

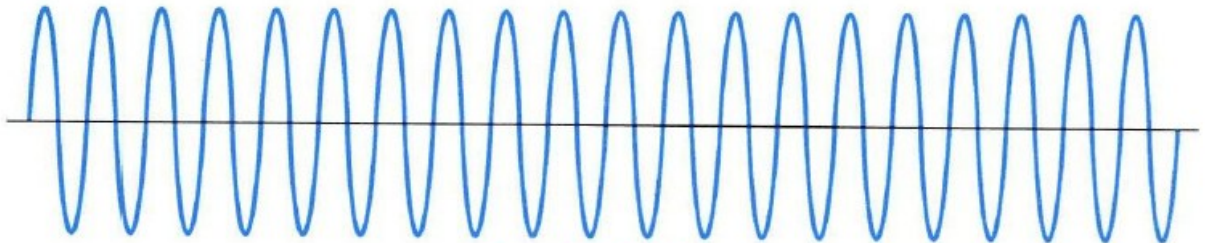
FREQUENCY MODULATION (FM)

Aim: To study frequency modulation and demodulation and observe the waveforms.
Calculate the modulation index for FM

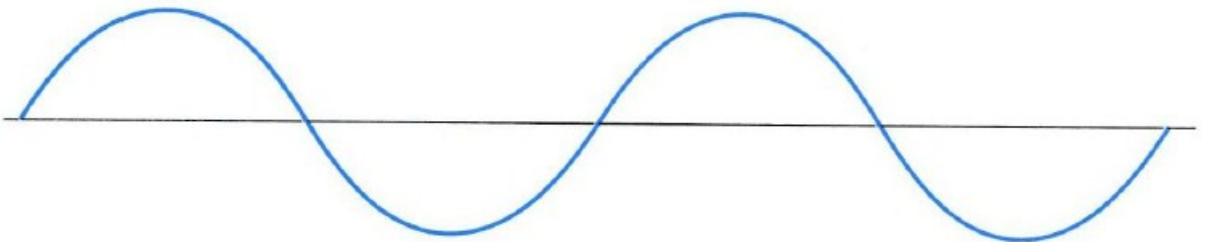
Apparatus: FM kit (ST2203), connecting wires, DSO, etc.

Frequency Modulation (FM):

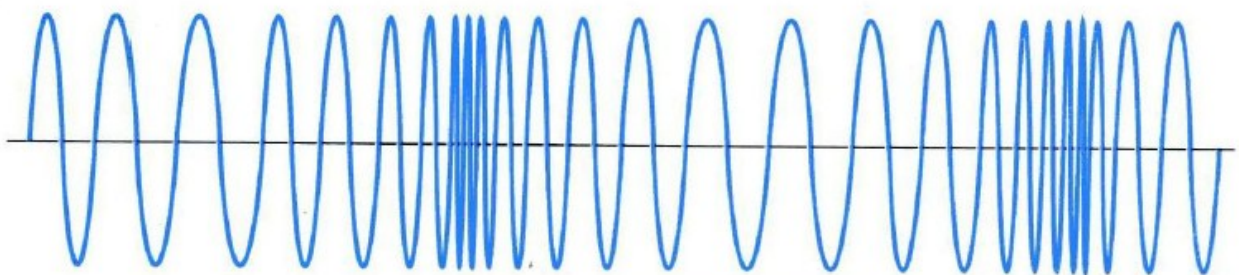
The frequency of the carrier waveform varies with the information signal



Carrier Wave



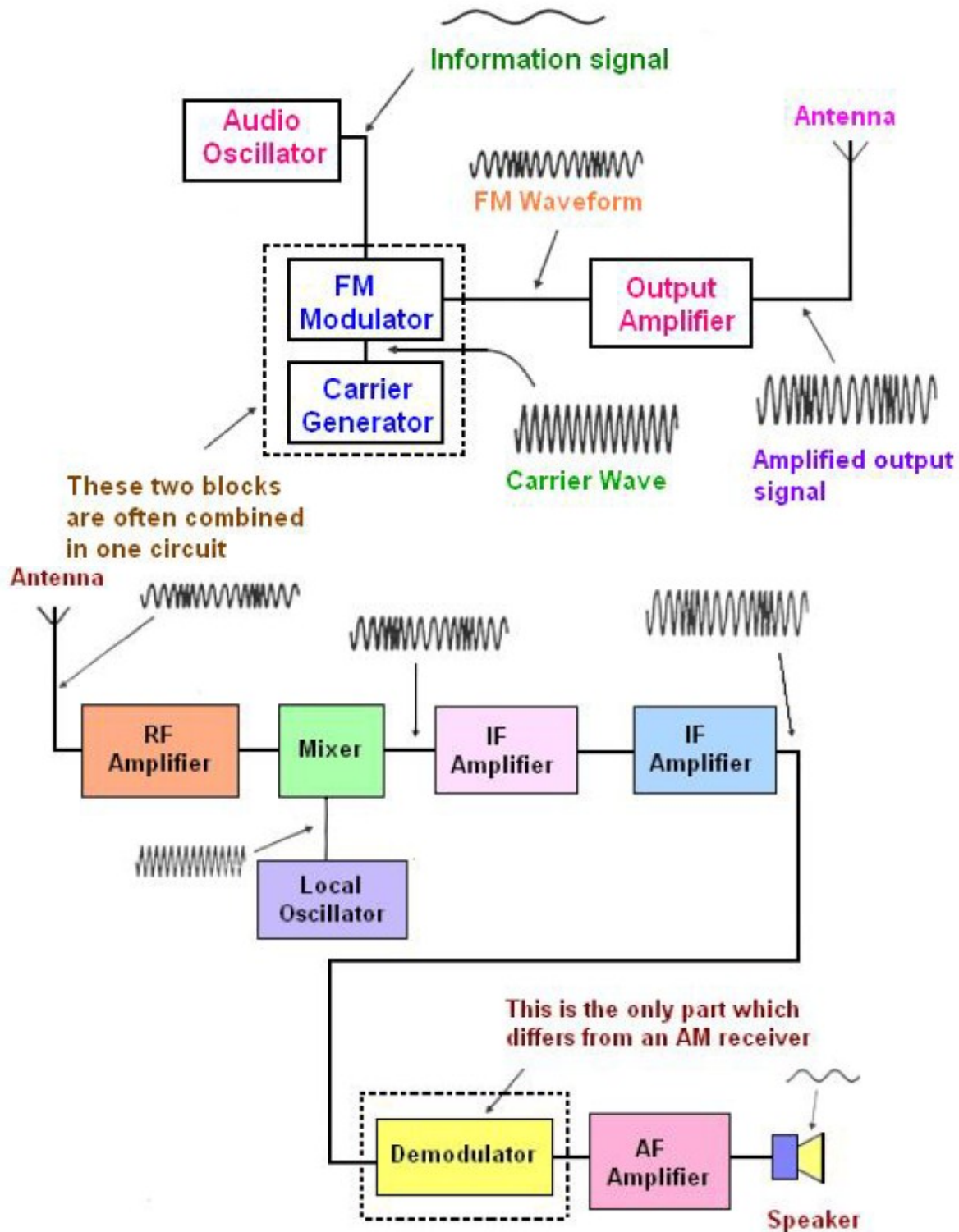
Modulating Wave



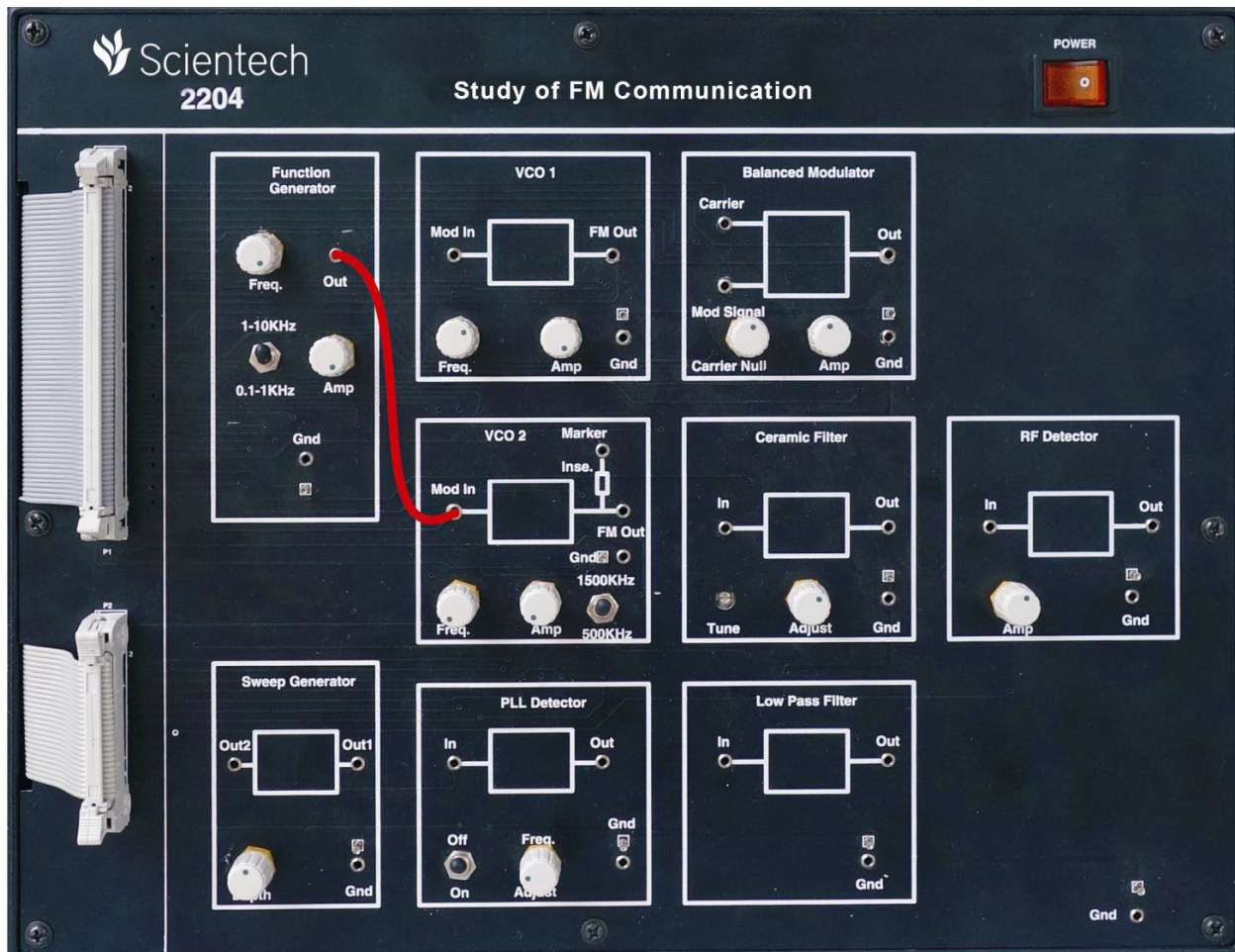
Frequency Modulated Wave

FM Transmitter:

The block diagram is shown in figure.



FM Receiver



Procedure:

Please check the following conditions:

- Function Generator: Frequency toggle switch at 1-10KHz
- VCO 2: Frequency toggle switch at 1500 KHz.
- PLL detector Switch at Off position.

Carry out the following presetting as under:

- VCO 2: Frequency at 455 KHz and amplitude at maximum.
- Function Generator: Frequency and amplitude both potentiometers at maximum.
- Make connections as shown in above figure.
- Connect the output of Function Generator to input of VCO 2.
- Now connect the CH I (Y) of Oscilloscope to the output of VCO 2 to observe frequency modulated waveform.
- Connect CH II (X) of Oscilloscope to Function Generator output to observe modulating signal.
- Now carry out following settings on CRO.
- Set CRO in dual channel mode.
- Keep CRO at AC coupling position.
- Keep CH I (Y) at 1 V/Div and CH II (X) at 1V/Div and Time base at 10 μ S.

- Use alternate Trigger mode

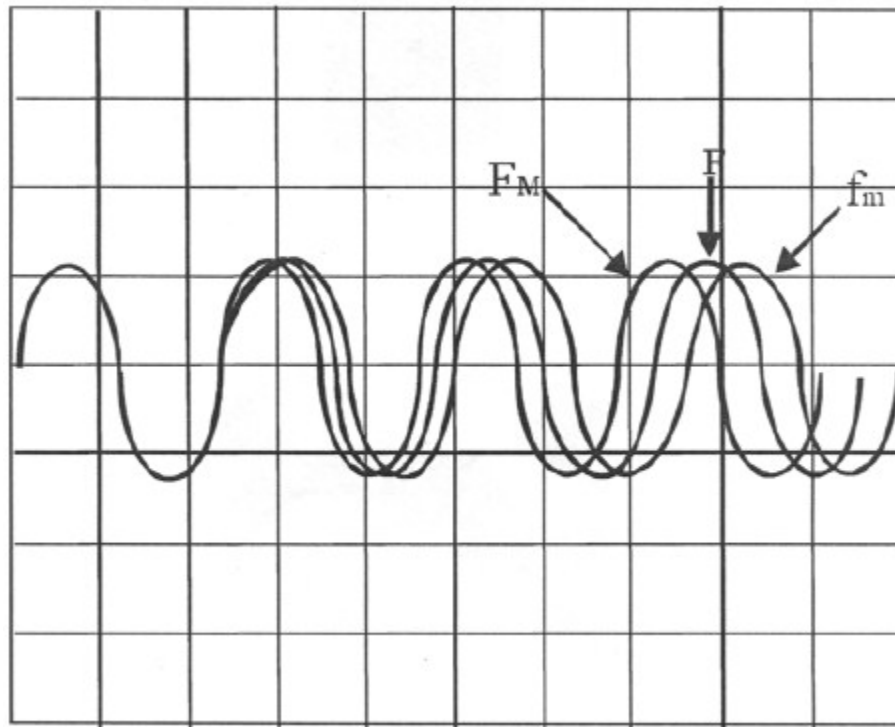
Connect the output of Function Generator to input of VCO 2.

Connect the Oscilloscope to the output of VCO 2.

Note : The frequency deviation can be calculated as follows

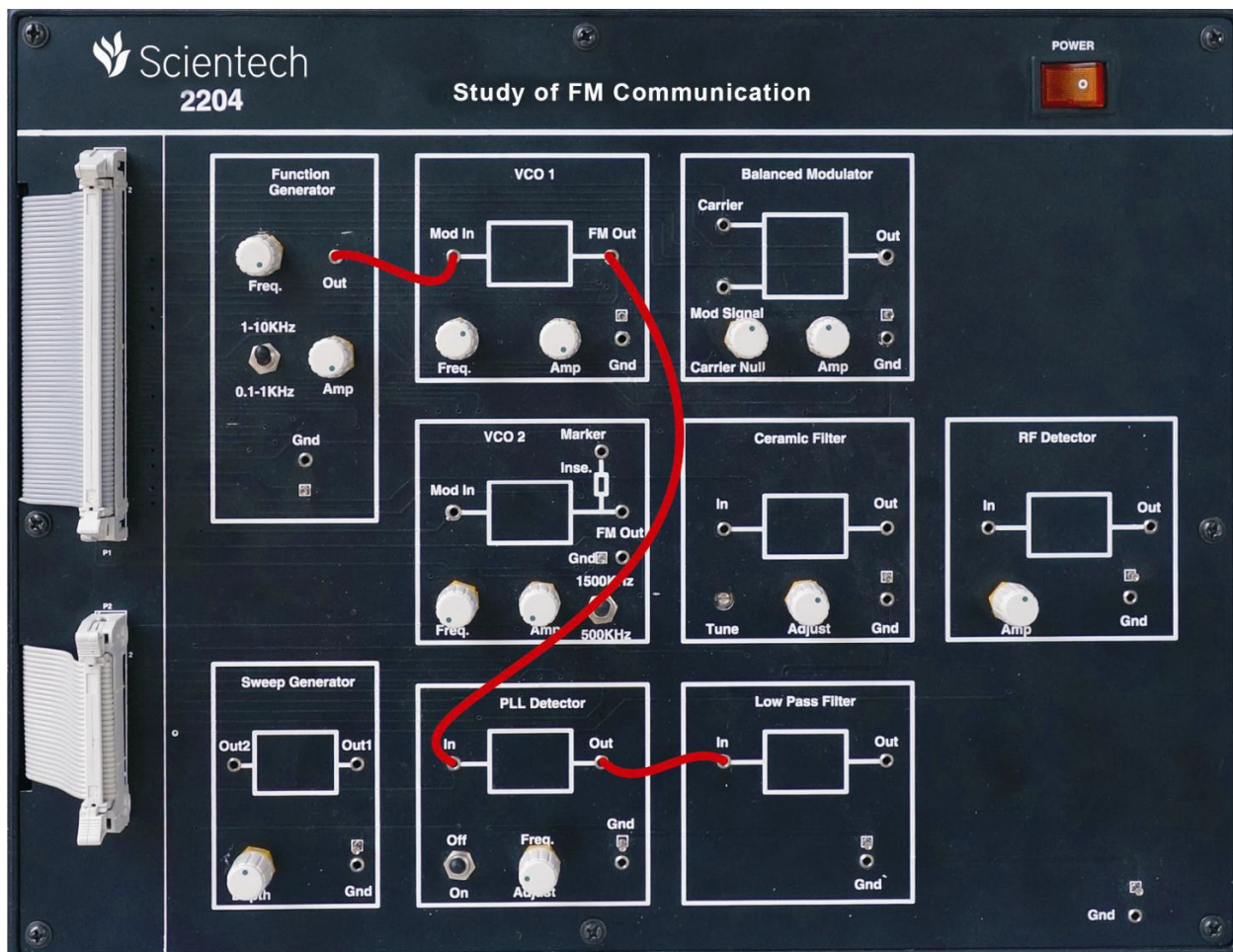
- From the waveform evaluate F_M and f_m detecting the periods of the respective sine waves.
- The frequency deviation is defined as $\Delta f = (F_M - f_m) / 2$.
- You can note that if the modulator operates in a linear zone so F_M and f_m are over and under the central frequency by the same Δf , otherwise this does not occur.
- Modulation index m_f is calculated by the relation.

$m_f = \Delta f / f$ Where, f is the frequency of the modulating signal



Observation Table:

Sr. No	Freq. (f)	Input Signal Amplitude	F_M	f_m	Freq. Deviation $\Delta f = (F_M - f_m) / 2$	Modulation Index $m_f = \Delta f / f$
1						
2						
3						



FM Detection Procedure:

- Please check the following conditions:
 - ▶ Function Generator: Frequency toggle switch at 1-10KHz
 - ▶ VCO 2: Frequency toggle switch at 1500 KHz.
 - ▶ PLL detector Switch at Off position.
- Carry out the following presetting as under:
 - ▶ VCO 2: Frequency at 455 KHz and amplitude at maximum.
 - ▶ Function Generator: Frequency potentiometer at center and amplitude 100mV.
- Make connections as shown in above figure.
- Connect output of FG block to input of VCO.
- Output of VCO to input of PLL detector.
- Output of PLL detector to input of low pass filter.
- Switch in PLL detector block in 'On' position.
- Now connect Oscilloscope between output of low pass filter and ground and Observe the output of low pass filter circuit, with adjusting the frequency adjust potentiometer in the PLL detector.
- Note that the sine wave observed on the CRO resembles the modulating signal. Vary the modulating signal's frequency and amplitude to confirm that it is the demodulated output.

- If you get distorted output at lower frequency, slightly adjust the amplitude of Function Generator to get optimum output.
- If At higher amplitude of modulating signal you will get distorted output because of over modulation

Conclusion:

Remark

Signature