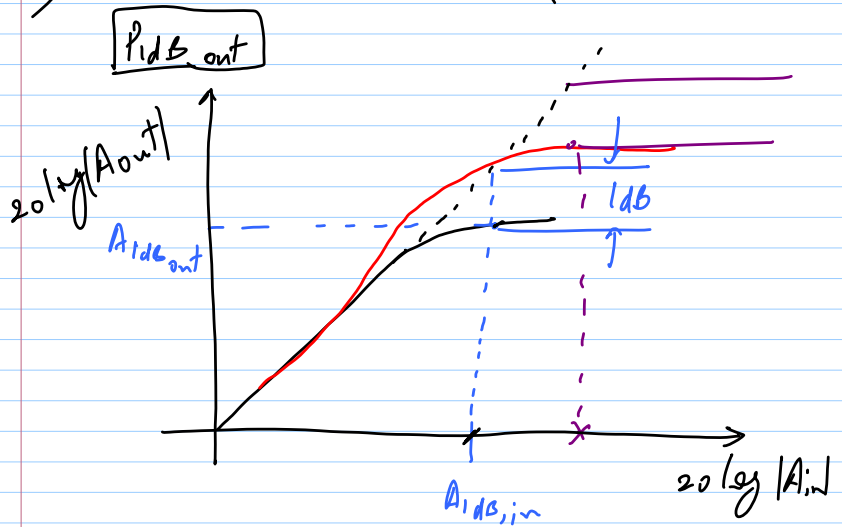
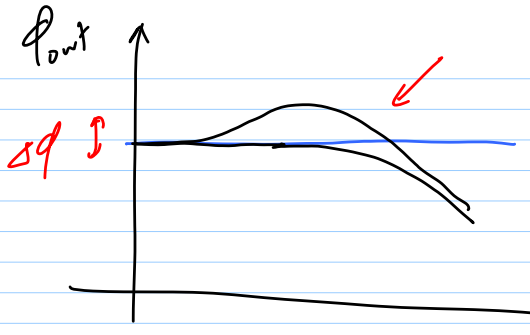
19/8/13

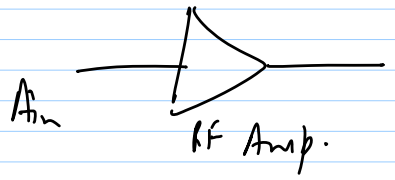
Lec 8

1) Gain Compression – (α_3 –ve)





To model phase distortion, α_i should be complex



Linear φ wrt freq. constant φ wrt Ain

Characterise an amp. using AM-AM & AM-PM curves

$$20 \log \left| \alpha_1 A + \frac{3}{4} \alpha_3 A^3 \right| = 20 \log |\alpha_1 A| - 1\,dB$$

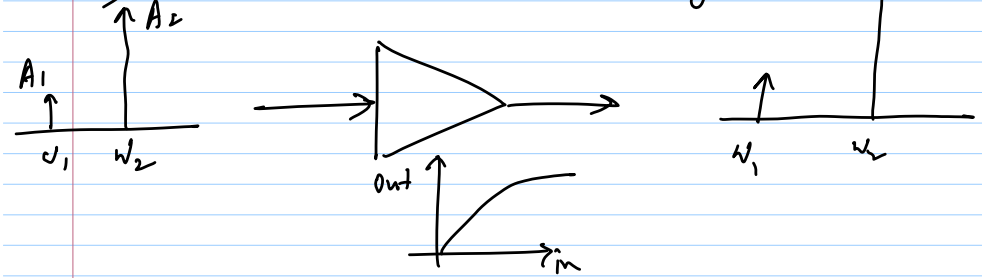
$A_{1dB,in}$

$$\Rightarrow A_{1dB,in} = \sqrt{0.145 \left| \frac{\alpha_1}{\alpha_3} \right|}$$

2) Harmonics

Harmonics – can be filtered out

3) Desensitisation & Blocking



$$x(t) = A_1 \cos\omega_1 t + A_2 \cos\omega_2 t$$

$$y(t) = \left(\alpha_1 A_1 + \frac{3}{4}\alpha_3 A_1^3 + \frac{3}{2}\alpha_3 A_1 A_2^2\right)\cos\omega_1 t + \cdots$$

$A_1 \ll A_2$

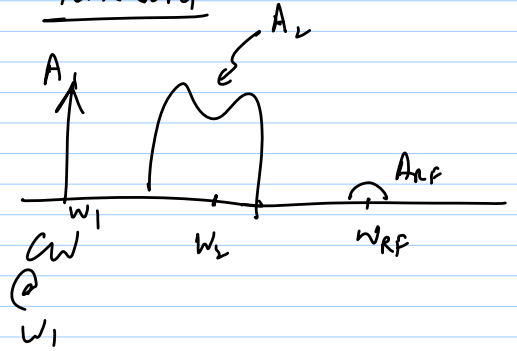
$$y(t) \approx \left(\alpha_1 + \frac{3}{2}\alpha_3 A_2^2\right) A_1 \cos\omega_1 t$$

gain – decreasing function of A_2 when $\alpha_3 < 0$

for very large A_2, gain $\to 0$

"Blocking" 60 - 70 dB

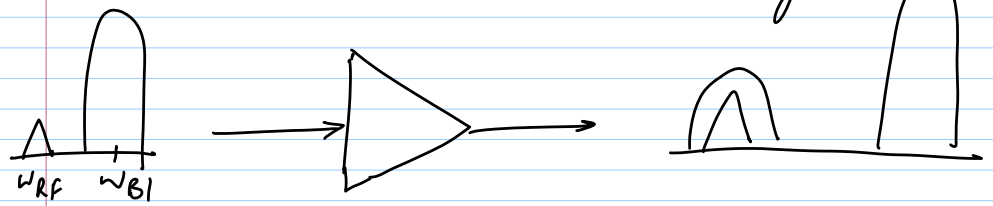
Standard



few MHz — ~ 12 GHz

4) Cross-modulation

transfer of modulation from blocker to desired weak signal



5) Intermodulation

$$x(t) = A_1 \cos\omega_1 t + A_2 \cos\omega_2 t$$

$$y(t) = \alpha_1(A_1\cos\omega_1 t + A_2\cos\omega_2 t) + \alpha_2(\ )^2 + \alpha_3(\ )^3$$

* ignore dc & higher harmonic terms

a) fundamental

$$= \left(\alpha_1 A_1 + \frac{3}{4}\alpha_3 A_1^3 + \frac{3}{2}\alpha_3 A_1 A_2^2\right)\cos\omega_1 t + \left(\alpha_1 A_2 + \frac{3}{4}\alpha_3 A_2^3 + \frac{3}{2}\alpha_3 A_1^2 A_2\right)\cos\omega_2 t$$

b) $\omega = \omega_1 \pm \omega_2$) IM_2

c) $\omega = 2\omega_1 \pm \omega_2$ & $2\omega_2 \pm \omega_1$) IM_3