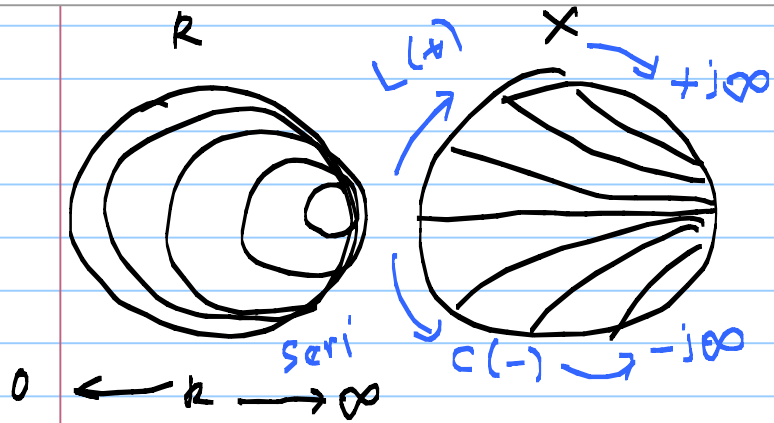


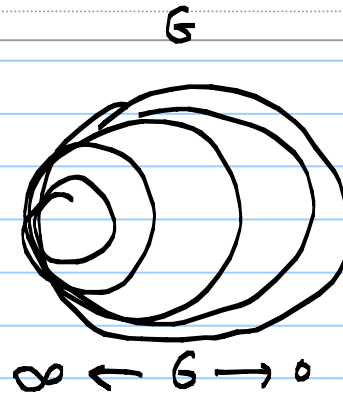
DOUBLE SMITH CHART



$$Z = R \pm jX$$

$$+ jX_L$$

$$- jX_C$$



$$Y = G \pm jB$$

$$+ jB_C$$

$$- jB_L$$

catatan :

$Z = 0,5 + j0,8$ SERI C (-j1,0) berlawanan arah jarum jam ref R tetap
 $Z = 0,2 + j0,2$ SERI L (+j0,6) searah jarum jam ref R tetap

$Y = 0,2 + j0,2$ PARALEL C (+j0,6) searah jarum jam ref G tetap

$Y = 0,2 - j0,2$ PARALEL L (-j0,6) berlawanan arah jarum jam ref G tetap

$$C_{\text{seri}} = \frac{1}{\omega X_N}$$

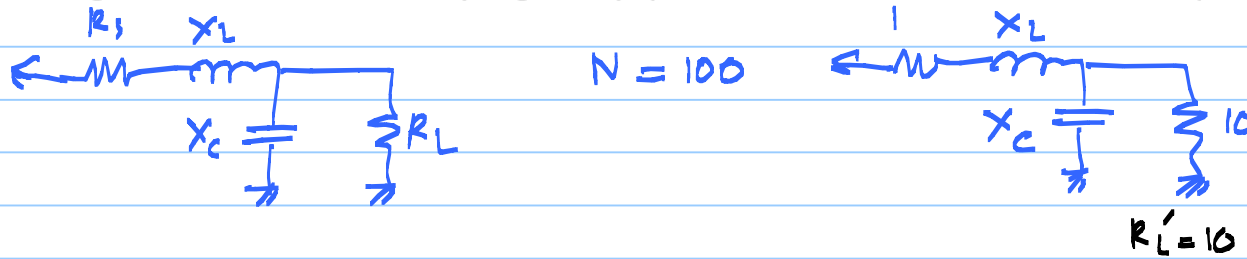
$$C_{\text{paralel}} = \frac{B}{\omega N}$$

$$L_{\text{seri}} = \frac{X_N}{\omega}$$

$$L_{\text{paralel}} = \frac{N}{\omega B}$$

Contoh :

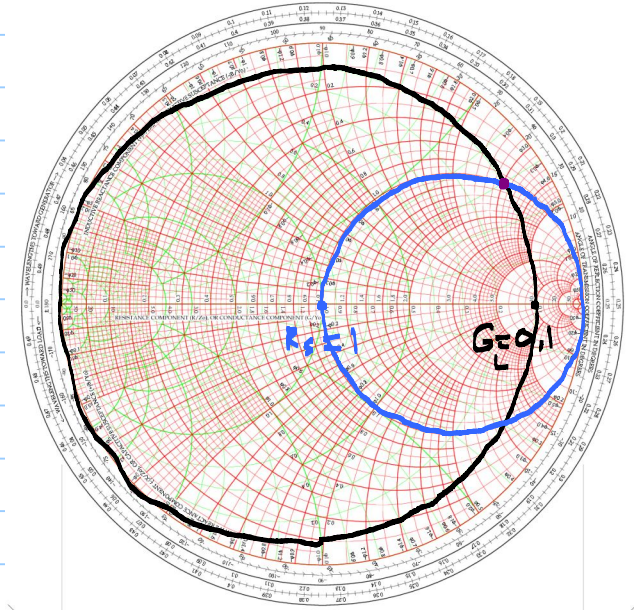
Rancang suatu IMC bentuk "L" yang menyepadankan $R_s = 100\Omega$ dan $R_L = 1K\Omega$ pada $f = 100\text{MHz}$, dengan sifat meloloskan sinyal DC.

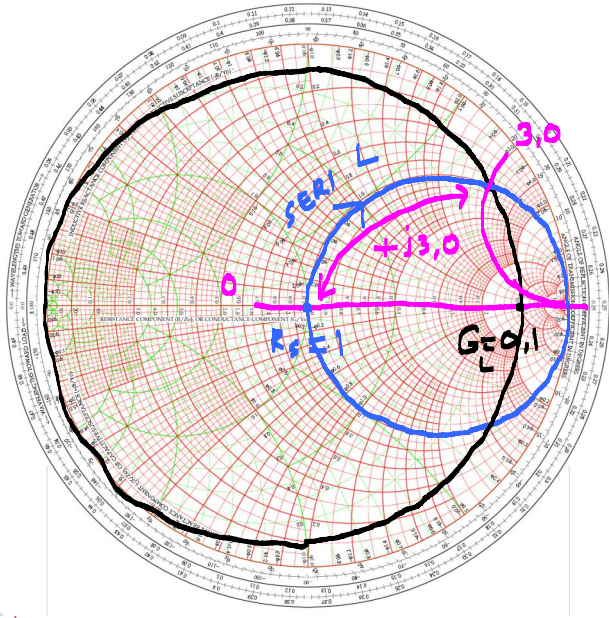


$$R'_L = 10$$
$$G'_L = \frac{1}{R'_L} = 0.1$$

Plot $R'_s = 1$ hasil normalisasi pada z chart (putar lingkaran $R=1$)
Plot $G'_L = 0.1$ hasil normalisasi pada Y chart (putar lingkaran $G=0.1$)

Mulai dari $R'_s = 1$ bertemu dengan SERI L (searah jarum jam dengan $R=1$ sebagai referensi) sampai titik pertemuan $R \& G$





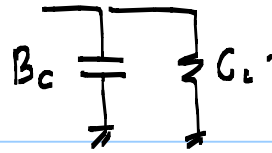
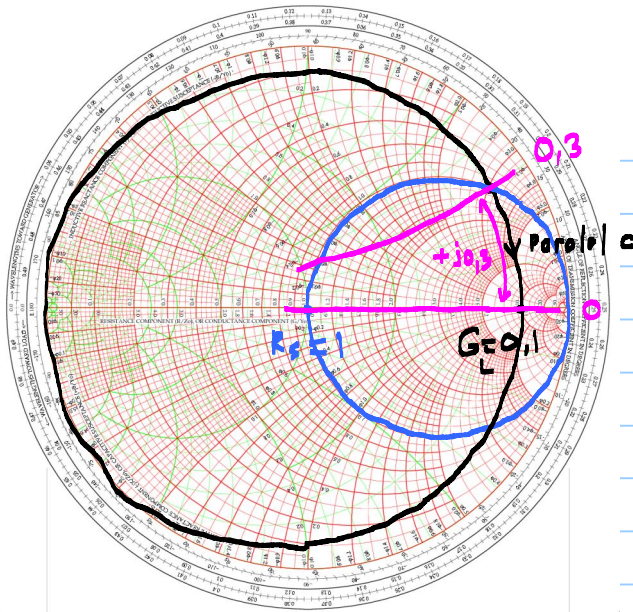
$$X_L = +j3,0$$

SERI L :

$$L = \frac{X_L}{\omega} = \frac{3 \cdot 100}{2\pi \cdot 100 \cdot 10^6}$$

$$L = 477 \text{ nH}$$

Dari titik pertemuan $R \& G$ bergerak ke beban $G_L = 0,1$ berputar sbg poros di G_L' karena paralel X_C searah jarum jam



$$B_c = +j0,3$$

Paralel c:

$$C = \frac{B}{\omega N} = \frac{0,3}{2\pi \cdot 100 \cdot 10^6 \cdot 100}$$

$$C = 4,8 \text{ pF}$$

Contoh :

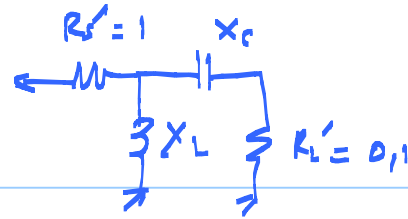
$$R_s = 100\Omega$$

$$R_L = 10\Omega$$

$$f = 10\text{MHz}$$

HPF

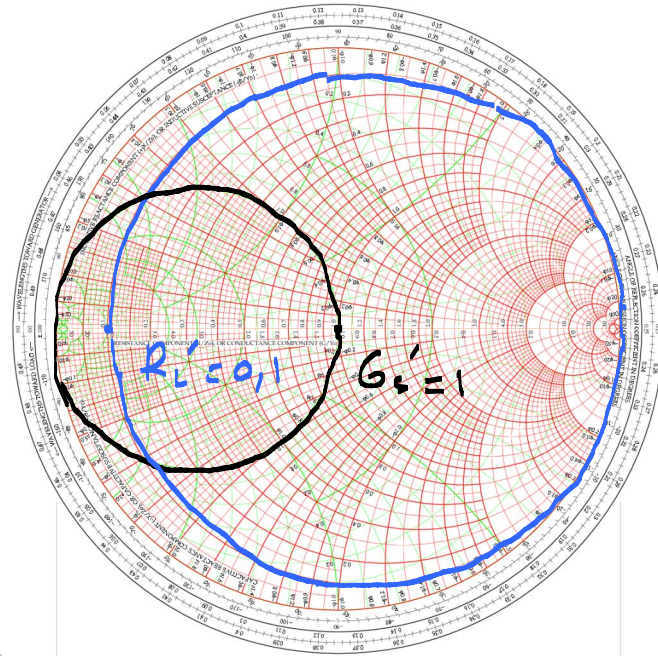
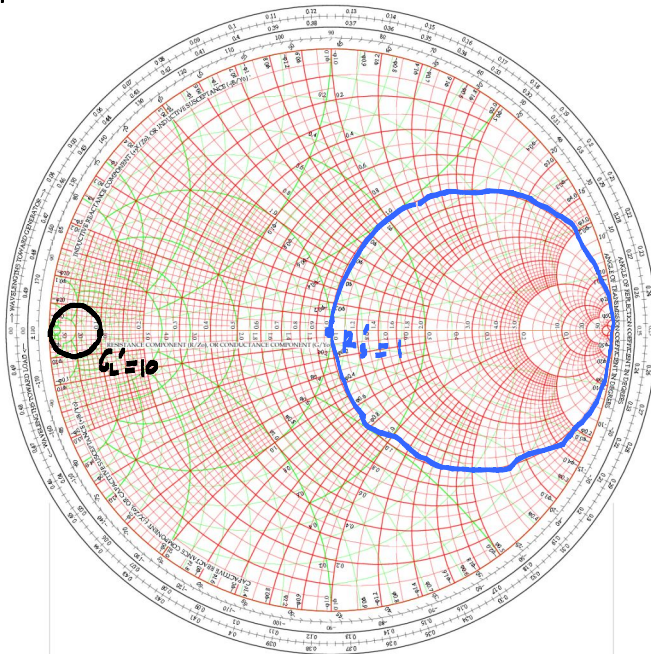
$$N = 100$$

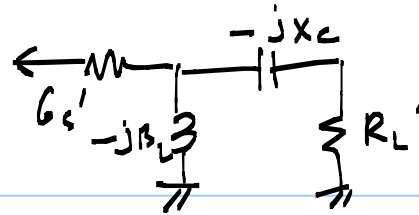


$$G_s' = 1$$

$$R_L' = 0,1$$

Jika
 $R_s' = 1$
 $G_L' = 10$
tidak akan
ketemu



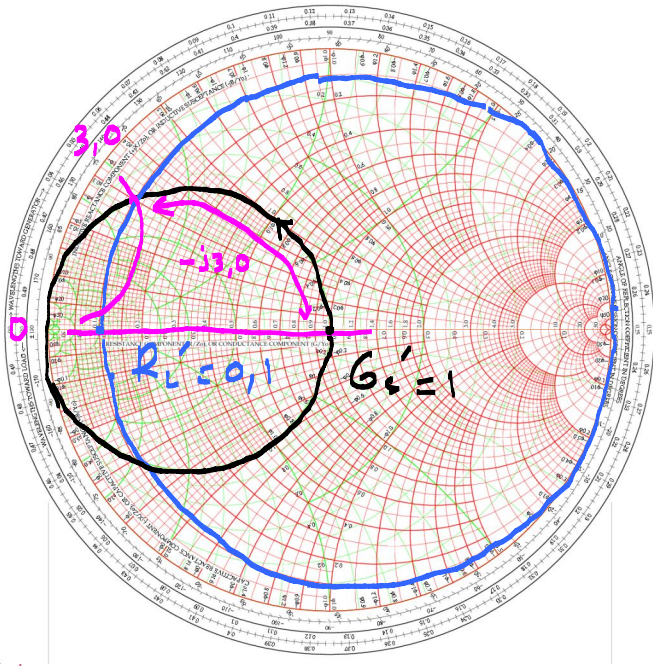


Dari titik $G_s' = 1$ paralel L
(berlawanan arah jarum jam)

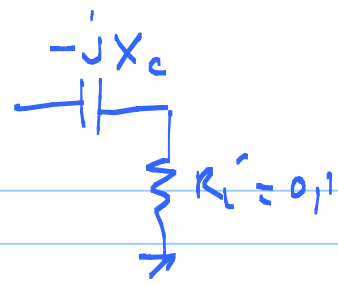
$$B_1 = -j3,0$$

$$L_{\text{paralel}} = \frac{N}{\omega B} = \frac{100}{2\pi \cdot 10 \cdot 10^6 \cdot 3}$$

$$L_{\text{paralel}} = 531 \text{ nH}$$



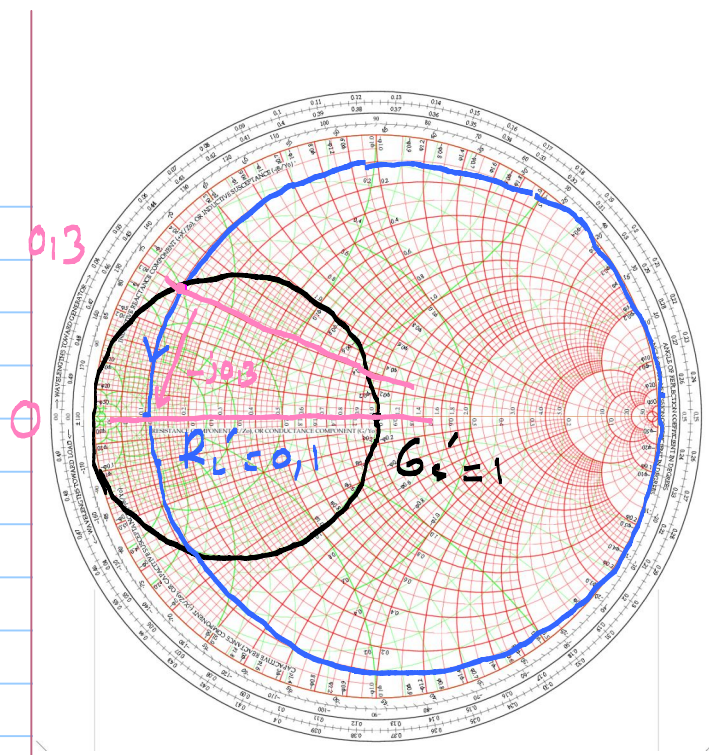
Dari titik pertemuan R & G menuju $R_L' = 0,1$
seri C (berlawanan arah jarum jam) dgn $R_L' = 0,1$
Sbg porosnya.



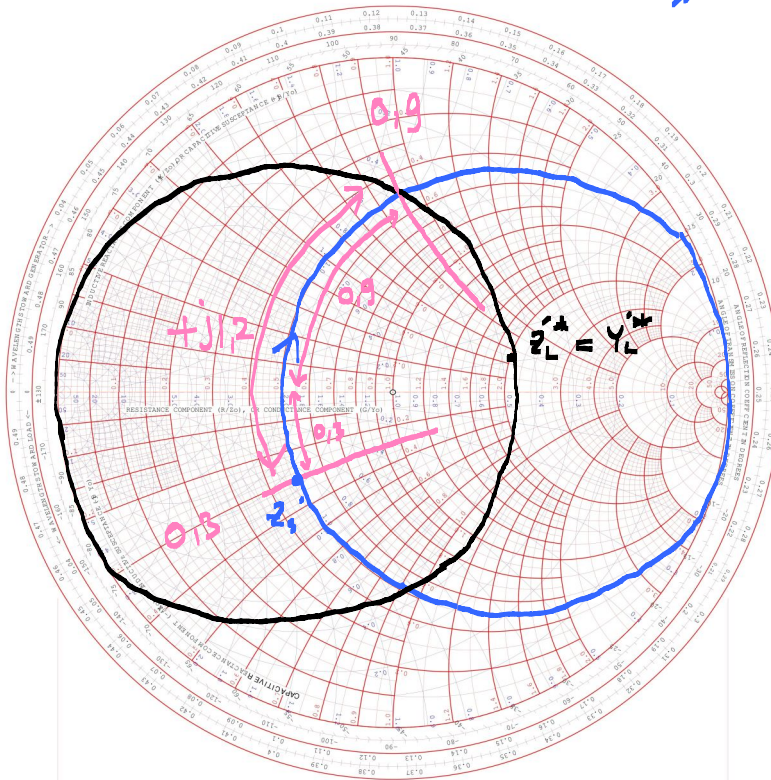
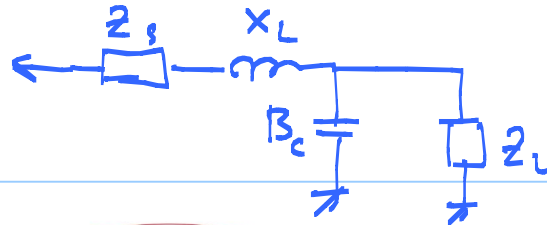
$$X_c \text{ ser1} = -j0,3$$

$$C_{\text{ser1}} = \frac{1}{\omega \times N} = \frac{1}{2\pi \cdot 10 \cdot 10^6 \cdot 0,3 \cdot 100}$$

$$C_{\text{ser1}} = 531 \text{ pF}$$



Rancanglah IMCL-
Network dengan Smith
Chart yang bisa
menyepadankan
sumber sebesar
 $25 - j15$ ohm dengan
beban $100 - j25$ ohm
pada 60 MHz dan IMC
harus bersifat LPF



$$N = 50$$

$$Z_s = 0,15 - j0,3$$

$$Z_L = 2 - j0,5$$

$$Z_L^* = 2 + j0,5$$

$$Y_L^* = 0,47 - j0,12$$

$$Z_s' \text{ seri dgn } L (+j1,2)$$

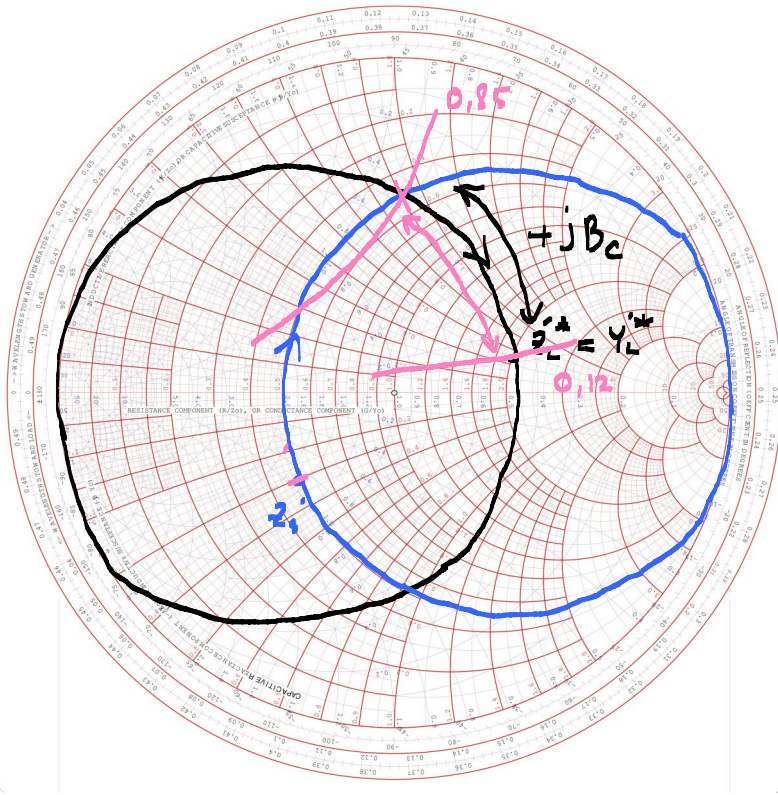
$$L_{\text{seri}} = \frac{X_N}{\omega} = \frac{1,2 \cdot 50}{2\pi \cdot 60 \cdot 10^6}$$

$$L_{\text{seri}} = 159 \text{ nH}$$

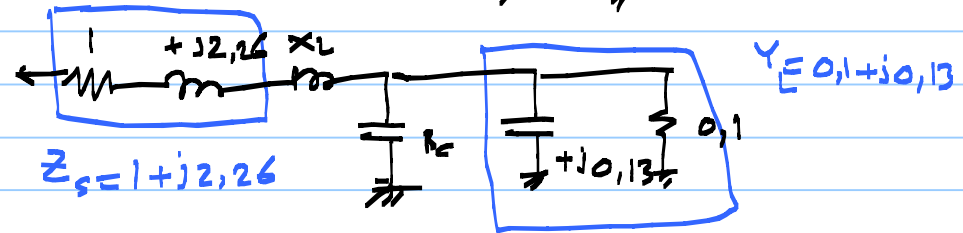
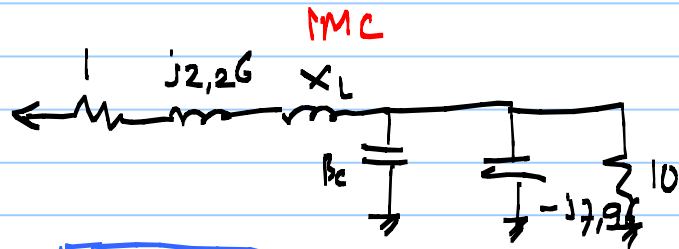
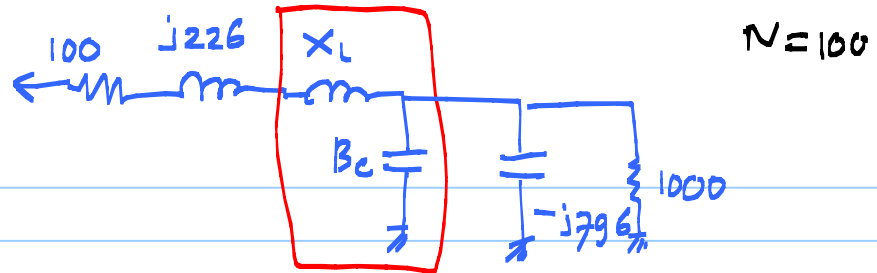
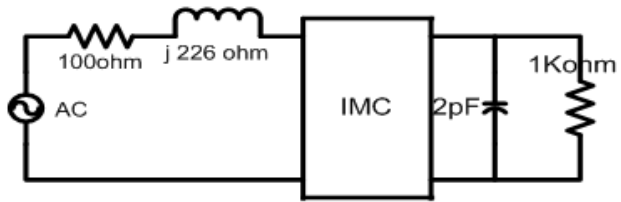
Parallel C (searah jarum jam)

$$B_c = 0,85 - 0,12 = +j0,73$$

$$C_{\text{parallel}} = \frac{B}{\omega N} = \frac{0,73}{2\pi \cdot 60 \cdot 10^6 \cdot 50} = 39 \text{ pF}$$



Dengan menggunakan [redacted] smith chart
 rancanglah IMC bentuk "L" pada 100MHz dengan sifat meloloskan sinyal DC
 pada rangkaian berikut:



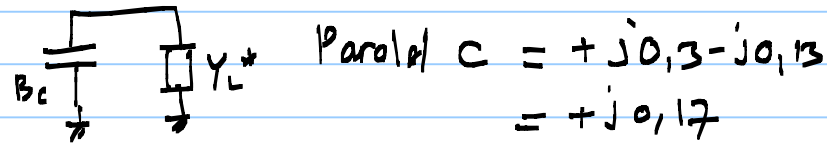
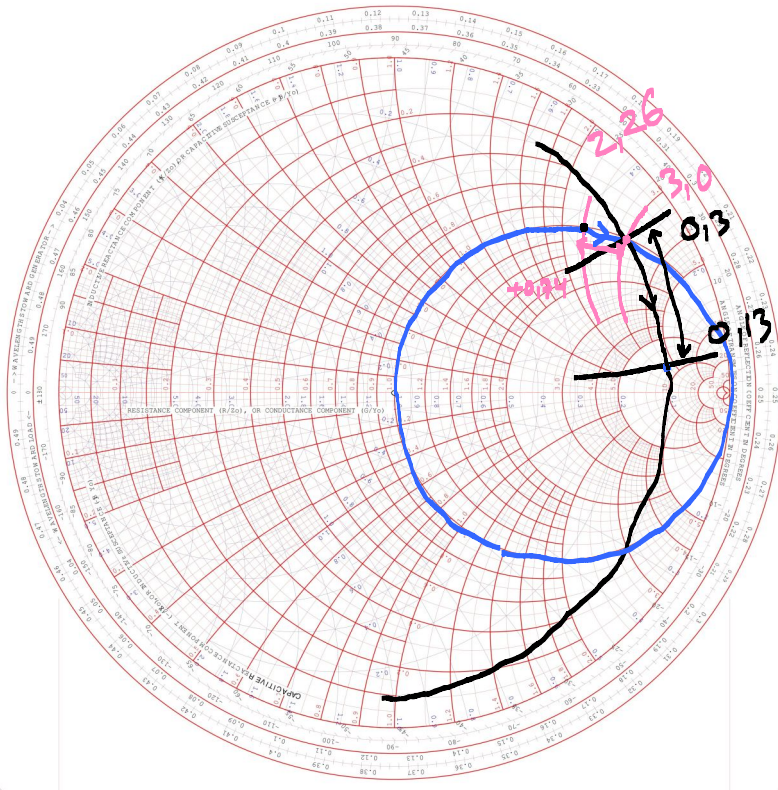
$$Z_s = 1 + j2,26$$

$$Y_L = 0,1 + j0,13 \Rightarrow Y_L^* = 0,1 - j0,13$$



$$\text{Som } L = +j3 - j2,26 = +j0,74$$

$$L_{\text{seri}} = \frac{X_N}{\omega} = \frac{0,74 \times 100}{2\pi \cdot 100 \cdot 10^6} = 117 \text{ nH}$$

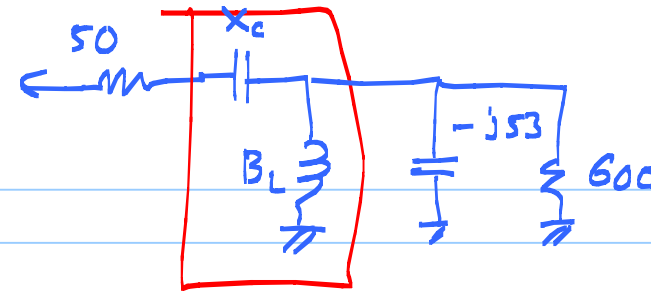
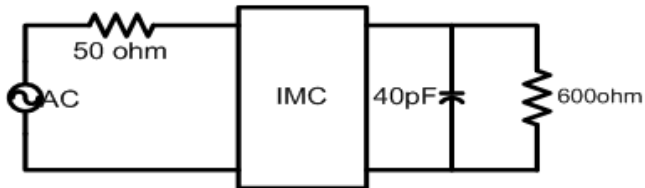


$$\text{Parallel } C = +j0,3 - j0,13 = +j0,17$$

$$C_{\text{paralel}} = \frac{B}{\omega N} = \frac{0,17}{2\pi \cdot 100 \cdot 10^6 \cdot 100} = 2,7 \text{ pF}$$

Rancanglah suatu IMC yang dapat memblock sinyal DC antara beban-sumber rangkaian dibawah ini, pada frekuensi operasi 75 MHz. Gunakan [redacted].

smith chart

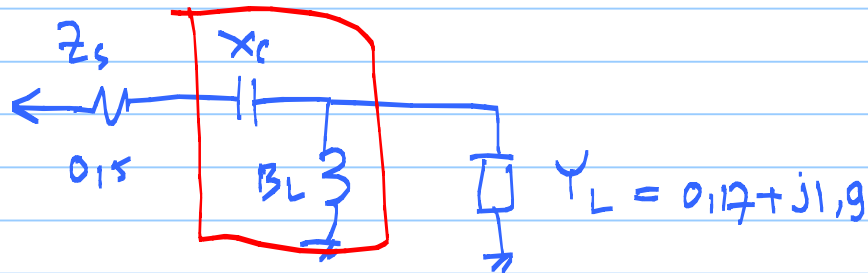


$$X_c = \frac{-j}{\omega C}$$

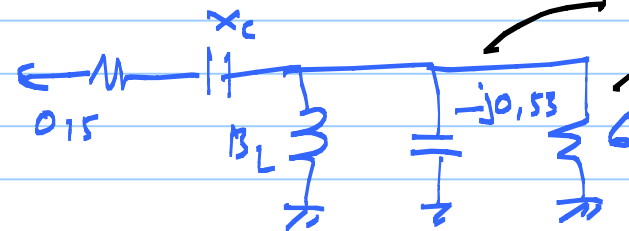
$$= \frac{-j}{2\pi \cdot 75 \cdot 10^6 \cdot 40 \cdot 10^{-12}}$$

$$= -j53$$

Solusi:



$$N = 100$$

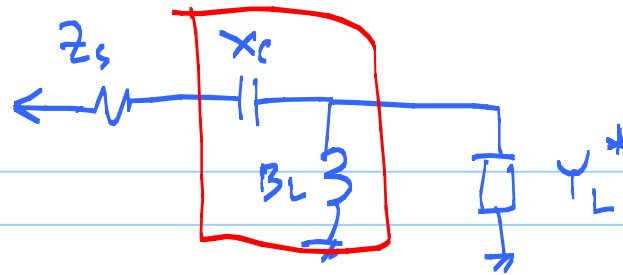
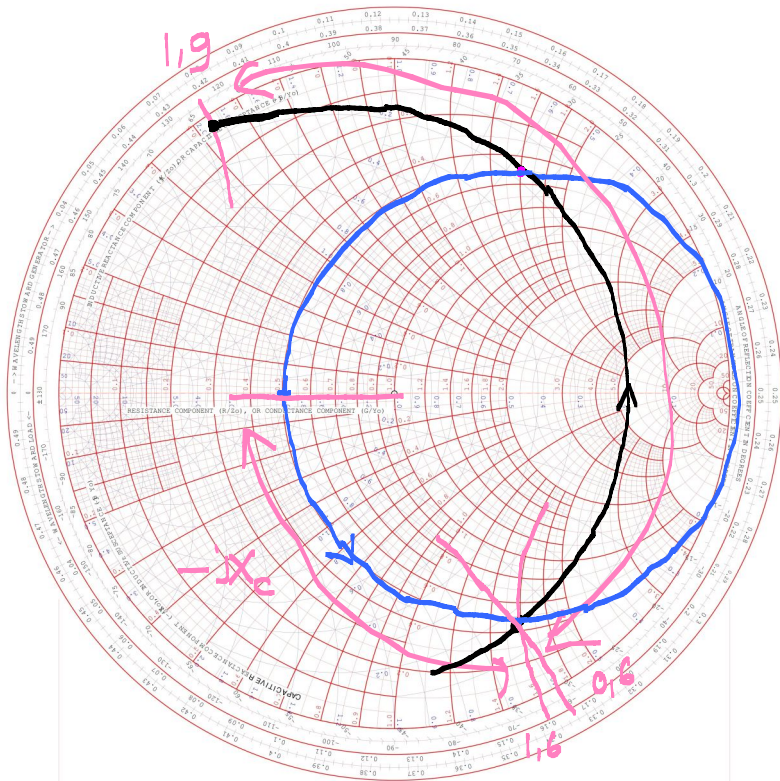


$$B_c = \frac{1}{-j0,153} = +j1,9$$

$$G = \frac{1}{6} = 0,17$$

$$Z_s = 0,15$$

$$Y_L = 0,17 + j1,9 \Rightarrow Y_L^* = 0,17 - j1,9$$



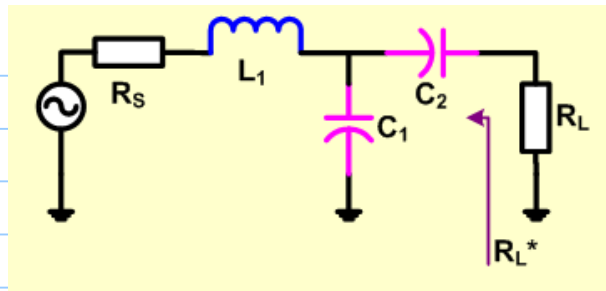
$$\text{Series C} \Rightarrow X_c = 0 + (-j1,6) = -j1,6$$

$$C_{\text{series}} = \frac{1}{\omega X_c} = \frac{1}{2\pi \cdot 75 \cdot 10^6 \cdot 1,6 \cdot 100} = 13,3 \text{ pF}$$

$$\text{Parallel L} \Rightarrow B_L = 0,6 + 1,9 = 2,5$$

$$L_{\text{parallel}} = \frac{N}{\omega B} = \frac{100}{2\pi \cdot 75 \cdot 10^6 \cdot 2,5} = 84,9 \text{ nH}$$

Rancanglah IMC T section dimana $R_s = 0,4 - j0,2$ dan $R_L = 1 - j0,2$ pada $Q = 2$



$$R_s = 0,4 - j0,2$$

$$R_L^* = 1 + j0,2$$

$$Q = 2 \rightarrow Q = \frac{R}{X}$$

$$10 \pm j20$$

$$5 \pm j10$$

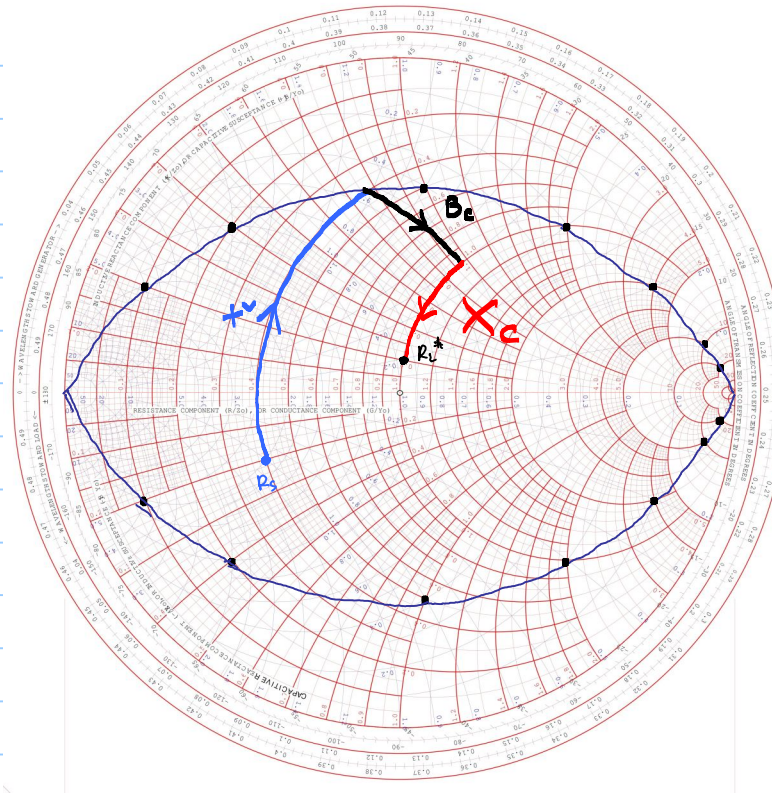
$$2 \pm j4$$

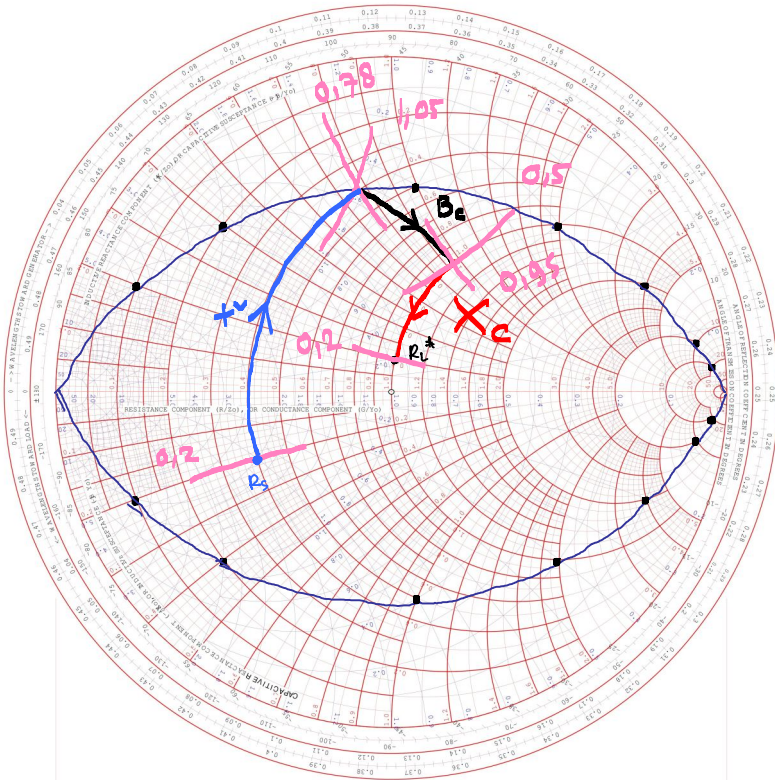
$$1 \pm j2$$

$$0,5 \pm j1$$

$$0,2 \pm j0,4$$

$$0,1 \pm j0,2$$

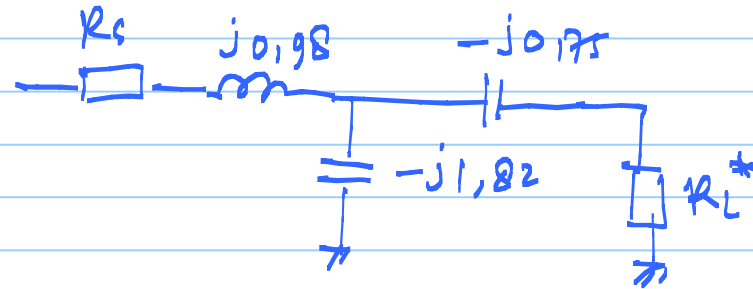




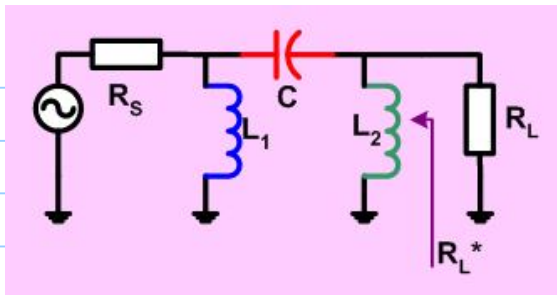
$$L \text{ seri} \Rightarrow X_L = 0,2 + j0,78 = j0,98$$

$$C \text{ paralel} \Rightarrow B_C = 1,05 - 0,5 = +j0,55$$

$$C \text{ seri} \Rightarrow X_C = 0,95 - 0,2 = -j0,75$$

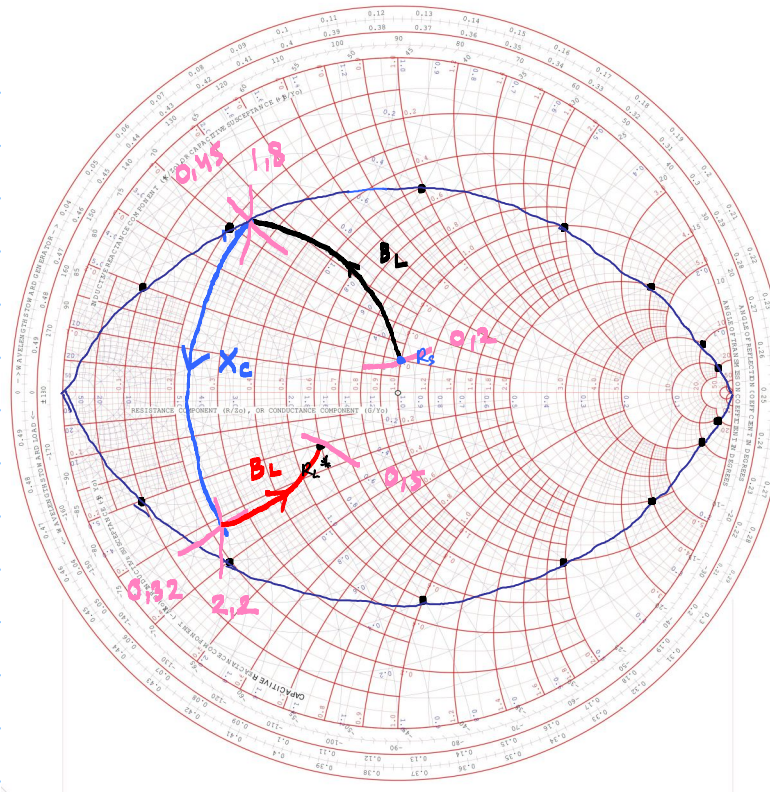
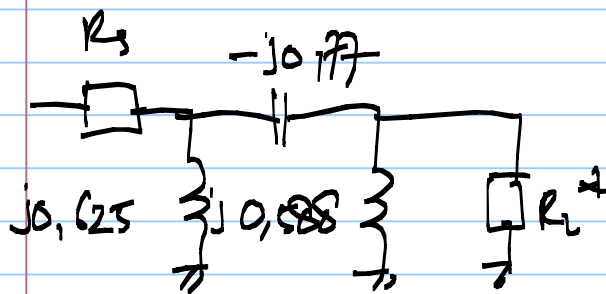


Rancanglah IMC π section dgn $R_s = 1 + j0,2$ dan $R_L = 0,6 + j0,2$ pd $\alpha = 2$



$$R_s = 1 + j0,2$$

$$R_L^* = 0,6 - j0,2$$



$$L_{\text{paralel}} = 1,8 - 0,2$$

$$B_{L_1} = -j1,6$$

$$C_{\text{seri}} = 0,45 + 0,32$$

$$= 0,77$$

$$X_c = -j0,77$$

$$L_{\text{paralel}} = 2,2 - 0,15$$

$$B_{L_2} = -j1,7$$

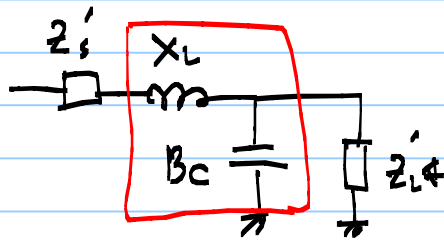
1. Rancanglah suatu IMC dua elemen yang menyepadankan beban $Z_L = 200 - j100 \Omega$ dan saluran transmisi dengan $Z_0 = 100 \Omega$ pada frekuensi kerja 500 MHz

$$Z_s = 100 \quad R_s < R_L \rightarrow \text{IMC L kiri}$$

$$Z_L = 200 - j100 \quad N = 100$$

$$Z_s' = 1$$

$$Z_L' = 2 - j \Rightarrow Z_L'^* = 2 + j$$



$$X_L \text{ seri} = 1,24 - 0 = +j1,24$$

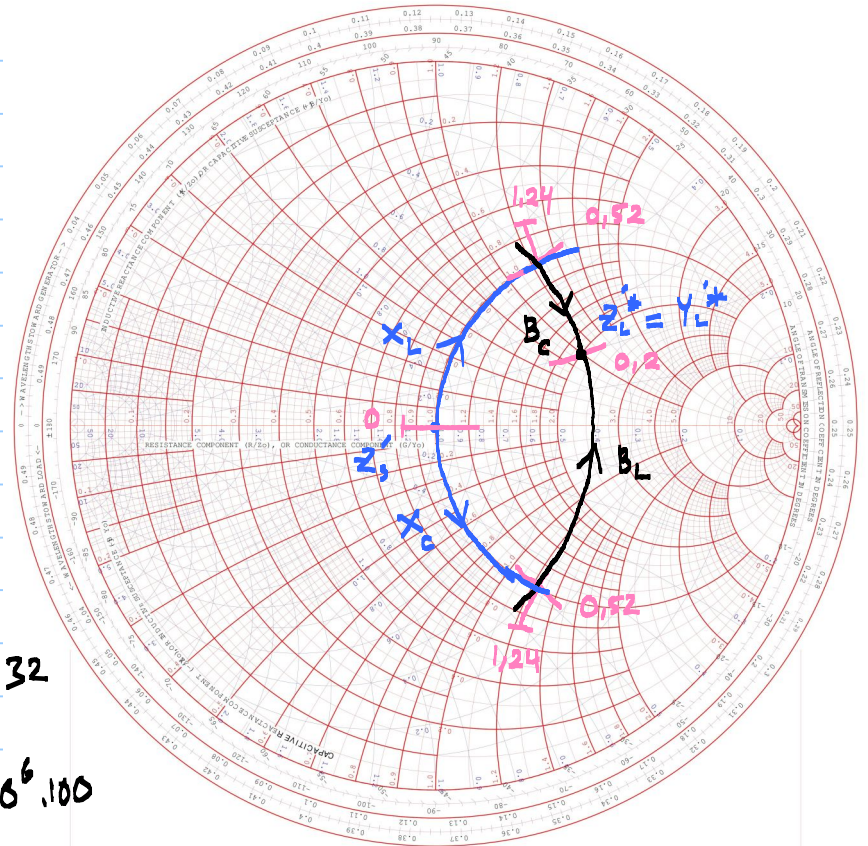
$$L \text{ seri} = \frac{X N}{\omega} = \frac{1,24 \cdot 100}{2\pi \cdot 500 \cdot 10^6}$$

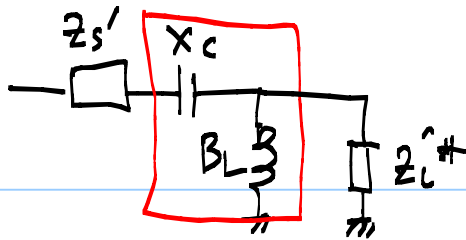
$$L \text{ seri} = 39,5 \text{ nH}$$

$$B_C \text{ paralel} = 0,52 - 0,2 = +j0,32$$

$$C \text{ paralel} = \frac{B}{\omega N} = \frac{0,32}{2\pi \cdot 500 \cdot 10^6 \cdot 100}$$

$$C \text{ paralel} = 1,02 \text{ pF}$$





$$X_{c \text{ seri}} = 0 - 1,24 = -j1,24$$

$$C_{\text{seri}} = \frac{1}{\omega \times X_c} = \frac{1}{2\pi \cdot 500 \cdot 10^6 \cdot 1,24 \cdot 100^{-6}}$$

$$C_{\text{seri}} = 2,57 \text{ pF}$$

$$B_{L \text{ paralel}} = 0,52 + 0,2 = -j0,72$$

$$L_{\text{paralel}} = \frac{N}{\omega B} = \frac{100}{2\pi \cdot 500 \cdot 10^6 \cdot 0,72}$$

$$L_{\text{paralel}} = 44,2 \text{ nH}$$

- Rancanglah IMC 2-elemen dengan Smith Chart yang bisa menyepadankan sumber sebesar $25 - j15$ ohm dengan beban $100 - j25$ ohm pada 60 MHz dan IMC harus bersifat LPF

$$Z_s = 25 - j15$$

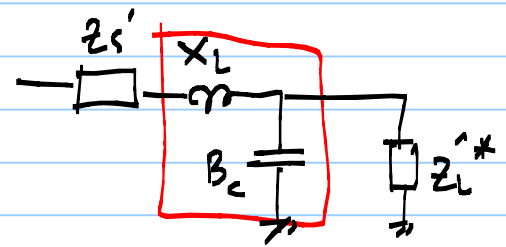
$$Z_L = 100 - j25$$

$R_s < R_L \rightarrow$ IMC L kiri LPF

$$N = 100 \rightarrow Z_s' = 0,25 - j0,15$$

$$Z_L' = 1 - j0,25$$

$$Z_L'^* = 1 + j0,25$$



$$X_{L\text{ seri}} = 0,15 + 0,45 = +j0,6$$

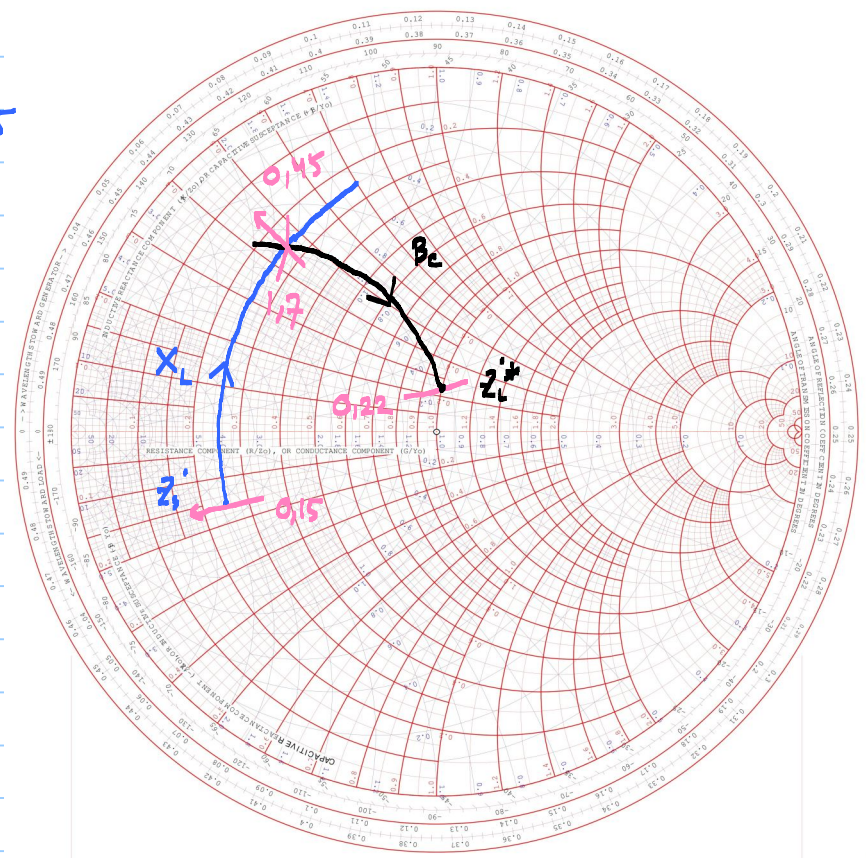
$$L_{\text{seri}} = \frac{XN}{\omega} = \frac{0,6 \cdot 100}{2\pi \cdot 60 \cdot 10^6}$$

$$L_{\text{seri}} = 159,2 \text{ nH}$$

$$B_{\text{c paralel}} = 1,7 - 0,22 = +j1,48$$

$$C_{\text{paralel}} = \frac{B}{\omega N} = \frac{1,48}{2\pi \cdot 60 \cdot 10^6 \cdot 100}$$

$$C_{\text{paralel}} = 39,9 \text{ pF}$$



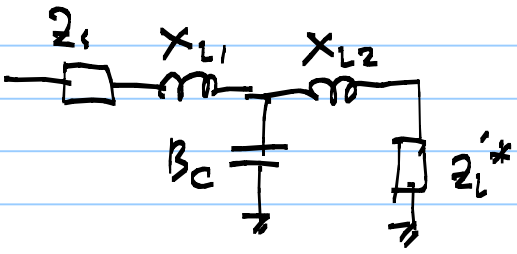
3. Rancanglah IMC T-section dengan Smith Chart yang menyepadankan sumber sebesar $15 + j15 \Omega$ dengan beban 225Ω pada frekuensi 30 MHz dengan faktor kualitas $Q = 5$!

$$Z_s = 15 + j15 \quad N = 100 \quad Z_s' = 0,15 + j0,15$$

$$Z_L = 225 \quad Z_L' = 2,25$$

$$Z_L^* = 2,25$$

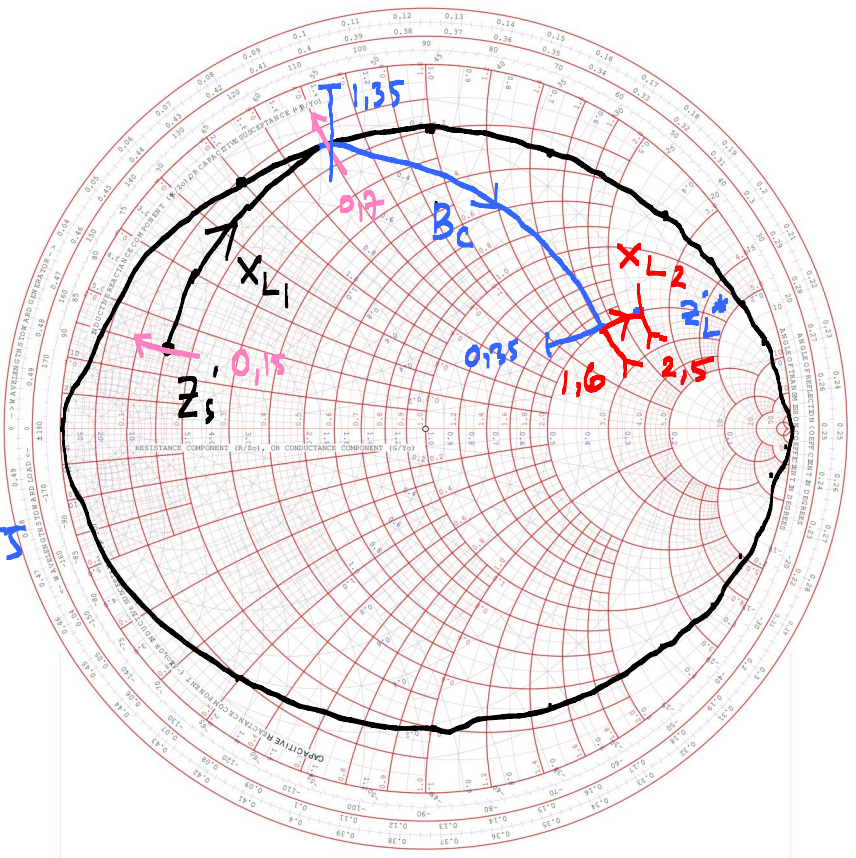
$Q = 5$	
$Q = \frac{R}{X}$	
$R \pm jX$	
$10 \pm j50$	$0,2 \pm j1$
$5 \pm j25$	$0,1 \pm j0,5$
$3 \pm j15$	$0,06 \pm j0,3$
$2 \pm j10$	$0,04 \pm j0,2$
$1,4 \pm j7$	$0,028 \pm j0,14$
$1 \pm j5$	$0,02 \pm j0,1$



$$X_{L1 \text{ seri}} = 0,7 - 0,15 = +j0,55$$

$$L_{\text{seri}} = \frac{XN}{\omega} = \frac{0,55 \cdot 100}{2\pi \cdot 30 \cdot 10^6}$$

$$L_{\text{seri}} = 292 \text{ nH}$$



$$B_{\text{parallel}} = 1,35 - 0,35 = +j$$

$$C_{\text{parallel}} = \frac{B}{\omega N} = \frac{1}{2\pi \cdot 30 \cdot 10^6 \cdot 100} = 53,1 \text{ pF}$$

$$X_{L2 \text{ seri}} = 2,5 - 1,6 = j0,9$$

$$L_{2 \text{ seri}} = \frac{X_N}{\omega} = \frac{0,9 \times 100}{2\pi \cdot 30 \cdot 10^6} = 477,5 \text{ nH}$$