Date 12/2/21 Expt. No. 3

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Experiment - 3

Aim :

To detect synchronous wave in amplitude modulation transmissions.

Theory :

In AM transmissions with or without a reduced carrier like,

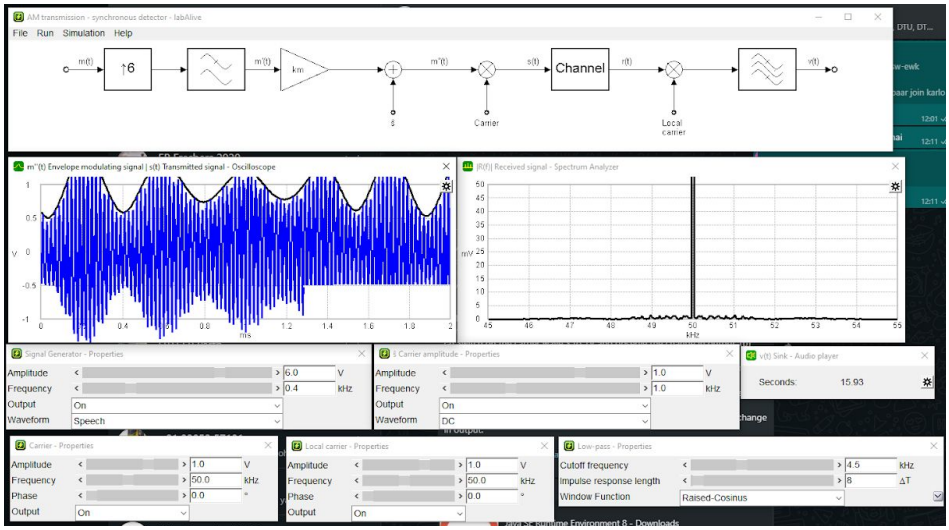
- → Double - Sideband suppressed carrier, DSB-SC or
- → Double - Sideband reduced carrier, DSB-RC or
- → Single - sideband suppressed carrier, SSB-SC

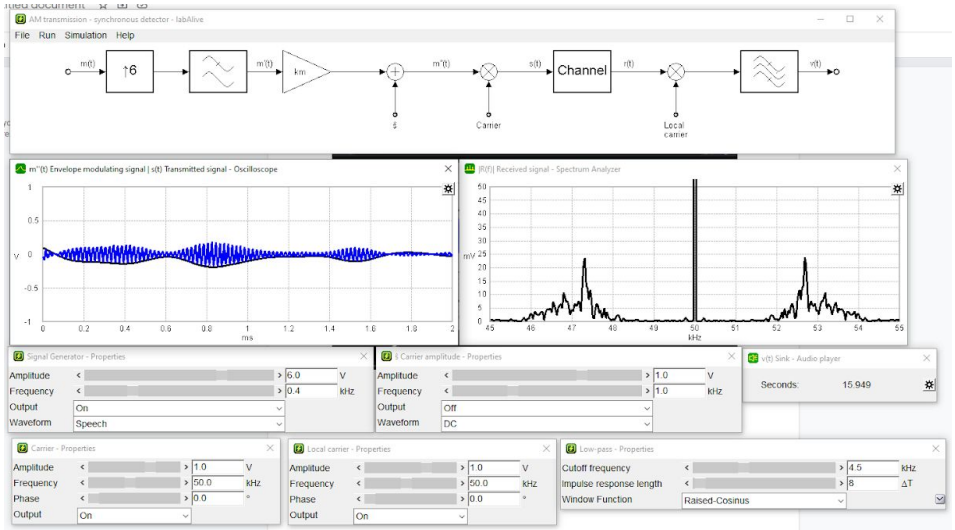
A simple envelope detection or non-coherent detection is not possible because the envelope detection condition is not met for oversmodulated signals and more complex signals synchronous or coherent detection is required like implemented in this setup.

Apparatus :

- → Java Runtime Environment
- → labAline experiment simulator.

Teacher's Signature:


AM transmission - synchronous detector - labAlive
File Run Simulation Help
m(t)
↑6
m'(t)
km
m''(t)
s(t)
Channel
r(t)
v(t)
$
Carrier
Local carrier
m''(t) Envelope modulating signal | s(t) Transmitted signal - Oscilloscope
|R(f)| Received signal - Spectrum Analyzer
Signal Generator - Properties
Amplitude 6.0 V
Frequency 0.4 kHz
Output On
Waveform Speech
$ Carrier amplitude - Properties
Amplitude 1.0 V
Frequency 1.0 kHz
Output On
Waveform DC
v(t) Sink - Audio player
Seconds: 15.93
Carrier - Properties
Amplitude 1.0 V
Frequency 50.0 kHz
Phase 0.0 °
Output On
Local carrier - Properties
Amplitude 1.0 V
Frequency 50.0 kHz
Phase 0.0 °
Output On
Low-pass - Properties
Cutoff frequency 4.5 kHz
Impulse response length 8 ΔT
Window Function Raised-Cosinus


AM transmission - synchronous detector - labAlive
File Run Simulation Help
m(t)
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m'(t)
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Carrier
Local carrier
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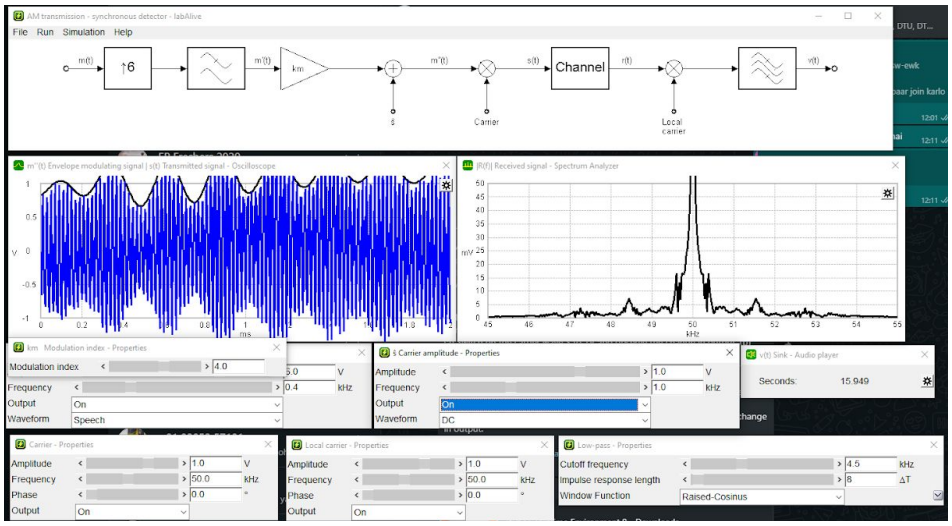
Signal Generator - Properties
Amplitude 6.0 V
Frequency 0.4 kHz
Output On
Waveform Speech
$ Carrier amplitude - Properties
Amplitude 1.0 V
Frequency 1.0 kHz
Output Off
Waveform DC
v(t) Sink - Audio player
Seconds: 15.949
Carrier - Properties
Amplitude 1.0 V
Frequency 50.0 kHz
Phase 0.0 °
Output On
Local carrier - Properties
Amplitude 1.0 V
Frequency 50.0 kHz
Phase 0.0 °
Output On
Low-pass - Properties
Cutoff frequency 4.5 kHz
Impulse response length 8 ΔT
Window Function Raised-Cosinus


AM transmission - synchronous detector - labAlive
File Run Simulation Help
m(t)
↑6
m'(t)
km
m''(t)
s(t)
Channel
r(t)
v(t)
$
Carrier
Local carrier
m''(t) Envelope modulating signal | s(t) Transmitted signal - Oscilloscope
|R(f)| Received signal - Spectrum Analyzer
Im Modulation index - Properties
Modulation index 4.0
Frequency 0.4 kHz
Output On
Waveform Speech
$ Carrier amplitude - Properties
Amplitude 1.0 V
Frequency 1.0 kHz
Output On
Waveform DC
v(t) Sink - Audio player
Seconds: 15.949
Carrier - Properties
Amplitude 1.0 V
Frequency 50.0 kHz
Phase 0.0 °
Output On
Local carrier - Properties
Amplitude 1.0 V
Frequency 50.0 kHz
Phase 0.0 °
Output On
Low-pass - Properties
Cutoff frequency 4.5 kHz
Impulse response length 8 ΔT
Window Function Raised-Cosinus

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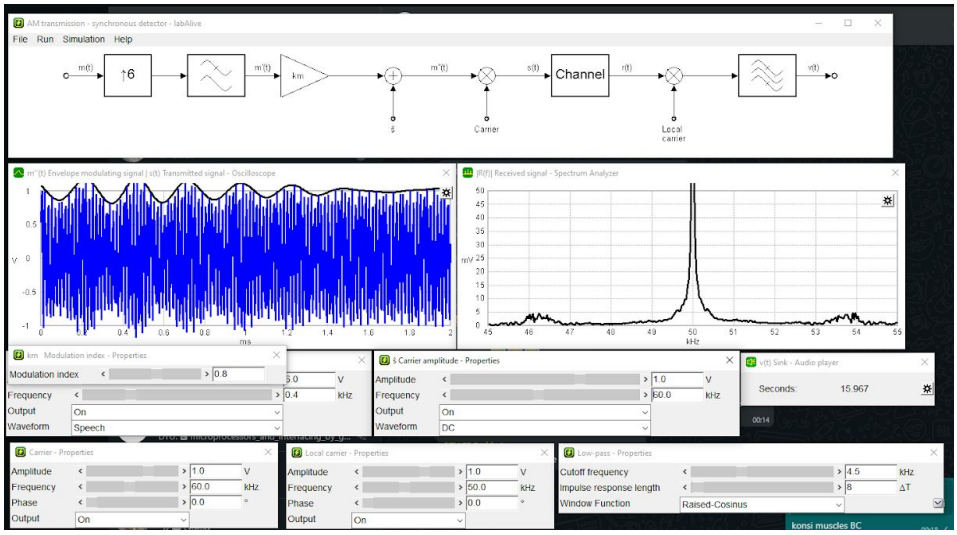
Procedure :

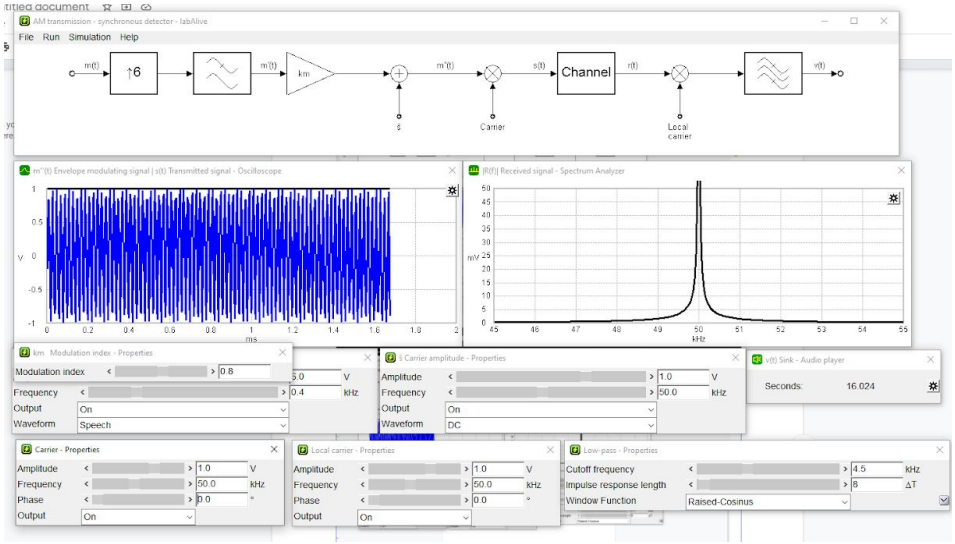
1. Switch ON the carrier wave ŝ and set its amplitude to 1V.
2. Switch OFF the carrier wave ŝ and observe the change in output.
3. Change the modulation index and note the changes in output signals for 4 values of modulation index.
4. Change the carrier freq to 60 KHz to decrease slowly to reach 50.003 KHz and observe waveform.

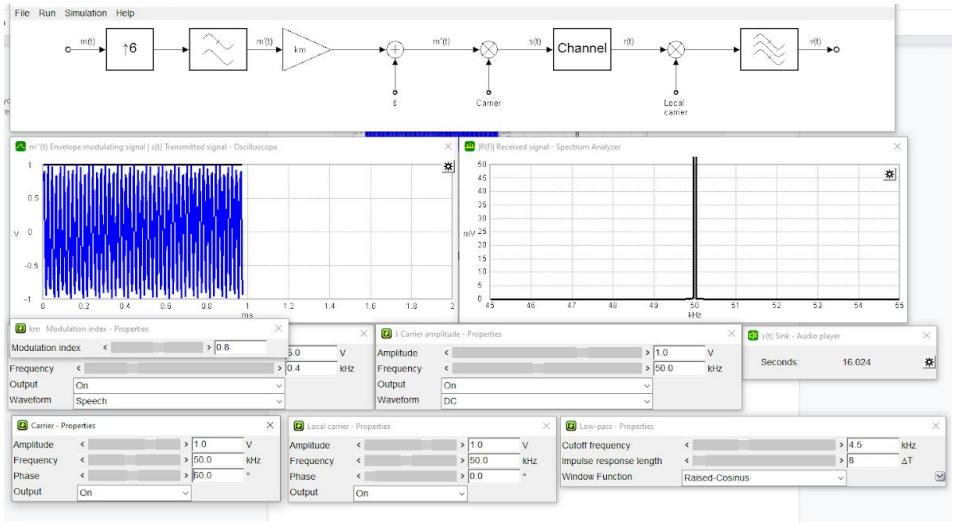
Observations :

1. Switching OFF the carrier signal results in drastic reduction in amplitude of $x''(t)$, envelope modulating signal.
2. On increasing the modulation index, the loudness of the signal increases and the recieved signals waveforms, shoots upward.
3. There was very low signal received at carrier freq. of 60 KHz.
4. Changing the phase of carrier signal brought no significant change in received signal.

Teacher's Signature:_____


AM transmission - synchronous detector - labAlive
File Run Simulation Help
↑6
km
Channel
Carrier
Local carrier
Modulation index - Properties
Carrier amplitude - Properties
Carrier - Properties
Local carrier - Properties
Low-pass - Properties
Seconds: 15.967


AM transmission - synchronous detector - labAlive
File Run Simulation Help
↑6
km
Channel
Carrier
Local carrier
Seconds: 16.024


File Run Simulation Help
↑6
km
Channel
Carrier
Local carrier
Seconds: 16.024