1. Angular Frequency (ω)

The angular frequency ω is related to the frequency f by:

$$\omega = 2\pi f$$

Substituting the given values:

$$\omega = 2 \times 3.14159 \times 6 \times 10^{14} = 3.769908 \times 10^{15}\,\mathrm{rad/s}$$

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2. Wavelength (λ)

The wavelength λ is given by:

$$\lambda = \frac{c}{f}$$

Substituting the given values:

$$\lambda = \frac{3 \times 10^{8}}{6 \times 10^{14}} = 5 \times 10^{-7}\,\mathrm{m} = 500\,\mathrm{nm}$$

3. Wave Number (k)

The wave number k is related to the wavelength by:

$$k = \frac{2\pi}{\lambda}$$

Using the previously calculated wavelength:

$$k = \frac{2 \times 3.14159}{5 \times 10^{-7}} = 1.256636 \times 10^{7}\,\mathrm{rad/m}$$

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4. Phase Velocity

In a vacuum, the phase velocity v_p of an electromagnetic wave is equal to the speed of light:

$$v_p = c = 3 \times 10^{8}\,\mathrm{m/s}$$

5. Magnetic Field Equation and Direction

The magnetic field $\vec{B}$ is perpendicular to both the electric field $\vec{E}$ and the direction of wave propagation. Given that the wave propagates in the $+x$-direction and the electric field oscillates in the y-direction, the magnetic field will oscillate in the z-direction.

The amplitude of the magnetic field B_0 is related to the electric field amplitude by:

$$B_0 = \frac{E_0}{c} = \frac{500}{3 \times 10^{8}} = 1.6667 \times 10^{-6}\,\mathrm{T}$$

The magnetic field equation is:

$$\vec{B}(x,t) = B_0 \cos(kx - \omega t + \Phi)\,\hat{z}$$

Substituting the known values:

$$\vec{B}(x,t) = (1.6667 \times 10^{-6}) \cos\left(1.256636 \times 10^{7}\,x - 3.769908 \times 10^{15}\,t + \frac{\pi}{4}\right)\,\hat{z}\,\mathrm{T}$$