

we have sinusoidal signal with $f_m \text{ Hz}$

is used to modulate both an AM

DSB-LC and an FM system

* peak freq deviation $\Delta f = 3$ times

the BW of AM signal

* the magnitude of those sidebands spaced at $\pm f_m \text{ Hz}$ from f_c in both systems are equal.

* total avg powers are equal in both systems.

find M and β ?

$$\textcircled{1} \Delta f = 3(2f_m) = 6f_m$$

$$\beta = \frac{\Delta f}{f_m} = \frac{6f_m}{f_m} = 6$$

$\textcircled{2}$

let A_1 and A_2 be the AM and FM

carrier peak amplitudes

Total avg power FM = total avg AM

$$\frac{A_2^2}{2} = \frac{A_1^2}{2} + \frac{A_1^2 M^2}{8} + \frac{A_1^2 M^2}{8}$$

$$\frac{A_2^2}{2} = \frac{A_1^2}{2} (1 + \frac{M^2}{2}) \quad \textcircled{1}$$

magnitudes are equal $f_c \pm f_m$

$$\frac{A_2}{2} |J_1(\beta)| = \frac{A_1 M}{2} \quad \textcircled{2}$$

$$\text{from } \textcircled{1} \text{ and } \textcircled{2} \quad M = \frac{2 |J_1(\beta)|}{\sqrt{1 - 2 J_1^2(\beta)}} \quad \boxed{\approx 0.61}$$