2.1.4 Non-zero IF Receiver

Q22. Draw and explain block diagram of CW Doppler radar with non zero IF receriver.

Oct./Nov.-18, Set-2, Q3(a)

(or)

Explain the operation of CW - IF radar with a block diagram.

Oct./Nov.-17, Set-4, Q3(b)

(or)

Explain the principle of operation of CW doppler radar with non-zero IF receiver with neat block diagram.

Nov./Dec.-14, Set-2, Q3(a)

(or)

Draw the block diagram of CW doppler radar with non-zero IF receiver and explain its principle of operation.

(Dec.-13, Set-4, Q3(c) | Nov.-10, Set-3, Q3(a)

(or)

Explain the operation of non-zero intermediate frequency receiver with neat block diagram. Compare it with zero IF receiver and bring out its advantages.

Nov.-11, Set-3, Q3(a)

(or)

Explain the non-zero IF receiver with a neat diagram compare it with zero IF receiver.

Ans:

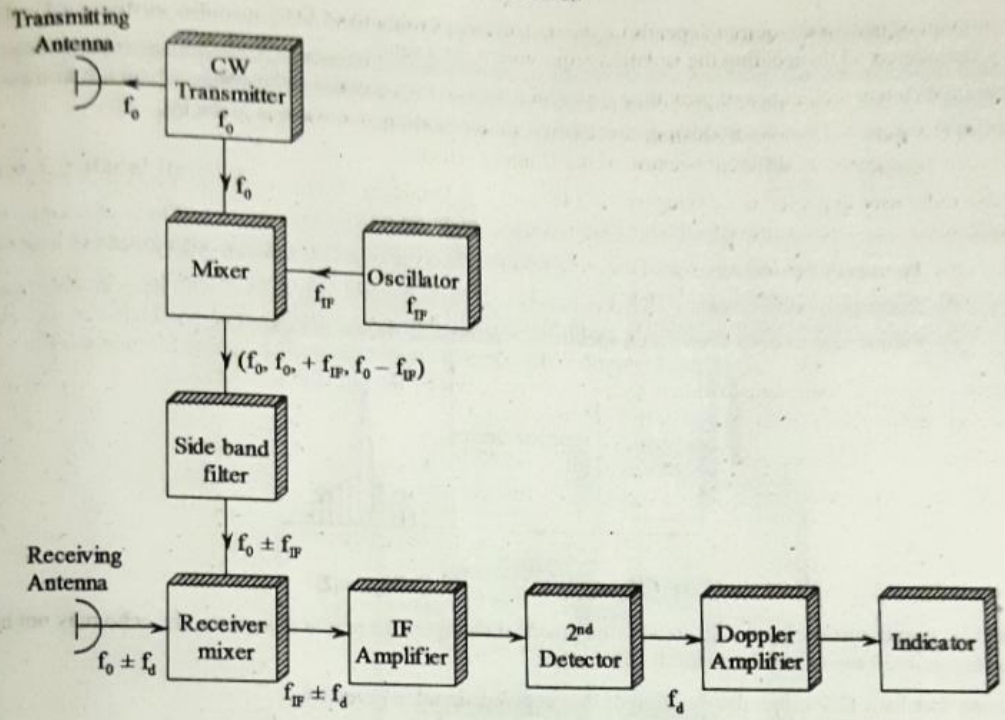
Nov.-10, Set-2, Q3(b)

Non-zero Intermediate Frequency Receiver

In simple CW radar, noise is generated due to some semiconductor devices such as diodes, transistors and vacuum tubes. This generated noise is inversely proportional to frequency hence called $\frac{1}{f}$ noise or flicker effect noise. Flicker effect noise reduces the sensitivity of CW radar because of low IF or zero IF.

The non-zero IF receiver employed in a CW radar reduces flicker effect noise or superheterodyne receiver with high IF.

The drawbacks of zero intermediate frequency receiver can be overcome by the nonzero intermediate frequency receiver. Figure shows the block diagram of CW radar with a nonzero IF receiver.



Figure

In this case, separate antennas are considered for transmission and reception. A portion of the transmitted signal mixed with a locally generated signal of frequency equal to that of the receiver IF is used to derive the required local oscillator or reference signal, unlike in conventional superheterodyne receiver. The narrowband filter is used to select one of the side band as a reference signal from the output of mixer which contains two side bands on either side of the carrier and higher harmonics. Then, the receiver mixer is used to translate the received frequency with an obtained reference signal. The resulting signal passed through an IF amplifier and further into a detector circuit to detect the doppler frequency shift and there after a proper amplifier circuit is used to increase the strength of the signal. Finally, an indicator (A-scope or PPI display) is used to find the doppler frequency shift, f_d.

Comparison of Non-zero and Zero Intermediate Frequency Receivers

1. Zero IF receiver is not as sensitive because of increased noise at the lower intermediate frequencies caused by flicker effect.
2. The reduction in sensitivity has greater effect on the maximum efficiency with CW radar.
3. The improvement in receiver sensitivity with an nonzero IF receiver might be around 30 dB over the zero IF receiver.

Advantages

1. The effects of flicker noise can be drastically reduced.
2. The sensitivity of nonzero IF receiver is much higher than simple CW receiver i.e., around 30 dB.
3. Because of the high receiver sensitivity, it is preferred in maximum efficiency CW radars.