1 Mag ind. ravnog. elmag vala :

$B_x = 0$

$B_y = -10^{-9}\,T \sin\left(2\times10^{14}\pi\, s^{-1}\left(t - \frac{x}{c}\right)\right)$

daje smjer gibanja našeg vala

$B_z = 0$

$\hat{B_y} = -\hat{y}$

$E = ?$

val se giba u x smjeru

cos ili sin, nebitno, zbog faznog pomaka

$\vec{B} = \vec{B_0} \sin\left[\vec{k}\cdot\vec{r} - \omega t + \phi\right]$

$\vec{E} = \vec{E_0} \sin\left[\vec{k}\cdot\vec{r} - \omega t + \phi\right]$

identičan dio

$\rightarrow \vec{E_0} = ?$ jer se samo po tome razlikuju ↑

smjer: $\hat{E} = \hat{B} \times \hat{k}$

$= -\hat{y} \times \hat{x} = -(-\hat{z}) = \hat{z}$

$B_0 = \frac{E_0}{c} \rightarrow E_0 = B_0 \cdot c = 0{,}3\, V/m$

$$\boxed{E_z = 0{,}3\,\frac{V}{m} \cdot \sin\left[2\times10^{14}\pi/s\left(t - \frac{x}{c}\right)\right)}$$

2 - nami izderivirati

$$\frac{\partial^2 E}{\partial x^2} = \frac{1}{c^2}\frac{\partial^2 E}{\partial t^2}$$

$$E_y = E_0\, e^{i(\omega t - kx)} \qquad e^{i(\omega t - kx)} = \cos(\omega t - kx) + i\sin(\omega t - kx)$$

$$\frac{\partial^2 E}{\partial x^2} = -k^2 E_0\, e^{i(\omega t - kx)} \qquad \frac{\partial^2 E}{\partial t^2} = \omega^2 E_0\, e^{i(\omega t - kx)}$$

$$-k^2 \cancel{E_0 e^{i(\omega t - kx)}} = \frac{-1}{c^2}\omega^2 \cancel{E_0 e^{i(\omega t - kx)}}$$

$$k^2 = \frac{\omega^2}{c^2} \rightarrow \boxed{k = \frac{\omega}{c}}$$

3. intenzitet odgovara srednjoj vrijednosti Poyntingovog vektora

$I = 1370\ W/m = \bar{S}$

$\vec{S} = \frac{1}{\mu_0}(\vec{E} \times \vec{B})$ $\quad E \perp B$

$S = \frac{1}{\mu_0} E B$

E_0 i B_0

$B = \frac{E}{c}$ $\quad c = \sqrt{\frac{1}{\varepsilon_0 \mu_0}}$

$S = \frac{1}{\mu_0} E^2 \cdot \sqrt{\frac{\varepsilon_0 \mu_0}{1}}$

$\bar{S} = \sqrt{\frac{\varepsilon_0}{\mu_0}} \bar{E}^2$

$S = \sqrt{\frac{\varepsilon_0}{\mu_0}} E_0^2$

→ kada trebamo srednju vrijednost $\bar{S}$ moramo koristiti i $\bar{E}$

↳ izraz za Poyntingovog vektora

$\bar{S} = \sqrt{\frac{\varepsilon_0}{\mu_0}} \overline{E_0^2 \sin^2(kz - \omega t)} = \frac{1}{2}\sqrt{\frac{\varepsilon_0}{\mu_0}} E_0^2 \Rightarrow \bar{S} = \frac{1}{2}\sqrt{\frac{\varepsilon_0}{\mu_0}} E_0^2$

$E_0^2 = 2\bar{S}\sqrt{\frac{\mu_0}{\varepsilon_0}}^{1/2} \longrightarrow \boxed{E_0 = 1016\ V/m}$

$B_0 = \frac{E_0}{c} \Rightarrow \boxed{B_0 = 3{,}4\ \mu T}$

4. λ, $x \Rightarrow \vec{k} = k\hat{x}$

E_0, $(\hat{y} + \hat{z})$

$\vec{B}$, $\vec{S}$ = ?

$\vec{E}(x,t) = \vec{E_0} \cos(\vec{k}\vec{r} - \omega t + \varphi)$

samo x preživi

$\vec{k} = k\hat{x} = \frac{2\pi}{\lambda}\hat{x}$

$E_0 = \sqrt{E_y^2 + E_z^2}$

$\vec{E_0} = \frac{E_0}{\sqrt{2}}(\hat{y} + \hat{z})$

$\vec{E}(x,t) = \frac{E_0}{\sqrt{2}}(\hat{y} + \hat{z}) \cos\left(\underbrace{\frac{2\pi}{\lambda}}_{k}(x - ct) + \phi\right)$ $\quad \omega = kc$

Magnetsko? iznos

$\vec{B_0} = \frac{\vec{E_0}}{c} \Rightarrow \boxed{\frac{E_0}{\sqrt{2}c} = B_0}$

Smjer

$B_0 = \hat{k} \times \hat{E}$

$= \hat{x} \times (\hat{y} + \hat{z})$

$= \hat{z} - \hat{y}$

$B(x,t) = \frac{E_0}{c\sqrt{2}}(-\hat{y} + \hat{z}) \cos\left(\frac{2\pi}{\lambda}(x - ct) + \phi\right)$

$\vec{S} = \frac{1}{\mu_0} \vec{E} \times \vec{B}$

$S(x,t) = \frac{E_0^2}{\mu c} \hat{x} \cos^2\left[\frac{2\pi}{\lambda}(x - ct) + \varphi\right]$ — iskoristimo $\cos 2x = \cos^2 x - \sin^2 x$

$\boxed{S(x,t) = \frac{E_0^2}{\mu c} \cdot \hat{x}\left[1 + \cos\left[\frac{4\pi}{\lambda}(x - ct) + 2\varphi\right]\right]}$