gradB :

$\vec{v} = -c{B_z+\frac{mc}{q}(\frac{cE_A\sin{2\pi(\frac{t}{T}-\frac{LR_0\theta}{\lambda})+\frac{\pi}{2}}}{B_z^2}\xi_r)}^{-1}(E_A\sin{2\pi(\frac{t}{T}-\frac{LR_0\theta}{\lambda})+\frac{\pi}{2}}-\frac{\mu}{q}\xi_r+\frac{mc^2}{q}\frac{(E_A\sin{2\pi(\frac{t}{T}-\frac{LR_0\theta}{\lambda})+\frac{\pi}{2}})^2\xi_r}{B_z^3})\vec{e_\theta}$

so, $v_{grad} =\frac{c}{B_z} \frac{\mu}{q}\xi_r$

assumption $B_z = \frac{B_E}{L^3}$ (in magnetic equator) , $B_E = 3.11\times10^{-5}\mathrm{T}= 3.11\times10^{-1}\mathrm{G}$ if $L = 6$, $B_z = 1.4\times10^{-7}\mathrm{T} = 1.4\times10^{-3}\mathrm{G}$

assumption : $v_\perp = 0.01c = 3.0\times10^8\mathrm{cm/s}$

$\mu = \frac{mv_{\perp}^2}{2B_z} = \frac{(9.1\times 10^{-28}\mathrm{g})\times(3.0\times10^8\mathrm{cm/s})^2}{2.0\times1.4\times10^{-3}\mathrm{G}}$

$\xi_r = \frac{\partial B_z}{\partial r} = \frac{\partial B_z}{\partial L}\frac{\partial L}{\partial r} =-3\frac{B_E}{L^4}\frac{1}{R_0} = \frac{-3\times 3.1\times 10^{-1}\mathrm{G}}{6^4\times6\times10^8\mathrm{cm}}$

$v_{grad} =\frac{c}{B_z} \frac{\mu}{q}\xi_r = \frac{3.0\times10^{10}cm/s}{1.4\times10^{-3}\mathrm{G}}\times\frac{1}{4.8\times10^{-10}\mathrm{statC}}\times \frac{(9.1\times 10^{-28}\mathrm{g})\times(3.0\times10^8\mathrm{cm/s})^2}{2.0\times1.4\times10^{-3}\mathrm{G}}\times\frac{-3\times 3.1\times 10^{-1}\mathrm{G}}{6^4\times6\times10^8\mathrm{cm}}$

$v_{grad} = -\frac{3.0\times9.1\times3.0\times3.0\times 3\times3.1}{1.4\times4.8\times2.0\times1.4\times6^4\times6}10^{5}\mathrm{cm}/s \approx 1500\mathrm{cm}/s$

from basic space plasma physics

$v_\nabla = \frac{mv_\perp^2}{2qB^3}(\vec{B}\times\nabla B)$

$v_\nabla = \frac{9.1\times10^{-31}\mathrm{kg}\times(3.0\times10^6\mathrm{m/s})^2}{2\times(1.6\times10^{-19}\mathrm{C})\times(1.4\times10^{-7}\mathrm{T})^3}(1.4\times10^{-7}\mathrm{T})\times (-3\frac{B_E}{L^4}\frac{1}{R_0})$

$v_\nabla = \frac{9.1\times10^{-31}\mathrm{kg}\times(3.0\times10^6\mathrm{m/s})^2}{2\times(1.6\times10^{-19}\mathrm{C})\times(1.4\times10^{-7}\mathrm{T})^3}(1.4\times10^{-7}\mathrm{T})\times (-3\frac{3.11\times10^{-5}\mathrm{T}}{6^4}\frac{1}{6.0\times10^6\mathrm{m}})$

$v_\nabla = -\frac{9.1\times9.0\times1.4\times3\times3.11}{2\times1.6\times1.4^3\times6^4\times6}\frac{10^{-31}}{10^{-34}}\mathrm{m/s}$

$v_\nabla = -\frac{9.1\times9.0\times1.4\times3\times3.11}{2\times1.6\times1.4^3\times6^4\times6}10^{3}\mathrm{m/s} = 0.015\times10^3 \mathrm{m/s} = 15\mathrm{m/s}$