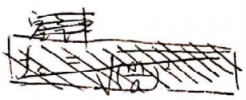
18373038 钱思远

3-8

解：



$$\lambda_c = \frac{2}{\sqrt{(\frac{m}{a})^2+(\frac{n}{b})^2}} = 14\ cm.$$

$$f_c' = \frac{v}{\lambda_c} = \frac{c}{\sqrt{\varepsilon_r}\cdot\lambda_c} = \frac{f_c}{3} = 0.714\ GHz.$$

相速度：

$$v_p = \frac{v}{G} = \frac{c}{\sqrt{\varepsilon_r}G} = \frac{c}{\sqrt{\varepsilon_r}\cdot\sqrt{1-(\frac{f_c}{f})^2}} \approx 1.07\times10^8\ m/s.$$

半波导波长：

$$\lambda_g = \frac{\lambda}{G} = \frac{c}{\sqrt{\varepsilon_r}\cdot f\cdot\sqrt{1-(\frac{f_c}{f})^2}} = 5.35\ cm$$

3-9.

解：$k_c = \sqrt{k_x^2+k_y^2} = \sqrt{(\frac{\pi}{30})^2+(\frac{\pi}{30})^2} = \frac{\sqrt{2}\pi}{30}$.

$$\lambda_c = \frac{2\pi}{k_c} = \frac{2\pi\cdot 30}{\sqrt{2}\pi} = 30\sqrt{2}\ cm.$$

$k_x = \frac{m\pi}{a}$　　$k_x|_{m=3} = \frac{3\pi}{a} = \frac{\pi}{30}$.　得 $a = 90\ mm$

$k_y|_{n=2} = \frac{2\pi}{b} = \frac{\pi}{30}$　　得 $b = 60\ mm$

3-10

解：$k_c = \sqrt{(\frac{m\pi}{a})^2+(\frac{n\pi}{b})^2} = \sqrt{(\frac{\pi}{a})^2} = \frac{\pi}{a}$.

$$\lambda_c = \frac{2\pi}{k_c} = 2a = 45.72\ mm.$$

$$f_c = \frac{c}{\lambda_c} = 6.56\ GHz$$

$$v_p = \frac{v}{G} = \frac{c}{\sqrt{1-(\frac{f_c}{f})^2}} = 3.97\times10^8\ m/s.$$

$$v_g = vG = c\cdot\sqrt{1-(\frac{f_c}{f})^2} = 2.27\times10^8\ m/s.$$

$$\eta_{TE10} = \frac{\eta}{\sqrt{1-(\frac{f_c}{f})^2}} = 498\ \Omega.$$

$a\uparrow$　$\lambda_c\uparrow$　$f_c\downarrow$　$v_p\downarrow$　$v_g\uparrow$　$\eta_{TE10}\downarrow$.

b 改变 不影响.

3-11

解：$\lambda_{c(mn)} = \frac{2\pi}{\sqrt{(\frac{m\pi}{a})^2+(\frac{n\pi}{b})^2}}$

$\lambda_{c(H_{10})} = 4.572\ cm$

$\lambda_{c(H_{20})} = 2.286\ cm$

$\lambda_{c(H_{01})} = 2.032\ cm$

$\lambda_{c(H_{11})} = \lambda_{c(E_{11})} = 1.857\ cm.$

当 $f > f_c$，$\lambda < \lambda_c$ 时 能传输

2 cm：~~λ_c~~ H_{10}. H_{20}. H_{01}

3 cm：H_{10}

5 cm：无法传输.

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