# DESIGN AND CONSTRUCTION OF MOBILE PHONE SIGNAL JAMMER

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**(2005 / 22073EE)**

**DEPARTMENT OF ELECTRICAL/COMPUTER ENGINEERING,**

**FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA**

**OCTOBER, 2010**

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A project submitted to the

Department of Electrical/Computer Engineering,
Federal University of Technology, Minna

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# DEDICATION

This project is dedicated to God almighty, the one and only true Omnipotent and Omniscience God

I also dedicate this project to my ever supporting Dad Mr. Ikokwu Eluwa for his financial and moral encouragement during the cause of this project. My dedication also goes to my one and only caring Mom Mrs. Ngozi Eluwa for her persistence prayers.

# DECLARATION

I Okezie David Chekwe, declares that this work was done by me and has never been presented elsewhere for the award of a degree. I also hereby relinquish the copyright to the Federal University of Technology, Minna.

OKEZIE DAVID CHEKWE

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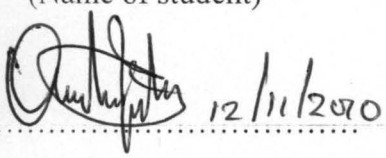
(Name of student)



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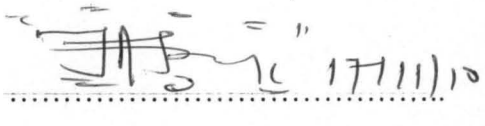

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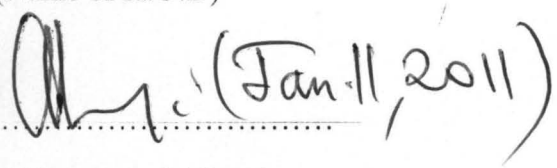
(Name of H.O.D)



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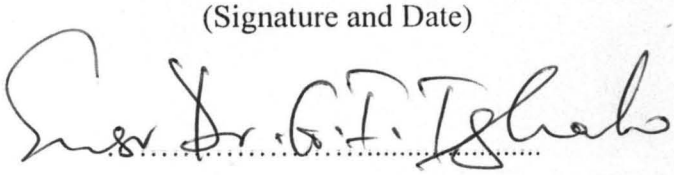

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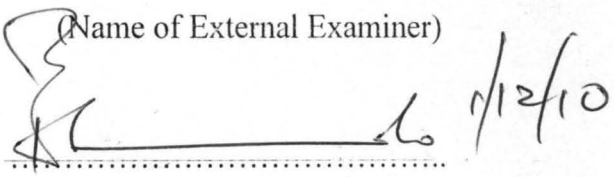

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# ACKNOWLEDGEMENT

All glory, honor and power be unto God almighty for the successful completion of this project. May his infinite goodness continue to abound on us, Amen

I wish to express my profound gratitude to my able and "Think and you can do it" supervisor Mr. J. A. Ajiboye for his support and believe in me throughout the period of my project undertaken. My truly appreciation goes to my laboratory supervisor in Mr. A. Bukola for guiding me through the difficult times of my circuit analysis. My profound appreciation also goes to my head of department (H.O.D) Engr. A. G. Raji, my level adviser Engr. M. B. Zungeru Adamu, DR. Jacob Tsado, and all the academics and non academics staff of Electrical and computer engineering department. I also acknowledge in a special way the unrelenting support and encouragement of my parent Mr. & Mrs. Ikokwu Eluwa, the encouraging effort of my elder brother Mr. Chidiebere Chekwe is also appreciated and I am saying thank you to all of you.

# ABSTRACT

Signal jammer is an electronic device that is use to block or jam the frequency of a transmitting device. Mobile phone signal jammer is used to interfere with the communication frequency within a specified radius depending on the strength of the signal jammer. This is achieved by generating and transmitting radio signal on the same frequency as the base station (BS) of the mobile phone and at high power so as to collide and cancels each other out.The method employed in achieving this project is pure analog using resistor, capacitor, inductor and transistor to generate the require frequency (noise) needed and then amplifier the frequency generated to about 800MHz to 1.4GHz in order to match the frequency of the phone being transmitted by the base station (BS).Jamming of a mobile phone succeeds, when a mobile phone within the area were the jamming device is, is disable. This is confirmed by the inability to make a call or to access mobile phone network service.The phone jammer helps to have control of mobile phone within some specified area where the distraction cause by mobile phone is highly undesirable.

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# CHAPTER ONE

## 1.1 INTRODUCTION

In line with the ongoing increase in the usage of mobile phone, there is a need to disable mobile phone in some specifics places where the use of cell phone is undesirable.

A global system mobile phone (GSM) jammer or a phone jammer is a device that transmit signal on the same frequency at which the GSM system operate, the jamming succeed, when the mobile phone in the area where the jammer is located is disable. A signal jammer or jamming transmitter is a small, low-powered transmitter that interferes with receivers in an area around the jammer. The radius of the jamming area will depend on the power of the jammer. [2]

The jammer transmits a signal that radiates from the jammer pretty much in all directions (for an Omni-directional antenna - which is what is usually on them). This small signal reaches all receivers within the area of its effective range and “swamp" the receivers in that area.

It should be noted that, the transmitters reaching out to receivers, are generally high power units. The jammer is low power, but because the signal from the transmitter is always far away from the receivers in the jammer's area, the signal from the transmitter is very tiny in that area. The jammer, on the other hand, has a "large" signal in that area because it's so close to those receivers [2].Signal jammer which is still under consideration weather it should be legally or not, be possessed and be use by the civilian, knowing it full effect on communication system such as the radio, telephone etc. still has its own advantages (importance) which cannot be overlooked or ignored.

## 1.2 OBJECTIVIES

- Signal jammer as a warfare device.

- To have full control of mobile phones within specified area.

- Signal jammer as a device against bugging.

1.2.1. ***Signal jammer as a warfare device*:** phone jammer was originally developed for the military as a warfare device to block any form of electronic communication from a sender to a receiver in an area where commanders or the enemies uses radio frequency (RF) communication to have a proper coordination and full control of their forces. With the increase of criminals and terrorist activities, the device (phone jammer) which primarily, was meant for the military was later allow to be used by the law enforcement agencies to interrupt communication by criminals and terrorist.

1.2.2. ***To have a full control of phones within a specified area***: Owing to the usefulness and advantages the phone has brought to the global communities, there are still some places where the ringing of cell is highly undesirable. Some of these places include worship centers, university lecture rooms, libraries, concert hall, meeting rooms and other places where silence is highly recommended.

1.2.3. ***Signal jammer as a device against bugging***: Signal jammer can also be seen as a device that can be used against bugging.

.***Bugging***: This is a deliberate act where a transmitter (conceal microphone) known as the bug is use to transmit an audio communication of a person or group of person without the person's

knowing. The conceal microphone (bug) transmit using RF frequency. Signal jammer also transmits on the same frequency but in an opposite signal wave that counterize the bugging signal. Hence phone jammer is very important in a meeting room where confidential matters are discussed to ensure confidentiality.

## 1.3 METHODOLOGY

This project is constructed using simple electronic component such as the resistor, capacitor, inductor and a transistor.

The resistor is use to regulate the amount of voltage and current going into the transistor

The capacitor in conjunction with the inductor forms the tank circuit which is the major oscillator or frequency generator sub circuit in the project circuit diagram. Some capacitors in the circuit diagram act as a filter.

Some transistor such as the BF30 is use to respond to a very high frequency.

# CHAPTER 2

## 2. LITERATURE REVIEW

A mobile phone jammer is an instrument used to prevent cellular phones from receiving signals from a base station. When used, the jammer effectively disables cellular phones. These devices can be used in practically any lòcation, but are found primarily in places where a phone call would be particularly disruptive because silence is expected.

## 2.1 HISTORY

The rapid increase in the usage of mobile phone at the beginning of the 21st century eventually raised problems such as their potential use to invade privacy or contribute to rampant and 0ffencive academic cheating. In addition, public strong reaction was growing against the intrusive disruption cell phones introduced in daily life. While older analog cell phones often suffered from chronically poor reception and could even be disconnected by simple interference such as high frequency noise, increasingly sophisticated digital phones have led to more elaborate counters. Cell phone jamming devices are an alternative to more expensive measures against cell phones, such as Faraday cages [1].

Faraday's cage is a device in form of a jammer that blocks virtually all electromagnetic radiation from entering or leaving building or a cage. [1]

## 2.2 WORKING PRINCIPLE

Cell phone jammer works by sending out radio waves along the same frequencies that cellular phone uses. This is achieved by transmitting a radio signal on the same frequency as the phone and at a high power that the signals collide and cancel each other out. This causes enough interference with the communication between cell phones and towers to render the phones unusable. On most mobile phones, the network would simply appear out of range. It's the amount of signal that gets to a receiver that is important. If a tiny transmitter (a jammer) is right on top of a receiver, it will hit that receiver hard compared to the tiny signal getting to that receiver from the (high powered) transmitter many miles away. The general rule of power for a transmitter getting to a receiver is that the signal strength is going to be the inverse square of the distance from that transmitter. That means that if you have "x" amount of signal at a given spot from a transmitter and then double your distance from the transmitter, the signal will be [1, 2]

$$X=\frac{1}{d^2} \tag{2.1}$$

Where X=Amount of signal

d=distance from the transmitter i.e. from the base station

$\frac{1}{2d^2}$ Or $\frac{1}{2^2}$ or 1/4th the amount you had before. Double the distance again and you're down to 1/16th the original amount of signal. A little transmitter works well to jam a receiver if it's right on top of it. It will blind the receiver to the real signal from the transmitter it is trying to capture.

Most cell phones use different bands to send and receive communications from towers (called frequency division duplexing, (FDD). Jammers can work by either disrupting phone to tower frequencies or tower to phone frequencies. Smaller handheld models block all bands from 800MHz to 1900MHz within a 30-foot range (9 meters). Small devices tend to use the former method, while larger more expensive models may interfere directly with the tower. The radius of cell phone jammers can range from a dozen feet for pocket models to kilometers for more dedicated units. The TRJ-89 jammer can block cellular communications for a 5-mile (8 km) radius.

Interestingly enough, small energy is required to disrupt signal from tower to mobile phone, than the signal from mobile phone to the tower (i.e. the base station), because the base station is located at larger distance from the jammer than the mobile phone and that is why the signal from the tower is not as strong as the signal jamming device. Jamming device transmits on the same radio frequency as the cell phone, disrupting the communication between the phone and the cell phone base stations; this is known as *denial-of-service attack*. [1, 2]

## 2.3 FORMS OF JAMMING TECHNIQUES

### 2.3.1 JAMMER

This type of device comes equipped with several independent oscillators transmitting 'jamming signal' capable of blocking frequencies used for paging devices as well as those used by cellular/personal computer system (PCS) control channel for call establishment. When active in a designated area, such devices will (by means RF interference) prevent all pagers and mobile

phone located in that area from receiving and transmitting calls. This type of device transmits only a jamming signal and has very poor frequency selectivity, which leads to interference with a larger amount of communication spectrum than it was originally intended to target

A technology Jim Mahan said "this form jammer is of two types". One is called brute force jammer, which just blocks everything. The problem is, it's like power-washing the airwaves and it bleeds over into the public broadcast area. The second took puts out a small amount of interference, and you could potentially confine it within a single cell block.

### 2.3.2 INTELLIGENT CELLULAR DISABLERS

Unlike jammer, intelligent cellular disabler device do not transmit an interfering signal on the control channel. The device, when located in a designated quite area, function as a dictator. It has a unique identification number for communication with the cellular base station. When an intelligent cellular disabler device detects the presence of a mobile phone in the quite room. filtering (i.e. the prevention of authorization of call establishment) is done by the software at the base station.

When a base station sends a signaling to a target user, the device after detecting simultaneously the presence of that signal and the presence of the target user, signal the base station that the target user is in a quiet room; therefore, do not establish the communication. Message can be routed to the user's voice-mail box, if the user subscribes to a voice mail service. This process of detection and interruption of call establishment is done during the interval normally reserved for signaling and handshaking. For emergency users, the intelligent detector device makes provisions for designated user who have emergency status. These users must pre-register their

phone number with the service provider. When an incoming call arrives, the detector reorganizes that number and the call are establish for a specified maximum duration, say two minutes. The emergency users are also allowed to makes outgoing calls. Similarly, the system is capable of reorganizing and allowing all emergency calls routed to '911'

### 2.3.3 ELETROMAGNETIC MAGNETIC INTENSITY (EMI)

This technique is using EMI suppression technique to make room into what called is a Faraday cage. Although labor intensive to construct, the Faraday cage essentially blocks or greatly attenuates, virtually all electromagnetic radiation from entering or leaving the cage or a target room as the case may be.

With current advance in EMI shielding techniques and commercially available products one could conceivable implement this into the architecture of newly designed building for a quite conference rooms. Emergency call will be blocked unless there was a way to receive and decode the 911 transmission, pass by coax outside the room and re-transmitted.[1, 2]

The circuit diagram for the mobile phone signal jammer consists of the following main stages-:

1. The power source

2. Noise generation

3. Radio frequency (RF)

4. Frequency multiplier

5. Frequency amplifier

**The power supply**: This supply the circuit with the require power it needs for its operation.

**Noise generation**: This is an oscillator that generates a high frequency about 45MHz to 50MHz to interfere with the mobile phone signal with the help of a transistor, capacitor, resistor and inductor. This stage also consists of some sub stages;

-Voltage divider: The voltage divider helps to control or regulate the amount of voltage going into the transistor by shearing the incoming voltage.

-Decoupling capacitor: Decoupling capacitor decoupling the signal from the d.c (battery) which might distort the signal.

-Feedback: The feedback capacitor regenerate the damping frequency been generated by the tank circuit.

-Tank circuit: This is the main frequency or signal generator circuit and it consists of an inductor and a capacitor.

**RF (radio frequency):** This radio frequency is a high frequency oscillator that generates frequency within the range of 200MHz to 800MHz with the help of a Bfw30 transistor having a frequency response of about 1.7GHz.

**Frequency multiplier**: This is the stage that multipliers or increase the RF frequency that has been missed with noise to match the frequency of network service provider

Where the input frequency at the stage is 650MHz, by passing through the multiplier, we will have 1.3 GHz at the output depending on the number of multiples

**Frequency amplifier:** At the frequency amplifying stage, the multiplied frequency is amplified to increase the jamming radius (area) with the help of an antenna.

## 2.4 MATERIAL SELECTION

The material selection for this project is based on its availability, simplicity and relative cheapness. The conductor use is manually constructed, because, the exact values required for this project are not available as at when the circuit is been constructed.

## 2.5 DIFFICULTIES THAT LIMIT PERFORMANCE

During the designing and construction of this project, some of the problems encountered are;

-*Problem of material selection*: Getting the exact or approximate value of the inductor needed for the project as of the time of construction was not available in the already made form; hence the need to make (construct) a local inductor was call for.

-*scarcity of high generating integrated circuit (IC):* The project circuit is a pure analog oriented; this is due to the unavailability of the IC to generate the required high frequency that was needed.

-*Interfering with the T.V. signal:* The jamming circuit, having the same frequency with the television transmitting frequency, was found to be interfering with the T.V signal. This interference could be seen as a problem because it was not intend.

# CHAPTER 3

The signal jamming circuit consists of five (5) major sub circuits which are namely:

1 Noise generator

The noise generator generate noisy frequency to interfere with the mobile signal

2 RF oscillator

This generate a higher frequency to help council the mobile phone signal

3 Frequency multiplier

Here, the generated frequency is multiplied in other to meet up with the amount of frequency required for the jamming

4 Frequency amplifiers

At this stage, the multiplied frequency is amplified

5 Power supply

This supplies the circuit with the right amount of power required for it operation

## BLOCK DIARAM

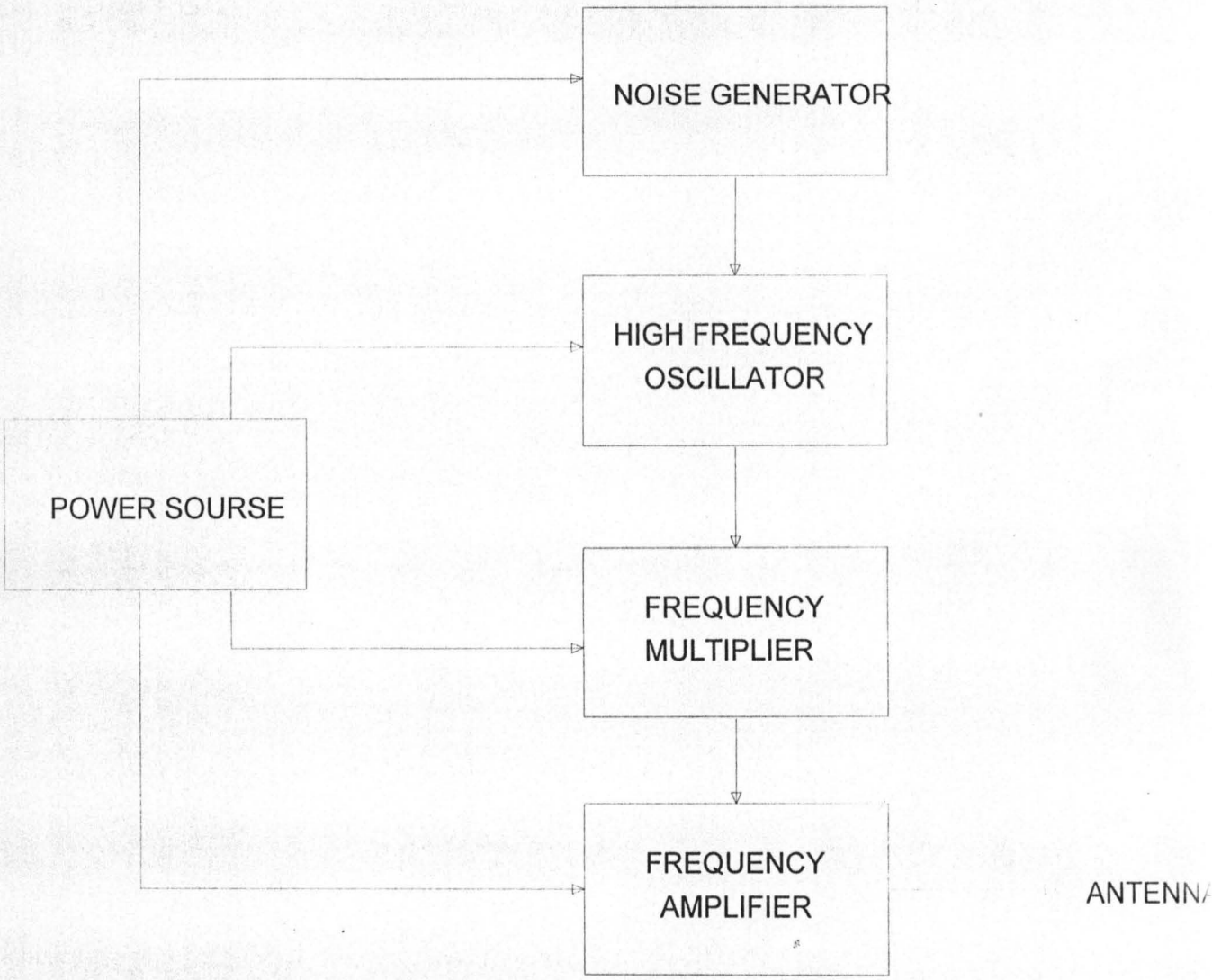


Fig (3.1) CIRCUIT BLOCK DIAGRAM

3.1 The noise generator: The noise generator is an oscillator made to generate high frequency up to 4MHz to interfere with the mobile signal. [4]

The part of the noise generator is divided into five (5) subparts which are the voltage divider, decompiling capacitor, feedback capacitor, tank circuit and a bypass capacitor.

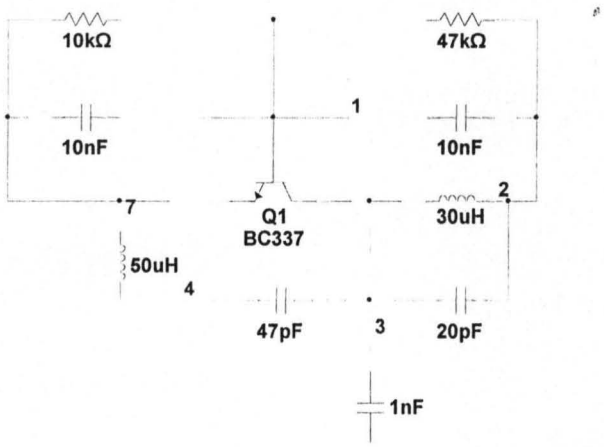


Fig (3.2) Noise generator

3.1.1 ` *Voltage divider.*

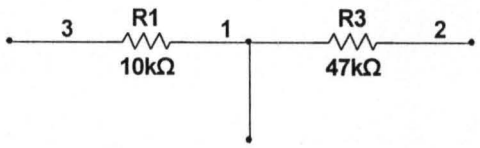


Fig (3.2.1) Voltage divider

The voltage divider is made up of two resistor connected in parallel to share or control the amount of voltage that get into the base of the transistor.

Base voltage, $V_b = \frac{9\times10\times10^3}{10\times10^3+47\times10^3}$

$$V_{b\ =1.57V}$$

Therefore the input base voltage to keep the transistor bias is 1.57v

3.1.2 *Decoupling capacitor*

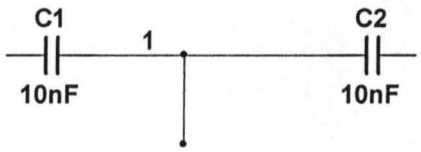


Fig (3.2.2) Decouplier

Decouples the signal from the battery source because the battery source act as negative feedback might distort the signal, therefore the decouple capacitor will in a way to disconnect the battery from the channel. The capacitors is connected in parallel

Frequency rang = 100 kHz - 45MHz

$10nF + 10nF$

$=10 \times 10^{-9} + 10 \times 10^{-9} = 20 \times 10^{-9}$

Therefore current signal channel to the base will be $I_C = \frac{V_{in}}{\frac{-1}{WC_{in}}}$

Where $V_{in}$= 1.57v

$C_{in}$ is the coupling capacitor

$I_C$= is the current going through the transistor

$$I_C = \frac{1.52}{-1/2\pi \times 100 \times 10^{-3} \times 20 \times 10^{-9}}$$

$$I_C = \frac{1.52}{79.5} = 0.019$$

0.019amp =19mA

Hence 0.0019 is the decouple current from the battery to the base

3.1.3 *Feedback capacitor*

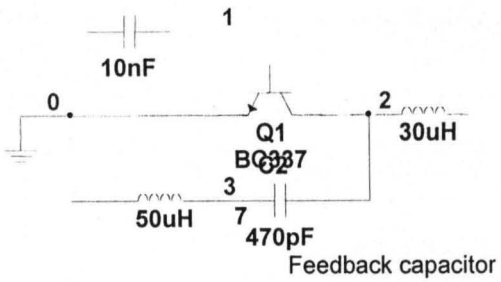


Fig (3.2.3) Positive feedback amplifier

The feedback capacitor is a capacitor that allows the regeneration of frequency at the tank circuit; this is because, in the absence of the feedback capacitor, the tank circuit will generate a damping frequency. Therefore, the feedback capacitor is a positive feedback voltage since the output voltage is feed to the input of the transistor to allow regeneration of frequency.

Caution should be taking when coupling a feedback capacitor to avoid shunting of the voltage

amplifier of the frequency by the transistor which is the gain of the transistor.

Therefore, voltage gain of the transistor = $\frac{V_{out}}{V_{in}}$

Voltage output = $I_c + R_c$

Gain = $\frac{Ic \times Rc}{Vin}$

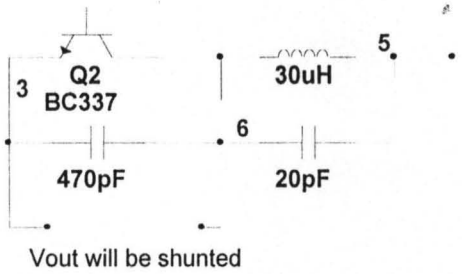


Fig (3.2.3.1) Shunting of transistor (positive feedback amplifier)

Therefore if a capacitor of Xl (reactance) is made as a feedback across emitter and collector, it will distort the gain of the amplifier and thereby making it a conductance.

$G_{ain/X_l} = \frac{I_c \times R_C}{V_{in} \times X_c}$ Where

$\frac{\text{Gain}}{R_C} = \frac{I_c \times R_C}{V_{in} \times X_c}$

$\frac{\text{Gain}}{R_C} = \frac{I_c}{V_{in}}$

Conductance = $\frac{I_c}{V_{in}}$

Gain has been converted to conductance at this point; the transistor cannot amplify the peak to peak voltage of the amplifier.

3.1.4 *Tank circuit (oscillator circuit)*

The tank circuit comprises of an inductor and a capacitor, couple to generate a radio frequency.

*Operation of the tank circuit*

The tank circuit consists of two reactive elements i.e. an inductor and a capacitor, both which are capable of storing energy. The capacitor stores energy in its electric field whenever there is potential difference across its plates. Similarly, a coil or an inductor stores energy in its magnetic field whenever current flows through it.

Suppose the capacitor is fully charge from a d.c. source, electron moves from plate A to plate B through coil L as shown by the arrow. This electron flow reduces the strength of the electric field and hence the amount of energy store in it. As electronic current starts flowing, the self induce e.m.f in the coil oppose the current flow. Hence, rate of discharge is somewhat slow down.

Due to the flow of current, magnetic is set up which stores the energy given out by the electric field

As plate A loses its electron by discharge, the electron has a tendency to die down and will eventually reduce to zero when all excess electrons on A are driven over to plate B so that both plates are reduce to the same potential. At that time, there is no electric field but the magnetic field has maximum value. However, due to self induction of the coil, more electrons are transfer to plate B than are necessary to make up the electron deficiency there. It means that now, plate B has more electron then plate A. Hence capacitor becomes charge again though in opposite direction as shown in fig c

The magnetic field L collapse and the energy given out by it is store in the electric field of the capacitor.

After this, the capacitor starts discharging in the opposite direction so that, now, the electrons move from plate B to plate A fig d. The electric field start collapsing whereas magnetic field start building up again though in opposite direction. However, these discharging electron overshoot and again an excess amount of electrons flow to plate A. thereby charging the capacitor once more.

This sequence of charging and discharging continues. The to and fro motion of electrons between the two plates of the capacitor constitutes an oscillator current.

This process involves the conversion of electric field to magnetic field and vice versa. [6]

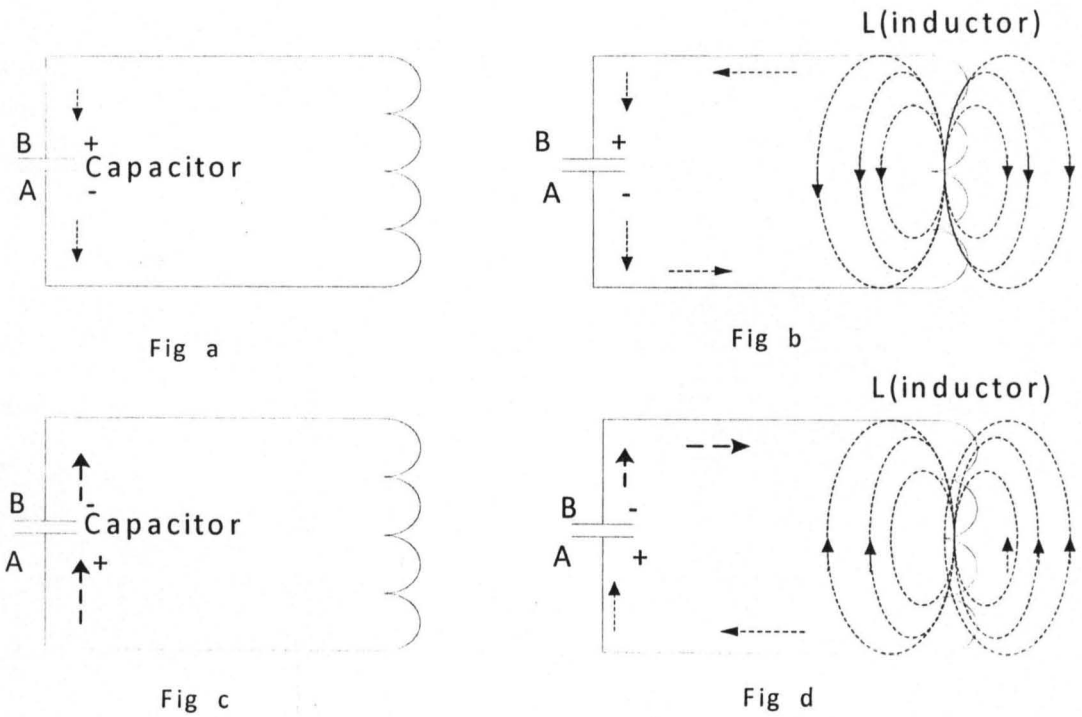


Fig (3.2.4 a, b, c and d) OSCILLATOR CIRCUIT [6]

3.1.5 *By pass capacitor*

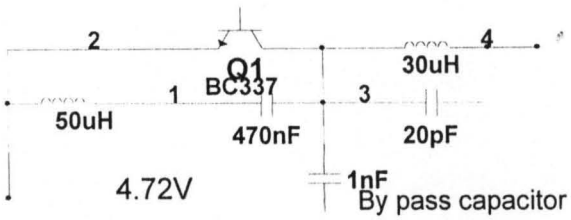


Fig (3.2.5) Bypass capacitor

The bypass capacitor is a coupling capacitor that allows only alternative signal (A. C) to pass and block any direct current (d.c).

There fore $\frac{Voltage\ base}{V_{in}} = \frac{r_{in}}{\sqrt{R^2in + \left(\frac{1}{W_c}\right)^2}}$

$$V_{in} = \frac{V_b \times \sqrt{R_{in}{}^2 + \left(\frac{1}{W_c}\right)^2}}{r_{in}}$$

$$V_b = \frac{9\times10\times10^3}{10\times10^3+10\times10^3} = 4.5$$

$$r_{in} = R_{BN}\ ||B(r_e + R_E)$$

Where $R_{b=}\ 10^3||10^3 = \frac{10^3\times10^3}{10^3+10^3}$ =5000

B = 200 = amplification factor

$(r_e + R_E)$= emitter resistor

$r_{in=}5000||B(r_e + R_E)$ ,

$$r_{e=}\ \frac{0.026}{I_E}$$

$$R_{b=} \frac{V_b - V_{BE}}{I_b}$$

$$I_b = \frac{V_b - V_{BE}}{R_b} = \frac{4.7-0.7}{5000}$$

$$I_b = \frac{4.0}{500} = 0.0008_{Amp}$$

$$I_c = I_b \times B$$

$$I_C = 0.0008 \times 200$$

$$I_C = 0.16_{Amp}$$

From, $r_e = \frac{V_E}{I_c}$

$$r_e = \frac{0.026}{0.16} = 0.1625\Omega$$

Therefore

$$r_{in} = 5000||200(0.1625 + 0)$$

$$r_{in} = 5000||32.5$$

$$r_{in} = \frac{5000 \times 32.5}{5000+32.5} = 32.3$$

But $V_{in=} V_b \times \frac{\sqrt{R^2 in + \left(\frac{1}{W_c}\right)^2}}{r_{in}}$

$$V_{in} = 4.7 \frac{\sqrt{32.3^2 + \left(\frac{1}{2\pi \times 45 \times 10^6 \times 1 \times 10^{-9}}\right)^2}}{32.3}$$

$$V_{in} = 4.7 \times \frac{\sqrt{32.3^2 + 12.50}}{32.3}$$

$$V_{in} = 4.27v$$

Hence, it was just 4.7v (volt) that pass through the 1nf at 45MHz

3.1.2 High frequency oscillator

The high frequency is an oscillator which generates frequency within the bandwidth of 200MHz to 700MHz with the help of the LC circuit which is parallel to each other. With the transistor Bfw30 having a frequency response of 1-1.7GHz, therefore posses the potential to amplify the high frequency. [4]

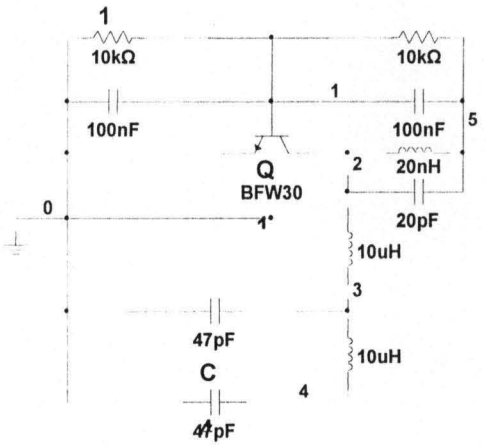


Fig (3.3) High frequency oscillator

*Mixing stage*

At the mixing stage, the noise generator signal was mixed with the high frequency generator signal; hence the two were modulated to yield frequency close to the frequency modulation, where lower frequencies were interpose in the high frequency.

3.1.3.a Frequency multiplier

The frequency multiplier is a device in the system that increases the number of the frequency by two times or three times harmonic frequency of the input frequency.

Where the input frequency = 650MHz

Multiplying the frequency by 2, we will have.659×2 = 1.3MHz.

Therefore, this enables the frequency of the signal jammer to interfere with that of the mobile phone.

*Bandwidth*: The bandwidth of the frequency ranges from 45MHz to 1.3MHz. Any frequency of any receiver and transmitter that falls within this bandwidth will be interfered with by the signal jammer

3.1.3. b Frequency amplifier

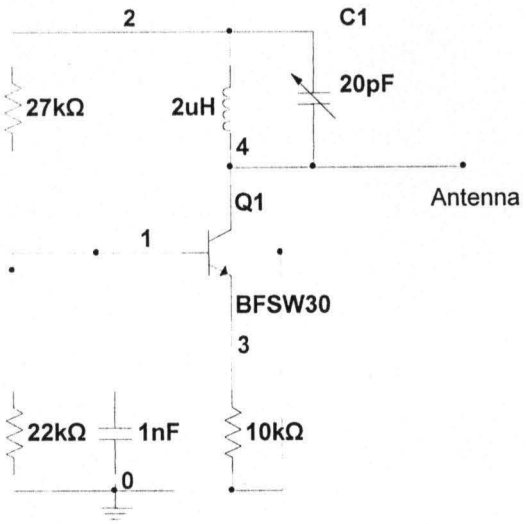


Fig (3.4) Frequency amplifier/multiplier

Frequency amplifier is a common base amplifier which has a low impedance and has high output impedance, in which the collector is connected to the tank circuit which also forms the circuit load. The output impedance is as high as 50KΩ, the amplifier can respond to frequency from a very low value to a high value of 1.3GHz.

3.1.4 Power supply

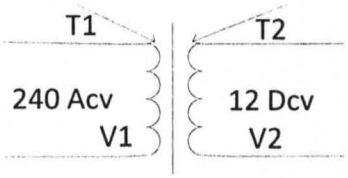


Fig (3.5) Transformer

Transformer is a device that creates a magnetic field around it coil when a current flow through the coil. The strength of the magnetic is determined by its number of turns and the amount of current passing through it.

Therefore transformer turn ratio is given by

$V1/V2 = T1/T2$

Where V1 = Primary voltage

V2 = Secondary voltage

T1 = Primary turns

T2 = Secondary turns

Transformer efficiency: This is the transformer output power ratio to the input power ratio.

The main transformer is design at 50 kHz or 60 KHz. The core are laminated silicon iron usually E and I in section.

Power rating: Rating of power transformer usually quotes a maximum rating of volte ampere (VA).

1VA = 0.6W

500Ma × 12 = 6watt

To convert to VA,

6/0.6 = 10VA

3.1.4.1 **Diode**

When p-type semi conductor is join to an n type semi conductor by a process known as diffusion .Electron from the n type region begin to cross over to fill the holes in the p region. This movement continues until a neutral zone known as the depletion layer is establish on either side of the pn junction. This depletion layer provides a potential barrier preventing further movement by electron across the junction.

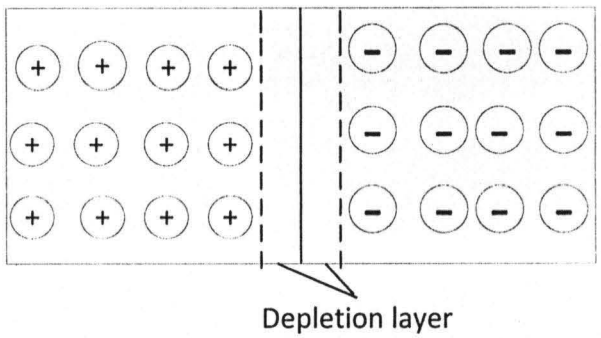


Fig (3.6) Electron and hole distribution in vicinity of a diode junction

3.1.4.2 *Diode configuration.* When the diode is revise bias, electrons in the n region are attracted to the positive electrode of the bias voltage which the holes in the p region are attracted to the negative electrode, the depletion layer is thus wider and producing a high potential barrier resisting further the flow of electron. [4]

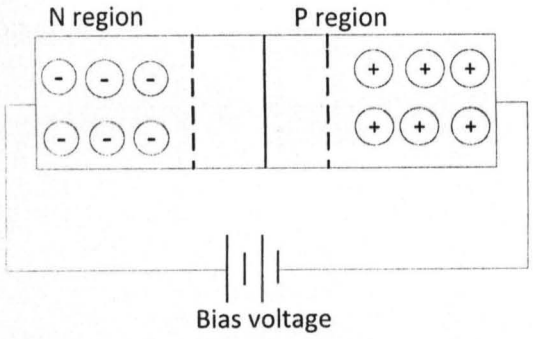


Fig (3.6.1 a) Reverse bias diode junction

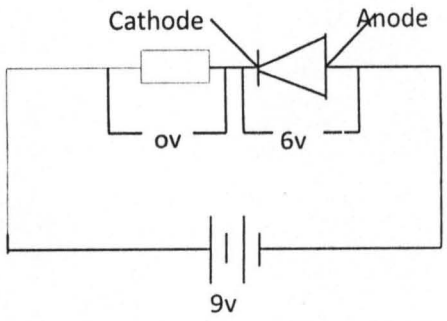


Fig (3.6.1 b) Reverse bias diode

A forward bias however removes the depletion layer allowing the electron to cross over, with current due to majority carrier flowing freely. The diode however, maintain a constant voltage drop across it, known as the forward voltage drop (0.3v for Germanium (Ge) and 0.6 for silicon (Si) diode)

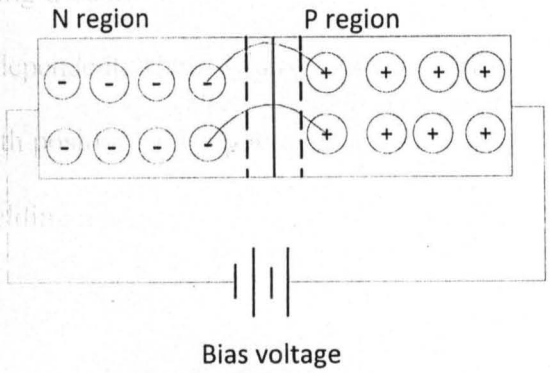


Fig (3.6.2.a) forward biased diode junction

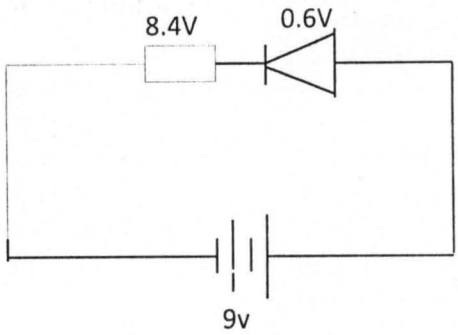


Fig (3.6.2.b) Forward biased diode

3.1.4.*3 Rectifier* (Bridge rectifier). The bridge rectifier is a full wave rectified wave form without using a center tapped transformer. In bridge rectifier circuit the output terminal are completely independent. There are two dc terminals; neither is common to the ac voltage. With This circuit, both positive and negative dc supply voltage can be produce. Connecting +dc terminal to ground yielding a negative supply, while connecting -dc terminal to the ground yield a positive supply.

Dividing this interval, the polarity of the ac voltage is such that it makes ac1 positive and ac2 negative. The polarity turns D1 and D3 on (forward bias) and D2 and D4 off (revise bias). As a result the current Ic through Rc has a direction from +dc to –dc. At interval t1 to t2 time ac1 is negative and ac2 is positive, hence D2 and D4 are on and D1 and D3 are off. The current through the load is the direction +dc and –dc. For either half of the ac voltage, the output has the same polarity resulting in the full wave rectified output wave form

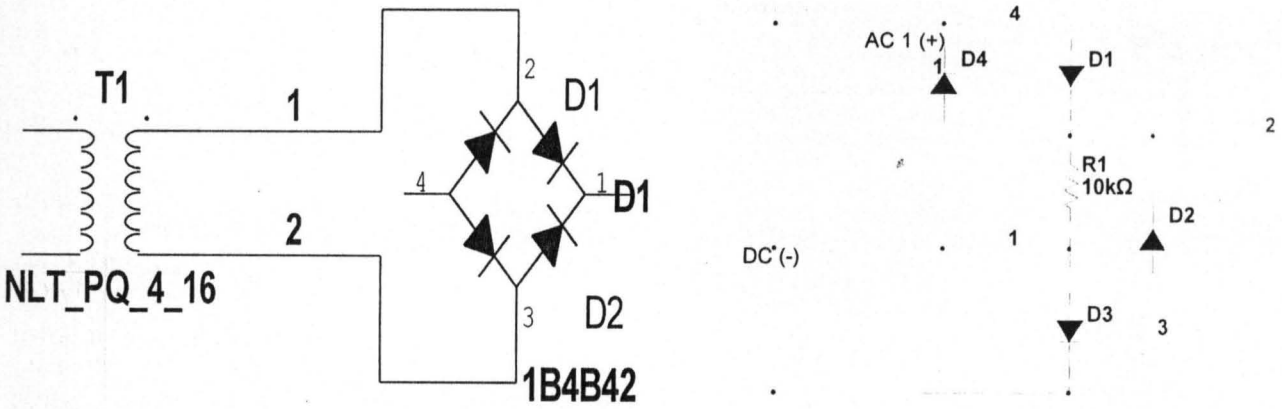


Fig (3.7) Bridge rectifiers

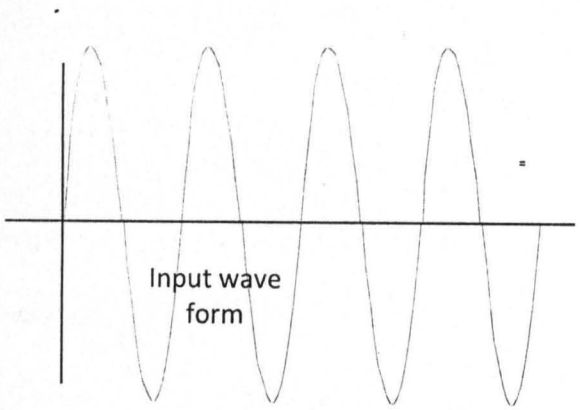


Fig (3.7.1.a) Unrectified wave

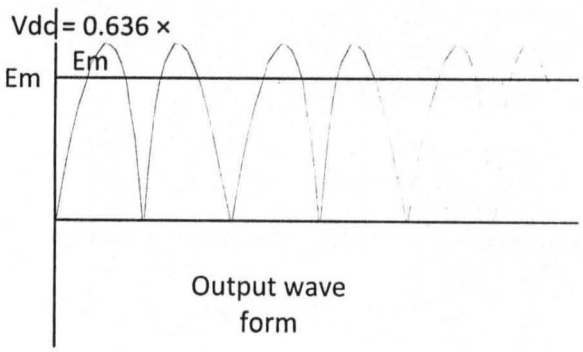


Fig (3.7.1.b) Rectified wave

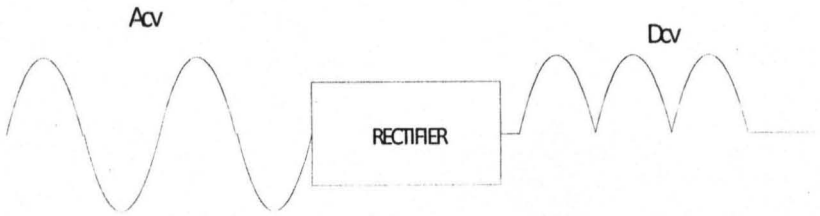


Fig (3.7.2) Rectifier

The transformer has 240rms is been step down by 20 times.

$\frac{240}{20}$=12rms

Therefore Em (voltage maximum) = 12×1.4414 = 17v

Therefore the vdc on the peak voltage = Vdc is

Vdc =2/π × 6 = 2/3.142 × 17 =10.82v. [4, 5]

*Filter.* The bridge rectifier wave form, contains ripple component, hence the voltage at the output keep varying with time, therefore a system such as high transmitter may not be able to tolerate it. The filter is added to the rectifier for filtering in which the primary purpose is to eliminate ac voltage which is affecting the dc voltage [4]

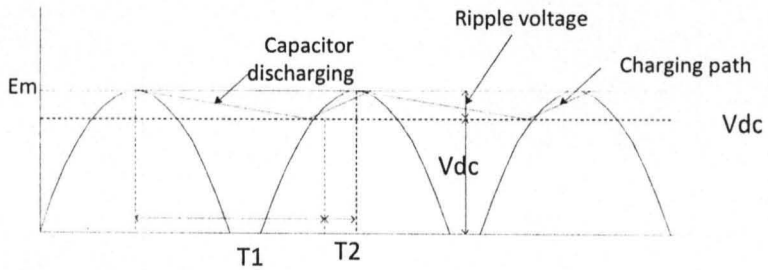


Fig (3.7.3) Filtering capacitor [4]

Where

$T_1$= time taken for the capacitor to start discharging

$T_2$= time taken for the capacitor to start charging

Em = maximum voltage

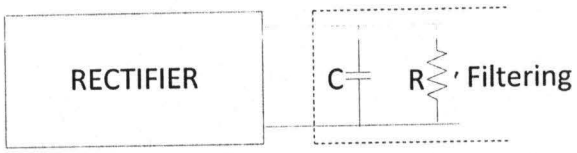


Fig (3.7.4) Rectifier, filtering capacitor and load

### 3.3 Component values

Where

C, Capacitor

L, Inductor

Q, Transistor

R, Resistor

Therefore

C1 10nF

C2 470Pf

C3 20pF

C4 1nF

C5 100nF

C6 47pF

C7 30pF-2pF (variable capacitor)

C8 12600pF

L1 30uH

L2 50uH

L3 20uH

L4 10uH

L5 2uH

Q1 BC337

Q2 BFW30

R1 10KΩ

R2 47KΩ

R3 22KΩ

**3.4 SIGNAL STRENGTH**

The signal strength or power density (p.d) of the jammer is given by

$$\text{P.d} = \frac{pt}{4\pi r^2} \qquad (3.1)$$

That is, the power density of the transmitter (either from the jammer or from the base station) to the receiver (mobile phone) is directly proportional to the transmitting power and indirectly proportional to the square of its distance "r" between the transmitter and the receiver [3]

.Pt = $\frac{V^2}{R_t}$, $R_c$ = total collector reactance

Were p.d = power density

Pt =transmission power

R= radius covered

$R_t = X_l + X_c$

Inductance reactance $X_l = 2\pi fl$ and the capacitance reactance $X_c = \frac{1}{2\pi fc}$

Assuming frequency f = 820Mz, C = 2pF and L = 2uH, therefore,

$X_l = 2 \times 3.142 \times 820 \times 10^6 \times 2 \times 10^{-6} = 10305\Omega$

$X_c = 2 \times 3.142 \times 820 \times 10^6 \times 2 \times 10^{-12} = 97.03\Omega$

Therefore the total reactance connected in parallel $X_c//X_l = \frac{97 \times 10305}{97+10305} = 96\Omega$

The amplifier base resistors connected in parallel $R_b = \frac{22 \times 10^3 + 27^3}{22 \times 10^3 \times 27 \times 10^3} = 12122.4\Omega$

Voltage across 22kΩ = $\frac{22\times10^3\times9}{22\times10^3+27\times10^3}$ = 4v

Amplifier base current $I_b = \frac{V_b}{R_b} = \frac{4}{12122.4} = 0.00033Amp$

$I_c = I_b \times B(amplification\ factor)$

$I_c = 0.00033 \times 200 = 0.06Amp$

Collector voltage $V_c = I_c \times R_c = 0.06 \times 96 = 5.76V$

Transmission power (Pt) = $\frac{V^2}{R_c} = \frac{5.76^2}{96} = 0.3456W$

If the radius is taken to be 1m, therefore the power density will be

P.d = $\frac{Pt}{A} = \frac{Pt}{4\pi r^2} = \frac{0.3456}{4\times3.142\times1^2} = \frac{0.3456}{12.568} = 0.027w$

# CHAPTER 4

## 4.1 RESULT

-The circuit is carefully and correctly connected as shown in the circuit diagram fig x above with it power source switch off.

-A mobile phone (GSM) is brought close to the area were the jamming circuit is to be tasted.

-The network service in the handset (GSM) is confirmed by physically observing the network service in the handset through the screen of the handset.

-The network service in the GSM is also confirmed by dialing a number from the GSM phone A or by receiving a call from another GSM phone B which could either be within or outside the area were the GSM phone A is.

-A call make or receive from the GSM phone A, confirmed the presence of network service in the phone

-Switch ON the jamming device: When the jamming device is switch on, it will be observed that the network service which was on the GSM disappears with an inscription "emergency call only" on the GSM phone screen. This, therefore, shows that the signal or service in the GSM phone have been blocked or interfered with.

## 4.2 CONFERMENTARY TEST.

While the jamming device is still on, try to make a call with the GSM phone A from the area were the jamming device is. It will be observed that call making from the jamming area will be impossible.

-With the jamming device still on, if the second GSM phone B with a network service that is outside the jamming area tries to reach or call the other GSM phone A that is in the jamming area, it will observed that the GSM phone A will not respond to the incoming call from GSM phone B, hence GSM phone A signal has been jammed.

## 4.3 OBSERVATIONS

In the cause of tasting the mobile phone signal jamming device, it was observed that the jamming device, jammed/interfered with the TV transmitting signal (frequency) and some frequency bandwidth in a radio receiver was also observed to be blocked by the jamming device.

### 4.3.1 *Observation procedure*

-Switch on a TV.

-Bring the jamming the device close to where the T.V is and ensure that the device is off.

-While the TV show (program) is on progress, switch on the jamming device

-The ongoing TV show will be observed to stop transmitting.

-The TV show will start transmitting again when the jamming device is switched off.

The jamming effect of the jamming device was observed to reduce with distance i.e. the strength of the jamming device is inversely proportion to the distance between the jamming device and the jammed device (GSM). The longer the distance between jamming and the jammed device the less effective the jamming will be, while the lesser the distance between the jamming device (mobile phone jammer) and the jammed device (GSM phone) the more effective the jamming will be.

## 4.4 LIMITATIONS

The mobile phone signal jammer was primary aimed at blocking mobile phone frequency. The blocking of TV, radio and other receivers whose frequencies fall within the jamming operating frequency was not intended.

Therefore, with the above drawback, the use of a mobile phone jammer is limited to places were TV, radio, and other devices that operate within the frequency of the jammer device, is not allow.

The mobile phone jamming device could also be use as a parental control device, used by parent to control the type of TV programmers their children watch.

# CHAPTER 5

## 5.1 CONCLUSION

A mobile phone signal jammer is a device that is used to interfere with a mobile phone frequency or used to restrict the use of mobile phone some quite required area e.g. churches, mosques, meeting rooms, lecture halls etc.

Jamming of mobile phone frequency is achieved by sending a noise signal with frequency equal to or a bit greater than the transmitting frequency of the network service which is been used by the mobile phone. The strength of the jamming device, increase with decrease in the distance between the jamming device and the phone, and also decrease with increase in the distance between the jamming device and the phone to be jammed.

The mobile phone jamming device can interfere with the TV, radio, etc. frequency which was not intent; this can therefore be seen as a disadvantage in the use of mobile phone signal jammer because this limits the areas where the device can be use. This jamming device can also jam TV frequency and hence could be use as a parental control device.

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