SVR ENGINEERING COLLEGE

Approved by AICTE & Permanently Affiliated to JNTUA

Ayyalurmetta, Nandyal – 518503.Website: www.svrec.ac.in

Department of Electronics and Communication Engineering

DIGITAL COMMUNICATION SYSTEMS LABORATORY

III B.Tech (ECE) I Semester

2020-21

STUDENT NAME	
ROLL NUMBER	
SECTION	

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Department of Electronics and Communication Engineering

DEPARTMENT OF

ELECTRONICS AND COMMUNICATION ENGINEERING

CERTIFICATE

ACADEMIC YEAR: 2021-22

This is to certify that the bonafide record work done by

Mr./Ms.____ bearing

H.T.No._________________ of III B.Tech I Semester in the

***ANALOG* COMMUNICATION SYSTEMS LABORATORY**

Faculty In-Charge **HEAD OF THE DEPT**

DEPARTMENT OF ECE
ANALOG COMMUNICTIONS LAB MANUAL

III-B.Tech (ECE), I- SEM.

INDEX

1. AMPLITUDE MODULATION AND DEMODULATION

AIM: **1.** To Observe The Modulated Signal On Oscilloscope By Standard Wave Method And
By Trapezoidal Method.
2. To Observe The Demodulated Signal On The Oscilloscope From The AM Wave With
The Help Of Diode Detector.

APPARATUS:
1. Transistor-BC108-1 2. Diode –0A76 -1 3.Resistor-10K-2,100K-1
6.8 K - 1 4. Capacitor - 0.01µf - 2 ,22µf - 1 5.Function Generator -1
6.RPS -1 7.CRO-1 8.DCB-2 9. Bread board-1 10.Connecting wires

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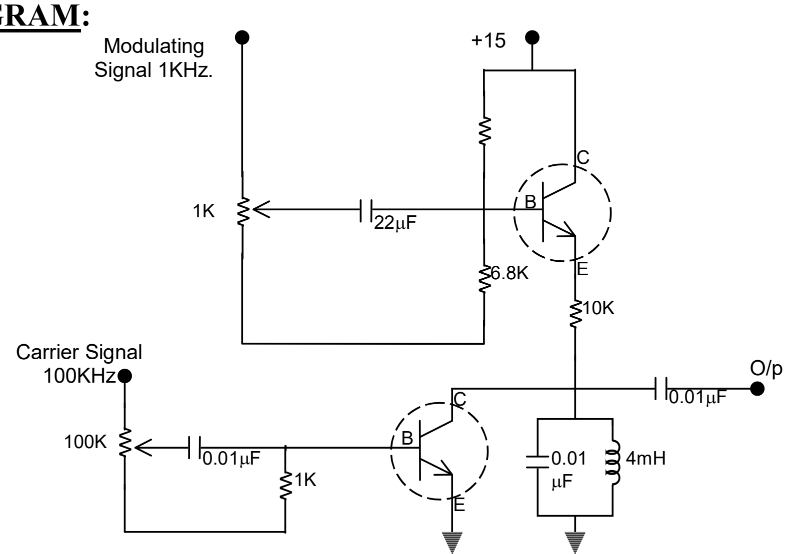
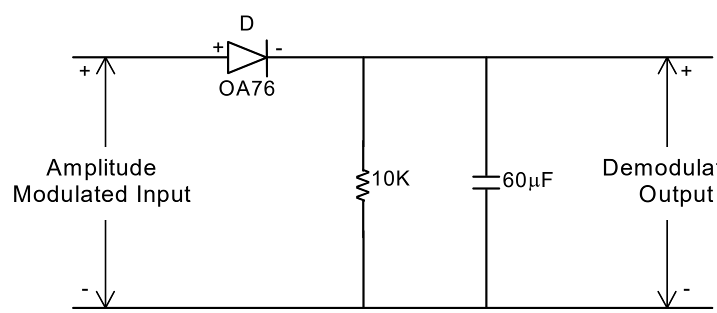
CIRCUIT DIAGRAM:



AM MODULATOR



AM DEMODULATOR

PROCEDURE:

AMPLITUDE MODULATION:

1. Circuit is to be connected as per circuit diagram.
2. Modulating signal of 1 KHz is given to the circuit through the potentiometer connection.
3. Similarly the carrier of $9.5v_{pp}$ and 100 KHz is generated and is also given to the circuit.
4. After the proper biasing adjustment at the potentiometer the modulation index of wave is computed both in standard wave method and trapezoid method.

AMPLITUDE DEMODULATION:

1. AM-input is given to the circuit.
2. Modulation index and the frequency of AM wave is noted.
3. With the help of the formula $Rc=1/wm\sqrt{[(1-M^2)/M^{2]}}$. The value of 'c' is determined
   by choosing say R=1000K.
4. For different values of 'C' the out put modulating signal is observed.
6. The wave forms are traced from CRO.

OBSERVATIONS:

AM MODULATION:

S.no	Modulating Voltage(V)	carrier volltage(V)	V_{max}(V)	V_{min}(V)	$M=(V_{max}-V_{min})/(V_{max}+V_{min})$

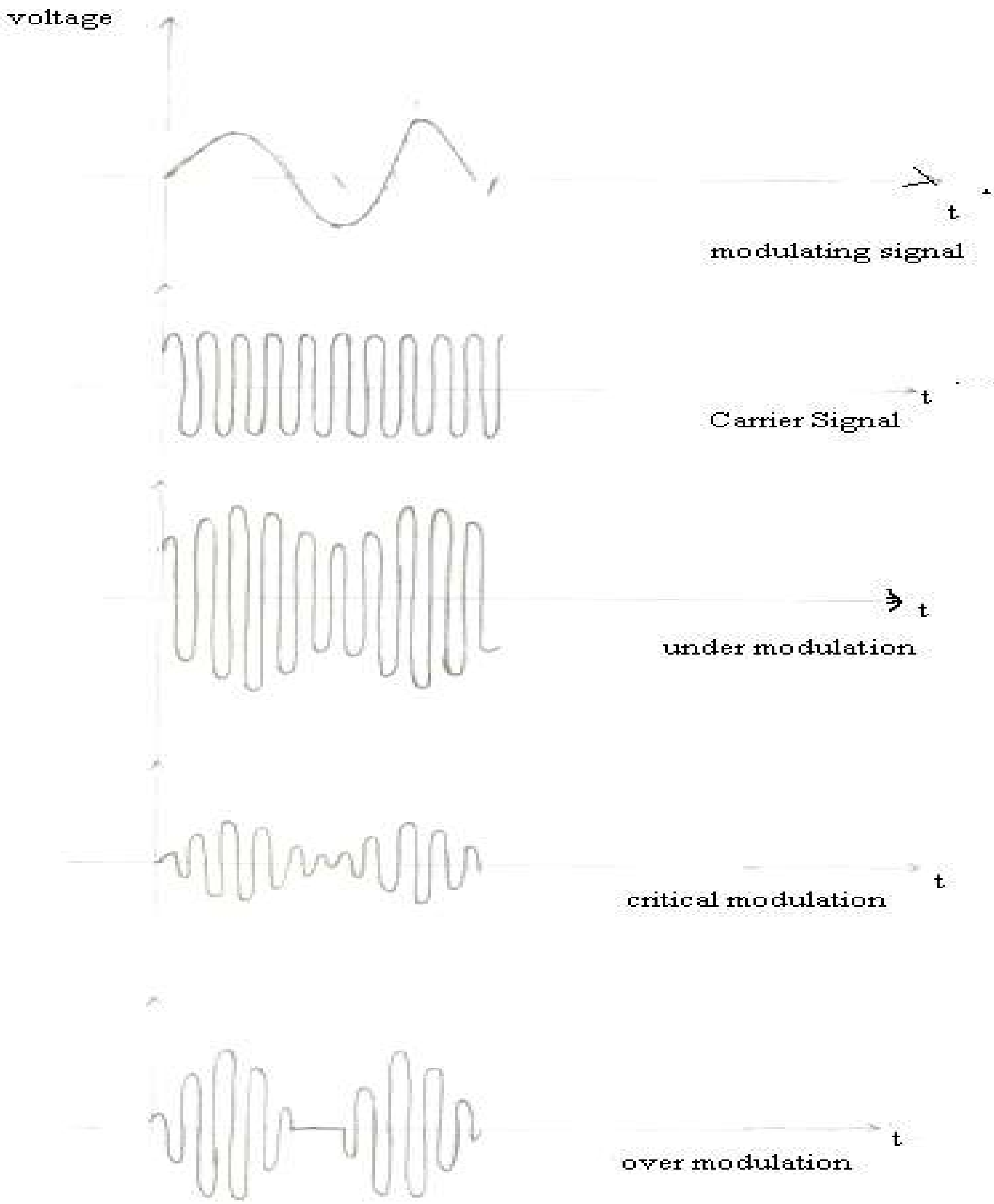
AM DEMODULATION:

Repetition rate of modulated signal =

Demodulated signal frequency = (for different RC values).

EXPECTED GRAPHS:

AM MODULATION:



RESULT:

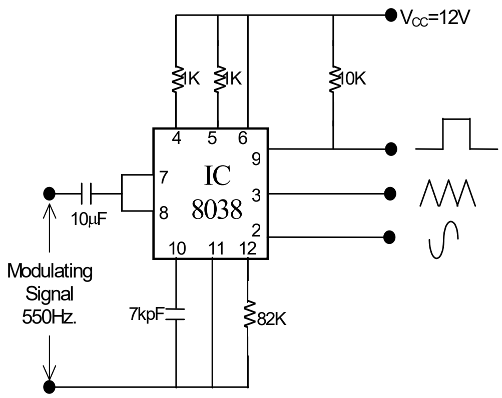
2. FREQUENCY MODULATION AND DEMODULATION

AIM: 1. To measure the frequency modulated signal on the CRO and to measure the modulation index.

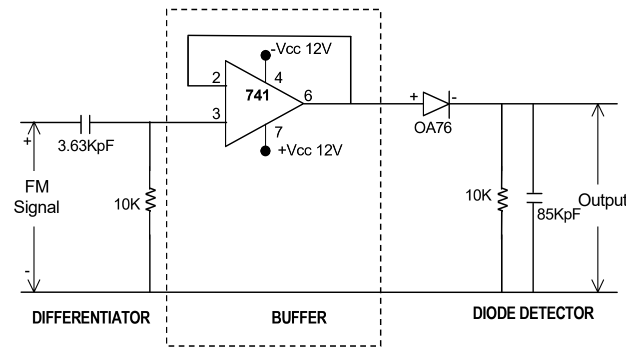
2. To get the base band signal from FM input using a demodulated circuit.

APPARATUS: 1. IC 8038-1 2.IC 741-1 3.Function Generator 4.Resistor 1K-2 5.10K-3 6.81 K-1 7.Capacitors 10µf -1,7Kpf -1 8.DCB -2 9. CRO with probes 10.RPS 11.Connecting wires

CIRCUIT DIAGRAM:



FM MODULATOR



FM DEMODULATOR

PROCEDURE:

FM MODULATION:

1. Connections are to be made as per circuit diagram.
2. With out applying any modulating signal at pin number 7+8 of Ic 8038 carrier signal frequency measures and denoted as fc.
3. Now a modulating signal of frequency Fm is applied at the input terminals. The amplitude of the modulating signal is varied and the frequency of the modulating signal is observed at pin no. 2 on CRO.
4. For different values of modulating signal amplitude f_{max} * f_{min} are recoded.
5. The frequency deviation is calculated as $\Delta f=(f_{max} - f_{min})/2$.

FM DEMODULATION:

1. Connections are to be made as per the circuit diagram.
2. FM signal is given as in put to the circuit.
3. The capacitor value shown in figure will be designed with the help of the formula C=1/(25Fmr).
4. AM input can be seen after the differentiator N/W
5. AM input is observed as it is after the buffer stage i.e. IC 741
6. After the diode detector network, the demodulated signal i.e. modulated signal is observed.
7. The value of the capacitor at the output stage is adjusted to get the distortion less out put.

OBSERVATIONS: FM MODULATION:

S.no	Modulating signal voltage(V)	f_{min} (HZ)	f_{max} (HZ)	$\Delta f=(f_{max}-f_{min})/2$(HZ)

FM DEMODULATION:

Repetition rate of modulated signal =

Demodulated signal frequency = (for different RC values).

DESIGN ASPECTS:

From frequency modulated signal

carrier frequency f_c=……… Hz.

f_{max}=…………… f_{min}=…………

$\Delta f=(f_{max}-f_{min})/2$=…………

From amplitude modulated signal:

V_{max}= ……………… V_{min}= ………………

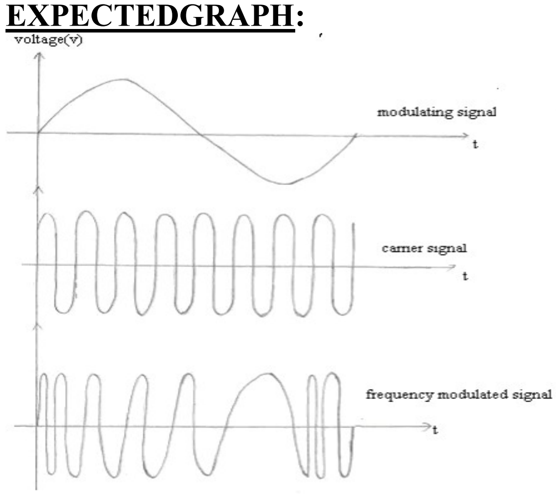
$M_a= (V_{max}-V_{min})/(V_{max}+V_{min})$= …………..

$RC=1/w_m\sqrt{(1-m^2)/m^2}$.

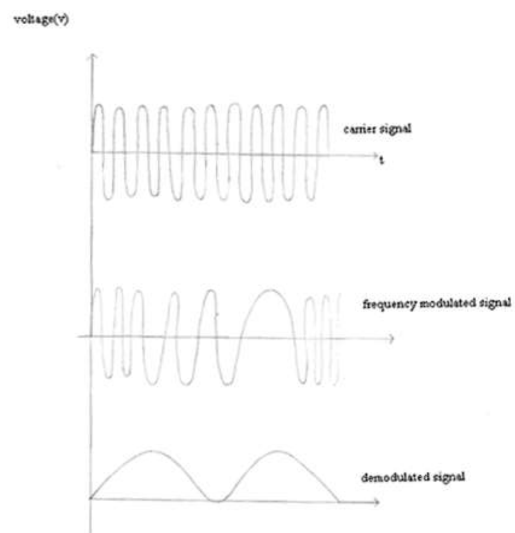
$C=\{\sqrt{(1-m^2)/m^2}\}/w_mR$

=

EXPECTEDGRAPH:



FM MODULATION

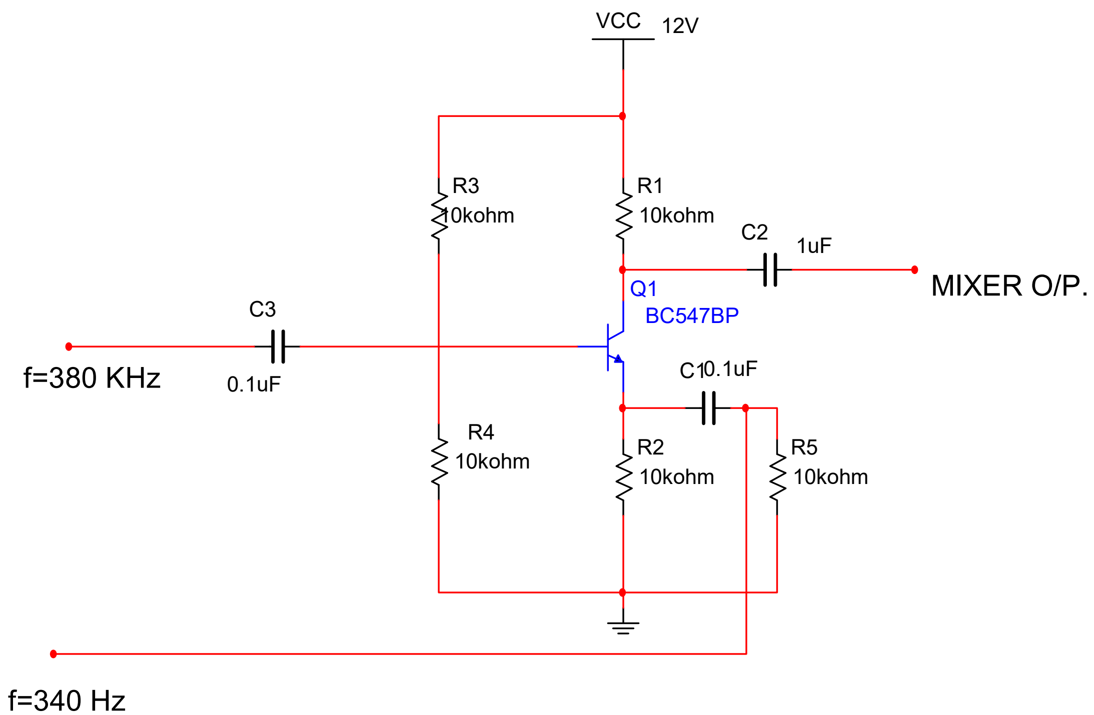


FM DEMODULATION

RESULT:

3.A) MIXER CHARACTERISTICS

AIM: To verify the characteristics of the mixer.
APPARATUS: Transistor BC-547, Resistors 10K-5,
Capacitors 0.1µf-2, 1µf-1.
CIRCUIT DIAGRAM:



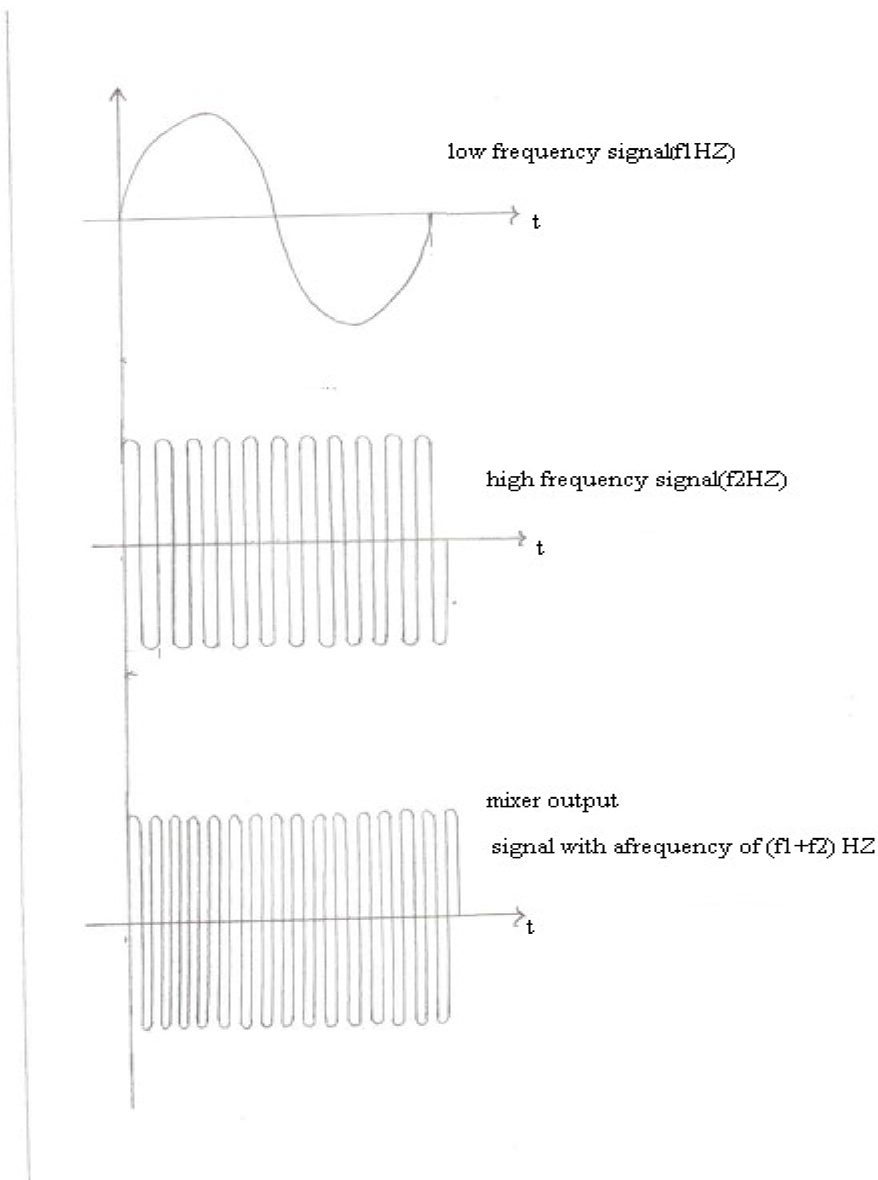
MIXER CIRCUIT

PROCEDURE:
1. Connections are to be made as per the circuit diagram.
2. Apply modulating signal with a frequency of f_m=340 Hz and a carrier signal with a frequency of f_c=380 KHz as shown in the circuit diagram.
3. Now observe the output across the collector.
4. This output signal is having a frequency which is equal to sum of modulating & carrier signal frequencies i.e., f_c+f_m.

OBSERVATIONS:

Frequency of signal-1 f_m=………….. Hz.
Frequency of signal-2 f_c=…………... Hz.
Frequency of output signal = …………Hz.

EXPECTED GRAPH:



RESULT:

3.B) PRE-EMPHASIS AND DE-EMPHASIS

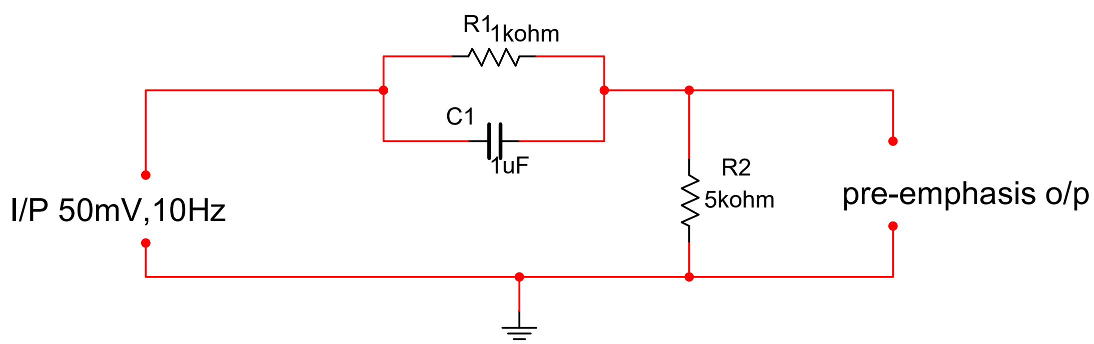
AIM:

1.To boost the high frequency signal.
2.To avoid the noise of the FM with respect to high frequency signal.
3.To get the original signal.
4.To verify the results graphically.

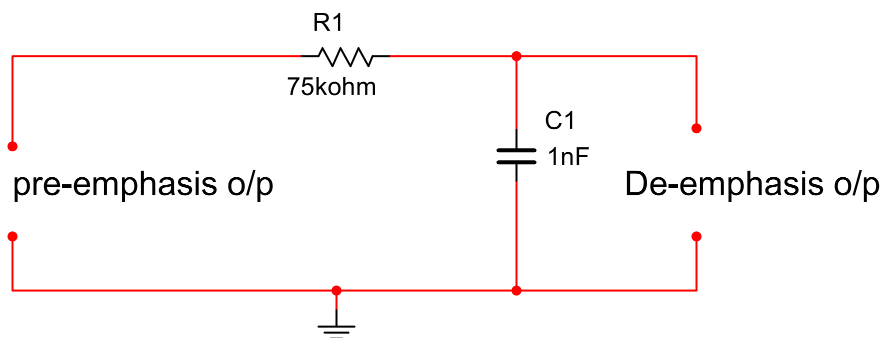
APPARATUS:

- Resistors 33k -1,10k -2, Capacitors 470-1, DCB-1, Inductance DLB-11 , Transistor BC 107-1,Function Generator.,CRO with probes.RPS,Connecting wires.
-

CIRCUIT DIAGRAM:



PRE-EMPHASIS CIRCUIT



DE-EMPHASIS CIRCUIT

PROCEDURE:

PRE-EMPHASIS:

1. Connections are to be made as per the circuit diagram.
2. 50 mv input is to be given and the output is observed varying the frequency.

3. By calculating the time constant of the circuit the corresponding frequency is calculated.
4. Exactly at the break down frequency the out put is observed.

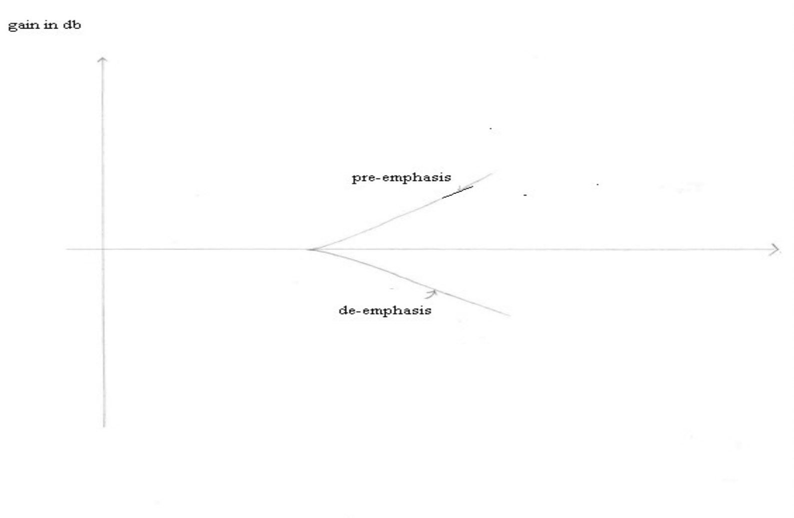
DE-EMPHASIS:

1. Connections are to be made as per the circuit diagram.
2. The pre-emphasis output is given as input to the de-emphasis circuit.
3. The gradual decay in gain is occurred.
4. Exactly at the break down frequency the output value is calculated and is compared with the theoretical value.

OBSERVATIONS:

S.NO:	FREQUENCY	PRE-EMPHASIS 0UTPUT(V) GAIN(dB)	DE-EMPHASIS OUTPUT(V) GAIN(dB)

EXPECTED GRAPHS:



RESULT:

4. PULSE AMPLITUDE MODULATION &DEMODULATION

AIM: To study the process of pulse amplitude modulation & demodulation

APPARATUS: PAM kit, CRO, Patch cards

CIRCUIT DIAGRAM:

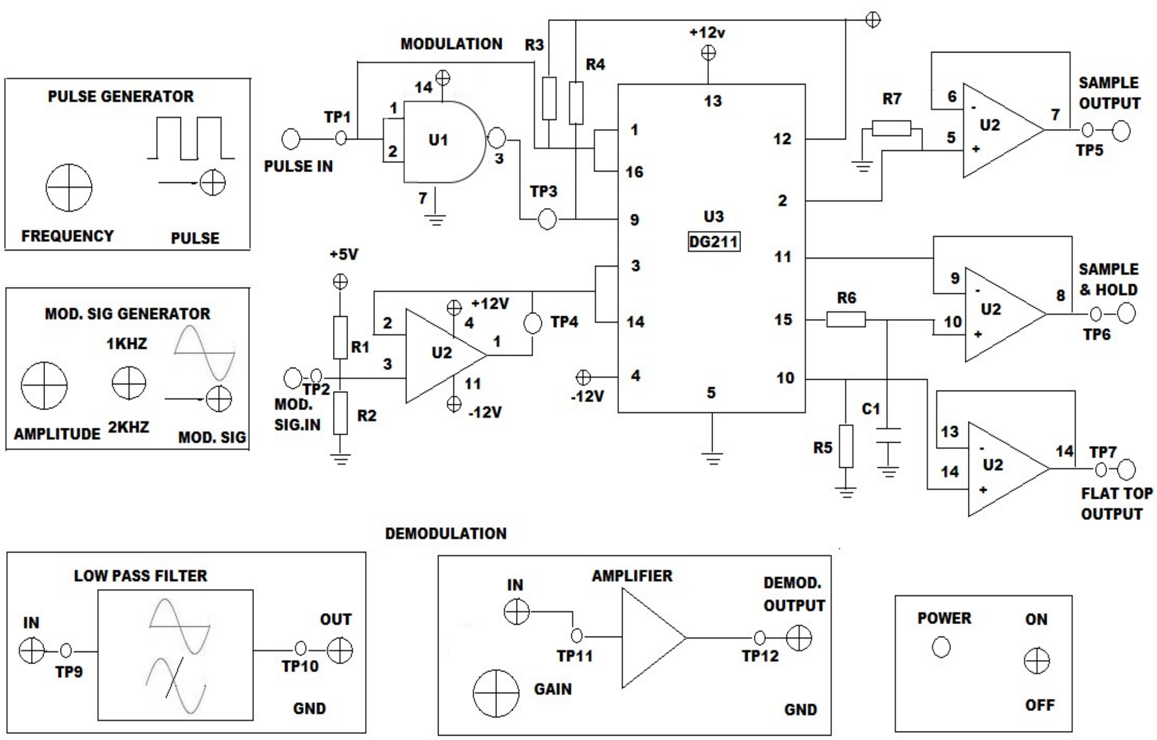


FIG: AMPLITUDE MODULATION AND DEMODULATION

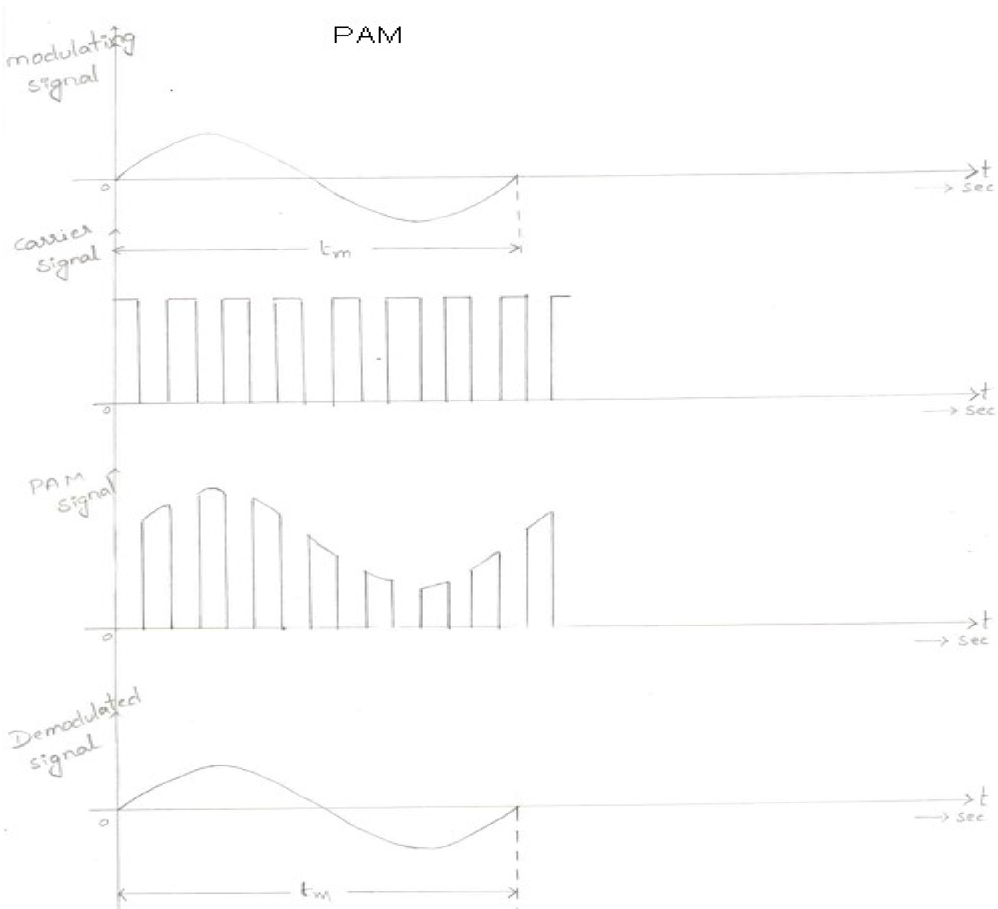
PROCEDURE:

1) Turn on the supply to the kit
2) Observe the modulating signal and clock signal on CRO (Signals obtained from corresponding generators)
3) Modulating signal and clock signals are applied to the modulator as shown in the above fig .
4) Observe the PAM signal on CRO
5) PAM signal as given as i/p to the demodulator and observe the o/p by varying the resistor until to get the original o/p

OBSERVATIONS:

1) Modulating signal amplitude=________________Frequency=________________
2) Carrier signal amplitude=__________ & frequency=______________
3) PAM signal:
4) Demodulation signal amplitude=_______________ & frequency=______________

EXPECTED WAVE FORMS:



RESULT:

5.PULSE WIDTH MODULATION AND DEMODULATION

AIM: 1)To study the process of pulse width modulation and demodulation
2)The effect of amplitude, frequency, of the modulating signal on PWM pulses
3)The effect of sampling frequency on the modulated and demodulated signal

APPARATUS: PWM kit, CRO, Patch cards

CIRCUIT DIAGRAM:

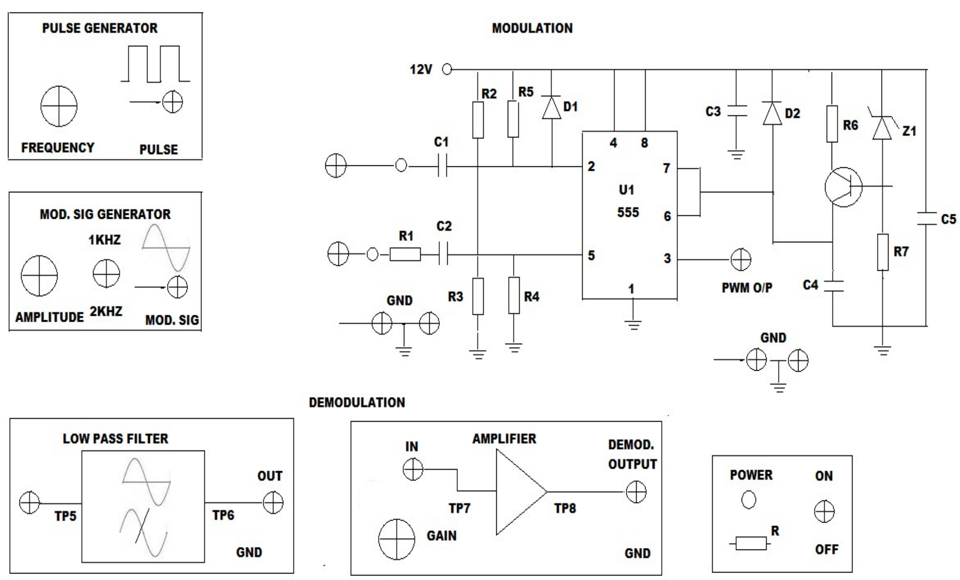


FIG: PULSE WIDTH MODULATION AND DEMODULATION

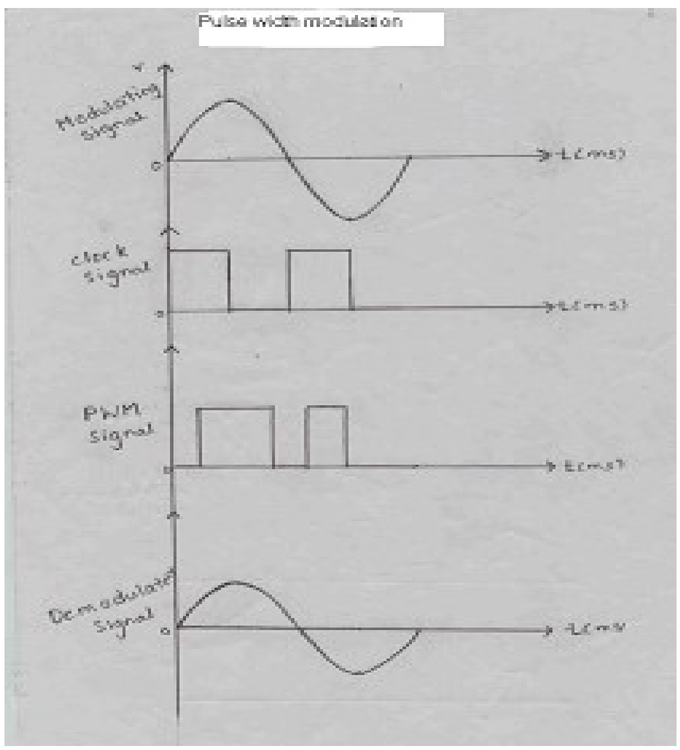
PROCEDURE:

1) Turn on the supply to the kit
2) Adjust sampling frequency to around 10 KHz and pulse width to 50% duty cycle. Connect the o/p to saw tooth generator
3) Observe the input & output of the saw tooth generator on CRO. Adjust the pulse width such that the positive slop of the saw tooth is about 90-95% of the negative slop portion
4) Observe the sine wave o/p from sine wave generator on CRO and adjust its frequency to about 1 KHz and amplitude +/- 1.5Vp-p
5) Observe the o/p of comparator (PWM) on CRO
6) Connect the LPF o/p of modulator to demodulator
7) Adjust the comparator level to get good PWM recovery
8) Observe the demodulator o/p
9) Vary the amplitude of modulating signal and observe demodulated signal. Beyond certain amplitude the o/p wave flatters indicating amplitude over load.
10) Vary the sampling frequency and observe the demodulated signal. Below a certain frequency distortion will takes place in the o/p signal.

OBSERVATIONS:

1) Sampling pulse generator:
   Frequency range_________(min) ________(max)
   Amplitude__________(volts)
   Adjust frequency to 32khz
2) Pulse width control
   Range___________µsec (min) _____________sec(max)
   Adjust for 50% duty cycle
3) AF signal generator:
   Frequency____________ Amplitude = +/- ______Vp-p

EXPECTED GRAPHS:



RESULT:

6.PULSE POSITION MODULATION AND DEMODULATION

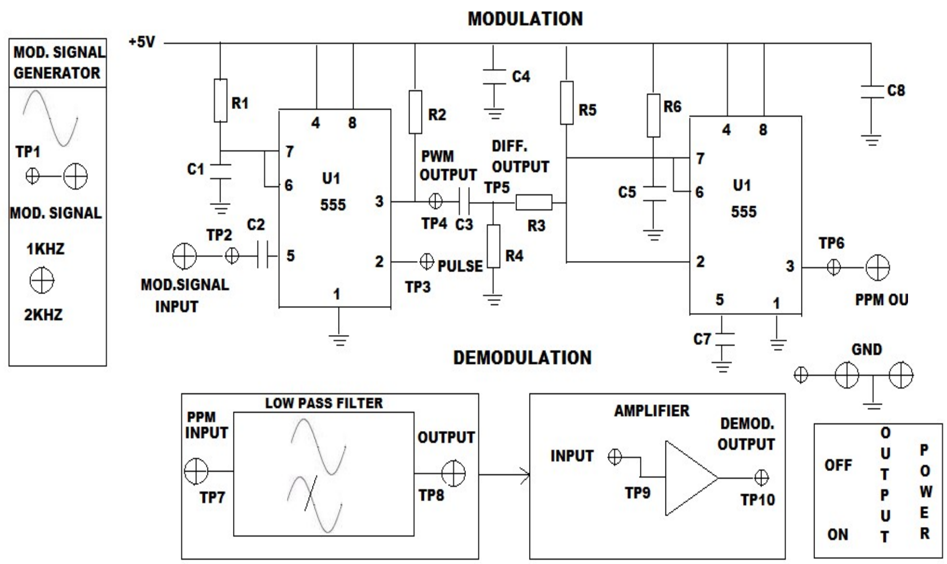
AIM:

1) To study the generation of PPM signal and its demodulation
2) To study the effect of amplitude & frequency of the modulating signal on its output.
3) To study the effect of sampling signal on the o/p of modulated signal

APPARATUS:

PPM kit, CRO, Probes, Patch cards

CIRCUIT DIAGRAM:



TL084

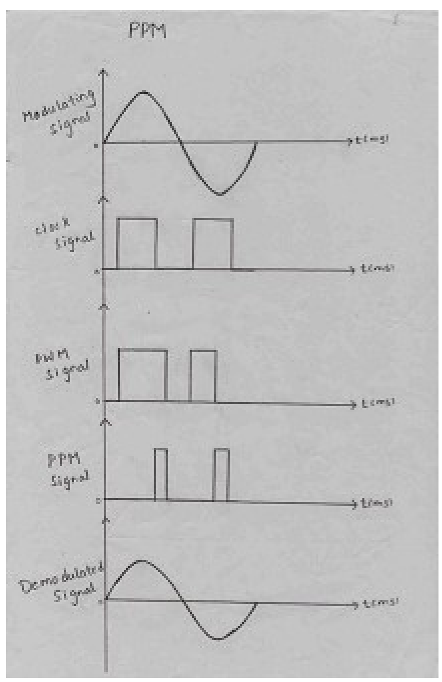
PROCEDURE:

1) Switch on the experimental kit
2) Observe the clock generator o/p and modulating signal outputs
3) Connect the clock generator o/p to the clock input point of PPM modulator and observe the same clock on a channel of a dual trace CRO
4) Trigger the CRO with respect to channel CH1
5) Apply a variable D.C voltage of 8 to 12 V from any external RPS
6) Observe the PPM output on channel CH2
7) By varying the modulating voltage, PPM o/p clock position changes but its width remains constant.
8) If we observe the PWM output, its width varies according to the modulating voltage.
9) A variable amplitude modulating signal is given to observe how the PWM & PPM signals are varying for A.C modulating voltages.
10) In this case we have triggered the CRO with respect to modulating voltage.

OBSERVATIONS:

Modulating signal amplitude=__________ & frequency=____________
Carrier signal amplitude=_____________& frequency= _____________
PPM signal amplitude=_______________& frequency=_____________
Change in Position: _______________
Demodulated signal amplitude=__________ & frequency____________

EXPECTED GRAPH:



RESULT:

7. RADIO RECEIVER MEASUREMENTS - SENSITIVITY & FIDELITY

AIM: To study the Radio receiver measurements i.e sensitivity, selectivity &fidelity

APPARATUS REQUIRED: Superhetrodyne receiver kit, Connecting leads.

CIRCUIT DIAGRAM:

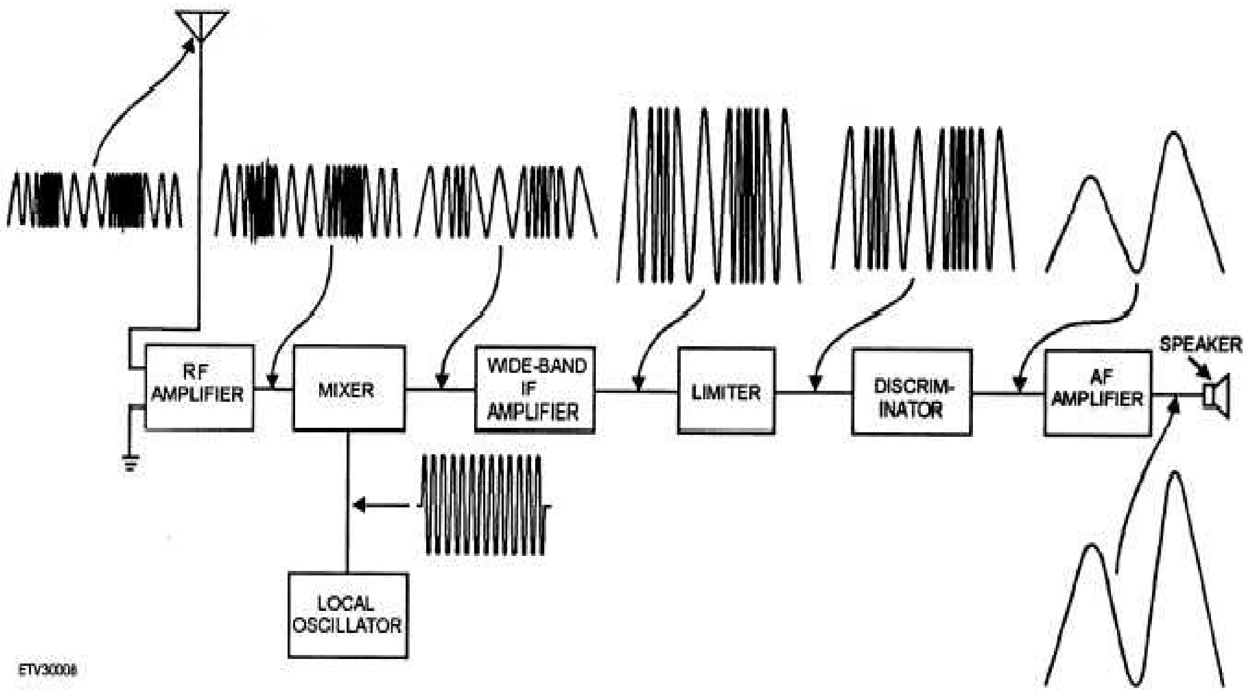


Fig. SUPERHETERODYNE RECEIVER

Theory:-

SUPERHETERODYNE RECEIVER The super heterodyne receiver was developed to overcome the disadvantages of earlier receivers. A block diagram of a representative super heterodyne receiver is shown in fig. Super heterodyne receivers may have more than one frequency-converting stage and as many amplifiers as needed to attain the desired power output. FM and AM receivers function similarly. However, there are important differences in component construction and circuit design because of differences in the modulating techniques. Comparison of block diagrams shows that electrically there are two sections of the FM receiver that differ from the AM receiver: the discriminator (detector) and the accompanying limiter. FM receivers have some advantages over AM receivers.

During normal reception, FM signals are static- free, while AM is subject to cracking noise and whistles. Also, FM provides a much more realistic reproduction of sound because of the increased number of sidebands.

PROCEDURE:

1. Connections are made as shown in the circuit diagram.
2. Ensure the Radio Receiver is in MW band.
3. Adjust the modulation index of AM signal at 30 % & fm = 400 Hz.
4. Let the receiver be tuned to 800 KHz. (can be anywhere between 540 KHz 1450 KHz).
5. Keeping the carrier frequency of the AM signal at 800 KHz, observe the demodulated signal.

Selectivity: -

The ability to reject adjacent unwanted signals. The spacing between the carrier frequencies allocated to different transmitters is limited by the available frequency spectrum. e.g. 9 kHz for broadcast in the medium waveband. The selectivity of a receiver is its ability to reject signals at carrier frequencies adjacent to the wanted carrier frequency. In the superheterodyne receiver see later) the selectivity is mainly determined by the gain versus frequency characteristics of the IF amplifier. The adjacent channel ratio is the ratio, in decibels of the input voltages at the wanted and adjacent channel signal frequencies necessary to produce the same output power.

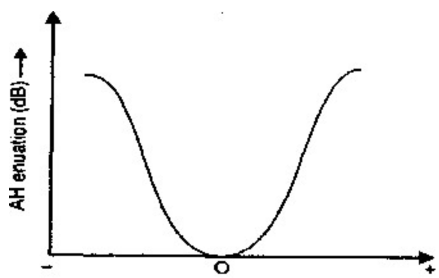


Fig. 5

PROCEDURE:

1. Connections are made as shown in the circuit diagram.
2. Ensure the Radio Receiver is in MW band.
3. Adjust the modulation index of AM signal at 30 % & fm = 400 Hz.
4. Let the receiver be tuned to 800 KHz. (can be anywhere between 540 KHz 1450 KHz).
5. Keeping the carrier frequency of the AM signal at 800 KHz, observe the demodulated signal.
6. changing the carrier frequency at 805, 810, 815 and 795, 790, 785 KHz.
7. Plot a graph of carrier frequency of AM signal Vs the amplitude of the output signal (Vo Vs fc).

Sensitivity: -

The ability to receive very small signals and produce an output of satisfactory signal to noise ratio. Usually expressed as the minimum input *signal (generally in micro volts), modulated at 400 Hz required to produce 50 mW* output power with a signal to noise ratio of 15 dB It is necessary to

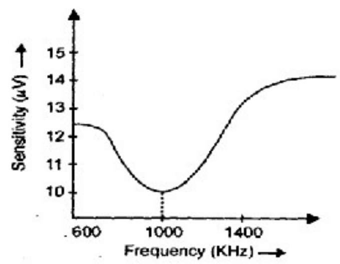


Fig. 4

include a signal to noise in the measurement of sensitivity because it would otherwise be possible for the output power to consist mainly of noise.

PROCEDURE:

1. Connections are made as shown in the circuit diagram.
2. Ensure the Radio Receiver is in MW band.
3. Adjust the modulation index of AM signal at 30 % & fm = 400 Hz.
4. Let the receiver be tuned to 800 KHz. (can be anywhere between 540 KHz 1450 KHz).
5. Keeping the carrier frequency of the AM signal at 800 KHz, observe the demodulated signal.
6. Vary the amplitude of the AM signal to get a standard value of output voltage (Volts). All the other parameters are kept constant (i.e., fc, fm, m). Note the change in the amplitude of the output signal.
7. Plot a graph of amplitude of input signal v/s carrier frequency of AM signal (Vi v/s fc).

Fidelity: -

The ability to preserve the exact shape of the information envelope of the carrier while the signal progresses through the receiver circuits

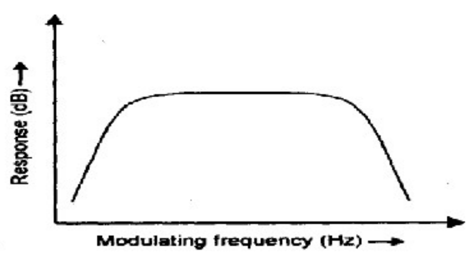


Fig. 6

PROCEDURE:

1. Connections are made as shown in the circuit diagram.
2. Ensure the Radio Receiver is in MW band.
3. Adjust the modulation index of AM signal at 30 % & fm = 400 Hz.
4. Let the receiver be tuned to 800 KHz. (can be anywhere between 540 KHz 1450 KHz).
5. Keeping the carrier frequency of the AM signal at 800 KHz, observe the demodulated signal.
6. Vary the frequency of the modulating signal keeping all other parameters constant (i.e., fc, VAM, m). Note the change in the amplitude of the output signal.
7. Plot a graph of amplitude of output signal Vs frequency of the modulating signal (Vo Vs fm).

RESULT:

8. MEASUREMENT OF HALF POWER BEAM WIDTH AND GAIN OF A HALF WAVE DIPOLE ANTENNA

AIM: to measure the half power beam width and gain of a half wave dipole antenna.

EQUIPMENT:

1) Transmitter antenna .
2) Receiver antenna.
3) AMS(antenna measurement system).

THEORY:

HALF POWER BEAM WIDTH:

In a radio antenna pattern , the half power beam width is the angle between the half power (-30dB)points of the main lobe ,when referenced to the peak effective radiated power of the main lobe .see beam diameter. Beam width is usually but not always expressed in the degree and for the horizontal plane .

HALF WAVE DIPOLE ANTENNA:

the half wave dipole is a half wave length long .this is the shortest resonant length the can be used for a resonant dipole .it also has a very convenient radiation pattern neglecting electrical inefficiency ,the antenna gain is equal to the directive gain.

CIRCUIT DIAGRAM:

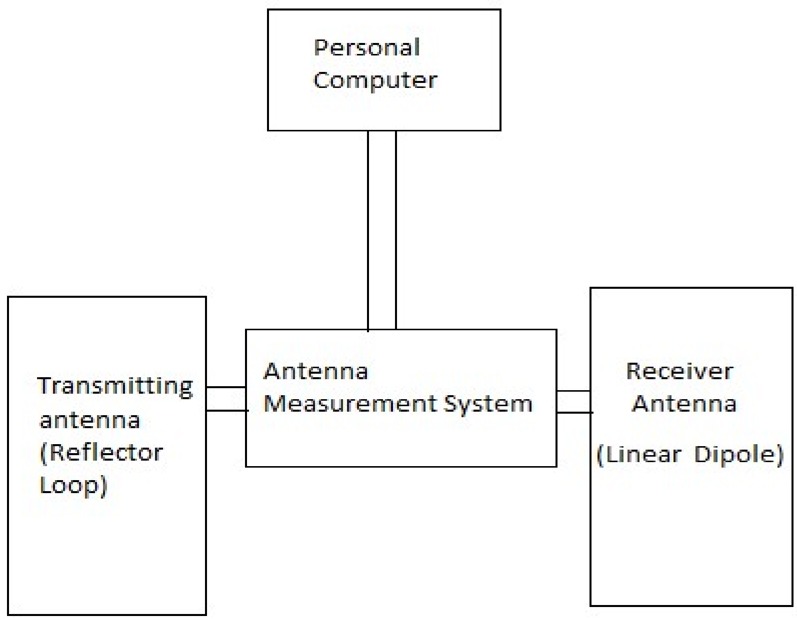
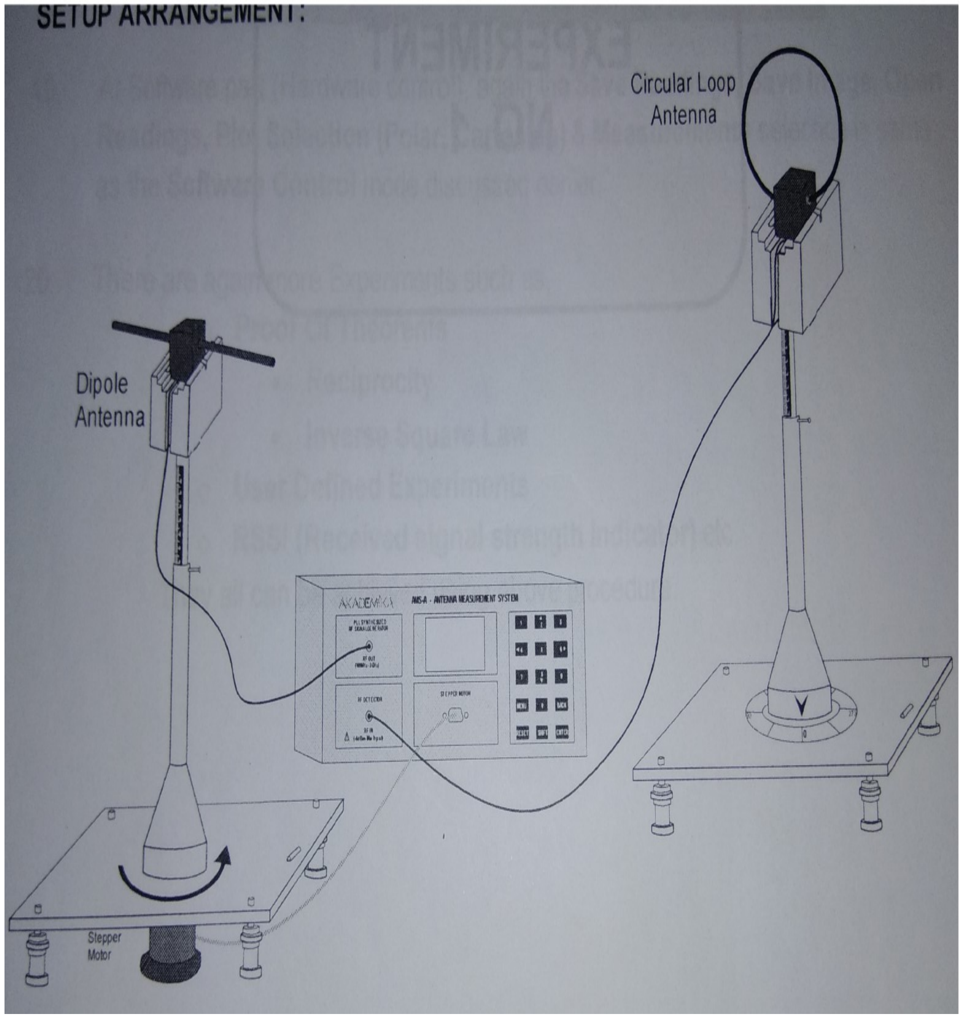
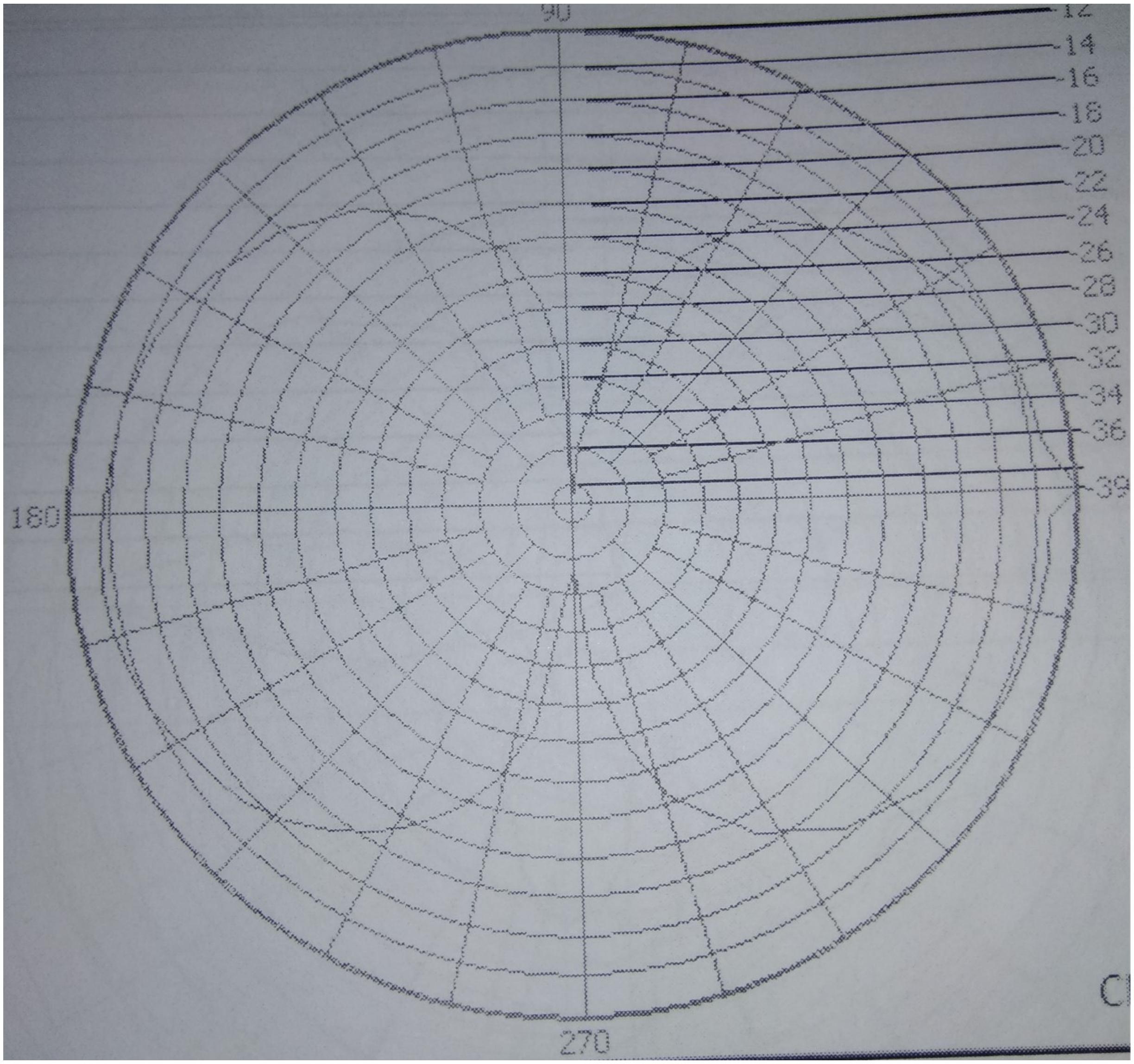


FIG: CIRCUIT DIAGRAM OF RADIO RECEIVER


SETUP ARRANGEMENT:
Circular Loop Antenna
Dipole Antenna
Stepper Motor

WAVE FORMS:

RADIATION PATTERN



PROCEDURE:

1) Firstly turn on the PC and AMS.
2) Press menu and then press menu to select PC mode
3) Double click on AMS in PC and process enter in AMS .
4) In AMS (PC),go to file and select control and then select PC.
5) Select COM& part and then click on ok button.
6) Select main experiment for far field pattern .
   A) Experiment ------------copolarisation.
   B) Type of antenna---------linear dipole.
   C) Name of RX antenna---------wire.
7) Then go for a start option
8) After radiation of receiver antenna ,go to measurement and then select appropriate parameter.

PRECAUTIONS:

Set transmitting antenna and receiving antenna with o® inclination and connect them to RF generator and RF detector.

RESULT:

9.MEASUREMENT OF THE RADIATION PATTERN OF A LOOP ANTENNA IN PRINCIPAL AXIS

AIM: To measure the radiation pattern of a loop antenna in the principal axis.

APPARATUS:

1) Antenna me measurements system
2) Personal computer
3) Transmitter antenna
4) Rectangular loops receiving antenna

CIRCUIT DIAGRAM:

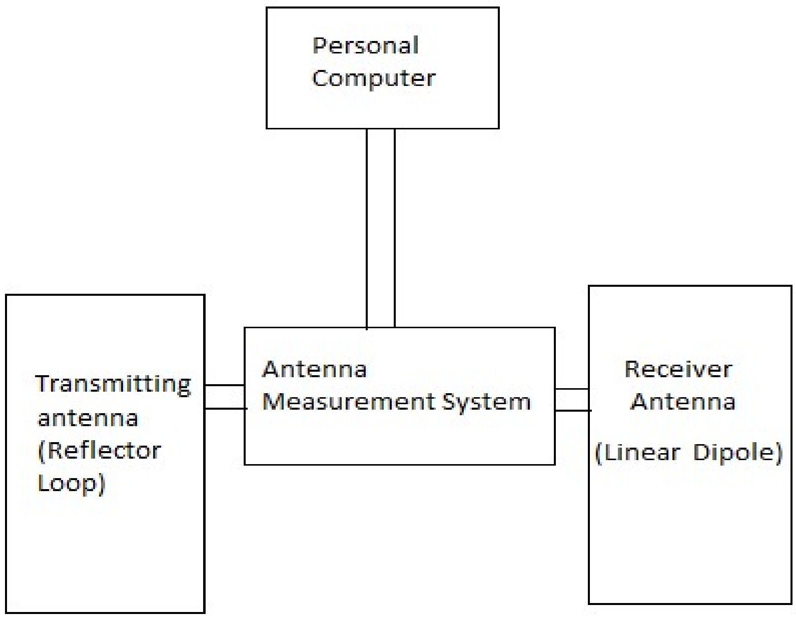
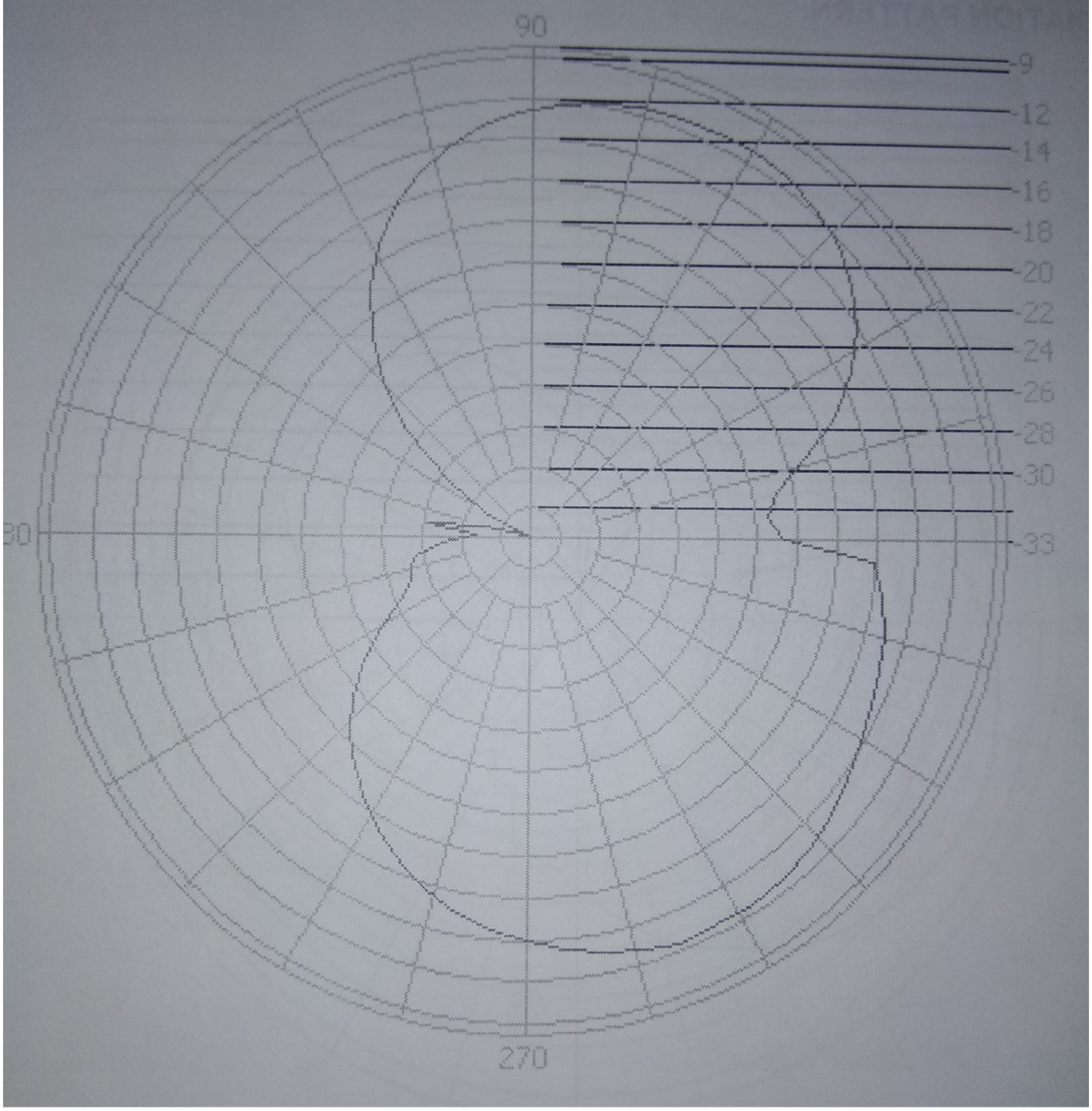
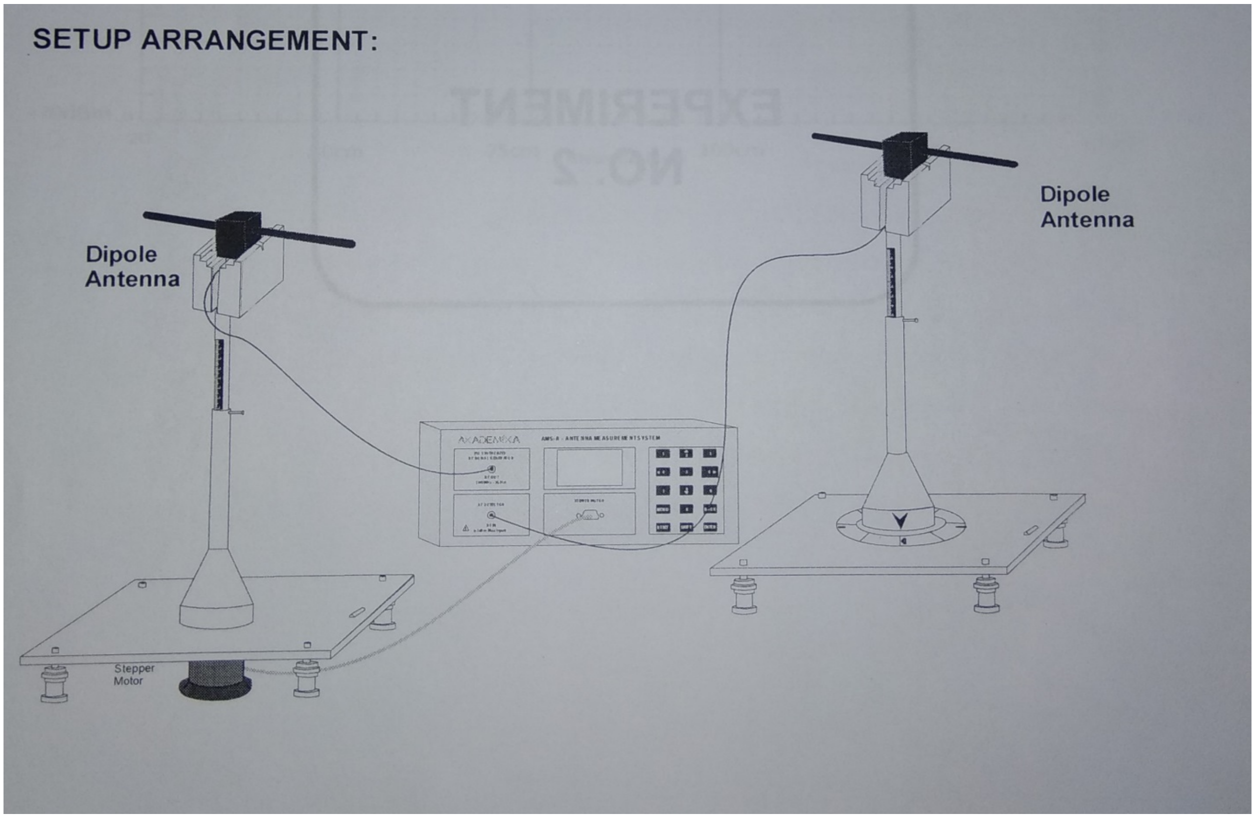


FIG: CIRCUIT DIAGRAM OF RADIO RECEIVER

RADIATION PATTERN:





PROCEDURE:

1) Turn on the personal computer and AMS
2) Press menu in AMS and then select PC
3) Now double click on AMS software in PC and press enter in AMS
4) Select com 8 part and then click on ok button.
5) Select main experiment –far field pattern.
   D) Experiment ------------ ----- copolarisation
   E) Type of antenna---------.---- wire
   F) Name of RX antenna---------. linear dipole
9) Then go for a start option
10) After radiation of receiver antenna ,go to measurement and then select appropriate parameter.

PRECAUTIONS:

Set transmitting antenna and receiving antenna with o® inclination and connect them to RF generator and RF detector.

RESULT: Hence the measurement of bandwidth pattern of a loop antenna in principal axis has been verified.

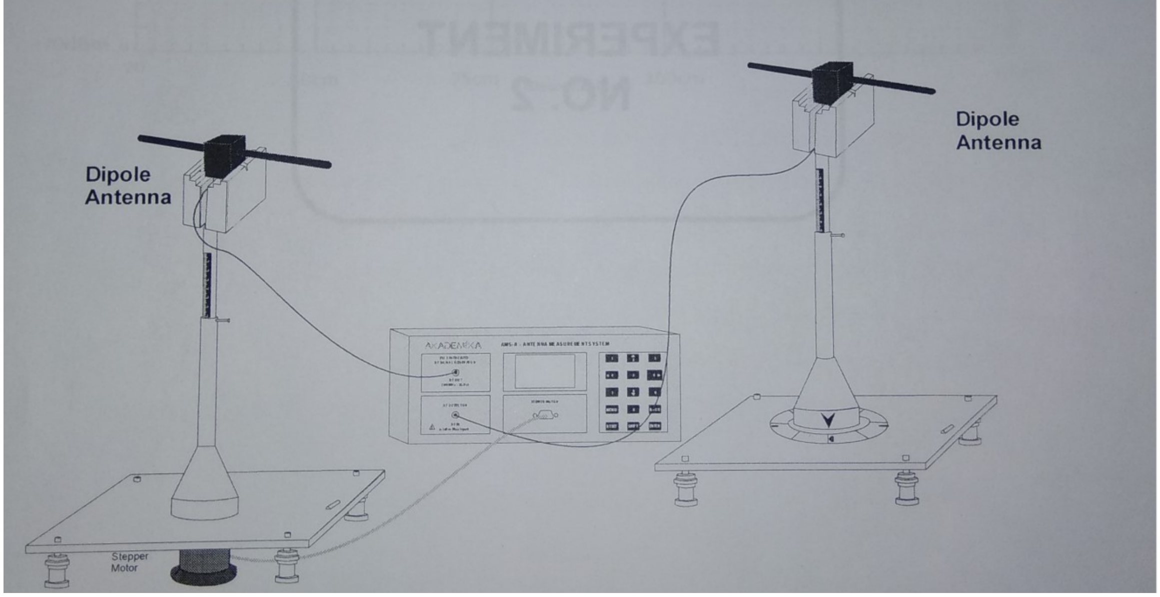
OBJECTIVE

To demonstrate that the transmitting and receiving radiation patterns of an antenna are equal and hence confirm the reciprocity theorem of antennas.

EQUIPMENT REQUIRED:

TX antenna	RX antenna	Transmitter input	Receiver output	Cable
Dipole RMSA	Dipole RMSA	Source (RF out)	Detector (RF input)	SMA To SMA cable
QTY =1	QTY =1	QTY =1	QTY =1	QTY =2

SETUP ARRANGEMENT:



RESULT: