



## Design and Construction of a Simple and Cost Effective Frequency Modulated Transmitter of the Range 100 Metres

Raghu B T<sup>1</sup>, Raj Krishna<sup>2</sup>, Mr. Praveen A<sup>3</sup>

<sup>1,2</sup>UG Students, Department of Electronics and Communication Engineering, K S Institute of Technology, Bangalore, Karnataka, India

<sup>3</sup>Assistant Professor, Department of Electronics and Communication Engineering, K S Institute of Technology, Bangalore, Karnataka, India

### ABSTRACT

Frequency Modulated (FM) signal transmitter is a device acts like a basic radio that can transmit Frequency Modulated signal over short range. This document explains the easiest and economical technique for building a FM transmitter by only using basic electronic components like RLC (resistor, capacitor, inductor) etc. The FM transmitter device receives human voice signals through microphone. It further amplifies it, modulate it over carrier and finally transmit signal to a specific frequency. Considering favourable conditions into account, output of transmitter can be received by anyone who tunes it in frequency of our transmitter. The design can be simulated using NI Multisim and implemented on bread-board before soldering on PCB. FM transmitter on low power supply has been achieved in this work. This small circuit with which you can listen to another people conversation from long distance using the normal FM radio set can also used as Bugger which is illegal but used by most security and spy agencies.

KEYWORDS: 2N2222 bipolar transistor, LC Oscillator, Resistor, Microphone, Antenna.

### 1. INTRODUCTION:

Today, communication enters our daily lives in so many different ways like telephone, radio, television, mobile etc. Irrespective of different communication process, there are three basic elements namely, transmitter, channel and receiver. There are different types of analogue modulation techniques in which one type of modulation is amplitude modulation, in which single side band (SSB) modulation and double side band (DSB) modulation are two types and another type of modulation is angular modulation in which the frequency modulation, phase modulation are the types. In this circuit FM modulation is used. FM modulation means, frequency of the carrier signal is varied with respect to the instantaneous amplitude of the modulating signal. All FM radio will use this type of modulation technique to transmit there signals (30-40miles distance covered), frequency modulation will give high output and efficiency when compared to amplitude modulation. Also, it is less susceptible to noise .FM waves are used for various purposes such as broadcasting a message, communication etc.

### 2. LITERATURE SURVEY:

[1] The journal consists of economical and easier way for building a FM transmitter circuit using basic electronic components like resistor, capacitor, inductor etc. The FM transmitter receives human voice signals through microphone. Voice transmitted, was received at output, more the power of signal transmitted, greater is its range and more noise immune it becomes.

[2] In this Paper it's discussed about recent trends in wireless Communication system design using Software Defined Radio (SDR). The Universal Software Radio Peripheral (USRP) B200 board is employed for constructing FM Transmitter and Receiver. Using Software Defined Radio it is possible to design prototype of the Communication systems and possible to verify the real time performance of the system.

[3] Calculating the power required for frequency modulated radio transmitter to cover a particular distance based on available radio receiver sensitivity and desired signal range. This research can be used to estimate transmitter power required to cover predetermined area or distance.

[4] The overall result of this project which is the outcome of construction procedures has revealed the successful achievement of the primary objective; the design and construction of an FM transmitter of appreciable range operating on 12v power supply. This study has showed that practical FM transmitter requiring low power input can be designed and constructed.

[5]In this book a chapter describes FM and VHF transmitters that can be assembled with easy-to-find parts and cheap components. In many cases, components found in old non-functioning radios, amplifiers, and TV sets can be used. In less cases, the projects can be assembled on either a printed circuit board or a terminal strip. And here they also explained assembly of circuit, working and PCB required too.

[6]Here in principle of communications it was explained about communication process which includes source of information, communication channels, modulation process and basic modulation techniques: AM, FM, Pulse Modulation. Also given the details of Analogue and Digital Modulation schemes which help to build a basic communication system.

[7] This model is meant for the wireless transmission of Frequency Modulated signal from one place to another with a limited but wide distance separation. The Digital Frequency Modulation Scheme has been used to boost the signal strength for long range communication. The used components are of low cost and reliable for prolonged use. The test of this project shows high quality sound reception at the receiving end from the source end using our model.

[8] The demand for the use of Frequency Modulation (FM) transmitter was explained. The FM transmitters are however a posh equipment needs high power supply and voltage system design, tough maintenance and exorbitant price. The FM transmitter is designed to receive at a range of about 100metres in free air. The transmitter features a condenser microphone which picks up very low and weak sound signals, a transistor, resistors, inductor, and capacitors. The circuit design procedure involves the modification of an output of transmitter. The report says that the sensible frequency modulated (FM) transmitter requiring a coffee power are often designed and constructed.

### 3. METHODOLOGY:

#### 3.1 Input Stage:

Inside the condenser microphone, a capacitive sensor diaphragm is present. It vibrates according to the air pressure changes and generates AC signals which are in turn given to the capacitor C1 where C1 is used for removing the noise in and turn on the transistor.

#### 3.2 Amplification (strengthen) Stage:

The input signal converted by microphone to alternating signal has very low power, hence if we modulate it directly over the carrier and transmit it that would not be possible to demodulate and retrieve the original signal from it. So the resistors R1 and R2 are used to bias the BJT.

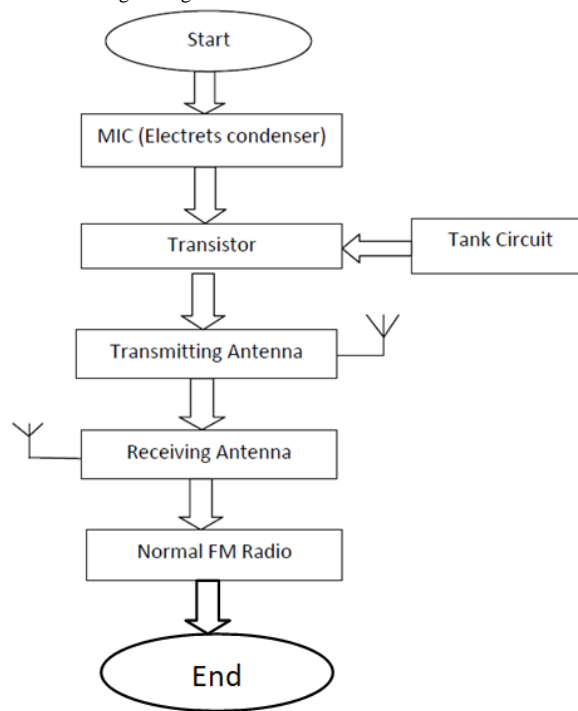


Fig.1 Flow chart

#### 3.3 Resonant Circuit:

The Resonant circuit (capacitor C6 and L1) will produce the carrier signal for transmit message signal, the transistor will amplify both the signals and send to air through the antenna (copper wire used as antenna). The capacitor C4 is used to rectify (removes) the noise in the transmitted signal. The variable capacitor (C6) is used because we can adjust the capacitor for producing own carrier signal. The carrier signal should be in range of 88 to 107 MHz so that FM radio receiver set can receive your transmitted signal.

#### 3.4 Output (Transmission) stage:

Now, the signal after amplification by BJT (2N2222) is further modulated with carrier signal generated by tank circuit. After successful modulation the wave is transmitted using antenna which is other side received by receiver (normal mobile FM radio set) antenna and again undergoes demodulation to retrieve original signal.

#### 4. CIRCUIT DIAGRAM:

The circuit contains basic components like:-

**Resistor:** 22K $\Omega$ , 47K $\Omega$  and 330 $\Omega$ .

**Capacitor:** 1nF(3), 50pF(variable capacitor),4.7pF and 22nF.

**Inductor:** It is made using about 25cm length of 25SWG wire. Wrap the copper wire around a cylindrical object of 6mm diameter and remove it after eight turns.

**Microphone:** It's a electrostatic capacitor based microphone enables communication and recordings. When sound hits diaphragm it starts moving, in turn changes capacitance of capacitor, which in turn results in flow of variable current. The operating voltage is 2v and operating frequency is 20Hz to 16,000Hz.

**Transistor:** The 2N2222 is a general purpose NPN bipolar junction transistor used for low power amplifying or switching applications.

**Antenna:** An antenna is used for radiating or receiving radio waves. Here in this circuit we are using copper wire as an antenna.

**Battery:** DC Power of 3V or 5V is supplied using batteries and by increasing the power supply we can increase transmitting range.

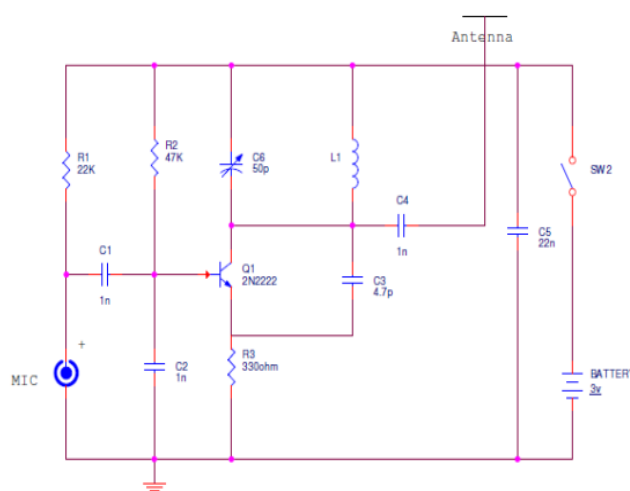


Fig.2 circuit diagram

#### 5. CONCLUSION:

Audio transmitted, was received at output on produced frequency (88 to 107 MHz). For extending the range and power of FM transmitter, we can increase Amplification rate. More the power of signal transmitted, greater is its range and more noise immune it becomes. Check the voltage of source applied to improve efficiency. Furthermore , Design should be implemented on PCB board as bread-board is not preferred for high frequency circuits.

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