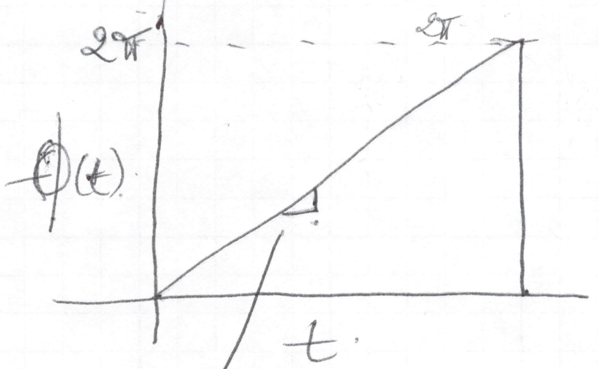
$$f_{OUT} = \sin(2\pi f_S t + \phi \cdot t)$$

$$= \sin\left[2\pi (f_{VCO} + f_\phi) t\right] \qquad f_{PS} = f_S = 312.5\ \text{MHz} = 312.5 \times 10^6$$

$$f_{VCO} = 1.2\ \text{GHz} = 1.2 \times 10^6$$



$$\Delta t - \phi_{update\_MAX} = 13 \times \left[\frac{1}{f_S}\right]$$

$$\Delta t_{MAX} = \frac{13}{f_S} = \frac{13}{312.5 \times 10^{-6}}$$

$$\Delta\phi = \frac{1}{56}\left[\frac{1}{f_{VCO}}\right] = \frac{1}{56 \times 1.2 \times 10^9}$$

VCO =

$$\frac{\Delta\phi}{\Delta t_{(MAX)}} = \frac{\left(\frac{1}{56 \times 1.2 \times 10^9}\right)}{\frac{13}{312.5 \times 10^6}}$$

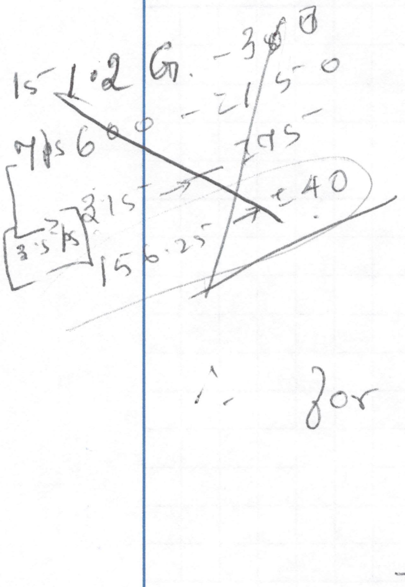
$$= \frac{f_{PS}}{13_{MAX} \times 56 \times f_{VCO}}$$

f_{PS} → constant for MMCM

56 → constant

13 → Large value (max)

$$= \frac{312.5 \times 10^6}{13 \times 56 \times 1.2 \times 10^9}$$



$$= 0.3577 \times 10^{-3}$$

$$= 357.7 \times 10^{-6} \Big\} \text{ Max VCO freq. change.}$$

∴ for (slave) (Phase-Shift) $f_S = f_{PS} = 312.5\ \text{MHz}$, $f_{VCO} = 1.2\ \text{GHz}$.

$$f_{OUT\,(MAX)} = f_{S\_VCO} \pm \boxed{PPM_{PS\_MAX}} = f_{VCO} \pm \underline{357.7}\ PPM\ (f_{VCO})$$

↑ 1.2 G.