

PROJECT NAME: AM TRANSMITTER AT FREQUENCY RANGE (540-1600) kHz

OBJECTIVES:

- To build a working AM Transmitter.
- To understand the working of AM Transmitter.

THEORY:

Transmitters are devices that are capable of transmitting audio as radio waves from an audio device. There are two types of transmitters: FM & AM.

AM transmitters create radio waves using Amplitude Modulation (that's why AM). That means only the amplitude of the waves gets changed but the frequency remains the same. In this case, the frequency of carrier frequencies falls within a predefined range called Carrier Frequency. The carrier frequency changes from country to country.

Battery: A DC 9-volt battery is the main DC power source of our project. But we have used a dc power source from lab also for better result.

Resistor: The resistor is a resistive purpose. It's basically used in all circuits. In our circuit, we also used for the resistive purpose and controlling voltage and current flow in different components of that circuit.

Capacitor: Capacitor is used for storing charge in the form of the field, separated by an insulator. In other words, we describe the capacitor as a component which has ability to store energy in form of electrical charge. We have used it for different purposes like storing charge, delaying charge, filtering noise, making tank circuit for generating carrier signal etc.

Inductor: A inductor which converts and store electrical energy to magnetic energy. When electricity passes the coil from left to right it will generate a magnetic field in the form of clock direction. We made a 5-turn inductor in a test n error system.

Trimmer Capacitor: It also called a variable capacitor. It has a facility to change capacitance value in a limit. We have used it to control the frequency of carrier signal of tank circuit.

Antenna: The radio wave passes through air at a speed of light. An antenna produces electric current to recreate the original signal and sent it from the circuit to the air. We have used an approximate 30CM to 1M telescopic shape antenna.

FIRST ATTEMPT:

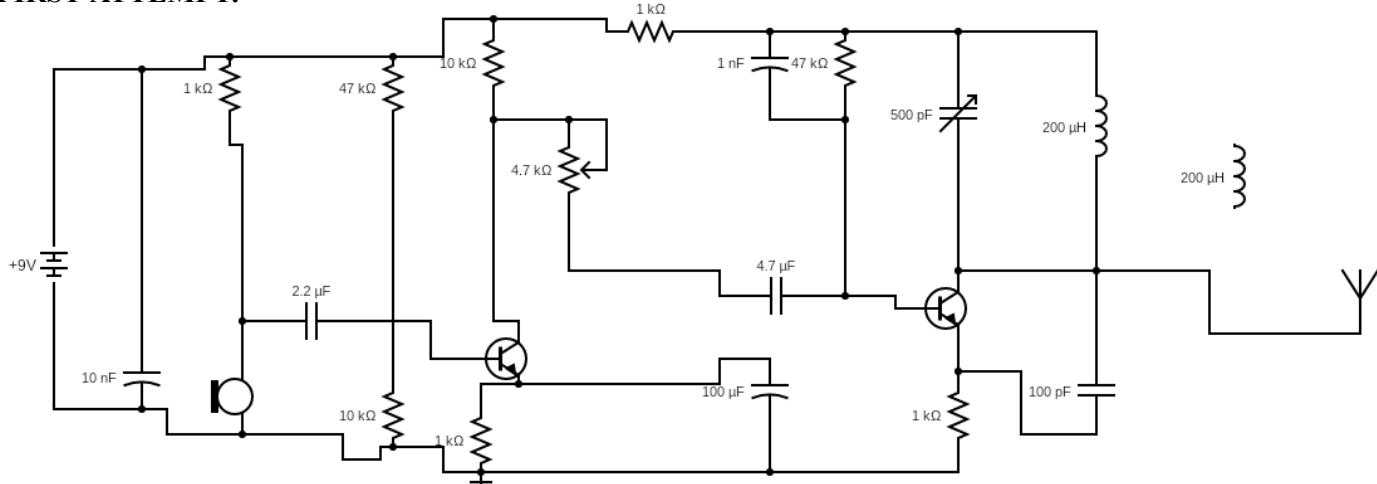


FIGURE 01: AM TRANSMITTER CIRCUIT DIAGRAM.

WORKINGS:

Here is the first circuit diagram of a simple AM transmitter circuit that can transmit our audio to our backyard. This circuit is designed with limited power output to match the FCC regulations and still produces enough amplitude modulation of voice in the medium wave band to satisfy our needs.

The circuit has two parts, an audio amplifier, and a radio frequency oscillator. The oscillator is built around Q1 (BC109) and related components. The tank circuit with inductance L1 and capacitance VC1 is tuneable in the range of 500kHz to 1600KHz. These components can be easily obtained from our old medium wave radio. Q1 is provided with regenerative feedback by connecting the base and collector of Q1 to opposite ends of the tank circuit.

C2, the 1nF capacitance, couples' signals from the base to the top of L1, and C4 the 100pF capacitance ensures that the oscillation is transferred from collector to the emitter, and through the internal base emitter resistance of the transistor Q2 (BC 109), back to the base again. The resistor R7 has a vital part in this circuit. It ensures that the oscillation will not be shunted to ground trough the very low value internal emitter resistance, r_e of Q1(BC 109), and increases the input impedance such that the modulation signal will not be shunted to ground.

Q2 is wired as a common emitter RF amplifier, C5 decouples the emitter resistance and unleashes full gain of this stage. The microphone can be electret condenser microphone and the amount of AM modulation can be adjusted by the 4.7 K variable resistance R5.

Result:

For the first attempts we tried to stick with our basics which is using transistors one to build oscillator around it. But due to lack of some components we couldn't finish our circuit and as a result we didn't get our modulated signal.

SECOND ATTEMPT:

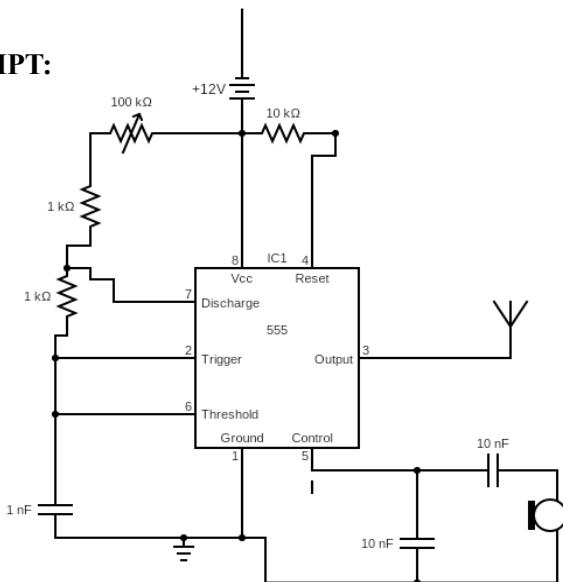


FIGURE 02: AM TRANSMITTER CIRCUIT DIAGRAM WITH 555 TIMER IC.

WORKING:

- Pin 5(Control voltage) is used to change the modulation. Based on the amplitude of the audio signal.
- Using the 100K variable resistor we can change the carrier frequency between (540-1600) kHz which is a typical AM Bandwidth.
- We can have out of different frequencies because it creates different frequencies.
- Audio signal goes to 5(cv) and modulate the output amplitude of the square wave.
- We can make some improvisation adding RF amplifier on antenna because this puts out about 100mW which is hardly anything.

THIRD ATTEMPT:

And here we are with our third attempt.

Since our second attempt didn't go as planned. Where we made a cheeky attempt to use Pin 5(Control Voltage) to Modulate the amplitude.

This time we planned to make the modulator separately and here we go,

We stucked to the part where we use 555 Timer IC as the oscillator to generate signal, but we used a different method to make the AM modulator.

So, the circuit goes like this,

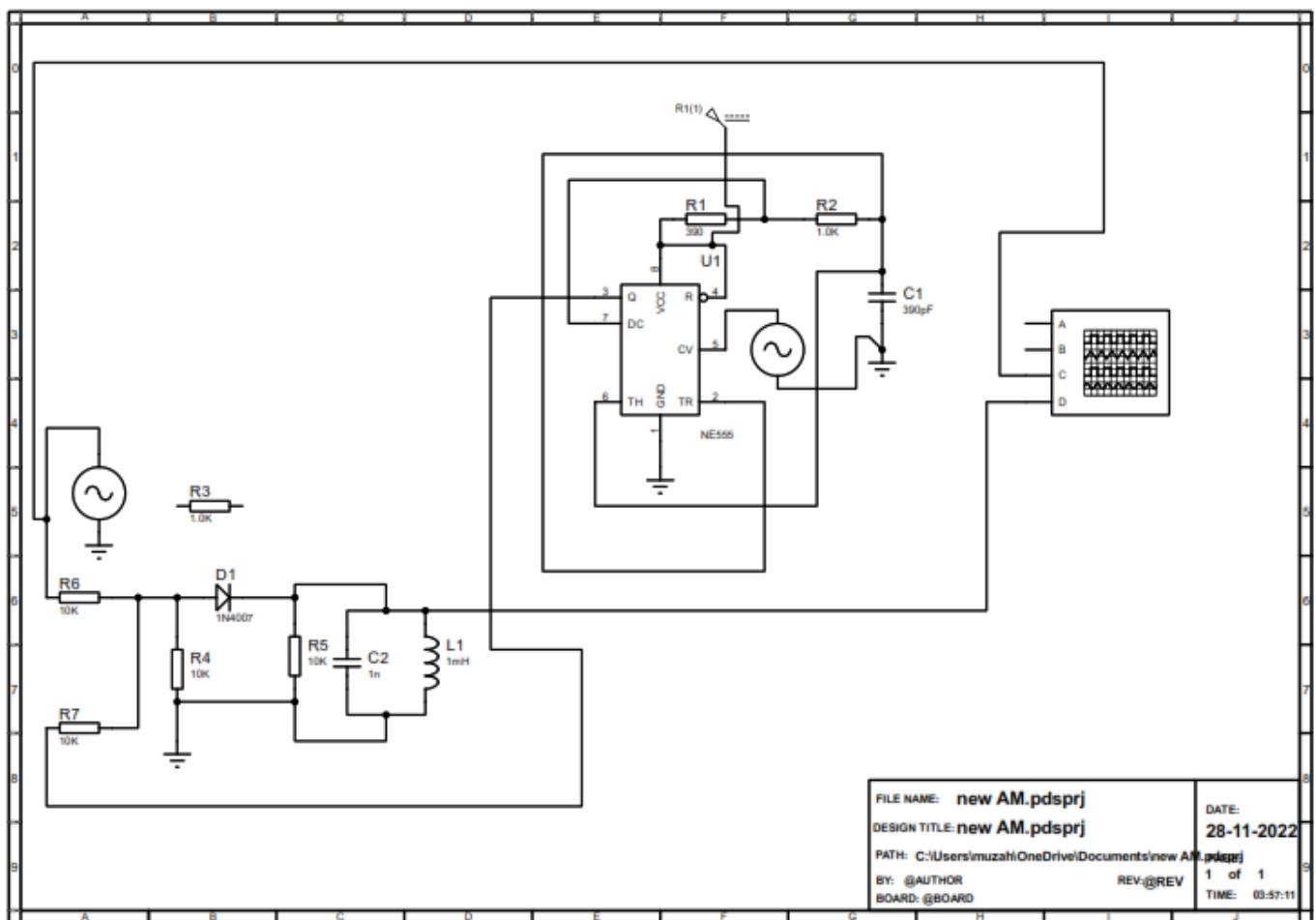


FIGURE 03: AM TRANSMITTER CIRCUIT DIAGRAM WITH 555 TIMER IC AND WITH SEPARATE MODULATOR.

AND HERE IS THE FINAL OUTPUT OF THIS ONE ON PROTEUS:

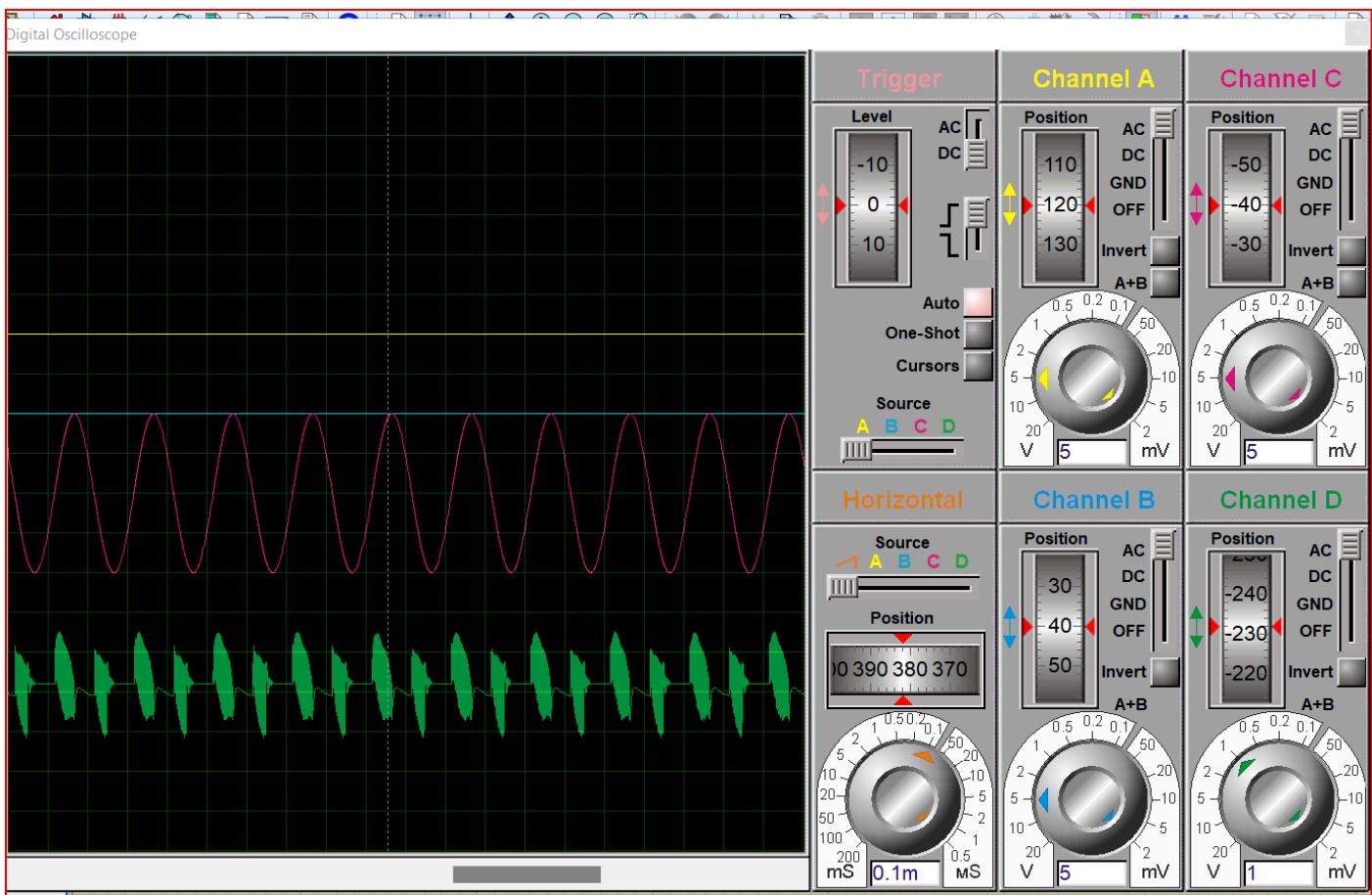


FIGURE 04: AM TRANSMITTER OUTPUT FORM PROTEUS.

Result:

We followed the principles of AM Modulation in a different way, this time with 555IC. Since it was hard getting the 1MHz oscillator we used its substitute 555 Timer IC as the frequency generator. We tried to use the PIN5(control voltage) to modulate the carrier frequency to changes its amplitude. But our plan was not quite successful with our attempt.

With our final attempt we tried to follow the basics and thus it led us to the third one where we tried to modulate the frequency differently and the output is shown above.

EFFECT ON SOCIETY:

The cost of amplitude modulation is low. Amplitude modulated signals are reflected by the earth from the ionosphere layer. Thus, they travel a long distance and cover a wider area. Required carrier frequency is low. This requires a simple transmitter and receiver. Thus, transmission and reception of an audio signal are less cumbersome. Demodulation of amplitude-modulated signals is less complex due to the use of a circuit having few components.

Environment And Sustainability:

AM transmitter can transmit signal wirelessly, so it reduces the use of wires, plastic, and other metal, like copper. So, it is environment and cost friendly and a sustainable solution in a way. The transmitter uses a very short amount of power, so it can work for a long amount of time with just a simple battery.

Components used in this project are also some basic components which naturally have a long lifetime with minimum side effects. So, from all these facts, we can say that this project is environmentally friendly and sustainable for a long time.

Ethics:

AM Transmitter is nothing new in this world of technologies. We have done our study on AM transmitter on various websites and watched different videos. Although we tried to improvise the circuit when we couldn't find some components and to get our expected output, we've modified the circuit can be seen above. So, if there isn't any loop hole no copyright laws have been violated. Apart from that we didn't disturb AM radio stations since our working frequency is far less compared to the stations.

Project Management and Finance:

Simplified cost details of the project are given below,

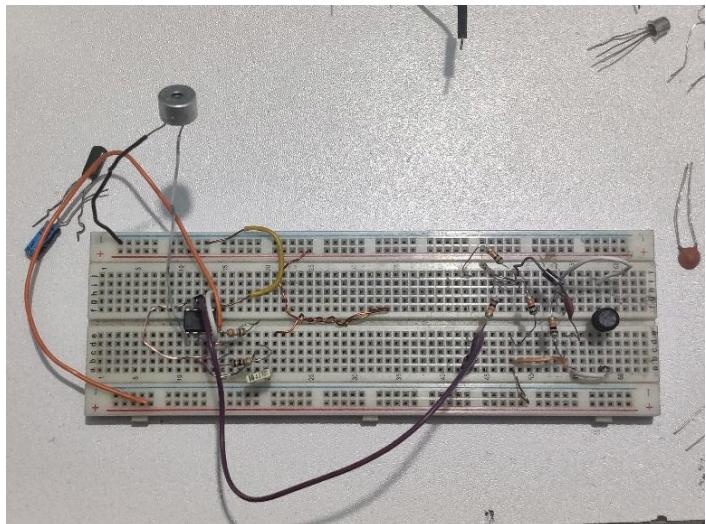
1. Capacitors =27taka
2. Resistors =8taka
3. Transistor =5taka
4. Inductor =5taka
5. Variable Capacitor =50taka
6. 3.5mm jack =15taka
7. Crocodile clip=5taka
8. Breadboard =60
9. Printing = 130 taka
10. Antenna= 30taka
11. 555TIMER IC =12 taka

Our total cost was approximately BDT 465. Total costing was equally distributed among the group members. It may seem to be a big amount respective to the project. But we should also keep in mind we have done proper research and had to design and implement our circuits several times to have the output.

Technical Contribution:

My role was to construct the circuit of attempt 2 (In figure 02) on the breadboard. I also tested the circuit and try to figure out if there was any mistake. I was also involved in discussing regarding AM Transmission and how it works.

PROJECT PICTURE:



Successful project submission after weeks of hardwork, Alhamdulillah 😊