DESIGN AND CONSTRUCTION OF FM TRANSMITTER WITH PUBLIC ADDRESS SYSTEM

BY

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SUBMITTED IN PARTIAL FULFILMENT FOR THE AWARD OF BACHLOR DEGREE ELECTRICAL AND COMPUTER ENGINEERING.

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CERTIFICATION

I hereby certify that this is the work of Mallam Abdullahi Ibrahim, submitted in partial fulfillment of award of A Bachelor Degree in Electrical and Computer Engineering

19-12-2005

Mr Emmanuel Eronu
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Date

27/09/06

Engr. M.d Abdullahi
Head of Department

Date

External Examiner

date

DEDICATION

I dedicate this project work to Almighty Allah for sparing my life to see the end of the program and also to the entire family of Ibrahim's.

ACKNOWLEDGEMENT

I sincerely acknowledge the immense contributions of my parents. My sisters, my brothers and the entire family for their moral and financial support during my programs in the university.

I also acknowledge the assistance of my project supervisor Mr. Emmanuel Eronu during the design and construction of the project. May almighty god reward him abundantly.

My sincere gratitude goes to these, people, who have by one way or the other contributed to the success of the project. They are my brothers Ya Saidu, Dan Azumi, Sani, my sisters Ya Habiba, Maman Idris, Ya Larai, my friends: Hashim, Muhammadu Sani, baba sheik, Ali Turaku, Usman, Shehum Bida, Yabagi Lokoja, Mallam Muazu and host of others.

It will amount to ungratefulness, if I should forget to acknowledge the contribution of my dear friends who have made my staying on campus a lively one, persons like Aitzaz Ashraf (Pakistan) a friend in deed, Safiu Gbodomosi, Biodun, Mushefiu Aderinola, Usman Nuhu Galadima, Muhammad Sani Muhammad and host of others. My prayers to Almighty Allah is to give all of us long live and abundant wealth. (Amen)

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ABSTRACT

This project report is on design and construction of FM (frequency modulation) transmitter with public address system. Due to man's curiosity for fast information dissemination, science and technology has made it so fast that information can be transmitted and received within seconds by electronics means. Information can be transmitted form one point to another through frequency modulation technique. Transmission of information through this means is so common, that it is found in almost every corner of our planet. A special integrated circuit (IC) was used for voltage amplification met gain and phase matched channels requirements. Also, the operational amplifier (OP – AMP) for low pass filter is overload protected on input and output with no latch up when common mode range is exceeded. External compensation capacitor is incorporated in the circuit for stability.

CHAPTER ONE

1.0 INTRODUCTION

Radio transmitter is a generator of high frequency electric current whose characteristics of amplitude, frequency or phase angle may be altered or modulated in accordance with the intelligence to be transmitted.

The most significant aspect of science and technology is communication. This area of science and technology is also the fastest growing field in terms of its vast applications. There are many other forms of electronic communication some which are, transmission of radio, video, sound, and text all in electronic form from one point to another.

A radio transmitter is any device that radiator a communication refers to the sending, processing and reception of information using electrical means. (the information or message is to be sent, processed and received) in this contest transmitter, from its definition, play an important role in electrical communication.

Transmitter occupies the second stage in electrical communication system and lies between the input transducer and channel as shown in figure 1.1

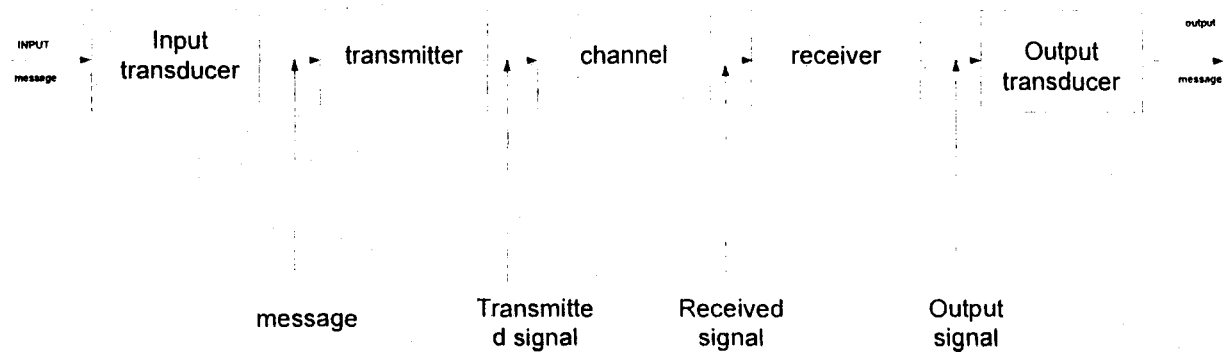

Fig 1.1: simple block diagram of a communication system.

A radio transmitter consists of several distinct major components to accomplished the objective of a particular design for a particular requirement. The power a transmitter delivers to the antenna may vary from a few watts to a few megawatts. Lower powers are used mainly for portable or mobile services, while higher powe4rs are required for broadcasting over large area and in point to point communication.

Depending on the characteristics of the electrical quantity modulated, transmitter can be classified as amplitude modulation transmitter (am transmitter) or frequency modulation transmitter (FM transmitter).

Frequency modulation (FM transmitter) or phase-angle modulation transmitter which is the same as FM transmitter.

The area of interest of this work I son FM transmitter, therefore, the discussion on AM transmitter will be brief.

AM transmitter is employed for broadcasting purposes at medium frequencies. The frequencies ranging from 535KHz – 160KHz, the power of RF carrier is specified by each country's body e.g FCC in America specified that for local area services the power at which AM should be transmitted is 1000watts while 50,000watts is for the largest stations serving large area and long distances.

FM, transmitters are basically similar to AM transmitters, except that the AM modulation amplifying systems is dispensed with and the exciter must be a variable frequency source. Frequency modulation (FM) and phase modulation system required much larger bandwidth is broadcast services, and are used mainly at very high frequency for broadcasting purpose.

One method of modulating the frequency at the exciter utilizes a reactance in the frequency determining section of the oscillator in the exciter. The reactance value is charge electronically or electrically in accordance with the low – frequency modulation signal. The transmitting frequency in FM transmitter is varied above and below the medium by an amount depending on the amplitude of the modulation signal and at a rate determined by the modulating signal.

Frequency modulation (FM), as employed in broadcasting occupies the frequency range between 88MHZ – 108MHZ and FM broadcasting stations operate in 100 channel with the spacing of 200Khz. The distance FM broadcasting station can cover ranges from 65km – 130km line of sight. For this reason it is employed in local broadcasting. Also, FM is used for sound channel in television services.

FM required more power for transmission. It provides grater signal – to noise ratio then amplitude modulation (AM) for the same antenna input power. There is also full provision for high fidelity, production, is ordinarily free of state, substantially suppresses noise and interference, and is relatively free of fading, the fading problem is being taken care of by a special circuit called automatic frequency control (AFC) incorporated in to the FM transmitter circuit.

The wireless broadcasting of information forms a major aspect of communication, which is used in the transfer of information from one point to several areas for public use. Among modes of broadcasting, frequency modulation, is the most preferred system due to its advantages over the others, some of which is responsible for its stereo quality. Its also has its short comings, mainly shorter are of broadcasting due to its line of sight characteristics.

The wireless broadcast type designed in this project is a frequency modulation (FM) transmitter, frequency modulation is a system of broad casting in which the amplitude of a carrier frequency is kept constant, while its frequency and rate of change are varied by the modulating signal. It is shown in the figure above. The first practical FM transmitter was put forward in 1936 as an alternative to AM in an effort to make radio transmission more resistant to noise.

A standard FM system is made up of sections namely the audio pre-amplification unit, oscillatory unit, modulation unit, amplification unit and the transmitting unit. The audio pre-amplification unit, transducers voice or sound into electrical pulses with the aid of a microphone. The modulating unit receives audio signals from the transducer, processes it then uses it to modulate the carrier frequency at the oscillatory unit. The modulating signal will cause the carrier to deviate from its resting frequency by a certain amount. The maximum deviation specified by the federal communication commission (FCC) is 750KHZ.

The amount of deviation ensures that the modulated signal is then fed into a class C amplifier, which amplifies the radio frequency for high transmitting power. The last section which is the transmission unit, consist of an antenna, which converts the modulated signal into electromagnetic waves for wireless transmission for public use.

The block diagram of an FM system is shown below

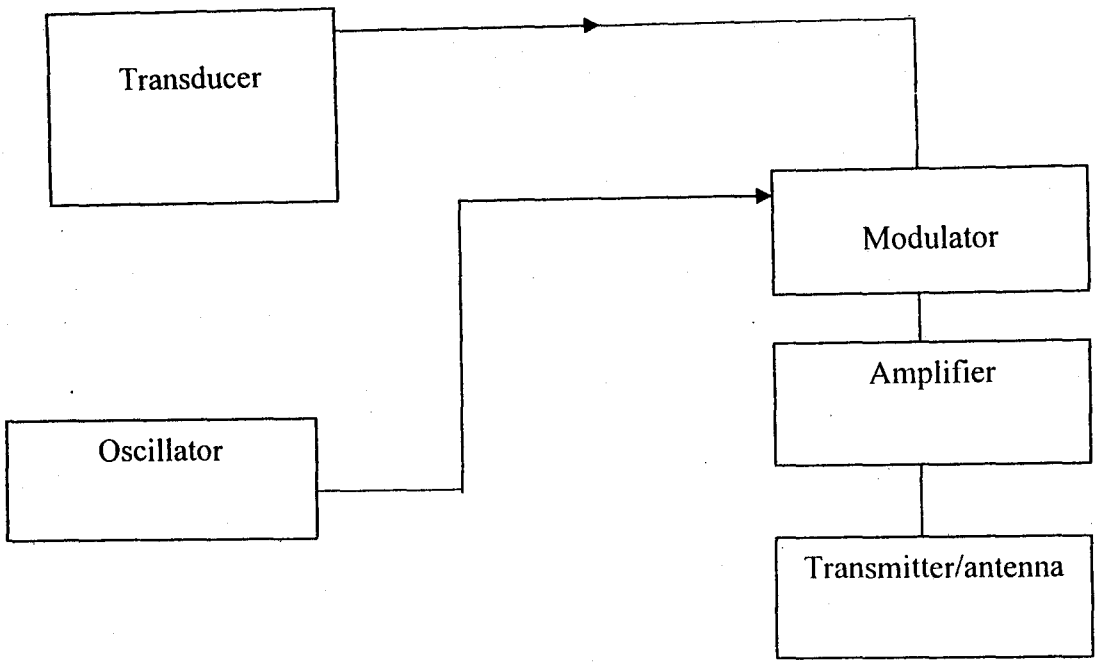

Fig 1.2: FM system block diagram

1.2 Methodology

The method used in the design of this project is the modular and unit approach, whereby the design is sub-divided into different units and modules, each of the units co-operating with other to achieve the objective of the project.

1.3 Aims and Objectives

1. FM transmitter provides a means whereby different people at different locations can receive information at the same time.
2. FM broadcasting provides the highest level of signal to noise ratio, and hence very resistant to noise.
3. FM transmitting with public addresses system requires the need for a reliable and efficient system of broadcasting.

4. To explains how this high efficient mode of broadcasting is designed.

1.4Project Outline

There are five (5) chapter in all, each chapter containing units and sections (i.e modules) concerning the project.

Chapter one and two general introduction and background information necessary for a proper comprehension of the project.

Chapter two has the theory and literature review of the project. Chapter three is the analysis of stages and definition of terms that constitute the project

Chapter four explains how the project was constructed and test, and the result of testing are given.

Chapter five gives the conclusion and recommendation for use and further research, and improvement.

References and appendix are given thereafter.

CHAPTER TWO

2.0 THEORY OF RADIO COMMUNICATION

2.1 THEORY OF THE WORK.

As define in the last chapter, a transmitter is any device that radiates a communication signal to be received by a receiver. A transmitter consists of some basic components. The block diagram shown in figure 2.1 gives a typical FM sound transmitter for broadcasting purpose.

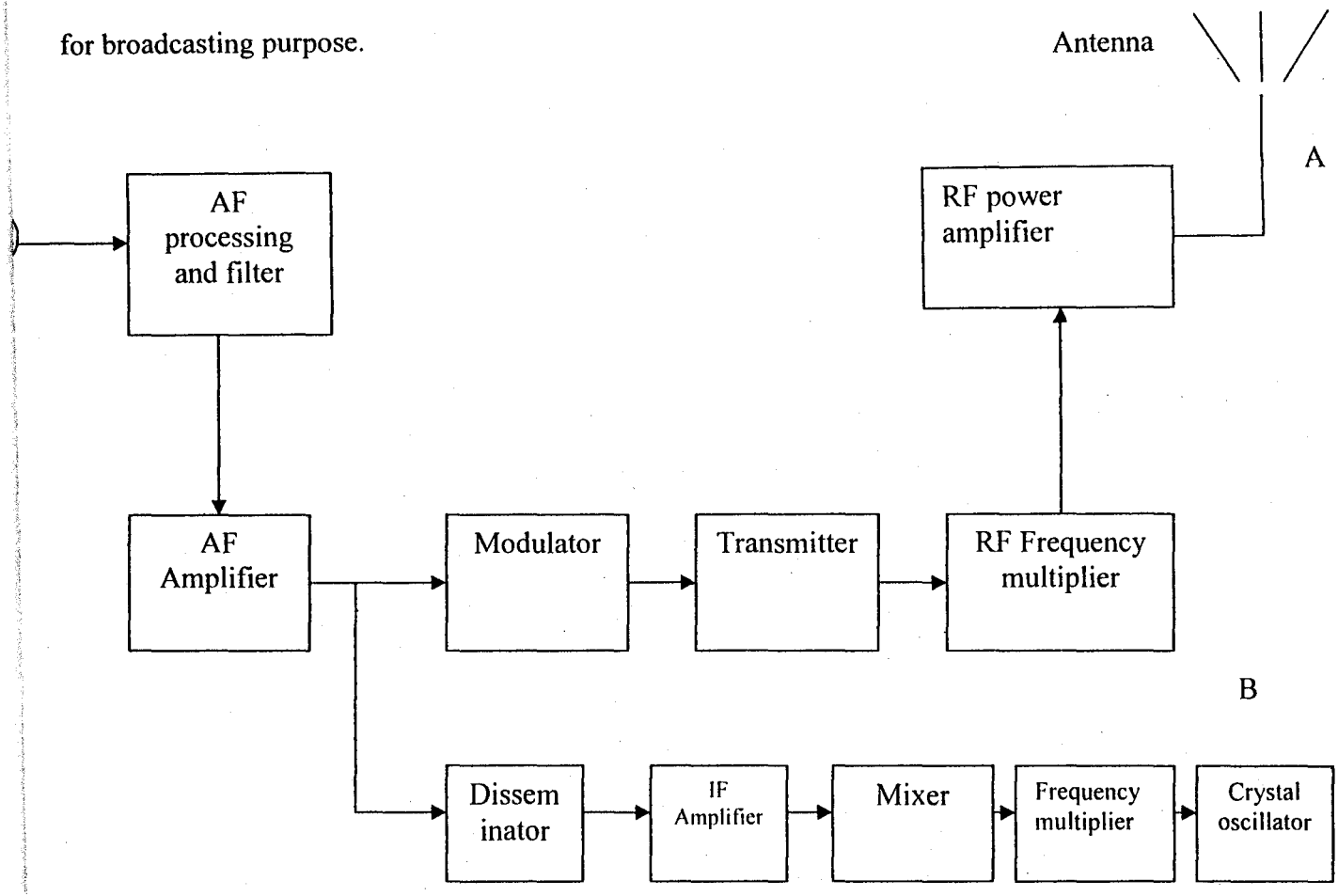

Fig 2.1: Block diagram of FM sound transmitter

The microphone converts the voice information to a message signal, which is processed, filtered and amplified within the required voice bandwidth of between 300HZ and 3.4Khz.

The FM modulator converts the changes in the message signal amplitude into frequency changes. The modulator may consist of a reactance modulator (e.g variator modulator) and an oscillator whose frequency is changed in accordance with the variation in the instantaneous value of the message signal. The resulting signal is then passed through a series of frequency. The final RF power amplifier boosts the power to a level high enough for radiation by the antenna.

The part B of the circuitry is called automatic frequency control network. The aim of the circuitry is to stabilize the centre frequency of the carrier signal so as to main broadcasting regulation that say the centre frequency of the carrier be held constant within specified limits.

2.2 Pre – Amplification Theory and Design Theory

Pre- amplifiers, amplifiers a low signal to a higher level power enough to driver the power amplifier to its maximum allowable power level.

The important factors are taken into consideration when designing a pre-amplifiers: - these are

1. Signal –to- noise factor: these are many ways in which noise could by introduced but for pre-amplifier, the two most likely sources of externally generated interference re noise introduced by the input signal lines and that due power supply .

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2. The other is from input and output: this is very important because the pre-amplifier is the stage that matches the signal source. The input in impedance of each stage in pre-amplifier should match the output of the preceding stage.

However, the basic consideration is to provide sufficient amplification on the input signal so that further signal handling adds minimal signal to noise degradation.

The design of a pre-amplifier must consider all potential signal degradation form source of noise, whether generated externally or within the pre-amplifier itself.

To achieve the objectives of this project the design of the pre-amplifier circuit is an oscillator with filter circuit and the type of oscillator employed is referred to as relaxation oscillator. However, an oscillator is an instrument for providing voltages that vary in a regular fashion the waveforms of the voltages that vary in a regular fashion the waveforms of the voltages are repeated exactly in equal successive intervals of time.

2.3 Literature Review

The transmission of intelligence between two or more points over wires or by radio is called communication are often used interchangeable, but telecommunication is usually preferred term when long distances are involved.

Electronic broadcasting requires a very accurate design to achieve a desired noise free transmission, since the aimed of transmission is to transfer information from one place to another without error or interference.

CHAPTER THREE

3.0 ANALYSIS, DEFINITION OF TERMS AND COMPONENTS

3.1 ANALYSIS

The diagrams below illustrated how FM and AM displaced in their signal waves: -

carrier frequency,

from V = FA 1

Where

V = constant velocity of light 3×10^8m/ss

F = frequency in hertz (or kilohertz)

λ = wavelength in meters (m)

F, λ are variable. For 2 given F, there is a constant λ.

From 1 $F = \frac{V}{\lambda}$ II

And

$\lambda = {}^{V}/_{F}$ III

Carrier frequency

FM:

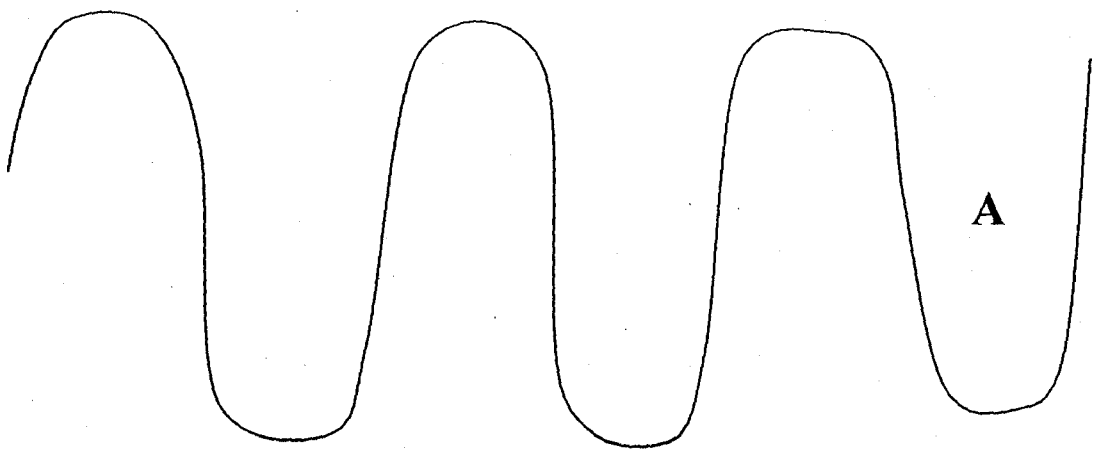

Fig 3.1: normal frequency modulation.

Frequency modulation (FM) additionally has the advantage, ever both AM and PM, of providing greater protection from noise for the lowest modulating frequencies. The resulting noise signal distribution is here seen as triangle, whereas it is rectangular in both AM and PM. A consequence of this is that FM is used for analog transmission, whereas PM is not. Because FM is used for analog transmission, whereas PM is not. Because FM broadcasting is a latecomer compared with AM broad casting, the system design has benefited from the experience gained with AM. Two of the notable benefits are the provision of guard. Bands between adjacent transmissions and the use of pre-emphasis and de emphasis with emphasis, the highest modulating frequencies are artificially boosted before transmission and correspondingly attenuated after reception, to reduce the effect of noise.

Without FM is for broadcast transmission, with or without stereo multiplier, and for the sound accompanying TV transmission. Narrowband FM is used for communications, in competition with single sideband (SSB), having its main applications in various forms of mobile communications, generally at frequencies above 30Mhz. two basic methods of generating FM, in which the tank circuit reactance, and a frequency of an oscillators is varied electronically by the modulating signal. To ensure adequate frequency stability, the output frequency is then compared with that of a crystal oscillating and corrected automatically as required. The alterative means of generating FM, the Armstrong system, is one in which PM is initially generated, but the modulating frequencies are correctly bass boosted, FM results in the output. Because only small frequency deviations are

possible in the basic Armstrong system, extensive frequency multiplication and mixing are used to increase deviation to the wanted value. The power and auxiliary stages of FM transmitters, except that FM has an advantage hence since it is a constant amplitude modulation system, all the power amplifiers can be operated in a class (i.e very efficiently)

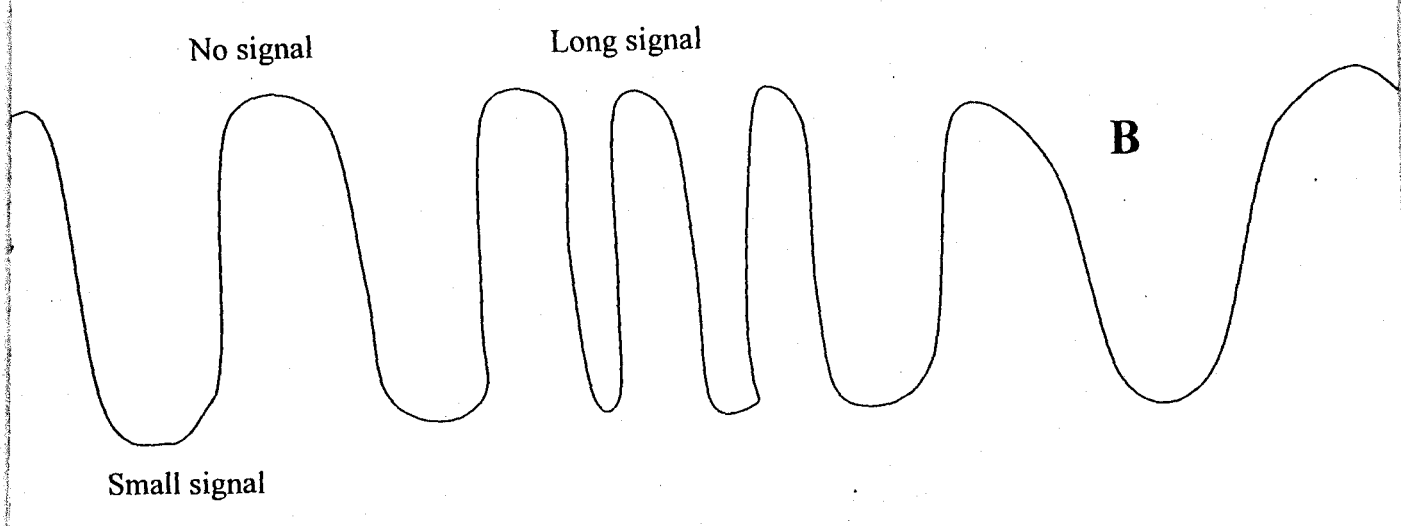

Figure 3.2: Radiating frequency modulation

Frequency modulation: Amplitude (a) is kept constant and the frequency changes with the signals.

From A

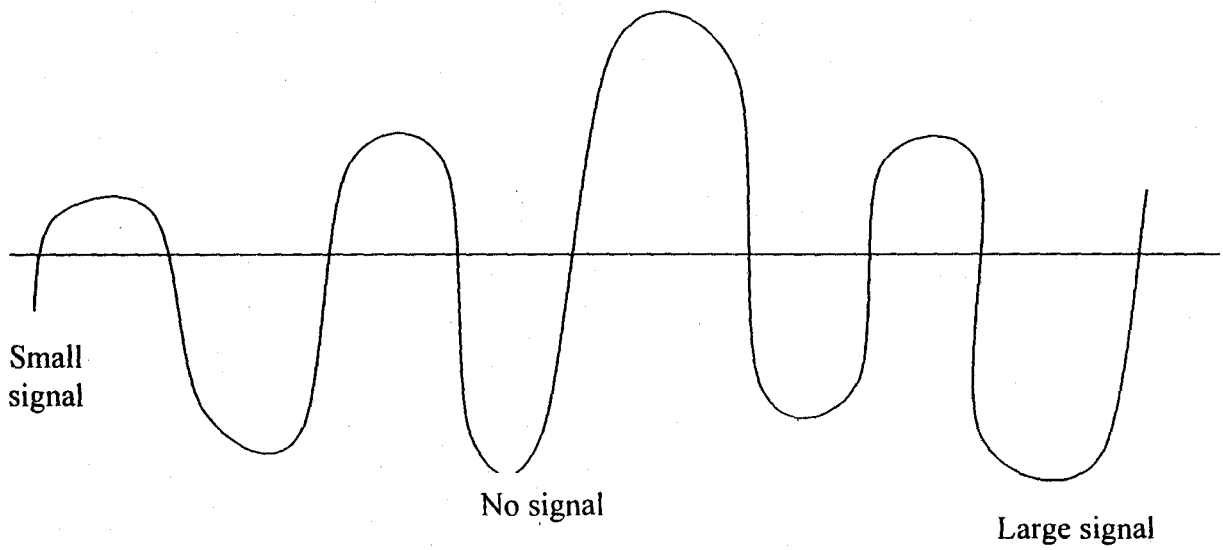

Fig 3.3: Amplitude modulation signal

In this project the small radiator (where L≤ λ) is used which is for frequencies in the range 10Khz – 1 GHZ. This type includes single. Dipole and slot. Radiators, strip and micro strip antennas. Having known the frequency of the transmission to be 108 MHZ (maximum FM range). Then the length of the antenna can be calculated by the ratio:

λ = V/F

Where

V = 3 x 10^8m/s, velocity of light in air

F = 108MHZ, Frequency with which the signal is to be radiated.

λ =?, wavelength of the signal

from : –

$$\lambda = V/F = \frac{3x10^8 m/s}{108x10^6 HZ}$$

$= 2.830m$

$\lambda \approx 3m$

Note: since 3M are too long and single dipole and slot radiators antenna are not available in our market, a strip of copper wire with length 3m was wound round a ferrite – rod to serve the purpose.

In designing good antenna there are some parameters, or characteristics, that are common to all antennas, which must be put into consideration. Among these parameters or characteristics are: -

I. Polarization

II. Radiation pattern (or polar diagram)

III. Band width etc

Antennas are classified into medium wav (or FM) Short wave (or HF), VHF/UHF, SHF, and optical waves other are small radiation where $L \leq \lambda$ traveling wave antennas, antennas arrays and operative type antennas.

An antenna or aerial is a structure that couples the output of a transmitter, or the input of a receiver to space. It either converts high frequency current into electromagnetic waves for radiation (transmitting antenna) or converts electromagnetic waves into high frequency current (receiver antenna). The same antenna can be used for either transmission or reception of radio waves or, even for both. Hence, antennas are reciprocal devices. In this project work the part B (i.e. gig 2.1) of the generalized FM sound transmitter is absent since the project is not meant for commercial purposes. Also it should be noted that there are two types of transmitters. They are noted that there two types of transmitters. They are:

i) high level transmitter

ii) Low-level transmitter.

i) High level transmitter: this is an arrangement that makes it possible for the modulated signal to go straight into the air at the modulator /oscillator stage without the help of RF amplifier. This is because the power at which the signal is being modulated is high enough to send the signal to a far distance through the antenna. This is the type of transmitter that was adopted for this project work.

ii) Low level transmitter: in this type of transmitter arrangement the power at which the signal is being modulated is weak and after the modulation it cannot go far before it will fade off. Therefore to get the signal to its destination. There is need to increase the power at which the signal will be sent into the air. In order to achieve this at the output of the modulator/oscillator a RF power delivered to the antenna will be high enough to radiates the signal into the air to a longer distance.

The loudness of sound produced by a loud speaker varies with the output power the louder the sound. An electronic device called a pre-amplifier is sometimes necessary to make a very weak signal strong to be handled by an audio amplifier i.e power amplifier stage.

3.2 Audio Frequency Amplifier

The audio frequency (AF) developed at the output of the detector is next amplified. Thus increases the signal of AF signal before power of AF signal is finally fed to the ward speaker. The AF amplifier finally boosts the low frequency signal to a level high enough to drive the loudspeaker.

In this design transistors and resistor, capacitors were used as an audio amplifiers. The connections are down in the circuit diagram below.

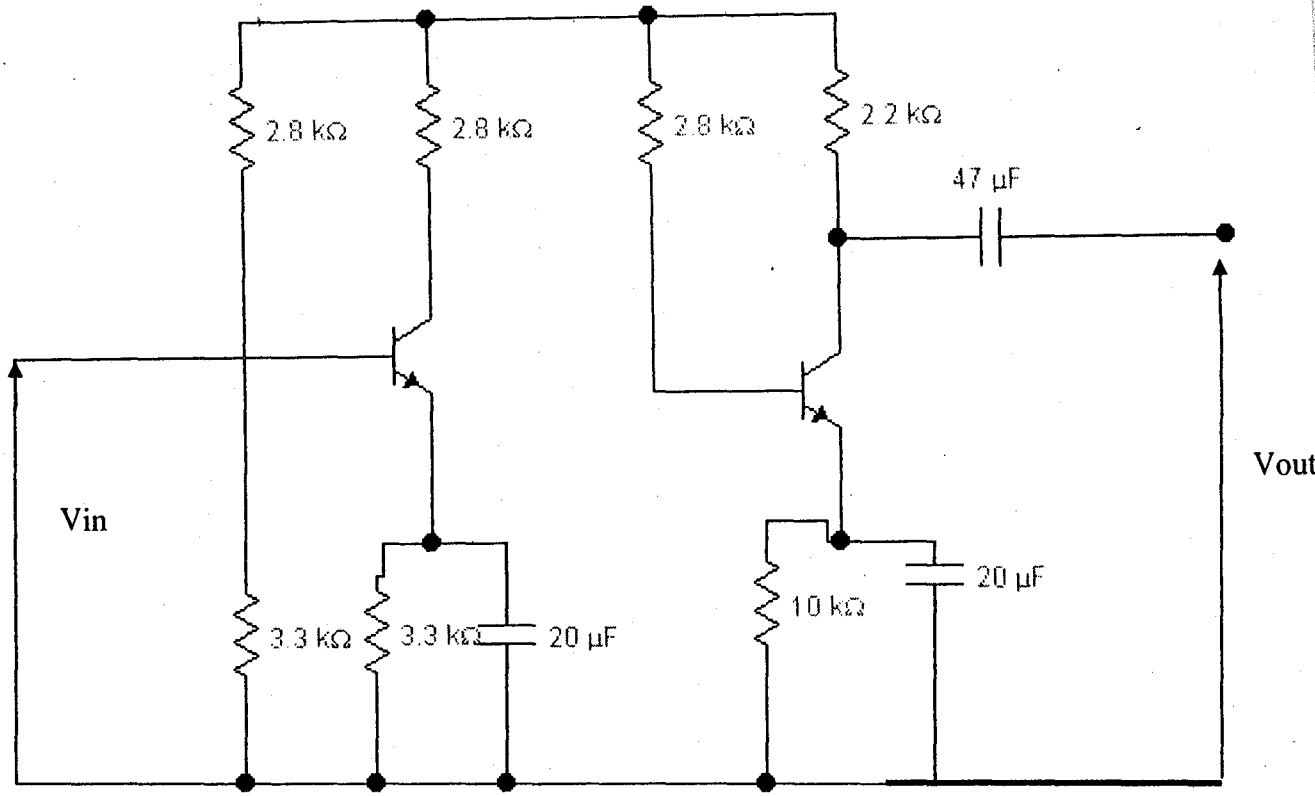

Fig 3.4 Audio Amplifier Circuit

3.3 Loud Speaker

The amplifier audio frequency (AF) signal is fed to the loudspeaker which is a transducer.

Loudspeaker converts low frequency alternating current energy into sound wav energy (acoustic wave). The loudspeaker used in this design employs the meaning coil or electromagnetic type as shown in figure below.

The audio signal is applied to the voice coil between magnetic pole pieces while produces a radial magnetic field set up by he audio current in the voice coil and the static magnetic field makes the voice coil to oscillate along its own axis at the frequency of the applied audio signal. The magnitude of the force on the coil is given by the expression:

$F = BIL$

Where

f = magnitude of a force in (N)

L = Length of the wire in the voice in (M)

B = Magnetic flux density within the air gap in (WB)

I= audio current flowing in the coil in (A)

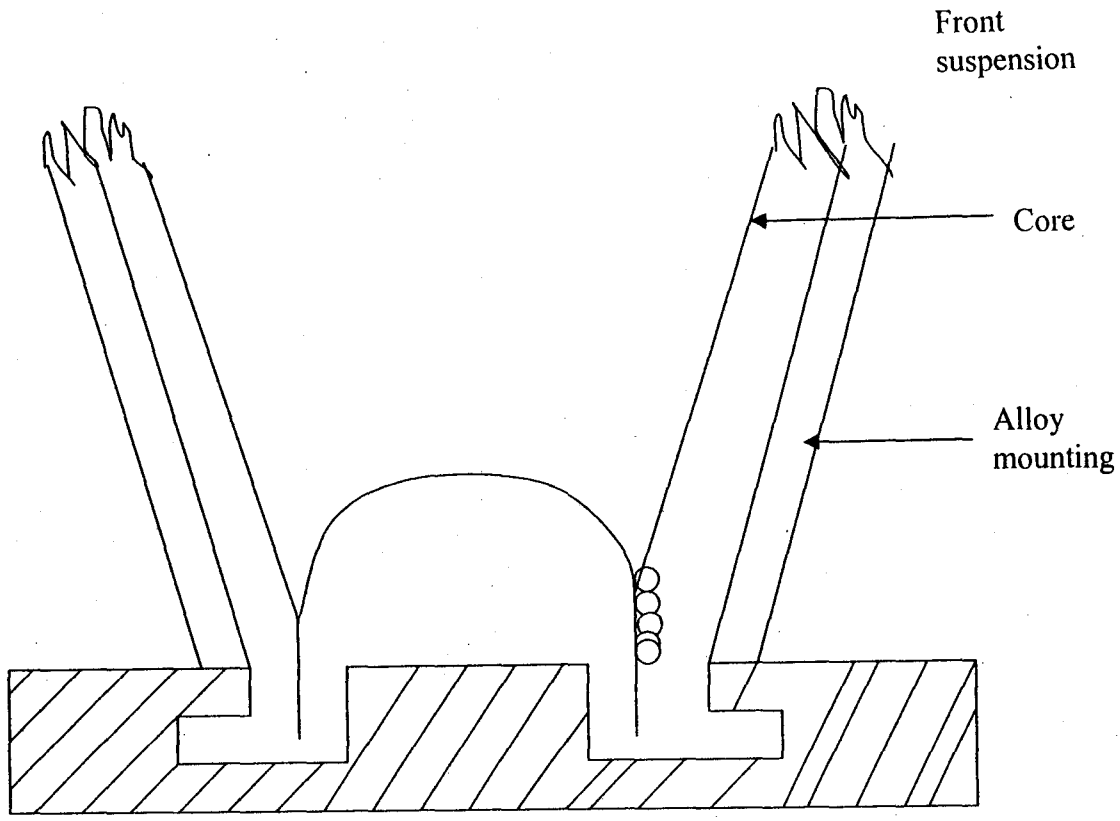

Fig 3.6: Cross section of a moving coil loudspeaker

3.4 Transducer

The transducers are generally used to convert physical quantities into electrical signals. The one used in this system converts sound into electrical pulses, by changing movement caused by air pressure into electrical pulses. This process is achieved with the use of a carbon microphone which changes movement caused by air pressure form a sound source into electrical pulses.

A single 4 kilo ohms MC480 carbon microphone is used to achieve this purpose. There are different types of microphones but for simplicity and convenience a small microphone is used. The signal input to the microphone is made small in order not to over drive the microphone circuit which could result s to positive feedback of the microphone. A loud humming sound could be heard due to this effect at the receiving end

The microphone to produce the required current need for it operation .

$$I_{in} = \frac{V_S}{R_{IN}} = \frac{9^V}{24K\Omega} = 0.0034MA.$$

Although it is wireless microphone but the receiver has I_{in} = 0.0034Ma

3.5 Modulation Unit

This is the unit where the audio signal is combined with carrier frequency to produce the frequency modulation. At this stage the audio signal is used to vary of shift the frequency of a carrier. The frequency of the carrier is determined by the values of he capacitance and inductance.

An oscillator circuit is used to achieve this purpose. The carrier frequency for this design is meant to be 95.0mhz carrier frequency. This design is meant to be 95.0mHZ. the values of the capacitance and inductance used to produce a 96.0Mhz. is carefully calculated to achieve a 95.0Mhz carrier circuit which work together to generate the required modulated signal for transmission.

The carrier frequency is determined using

$$F = \frac{I}{2\pi LC} \qquad 3.7$$

Where

$$\pi = \frac{22}{7} = 3.142$$

$$l = 0.152mH$$

$$C = 23\mu F$$

$$\therefore F = \frac{1}{2X\pi X23X10^{0-6}X0.152X10^{-2}}$$

$$= 96.0mhZ$$

The hfe of the transistor C830 is 100

$$\text{hfe} = \frac{outputcurrent}{inputcurrent} \qquad 3.8$$

input current = 0.34Ma

output current $=10^{-2}$x 0.34 = 3.4Ma

$$\text{deviation radio} = \frac{Fdeve(\max)}{Faf(\max)} \qquad 3.9$$

where

Fdev = is the maximum deviation of the carrier frequency

Faf = is the maximum modulation frequency

Fdev = 75Mhz

Faf = 15KHZ

Therefore deviation ration = $\frac{75}{15} = 5.0$. this is the maximum allowed in commercially broadcast FM.

The carrier power pc is given as follows: $p = V^2/R$

Where v= is carrier voltage R = carrier resistance, V = qv, R = 7Ω

Therefore $pc = 9^2/7 = 11.6$watts.

Transistor C830 has an hfe of 100

$\frac{output}{input}, where input signal = 0.003mA$

Hfe = $hfe = 100$

Output signal amplification = 100 x 0.0034

= 0.34Ma

signal power = IV, where V = Signal voltage

I = Signal current.

Signal power = 0.34 x 9 = 3.06watts

Modulation power Mp is the summation of carrier and signal power which is given as signal power + carrier power is 3.06 watts

Carrier power is 11.6watt. therefore modulating power

Mp = 3.06 + 11.6 = 14.66watts.

3.6 The power supply

the TTNCS used run on a power supply of ± 5%.thus the supply must be regulated to prevent any fluctuations in voltage level. Its design is given below.

The main voltage of 220V is stepped down by a 220V/9V = 1.2A transformer. It is then rectified by a full wave bridge rectifier.

The wave form of this stage has no negative component but a lot of ripple. Smoothing capacitors are needed to reduce the ripple to an acceptable level. The resulting ripple voltage can be calculated by considering the wave given below.

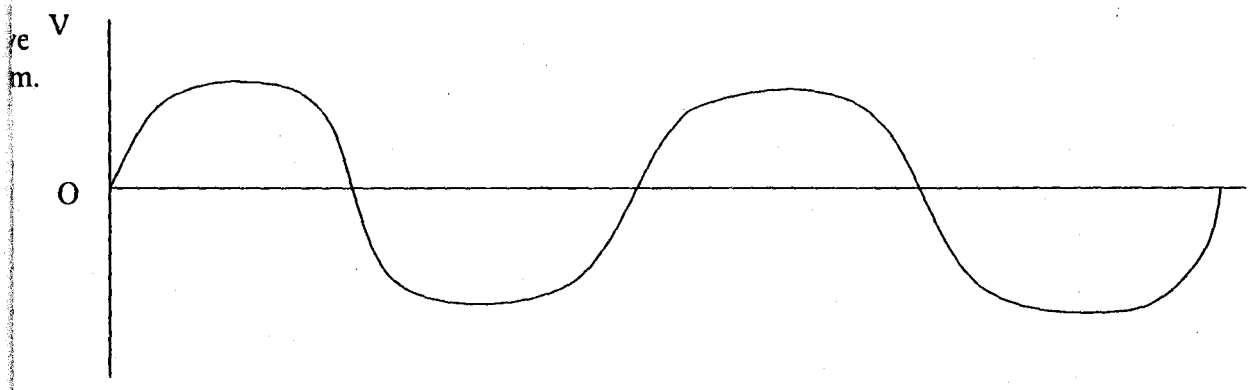

Figure 3.6 power supply waveforms

However, the power supply unit are electronic circuit provided direct current D.C voltages and current from A.C. sources from the mainly supply. The output d.c signal is used to operate the constructed project.

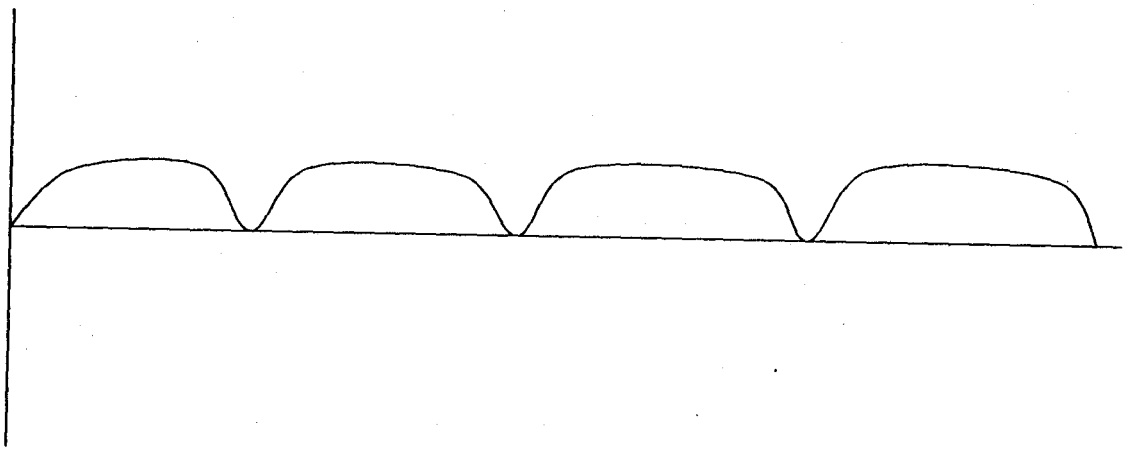

Fig: 3.6: Rectified wave form

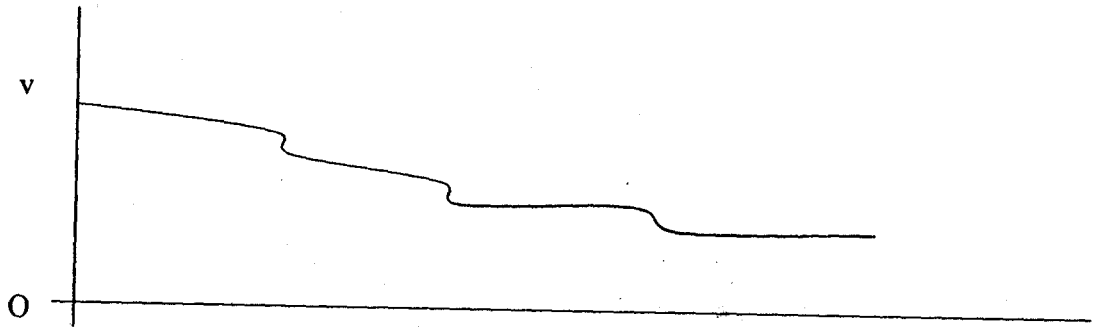

Fig 3.8: power supply waveforms

3.7 Transmission Unit

The transmission unit consists of basically an antenna which converts the modulated signals into electromagnetic waves for wireless broadcasting. The antenna type used here is a 5 Ω .four (4) ohms is used here to establish impedance matching which is very necessary in preventing over driving the modulating system or the antenna. The transmitting range of the transmitter depends on the height of the antenna and the transmitting power of the modulated signal. Since the predicted transmitting of 0.2, meters is used to achieve this range. The diagram shows the antenna.

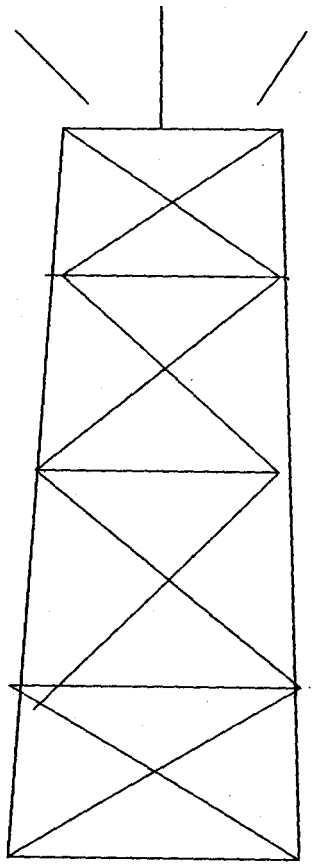

Fig: 3.7 Antenna

3.8 Definitions of Terms

FM – frequency modulation

RF – Radio Frequency

IF – Intermediate frequency

AC – Alternating current

DC – Direct current

V – Voltage

R- Resistor

C – Capacitors

I – current

KHZ-kilo hertz

HZ-hertz

MHZ – mega hertz

IC-Integrated circuit

F – Farad

A – Ampere

CW – Carrier wave.

H-F –High frequency

L-F-Low frequency

TRANSFORMER; its job is either to step up or (mostly) step down the a.c supply voltage to suit the requirement of the solid state electronics devices and circuits

RECTIFIER: this is a circuit which employs one or more diodes to converts a.c voltages to pulsating d.c voltages.

FILTER: this function of this circuit element is to remove the fluctuation or pulsations (called ripples) present in the output voltage supplied by he rectifier.

VOLTAGE REGULATOR: this is to keep the terminal voltage of the d.c supply constant even when a.c input voltage to the transformer varies (deviation from 220V are common) or the load varies.

SOUND: It is a soft of disturbance which requires some physical medium for its propagation. Human voice consist of a series of compression and rarefaction which travels through air with a velocity of about 345m/s. the frequency range of human voice is from 20-400HZ.

CHAPTER FOUR

4.0 CONSTRUCTION, TESTING AND RESULT.

From the design, it could be noted that not all values from calculations that are standard values. Due to this fact, the nearest valued are used for the construction of the circuit. The complete frequency modulation transmitter circuit design consists of stages . the pre-amplifier stage, he modulation stage, the oscillation stage. The class amplifier stage and he transmission stage. These stages perform their various functions to achieve the desired goal of this project.

4.1 Construction

The design was carried out in stages, one unit after the other using a board or testing board. The first stage for transducing voice or sound into electrical signals. Capacitors were also used to filter and block any d.c signals at the output of this stage from upsetting the next bias. At this stage, resistors were also used to establish the required bias voltage and current levels for the other components in action.

The modulation stage consists of a transistor capacitors resistors and an inductor. The transistor here, amplifiers the audios signals to an ideal level for modulation. The capacitors block all d.c component from affecting the a.c signals. The inductor establishes the bias for the collector and prevents the a.c signals from driving into the power supply. The resistors establish bias at various terminals for the transistor modulation the oscillation stage consist of an inductor capacitors. Resistors and a transistor.

Capacitor and inductor combine in parallel form to produce an oscillator which produces the carrier frequency to be modulated.

The transistor amplifies the carrier frequency and also acts as a feed back for the oscillator in order to stabilize the frequency of oscillation. The resistors here, also establish required bias for the transistor terminals.

The amplifying stage, consist of a class B amplifier resistors and capacitors. The class B amplifier which is deal for AF amplification is used to amplify the AF signals to an ideal level for broadcasting. The resistors here also establish the necessary bias for the terminals of the class c transistor. The capacitor also filters the signal output and blocks all the d.c component of the signal from affecting the next bias.

The transmission/transmitting stage, consists of mainly an antenna. The antenna type is capable of dissipating the output AF signal of the class B amplifier.

After these stages were assemble on different bread boards and tested accordingly, they were later connected together sequentially, for final testing before assembling and soldering on a veroboard. The result of the test was satisfactorily after minor adjustment on the circuit design. The divide on the breadboard was later transferred component by component for final soldering on a vero board.

The device on the veroboad was later transferred to a housing of a well treated wooden materials having the following dimension 20cm x 25cm x 36cm.

Moreover, the 200W amplifier is constructed on a single module. The powder amplifier transistors were mounted directly on the verobaod which served as a link between the veroboard and the heat sink in turn was mounted directly on the back panel of the system.

4.2 Testing

Microphone was considered first in the testing of this device because it is the first component in the FM system. Two important characteristics of the microphone are their impedance and pick –up pattern for this test. A 10k impedance microphone of about 2.5MV output voltage was chosen to match the input impedance of the pre-amplified circuit. Initially when the system was tested with an FM receiver (i.e Radio), there was serious distortion in the signal output, which was done to over modulation. It was corrected by limiting the modulating signal to an ideal level. The final testing was carried out by checking the frequency range of the transmitting frequency. This was necessary due to the fact that commercial broadcasting frequency modulating channel occupies 200Khz of which 180KHZ is used, and the remaining 20KHZ guard band goes a long way towards, reducing adjacent channel interference even further. This test is necessary to ensure that too much frequency range is not occupied. The use of a digital FM receiver was accurately used to carry out this procedure which achieved the desired result.

4.3 Result

It was noticed that as the inductor of the oscillator was varied, the carrier frequency also changed. This particular properly is very useful, in the sense that the transmitting frequency can be changed in case the transmitting frequency interferes with another broadcasting stations transmitting frequency.

The transmitting range of this system occupies about 200meters radius, which depends on antenna height and the transmitting power.

The signals generated at different stages of the FM system were studied by the use of oscilloscope considering a microphone as source of signal. The following different illustrate the performance.

4.4 Trouble Shooting Checks

The following trouble checks will help to locate major faults occurring in the FM transmitter.

When the system is on and the light emitting diode is not glowing, the power supply may be faulty.

When the system is on but there is no output, the system may be put under fault investigation. The fault may be a disconnection of a component or its complete deterioration.

When a loud humming sound is heard from the receiver unit, the system may be too close to the receiver.

When there is transmission signal but no signal, the microphone may be faulty.

4.5 Discussion of Result

The project has been designed to produce a predicted transmitting of 200meters. Since there is no formula to estimate the maximum transmitting range, the height of the antenna and the transmitting power are used to estimate transmission range could be achieved due to the following reasons:

i. Power loses along connecting cables.

ii. Error introduced by measuring equipment

iii. The non exactness of components values

iv. Power consumed by power components (transistors and resistors).

Since the project was designed to work within the limits 0.876 gained for a 100hrs of operation can certify the efficiency of the system.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

The frequency modulation transmitter designed in this project worked within the limit of human errors. It was constructed successfully not without hitches anyway.

Moreover a few difficulties were encountered before the completion of the projects. First among these was finance. Although the design was done with components that are really available, the market price was too high for the smallest components however on the whole we have learnt a lot theoretically and practically in the process of the design.

5.2 Recommendation

An aspect of vital importance is the maintenance of the device. It is recommended here to be familiar with the precautions in case of any fault, it is advisable not to open the device if the user is a layman. Safety remove the supply cable and bring the device to a well trained person.

The financing of the project is also a very important issue. More often students of have some bright ideas on the project but due to the cost of its implementation, it is dropped. Recommend that the department should find a way assisting students undertaking construction projects. The supervision have sounded ideas on a particular proposed project before taken it.

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