EXPERIMENT#3

TO ANALYZE DOUBLE SIDE BAND AM DEMODULATIONUSING DIODE DETECTOR

OBJECTIVE:

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DOUBLE SIDE BAND (DSB) AM DEMODULATION:

A DSB modulated carrier is normally demodulated with a synchronous detector. This means that the modulated carrier is multiplied by a local oscillator and the product is then sent to a low-pass filter. With synchronous detection the frequency and phase of the local oscillator are important. Its frequency must match that of the carrier. The local oscillator phase must approximately match that of the carrier.
When the modulated carrier y (t) (in DSB modulation) is sent to a synchronous detector, the demodulator (detector) output z (t) can be written as;

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\begin{aligned}
z(t) &= \mathcal{S}\{y(t)\cdot\cos(2\pi f_c t+\phi)\}\\
&= \mathcal{S}\{x(t)\cdot\cos(2\pi f_c t)\cdot\cos(2\pi f_c t+\phi)\}\\
&= \mathcal{S}\left\{\frac{1}{2}x(t)\cos(\phi)+\frac{1}{2}x(t)\cos(4\pi f_c t+\phi)\right\}
\end{aligned}
$$

The local oscillator is modeled as $\cos(2\pi f_c t+\phi)$. It has a frequency that matches that of the carrier
The low-pass filtering is represented by $\mathcal{S}\{\cdot\}$.

The message signal x (t) is the base band signal. The term $\frac{1}{2}x(t)\cos(4\pi f_c t + \phi)$ represents a band-pass signal centered at 2fc in the frequency domain. The bandwidth of the low-pass filter should be large enough that x (t) passes through the filter with little distortion.

DOUBLE SIDE BAND SUPPRESSED CARRIER DEMODULATION:

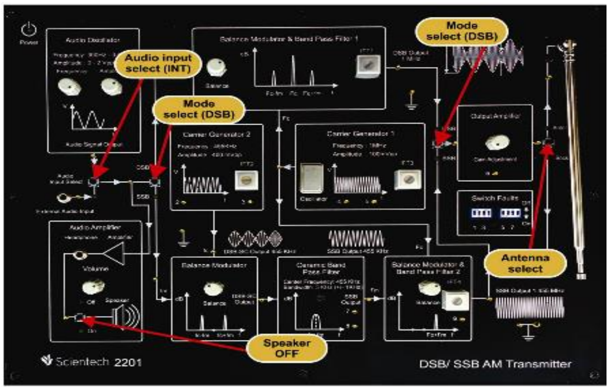
Demodulation is done by multiplying the DSB-SC signal with the carrier signal just like the modulation process. This resultant signal is then passed through a low pass filter to produce a scaled version of original message signal.

$$\overbrace{\frac{V_m V_c}{2}\left[\cos\left(\left(\omega_m+\omega_c\right)t\right)+\cos\left(\left(\omega_m-\omega_c\right)t\right)\right]}^{\text{Modulated Signal}} \times \overbrace{V_c' \cos\left(\omega_c t\right)}^{\text{Carrier}}$$

$$= \left(\frac{1}{2}V_c V_c'\right) \underbrace{V_m \cos(\omega_m t)}_{\text{original message}} + \frac{1}{4}V_c V_c' V_m \left[\cos((\omega_m + 2\omega_c)t) + \cos((\omega_m - 2\omega_c)t)\right]$$

The equation above shows that by multiplying the modulated signal by the carrier signal, the result is a scaled version of the original message signal plus a second term. Since $\omega_c \gg \omega_m$, this second term is much higher in frequency than the original message. Once this signal passes through a low pass filter, the higher frequency component is removed, leaving just the original message.

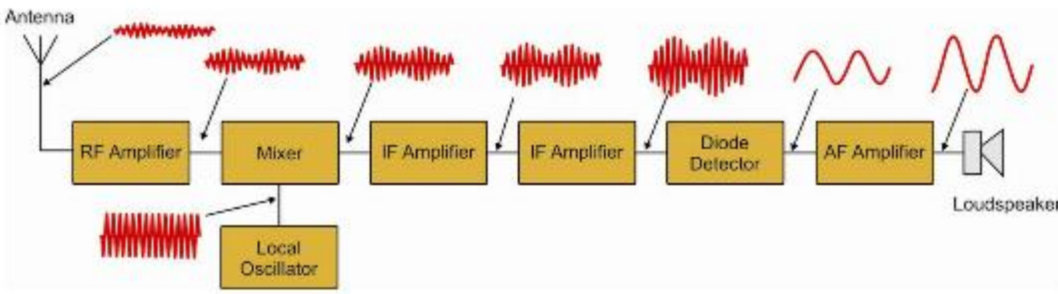
EQUIPMENT USED:



MAIN COMPONENTS:

- *RF AMPLIFIER*: This is the first stage of amplification. It has to amplify the incoming signal above the level of internally generated noise also start selecting the wanted station and rejecting the unwanted.
- *LOCAL OSCILLATOR***:** The oscillator is used to produce the sinusoidal output similar to carrier wave form

- *MIXER***:** This will perform the same function as modulator. Mixer will mix the signal from RF amplifier and carrier from local oscillator.
- *IF AMPLIFIER***:** This amplifier consists of two stages of amplification and provide the signal amplification and selectivity
- *DIODE DETECTOR:* It extract the audio signal from signal from the output of IF amplifier.
- *AF AMPLIFIER:* At the input of AF amplifier the filter will remove the ripples from the signal and capacitor will block the DC level.The remaining signal will be amplified to have final output.



DSB Receiver

PROCEDURE:

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Lab Task :

Observe the output of all the components of DSB/SSB Receiver ST2202 and attach the output.

CONCLUSION:

Post Lab Questions

a) **What is RF Amplifier?**

b) **Which trainer is used for Modulation and Demodulation ?**

c) **Which two methods are used for Demodulation?**