ELL301

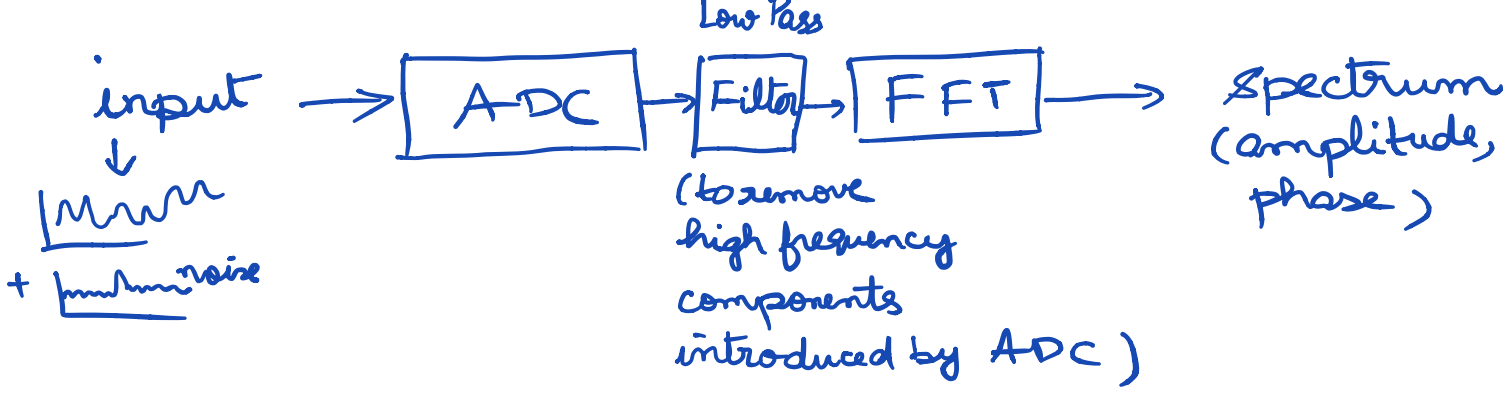
22.01.2019

Some basic ideas for the working of a Spectrum Analyzer

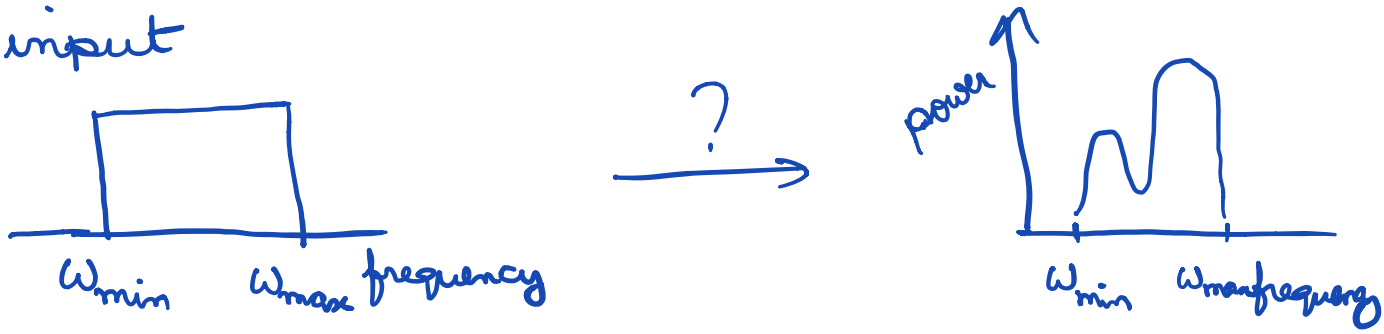
Instrument to measure power at different frequencies. (apps also available)

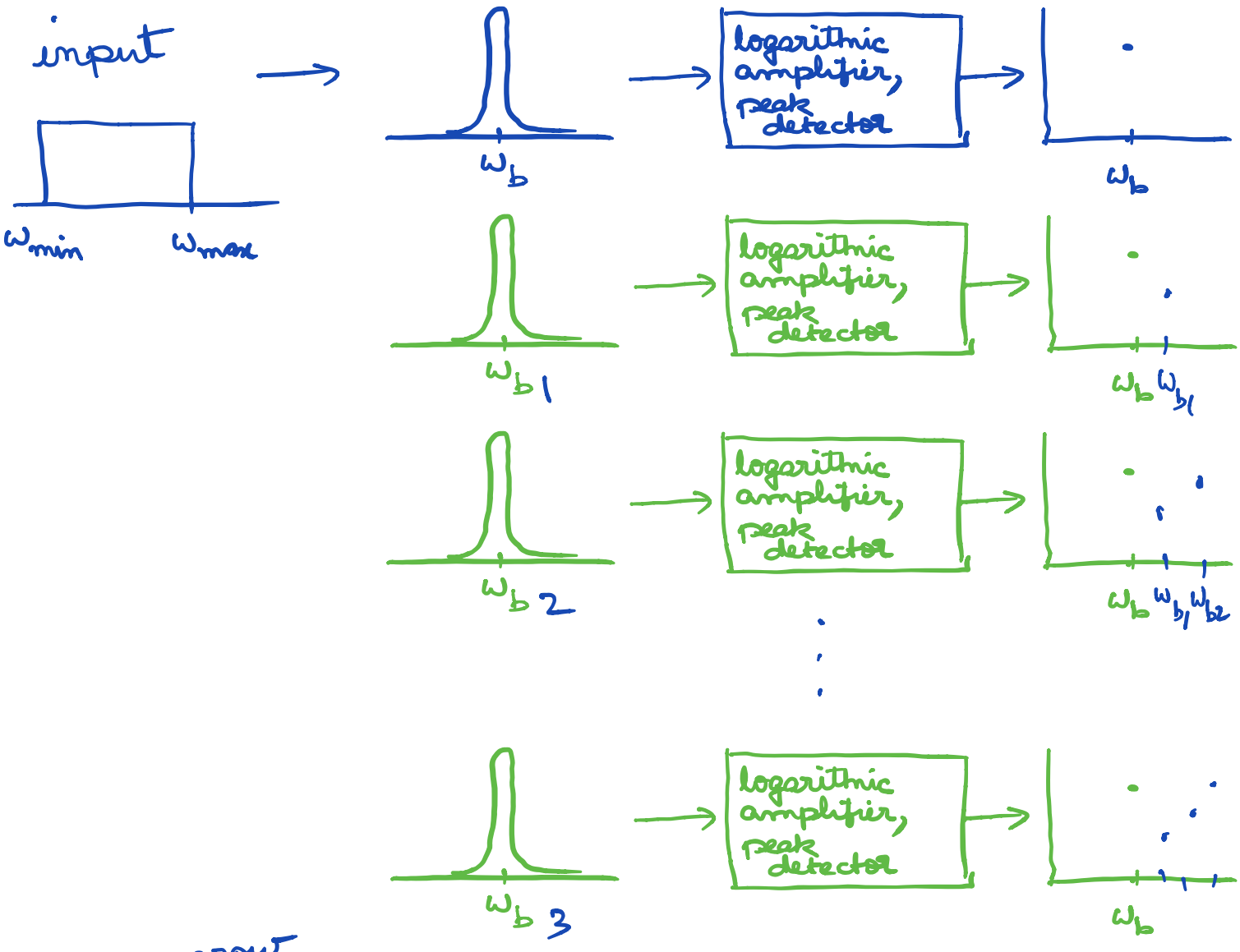
Possible mechanisms?

① Purely digital scheme



②



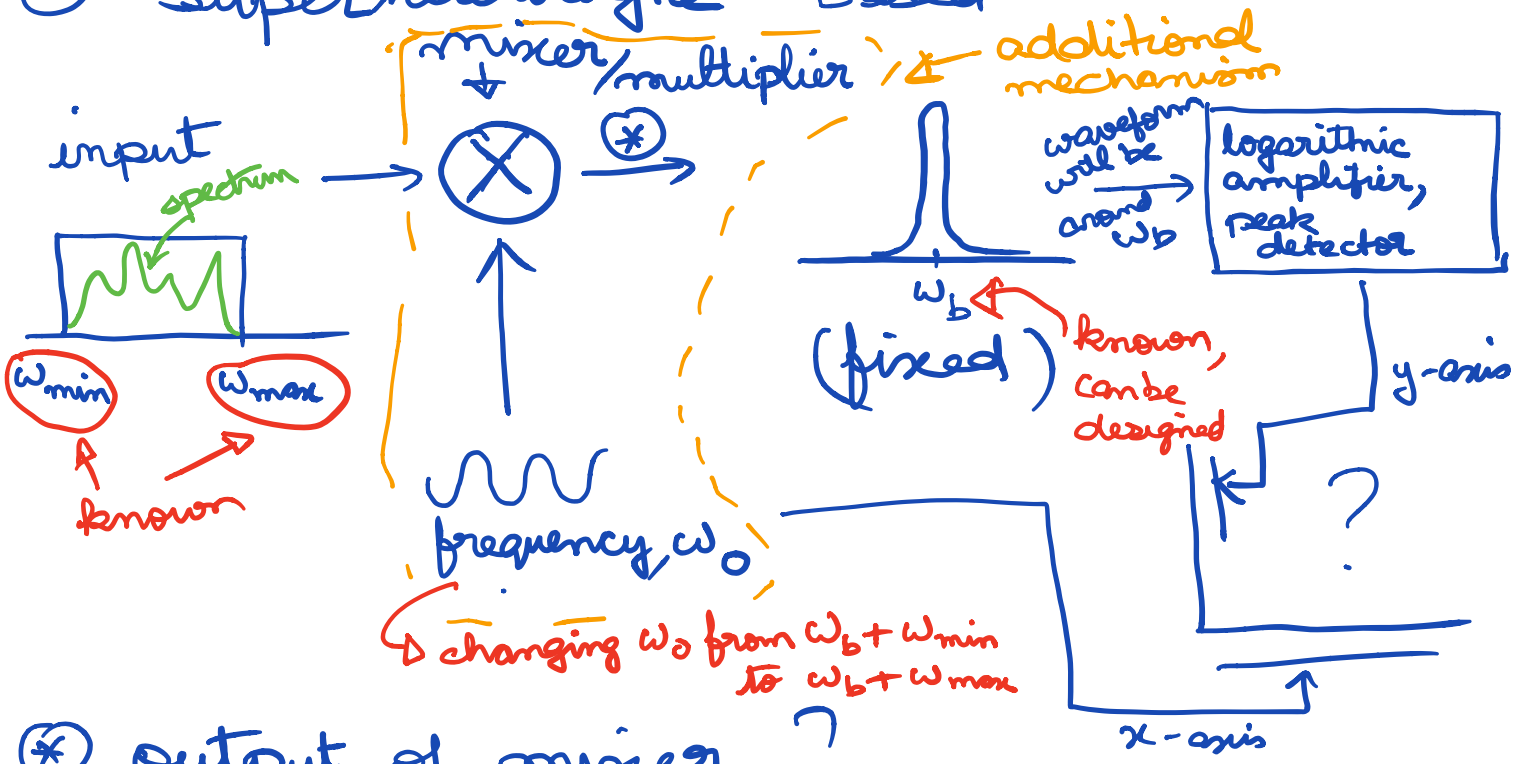


narrow
Many bandpass filters may be used.

How to avoid multiple bandpass filters?
→ variable ω_b bandpass filters?

→ use of 'mixer' to translate input frequencies by different amounts.

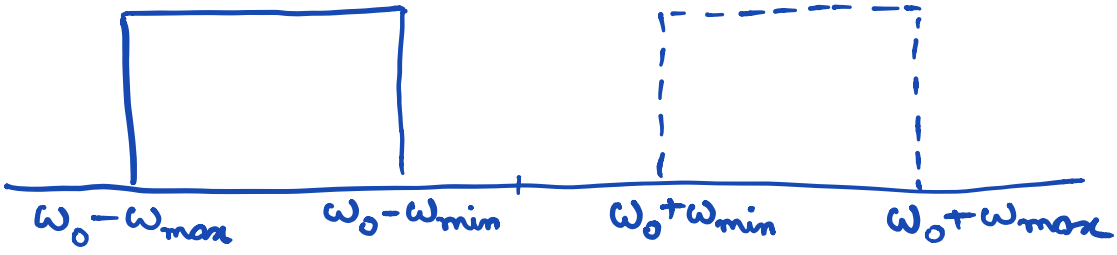
③ Superheterodyne - based



(*) output of mixer ?

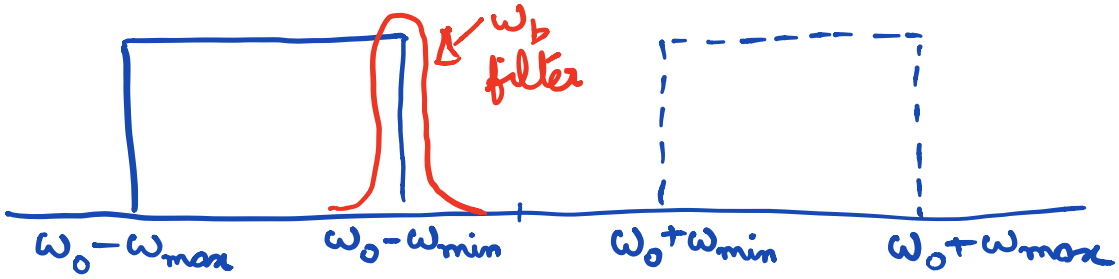
$$\sin\omega t \times \sin\omega_0 t = \cos(\omega-\omega_0)t - \cos(\omega+\omega_0)t$$

$\omega \in [\omega_{min}, \omega_{max}]$



(assuming $\omega_0 > \omega_{max}$)

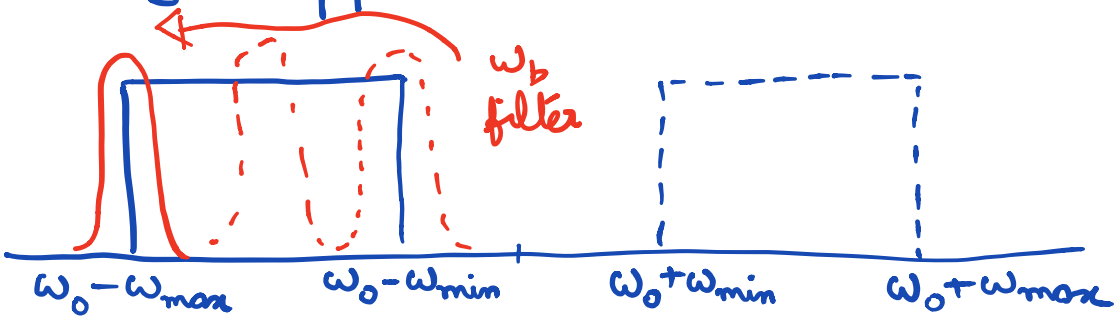
For what value of ω_0, will following happen



$$\Rightarrow \omega_0 - \omega_{min} = \omega_b$$

$$\Rightarrow \omega_0 = \omega_b + \omega_{min}$$

As ω_0 increases, there is one value where following happens



this is at $\omega_0 - \omega_{max} = \omega_b$

$$\omega_0 = \omega_b + \omega_{max}$$

For spectrum,

Y-axis is from the amplifier / detector

X-axis is from the changing 'ω_0' frequency