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3-13

解: BJ-32 型 $a = 72.14\,mm$ $b = 34.04\,mm$

① $k_c = \sqrt{(\frac{m}{a}\pi)^2 + (\frac{n}{b}\pi)^2}$

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

当 $\lambda_c > \lambda_0$ 时. 导通

$(\lambda_c)_{H_{10}} = 14.428\,cm.$

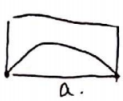
$(\lambda_c)_{H_{20}} = 7.214\,cm$

$(\lambda_c)_{E_{01}} = 6.808\,cm$ $> 6\,cm$

$(\lambda_c)_{E_{11}, H_{11}} = 6.157\,cm$

② 相邻波节点. 距离为 10.9cm

~~波导波长~~ $\lambda_g = ~~10.9\,cm~~ 20.18\,cm$



$\lambda_g = \frac{\lambda_0}{G} = \frac{\lambda_0}{\sqrt{1-(\frac{\lambda_0}{\lambda_c})^2}}$

得 $\lambda_0 \approx 17.02\,cm.$

③ 还能通 H_{10} 模式.

$(\lambda_c)_{H_{10}} = 14.428\,cm.$

$G = \sqrt{1-(\frac{\lambda_0}{\lambda_c})^2}.$

$v_p = ~~\frac{v}{G}~~ \frac{v}{G} = 4.17\times10^8\,m/s$

$v_g = vG = 2.16\times10^8\,m/s$

$\lambda_g = \frac{\lambda_0}{G} = 13.90\,cm$

3-14

解: BJ-100 $a = 22.86\,mm$ $b = 10.16\,mm$

① H_{10}

$\lambda_c = 2a = 45.72\,mm = 4.572\,cm$

$G = \sqrt{1-(\frac{\lambda_0}{\lambda_c})^2} \approx$

$\lambda_g = \frac{\lambda_0}{G} = 3.976\,cm.$

$\beta = \frac{2\pi}{\lambda_g} = 1.58\,rad/cm.$

$\eta_{TE10} = \frac{\eta}{G} = \frac{120\pi}{\sqrt{1-(\frac{\lambda_0}{\lambda_c})^2}} = 500\,\Omega$

② a 增大为 2 倍

$\lambda_c' = 2\lambda_c = 9.144\,cm$

$\lambda_g' = \frac{\lambda_0}{\sqrt{1-(\frac{\lambda_0}{\lambda_c})^2}} = 3.176\,cm.$

$\beta' = 1.98\,rad/cm$

$\eta'_{TE10} \approx 398\,\Omega.$

$3 = \lambda_0 < \lambda_c = \frac{2}{\sqrt{(\frac{m}{a})^2 + (\frac{n}{b})^2}}$

$(\frac{m}{a})^2 + (\frac{n}{b})^2 < (\frac{2}{3})^2$

能通过 H_{10}. H_{20}. H_{30}.

③ b 增大. 以上量不变

能通过 H_{10}. H_{01}. H_{11}. E_{11}

④ $\lambda_0 = 2\,cm.$

λ_c'' 不变.

$\lambda_g'' = \frac{\lambda_0}{\sqrt{1-(\frac{\lambda_0}{\lambda_c})^2}} = 2.224\,cm$ $\beta'' = \frac{2\pi}{\lambda_g''} = 2.82\,rad/cm$

$\eta''_{TE10} = 419\,\Omega.$

能通过 H_{10}. H_{20}. H_{01}.

3-15

解：$\lambda_c = \frac{2}{\sqrt{(\frac{m}{a})^2+(\frac{n}{b})^2}} = \frac{2}{\sqrt{\frac{m^2}{4b^2}+\frac{n^2}{b^2}}}$.

$(\lambda_c)_{H_{40}} = b$.

$\lambda_0 < (\lambda_c)_{H40} < (\lambda_c)_{Hmn}$.

$\therefore \sqrt{\frac{m^2}{4b^2}+\frac{n^2}{b^2}} < \frac{2}{b}$.

解得 $\begin{cases} m=0 \\ n=1 \end{cases}$ $\begin{cases} m=0 \\ n=2 \end{cases}$ $\begin{cases} m=1 \\ n=0 \end{cases}$ $\begin{cases} m=2 \\ n=0 \end{cases}$

$\begin{cases} m=3 \\ n=0 \end{cases}$ $\begin{cases} m=1 \\ n=1 \end{cases}$ $\begin{cases} m=2 \\ n=1 \end{cases}$ $\begin{cases} m=3 \\ n=1 \end{cases}$ $\begin{cases} m=4 \\ n=0 \end{cases}$

3-16

解：① $m=1$. $n=0$.

$\lambda_c = 2a = 1.4224$ cm.

$f_c = \frac{c}{\lambda_c}$ $\lambda_0 = \frac{c}{f_0} = 10$cm

$G = \sqrt{1-(\frac{f_c}{f})^2}$.

$\lambda_g = \frac{\lambda_0}{G} = 1.406$ cm.

$\beta = \frac{2\pi}{\lambda_g}$.

$\phi = \beta l = 44.67$ rad.

② $\varepsilon_r = 4$. $\mu_r = 1$

$\lambda_0' = \frac{c}{\sqrt{\varepsilon_r \mu_r} \cdot f_0}$

$\lambda_g' = \frac{\lambda_0'}{\sqrt{1-(\frac{\lambda_0'}{\lambda_c})^2}} = 0.534$ cm.

$\beta' = \frac{2\pi}{\lambda_g'} =$

$\phi' = \beta' l = 117.6$ rad.

$9.5\text{cm} = \lambda_0 < \lambda_c = \frac{2}{\sqrt{(\frac{m}{a})^2+(\frac{n}{b})^2}}$

还能通 H_{01}. H_{20}、H_{11}. E_{11}. H_{21}、E_{21}.

3-17.

解：

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

$3.2\text{cm} = \lambda_0 < (\lambda_c)_{H10}$

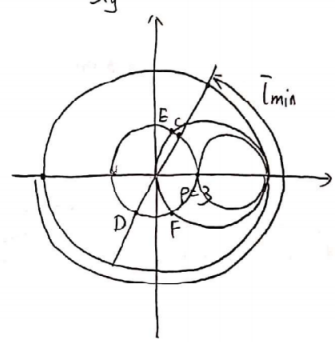
$\lambda_0 > (\lambda_c)_{H11}$

$\lambda_0 > (\lambda_c)_{H10}$.

$\therefore \lambda_c = 2a = 4.572$ cm.

波导波长：$\lambda_g = \frac{\lambda_0}{\sqrt{1-(\frac{\lambda_0}{\lambda_c})^2}} \approx 4.48$cm.

$\bar{l}_{min} = \frac{l_{min}}{\lambda_g} \approx 0.30$



$\bar{z}_c = \bar{z}_L = 1.70 + j1.30$.

$\bar{Y}_D = 0.380 - j0.280$. $\bar{l}_D = 0.050$

$\bar{Y} = \bar{Y}_D$

D 沿等反射系数圆顺时针转到 E

$\bar{Y}_E = 1 + j1.15$ $\bar{l}_E = 0.165$

并联：$\bar{Y}_2 = -j1.15$.

$\bar{d} = \bar{l}_D + \bar{l}_E = 0.215$

距离负载：$d = \bar{d} \cdot \lambda_g \approx 9.6$mm