

2) Trägerfrequenz ($\cos \omega_c t$) mit Rechteckimpulsen moduliert.
(vgl. Beispiel 1)

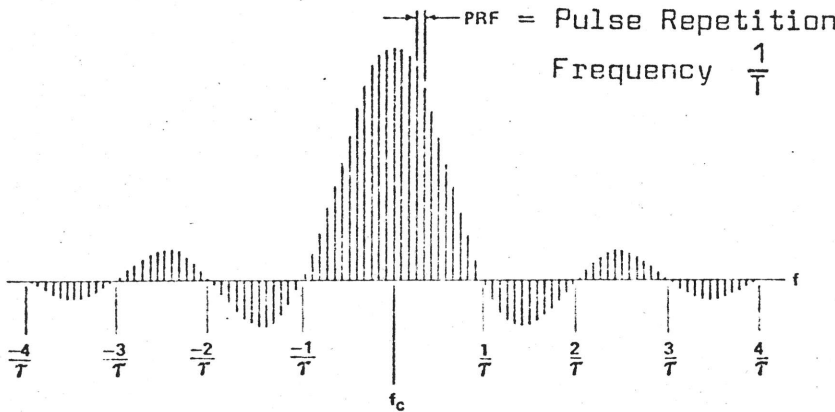


Figure 3. Resultant spectrum of a carrier amplitude modulated with a rectangular pulse.

$$f(t) = f(t + T) = f(-t) ; T = \frac{2\pi}{\omega}$$

$$f(t) = \cos \omega_c t \quad 0 \leq t < \frac{\tau}{2} ; T - \frac{\tau}{2} < t \leq T$$

$$f(t) = 0 \quad \frac{\tau}{2} < t < T - \frac{\tau}{2}$$

$$f(t) = \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \cos n\omega t$$

$$a_n = \frac{4}{T} \int_0^{\tau/2} \cos \omega_c t \cos n\omega t dt$$

$$= \frac{2}{T} \int_0^{\tau/2} [\cos (n\omega - \omega_c)t + \cos (n\omega + \omega_c)t] dt$$

$$a_n = \frac{\tau}{T} \left[\frac{\sin (n\omega - \omega_c) \frac{\tau}{2}}{(n\omega - \omega_c) \frac{\tau}{2}} + \frac{\sin (n\omega + \omega_c) \frac{\tau}{2}}{(n\omega + \omega_c) \frac{\tau}{2}} \right]$$

$$\cos \alpha \cdot \cos \beta = \frac{1}{2} [\cos(\alpha - \beta) + \cos(\alpha + \beta)]$$

Für $\omega_c \gg \omega$ ist nur der erste Term wesentlich; man erhält also das um ω_c verschobene Spektrum des Rechteckimpulses (Beispiel 1).

Andere Betrachtung: $\cos \omega_c t (-\infty < t < +\infty)$ ergibt nur eine Spektrallinie bei ω_c ; durch die Modulation entstehen weitere Linien. (Amplitudenmodulation).

Nimmt man als Maß für die Breite der Frequenzkurve $\Delta f = \frac{1}{\tau}$,

so ist $\Delta t \cdot \Delta f = \tau \cdot \frac{1}{\tau} = 1$;

$$\Delta t \cdot \Delta f \geq 1$$

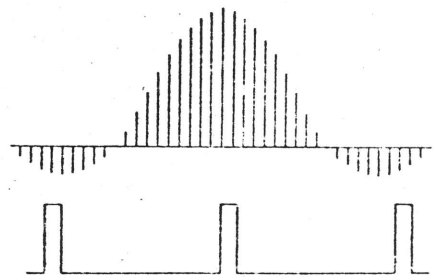


Figure 4a. Narrow pulse width causes wide spectrum lobes, high PRF results in low spectral line density.

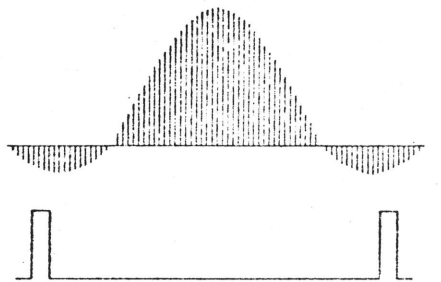


Figure 4c. PRF lower than 4a results in higher spectral density. Lobe width is same as 4a since pulse widths are identical.

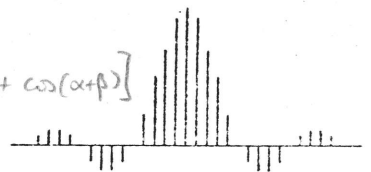


Figure 4b. Wider pulse than 4a causes narrower lobes, but line density remains constant since PRF is unchanged.

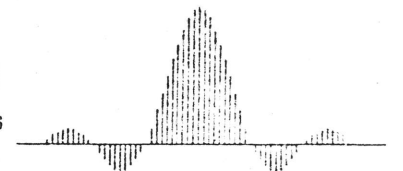


Figure 4d. Spectral density and PRF unchanged from 4c, but lobe widths are reduced by wider pulse.