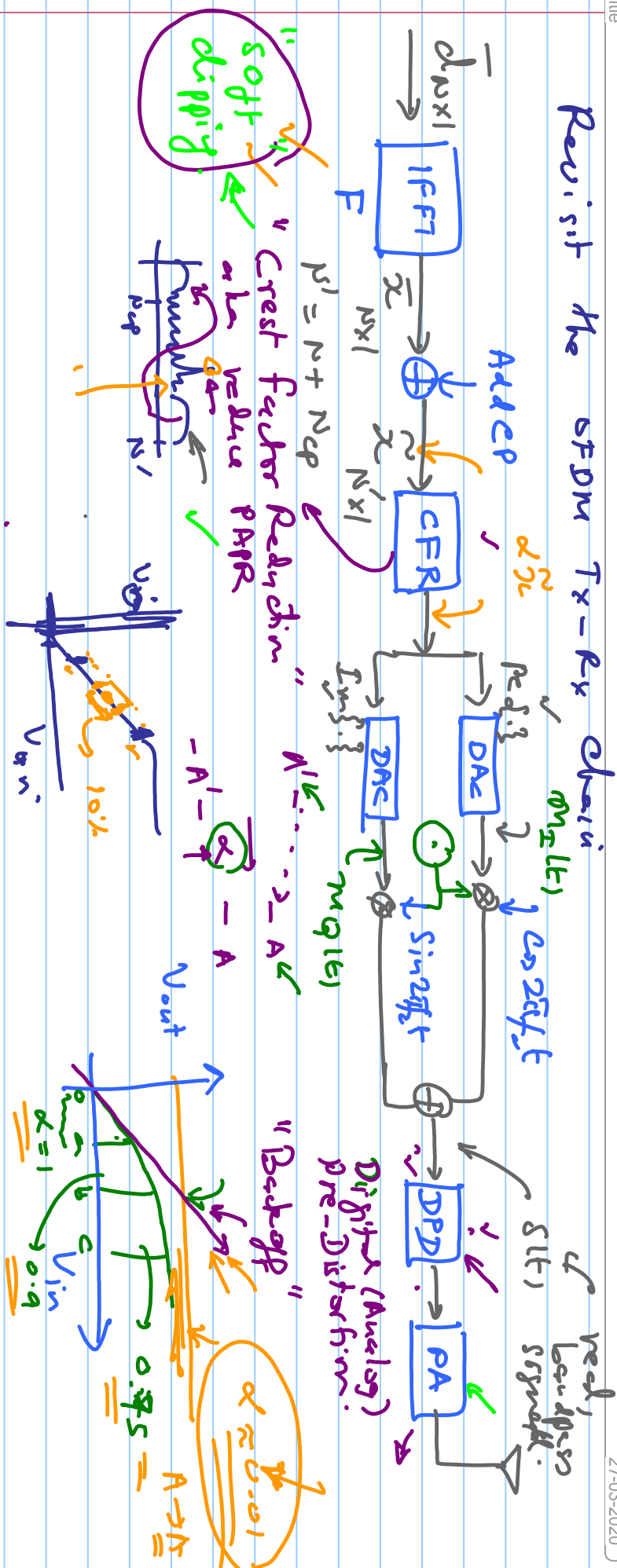
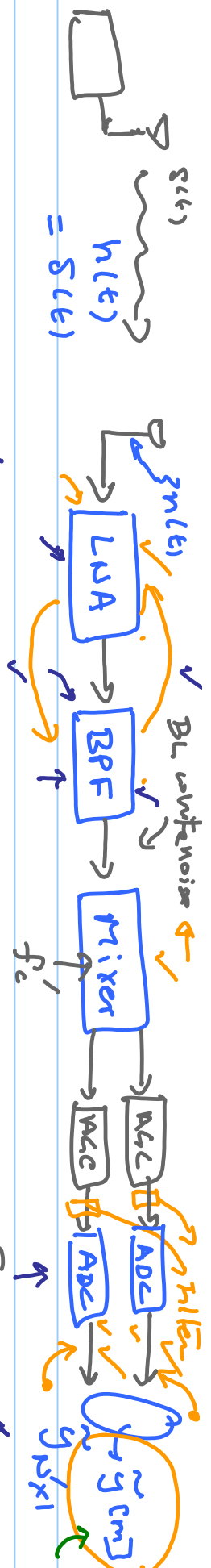


Revisit the OFDM Tx-Rx Chain





$2300 \leftrightarrow 2320$
 $\rightarrow 2320 \leftrightarrow 2340$

Signal demodulation

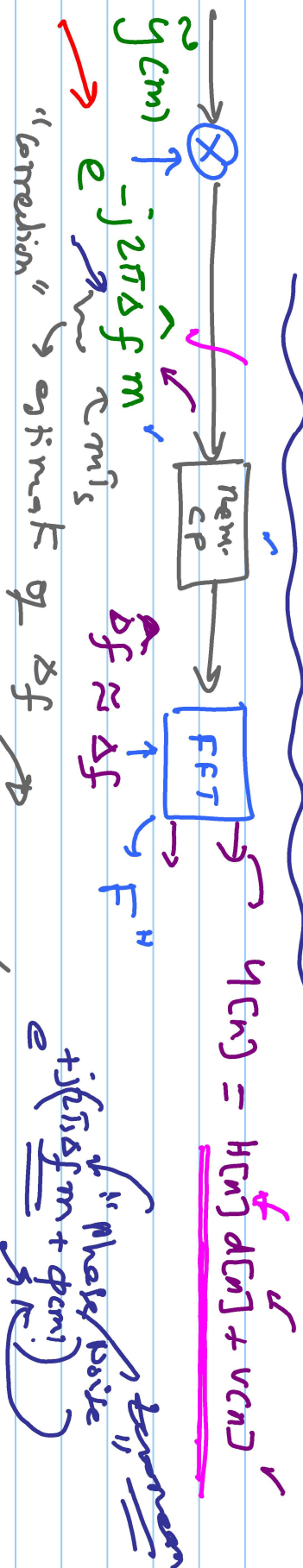
1. Timing Sync. \rightarrow finding "appropriate" FFT windows.

2. Freq. Sync. \rightarrow "fractional" freq. offset \rightarrow "integer" freq. offset



Δf_{sub}
 WiFi $\rightarrow 375$ kHz
 LTE $\rightarrow 15$ kHz
 4G LTE $30 \rightarrow 60$
 240 \leftarrow

Work on freq. offset estimation



(1x) $f_c - f_c' = \Delta f$

eg: $f_c = 2.5 \text{ GHz}$; $f_c' = 2.5 \text{ GHz} + \Delta f$

$\Delta f_{VCO} = 2 \text{ kHz}$

$\Delta f_{\text{Doppler}} = 0.3 \text{ kHz}$

$\Delta f_{\text{ppm}} = 1 \text{ ppm}$

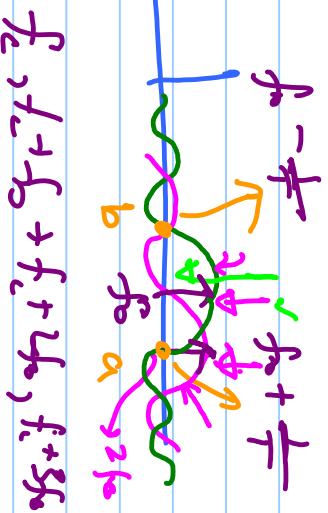
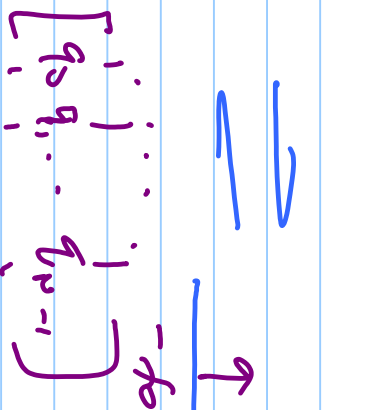
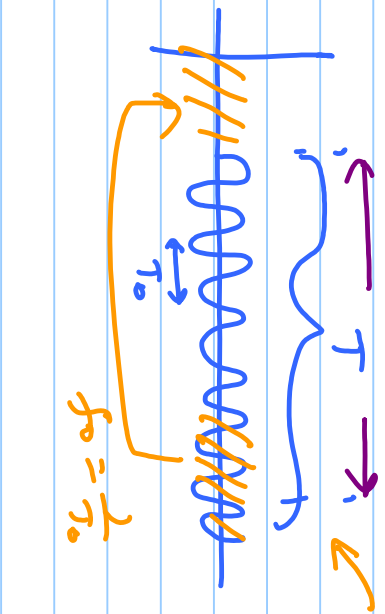
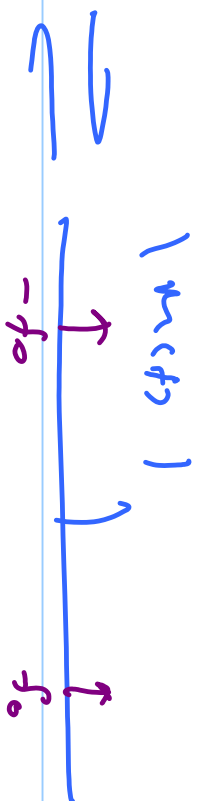
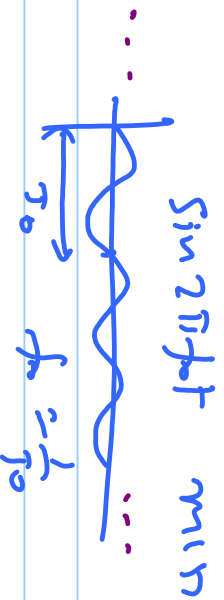
$\Delta f_{\text{ppb}} = \text{parts per billion}$

$2 \times 10^9 \times 1 \times 10^{-6} \Rightarrow 2 \times 10^3 = \pm 2 \text{ kHz}$

$2.5 \text{ GHz} \Rightarrow 2.5 \text{ MHz/s}$

$\Delta f_D = \frac{2V}{\lambda} \text{ can be } \frac{2 \times 1000 \text{ m/s}}{3 \times 10^8 \text{ m/s}} \approx 2.2 \times 10^{-6} \text{ Hz}$

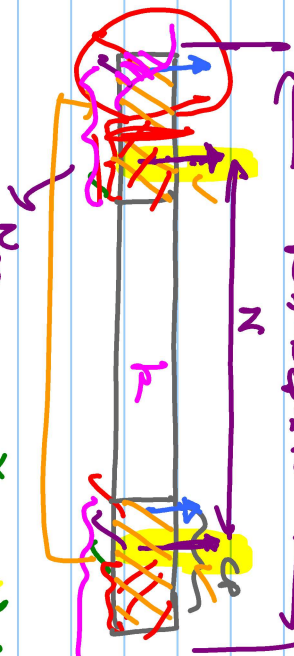
(2*)



ISI due to f_0 \Rightarrow ISI due to f_0
 frequency \Rightarrow freq. ems
 in DMFT \Rightarrow OFDM
 modula \Rightarrow modula

Quick insight :

CP Condition



$\frac{1}{N}$
 $\frac{1}{N}$
 Δf
 Δf

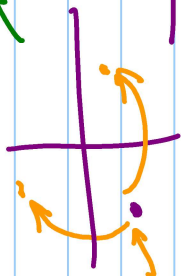
$y^*(m)$
 $y^*(m+N)$
 $y^*(m+N)$

$\Delta f \rightarrow \text{noise}$
 $\Delta f \rightarrow \text{closed fidelity}$
 $\Delta f \rightarrow \text{freq. error}$

$$e^{-j2\pi \Delta f m}$$

$$e^{-j2\pi \Delta f (m+N)}$$

$$y[m] \leftrightarrow y[m+N]$$



$$\Delta f \leftarrow \frac{\phi}{N}$$
