7-10-13

# Lec 28

## Tx Architecture

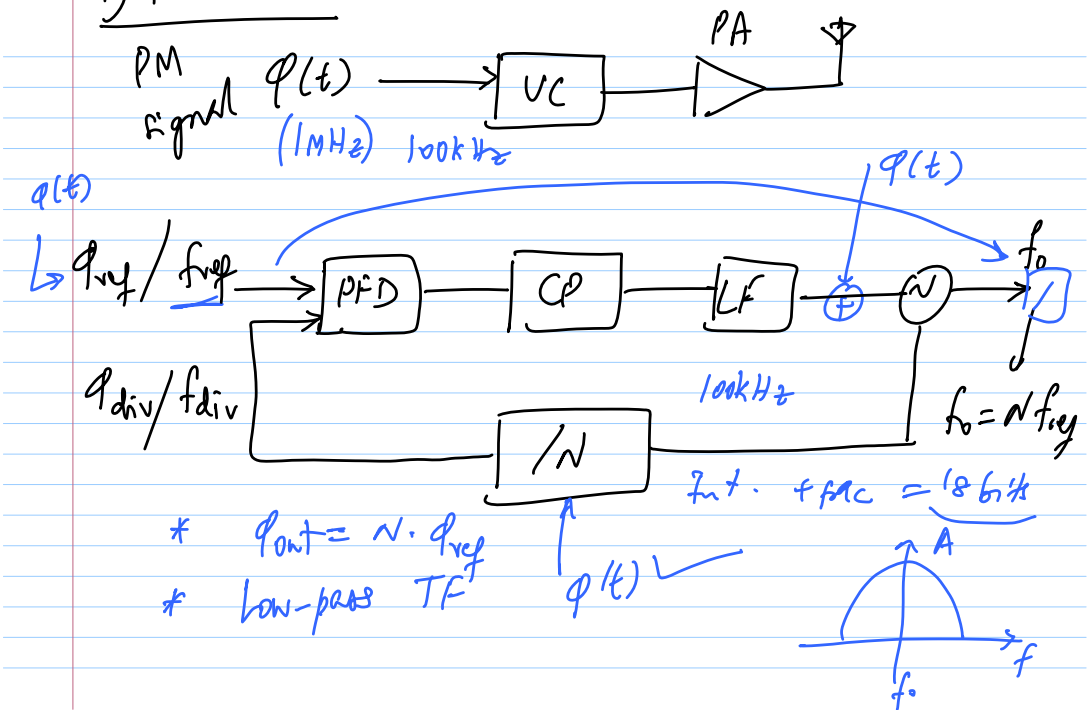
1) Polar $x(t) = a(t)\cos(\omega_0 t + \varphi(t))$ ($a(t)$: AM, $\varphi(t)$: PM)

2) Cartesian: $x(t) = x_I(t)\cos\omega_{LO}t - x_Q(t)\sin\omega_{LO}t$

3) Complex envelope: $x(t) = \mathrm{Re}\left[\tilde{x}(t)\, e^{j\omega_{LO}t}\right]$

Polar Tx : purely PM Tx signals

## 1) Polar Tx

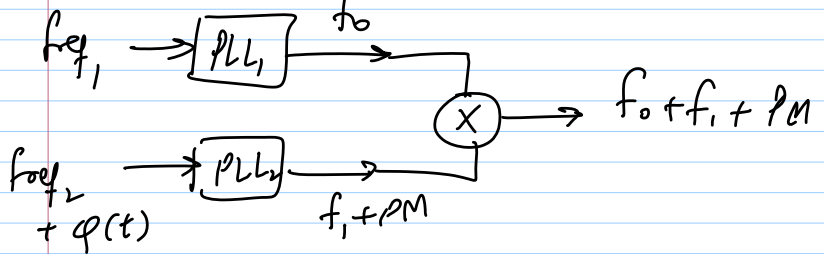


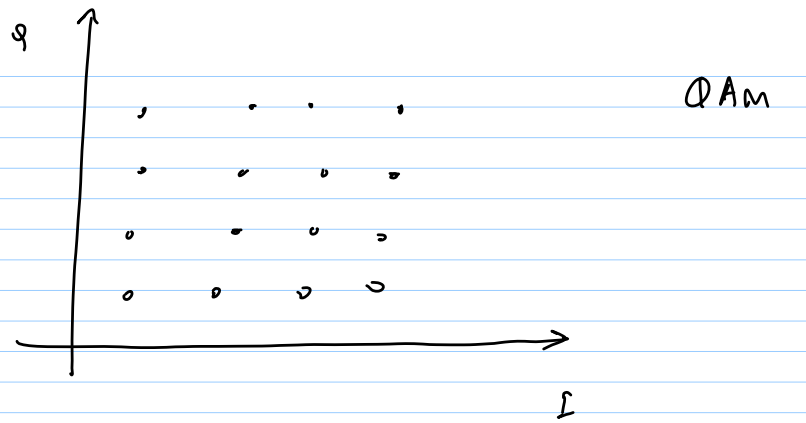

LTE signal $x(t) = x_I(t) + j\,x_Q(t)$

$\hookrightarrow$ $a(t)\cos(\varphi(t))$

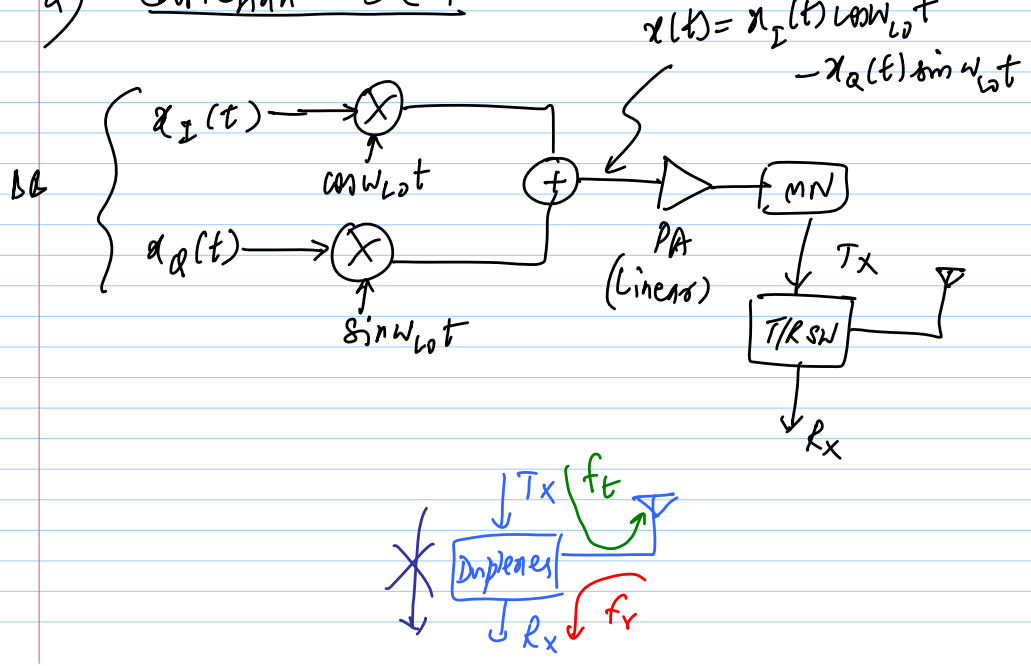
$x_I$, $x_Q$ $\rightarrow$ BW of 20MHz

$a(t)$, $\varphi(t)$ $\rightarrow$ BW of 4-5x



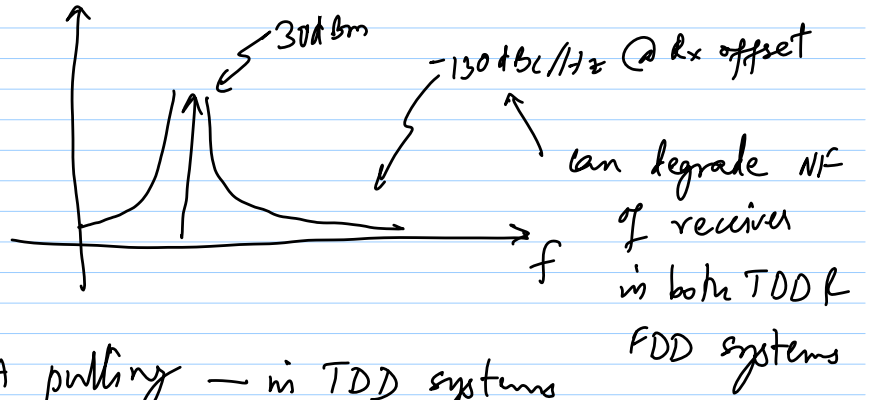



2) Cartesian DCT

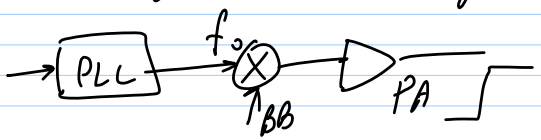


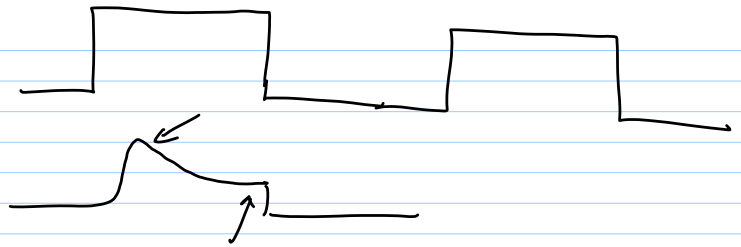

* Linearity, efficiency, noise in $R_x$ band

* in-band noise is not critical




* PA pulling — in TDD systems



Solution

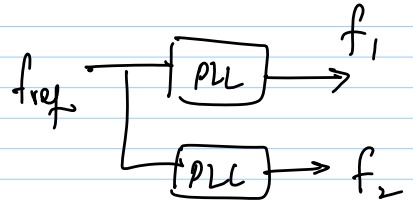
* Do not share PA supply

* PA on diff. substrate

* Far away to avoid magnetic coupling

* Differential PA

* Different frequencies for PA & PLL




Heterodyne Tx