DESIGN,CONSTRUCTION AND TESTING OF A WIRELESS T.V SENDER (500MHZ)

BY

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A PROJECT REPORT SUBMITTED TO THE DEPARTMENT OF ELECTRICAL/COMPUTER ENGINEERING SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY. MINNA

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DECLARATION

I hereby declare that this project work was designed and constructed by Mr. TAJUDEEN OGUNRIN under the supervision of Engineer Paul Attah.

Mr TAJUDEEN OGUNRIN
NAME

24/03/2000
Sign & Date

CERTIFICATION

This is to certify that this project titled wireless T.V sender was carried out by Mr. TAJUDEEN OGUNRIN under the supervision of Mr. Paul Atta and submitted to Electrical and computer Engineering department, Federal University of Technology, Minna in partial fulfillment of the requirements for the award of Bachelor of Engineering (B. Eng.) degree in Electrical and computer Engineering.

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DEDICATION

This project report is dedicated to the glory of (God) Almighty Allah for His love, guidance and protection over me throughout the entire period of my study.

It is also dedicated to my daughter Aishat (Lolade), her mother, Mrs. Adeola and all my friends.

ACKNOWLEDGEMENT

All glory, honour and adoration should be given to God for sparing my life throughout my University Education. I thank Him for his invaluable blessings and mercies He has always showered upon me.

My sincere and profound gratitude goes to my parents: Alhaji Yahaya G. Ogunrin and Mrs. Asumawu Ogunrin for their persistant prayer,and moral up bringing throughout my academic carrier and also special thank to my beloved wife, Mrs. Adeola T. Ogunrin for the prayer, words of encouragement and understanding.

I also wish to express my profound, gratitude to my sisters: Mrs. Sidikat Afolayan, Mrs Taiwa, Mrs. Taibat, Miss Fatimoh and the entire member of Ogunrin's family.

Readily comes to mind is the role played by my colleaques in the field. They are: Student Engineer Salawu Yusuf, Mr Taofee Olofa.

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A load of thanks goes to numerous others who had contributed positively to the success of my programme.

ABSTRACT

This report presents the design and construction of wireless T.V sender with a frequency of 500MHz. The wireless T.V sender is crystal controlled, its first stage is crystal controlled oscillator with a frequency of 62.5MHz.

The design was divided into five unit section, such as: Power section, Video input section/modulation section, Audio input/voltage control oscillation section, R.F oscillation/Frequency section. The unit circuits were assembled, tested and found working satisfactory. During the choice of components, the reliability, maintainability and availability of the utilized component have been taken into consideration.

TABLE OF CONTENT

	PAGE
Declaration	i
Certification	ii
Dedication	iii
Acknowledgement	iv
Abstract	v
Table of contents	vi

CHAPTER ONE GENERAL INTRODUCTION

1.1 General Introduction	1
1.2 Aim and objective	4
1.3 Methodology	4
1.4 Literature Review	5
1.5 Project outline	6

CHAPTER TWO DESIGN ANALYSIS

2.0 System design	7
2.0.1 Detailed system description	7
2.1 Design analysis	8
2.1.1 The power supply unit	8
2.1.2 RF Crystal control colpitts oscillator/frequency doubler Section	11
2.1.3 First stage of frequency doubler	16
2.1.4 Second stage of frequency doubler	19

2.1.5 RF power amplifier stage 23

2.1.6 Video input/modulator stage 25

2.1.7 Audio input/voltage controlled oscillator stage 27

2.1.8 Audio Rre-amplifier stage 29

CHAPTER THREE CONSTRUCTION $ TESTING

3.1 Construction 30

3.2 Testing 31

3.3 Results 32

CHAPTER FOUR CONSTRUCTION $ RECOMMENDATION

4.1 Conclusion 33

4.2 Recommendation 33

4.3 References 34

4.4 List of components 35

CHAPTER ONE

1.0 GENERAL INTRODUCTION

Television broad casting begin on a small scale until the late 1940's then it quickly become one of the world's most popular forms of entertainment and communication.

Wireless TV sender "Television", can transmits live event to reach million of people. By a flick of a switch viewers can capture an event as it happened. Since television has become one of the most important tools for mass communication, then the need for a TV transmitter become necessary.

A wireless T.V sender transmitter consists of two basic section, irrespective of the kind of information they are designed to transmit thus:

(i) The video frequency section which is purely a network of amplifier.

(ii) The radio frequency (RF) section which consists of an Oscillator stage and network of R.F amplifier.

A wireless T.V sender is a device that is capable of generating a radio frequency (RF) energy which is modulated by the information to be transmitted,.

The aim of wireless T.V sender is to transmit a quality Audio and Video signal to any UHF TV channel. By doing this, it enable masses to watch an event by tuning their TV to a frequency within the range of UHF TV channel and also to design a transmitter that is of 10 low power requirement.

This transmitter would also be free of the external wire, or cable that connects your Video camera to your Video cassette recorder.

The block diagram of the transmitter is shown below in Fig 1.1

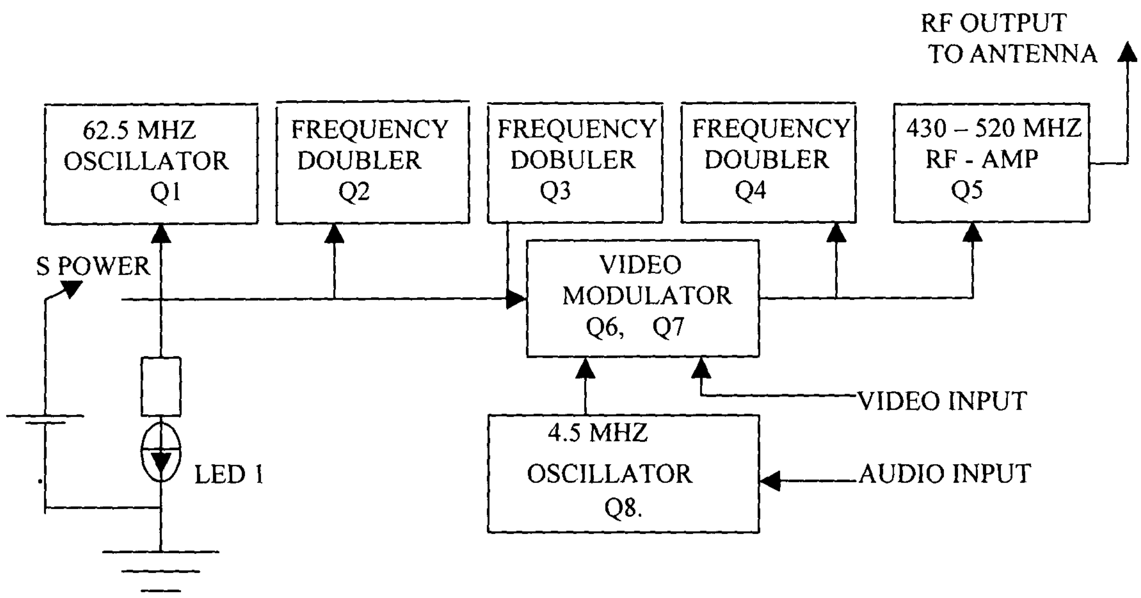


FIG 1.1 BLOCK DIAGRAM OF A WIRELESS TV SENDER

The block diagram of the wireless T.V sender is shown Fig 1. The first chain is the RF chain which is fairly conventional. Its first stage is crystal controlled Oscillator Q_1 with a frequency of 60 to 65 MHZ. But prototype design used a crystal frequency of 60.40625 MHZ, which gives a final out put frequency of 483.25 MHZ.

The Oscillator produces a signal that drives three stage of frequency doublers. The combined action of those doubler multiplies the input frequency by eight for a final output frequency of nominally 500MHZ. Double turned circuit ore used between each stage to help reduce spurious output that might cause unwanted interference.

The Video input signal drive a Video modulator (Q_6 and Q_7) that adds the Video signal to the +12. Volt line supplying power to final doubler Q_4

Audio input is applied to Q_8 "Transistor" which operates as a VCO "Voltage controlled Oscillator" running at a nominal frequency of 4.5 MHZ to produce the modulated sound carrier.

The Block diagram of the TV Transmitter reveals the overall simplicity of the circuit, which is composed of an Oscillator, three frequency doublers and video and audio modulator.

1.2 AIM AND OBJECTIVE

Design and construction of a wireless T.V sender.

OBJECTIVE

To design a transmitter that is crystal controlled.

To transmit high quality Audio and Video to any UHF TV channel.

To design a sender that is of low power requirement.

To be free of the external wire or cable that connects your video camera to your video cassette recorder (VCR).

To achieve this goal, the design approach circuit diagram, block diagram and circuit analysis include their value gotten from calculation were provided to give adequate information about the design of the project.

1.3 METHODOLOGY

The building of the circuitry involves different stages and it consist of different unit building blocks are made up of component, such as resistor, capacitor, Transistor and inductors, e.t.c

The circuitry it fested in a bread board before transferred into vero board for soldiering

The design is divided into five stages

- Power section.
- RF crystal Oscillator/frequency doubler section.
- RF power Amplifier section.
- Audio input/voltage controlled Oscillator section
- Video input/modulator section.

Each of the stages are made up of components of building block.

LITERATURE – REVIEW

Television is a division of Telecommunications which has to do with the transmission and reception of still and moving images by electric communication facilities in real time.

The task of television transmitter is to produce at the receiving end and image which is a faithful replica of the scene being televised. This task is tackled by an assemblage of apparatus intend to transmit, encode, decode, convert and present visual information.

The scientific foundation for TV has been laid by the removable discoveries made in many countries. The advent of the first motion picture projectors followed the invention of the incandescent lamp by A.N ladyguin of Russia in 1873 and accidental discovery of the properties of selenium by W. Smith and L. Mary in the same year. These two discoveries enable electric energy to be converted to light and back.

Basing himself on these two discoveries J. Kerry of the United States come up in 1875 with a system for the transmission of moving image. He was the first to propose that the image should be analyzed into elements were to be transmitted in parallel and this called for a great No of communication channels as many as there would be picture elements. The idea was obviously impractical. Its limitations were avoided in what are known as sequential television systems using only one communication channel over which the picture elements are transmitted in turn. Systems based on this principle of transmission were proposed in a variety of designs by a. de Paiva (1878) of Portugal. The Russian physiologist P.I Bakhmetyer (1880) S. Bidwell of Britain (1881) and Seneca of France (1881).

The detail and techniques have of course changed since then, but the basic principle of sequential transmission has survived.

In 1884, N. Nipkow, a polish scientist working in Germany, invented his mechanical analyzer now known as the Nipkow dise, which ushered in the era of mechanical TV systems. Mechanical TV was able to show something for the effort put into it in 1925 when J.L Baird in Britain and C. Jenkins in the United States first demonstrated the transmission of moving silhouettes over a distance. The first transmitting TV system used the Nipkow disc.

PROJECT OUTLINE

Chapter one of this project basically introduces the project topic begins with the general introduction of the project topic, the Aims and Objective methodology, Literature Review and project outline

Chapter two gives an indept description of the entire system design. The various sections of the design are outline here and the stages are equally described.

In chapter three, the various steps taken in construction and testing were discussed and the result was also discussed.

Chapter four contains the conclusion, recommendation and reference.

CHAPTER TWO

2.0 SYSTEM DESIGN

2.0.1 DETAILED SYSTEM DESCRIPTION.

The complete schematic diagram of the T.V transmitter is shown in fig 2.1 Transistor Q_1 is a common base (or colpitts), Oscillator biased by resistor R_1, R_2 and R_3. Inductors L_4 and capacitors C_3, C_4, C_5 and C_8 form a circuit that is tuned to the frequency of the crystal.

The crystal is series – resonant at some frequency between 60 and 65MHZ, so, it appears as a low impedance (50oohm or less) at that frequency. Therefor Q_1 will have sufficient gain as a common – base amplifier only at the resonant frequency of the crystal. Hence the signal developed at the junction of C_4 and C_5 will be amplified by Q_1 only if that signal is at the same frequency as the crystal. At that frequency, Q_1, has sufficient gain to oscillate. Capacitor C_3 and C_8 complete the tuned circuit, they also form a voltage divider that feeds the base of Q_2.

Transistor Q_2 functions as an overdriven amplifier that distorts its input signal and thereby produces harmonics of the input frequency. L_2 and C_{10} are tuned to that harmonic i.e. the second harmonic (120MHZ) which is the frequency we're interested in. C_8 is also series – resonant at that frequency, Q_2's efficiency of oscillation is improve by the additional base current supplied by C_8. C_{11}, C_{12}, C_{13} and L_3 provide a doubled – tuned circuit. Those components filter harmonics higher than the second.

Q_3 provides another stage of frequency doubling, it operates very much like Q_2, except that the tuned circuits at its input resonate at approximately 125MHZ and its output circuits resonate at about 250MHZ.

Again, Q_4 operates like Q_3, taking account of the values of the components in the tuned circuits. However, note that no emitter – Bypass capacitor or resistor is used. It is difficult to get good bypassing in the 430 – 500MHZ range with ordinary components, and it takes only a very small impedance in the emitter to kill the power gain of that stage therefore, the emitter is directly grounded.

Q_5 provides power amplification, L_7, L_8, C_{22},C_{24}.amd C_{25} constitutes the double – tuned circuit.

Both Q_4 and Q_5 receive their supply voltage from the emitter of Q_7, which supply 4.5V that voltage has positive sync – tip video supper imposed on it.

Negative – sync input video from a camera VCR, e. t. c is DC – coupled to the junction of R_{21} and R_{22}. Video by pass is provided by C_{31}. Gain and Q – point are set by R_{24}. Potentiometer R_{31} acts as a video gain control and R_{29} keeps the input impedance around 750hms.

FET Q_8 functions as a Harley – type VCO with a free – running frequency of 4.5 MHZ. C_{36} is used to fine – tune that frequency. Feedback is provided by C_{35} and C_{34}. D_2 is a Varactor (Variable – capacitance) diode. It is biased by R_{25}, R_{26} and zener diode D_1 which also biases Q_8.

The varactor D_2 provides frequency modulation (FM). This it does by changing capacitance at the audio rate and that would cause the oscillator's frequency to vary. Audio is fed to D_2 via R_{27} and C_{38}, C_{37} provides RF by-

. Audio pre-amplification is provided by Q_9. R_{32} is the audio gain control. The 4.5 MHZ FM signal from Q_8 is summed with the video signal through R_{23}.

NOTE:

The sound – level carrier may be varied by changing R_{23} as necessary.

POWER SUPPLY.

External power is coupled in through Jack J_3. The power-on condition is indicated by LED1, which is current-limited by R_{28}.

2.1 DESIGN ANALYSIS

2.1.1 THE POWER SUPPLY UNIT.

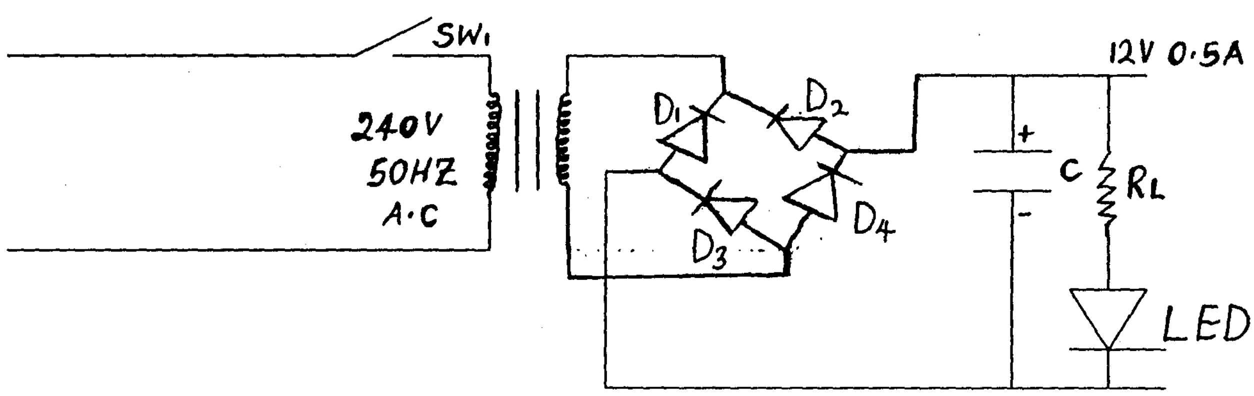


Fig 2.2 POWER SUPPLY UNIT

The power is obtained from a unit that converts the normal single phase a. c main supply (240V at 50HZ) to 12V a. c, the function of the power supply is to provide the necessary d. c voltage and current, with low levels of a .c ripple (main hum) and with good regulation and stability.

Components:

(i) 12V; 500mA transformer

Components:

(i) 12V; 500mA transformer

(ii) Four silicon diodes for bridge rectification

(iii) 1000µF 35V reservoir electrolytic capacitor.

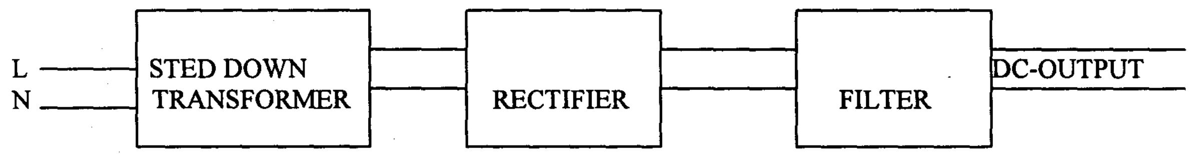


Fig 2.3 BLOCK DIAGRAM OF THE POWER SUPPLY UNIT.

The bridge rectifier produce full – wave rectification, consideration is given to this because it does not use expensive centre – tapped transformer and the transformer is used to alter the level of the a. c input to the rectifier.

The four diodes used for rectification must be able to withstand the 12V a. c voltage from the transformer, so has a peak inverse voltage.

(PIV) of > 2Vp

Since $V_p = \sqrt{2}\ V_{a.c}$

$V_{a.c} = 12V$

Therefore $V_p = 16.97V$

Therefore PIV of each of the diode = 2 x 16.97

=33.94V.

Therefore a diode of PIV > 33. 94V was chosen

1N4001 with PIV of 50V is chosen.

In order to reduce a. c variation of the rectified waveform, a reservoir capacitor C was connected across the output of the bridge rectified diodes. The reservoir capacitor is expected to discharge at a shorter time (t) i. e to give a smaller a. c ripple.

Let the time t = 0.1sec

Load Resistance RL = 100ohm

To calculate the value of the reservoir capacitor,

$t_1 = (C.R_L$ (secs).

But $t_1 = 0.1$ sec.

$R_L = 100$ohm

$$\text{Therefore } C = \frac{t}{R_L} = \frac{0.1}{100}$$

$$C = 1000\mu F$$

Since the voltage is 12V d. C, then a capacitor with voltage rating > 12V is chosen.

i. e

C = 1000μF, 35V was chosen.

2.1.2 RF CRYSTAL CONTROL COLPITTS OSCILLATOR / FREQUENCY DOUBLER SECTION.

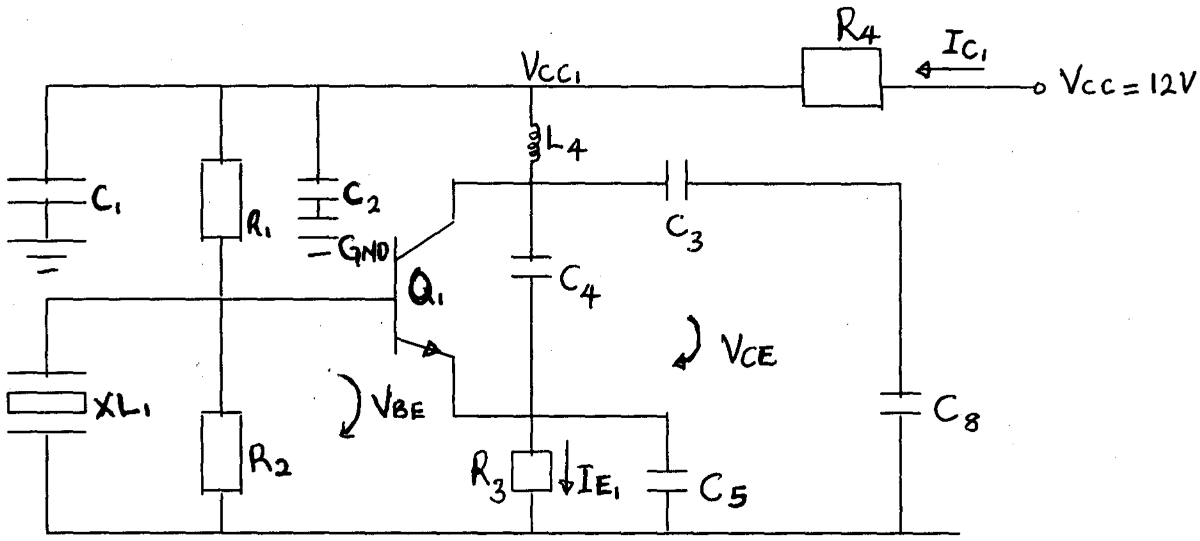


Fig 2.4 CRYSTAL – CONTROLLED OSXILLATOR STAGE.

Choice of transistor

The transistor 2N 3563 was chosen for Q_1 and from the data book for Electronic component guide (ECG), the parameters of transistor Q_2 was given as stated below.

Ic max = 50mA.

V_{CE} = 15V

P_D = 0.600W (dissipation power) at 25^0C.

hFE = 20min.

F_T = 800MHZ

V_{BE} = 0.7V (silicon transistor).

Since a U.H.F Video frequency is needed, then our design was based on a tunable U.H.F channel.

A video frequency S/W 483.25MHZ.

A three stage of frequency doubler was used to generate this frequency.

Since an LC Oscillator was used in conjunction with the crystal Oscillation, then the value of crystal Oscillator is given by

$$XL_1 = \frac{U.H.F}{8} = \frac{483.25MHZ}{8}$$

$$XL_1 = 60.40625MHZ.$$

C_1 and C_2 are grounded to remove voltage spark of VHF or Electromagnetic interference (EMI) that might appear on the screen.

Chosen values for C_1 and C_2

$C_1 = 0.01UF$ (Ceramic disk).

$C_2 = 470PF$ (Ceramic disk).

$$Vcc - Vcc_1 = Ic_1 R_4$$

But $Vcc = 12V$

Let

$Vcc_1 = 10V;$

$Ic_1 = 20mA.$

Therefore $$R_4 = \frac{Vcc - Vcc_1}{Ic_1} = \frac{12 - 10}{20 \times 10^{-3}}$$

$$R_4. = 100ohm$$

Therefore R_4 was chosen to be 100ohm

Biased voltage $V_{BR2} = \dfrac{R_2}{R_1 + R_2} \times Vcc_1$

Let $V_{BR2} = 2V$

But $Vcc_1 = 10V$

Chosen $R_1 = 22K$

Therefore $R_2 = \dfrac{2R_1}{8} = \dfrac{2 \times 22}{8}$

Therefore $R_2 = 5.5K$

But for standard resistor value, R_2 was chosen to be 4.7K.

$V_{BR2} = V_{BE} + V_{E1}$

$2 = 0.7 + V_{E1}$

$V_{E1} = V_{BR2} - V_{BE}$

Therefore $V_{E1} = 1.3V$.

But $V_{E1} = IE_1R_3$.

Let $I_{E1} = 6mA$

$R_3 = \dfrac{V_{E1}}{I_{E1}} = \dfrac{1.3}{6 \times 10^{-3}}$

Therefore $R_3 = 217ohm$

But for standard resistor value, R_3 was chosen to be 220ohm.

$R_{B1} = R_1 // R_2$

$= \dfrac{22 \times 4.7}{22 + 4.7}$

Therefore $R_{B1} = 3.87ohm$.

$$I_{B1} = \frac{V_{BR2}}{R_{B1}} = \frac{2}{3.87 \times 103}$$

Therefore $I_{B1} = 0.52mA$.

$$Vcc = Ic_1 R_4 + Vc_E + V_{E1}$$

$$12 = 20 \times 10^{-3} \times 100 + V_{CE} + 1.3$$

$$V_{CE} = 12 - 3.3$$

Therefore $V_{CE} = 8.7V$

Calculating the value of the decoupling capacitor C_5

$$C_5 = \frac{1}{2\pi \sqrt{f^1 R_3}}$$ where f^1 = minimum frequency to require to decouple R_3.

But $R_3 = 220ohm$

Therefore $C_5 = \frac{1}{2\pi \times (12.9 \times 10^6 \times 220)}$

$C_5 = 56PF$

But $\frac{C_3 * C_8}{C_3 + C_8} = 23.53PF$

Chosen $C_3 = 33pF$

Therefore $C_8 = \frac{23.53}{9.47} C_3$

$C_8 = \simeq 82pF$

Chosen value for $C_4 = 15pF$

Therefore $Ceq = C_4 + C_5 + \frac{C_3 * C_8}{C_3 + C_8}$

$Ceq = 94.53pF$

Calculating the operating frequency f_0

$$f_0 = \frac{1}{2\pi \sqrt{L_4 Ceq}}$$

chosen $L4 = 68ohm^H$

Therefore $f_0 = \frac{1}{2\pi\sqrt{(68 \times 10^{-9} \times (94.53 \times 10^{-12})}}$

$f_0 = 62.7MHZ$

To test if the circuit will oscillate.
Condition for testing.

H_{FE} must be $\geq \frac{C_4}{C_5}$ i.e. $HFE \geq \frac{C_4}{C_5}$

Therefore $\frac{C_4}{C_5} = \frac{15pF}{56pF}$
$= 0.2679$

Since $H_{FE} = 20$, and calculated $H_{FE} = 0.2679$ therefore the crystal oscillator would oscillate

2.1.3 FIRST STAGE OF FREQUENCY DOUBLER.

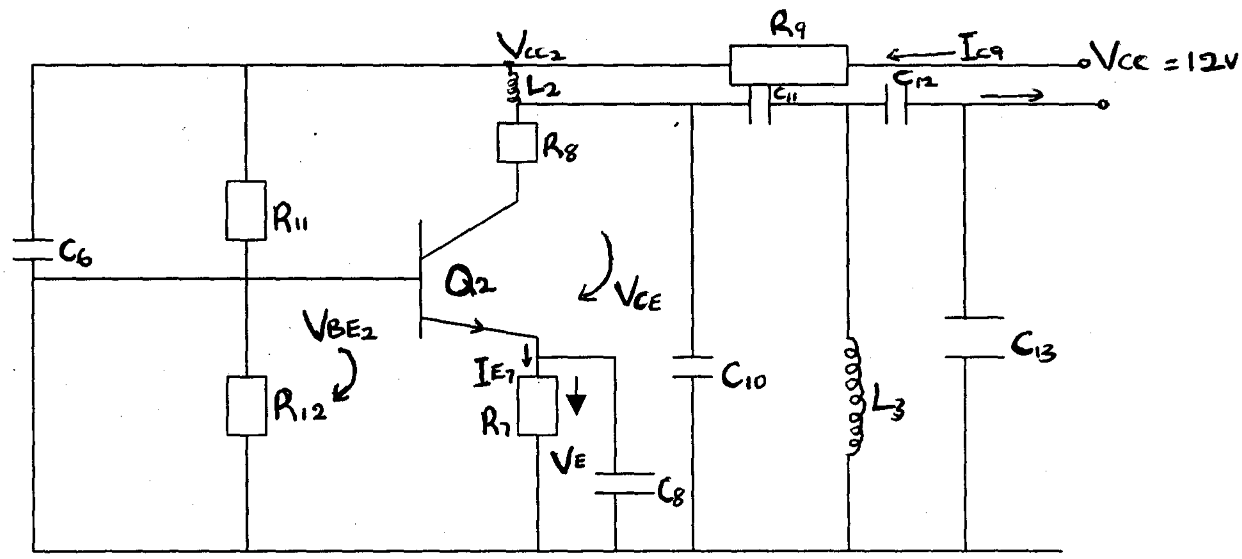


Fig 2.5
Choice of transistor.

Transistor 2N 3563 was chosen for Q_2 with the following parameters

Icnax = 50mA

$P_D = 0.6W$(at 25^0C)

HFE = 20

$V_{CE} = 15V$.

$Vcc - Vcc_2 = Icq. Rq.$

Vcc = 12V

Let $Vcc_2 = 10V$

Chosen Rq = 100ohm

Therefore $Icq = \frac{Vcc - Vcc_2}{Rq} = \frac{12 - 10}{100}$

$Icq = 20mA$

Biased voltage $V_{B12} = \frac{R_{12}}{R_{11} + R_{12}} \times Vcc_2$

Chosen

$R_{11} = 22K, R_{12} = 4.7K$

$V_{B12} = \frac{4.7}{22 + 4.7} \times 10$

$V_{B12} = 1.76V.$

$R_{B2} = R_{11}/R_{12} = \frac{22 \times 4.7}{22 + 4.7}$

$R_{B2} = 3.87K.$

Therefore $I_{B2} = \frac{V_{B12} \quad 0}{R_{B2}} = \frac{1.76}{3.87 \times 10_3}$

$I_{B2} = 0.455mA.$

$Ic_2 \simeq I_{E2} = \beta \, IB_2$

$= 20 \times 0.455$

therefore $I_{E2} = 9.1mA.$

$V_{B2} = V_{BE} + V_{E2}$

Therefore $V_{E2} = V_{B12} - V_{BE}$

$= 1.06V.$

$V_{E2} = I_{E2} \cdot R_7$

Therefore $R_7 = \dfrac{V_{E2}}{I_{E2}} = \dfrac{1.06}{9.1 \times 10^{-3}}$

$R_7 = 116ohm$

But for standard resistor value, R_7 was chosen to be 220ohm.

Calculating the value of the decopling capacitor

$$C_8 = \frac{1}{2\pi f_2' R_7}$$

Where f_{21} = Minimum frequency required to decouple R_7

Let f_{21} = 8.82MHZ

Therefore

$$C_8 = \frac{1}{2\pi (8.82 \times 10^6) \times 220}$$

$= 82pF$

But $C_{12} + C_{13} = 63pF$

Chosen $C_{12} = 24\ pF$

Therefore $C_{13} = 63 - 24$

$C_{13} = 39pF$

Similarly

$C_{10} + C_{11} = 20pF.$

Chosen $C_{10} = 18pF$

Therefore $C_{11} = 20 - C_{10}$

$C_{11} = 2pF$

Inductors L_2 and L_3 was chosen to be

$L_2 = L_3 = 0.074\mu H$.

Capacitor C_6 was chosen to be $0.01\mu F$ 50 volts (Ceramic disc).

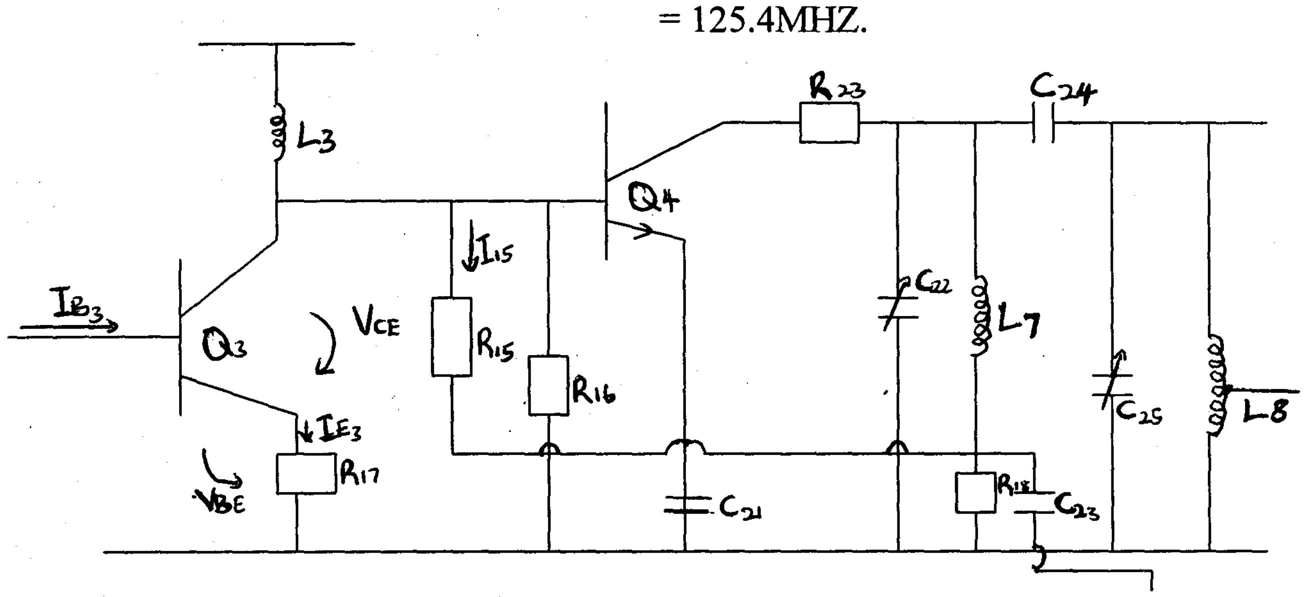
Since the function of this stage of amplifier is to double the input frequency by two

Therefore

Output frequency $f = 2 \times f_o$

$= 2 \times 62.7$

$= 125.4MHZ.$



2.1.4 Fig 2.6 SECOND AND THIRD STAGE OF FREQUENCY DOUBLER.

Choice of transistor.

Transistor 2N3563 was chosen for Q_3 with the following parameters.

$V_{CE} = 15V$

$V_{CB} = 30V$

Icmax = 50mA

V_{EB} = 2V

HFE = 20min

P_D = 0.600.

Transistor 2N3564 was chosen for Q_4 with the following parameters.

Vc_E = 40V

V_{EB} = 6V

Ic (max) = 0.8A

P_D = 0.5

HFE = 200

VbE = 0.7 (silicon transistor).

Biasing Transistor Q_3

$$V_{B3} = V_{BE} + V_{E3}$$

But $V_{E3} = I_{E3}R_{17}$

Let $Ic_3 \simeq I_{E3} = 3mA$.

Let $V_{E3} = 6.6V$.

$$\text{Therefore } R_{17} = \frac{V_{E3}}{I_{E3}} = \frac{6.6}{3 \times 10^{-3}}$$

$$R_{17} = 2200\text{ohm}$$

Chosen value for R_{15} = 100K

Chosen value for L_3 = 0.074µH

$$V_{B3} = V_{BE} + V_{E3}$$

$$= 0.7 + 6.6$$

Therefore V_{B3} = 7.3V

$Ic_3 \simeq I_{E3} = \beta I_B.$

Therefore $I_{B3} = \frac{IE_3}{\beta} = \frac{3 \times 10^{-3}}{20}$

$I_{B3} = 0.15mA.$

$Vc_E = Vcc - V_{E3}$

Therefore $Vc_E = 12 - 6.6$

$= 5.4V.$

Biasing transistor Q_4.

Since both transistor Q_4 and Q_5 receive their supply voltage from the emitter of Q_7 which supply 4.5V to Both Q_4 and Q_5

Therefore for Q_4

$Vcc = 4.5V.$

$I_{15} = \frac{Vcc}{R_{15}}$

Chosen $R_{15} = 100K$

$I_{15} = \frac{4.5}{100}$

Therefore $I_{15} = 0.045mA.$

But $\frac{R_{15} * R_{16}}{R_{15} + R_{16}} = 4.5Kohm$

Since $R_{15} = 100K$

Therefore $R_{16} = \frac{4.5}{95.5} \times R_{15}$

$= \frac{4.5}{95.5} \times 100$

$R_{16} = 4.71K$

Therefore R_{16} was chosen to be 4.7K.

Chosen value for $R_{23} = 10K$

Chosen value for $C_{22} = C_{25} = (1 - 8)$ pF

Chosen value for $C_{24} = 1PF$

Chosen value for $C_{18} = 100ohm$

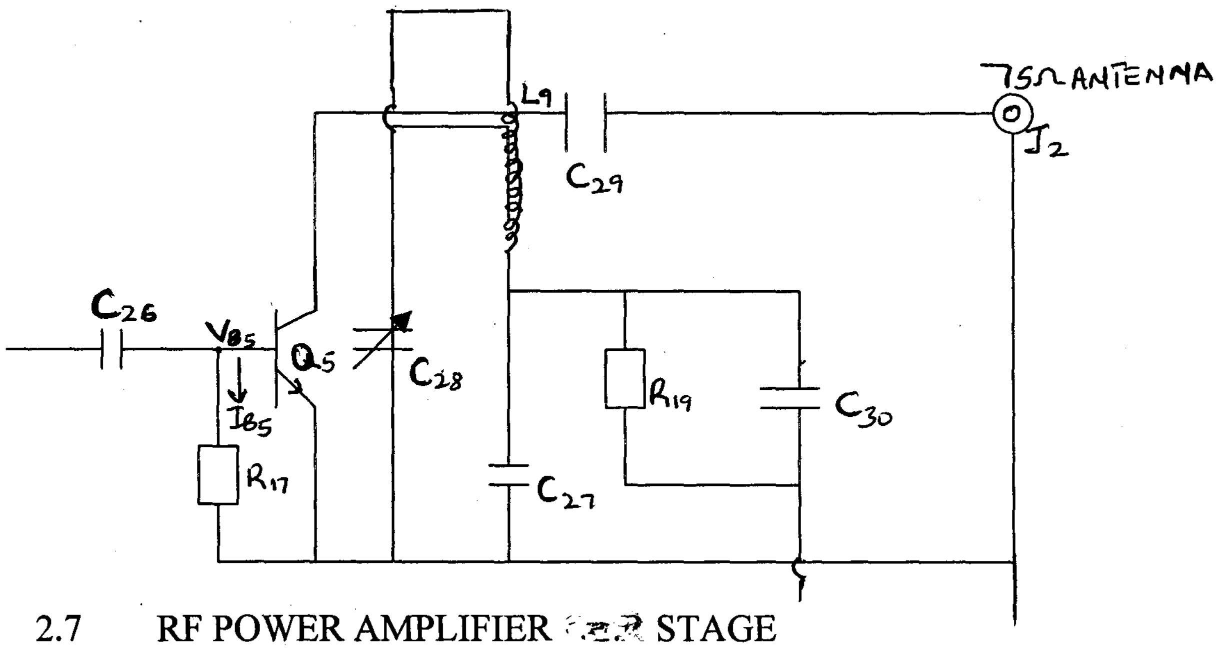
Chosen value for $L_7 = L_8 = L_9 = 0.018\mu H$.

But $C_{21} + C_{23} = 517pF$

Chosen $C_{21} = 47pF$

Therefore $C_{23} = 517P - C_{21}$

$= 470pF$



2.7 RF POWER AMPLIFIER STAGE

Choice of Transistor

Transistor Q_5 is chosen to be 2N 3866 with the following parameters.

$$I_c(max) = 0.4A$$

$$V_{CE} = 30V$$

$$P_D = 5Watt$$

$$HFE = 25min.$$

Biasing the transistor

$$V_{B5} = I_{B5}.R_{17}$$

Let $Ic_5 = 0.15A$.

But $Ic_5 \simeq I_{E5} \simeq \beta I_{B5}$

$$\therefore I_{B5} = \frac{Ic_5}{\beta} = \frac{0.15}{25}$$

6mA.

$$V_{B5} = I_{B5}.R_{17}$$

Chosen R_{17} = 2200ohm

Therefore $V_{B5} = 0.006 \times 2200$

$$= 13.2V$$

$$Vcc \simeq Vc_E$$

But $V_{cc} = 4.5V$

Therefore $V_{CE} = 4.5V$.

Chosen value for $L_9 = 0.018\mu H$.

Chosen value for $C_{29} = 470PF$ (ceramic disc)

Chosen value for $R_{19} = 100ohm$

But $C_{27} + C_{30} = 517PF$

Chosen $C_{27} = 47PF$

Therefore $C_{30} = 517 - C_{27}$

$= 470PF$.

To calculate the value of C_{28}

For a low frequency range of 430MHZ.

$$C_{EFF}\ max = \frac{1}{4\pi^2 f^2 L_9}$$

Chosen $L_9 = 0.018NH$

$$C_{EFF}\ max = \frac{1}{4\pi^2 \times (430 \times 10^6)^2 \times (0.018 \times 10^{-6})}$$

$$= \simeq 8PF.$$

For a high frequency range of 520MHZ.

$$C_{EFF}mm = \frac{1}{4\pi^2 \times (520 \times 10^6)^2 \times (0.018 \times 10^{-6})}$$

$$= \simeq 5PF$$

HFE = 20

P_D = 600W, V_{CB} = 30V.

Transistor Q_7 is 2N 3866 with the following parameters

Icmax = 0.4A

P_D(max) = 5

V_{EB} = 3.5V

V_{CE} = 30V

HFE = 25

V_{CB} = 55

Biasing the transistor.

$V_{B6} = R_B I_{B6}$.

$R_B = R_{29}//_{31}//R_{21} + R_{22}$

Chosen values for R_{29}, R_{31}, R_{21} and R_{22} are

R_{31} = 10K,

R_{29} = 82ohm

R_{21} = 100ohm

R_{22} = 470ohm

Therefore $R_B = R_{29}//R_{31}//R_{21} + R_{22}$

= 515ohm

Let Ic_6 = 40mA.

But $Ic_6 \simeq \beta I_{B6}$

Therefore $I_{B6} = \dfrac{40 \times 10^{-3}}{20}$

= 0.002A

The effective capacitance range is (5 – 8PF). But, for stand effective capacitance range, (1 – 8PF) was chosen for C_{28}.

To calculate the output power of the R.F Amplifier stage,

$$Power = IV$$

$$But\ V = IR$$

$$\text{Therefore power output} = I^2R$$

$$I \simeq Ic_5 = 0.15A.$$

$$R = 2200ohm$$

$$\text{Therefore output power (P)} = (0.15)^2 \times 2200$$

$$= 49.5W$$

$$\simeq = 50W.$$

$$fmin = 430MHZ$$

$$fmax = 520MHZ$$

$$\text{Bandwidth } B = Fmax - Fmin$$

$$= 90MHZ$$

2.1.6 fig 2.8 video input / modulator stage

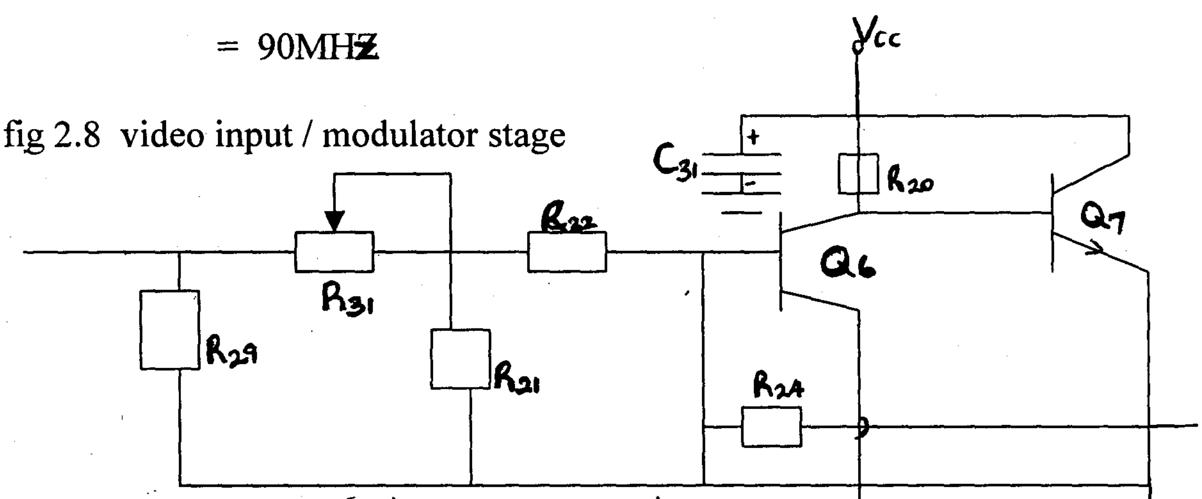


Fig 2.8 VIDEO INPUT / MODULATOR STAGE

Choice of transistor

Transistor Q_6 is 2N 3563 with the following parameters

$$Icmax = 50mA,$$

$$V_{EB} = 2V$$

$$V_{CE} = 15V$$

Therefore $V_{B6} = 515 \times 0.02$

$= 1.03V$

$V_{b6} = V_{Bt} + V_{E6}$

Therefore $V_{E6} = V_{b6} - V_{BE}$

$= 1.03 - 0.7$

$= 0.33V$

$V_{B7} = V_{BE} + V_{E7}$

Let $V_{B7} = 5.2V$

Therefore $V_{E7} = V_{B7} - V_{BE}$

$= 5.2 - 0.7$

$= 4.5$

$Vcc = Vc_{E7} + V_{E7}$

But $Vcc = 12V$

Therefore $Vc_{E7} = Vcc - V_{E7}$

$= 12 - 4.5$

$= 7.5V.$

2.1.7

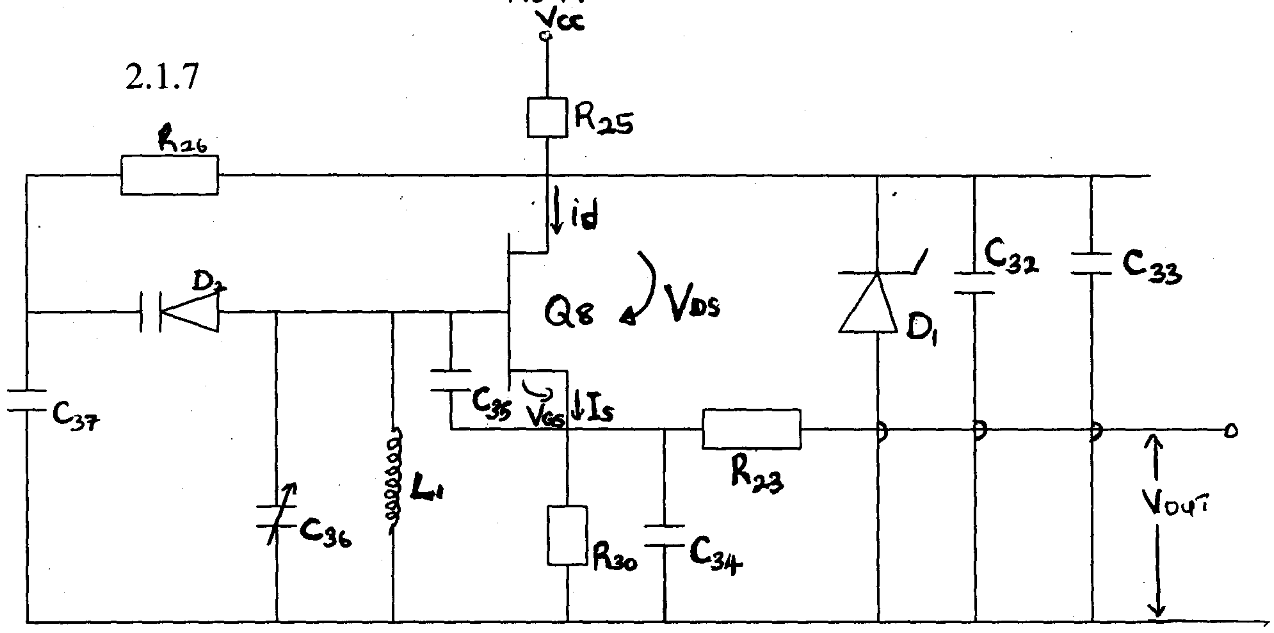


Fig 2.9 AUDIO INPUT/ VOLTAGE CONTROLLED OSCILLATOR STAGE.

Choice of transistor

Transistor Q_8 is an MPF 102 with the following characteristics

$Gf_0 = 4{,}000\mu$mhos

V_{GS} max = 4 v

I_{DSS} (min – max) = 4 – 10mA

BV_{GSS} min = 25V.

Biasing the transistor

$$I_D = I_{DSS}\left[1 - \frac{V_{GS}}{VP}\right]^2$$

$$gfs = \frac{-2}{VP}\sqrt{I_{DSS}.I_D}$$

Let I_{DSS} = 6mA

V_P = 4V

$$4{,}000 \times 10^{-6} = \frac{-2}{VP}\sqrt{6 \times 10^{-3} \times I_D}$$

$$(4 \times 10^{-3})^2 = (-2/VP)^2 \times 6 \times 10^{-3} I_D$$

since V_P = 4V

$$\text{Therefore } I_D = \frac{256 \times 10^{-6}}{24 \times 10^{-3}}$$

$$= 0.0107A$$

$$\text{But } I_D = I_{DSS}\left[1 - \frac{V_{GS}}{4}\right]^2$$

Let V_P = 4V

I_D = 0.0107A

$$0.0107 = 6 \times 10^{-3}\left[1 - \frac{V_{GS}}{4}\right]^2$$

$$\sqrt{\frac{0.0107}{6 \times 10^{-3}}} = 1 - \frac{V_{GS}}{4}$$

$$1.335 = 1 - \frac{V_{GS}}{4}$$

$$\text{Therefore } V_{GS} = (1 - 1.335) \times 4$$

$$= -1.34V$$

Calculating the capacitance value.

But $C_{34} + C_{35}$ = 690PF

Chosen C_{34} = 470PF

Therefore C_{35} = 690 – 470

= 220PF.

2.1.5 AUDIO PRE – AMPLIFIER STAGE.

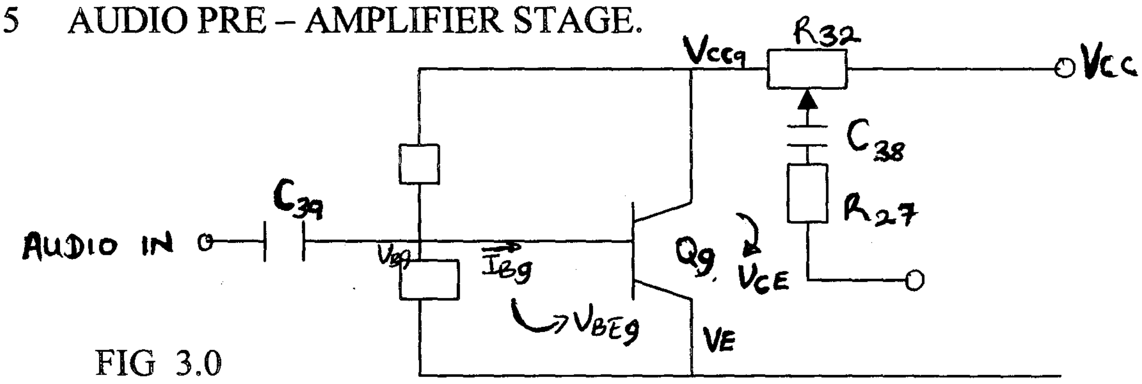


FIG 3.0

Fig 3.0 AUDIO PRE – AMPLIFIER STAGE.

Choice of Transistor.

Transistor 2N 3565 was chosen for Q_9 with the following parameters

$Icmax = 0.8A$

$V_{CE} = 40V$

$V_{EB} = 6$

$HFE = 200$

Biasing the transistor.

$Vcc - Vcc_9 = Ic_9 \times R_{32}$

Let $Vcc_9 = 10V$

$Ic_9 = 0.2mA$

$12 - 10 = 0.2 \times 10^{-3} \times R_{32}$

therefore $R_{32} = \dfrac{2}{0.2 \times 10^{-3}}$

$= 10{,}000ohm$

:- R_{32} was chosen to be 10,000ohm.

$V_{B9} = \dfrac{R_{34}}{R_{34} + R_{35}} \times Vcc_9$

Chosen $R_{34} = 10K$

$R_{35} = 100K$

$V_{B9} = \dfrac{10}{10 + 100} \times 10$

$= 0.909V$

$R_B = R_{34} // R_{35}$

$= \dfrac{100 \times 10}{110}$

$= 9.090K$

But $V_{B9} = I_{B9} R_B$

$I_{B9} = V_{B9}/R_B$

$= 0.909/9.090 \times 10^3$

$= 0.1mA$

$Ic_9 \simeq BI_{B9} = 200 \times 0.1$

$= 20mA$

$V_{B9} = V_{BE} + V_E$

Therefore $V_E = V_{B9} - V_{BE}$

$= 0.909 - 0$

$= 0.209$

CHAPTER THREE

3.1 CONSTRUCTION

Having gotten the components together, then I started by referring to the circuit diagram. I insert and soldered the components starting with the resistors and diodes and working up to the electrolytic and trimmer capacitors. Care was taken not to overheat the semiconductors when soldering them to the project board. The breadboard was extensively used as a testing ground for the construction.

The RF coils was wound and installed, the turns of each coil was spread evenly without spacing perfectly as coils will be compressed and expanded when the transmitter is tune-up.

L_1 is a constructed eight turns of 22-gauge wire wound on a Ferro X cube, L_2 and L_3 are seven turns of 22-gauge wire wound on a 26 drill bit and the drill bit was removed after the coil tense completed. L_4 is wound around a standard 10-32 screwthread and the screw was removed after the coil tense completed, L_7, L_8, and L_9 are 1.5cm loops of wire wound on a 3/8-inch form and soldered to the project board. L_{10} and L_{11} are standard 5.6uH. One end of capacitor C_{26} was mounted in the normal fashion, and the other end hangs from the approximate midpoint of L_8's loop. Similarly, C_{29} was

Finally, before applying power, the work was checked over to make sure no solder bridges exist and to be sure that all polarised, components Components are correctly oriented.

CONSTRUCTION OF CASING.

The casing was designed and constructed with respect to the length and width of the Vero boards. The casting was made from wood with adequate outlets and provisions was made for the video jack, the antenna, the transformer, the power supply and other components.

The Vero boards were fastened inside the casing in a way that allows for ease of access or removal for repairs in the case of any fault.

3.2 TESTING

The testing was carried out with the following

Equipment's was used to test the transmitter

(i) Television set and video camera or video cassette recorder (VCR).

(ii) The video cassette inserted on video machine for playing, the video jack corresponding to the Audio (Black jack) and video (Red jack) then we started turning the TV UHF channel to get event been played by the video machine.

In testing this project, the precaution was taken such as all components are correctly fixed and to ensure that no solder bridges exist before power was applied.

3.3 RESULTS

The aim and objective of this project work has been achieved. But due to reflection loss, loss from "dead spots" terrain loss and obstacle shielding, the transmitter does not really cover a wide distance as expected.

But However, a distance of about 130m was covered by the transmitter. This we got by the use of measuring tape to measure the distance of the receiving TV from the transmitter.

CHAPTER FOUR

4.1 CONCLUSION

In conclusion, having undergone testing the results show the success of the work. I therefore recommend this project topic to any willing for further improvement.

The problem encountered include loss from dead spots, reflection loss, and obstacle shielding and that affected the range of transmission.

RECOMMENDATION

Based on the experience I have acquired during the period of research work which I found useful to my carrier, I hereby recommend to any student of Electrical department might choose this project topic in future with his or her extensive research an equivalent IC can be used to replace the frequency doubling stage and it would still serve the same purpose.

But due to our limited time and scope of research we were unable to get a text book on IC technology to guide us in choosing a particular IC for the said stage.

Any further improvement is highly welcomed by any reader.

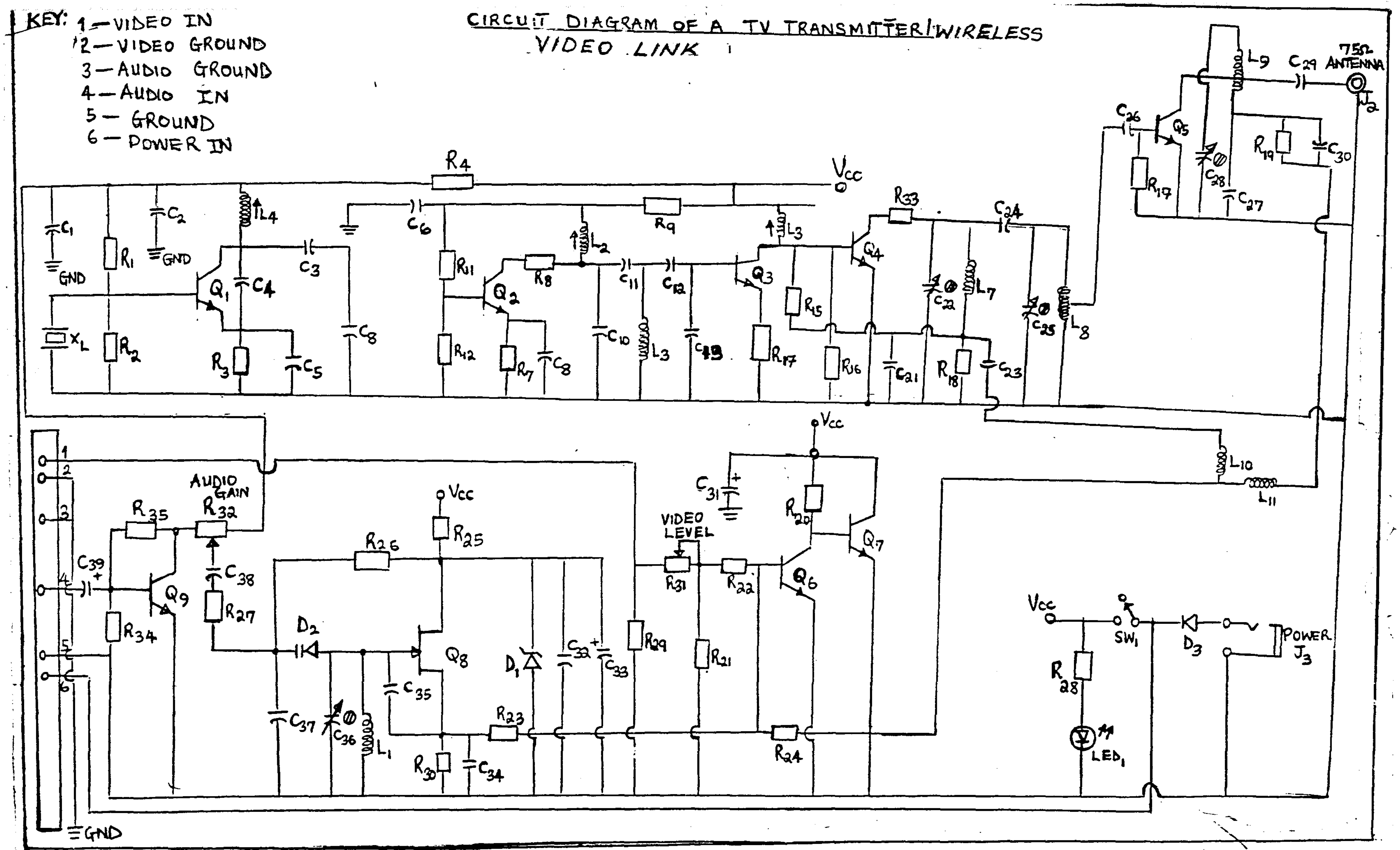


Fig 2·1 CIRCUIT DIAGRAM OF A WIRELESS TV SENDER

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LIST OF COMPONENTS

RESISTORS	INDUCTORS	CAPACITORS
R_1, R_{11} = 22 K	L_1 = 6.2uH	C_1, C_6, C_{32}, C_{38}
R_2, R_{12}, R16 = 4.7k	L_2, L_3=0.074µH	= 0.01µF
R_3, R_7 = 220ohm	L_4 = 68nH	C_2, C_{23}, C_{26}, C_{29}
R_4, R_9, R_{18}, R_{19}	L_7, L_8, L_9=0.018µH	C_{30}, C_{34} = 470pF
R_{21}, R_{25} = 100ohm	L_{10}, L_{11} = 5.6µH	C_{33} = 33PF
R_8, R_{33} = 10ohm		C_4, C19 = 15pF
R_{15}, R_{26}, R_{35}-100k		C_5 = 56pF
R_{17}, R_{28}, R_{30}=2.2k		C_8 = 82pF
R_{20}, R_{22} = 470ohm		C_{10} = 18pF
R_{23}, R_{27}, R_{34}=10k		C_{11} = 2pF
R_{24} = 3300ohm		C_{12} = 24pF
R_{29} = 82ohm		C_{13} = 39pF
R_{31} = 1000ohm		C_{24} = 1pF
R_{32} = 10k		C_{21}, C_{27}=47pF
		C_{22},C25,C28=1-8pF
		C_{31},C_{33},C_{39}=8.2uF
		C_{35} = 220pF
		C_{36} = 5-60pF
		C_{37} = 100pF
TRANSISTORS	DIODES	OTHER COMPONENTS
Q_1 – Q_3, Q_6=2N3563	LED 1 Standard red LED	J_1 – Video Camera Jack
Q_4 = 2n3564	D_1-IN 757 9V Zener	J_3 – coaxial power Jack.
Q_5, Q_7 = 2n3866	D_2-MV 2117 Varactor	J_2 – BNC Jack.
Q_8 = MPF 102	D_3 – IN 4002	
Q_9 = 2N 3565