5.1 for Maxwell's law to be true $\vec{\nabla} \times \vec{B} = 0$, $\vec{\nabla} \cdot \vec{B} = 0$

$$\vec{B} = \frac{-B_0}{K_y}\Big[K_x \operatorname{Sinh}(K_x X)\operatorname{Sinh}(K_y Y)\operatorname{Sin}(K_u z)\hat{x}$$
$$+ K_y \operatorname{Cosh}(K_x x)\operatorname{Cosh}(K_y Y)\operatorname{Sin}(K_u z)\hat{y}$$
$$+ K_u \operatorname{Cosh}(K_x X)\operatorname{Sinh}(K_y Y)\operatorname{Cos}(K_u Z)\hat{Z}\Big]$$

$$\vec{\nabla} \times \vec{B} = \left(\frac{\partial B_z}{\partial y} - \frac{\partial B_y}{\partial z}\right)\hat{x} + \left(\frac{\partial B_x}{\partial z} - \frac{\partial B_z}{\partial x}\right)\hat{y} + \left(\frac{\partial B_y}{\partial x} - \frac{\partial B_x}{\partial y}\right)\hat{Z} = 0$$

$$\frac{\partial B_z}{\partial y} - \frac{\partial B_y}{\partial z} = K_y K_u \operatorname{Cosh}(K_x X)\operatorname{Cosh}(K_y Y)\operatorname{Cos}(K_u Z) - K_y K_u \operatorname{Cosh}(K_x X)\operatorname{Cosh}(K_y Y)\operatorname{Cos}(K_u Z)$$
$$= \emptyset$$

$$\frac{\partial B_x}{\partial z} - \frac{\partial B_z}{\partial x} = K_u K_x \operatorname{Sinh}(K_x X)\operatorname{Sinh}(K_y Y)\operatorname{Cos}(K_u Z) - K_u K_x \operatorname{Sinh}(K_x x)\operatorname{Sinh}(K_y Y)\operatorname{Cos}(K_u z)$$
$$= \emptyset$$

$$\frac{\partial B_y}{\partial x} - \frac{\partial B_x}{\partial y} = K_y K_x \operatorname{Sinh}(K_x X)\operatorname{Cosh}(K_y Y)\operatorname{Sin}(K_u z) - K_x K_y \operatorname{Sinh}(K_x X)\operatorname{Cosh}(K_y Y)\operatorname{Sin}(K_u z)$$
$$= \emptyset$$

$$\vec{\nabla} \cdot \vec{B} = \frac{\partial}{\partial x} B_x + \frac{\partial}{\partial y} B_y + \frac{\partial}{\partial z} B_z = 0$$

$$\frac{\partial}{\partial x}\left[K_x \operatorname{Sinh}(K_x x)\operatorname{Sinh}(K_y Y)\operatorname{Sin}(K_u z)\right] + \frac{\partial}{\partial y}\left[K_y \operatorname{Cosh}(K_x X)\operatorname{Cosh}(K_y Y)\operatorname{Sin}(K_u z)\right]$$
$$+ \frac{\partial}{\partial z}\left[K_u \operatorname{Cosh}(K_x x)\operatorname{Sinh}(K_y Y)\operatorname{Cos}(K_u Z)\right] = 0$$

$$K_x^2 \operatorname{Cosh}(K_x X)\operatorname{Sinh}(K_y Y)\operatorname{Sin}(K_u z) + K_y^2 \operatorname{Cosh}(K_x x)\operatorname{Sinh}(K_y Y)\operatorname{Sin}(K_u Z)$$
$$- K_u^2 \operatorname{Cosh}(K_u X)\operatorname{Sinh}(K_y Y)\operatorname{Sin}(K_u Z) = 0$$
$$\Downarrow$$
$$K_x^2 + K_y^2 = K_u^2$$