- Principles of Telecommunication
- Module 3- Angle Modulation
- Lecture plan- Part 8

8.Pre-emphasis and De-emphasis in FM

(a) Pre-emphasis

- As we already know that in FM, the noise has a greater effect on the higher modulating frequencies. This effect can be reduced by increasing the value of modulation index (mf) for higher modulating frequencies (fm).
- This can be done by increasing the deviation Δf and Δf can be increased by increasing the amplitude of modulating signal at higher modulating frequencies.

- Thus, if we boost the amplitude of higher frequency modulating signals artificially then it will be possible to improve the noise immunity at higher modulating frequencies.

The artificial boosting of higher modulating frequencies is called as pre-emphasis.

Boosting of higher frequency modulating signal is achieved by using the pre-emphasis circuit as shown in fig.1(a).

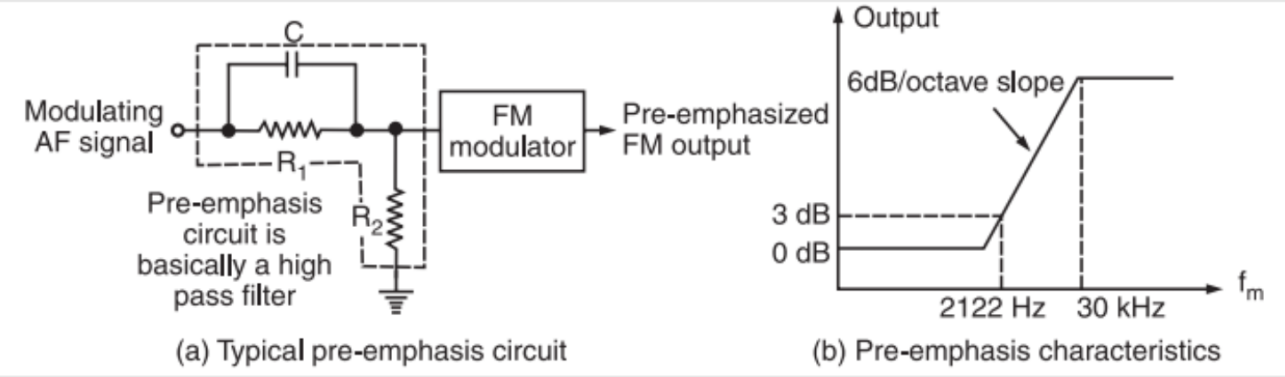

Fig.1 Pre-emphasis circuit and characteristics

- As shown in the fig.1, the modulating AF signal is passed through a high pass RC filter, before applying it to the FM modulator.
- As fm increases, reactance of C decreases and modulating voltage applied to FM modulator goes on increasing.
- The frequency response characteristics of the RC high pass network is shown in fig.1(b).
- The boosting is done according to this pre arranged curve.
- The amount of pre-emphasis in US FM transmission and sound transmission in TV has been standardized at 75 μsec.

- The pre-emphasis circuit is basically a high pass filter. The pre-emphasis is carried out at the

transmitter.The frequency for the RC high pass network is 2122 Hz as shown in fig.1 (b). Hence, the pre-emphasis circuit is used at the transmitter as shown in fig.2.

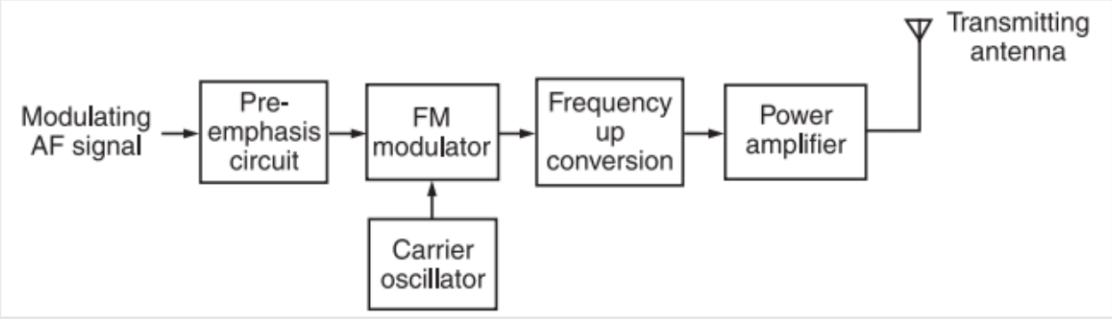

Fig.2 : FM transmitter including the pre-emphasis

(b) De-emphasis

- The process that is used at the receiver end to nullify or compensate the artificial boosting given to the higher modulating frequencies in the process of pre-emphasis is called De-emphasis.
- That means, the artificially boosted high frequency signals are brought to their original amplitude using the de-emphasis circuit.

The 75 μsec de-emphasis circuit is standard and it is as shown in fig. 3.

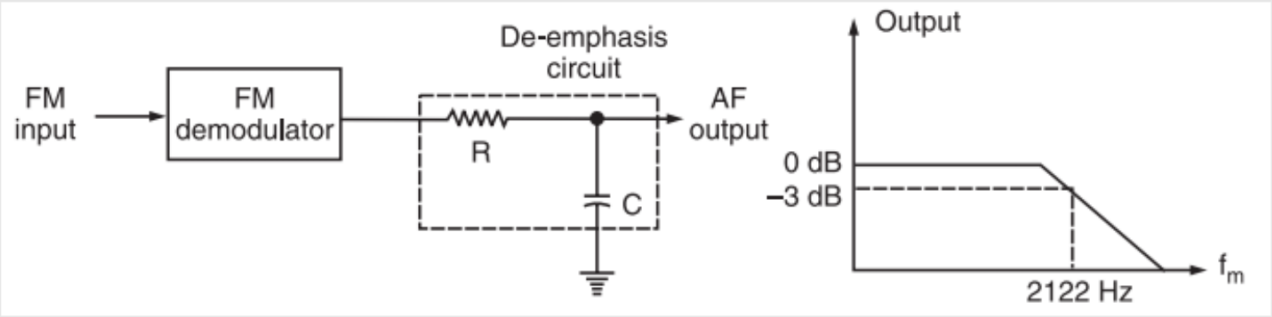

Fig.3 : De-emphasis circuit and its characteristics

It shows that it is a low pass filter. 75 μsec de-emphasis corresponds to a frequency response curve that is 3 dB down at a frequency whose RC time constant is 75 μsec.i.e.,

$$f = \frac{1}{2\pi RC} = \frac{1}{2\pi \times 75 \times 10^{-6}} = 2{,}122 \text{ Hz.}$$

The demodulated FM is applied to the De-emphasis circuit. With increase in fm the reactance of C goes on decreasing and the output of de-emphasis circuit will also reduce as shown in fig.3.