequency band and the antenna is nothing but copper wire of 20cm long and 24 gauge. In this circuit, the length of the antenna should be significant and here you can use the 25-27 inches long copper wire of the antenna.

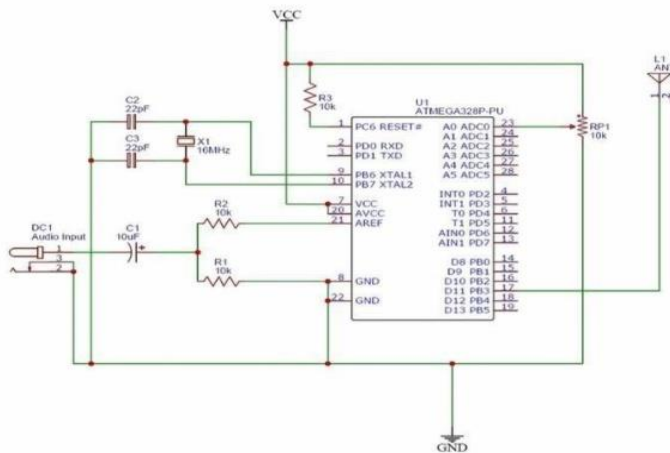


Figure 3.B.6 . CIRCUIT DIAGRAM OF FM TRANSMITTER

RESULTS AND ANALYSIS

The outcome of this research gave rise to an FM transmitter equipment with a robust search and discover capabilities in terms of radio transmission.

In order to assess the functionality of the device, an evaluation test was carried out on the device inside a laboratory.

During the experimental procedure the following test was carried out on the transmitter components using a digital multi-meter.

- i. Polarity test
- ii. Frequency test
- iii. Inductance test

CONCLUSION

Conclusively from this research work which is aimed at modulating frequency with the aid of a transmitter, we were able to transmit audio signals from a phone, laptop and also from oral communication, after going through several experiment test. This design and construction were achieved after going through several literature reviews of which the principle of modulation was discussed and the beginning of radio transmission also put into view. Though transmission was possible after testing but didn't give the desired result of having a crystal reception and longer transmission. Signals from a phone, laptop and also from oral.

Frequency Modulation (FM) is an important modulation scheme both because of its widespread commercial use, and because of its simplicity. As we have seen in this document, frequency modulation can be simplified to angle modulation with a simple integrator.

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