GGÜ 12

Dienstag, 5. Juli 2011
14:04

3.2.1) graphisch: $\frac{\omega_1}{h} = 3{,}1$

$\Rightarrow \omega_1 = 5{,}175\,\text{mm}$

rechn.: $\frac{\omega_1}{h} = 3{,}124$

$\Rightarrow \omega_1 = 5{,}155\,\text{mm}$

3.2.2) $\frac{\omega}{h} = 4\left(\frac{1}{2}e^{A} - e^{-A}\right)^{-1}$

$A = 2{,}2134$

$\frac{\omega_2}{h} = 0{,}896 \Rightarrow \omega_2 = 1{,}478\,\text{mm}$

$A = 3{,}0797$

$\frac{\omega_3}{h} = 0{,}3801 \Rightarrow \omega_3 = 0{,}611$

4.2.3) $\frac{L_3}{\lambda_{\varepsilon 3}} = \frac{1}{4}$

$\lambda_{\varepsilon 3} = \frac{c_0}{f\sqrt{\varepsilon_{rell3}}}$

$\varepsilon_{rell} = \frac{\varepsilon_r' + 1}{2} + \frac{\varepsilon_r' - 1}{2} \cdot F\left(\frac{\omega}{h}\right)$

$F\left(\frac{\omega}{h}\right) = \frac{1}{\sqrt{\quad}} + 0{,}04\left(1 - \frac{\omega}{h}\right)^2 = 0{,}1888$

$$F\left(\frac{w}{u}\right) = \frac{1}{\sqrt{1{,}112\,\frac{w}{u}}} + 0{,}04\left(1-\frac{w}{u}\right)^2 = 0{,}1888$$

$$\Rightarrow \varepsilon_{r\,eff} = 1{,}7133$$

$$L_3 = 5{,}73\,mm$$

4.2.4 $\quad \alpha_2 =$

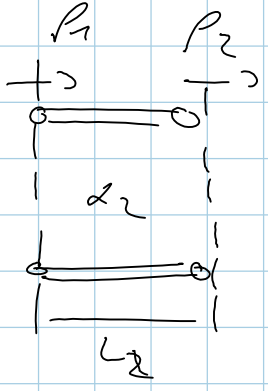
$$= \frac{\delta \cdot \omega}{\delta \cdot \omega}$$

$$R' = \frac{1}{\varkappa \cdot A_{Lin}} + \frac{1}{\varkappa \cdot A_{Risse}} = \frac{2}{\varkappa\,\delta\,\omega}$$

$$\alpha = \frac{R'}{2 Z_L} = \frac{1}{\varkappa \cdot \delta \cdot \omega \cdot Z_L} = 0{,}1767\ \frac{Np}{m}$$

$$\frac{\alpha}{dB/m} = 8{,}686 \cdot 0{,}1768 = 1{,}535$$

4.2.5)



$$P_1 = \frac{P_{verl}}{2}$$

$$P_2 = P_1 \cdot \underbrace{10^{-\frac{\alpha L_2}{10\,dB}}}$$

$$= 0{,}9825$$

98,25 % von P_{verl}

4.3.1)

$$\varepsilon_{r\,eff}(f) = \varepsilon_r' + \frac{\varepsilon_{reff}(f=0) - \varepsilon_r'}{1+p}$$

$$\rho \approx \left(\frac{4/\mathrm{mm}}{Z_L/\Omega}\right)^{4/3}\left[0{,}43\cdot\left(\frac{f}{6\,\mathrm{GHz}}\right)^2 - 0{,}009\left(\frac{f}{6\,\mathrm{GHz}}\right)^3\right]$$

$\varepsilon_{r,\mathrm{eff}_1}(f=10\,\mathrm{GHz}) = 1{,}957 \quad (1{,}87)$

$\varepsilon_{r,\mathrm{eff}_2}(f=10\,\mathrm{GHz}) = 1{,}815 \quad (1{,}76)$

$\varepsilon_{r,\mathrm{eff}_3}(f=10\,\mathrm{GHz}) = 1{,}852 \quad (1{,}71)$

4.3.2) $Z_L(f) = Z_L(f=0)\cdot\sqrt{\frac{\varepsilon_{r,\mathrm{eff}}(f=0)}{\varepsilon_{r,\mathrm{eff}}(f)}}\cdot\frac{\varepsilon_{r,\mathrm{eff}}(f)-1}{\varepsilon_{r,\mathrm{eff}}(f=0)-1}$

$Z_L(f=0)$	$Z_L(f=10\,\mathrm{GHz})$	Abw.
$50\,\Omega$	$53{,}76\,\Omega$	$7{,}52\,\%$
$100\,\Omega$	$105{,}60\,\Omega$	$5{,}60\,\%$
$141\,\Omega$	$147{,}54\,\Omega$	$4{,}64\,\%$

4.3.3)

$$\frac{L_3}{\lambda_{\varepsilon 3,\mathrm{disp}}} = \frac{f\cdot L_3}{c_0\sqrt{\varepsilon_{r,\mathrm{eff}_3}(f=10\,\mathrm{GHz})}}$$

$L_3 = 5{,}67\,\mathrm{mm} \quad (5{,}33\,\mathrm{mm} \Rightarrow 1{,}2\,\%)$

$$\boxed{\frac{L_3}{\lambda_{\varepsilon 3,\mathrm{disp}}} = \frac{5{,}73\,\mathrm{mm}\cdot f}{c_0\sqrt{\varepsilon_{r,\mathrm{eff}_3}(f=10\,\mathrm{GHz})}}} = \frac{1}{4}\cdot 1{,}012$$

Aufgabe 5

5.1.1 H10 (E10 ex. nicht, Randbedingung)