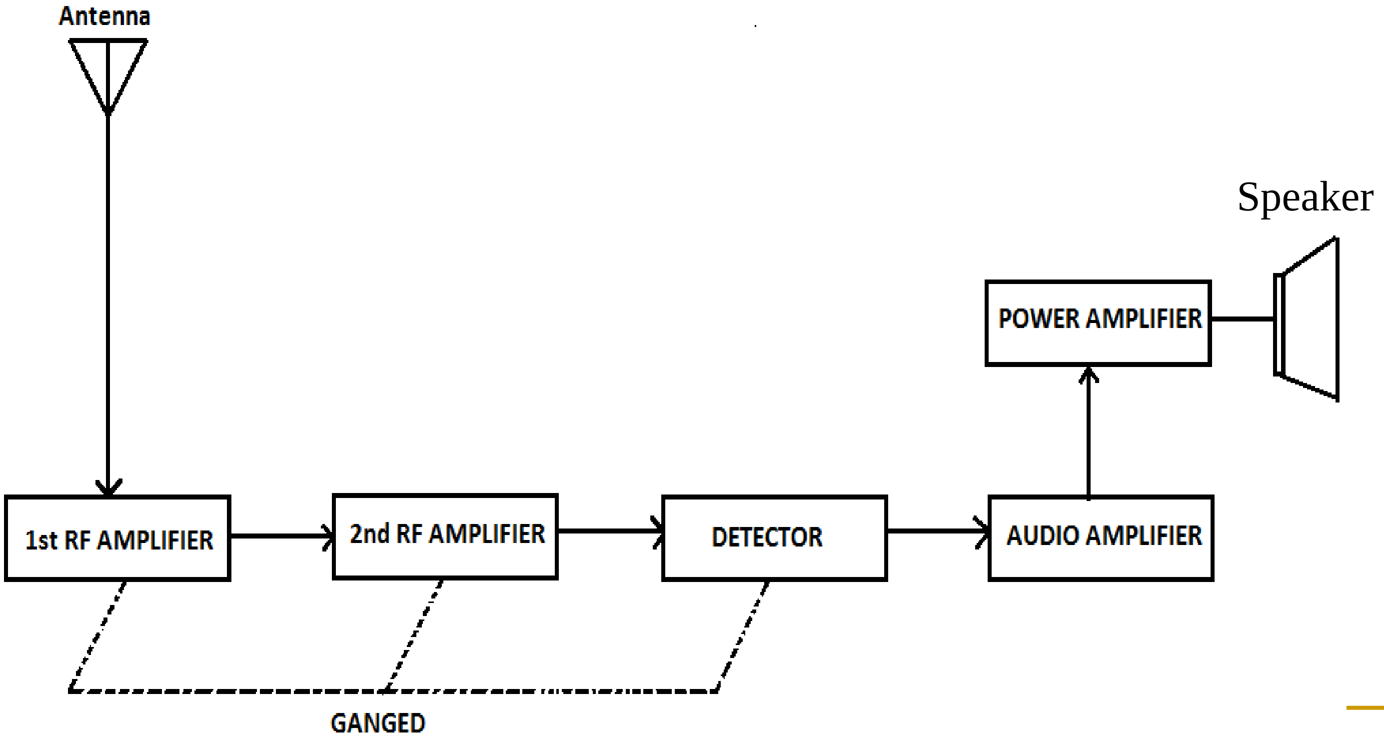
TRF (Tuned Radio Frequency) Receiver



A TRF AM receiver is designed to receive the signals in the standard broadcast frequency range from 535kHz to 1605kHz. The bandwidth of the channel is 10kHz. Calculate the required range of Q factor of the tuned circuit

At given values of $f_c = 535$ kHz, bandwidth = 10 kHz, $Q = \dfrac{535 \text{ kHz}}{10 \text{ kHz}} = 53.5$

At given values of $f_c = 1605$ kHz, bandwidth = 10 kHz, $Q = \dfrac{1605 \text{ kHz}}{10\text{kHz}} = 160.5$

Hence, the required range of Q-factor of the tuned RF circuit is from **53.5 to 160.5**.

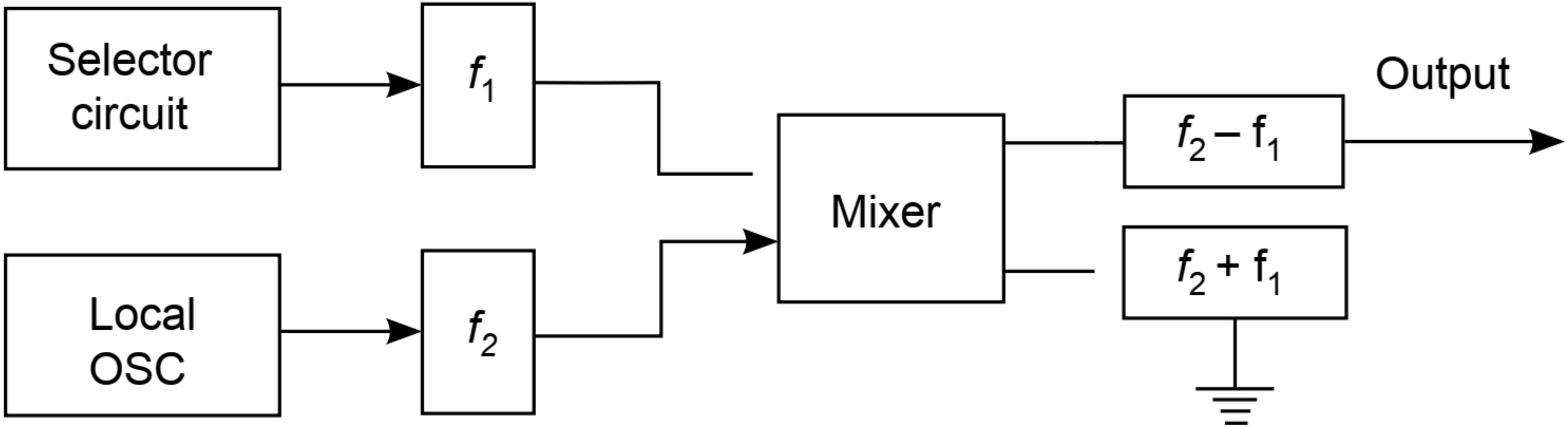
A TRF AM receiver is designed to receive the signals in the standard broadcast Frequency range from 535KHz to 1605kHz. The specified bandwidth of a channel is 8kHz. If the maximum practical value of the Q of RF tuned circuit is 120, then determine the practical bandwidth and comment on the results

TRF Receiver

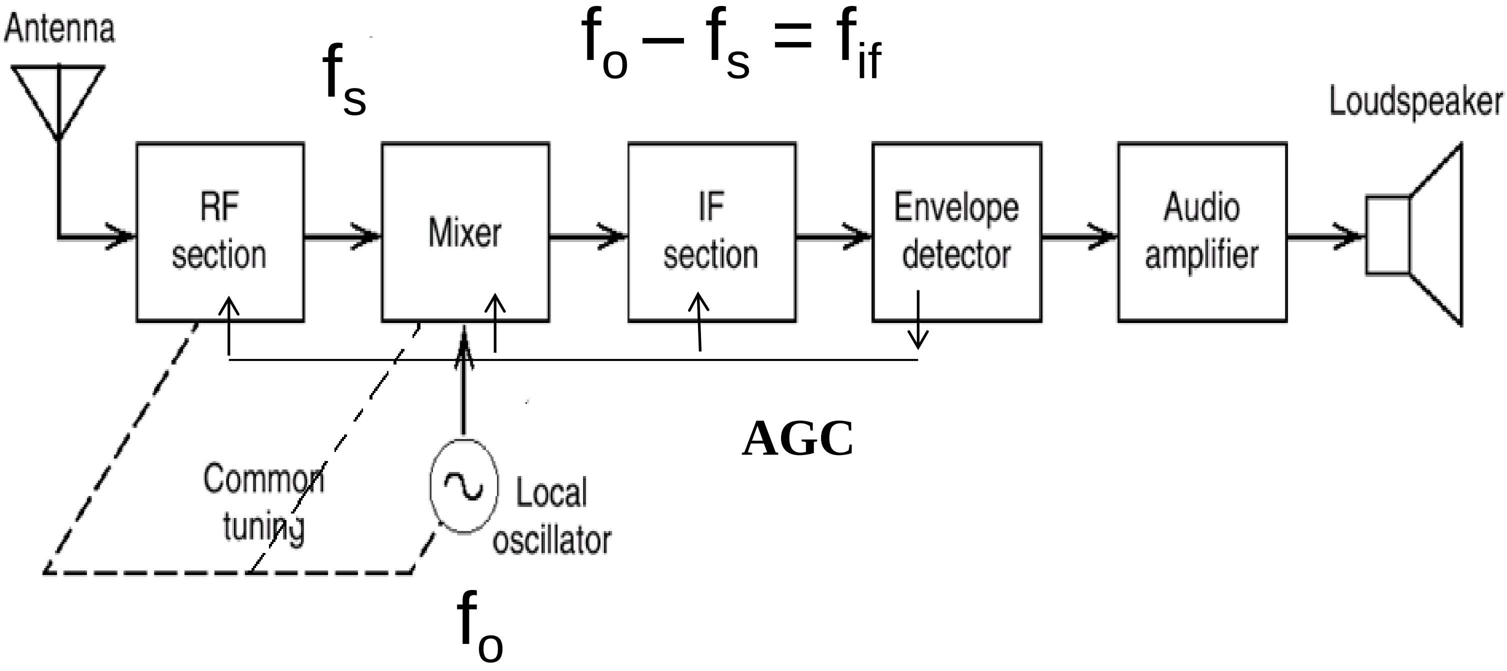
- **ADVANTAGES**:
- TRF receivers are simple to design as it does not involve mixing and IF operation.
- Good sensitivity and very much suitable for single frequency.
- Allow the broadcast frequency 535 KHz to 1640 KHz.
- **DRAWBACKS**:
- Instability
- Variation in the bandwidth over the tuning range
- Insufficient Selectivity at higher frequencies
- At the higher frequency, it produces difficulty in design.
- It has poor audio quality.

Superheterodyne Receiver

All modern radio receivers are essentially the superheterodyne receivers. They are the most superior (super) circuits which utilize the principle of 'heterodyning' (mixing or beating) two frequencies.



Superheterodyne Receiver



TRF Receiver

- No frequency conversion
- No IF frequency
- Instability , variation in BW and poor selectivity due to high frequencies
- Difficult to design tunable RF stages.
- Rarely used

Super hetrodyne Receiver

- Frequency conversion
- Downconvert RF signal to lower IF frequency
- No instability, variation in BW and poor selectivity as IF introduced.
- Main amplifixcation takes place at IF
- Mostly used

Choice of IF

Too High	Too Low
Poor Selectivity	Image Frequency Rejection is poorer
Tracking Problem increase	Selectivity too sharp,cuts the sidebands
	Need Frequency stability of Local oscillator too high

Image Frequency

Undesired input frequency that is capable of producing the same intermediate frequency (IF) that the desired input frequency produces is called "IMAGE FREQUENCY"

It is given by signal frequency plus twice the intermediate frequency

$$f_{si} = f_s + 2IF$$

Image Frequency

fsi = fs +2IF

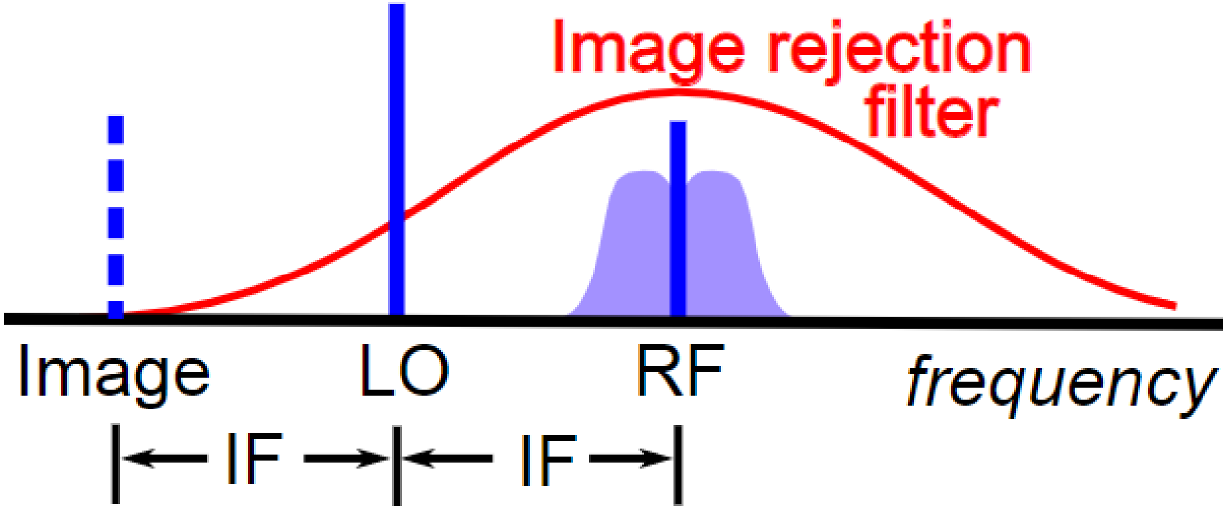
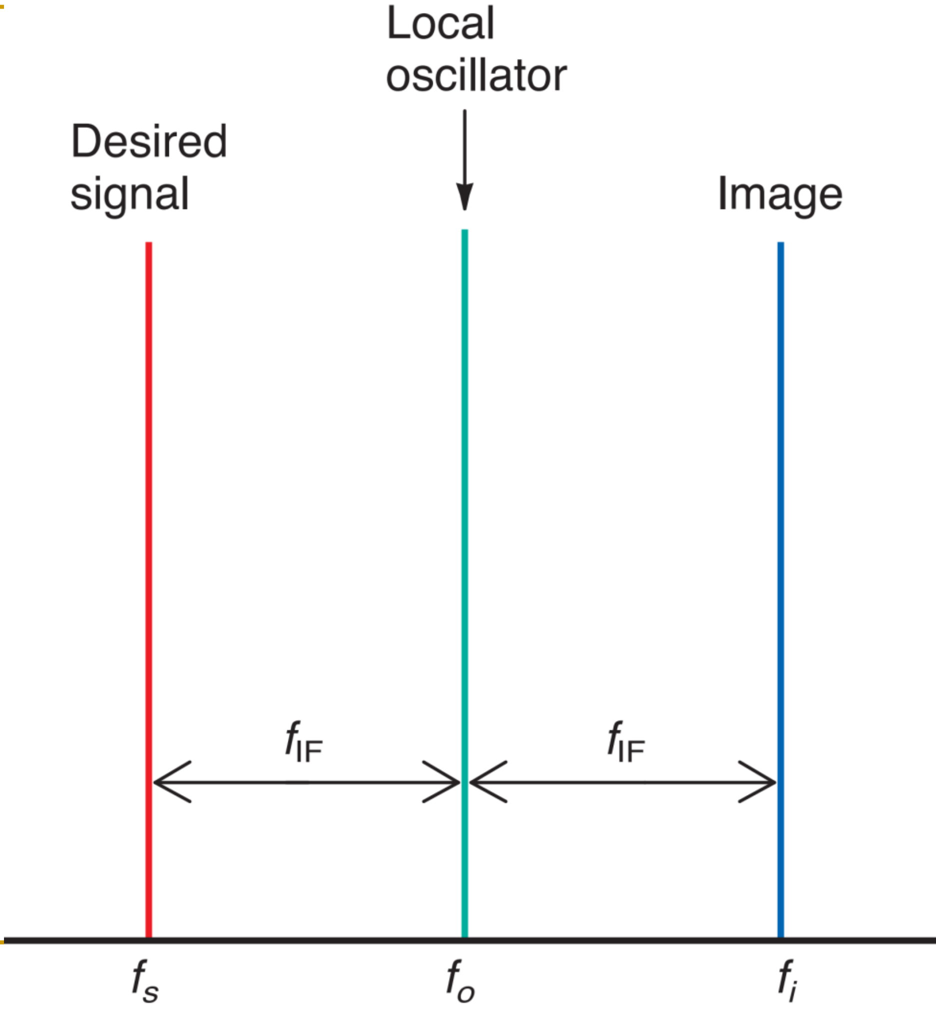


Image Frequency

fsi = fs +2IF



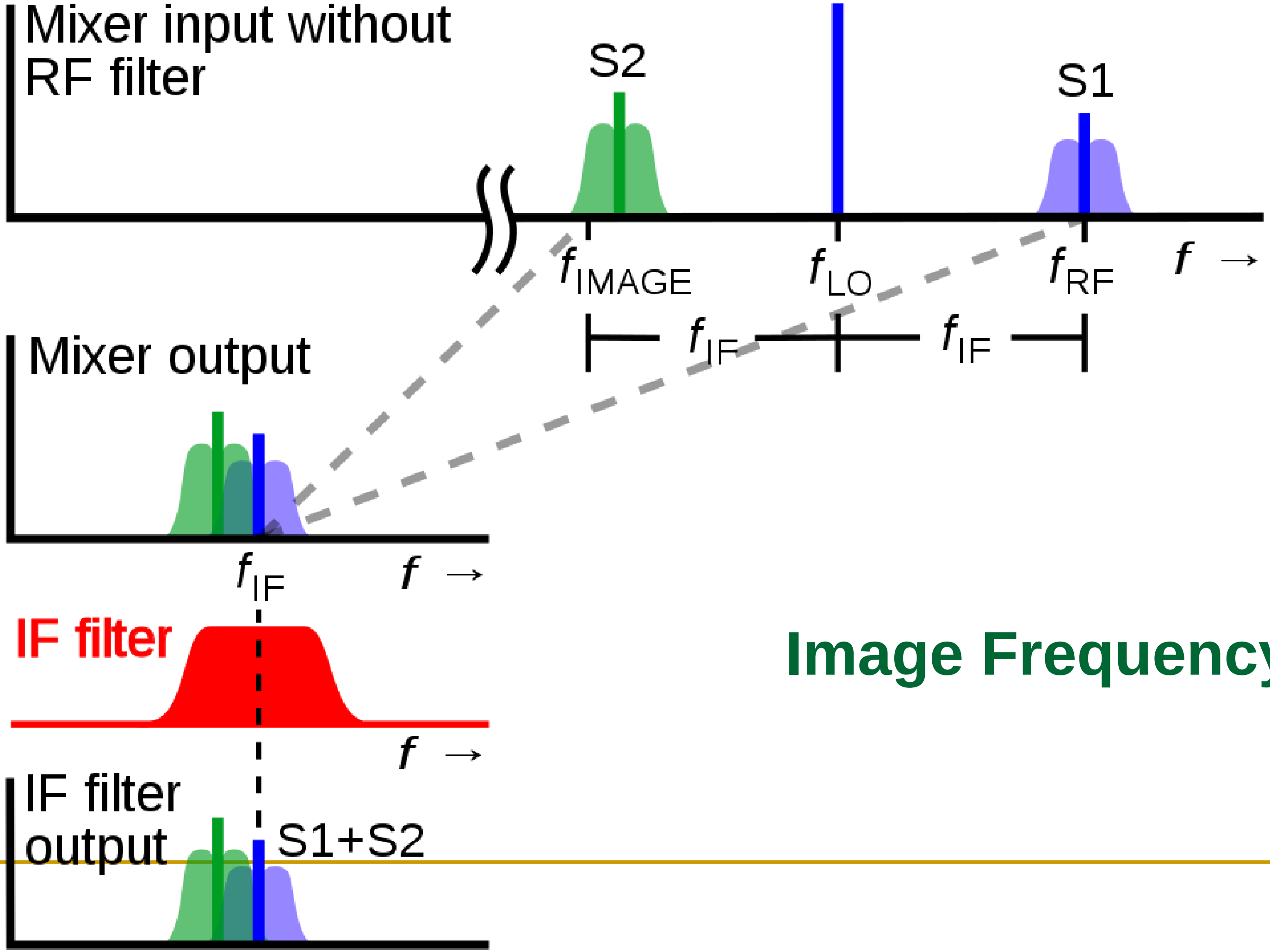
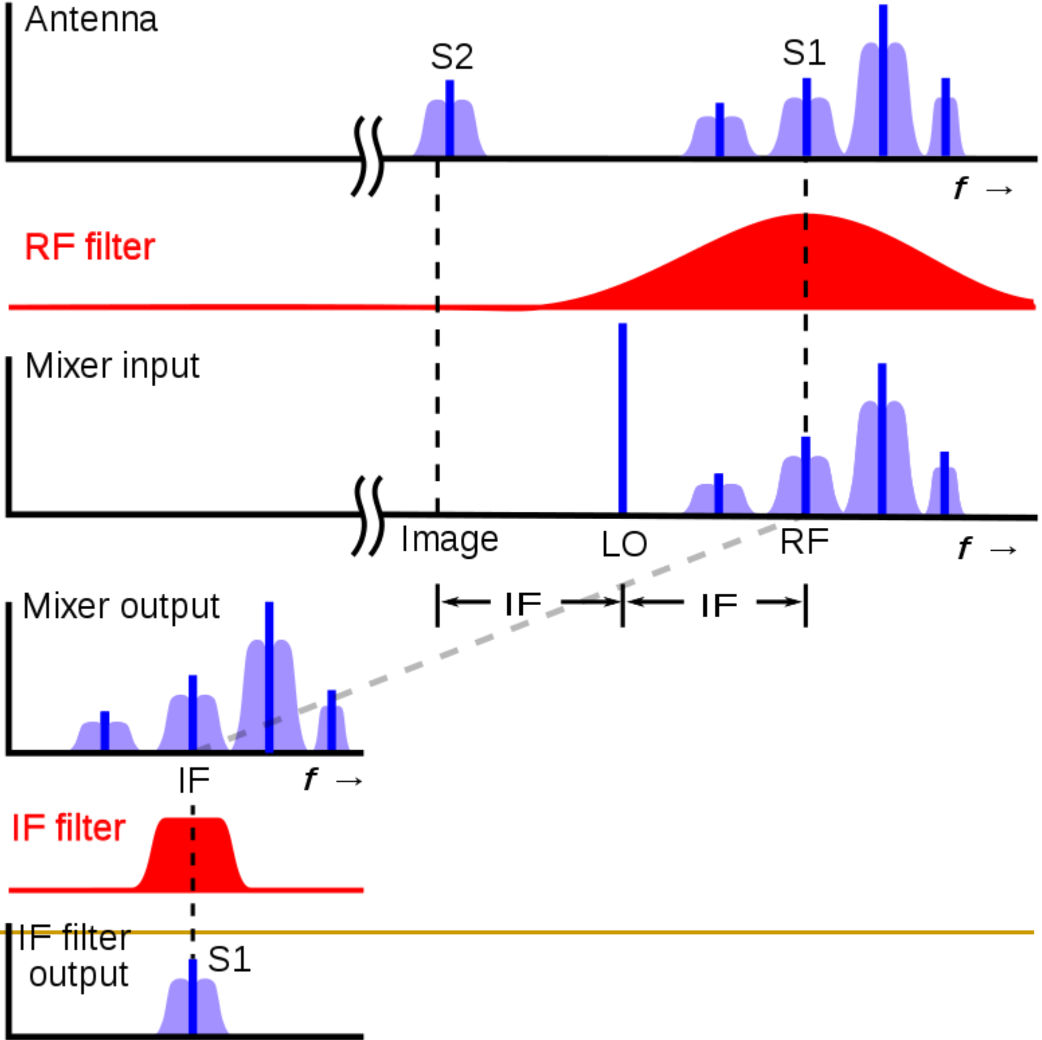


Image Frequency S2

Image Frequency Rejection

- Remedy: Its rejection before IF stage →High Selectivity
- The Image frequency rejection ratio can be defined as a ratio of the gain at the signal frequency to the gain at the image frequency.
- This gives the degree of image frequency rejection.

Image Frequency Rejection



- Image frequency

$$f_{si} = f_s + 2f_{IF}$$

- Image Frequency rejection ratio

$$IFRR = \sqrt{(1 + Q^2 \rho^2)}$$

where $\rho = (f_{si}/f_s) - (f_s/f_{si})$