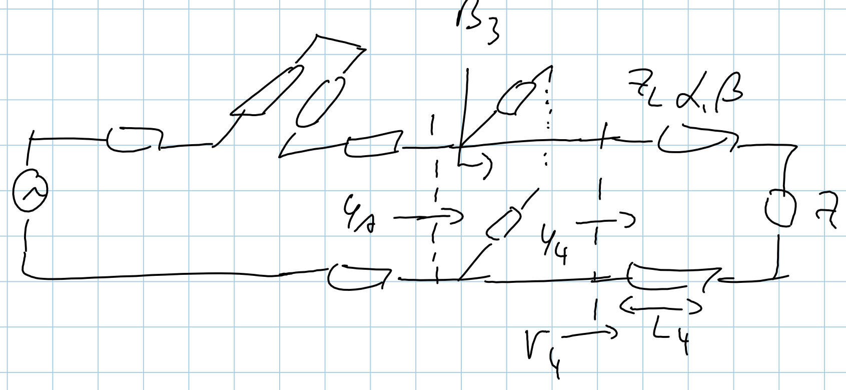
RÜ 5

Dienstag, 10. Mai 2011
15:52

Aufgabe 7 (4.07)

4.2.a



$Y_1 \cdot R_n = \underbrace{B_3 R_n}_{\pm 0{,}55} + Y_4 \cdot R_n$

$Y_1 \cdot R_n - Y_4 \cdot R_n = \pm 0{,}55$

Ablesen von Smith Chart $\Rightarrow \underline{Y}_4 = 0{,}52 - j1.05$

Die Transformation über L_4

$r_z = r_4 e^{2\alpha L_4} e^{j2\beta L_4}$ gegeben

$\left.\begin{array}{l} f = 1\,GHz \\ Z = 0{,}3\,m \\ \beta = 20{,}944 \end{array}\right\}$ $r_z = r_4\, e^{0{,}223} e^{j4{,}19}$

$= 1{,}25\, r_4\, e^{j4{,}19}$

fürs Einzeichnen:

ablesen vom Smith-Chart:

$|r_4| \rightarrow 5{,}3\,cm$

$|r_z| = 1{,}25 \cdot 5{,}3\,cm = 6{,}62\,cm$

Winkel von r_z: $4{,}19\,rad = 240\,grad$

$\angle r_z = 280° + 240° = 520° \sim 160°$

$Y \rightarrow Z$ Ablesen

$\frac{Z}{R} = 2{,}8 - j3{,}5$

$$\frac{Z}{R_n} = 2{,}8 - j\,3{,}5$$

$$\underline{Z = 168 - j\,210\,\Omega}$$

4.2.5 Anhand Y_A können wir L_1 im Smith Chart bestimmen

$$\underbrace{0{,}41}_{\text{Ablesen}} + 0{,}178 = 0{,}588 - 0{,}5 = 0{,}088$$

Einzeichnen: $Y_A \longmapsto 3{,}7\,cm$

$$Y \to Z \Rightarrow x = -0{,}95\,R_n$$

$$x_n \overset{!}{=} +0{,}095\,R_n = 57\,\Omega = \tan(\beta L_1)\,R_n$$

$$\beta L_1 = \arctan(0{,}95)$$

$$L_1 = 36{,}27\,mm$$

4.3.1 $Z_S = 120 - j\,300$

$$\Omega = 40$$

$$\beta_0 \frac{L}{2} = 3{,}5$$

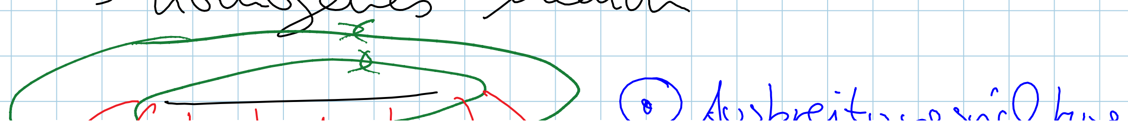
↑ Ablesen Skript S 99

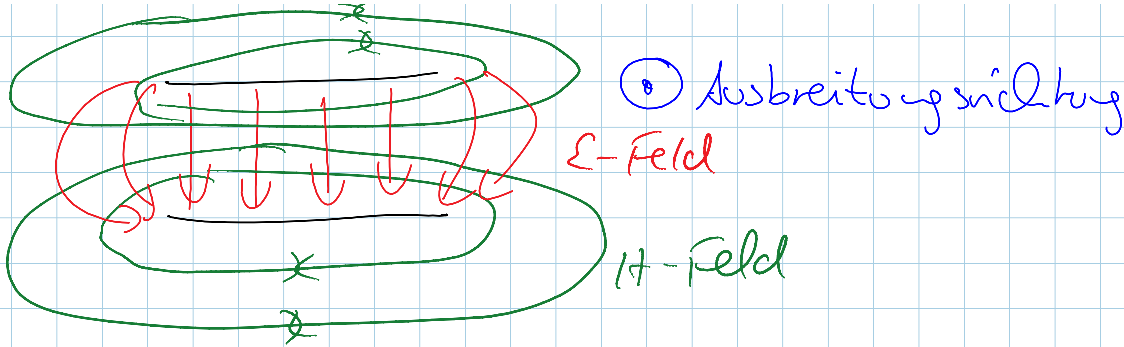
Herbst 02

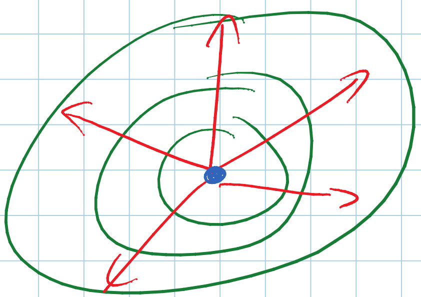
A1.1

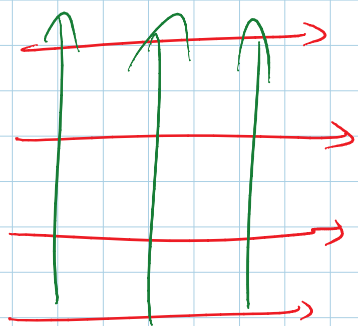
$\Rightarrow \geq 2$ Leiter im Querschnitt

$\Rightarrow$ homogenes Medium



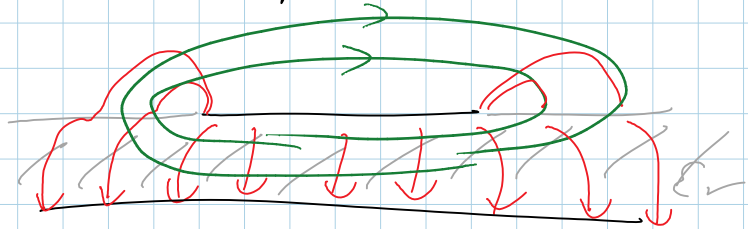






1.2 Quasi-TEM-Leitung

bedeutet dass es die Komponente E_z, H_z gibt, die aber relativ klein gegenüber der transversalen Komponente sind



1.4

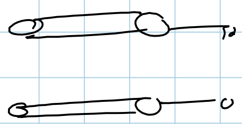
$$Z_e = Z_L \frac{\frac{Z_2}{Z_L} + \tanh(\gamma L)}{1 + \frac{Z_2}{Z_L} \tanh(\gamma L)}$$

$$\gamma = \cancel{\alpha} + j\beta$$

$$Z_e = Z_L \frac{\cancel{\frac{Z_2}{Z_L}} + j\cancel{\tan}(\beta L)}{\cancel{1+} \frac{Z_2}{Z_L} \cancel{j}\tan(\beta L)}$$

$\underline{Z_2 = 0}$

$$Z_e = Z_L\, j\tan(\beta L)$$



$\underline{Z_2 = \infty}$

$$Z_e = Z_L \frac{1}{j\tan(\beta L)}$$

$$= -j\, Z_L \cot(\beta L)$$

Leitungsende	Eingangs-Imp.	$0 < L/\lambda < 0{,}25$	$\frac{L}{\lambda} = 0{,}25$	$0{,}25 \le \frac{L}{\lambda} < 0{,}5$	$L/\lambda = 0{,}5$
Kurzschluss	$Z_e = Z_L j\tan(\beta L)$	—mm—	LL	—||—	KS
LL	$Z_e = -j Z_L \cot(\beta L)$	—||—	KS	—mm—	LL

1.5) a) Mikrostreifenleitung: LL, da keine Durchkontaktierungen nötig sind

b) Koaxialleitung: Kurzschluss, da keine Abstrahlungsverluste auftreten.

A.2.1 Skript Abbildung 3.18 (S. 34) ablesen

$$\frac{w}{h} = 3{,}1$$

$$w_3 = w_4 = 3{,}1 \cdot h = 5{,}58\,mm$$

2.2 $Z_A = 20 + j15\,\Omega$

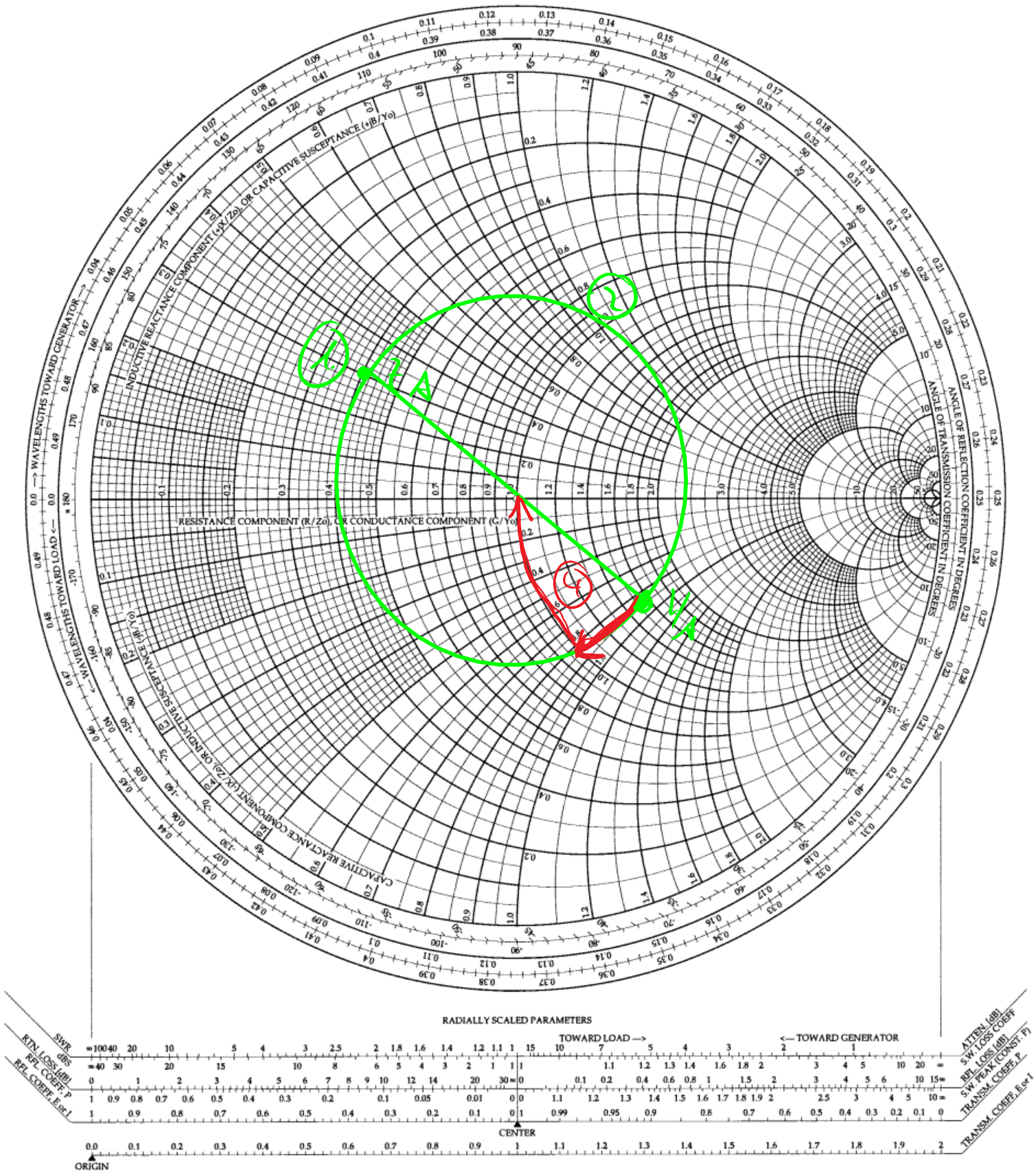
$$\left.\begin{array}{l} Z_{L3} = Z_{L4} = 50\,\Omega \\ Z_{L2} \overset{!}{=} 50\,\Omega \end{array}\right\} R_N = 50\,\Omega$$

1.) $Z_A = 20 + j15\,\Omega$ $\quad \frac{Z_A}{Z_W} = 0{,}4 + j\,0{,}3$

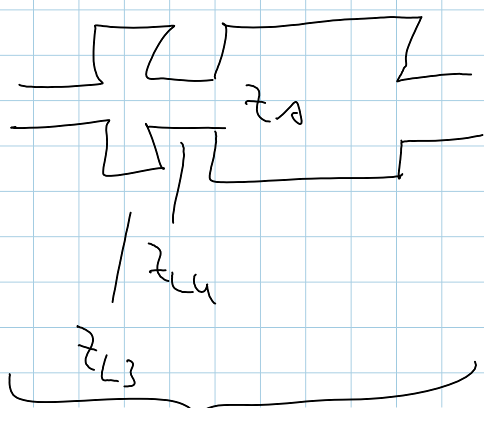
2.) über Z_{L4} Drehkreis um Mittelpunkt

The Complete Smith Chart

Black Magic Design



3.)



L_3

$:= \quad Z_{L3} \parallel Z_1 + Z_4$

4.) Länge L_3 Drehung auf Imaginärkreis zu 1

L_4 aus Diagramm $\frac{L_4}{\lambda} = 0{,}336 - 0{,}308 = 0{,}028$

L_3

$Y_3 \cdot R_L = + j\,1{,}5$

$Y_3 = \frac{1}{Z_L}\, j \tan(\beta L)$

da ℓL

$Y_3 \cdot R_L = j \tan(\beta L) = j\,1{,}5$

$\beta L = \frac{2\pi}{\lambda} \cdot L = 56{,}31$

$L/\lambda = 8{,}96$

2.3 $\quad \frac{L_1}{\lambda_{\varepsilon 1}} = \frac{1}{4}$

$Z_{L1} = \sqrt{Z_{L2} \cdot R_i} = 54{,}77\,\Omega$

3.1 $\quad f = f_0 = 2{,}4\,GHz$

$\alpha = \alpha_R + \alpha_G$

$E(z) = E_0\, e^{-\gamma z}$

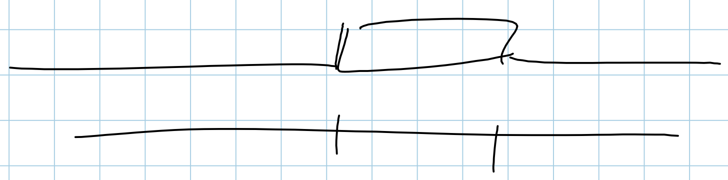
$\gamma = \alpha + j\beta$

$$|E(z)| = |E_0| \, e^{-\alpha z}$$

$$z = 1\,\text{m}$$

$$\frac{|E(z)|}{|E_0|} = e^{-\alpha}$$

$$\alpha = \ln\left(\frac{|E(z)|}{|E_0|}\right) \quad \left[\frac{\text{Np}}{\text{m}}\right]$$



$$\alpha = \alpha_R + \alpha_G$$

$$\alpha_R = \frac{1}{\kappa \delta w \cdot Z_L}$$

$$\delta = \frac{1}{\sqrt{\pi f \kappa \mu}} = 1{,}35\,\mu\text{m}$$

$$\mu = \mu_0$$

$$\alpha_R = 0{,}0458\,\text{Np/m}$$

$$w\big|_{Z_L = 60\,\Omega} = 5{,}58\,\text{mm}$$

$$\alpha_G = \frac{k_0}{2}\sqrt{\varepsilon_{reff}} \, \frac{\frac{1}{\varepsilon_{reff}} - 1}{\frac{1}{\varepsilon_r} - 1} \tan\delta_E$$

$$\varepsilon_{reff} = 1{,}37$$

↑ Script S. 34

$$\tan\delta_E = \frac{\varepsilon_r''}{\varepsilon_r'} = \frac{0{,}003}{2{,}2}$$

$$\alpha_G = 0{,}04\,\frac{\text{Np}}{\text{m}}$$

$$\alpha = 0{,}04 + 0{,}046 = 0{,}086\,\text{Np/m}$$

3.2)

$$\frac{P_{r2}}{P_{verl.}} = \frac{P(z=0) - P(z=L_2)}{P_{verl}}$$

$$= \frac{P(z=0) - P(z=0)e^{-2\alpha L_2}}{P_{verl}}$$ Leistung

$$= 1 - e^{-2\alpha L_2} = 0{,}0169$$