DESIGN Of TUNABLE FM RADIO

Submitted in partial fulfillment of the requirements for the award of the degree of

Bachelor of technology

in

Electronics and Communication Engineering

By

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Table of Contents Page Number

Chapter 3

Proposed model

Chapter 4

Circuit Diagram and working

Chapter 5

Chapter 6

LIST OF FIGURES

DECLARATION BY THE SCHOLAR

We therefore proclaim that the work introduced in this report entitled "**Design of Tunable FM Radio**" submitted at **Jaypee University of Information Technology, Waknaghat India**, is a valid record of my work completed under the supervision of **Dr. Shweta Pandit** (Assistant Professor, Electronics and Communication Engineering Deptt.). We have not presented this work somewhere else for some other degree or confirmation.

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CERTIFICATE

This is to certify that the work reported in the B.Tech project report entitled "**……** "which is being submitted by …….. in fulfillment for the award of Bachelor of Technology in Electronics and Communication Engineering by the Jaypee University of Information Technology, is the record of candidate's own work carried out by him/her under my supervision. This work is original and has not been submitted partially or fully anywhere else for any other degree or diploma.

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SUPERVISOR CERTIFICATE

This is to certify that the work reportable within the B-Tech report entitled "Design of tunable FM Radio", submitted by Rohit Pathak, Abhinav Goel and Shubham Nanda at Jaypee University of Information Technology, Waknaghat, India, could be a bonafide record of their original work carried out underneath my direction. This work has not been submitted elsewhere for the other degree or certificate.

Dr. Shweta Pandit

Affiliation :

Date :

ACKNOWLEDGEMENT

We have put lot of hardwork and efforts in this project, and it would not have been possible without the constant support and guidance of our guide and mentor Dr. Shweta Pandit.
We are extremely indebted to her for her steerage and constant management additionally, as for providing necessary data concerning the project and additionally for her support in finishing the project.
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Finally, we might prefer to give thanks to all those people who are somehow involved to the project

ABSTRACT

In radio transmission modulation is achievable in three different manners namely frequency modulation, amplitude modulation and phase modulation.

In over 3 techniques frequency Modulation is generally utilized due to its substantial advantages over the other two like extensive zone scope, signal quality and so forth. FM radio correspondence includes transmitter and beneficiary. Transmitter is at sender side and beneficiary is at beneficiary side. FM transmitter comprises of frequency balance; in this strategy the encoding of data in a transporter wave by fluctuating the momentary frequency of the wave.

It has applications spread over different domains like broadcasting, in very little college grounds regions, climate estimation and many more, in this communication only the frequency of the wave carrying the signal is varied in accordance with the signal.But the wave being modulated has the same magnitude of amplitude i.e. carrier wave amplitude. Instant amplitude of the signal is a major factor in the variations of frequency. At the broadcasting side the process of modulating a signal is carried out before transmission. The signal on reaching the receiver passes through the various stages of the receiver and then it is demodulated to obtain the desired value of the signal.

CHAPTER-1

PROJECT INTRODUCTION

1.1) Introduction

Communication implies passing on information or trade of knowledge between any 2 living animals. The information can be of any type like picture, video, text and even voice notes. To carry out the efficient data transfer, the entire setup needs a sender, a message and a beneficiary. A communication needs a medium to exchange the info amongst sender and beneficiary; those mediums are radio, TV, daily paper. During this, radio communication is mostly utilized on the grounds that, we have a tendency to needn't hassle with any physical medium.

Frequency Modulation or FM might be an assortment of control that passes on data by moving the frequency of a carrier wave; the older method, or AM changes the amplitude of the carrier, with its frequency remaining consistent. With FM, frequency deviation from the allocated carrier frequency at any minute is proportionally similar to the amplitude of the data, choosing the instantaneous frequency of the transmitted signal. Since transmitted FM signals use more data transmission than AM signals, this kind of change is usually used with the upper (VHF or UHF) frequencies used by TV, the FM impart band and land transport radio.

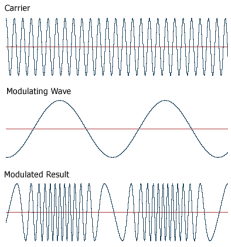


Figure 1.1: Frequency Modulation

1.2) FM Radio

FM broadcasting is a method of radio telecom utilizing frequency modulation (FM). It had been made in 1933 by yank build Edwin Armstrong, it's used worldwide to give high-constancy sound over communication radio. FM broadcasting is prepared to attempt and do higher stable quality than AM communication, the zenith competitory radio medium is used for music broadcast.

FM radio stations utilize the VHF frequencies. The articulation "FM band" depicts the frequency band in an extremely given country that is focused on FM broadcasting. sooner or later of the globe, the FM impart band falls inside the VHF part of the radio spectrum, in some cases eighty eight to 108.0 MHz that could be an essentially higher extent of frequencies than AM radio.

The range of FM transmissions is limited – in some cases underneath one hundred miles. In any case, FM radio is suitable for music broadcast; the higher bandwidth conveys the sound quality we tend to as a rule want to tune to and appreciate.

FM broadcasts are also commonly done in stereo – a few AM stations are also able to broadcast stereo signals. And although FM signals are less susceptible to noise and interference, they can be limited by physical barriers (e.g. buildings, hills, etc.), which impacts overall reception. This is why you can pick up certain radio stations more easily in some places than others, whether it's inside your home or around the city.

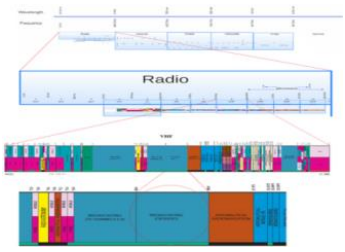


Figure1.2:Frequency Bands

1.3) FM Radio Transmitter

FM transmission is finished by the strategy for sound pre enhancement, adjustment then transmission. Here we've customized a comparable procedure by first opening up the sound signal, creating a bearer signal uitlizing an occasional at that point adjusting the transporter motion with the intensified sound signal. The intensification is finished by degree electronic hardware, while the regulation and transporter signal age is finished by a variable frequency generator circuit. FM transmission is finished by the technique for sound pre intensification, regulation then transmission. Here we've customized a comparative equation by first opening up the sound signal.

A sender is normally a half of a radio correspondence framework that utilizations attractive power waves (radio waves) to move information (for this situation sound) over a distance. A transmitter will be a different bit of gear, or A circuit inside another gadget. A transmitter and a collector joined in one unit is named a handset. The term transmitter is generally contracted "XMTR" or "TX" in specialized archives. The point of most transmitters is radio correspondence of information over a separation. The information is given to the transmitter inside the assortment of a sign, similar to a (sound) motion from a mike, a video (TV) motion from a camcorder, or in remote systems administration gadgets, a computerized motion from a pc. The transmitter consolidates the learning sign to be conveyed with the regularly signal that produces the radio waves, that is named the transporter signal. This technique is named tweak. the learning will be other to the bearer in numerous elective manners by which, in various types of transmitters. In AN (AM) transmitter, the information is other to the radio radiation by factor its abundancy. All through a balance (FM) transmitter, it's other by factor the radio signal's frequency somewhat. a few elective types of tweak additionally are utilized. The radio radiation from the transmitter is connected to the reception apparatus that emanates the vitality as radio waves. The receiving wire is additionally fencelike inside the case or associated with the surface of the transmitter, as in moveable gadgets like PDAs, walkie-talkies, and carport entryway openers. in extra effective transmitters, the radio wire is likewise settled on high of a building or on a

isolate tower, and associated with the transmitter by an encourage line, that is a conductor. Varying its adequacy. In a frequency regulation (FM) transmitter,it's esteem included by shifted the radio signal's frequency marginally. a few distinct types of adjustment square measure likewise utilized.

1.4) FM Radio Receiver

A radio receiver is an electronic device that receives radio waves and converts the information carried by them to a usable form. An antenna is used to catch the desired frequency waves. The receiver uses electronic filters to separate the desired radio frequency signal from all the other signals picked up by the antenna, an electronic amplifier to increase the power of the signal for further processing, and finally recovers the desired information through demodulation.Of the radio waves, FM is the most popular one. Frequency modulation is widely used for FM radio broadcasting.

It is also used in telemetry, radar, seismic prospecting, and monitoring newborns for seizures via EEG, two-way radio systems, music synthesis, magnetic tape-recording systems and some video-transmission systems. An advantage of frequency modulation is that it has a larger signal-to-noise ratio and therefore rejects radio frequency interference better than an equal power amplitude modulation (AM) signal.

1.5) FM frequency ranges

Frequency tweak is used as a piece of radio convey in the 88-108MHz VHF band.This information transmission go is separate as FM on the band sizes of radio beneficiaries, and the contraptions that can get such signals are called FM gatherers. The FM radio transmitter has a 200kHz wide channel. The best solid frequency transmitted in FM is 15 kHz when stood out from 4.5 kHz in AM. This empowers generously greater extent of frequencies to be moved in FM and thusly the idea of FM transmission is on a very basic level higher than of AM transmission.

FREQUENCY	DESIGNATION	ABBREVIATION	WAVELENGTH
3-30KHz	very low frequency	VLF	10^5 to 10^4 m
30-300KHz	low frequency	LF	10^4 to 10^3 m
300-3,000KHz	Medium frequency	MF	10^3 to 100m
3-30MHz	High frequency	HF	100to 10m
30-300MHz	very high frequency	VHF	10to 1m
300-3,000MHz	Ultra high frequency	UHF	1 m to 10 cm
3-30GHz	Super high frequency	SHF	10 cm to 1cm
30-300GHz	Extremely high frequency	EHF	1cm to 10 mm

Figure 1.5:List of Wavelengths

CHAPTER- 2

LITERATURE SURVEY

2.1 Introduction

FM Radio is the device used to transfer information in any from one point to another via a carrier and message signal. It has been a common mode of information exchange in the present world and also promises to be the technology to stay in the domain of data transfer.

In the following chapter we surveyed the following papers [1]-[5] regarding the technology and tried to collect knowledge for our project.

Ranjana Singh and Nidhi in the paper [1] have tried to create a miniature FM Radio transmitter, which can work in applications like hearing aid for touring guide, security of small areas and entertainment purposes.

In [2] Hetal V Dave and Prof. D U Shah works on the design of a FM radio with the help of a Universal serial bus connector through PC. In [3] the lecturers at the Nnamdi Azikiwe University have worked on the model and performance evaluation of a superheterodyne receiver. Paper [4] depicts the designing of a portable transceiver for the application of FM transmission and reception together.

The following papers are explained briefly below

2.2) Design and working of FM transmitter [1]

UG department of Electronics and communication engineering, Raj kumar Goel institute of technology for women Ghaziabad

- The project focuses on the target of planning the scale down low – control FM transmitter, and its uses in various applications.

- Applications like listening device for systems like tour guide, security of small territories, and for the amusement reason, FM transmitter has various advantages over the AM.

- FM shields the signal from obstruction and undesirable noise. It gives high S/N (signal to noise) than AM.

2.3) Implementing USB FM Radio receiver for computer[2]

Department of Electronics and Communication ,

School of Engineering, R.K University,Gujarat.

- The previously mentioned demonstrate depicts the making of a FM Radio using PC fringe known as USB (Universal serial transport) radio, worked as play device for the PC.

- ·The Radio is prepared for tolerating FM motions in standard FM band of 88 to 108 MHz.

- ·The display is proposed to take favorable position of the outstanding correspondence convention Universal Serial Bus (USB) by partner a FM radio to an individual PC.

- ·A required power for the hardware module is conveyed by the PC by means of Universal Serial Bus. In the equipment module, critical sections are the FM radio beneficiary IC and the microcontroller.

- ·Software programming like keil, java, C++ is used in the model

2.4) Performance Evaluation and modelling of a Superheterodyne Receiver[3]

Department of Electronics and Communication Engineering, Nnamdi Azikiwe University, Awka Anambra State, Nigeria.

- ·High rate of obstruction happens between the stations because of the addition of various FM stations. This obstacle provokes low quality of sound.

- ·This impedance prompts low quality of sound of a fundamental AM/FM collector. Research has exhibited that the usage of wrong part and poor ICs are prompting such obstruction and different inconveniences of a recipient framework.

- ·This inquire about work examines and evaluates an exceptionally coordinated FM/AM radio single-chip recipient streamlined for control utilization of a low extent and slightest outer parts, with the working frequency of 88 MHz - 108 MHz and 550kHz - 1600 kHz covering the essential FM and AM groups separately

- ·The single-chip beneficiary similarly gets rid of the hindrances of reliable beneficiaries, with better selectivity, affectability, proper between balance (IM) rejection and sound speaker. For the outlining and assessment of the coveted collector, Multisim programming is utilized.

2.5) Designing of portable FM radio transceiver[4]

Dept. of Electronics & Communication Engineering Alpha College Of Engineering, Bangalore India

- In this paper, a framework is clarified that is prepared of transmitting and Receiving FM Radio signals in the band of 76MHZ to 108 MHZ.

- · Basic C-programming orders and codes are utilized as a part of this model to accomplish FM transmission and gathering.

- ·The essential intention of communicate FM radio handset is for the compact and advantageous applications like telecom scholarly data in any of the unreservedly open station.

- · In India, however the thought is still under investigation by WPC, transmission of low power signs can be accomplished without obstruction.

- ·The same device can be extending to impart inconvenience movement in case of basic fiascos and human ascent needs.

Chapter 3

PROPOSED MODEL

3.1) Project Introduction

A radio collector is an electronic gadget/contraption that gets radio waves and changes over the information passed on by them to a usable form. An reception apparatus comes being used to get the signal. The beneficiary uses the electronic channels to separate the coveted radio frequency motion from different signs which are gotten by the receiving wire, to build the energy of the signal, an electronic enhancer is utilized for additionally preparing, and at last recuperates the required data through the procedure of demodulation. Of the radio waves, FM is the most widely recognized one being used .Frequency balance is by and large utilized for broadcasting the FM. It likewise has different applications like telemetry, radar, frameworks, synthesis of music, attractive copying frameworks and some video-transmission frameworks. Frequency balance has favorable position of a bigger signal to-clamor proportion and in this way expels radio frequency obstruction superior to anything a similarly fueled adequacy tweak (AM) signal.

3.2)More About FM Receiver

In FM receiver application the transistor works as an amplifier. In radios, they are devices that lifts faraway signals. An amplifier performs better if utilized in a certain range of frequencies called bandwidth. Amplifier job is to convert a miniature electric current into a larger one. An amplifier has a threshold for boosting the signal without distortion. One approach to get around this is to connect more than one amplifier, so output from one is sustained into next one’s input. Devices like these are multistage amplifier. Some audio equipments uses 2 separate amplifier.

- Pre amplifier

-main amplifier

Pre amplifier-Takes original signal and boost it to minimum input level.

Main Amplifier- Boosts the signal enough to power up the loudspeakers.

3.3) Signal to Noise Ratio

Every now and again named as a measure of Sensitivity execution of a radio collector. Affectability or commotion level can be computed by looking at the signal and clamor levels for a known signal level. Clearly more noteworthy the Signal to clamor proportion, more noteworthy is the contrast between the signal and the bothersome commotion, better the radio beneficiary affectability execution .

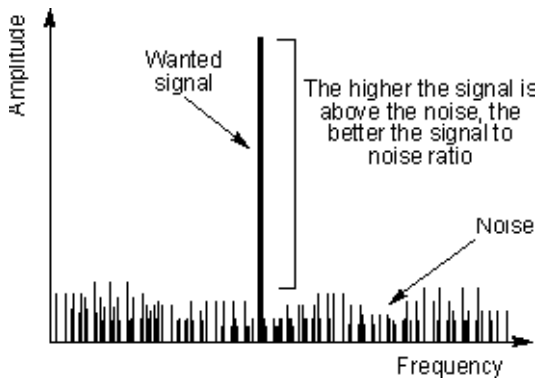


Figure 3.3:Signal to noise ratio

The difference is usually depicted as the ratio between the signal to noise and it is expressed in the unit of decibels. Input signal must be entered in microvolt (mV).Commonly, a certain input level is necessary to give a 10dB signal to noise ratio is specified.

3.4) Hardware equipment

- IC- LM386
- T1 andT2 BF494 andBF495
- 22SWG 4mm dia air core
- C1 220nF
- C2 2.2nF
- C 100nF * 2
- C4 10uF
- C5 10uF (25 V)
- C7 47nF
- C8 220 uF(25 V)
- C9 100 uF (25 V) * 2
- R 10KΩ * 2
- R3 1KΩ
- R4 10Ω
- Variable resistance
- Variable capacitance
- Speaker
- Switch
- Antenna
- Battery

3.5) LM 386

The Lm386 coordinated chip in a low power sound frequency enhancer, it utilizes the low level power supply like batteries in electronic circuits. It is made as 8 stick little DIP package. This gives the voltage improvement of 20. Voltage get can be raised up to 200 by using the outside parts. When it works from a 6 volt control supply, peaceful power will be 24 milliwatts, which impacts LM386 for idealize battery to task

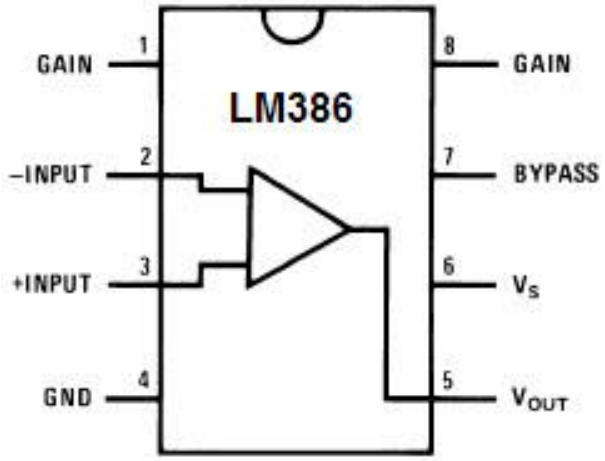


Figure 3.5 a:Pin diagram of LM386

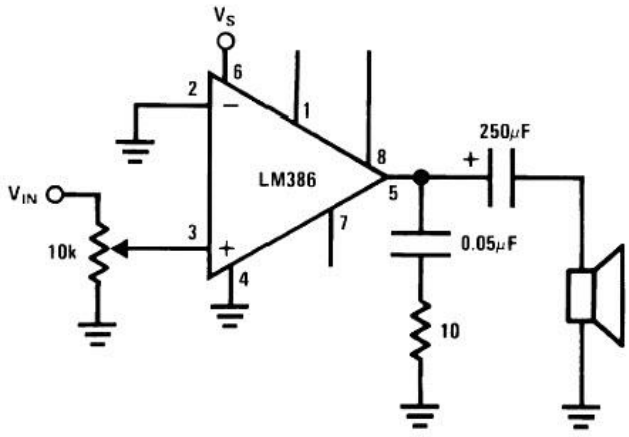


Figure 3.5 b:Circuit diagram of LM386

3.6) Transistor BF494 and BF495

PIN	DESCRIPTION
1	base
2	emitter
3	collector

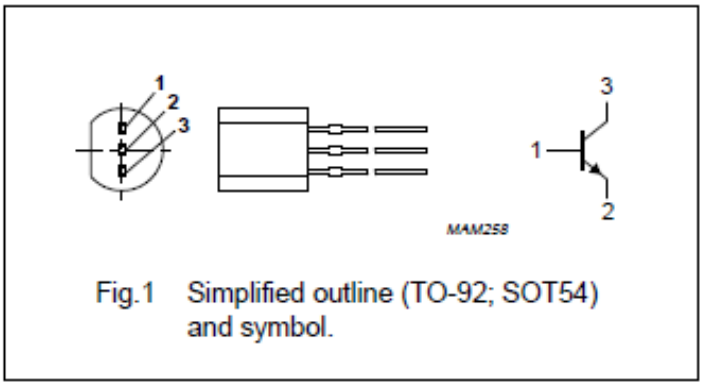


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

Figure 3.6: Pin diagram of BF494

3.6.1) FEATURES

- Low current (max. 30 mA)
- Low voltage (max. 20 V).

3.6.2) APPLICATIONS

- High repeat Application iv TV and radio FM tuners
- ·Amplitude tweak blender osscilator with low clamor
- ·IF speakers in AM/FM collectors.

CHAPTER- 4

CIRCUIT DIAGRAM AND WORKING

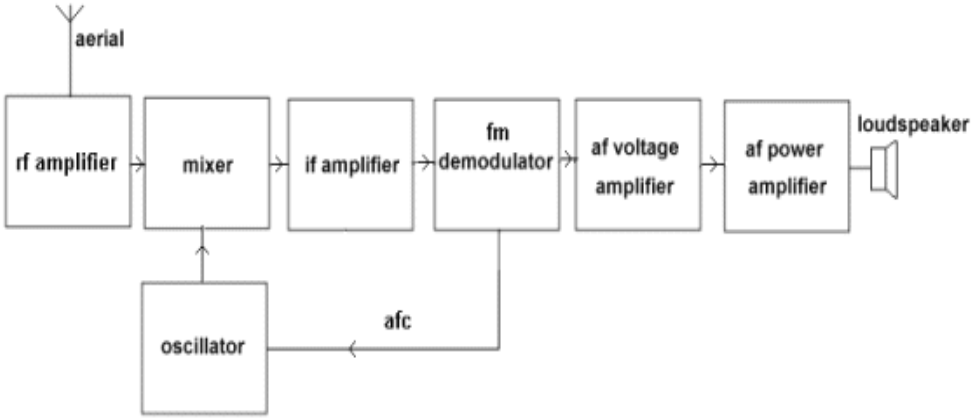


Figure 4.1:Block Diagram

4.1) Block diagram

The FM band covers 88-108 MHz. There are signals from different radio transmitters in this band affecting sign voltages in the aeronautical. The RF speaker picks and expands the pined for station from the many. Selected frequency can be changed in this band, therefore it is customisable. This is insinuated as TUNING. In recipients which are made of a facilitate the tuning is settled and the tuning channel is adequately wide and allows each one of the signs in the frequency change band. The picked frequency is associated with the blender. The blender is reinforced with the yield of the oscillator. The blender and oscillator together constitute a FREQUENCY CHANGER circuit. The yield achieved from the blender is the transitional frequency (IF). The IF is a specific frequency of 10.7 MHz. Unrelated to what the frequency of the picked radio station is, the IF is continually 10.7 MHz. The IF signal is managed into the IF enhancer. The advantage of the IF intensifier has inclination of settled frequency and information exchange limit, paying little heed to what the frequency the moving toward sign has. This makes the arrangement and errand of the intensifier less convoluted."

This guarantees that the oscillator frequency is steady disregarding the temperature changes. The audio signal voltage is increased in amplitude by a voltage amplifier. The power level is expanded in a sufficient way to drive the loudspeaker by the power amplifier. Some of the audio is fed back to the oscillator as an AUTOMATIC FREQUENCY CONTROL voltage.

4.2) Superheterodyne Receiver

A Superheterodyne Receiver, consistently abridged to superhet, is a sort of radio collector that uses the blending of frequency to change a got signal to a settled Intermediate frequency(IF) which can be more accommodatingly took care of than the first transporter frequency..

4.3) Design and Principle of Operation

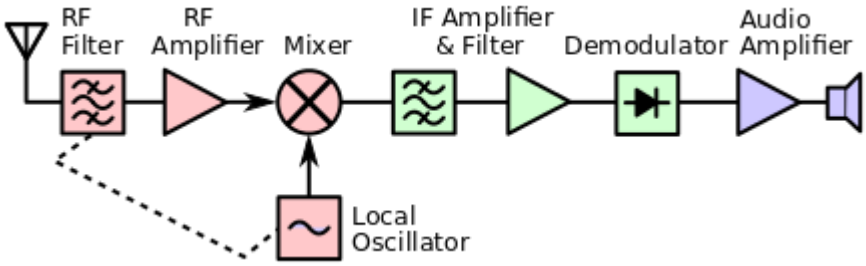


Figure 4.3:Block diagram of superhet

The outline has obstructs that are basic to superheterodyne collectors. The reception apparatus assembles the radio wave. The tuned RF organize with elective RF intensifier gives some underlying selectivity; it's important to cover the picture frequency and may in like manner serve to check powerful out-of-passband signals from immersing the underlying electronic hardware.

Blending of the frequency is given by an area generator; it's essentially a variable frequency oscillator that is utilized to tune the beneficiary to different totally extraordinary stations. The frequency blender will the standard heterodyning that from wherever we tend to get the name of superheterodyne; it modifies the approaching frequency signal to a superior or lower, settled, middle frequency (IF). The IF band-pass channel and enhancer chiefly give the majority of the pick up and along these lines the narrowband separating for the radio. The demodulator isolated the sound or other balance from the IF radio frequency.

The isolated signal is then expanded by the enhancer. The obtained signal is at present handled by the demodulator arrange wherever the sound banner is recuperated thus more opened up. AM gathering needs the direct amendment of the RF hail (charged envelope distinguishing proof), and a simple RC low pass channel to get free of leftovers of the center fequency.FM signals is additionally distinguished utilizing a spirit, extent connection identifier, or stage darted circle. Steady wave (Morse code) and single sideband signals require a thing pointer using a gathered beat frequency generator, and there territory unit distinctive systems utilized for various sorts of alteration. The following sound movement (for instance) is then opened up and drives an amplifier system.

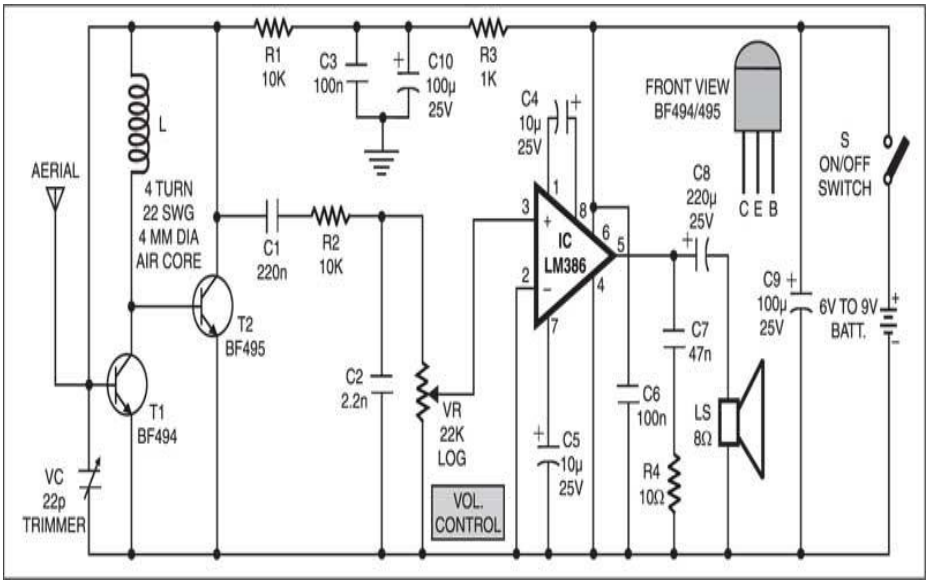


Figure 4.4: Circuit diagram of receiver

4.4)Implementation and working

Transistor BF495(T2), in conjunction with resistance R1 , coil L, twenty two pico farad Variable capacitor and intrinsic capacitance of semiconductor device , includes generator colpitts.

Reverberation frequency of this generator is about by trimmer VC to the frequency of transmission station that we have a tendency to should need to continue i.e tuned between eighty eight to 108 megacycle. Data signal utilized as a part of transmitter to perform modification is isolated on electrical contraption R1 and supported to the enhancer over a 220nF coupling capacitor(C1). The difference in factor electrical condenser is from a couple of picofarads to concerning 20pF. Accordingly a 22pF trimmer could be a better than average assurance and is irrefutably open inside the market. In case abuse another electrical condenser having a more prominent capacitance and square measure unfit to get full FM information measure, by then undertaking dynamical VC. Variable capacitance is picked through a trial. Self supporting circle has four turns of 22SWG enameled copper wire, with air focus having 4mm internal expansiveness. once required extent of turns has accomplished, the twist is started the barrel and broadened a trick all together that the turns don't bit each other. electrical condenser C3(100uF) and C10(100uF,25V), in conjunction with R3(1K), consolidates a Band Pass Filter for disagreeably low frequency that is used to detach the low frequency movement from high frequency movement in recipient.

4.4.1) Collpitts oscillator

Colpitts oscillator utilize 2 centre tapped capacitors who are connected in series connection along with a inductor in parallel to them to form its resonance tank circuit and produce oscillations which are sinusoidal.

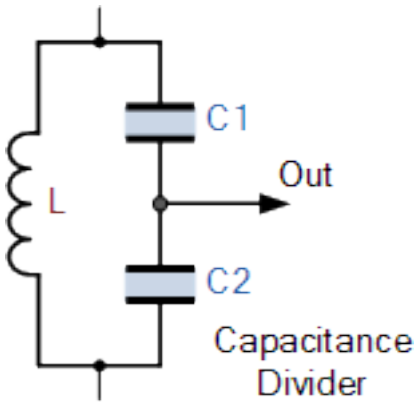


Figure 4.4.1:Colpitts oscillator

4.4.2) Resonance Frequency

In material science, Resonance could be a development within which a vibratory system drives another framework to waver with expanding abundancy at bound frequencies. Frequencies at that the reaction amplitude could be a relative most are called the framework's full frequencies or reverberation frequencies."

4.4.3) Band Pass Filter

BP channel is a gadget that exclusive permits frequencies upto a specific range and weakens frequencies which don't fulfill the criteria.

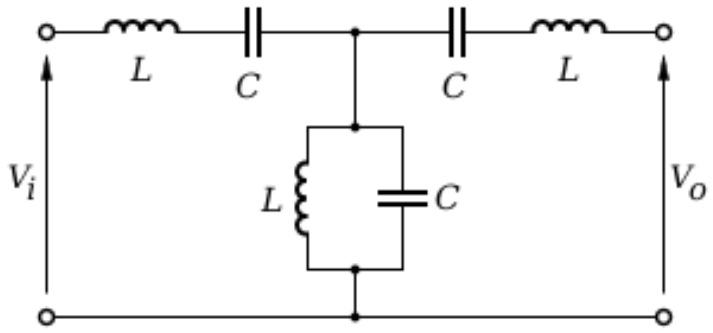


Figure 4.4.3: Bandpass filter

4.4.4) Q Factor

Bandpass can be recognized by its Q factor. The Q factor is the proportional of partial data transfer capacity. A high-Q channel connotes a tight passband and low-Q channel means a wide passband.

4.4.5) Antenna

For receiver antenna we can make use of any telescopic antenna of any kind. A piece of isolated copper can help in achieving a good reception. The ideal length of copper wire can be acquired tentatively.

CHAPTER - 5

FM Radio using TEA5767 and Arduino UNO

5.1)List of components

The list of components required for the project is:

-Arduino UNO, or any other similar board friendly with the arduino environment.

-TEA5767 FM Radio module

-16X2 LCD

-2 Buttons Normally open (NA) or push buttons

-330 ohms resistor

-2x 10 k ohms resistor

-Jumper wires

-Switch for to power on the radio

-Led (as a power on indicator)

5.2) Arduino UNO

It could be wide used open source microcontroller assisted equipment on the ATmega328P micro controller and advanced by Arduino. The board is equipped with gathering of advanced and simple information/yield (I/O) pins that may be interfaced to various growth boards (shields) and alternative circuits. The board options fourteen digital pins and six analog pins. It's programmable with the Arduino IDE (Integrated Development Environment) through a sort B USB line.

It is often powered by a USB interface or by an external nine volt battery, although it recognizes voltages in middle of seven and twenty volts. This is conjointly kind of like the Arduino Nano and designer. The hardware reference style is distributed underneath a creative Commons attribution Share-A like 2.5 allow and is out there on the Arduino web site. Plan and creation files for a few versions of the hardware are obtainable. "Uno" means that one in Italian and was chosen to mark the discharge of Arduino software(IDE)1.0 .The Uno board and version 1.0 of Arduino software (IDE) were the reference types of Arduino, currently evolved to additional forward releases. The Uno board the beginning one in the series of USB Arduino boards, and moreover the reference exhibit for the Arduino platform. The ATmega328 on the Arduino Uno thinks about a pre programming with a bootloader that permits to upload new code there to while not the employment of an external hardware computer programmer. It communicates using the initial STK500 rule. The Uno doesn't use the FTDI USB-to-serial driver chips as it conjointly varies among all past boards . Or maybe, it options the Atmega16U2 (Atmega8U2 up to adjustment R2) tweaked as a USB--serial changer. The Arduino UNO is mostly thought of the foremost easy and well-liked board.

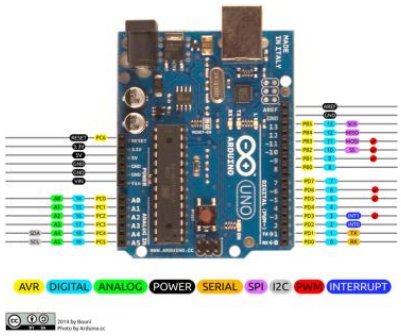


Figure 5.2: Pin diagram of arduino uno

5.2.1)Arduino technical specifications

- Microcontroller: ATmega328P
- Operating Voltage: 5v
- Input Voltage: 7-20v
- Digital I/O Pins: 14 (of which 6 provide PWM output)Analog Input Pins: 6

- DC Current per I/O Pin: 20 mA.
- DC Current for 3.3V Pin: 50 mA
- Flash Memory: 32 KB of which 0.5 KB used by bootloader
- SRAM: 2 KB
- EEPROM: 1 KB
- Clock Speed: 16 MHz
- Length: 68.6 mm
- Width: 53.4 mm
- Weight: 25 g

5.2.2) Arduino Pins

- LED: There is an intrinsical LED driven by advanced stick 13.Once the stick is HIGH esteem, the LED is on, once the stick is LOW, it's off.
- VIN: The input voltage to the leading group of the arduino once it's utilizing an outside power source. You can offer voltage through this stick, or, if offering the voltage by means of the power jack, utilize it through this stick.
- 5V: ·On the board five volt directed yield is given from the controller on the board by this stick. The board might be outfitted with control from on of the DC control jack or the USB connector (5V), or the VIN stick of the board (7-20V).
- 3V3: 3.3 potential unit provided by the on-board controller. Most present draw is 50 mA.

- IOREF: ·This stick on the Arduino board supplies the voltage reference with that the microcontroller works. An appropriately outlined protect will read the IOREF stick voltage and pick the reasonable power source or alter voltage interpreters on the yields to work with the 5V or 3.3V.

- Reset: Shields which block the one on the board are reset through this pins.

5.2.3) Special Pins

Every one of the fourteen advanced pins and six Analog sticks on the Uno will be utilized as either information or yield, using pinMode(), digitalWrite(), and digitalRead() capacities. They work at 5 volts.

Each stick will plus or minus 20 mA as recommended operational condition and has an encased draw up resistor (separated as a matter of course) of 20-50k ohm. A the greater part of 40mA is the limit esteem not to be surpassed on any I/O stick to stay away from perpetual harm to the microcontroller. The Uno has 6 simple information sources, marked A0 through A5, everything about gives ten bits of determination (i.e. 1024 completely separated qualities). As a matter of course they measure from ground to 5 volts, despite the fact that it is possible to change the upper end of their range utilizing the AREF stick andtherefore the analogReference() work.

In addition, some pins have specialized functions:

- Serial: Implemented in receiving and transmitting .These pins are associated with the relating pins of the ATmega8U2 USB-to-TTL Serial chip..
- External Interrupts: These are often designed to trigger a hinder on a low esteem, a rising or falling edge, or alteration in esteem.
- SPI:These sticks back the SPI correspondence using the SPI library.
- TWI:. Support Two wire interface exchange of data utilizing the Wire library.

5.3) TEA5767 FM Radio module

The TEA5767HN could be a single-chip which is tuned electronically for low-tension applications subsisting of totally integrated Intermediate Frequency (IF)selectivity and demodulation. The best part of this module is that this radio module is totally adjustment-free and solely needs a minimum of small and low value external parts. The power utilization of the tuner is low. Current is about 13 mili ampere and voltage to be provided can be fluctuated in the vicinity of 2.5 and 5V.

This application note portrays this FM radio in a minor size and smal potential use. To exhibit the task of the tuners a demoboard is produced, which may be reached out with a product manageable enhancer and a RDS chip. The total application can be managed through a PC by implies that of demo a product framework.

5.3.1)Block Diagram

A piece chart of TEA5767HN,the FM radio module is appeared in Figure 3.5.1. The outline involves assortment of hinders that will be disclosed by the signal way driving from the receiving wire to the sound yield. The RF receiving wire signal is put into an adjusted low commotion intensifier (LNA) through a RF coordinating circuit. LNA yield signal is sustained to a programmed pick up control circuit (AGC) to keep away from the over-burdening of the LNA and the mixer.The Radio Frequency signal is changed over to an Intermediate Frequency signal of 225KHz by duplicating the signal with a nearby oscillator signal (LO) in the quadrature mixer.The picked blender design supplies inalienable picture dismissal. The VCO produces a signal with the frequency equivalent to twofold of important frequency for the I/Q blender structure. In the N1 divider hinder, the required LO signal is made. The frequency of the VCO is taken care of with a PLL synthesizer framework. The I/Q motions out the blender are given to a coordinated IF channel (RESAMP piece). The IF frequency of this channel is controlled by the IF Center Frequency change piece.

The IF signal is so on passed on to the limiter square, which disposes of the plentifulness variety from the signal. The limiter is associated with the level ADC and in this way the IF counter pieces. These two squares give the suitable data with respect to the adequacy and frequency of the Radio Frequency input signal, which will be utilized by the PLL as stop paradigm. The Integrated chip bargains of a demodulator alongside a coordinated resonator. The demodulator is completely incorporated which makes IF arrangements or an outer resonator superfluous.

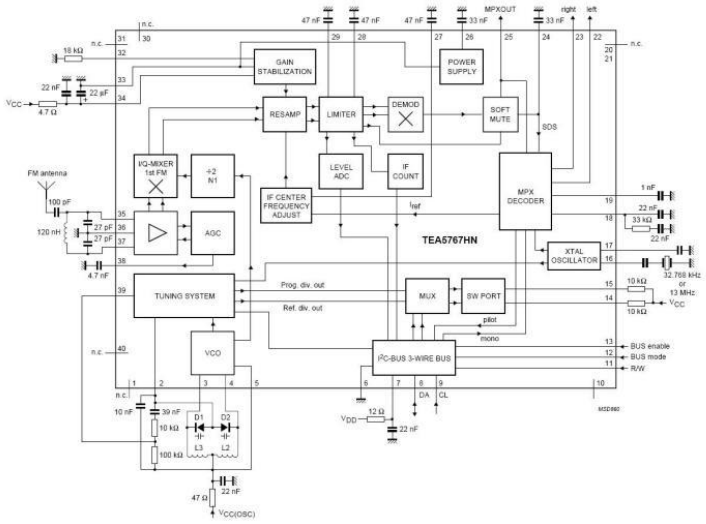


Figure 5.3.1:Block diagram of TEA5767

5.3.2)FM STEREO application

This application involve two important circuits: RF input circuit and a FM oscillator circuit. The trading of information with a µ-PC can be performed through an I2 C or a 3-Wire serial interface transport, selectable with BUSMODE stick, for the TEA5767HN. TEA5768HL works in I2 C transport mode and TEA5757HL in 3-Wire transport mode. The beneficiaries can be modified by the vehicle interface to work with 32.768KHz or 13MHz clock gem. The PLL additionally, can be planned with 6.5MHz clock signal. The amount of yields that are available are three i.e: sound left, stable right and MPX (multiplex). A fundamental application graph of the FM collector is appeared in Figure 3.5.2.

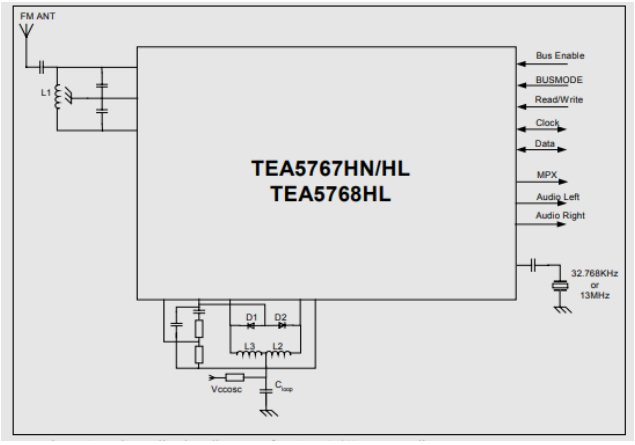


Figure 5.3.2:Basic application diagram of TEA5767

5.3.3)TEA5767 Package

It is a 40 pins HVQFN package Integrated chip which can be rum along I2 C or.The designing of miniature application packagewith least or very small and low price equipments is possible due to fully integrated intermediate frequency selectivity and demodulation.

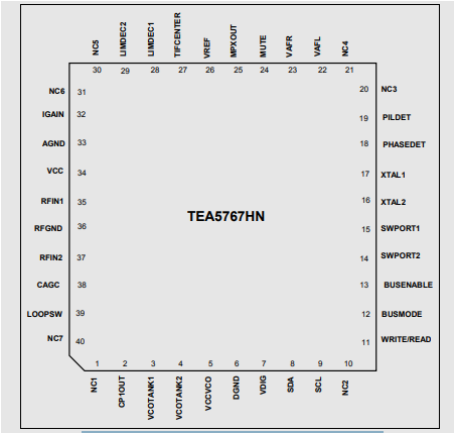


Figure 5.3.3-a:Pin diagram

SYMBOL	PIN	DESCRIPTION	Voltage min.	SYMBOL	PIN	DESCRIPTION	Voltage min.
NC1	1	Not connected		NC4	21	Not connected	
CPOUT	2	Charge pump output of the synthesiser PLL	1.64V	VAFL	22	Audio left output	
VCOTANK1	3	VCO tuned circuit output 1	2.5V	VAFR	23	Audio right output	
VCOTANK2	4	VCO tuned circuit output 2	2.5V	TMUTE	24	Time constant for the softmute	1.5V
VCCVCO	5	VCO supply voltage	2.5V	MPXOUT	25	FM demodulator MPX out	
DGND	6	Digital ground	0V	VREF	26	Reference voltage	1.45V
VDIG	7	Digital supply voltage	2.5V	TIFCENTER	27	Time constant for IF centre adjust	1.34V
DATA	8	Bus data line input/output		LIMDEC1	28	Decoupling IF limiter 1	1.86V
CLOCK	9	Bus clock line input		LIMDEC2	29	Decoupling IF limiter 2	1.86V
NC2	10	Not connected		NC5	30	Not connected	
WRITE/READ	11	Write/read control for the 3-Wire bus		NC6	31	Not connected	
BUSMODE	12	Bus mode select input		IGAIN	32	Gain control current for IF filter	0.48V
BUSENABLE	13	Bus enable input		AGND	33	Analog ground	0V
SWPORT1	14	Software programmable port 1		VCC	34	Analog supply voltage	2.5V
SWPORT2	15	Software programmable port 2		RFIN1	35	RF input 1	0.93V
XTAL1	16	Crystal oscillator input 1	1.64V	RFGND	36	RF ground	0V
XTAL2	17	Crystal oscillator input 2	1.64V	RFIN2	37	RF input 2	0.93V
PHASEDET	18	Phase detector loop filter	1.0V	CAGC	38	Time constant RF AGC	
PILDET	19	Pilot detector lowpass filter	0.7V	LOOPSW	39	Switch output of synthesiser PLL filter	
NC3	20	Not connected		NC7	40	Not connected	

Figure 5.3.3-b:Pinning description of TEA5767

CHAPTER -6

CIRCUIT DIAGRAM AND WORKING

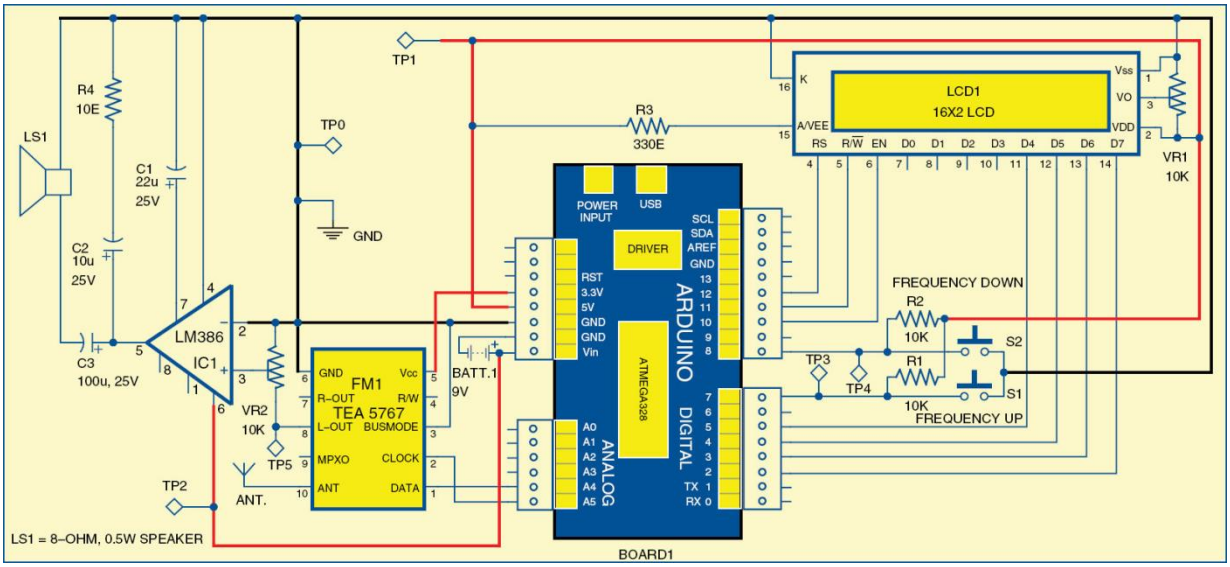


Figure 6.1 Circuit connections for Arduino based FM Radio

6.1) Circuit description and working

The circuit of the Arduino-based FM beneficiary, appeared in Fig. 4.1.1-a, is worked around Arduino UNO board (board1), TEA5767 radio collector module (FM1), LM386 low-control (IC1), 16×2 LCD (LCD1) and 8-ohm speaker (LS1).

6.1.1)Arduino UNO board

Arduino is an open source contraptions prototyping stage in perspective of versatile, easy to-use gear and programming. It is normal for authorities, organizers, masters and anyone enthusiastic about making shrewd articles or conditions.

Arduino UNO is a board in perspective of ATmega328 microcontroller. It has 14 modernized information/yield pins, six straightforward wellsprings of data, a USB relationship for programming the on-board microcontroller, control jack, an ICSP header and a reset get.

Task is with a 16MHz gem oscillator and contains everything anticipated that would help the microcontroller.

It is anything but difficult to use as the client just needsto interface it to a PC with a USB connection, or power it with an AC-to-DC connector or battery, to start. The microcontroller on the board is modified using Arduino programming lingo and Arduino progression condition.

Pins A4 and A5 of the Arduino load up are associated with DATA and CLOCK pins of the FM module (FM1), separately. 10 through 12 pins of the Arduino board are associated with EN, R/W and RS pins of LCD1 while pins 2 through 5 are associated with information pins of the LCD. Pins 7 and 8 of the Arduino board are associated with material switches S1 and S2 to increment and diminishing FM frequency, individually.

6.1.2) Arduino code

1 - > Arduino SDA (stick A5 arduino uno)

2 - > Arduino SCL (stick A4 arduino uno)

3 - > GND

5 - > +3.3 V

6 - > GND

7 - > Audio out (right channel)

8 - > Audio out (left channel)

10 - > Antenna

* LCD RS stick to computerized stick 12

* LCD Enable stick to advanced stick 11

* LCD D4 stick to advanced stick 5

* LCD D5 stick to computerized stick 4

* LCD D6 stick to computerized stick 3

* LCD D7 stick to computerized stick 2

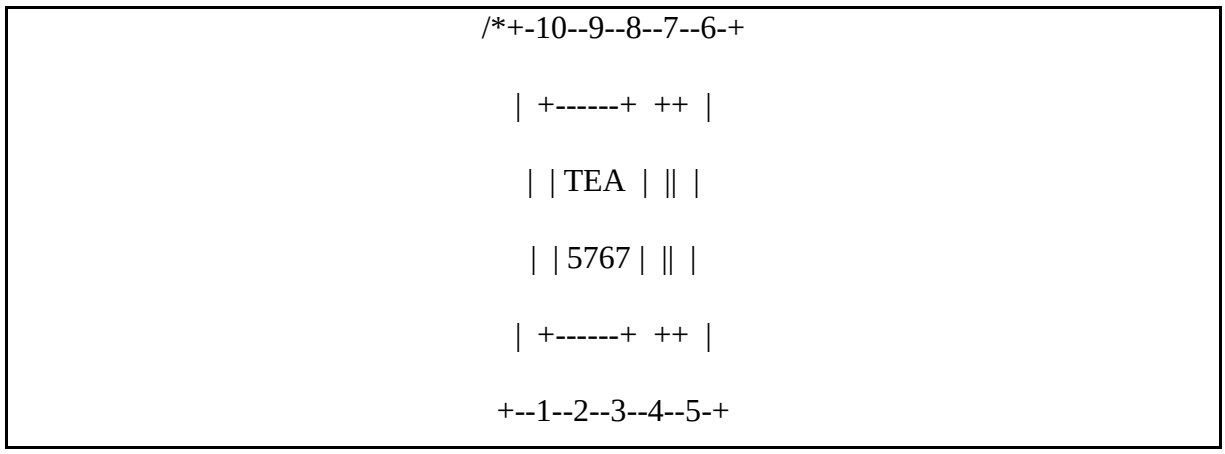
* LCD R/W stick to ground

* closures to +5V and ground

* UP SEARCH (A0)

* DOWN SEARCH (A1)

* ALL RESISTOR ARE 10K AND PUSH BUTTON IN PULL DOWN MODE



#include<Wire.h>

#include <TEA5767Radio.h>

#include <LiquidCrystal.h>

```
TEA5767Radio radio = TEA5767Radio();
LiquidCrystal lcd(12, 11, 5, 4, 3, 2);
skim frequency = 0;
int fUP = A0;
int fDOWN = A1;
int tally = 0;
void setup()
{
delay(1000);
Wire.begin();
frequency = 91.1;/beginning frequency
radio.setFrequency(frequency);
lcd.begin(16,2);
lcd.clear();
lcd.setCursor(0,0);
lcd.print("FM: ");
lcd.setCursor(0, 1);
lcd.print(frequency); }
void circle()
{
if(digitalRead(fUP))
{
```

```
count=0;
while (digitalRead(fUP))
{
count++;
if(count > 0 && tally <= 6)
{
frequency += 0.1;
frequencyUpdate();
delay(200);
}
else if (check > 6 && tally <= 2)
{
frequency += 0.1;
frequencyUpdate();
delay(80);
}
else
{
frequency += 0.1;
frequencyUpdate();
delay(5);
}}}
```

```
if(digitalRead(fDOWN))
{
check = 0;
while (digitalRead(fDOWN))
{
check - ;
if(count < 0 && check >= - 6)
{
frequency - = 0.1;
frequencyUpdate();
delay(200);
}
else if (check < - 6 && tally >= - 12)
{
frequency - = 0.1;
frequencyUpdate();
delay(80);
}
else
{
frequency - = 0.1;
frequencyUpdate();
```

```
delay(5);
}
}
}
}
void frequencyUpdate()
{
frequency = constrain(frequency, 88.0, 108.0);
lcd.setCursor(0,0);
lcd.print("ESTACION DE FM:");
lcd.setCursor(0,1);
lcd.print(frequency);
radio.setFrequency(frequency);
}
```

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