PARCIAL 1

1]

$$U = U_0 \sqrt{\frac{1+v/c}{1-v/c}} = 15.000050 \text{ kHz}$$

$$v = 150 \text{ km/h}$$

2] $\dfrac{1}{1-v^2/c^2} = 1 + \dfrac{p^2}{m^2c^2}$

$$1 + \frac{p^2}{m^2c^2} = 1 + \gamma^2 \frac{m^2v^2}{m^2c^2} = 1 + \frac{v^2}{c^2}\frac{1}{1-v^2/c^2}$$

$$= \frac{(1 - v^2/c^2) + v^2/c^2}{1-v^2/c^2} = \frac{1}{1-v^2/c^2} = \gamma^2$$