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Experiment - 4

Spectra of Frequency Modulation Signals

Aim :

a) Change the modulation index values and observe the change in spectra for all of them.
b) For which value of modulation index, the carrier frequency disappears.
c) For what values of the modulation index, first frequency band disappears.
d) For what values, 2nd and 3rd side band disappears.

Apparatus :

1) Lab Alive Online Simulator
2) Java Runtime Environment

Theory :

Frequency modulation varies the frequency of a sine wave carrier depending on the source signal.

The difference between the instantaneous and center frequency of the carrier is proportional to the modulating signal's instantaneous amplitude.

$$\Delta f(t) = K_m m(t).$$

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where

$\Delta f(t)$ → frequency deviation

K_m → sensitivity of the frequency modulator $\left[\frac{V}{Hz}\right]$

$m(t)$ → modulating signal

Modulation index, $\beta = \frac{\Delta f_{max}}{f_m} = \frac{K_m \hat{m}}{f_m}$

$\hat{m}$ → amplitude of modulating signal

f_m → modulating sinewave signal frequency.

Observations :

a) Carrier frequency is set to 10 Hz and carrier amplitude to 0.9 V.

b) By varying modulation amplitude at 2.4, the carrier frequency disappears.

c) at around modulation amplitude value of 3.8, the first frequency band disappears.

d) Second band disappears at 5.12 and third band disappears at 6.4.

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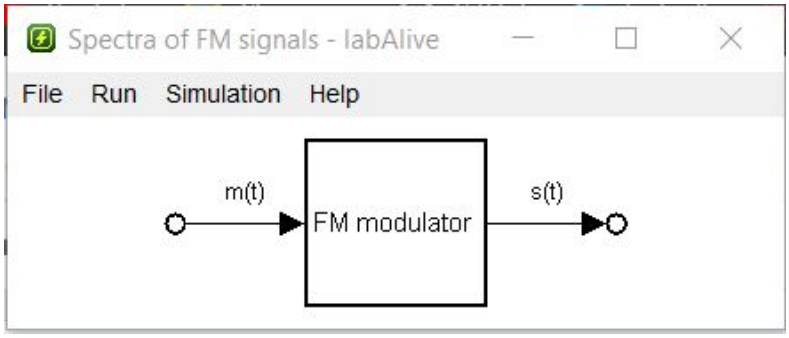
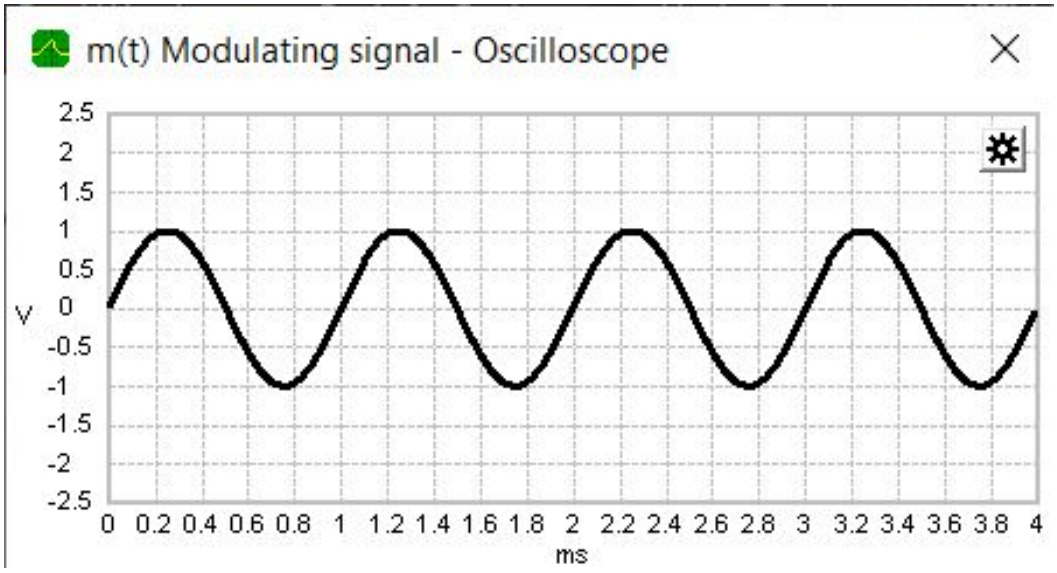
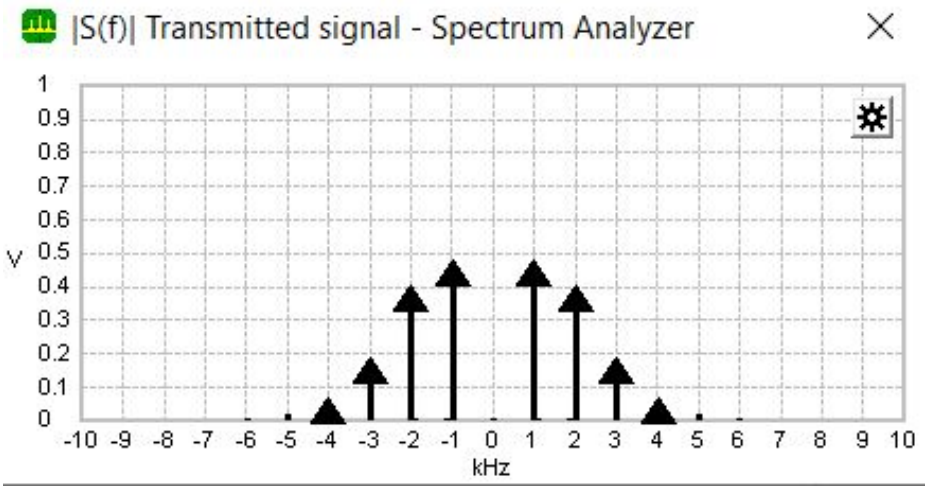
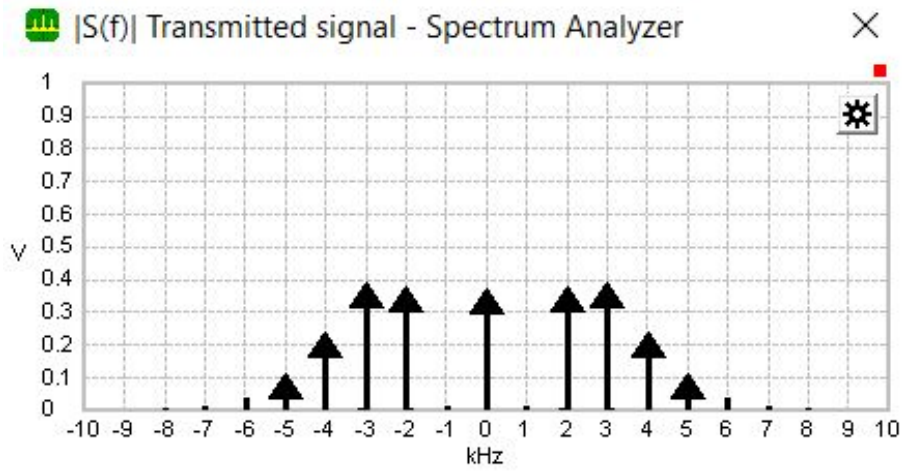




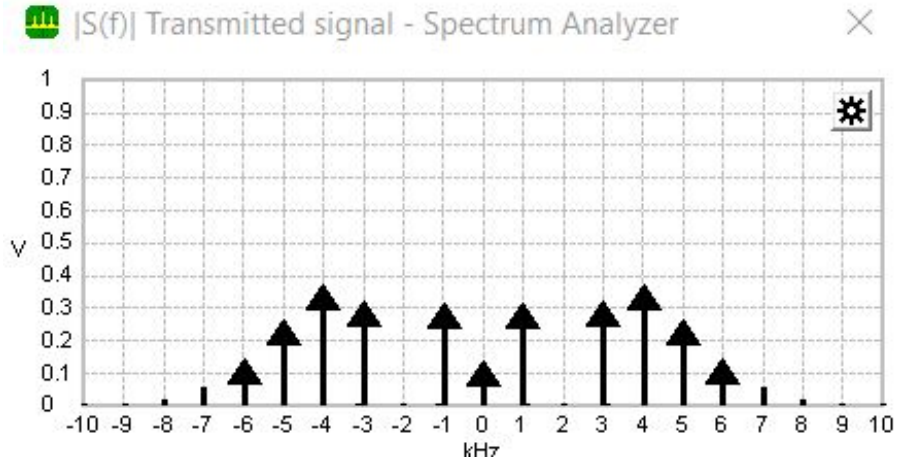
Carrier Frequency disappears at 2.4 V



First Band at 3.8



Second Band at 5.12



Third Band at 6.4