DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING,
FACULTY OF ECE,
Rajshahi University of Engineering & Technology, Bangladesh

EEE-4118– Radio & TV Engineering Sessional

Student Sessional Report

Submitted to

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Heaven's light is our guide.

Rajshahi University of Engineering and Technology

Department of Electrical & Electronic Engineering

Course no. EEE 4118

Course title: Radio & TV Engineering Sessional

Experiment no. 01

Experiment name: Study of AM receiver and observation of signals at different stages of AM receiver kit.

Date of experiment: May 3, 2023

Date of submission: May 17, 2023

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Experiment no. 01

1.1 Experiment Name

Study of AM receiver and observation of signals at different stages of AM receiver kit

1.2 Objectives

- To get acquainted with the operation of the AM Receiver Kit
- To know the process of tuning of the local oscillator and the receiver for any particular station

1.3 Theory

AM receiver is that receiver which takes input AM modulated electromagnetic wave, demodulate it and output as a voice signal. This is an electronic equipment which pick-ups the desired signal, reject the unwanted signal and demodulate the carrier signal to get back the original modulating signal. This receiver is a super-heterodyne type receiver. This type of receiver uses an intermediate frequency by mixing the message signal and a high frequency signal. From the intermediate signal output is taken to speaker.

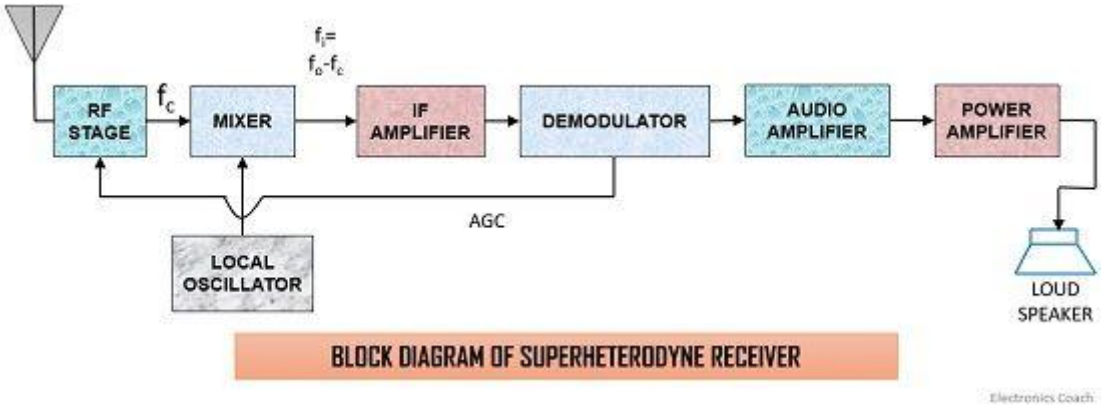

Fig 1.1 Block Diagram of a Superheterodyne AM Receiver

A Super-heterodyne receiver has different stages of operation, such as,

- ***Receiving Antenna*:** Receiving antenna convert the electromagnetic signal to electrical signal. It can sense all frequencies.
- ***RF amplifier*:** RF amplifier amplify the input signal voltage to a suitably high level before feeding it to the frequency mixer which contributes large noise. Thus, the signal/noise ratio is improved. It also provides discrimination or selectivity against image frequency signal and intermediate frequency signal.
- ***Mixer*:** Here,
  - ***Local oscillator*** maintain constant frequency difference is between the local oscillator and the RF circuits, normally through capacitance tuning. The local oscillator is a variable oscillator capable of generating a signal from 0.995 MHz to 2.105 MHz
  - ***Frequency mixer*** mixes RF carrier frequency signal with a predetermined local oscillator signal in the mixer. The signal from the mixer is then supplied to the IF (intermediate-frequency) amplifier and generally it is 455 kHz.
- ***IF amplifier*:** IF amplifier amplify the intermediate frequency signal. Because of its narrow bandwidth, the IF amplifier rejects all other frequencies but 455 kHz. This rejection process reduces the risk of interference from other stations. This selection process is the key to the superheterodyne's exceptional performance, which is why it is widely accepted.
- ***Detector***: Detector detects the IF signal by filtering the signal by eliminating one of the sidebands still present and separates the RF from the audio components of the other sideband

- ***Audio amplifier:*** Audio frequency output from detector is fed to the a.f. amplifier which provides additional amplification. If the signal strength is low to drive a speaker, power amplify is used to add power.
- ***Speaker:*** Speaker converts the electrical signal to audio signal.

1.4 Apparatus

- AM/DSB Receiver (Model: KL-93062)
- Power supply
- Multi-meter
- Connecting wire
- Oscilloscope

1.5 Experimental Setup

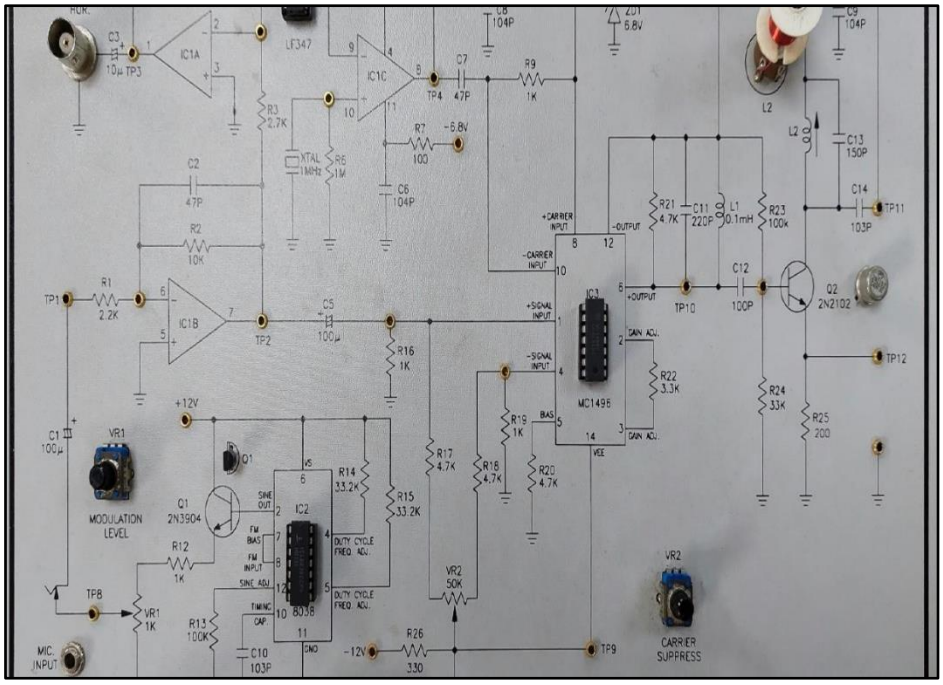

Fig 1.2 Kl-93061 AM/DSB Transmitter radio kit

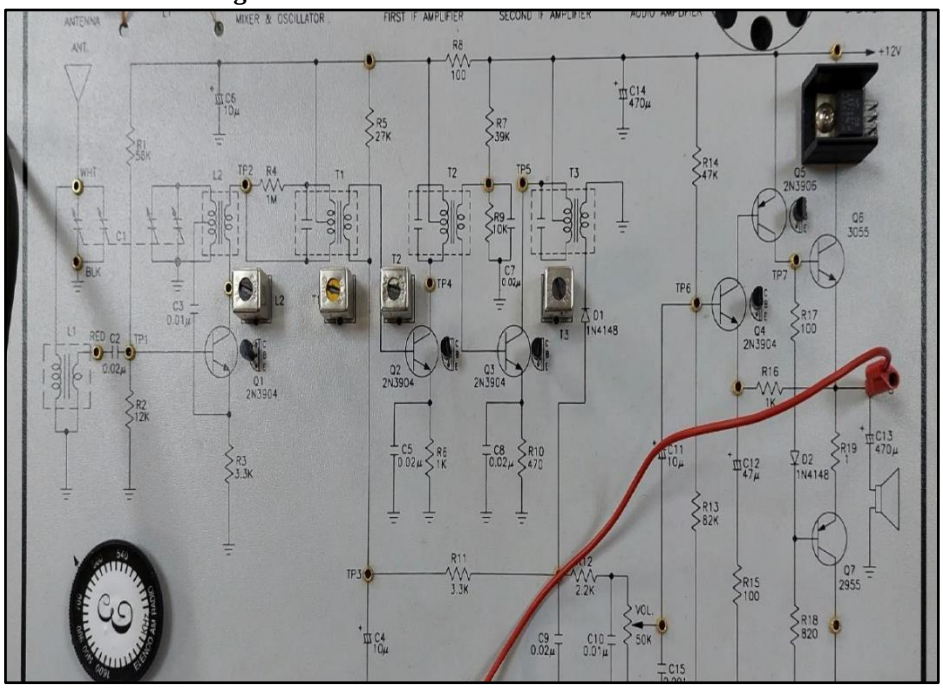

Fig 1.2 Kl-93061 AM/DSB Receiver radio kit

1.6 Oscilloscope Output

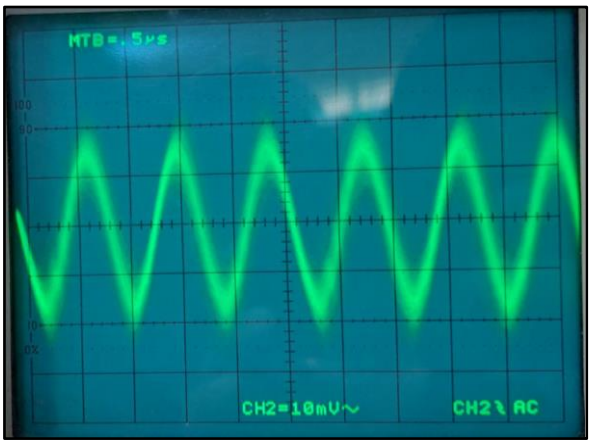

Fig 1.3 Signal received by antenna

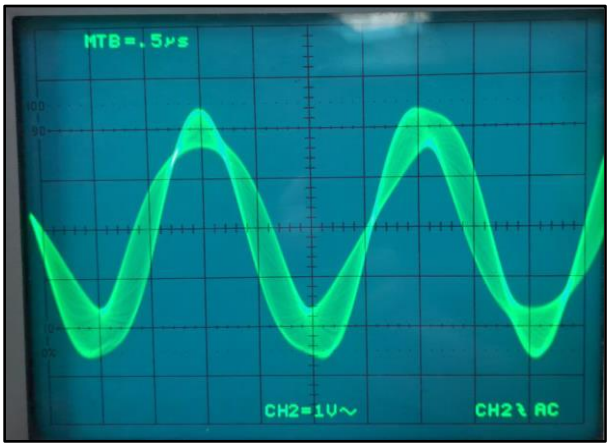

Fig 1.4 Signal of mixer output

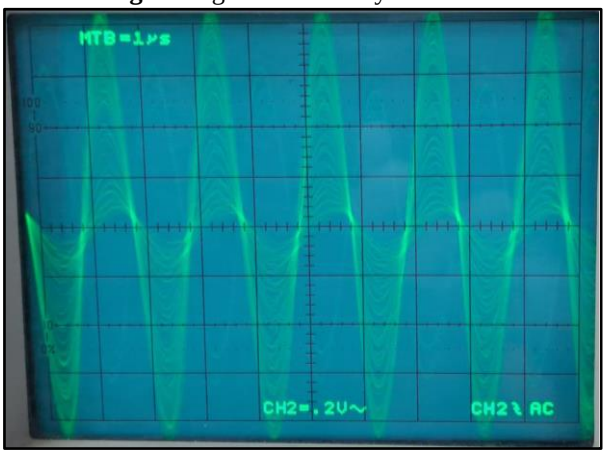

Fig 1.5 Signal at1st IF amplifier output

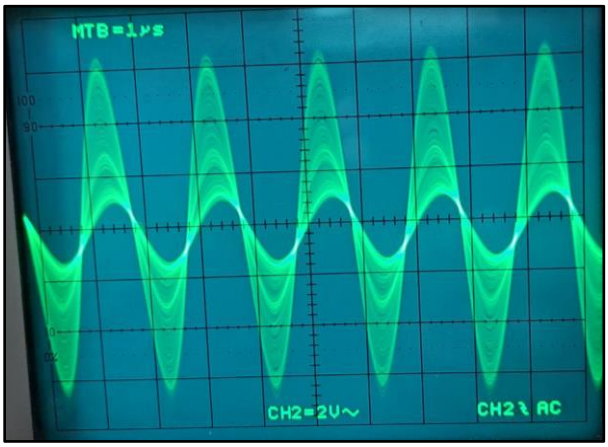

Fig 1.6 Signal at 2nd stage amplifier

Fig 1.7 Signal at receiver's output

1.7 Discussion & Conclusion

Signal reception was successful in this experiment. The experiment, according to our theoretical knowledge, was carried out in Kl-93062 AM Radio KIT. Step by step, various block and tuning procedures were noticed. The intended signal was then viewed on the oscilloscope. A signal at 1 MHz was received by the receiver's antenna.

The signal is then routed through the Mixer and Oscillator, the IF amplifier, and the RF amplifier before reaching the output end. Due to a training kit malfunction, the received signal can be seen distorted at times. However, that experiment was deemed a success.

1.8 Reference

• Radio Engineering – GK. Mithal

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Rajshahi University of Engineering and Technology

Department of Electrical & Electronic Engineering

Course no. EEE 4118

Course title: Radio & TV Engineering Sessional

Experiment no. 02

Experiment name: Study of FM receiver and observation of signals at different stages of FM receiver kit

Date of experiment: May 3, 2023

Date of submission: May 17, 2023

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Experiment no. 02

2.1 Experiment Name

Study of FM receiver and observation of signals at different stages of FM receiver kit

2.2 Objectives

- To get acquainted with the operation of the FM Receiver Kit
- To learn the procedure of how FM receiver works
- To understand about the operation of an antenna and how it radiates electromagnetic waves.
- To gain an understanding of the process of combining the message or modulating signal with the high frequency carrier signal.

2.3 Theory

FM receiver is that receiver which takes input FM modulated electromagnetic wave and converts the information carried by them to a usable form. The received signal captured by the antenna is amplified by the RF amplifier. After that, the amplified signal is applied to the mixer stage. The local oscillator provides the mixer's second input.

The IF amplifier then amplifies this signal. The limiter circuit receives the output of the IF amplifier. The limiter reduces noise from the incoming signal and produces a signal with consistent loudness. When a phase discriminator is used to demodulate an FM signal, this circuit is necessary. The limiter output is now fed into the FM discriminator, which recovers the modulating signal.

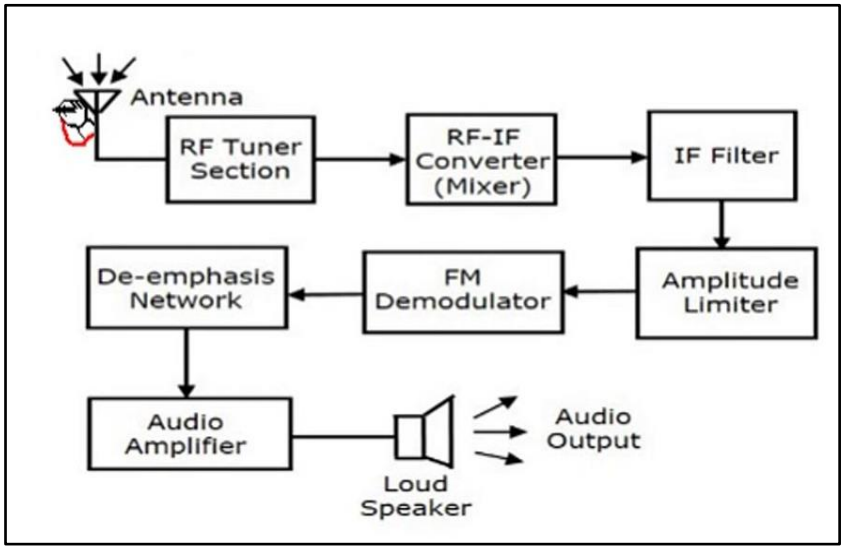

Fig 2.1 Block Diagram of a Superheterodyne FM Receiver

This signal, however, is not the original modulating signal. It is deemphasized before being applied to the audio amplifier stages. De-emphasizing attenuates higher frequencies to restore them to their original amplitudes after they have been boosted or accentuated prior to transmission.

The audio signal is produced by the de-emphasized stage and is then applied to the audio stages and lastly to the speaker. It should be noted that the FM discriminators require a limiter circuit. If the demodulator stage employs a ratio detector rather than a discriminator, no limiter is necessary. This is because the loudness of the received signal is limited by the ratio detector.

2.4 Apparatus

- FM Receiver (Model: KL-93064)
- Power supply

- Multi-meter
- Connecting wire
- Oscilloscope

2.5 Experimental Setup

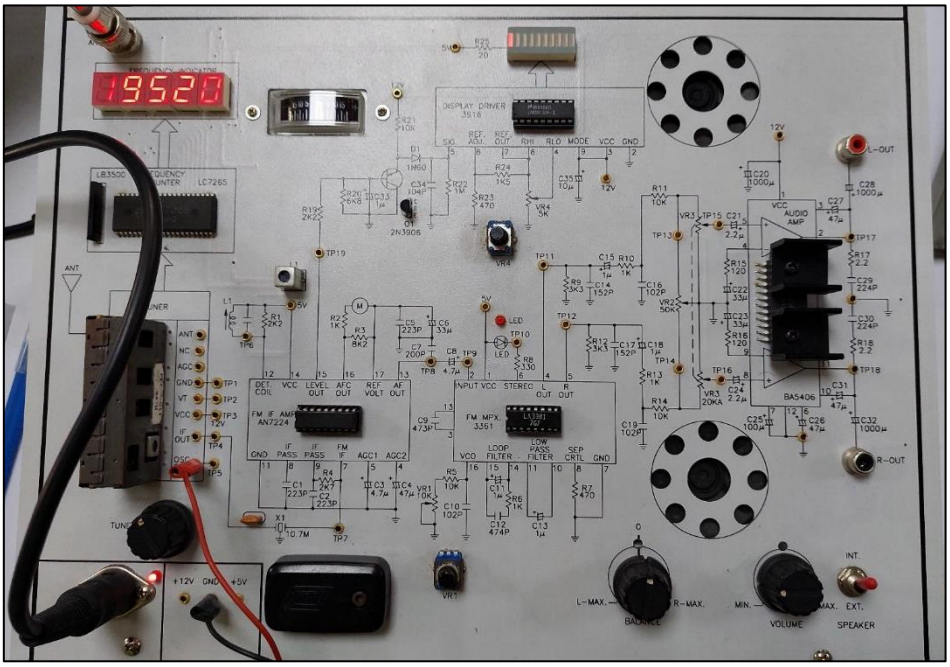

Fig 1.2 Kl-93064 FM Receiver Radio kit

2.6 Oscilloscope Output

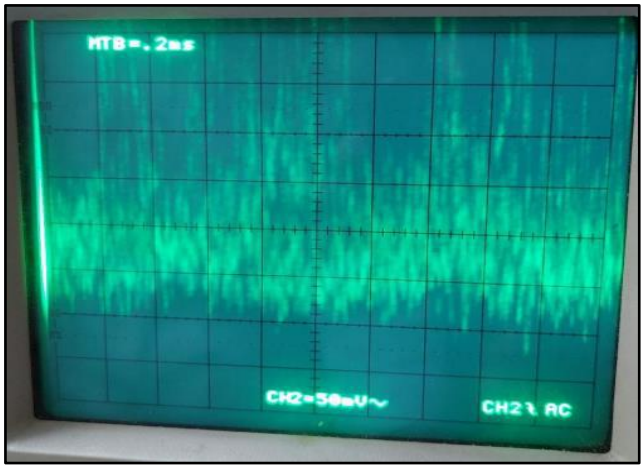

Fig 2.3 Signal received at the AF stage

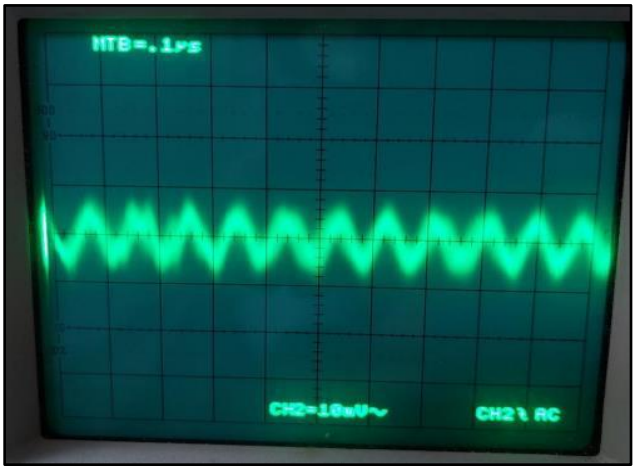

Fig 2.4 IF output ideal 10.7Mhz

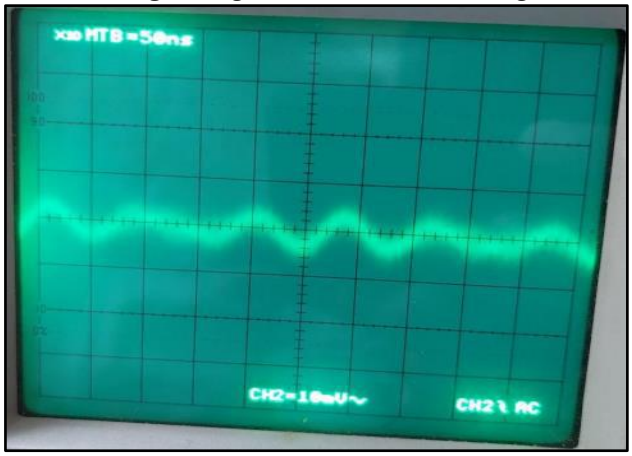

Fig 2.5 IF output Experimental 11.11Mhz and ideal 10.7 Mhz

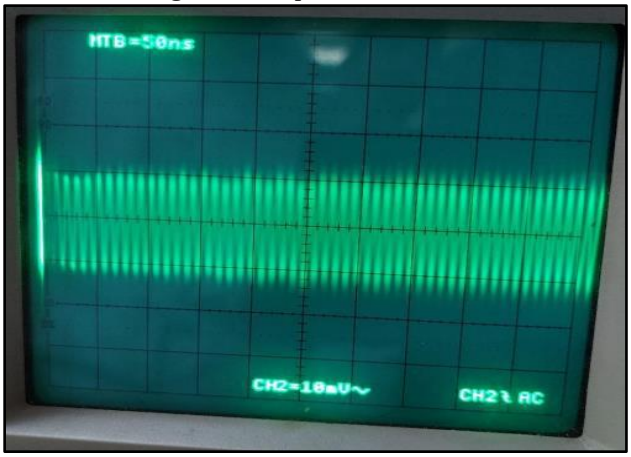

Fig 2.6 Oscillator output ideal 109.1MHz

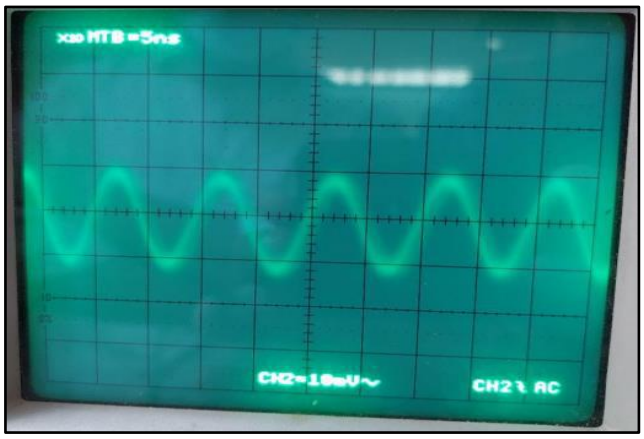

Fig 2.7 Oscillator output 100 MHz Experimental

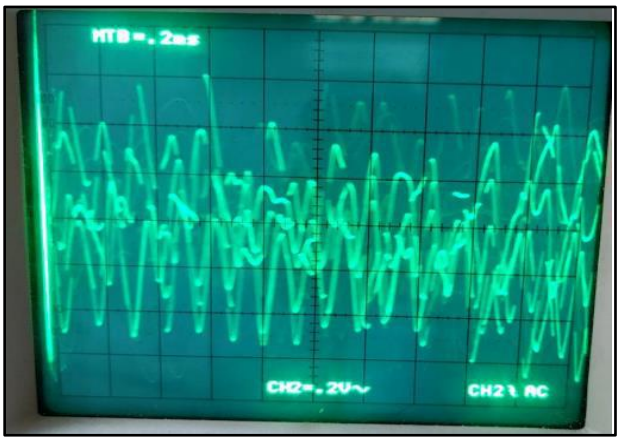

Fig.2.8 Signal at audio output

2.7 Discussion & Conclusion

Signal reception was successful in this experiment. The experiment, according to our theoretical knowledge, was carried out in Kl-93064 FM Radio KIT. Step by step, various block and tuning procedures were noticed. The intended signal was then viewed on the oscilloscope.

In the experiment, we tuned 99.2 Radio Padma FM radio channel. Due to a training kit malfunction, the tuning signal can be hampered at times. This is mainly due to the damaged indicator. Thus, too many noises in the signal present. Apart from that, the experiment was deemed a success.

2.8 Reference

- Radio Engineering – GK. Mithal

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Rajshahi University of Engineering and Technology

Department of Electrical & Electronic Engineering

Course no. EEE 4118

Course title: Radio & TV Engineering Sessional

Experiment no. 03

Experiment name: Study of color TV trainer and observation of different signals

Date of experiment: ,2023

Date of submission: August 8, 2023

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Experiment no. 03

3.1 Experiment Name

Study of color TV trainer and observation of different signals

3.2 Objectives

- To get acquainted with the operation of the color TV trainer
- To learn about the signal generated from the color TV trainer
- To understand about the basics of the components of color TV receiver and how they work together to produce a color image on the screen

3.3 Theory

A color TV trainer is an appliance that replicates the basic components of a color TV system. The trainer allows for practical experiments and demonstrations without the need for actual television sets, which can be more complex and difficult to deal with. An oscilloscope is required to view various signals. The waveform of signals such as the luminance (Y), in-phase (I), and quadrature (Q) components of the chrominance signal can be seen on an oscilloscope.

The frequency spectrum of signals such as the video carrier, sound carrier, and color subcarrier can be displayed via a spectrum analyzer. By examining these signals, one can learn how color information in a color TV system is encoded and decoded. The working method of this experiment may vary depending on the type and model of the color TV trainer, but the following is a general outline:

- ❖ Connecting an antenna, video signal generator, and power source, to the color TV trainer & turn them on.
- ❖ Pay attention to the colored image on the screen and make any required brightness, contrast, and color adjustments. Locating the color TV trainer's test points, sockets, and terminals that correspond to the various reception stages, such as the tuner, IF, video, sound, system, and so on.
- ❖ Using a multimeter, oscilloscope, and other tools to measure and monitor signals at various test locations and compare them to expected values.
- ❖ Using the fault simulator, establish various faults in the color TV receiver and watch how the signals and image on the screen change. Finally, using the test points and the fault simulator to diagnose and repair faults in the color TV receiver.

2.4 Apparatus

- Color TV trainer
- Multi-meter
- Oscilloscope

3.5 Experimental Setup

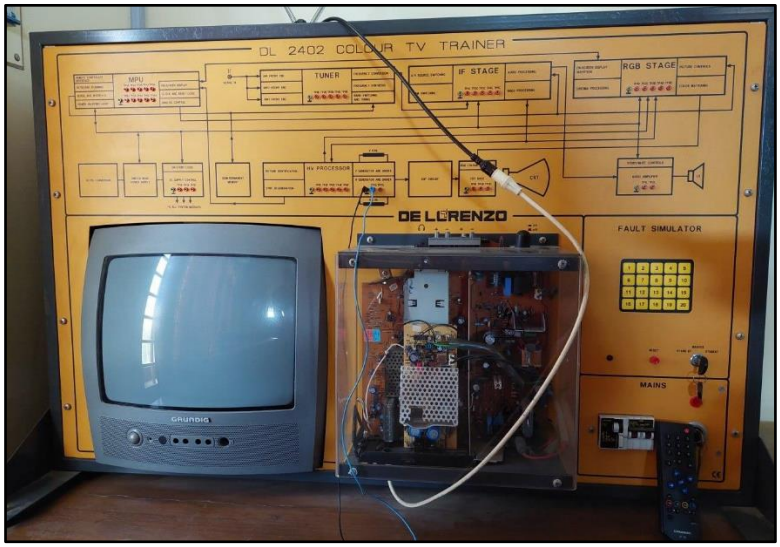

Fig 3.1 Color TV trainer

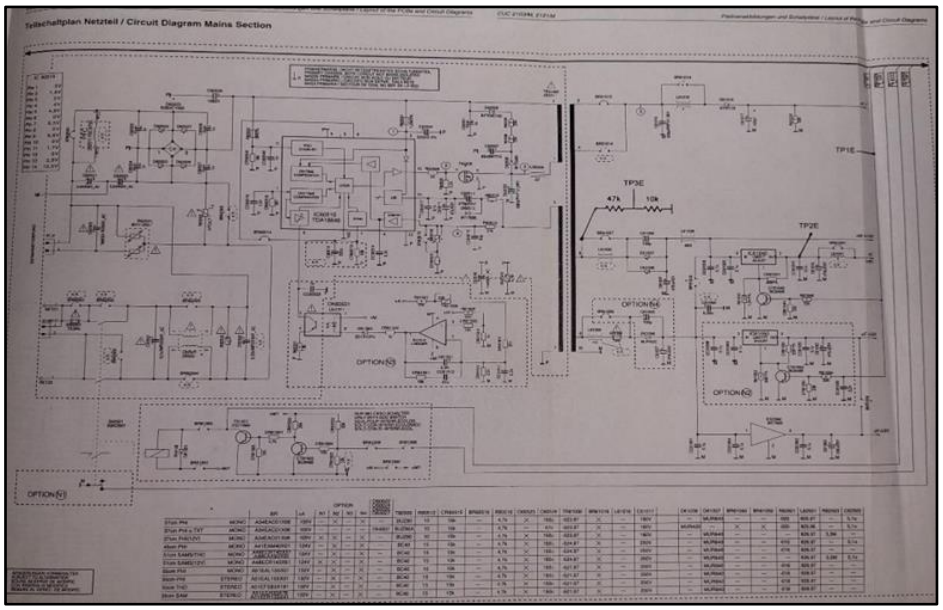

Fig. 3.2: Internal Circuit diagram of Mains Section

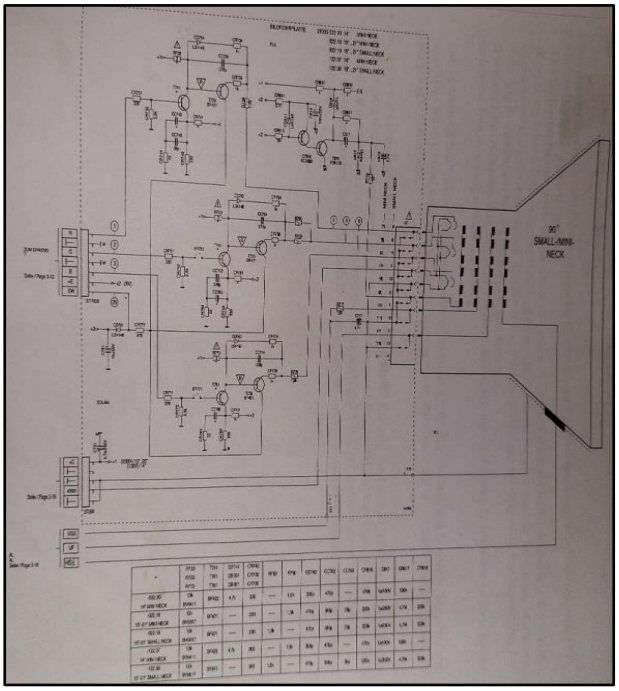

Fig. 3.3 Internal Circuit diagram of CRT panel

3.6 Oscilloscope Output

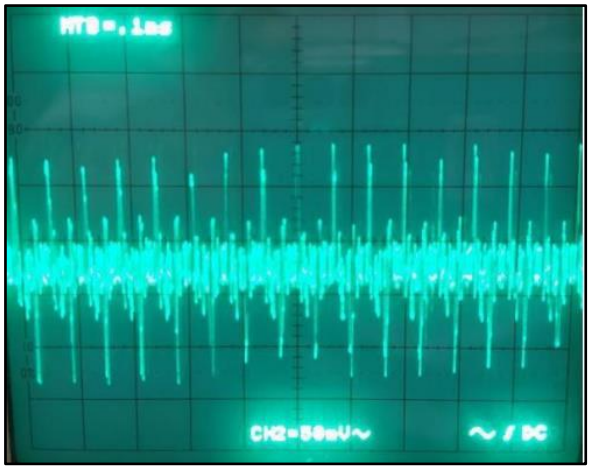

Fig 3.4 Output waveshape from TP1F

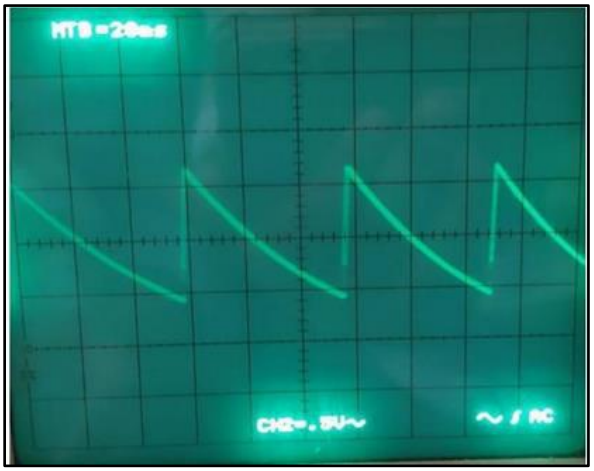

Fig 3.5 Output waveshape from TP2F

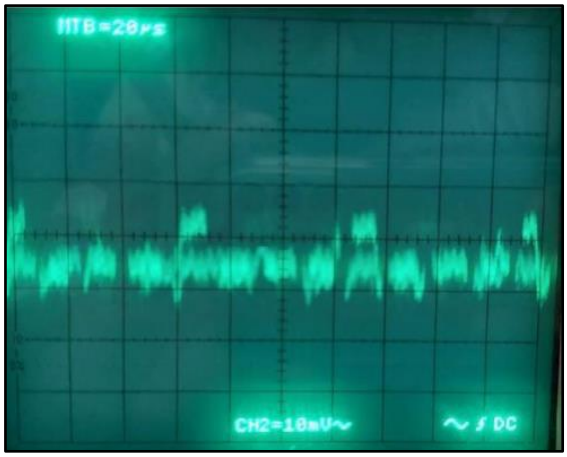

Fig 3.6 Output waveshape from TP4F

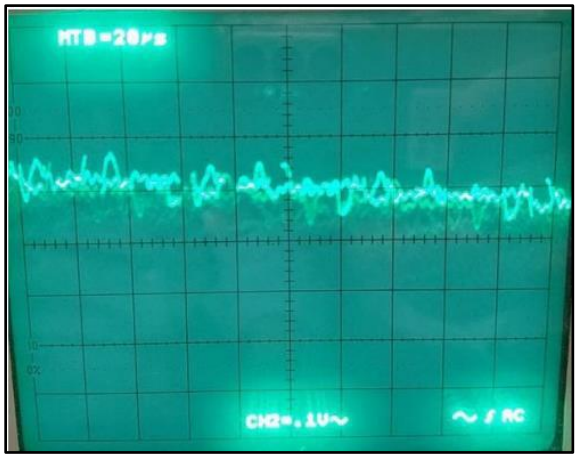

Fig 3.7 Output waveshape from TP5F

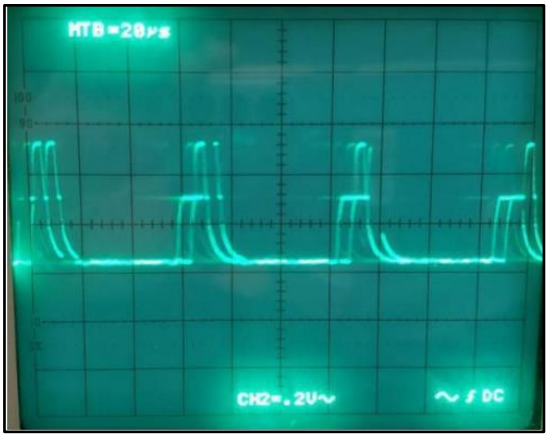

Fig 3.8 Output waveshape from TP1G

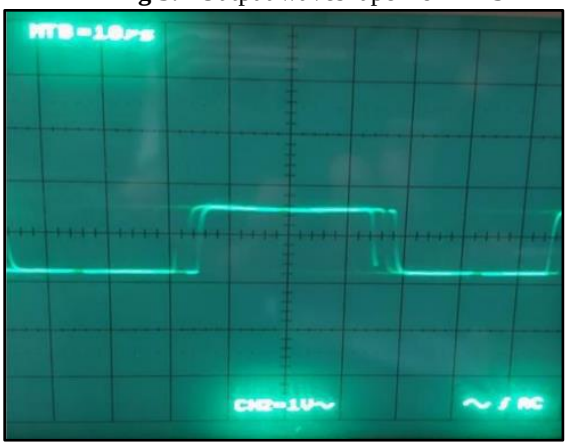

Fig 3.9 Output waveshape from TP2G

3.7 Discussion & Conclusion

Signal reception was successful in this experiment. The experiment, according to our theoretical knowledge, was carried out in color TV trainer. Step by step, various block and tuning procedures were noticed. The intended signal was then viewed on the oscilloscope.

In the experiment, we understood how each color TV trainer level functioned. We looked at the output waveforms of other stages. In addition, we compared our oscilloscope waveforms to the normal waveforms in the lab manual. The color TV trainer's output waveforms differed from the standard waveforms in the lab guide due to its age and noise. After all of these discussions, it is safe to declare that the experiment was a success.

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Rajshahi University of Engineering and Technology

Department of Electrical & Electronic Engineering

Course no. EEE 4118

Course title: Radio & TV Engineering Sessional

Experiment no. 04

Experiment name: Fault simulation of color TV trainer

Date of experiment: July 26, 2023

Date of submission: August 8, 2023

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Experiment no. 04

4.1 Experiment Name

Fault simulation of color TV trainer

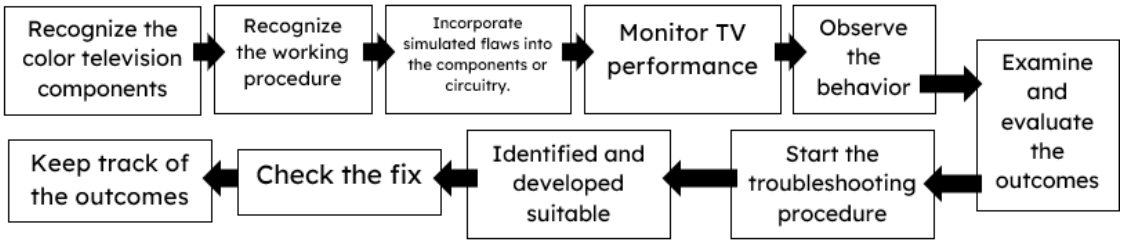
4.2 Objectives

- To get acquainted with the operation of the color TV trainer
- To learn about the fault simulated from the color TV trainer and their responses observed
- To understand about the basics of the components of color TV receiver and how they work together to produce a color image on the screen

4.3 Theory

A color TV trainer is an appliance that replicates the basic components of a color TV system. The trainer allows for practical experiments and demonstrations without the need for actual television sets, which can be more complex and difficult to deal with. An oscilloscope is required to view various signals. The waveform of signals such as the luminance (Y), in-phase (I), and quadrature (Q) components of the chrominance signal can be seen on an oscilloscope.

Simulating flaws or issues that may develop in the circuitry or components of a color television includes creating and analyzing simulated issues. This technique assists engineers or technicians in recognizing potential problems with a color television, diagnosing them, and devising appropriate solutions. Follow these broad methods to imitate a color TV malfunction:



2.4 Apparatus

- Color TV trainer
- Multi-meter
- Oscilloscope

4.5 Experimental Setup

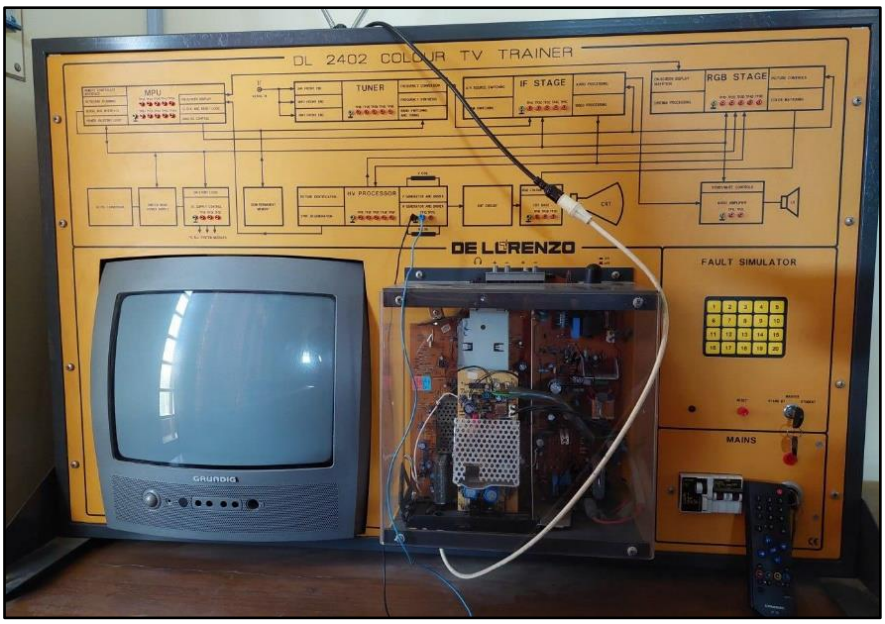


Fig 4.1 Color TV trainer

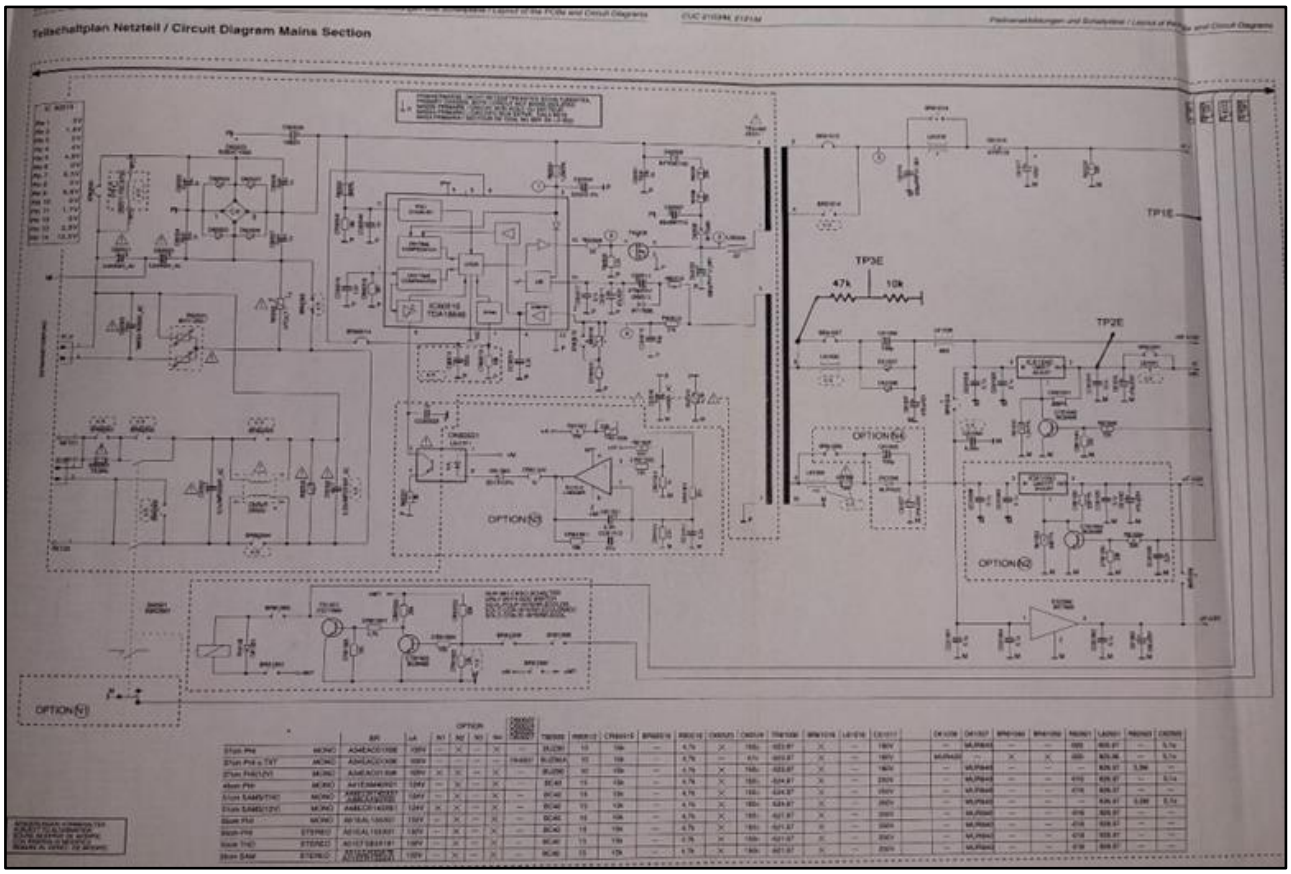


Fig. 4.2: Internal Circuit diagram of Mains Section

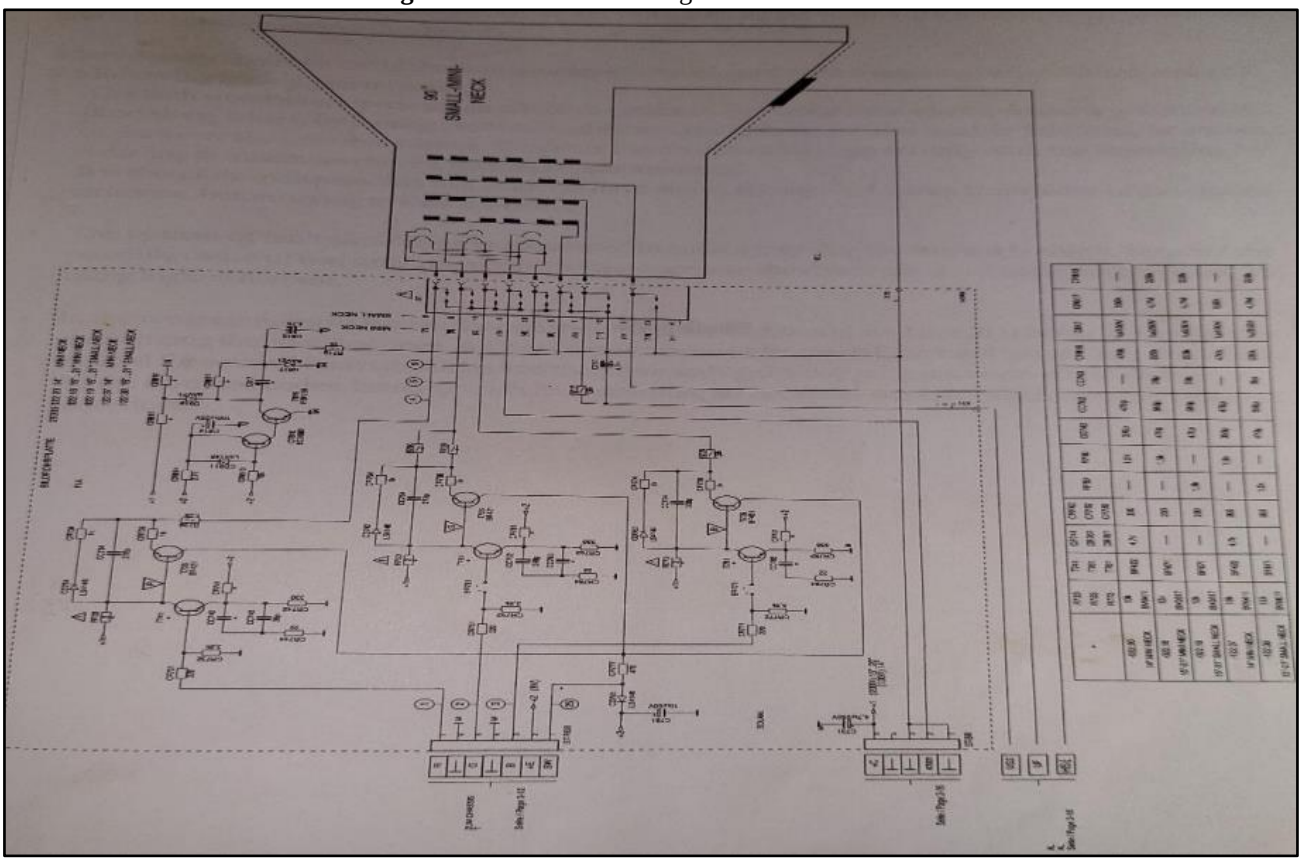


Fig. 4.3 Internal Circuit diagram of CRT panel

4.6 Faults in color TV trainer

FAULT NO.	FAULT LOCATION	SIMULATION QUALITY		FAULT NO.	FAULT LOCATION	SIMULATION QUALITY
1	REMOTE CONTROL FAULT	PROPERLY SIMULATED		11	TUNER	NOT PROPERLY SIMULATED (BEHAVING LIKE 4TH FAULT)
2	KEY-BOARD OPERATION	NOT PROPERLY SIMULATED		12	TUNER	NOT PROPERLY SIMULATED
3	RESET OF MICROCONTROLLER	PROPERLY SIMULATED		13	TUNER	NOT PROPERLY SIMULATED
4	AUDIO	NOT PROPERLY SIMULATED		14	CPU	PROPERLY SIMULATED
5	ON-SCREEN-DISPLAY	PROPERLY SIMULATED		15	IF STAGE	PROPERLY SIMULATED
6	ON-SCREEN-DISPLAY	NOT PROPERLY SIMULATED		16	IF STAGE	NOT PROPERLY SIMULATED
7	ON-SCREEN-DISPLAY	NOT PROPERLY SIMULATED		17	IF STAGE	PROPERLY SIMULATED
8	RGB STAGE	PROPERLY SIMULATED		18	RGB STAGE	NOT PROPERLY SIMULATED
9	ON-SCREEN-DISPLAY	NOT PROPERLY SIMULATED		19	PICTURE CONTROL	PROPERLY SIMULATED
10	ON-SCREEN-DISPLAY	PROPERLY SIMULATED		20	AUDIO AMPLIFIER	NOT PROPERLY SIMULATED (BEHAVING LIKE 4TH FAULT)

4.7 Discussion & Conclusion

The experiment, according to our theoretical knowledge, was carried out in color TV trainer. Step by step, various block and tuning procedures were noticed. The intended signal was then viewed on the oscilloscope.

We learned how to simulate flaws in a color TV trainer in this experiment. Using fault simulation, the significance of troubleshooting talents in locating and fixing problems in color television systems was demonstrated. We obtained practical experience by researching the inner workings of color televisions and fixing real-world problems by making particular errors and analyzing their impact.

We discovered that some errors were properly recreated while others were not because the color television trainer was old. The preceding discussion indicates that the experiment was a success.

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Rajshahi University of Engineering and Technology

Department of Electrical & Electronic Engineering

Course no. EEE 4118

Course title: Radio & TV Engineering Sessional

Experiment no. 05

Experiment name: Fault simulation in integrated AM/FM fault simulation

Date of experiment: July 26, 2023

Date of submission: August 8, 2023

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Experiment no. 05

5.1 Experiment Name

Fault simulation in integrated AM/FM fault simulation

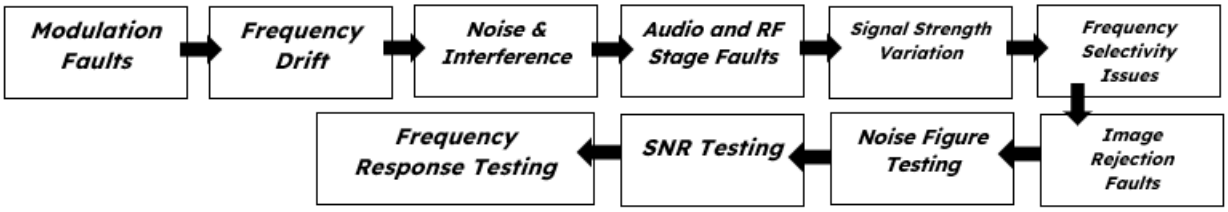
5.2 Objectives

- To get acquainted with the operation of the integrated AM/FM
- To learn about the fault simulated from the color integrated AM/FM
- To understand about the basics of the components of integrated AM/FM and how they work together

5.3 Theory

An FM/AM fault simulator is a tool that is used to model various types of faults or mistakes that may occur in FM (Frequency Modulation) and AM (Amplitude Modulation) radio receivers. This is used to evaluate the performance and robustness of radio equipment under various fault scenarios without interfering with live broadcast signals. This contributes to the dependability and quality of communication networks.

To analyze how the equipment responds, the simulator may generate a variety of simulated faults and interference conditions. The following are the main attributes and characteristics that can be found in an FM/AM failure simulator:



5.4 Apparatus

- Integrated AM/FM
- Multi-meter
- Oscilloscope

5.5 Experimental Setup

Fig 5.1 AM & FM receiver trainer

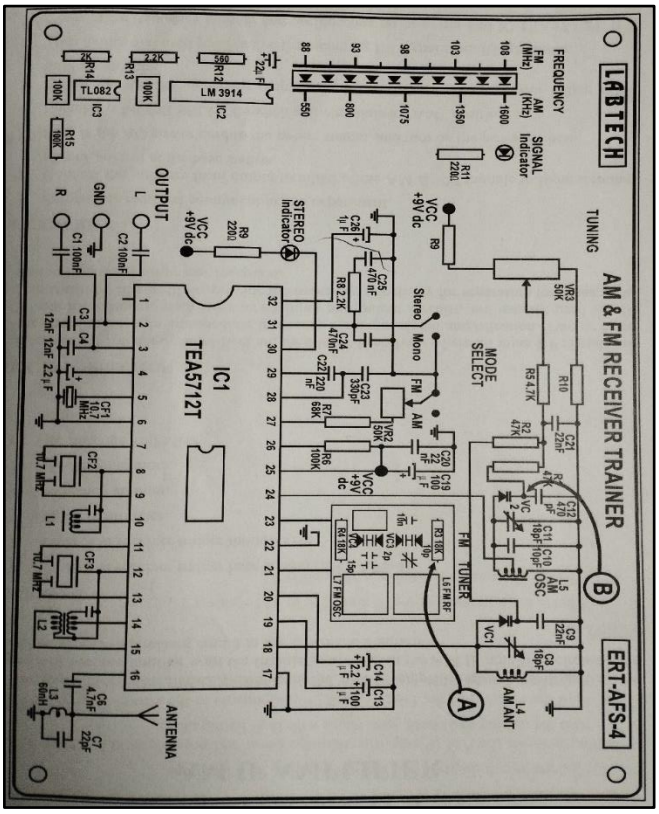


Fig. 5.2: Internal Circuit diagram of AM/FM receiver trainer

5.6 Faults in AM & FM receiver trainer

FAULT NO	DEFECTIVE CIRCUIT	DEFECTIVE COMPONENT	SYMPTOM	FAULT NO	DEFECTIVE CIRCUIT	DEFECTIVE COMPONENT	SYMPTOM
1	DC POWER INPUT	DC POWER LINE	SYSTEM IS NOT WORKING	6	AM IF STAGES	L1	NO AM SIGNAL OUTPUT
2	STEREO DECODER	R9	STEREO INDICATOR DOES NOT LIGHT	7	AM RF	R2	WEAK AND NOISES AM SIGNAL
3	AUDIO OUTPUT	C2	NO LEFT (L) AUDIO SIGNAL	8	AM OSCILLATOR	R1	CANNOT RECEIVE AM SIGNAL
4	DETECTOR & MPX	IC1 PIN6	NOISES AND WEAK SIGNAL OUTPUT	9	FM TUNER	R3	CANNOT RECEIVE FM SIGNAL
5	FM IF STAGES	CF2	WEAK FM SIGNAL OUTPUT	10	AM AGC	C14	NO AM SIGNAL OUTPUT

5.7 Waveshapes

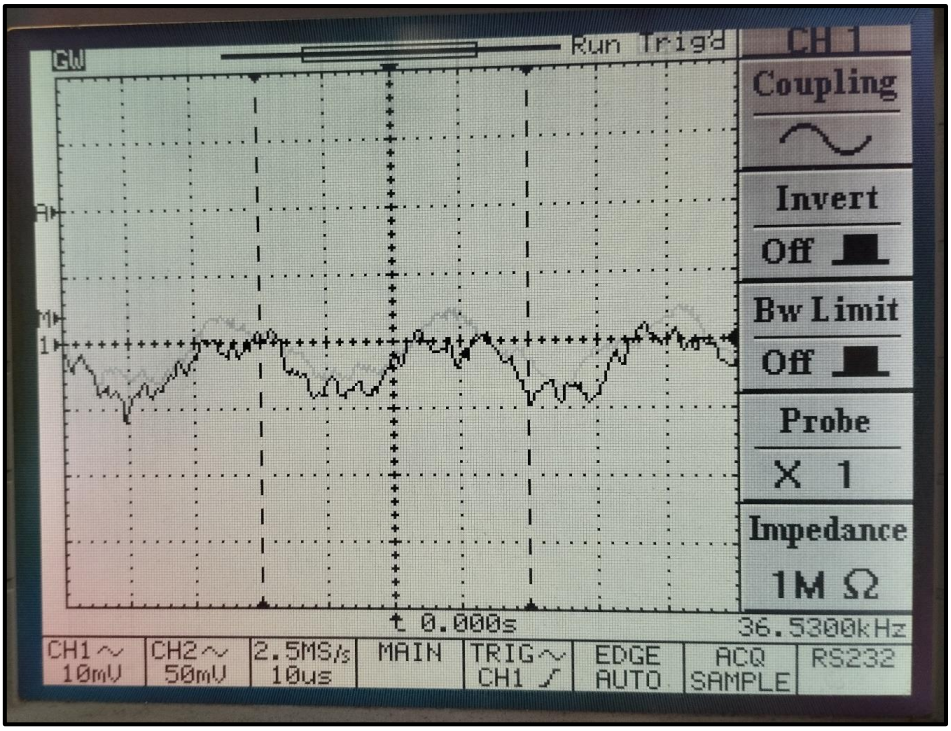


Fig. 5.3. Output of AM/FM receiver trainer

5.8 Discussion & Conclusion

The experiment, according to our theoretical knowledge, was carried out in AM/FM receiver trainer. Step by step, various block and tuning procedures were noticed. The intended signal was then viewed on the oscilloscope.

We witnessed an AM/FM failure simulation that was incorporated. We examined the system's output. Then we used the F1 through F10 keys to generate different types of errors and observe how they influenced the system's output. All of these discussions indicate that the experiment was a success.

We discovered that some errors were properly recreated while others were not because the color television trainer was old. The preceding discussion indicates that the experiment was a success.

Heaven's light is our guide.

Rajshahi University of Engineering and Technology

Department of Electrical & Electronic Engineering

Course no. EEE 4118

Course title: Radio & TV Engineering Sessional

Experiment no. 06

Experiment name: Observation of waveshapes in FM transmitter

Date of experiment: July 26, 2023

Date of submission: August 8, 2023

Submitted to	Submitted by
Belal Hossain **Assistant Professor** Dept. of Electrical & Electronic Engineering, Rajshahi University of Engineering and Technology.	**Ashraf Al- Khalique** **Roll:** 1801171 **Session:** 2018-2019 Dept. of Electrical & Electronic Engineering, Rajshahi University of Engineering and Technology.

Experiment no. 06

6.1 Experiment Name

Observation of waveshapes in FM transmitter

6.2 Objectives

- To get acquainted with the operation and the basics operation of the FM transmitter
- To learn about the waveshapes generated from the transmitter

6.3 Theory

The FM transmitter is a low-power transmitter that transmits sound via FM waves. Based on the frequency difference, this transmitter sends audio signals via the carrier wave. The carrier wave frequency is equivalent to the amplitude of the audio signal, and the FM transmitter creates a VHF band ranging from 88 to 108 MHz

The microphone, audio pre-amplifier, modulator, oscillator, RF amplifier, and antenna are all needed components of an FM transmitter. The FM signal contains two frequencies: one for the carrier frequency and one for the audio frequency. The carrier frequency is modulated using the audio frequency. By allowing the AF, the FM signal is obtained by altering the carrier frequency. The FM transistor consists of the oscillator that produces the RF signal.

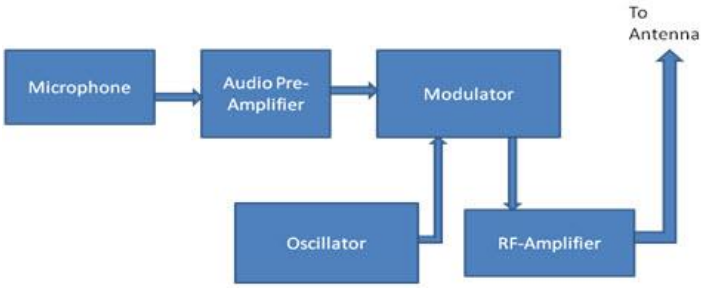


Fig. 6.1. Block diagram of FM transmitter

Advantages of the FM Transmitters is that the efficiency of the transmitter is very high and this transmitter will reject the noise signal from an amplitude variation. The FM transmitter and receiver will tend to be more complex. Due to some interference, there is poor quality in the received signals.

6.4 Apparatus

- FM transmitter
- Multi-meter
- Oscilloscope

6.5 Experimental Setup

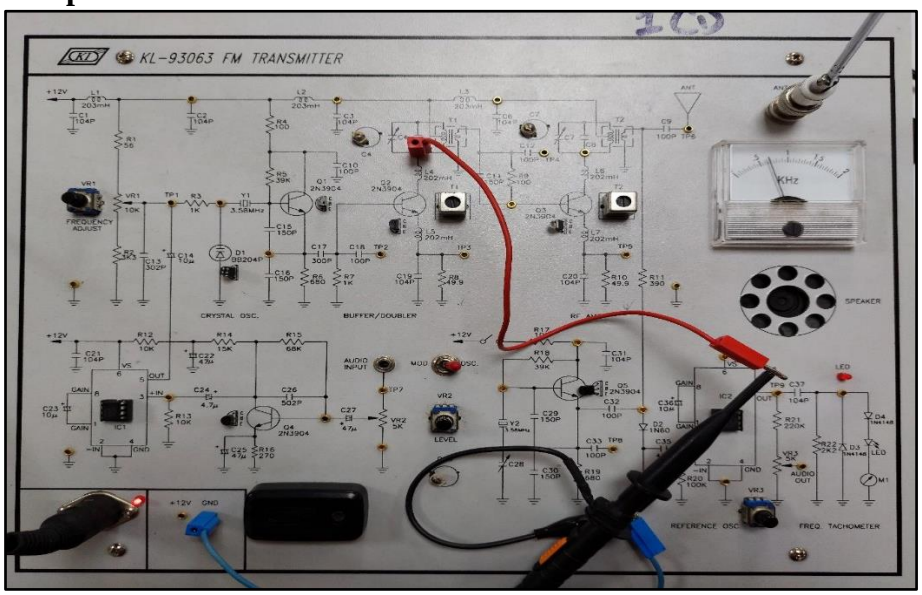


Fig. 6.2: Internal Circuit diagram of FM receiver

6.6 Waveshapes

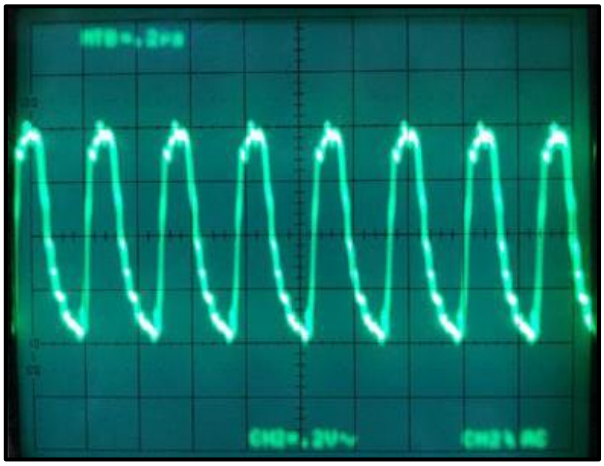


Fig. 6.3. Carrier signal of 3.58MHz

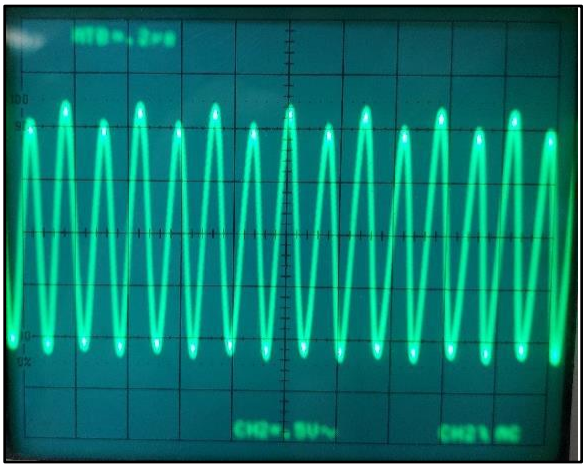


Fig. 6.4. C8 signal

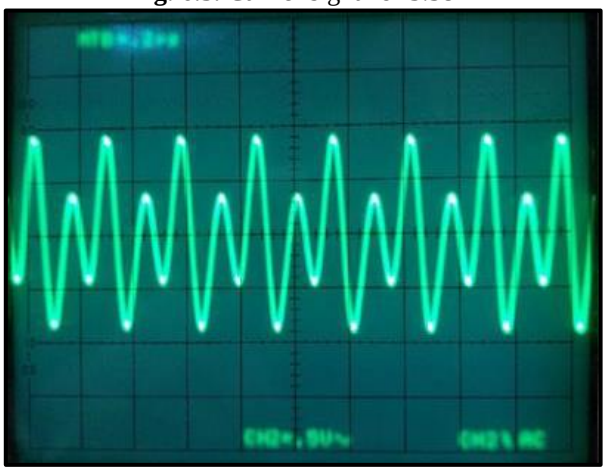


Fig. 6.5. Voltage signal due to Non-Linear harmonics current

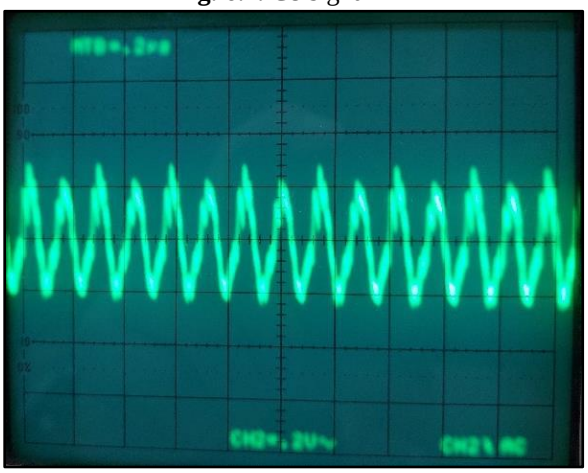


Fig. 6.6. Final output of amplified or boosted carrier

6.7 Discussion & Conclusion

The experiment, according to our theoretical knowledge, was carried out in AM/FM receiver trainer. Step by step, various block and tuning procedures were noticed. The intended signal was then viewed on the oscilloscope.

We concentrated on how the FM transmitter works in this experiment. To send the signal, the oscillator's carrier frequency was first changed. By adjusting the input voltage, the carrier signal was amplified or boosted and was then ready for transmission. Furthermore, as seen in fig.6.5, the amplitude of the carrier signal fluctuates due to non-linear harmonics current. Following all of these discussions, it is safe to declare that the experiment was a success.

We discovered that some errors were properly recreated while others were not because the color television trainer was old. The preceding discussion indicates that the experiment was a success.