Bredbåndstilpasning og antenne Q

OZ9AU

Anvendte programmer

MMANA-GAL: hamsoft.ca

Smith 4.1: www.fritz.dellsperger.net

Smith Chart 3.0: www.iowahills.com/

Autodesk Eagle: www.autodesk.com/products/eagle/free-download

Bredbåndstilpasning og antenne Q

Hvad betyder noget?

Antennens Q

ZL= r +jX Ω

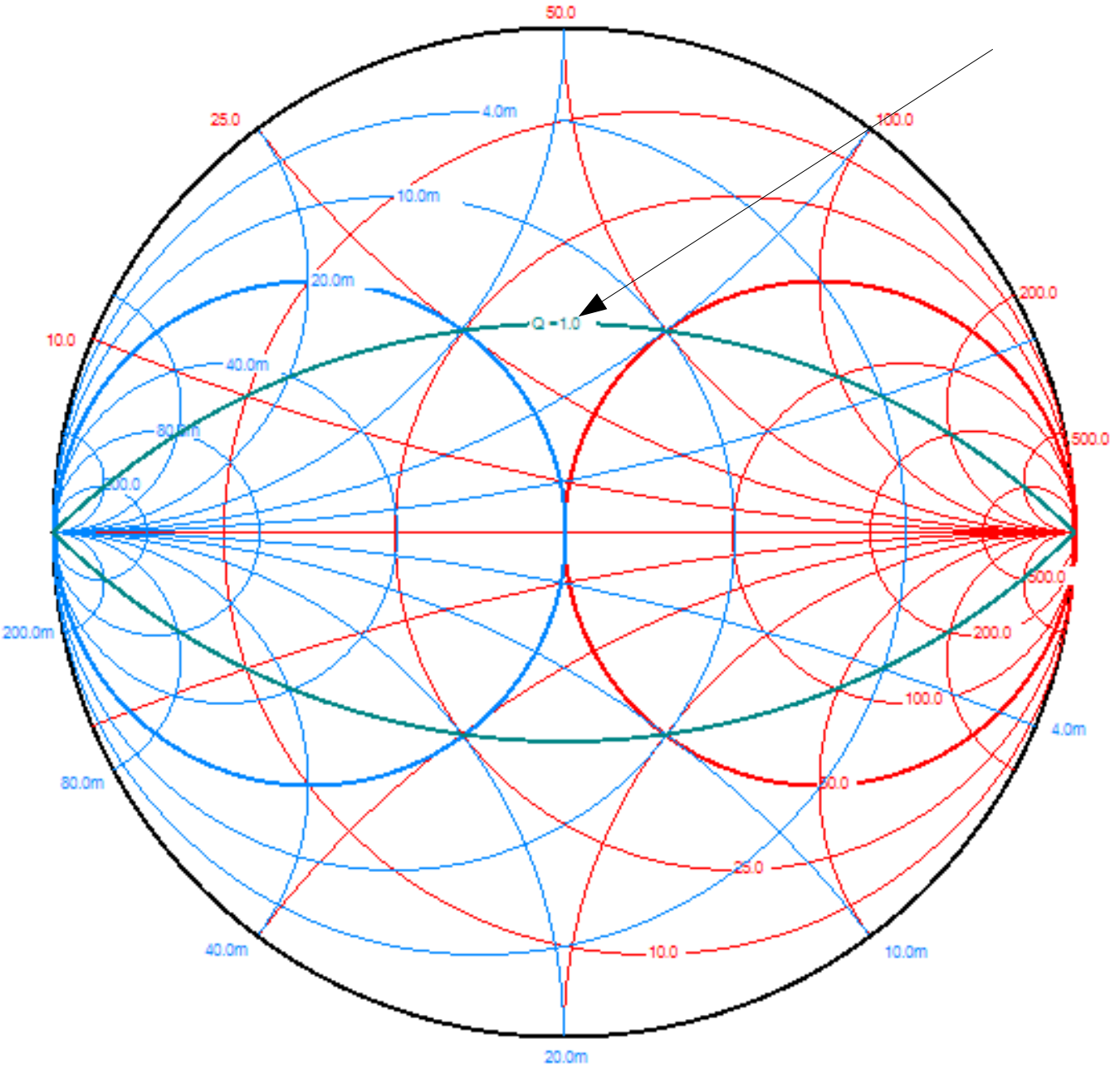
$$Q = \frac{X}{r}$$

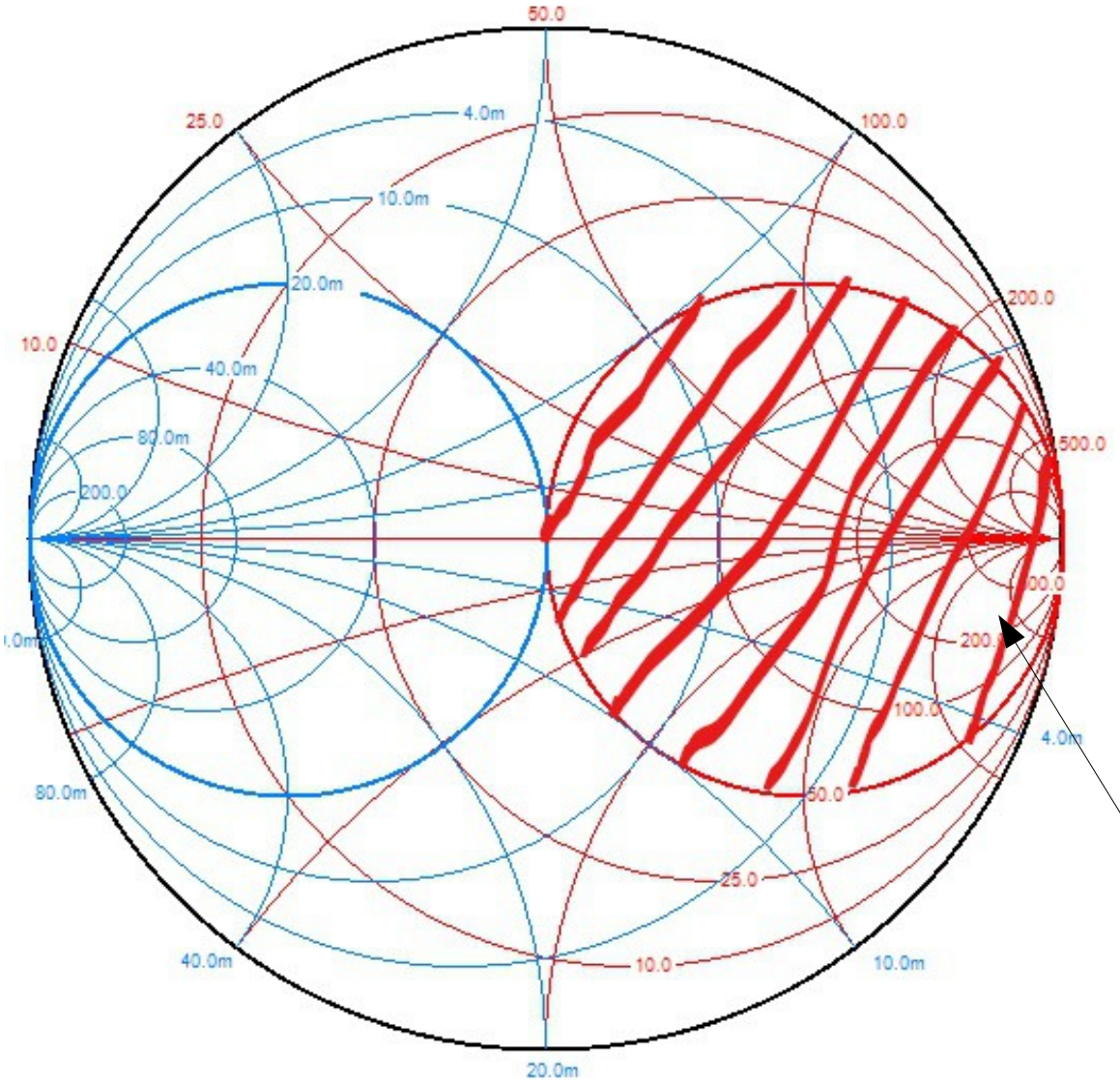
50 + j100 Q=2
200 -j300 Q=1,5
10 -j100 Q=10

Q under 1 er bedst

Antenne Q

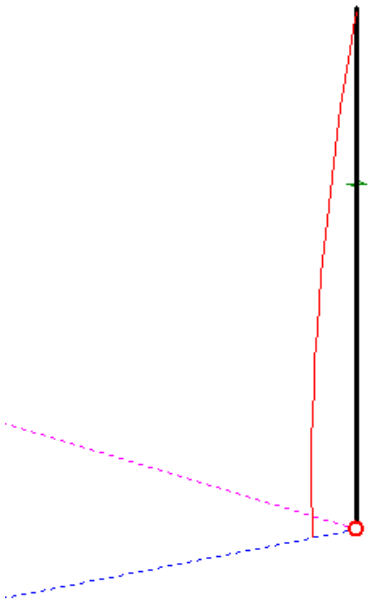
Q cirkel på 1



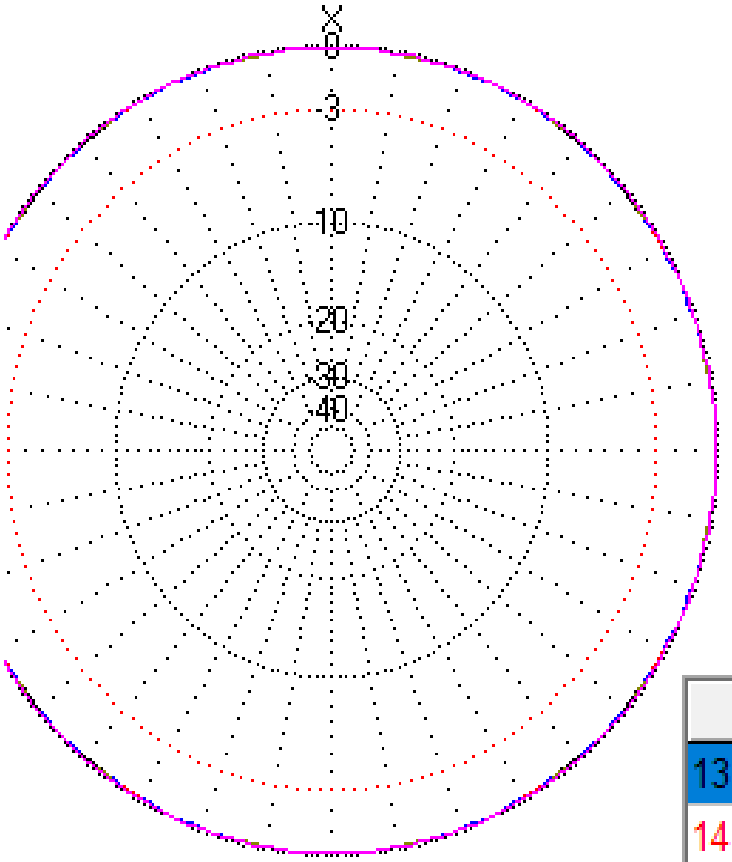


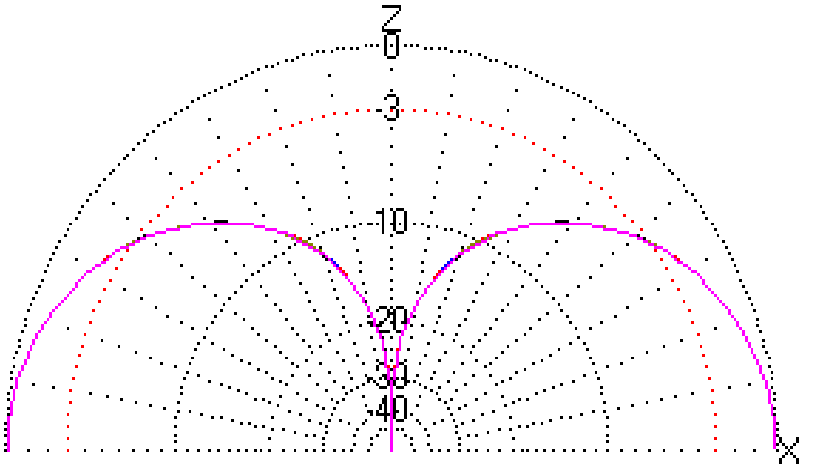
Hvis RL er større end Z0

14 Mhz. Forlænget 1/4 λ 5.56m
ZL= 50 +j51.3 Ω. Q= 1.03



SWR | Gain/FB | Far fields | Setup





5.2(dBi) = 0dB

Colours

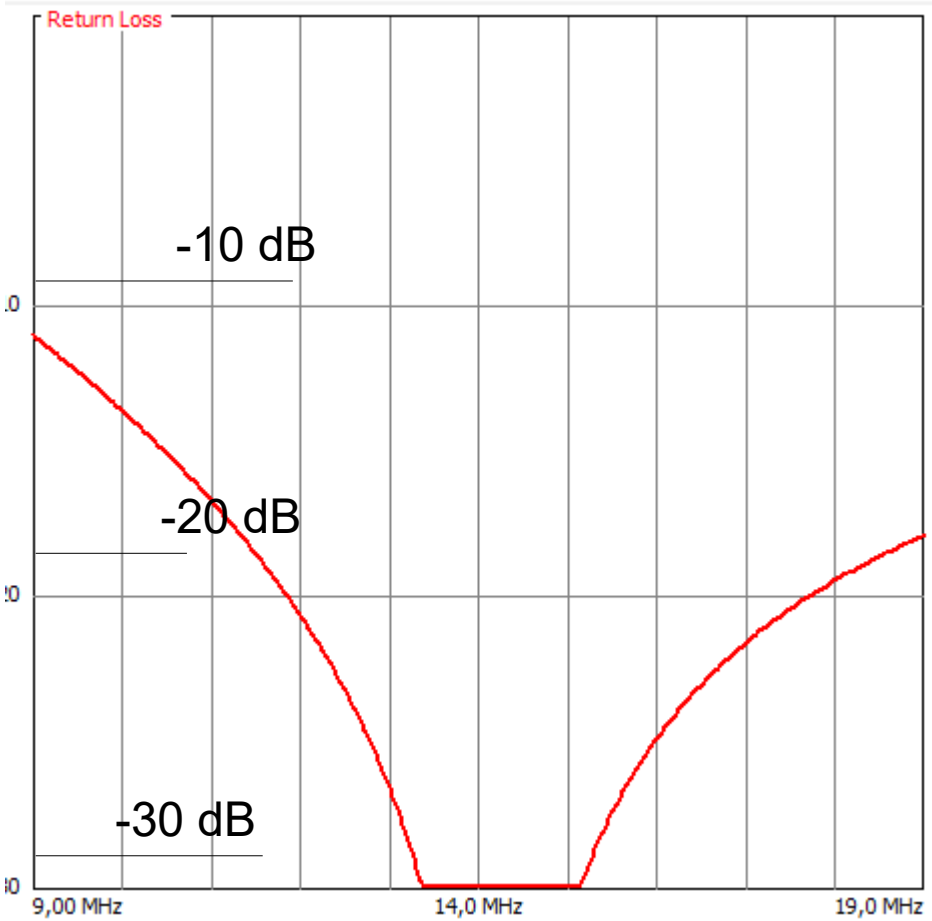
s)

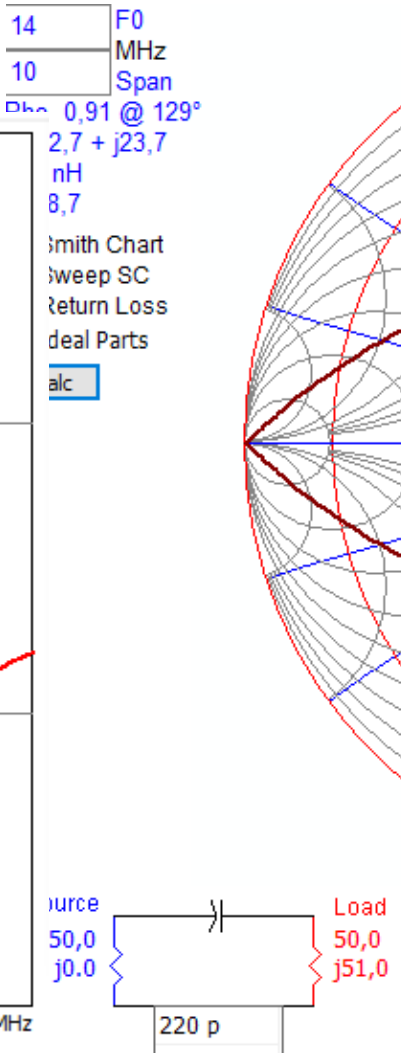
H Total V+H

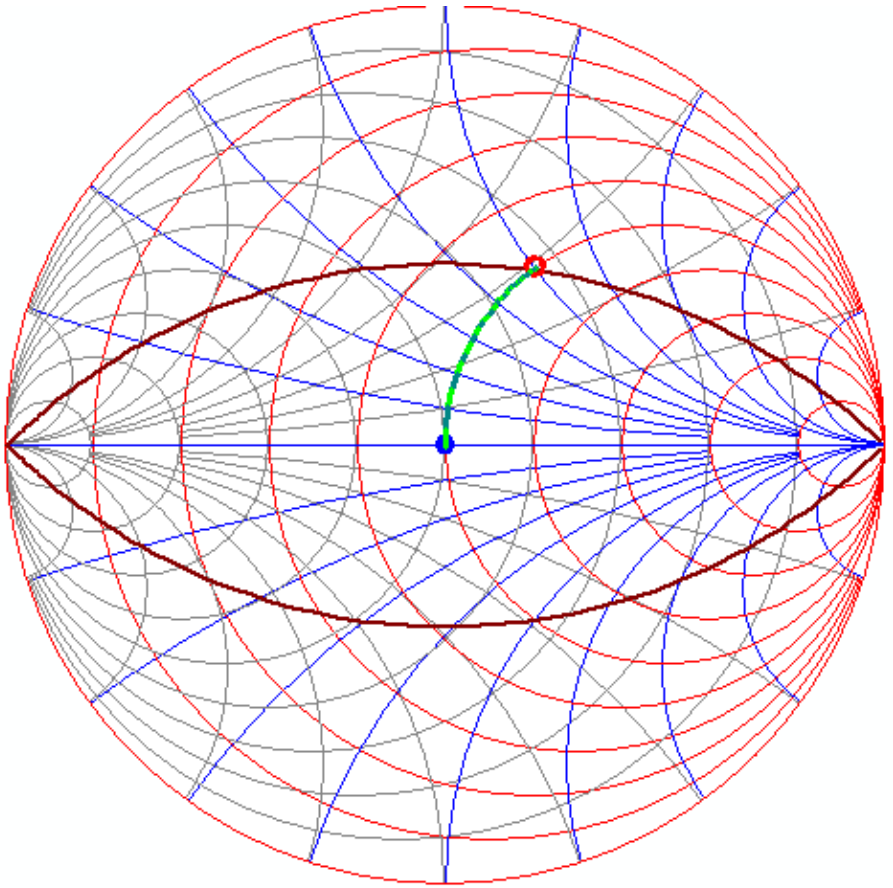
Freq	R	jX	Ga	F/B	ON
13.95	47.4	42.8	5.2	0.0	On
14.05	48.7	47.1	5.2	0.0	On
14.15	50.0	51.3	5.2	0.0	On
14.25	51.4	55.5	5.2	0.0	On
14.35	52.8	59.8	5.2	0.0	On

14 Mhz. Forlænget 1/4 λ 5.56m
ZL= 50 +j51.3 Ω. Q= 1.03

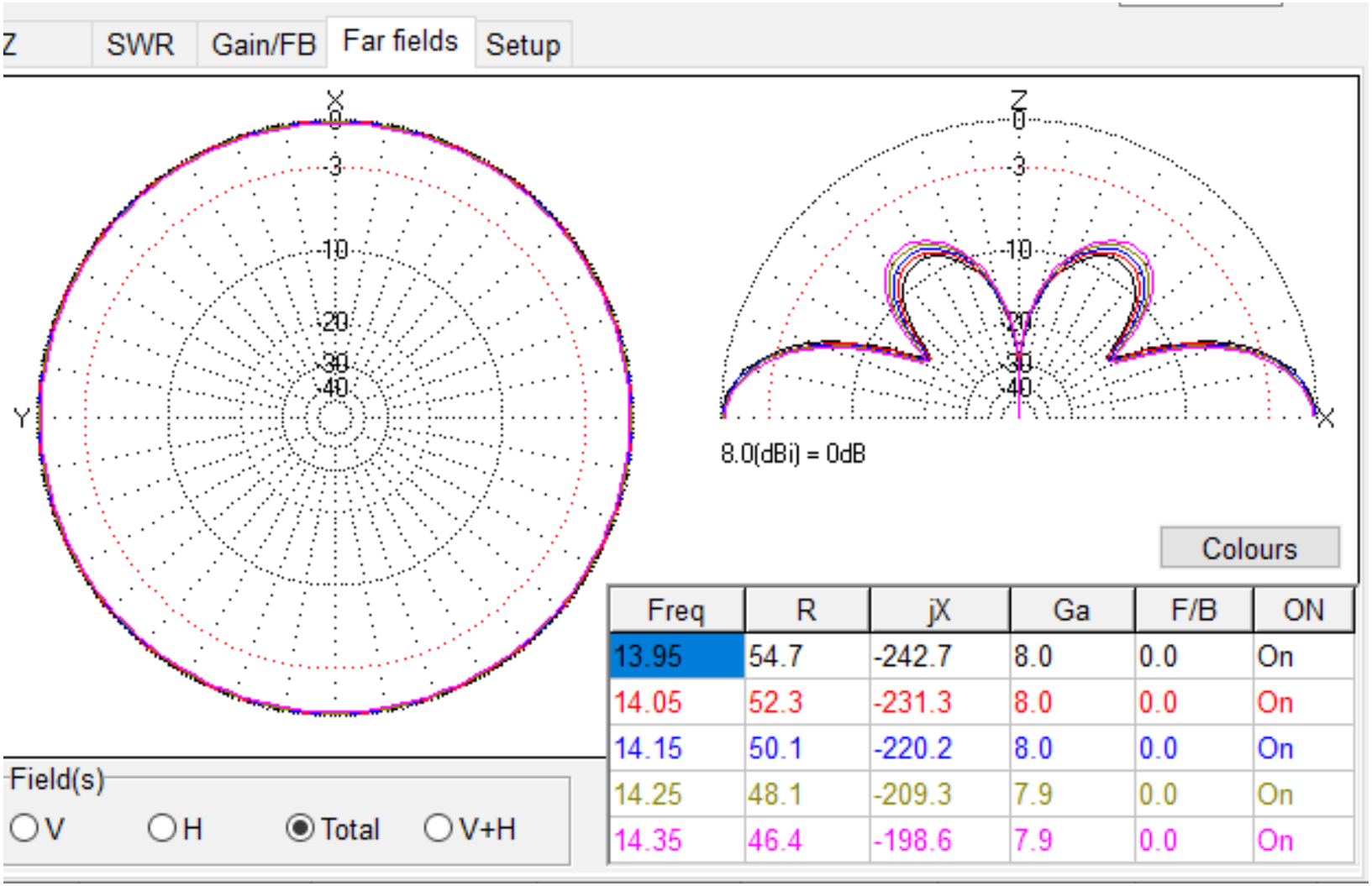
Return Loss
-10 dB, SWR=1.9
-20 dB, SWR=1.22
-30 dB, SWR= 1.06





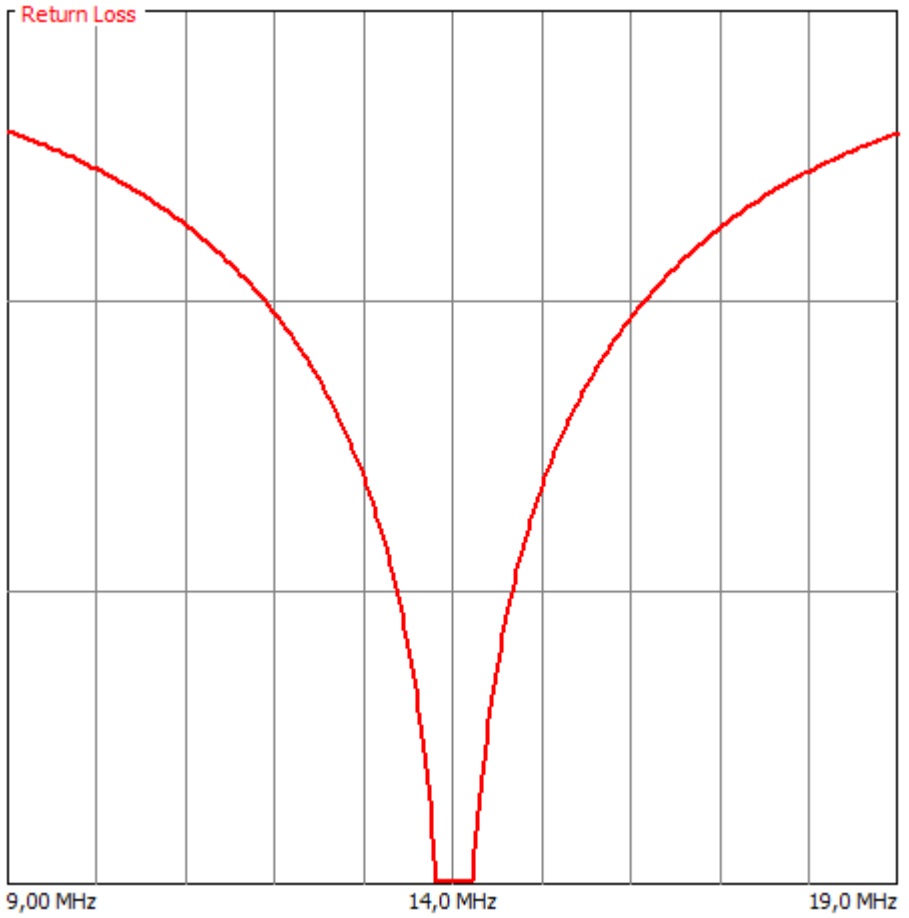


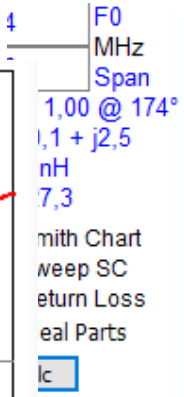
14 Mhz. 5/8 λ, 13.51m
ZL= 50.1 -j220 Ω. Q= 4.4

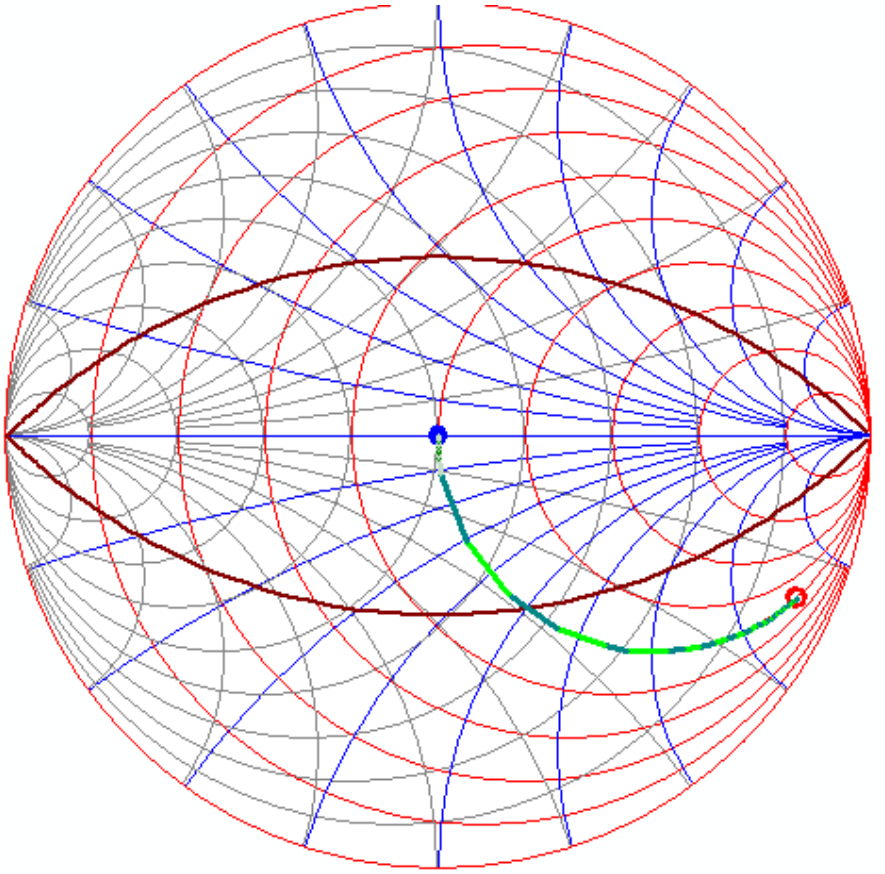


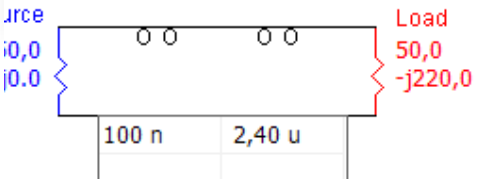
Freq	R	jX	Ga	F/B	ON
13.95	54.7	-242.7	8.0	0.0	On
14.05	52.3	-231.3	8.0	0.0	On
14.15	50.1	-220.2	8.0	0.0	On
14.25	48.1	-209.3	7.9	0.0	On
14.35	46.4	-198.6	7.9	0.0	On

14 Mhz. 5/8 λ, 13.51m
ZL= 50.1 -j220 Ω. Q= 4.4





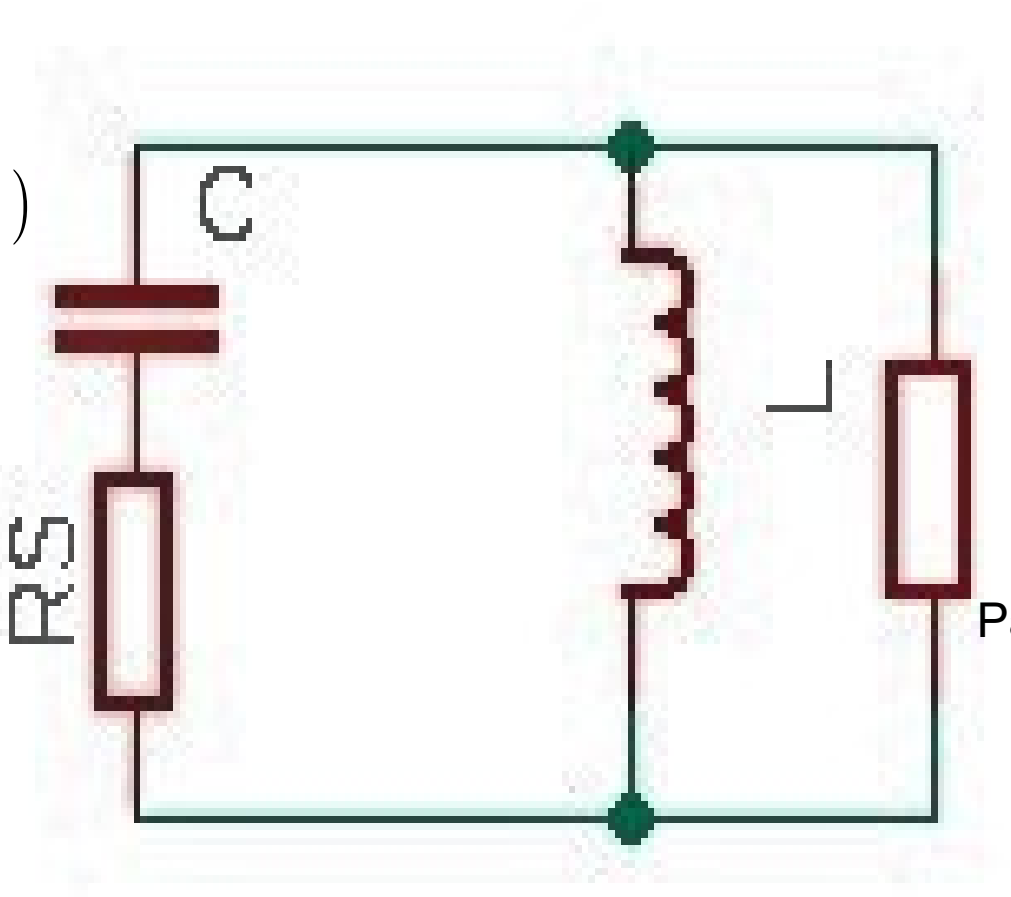




LC tilpasning

$$Q = \sqrt{\frac{R_P}{r_s} - 1}$$

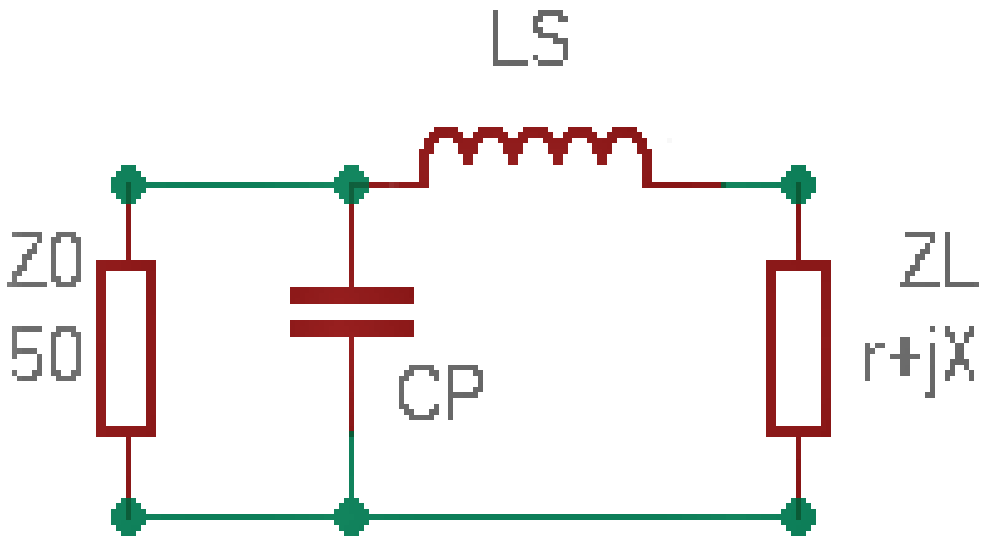
$$R_P = r_s * (Q^2 + 1)$$

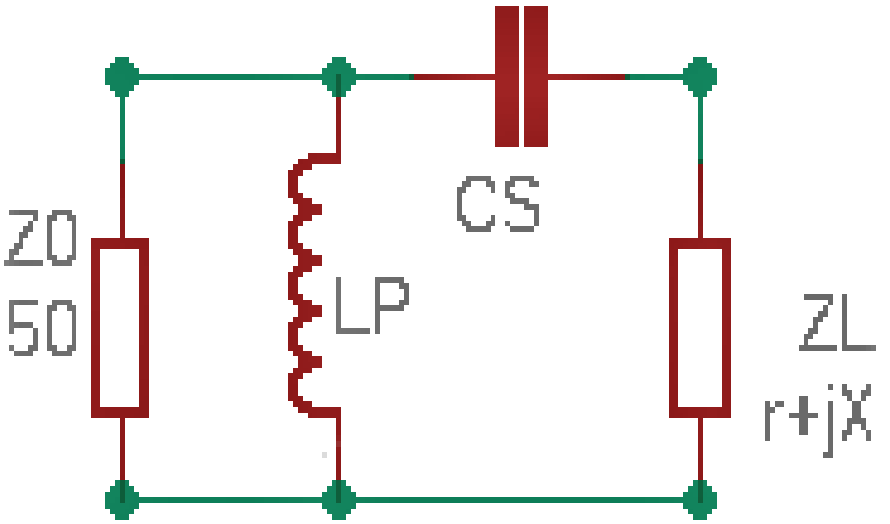


Serie tabsmodstand

Parallel tabsmodstand

Omregn fra serie til parallel eller omvendt





Høj til lav

Høj til lav

Lav til Høj

Lav til Høj

- Beregn Lp, Ls, Cp og Cs vha Q

$$\grave{Q} = \sqrt{\frac{Rp}{rs} - 1}$$

$$Ls = \frac{\grave{Q} \cdot Rs}{\omega}$$

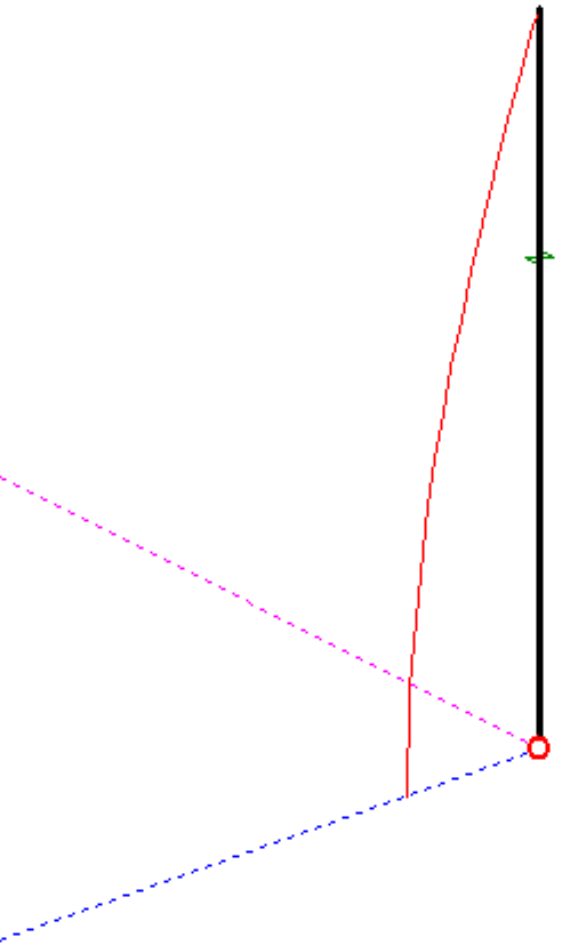
$$Cs = \frac{1}{\omega \cdot \grave{Q} \cdot Rs}$$

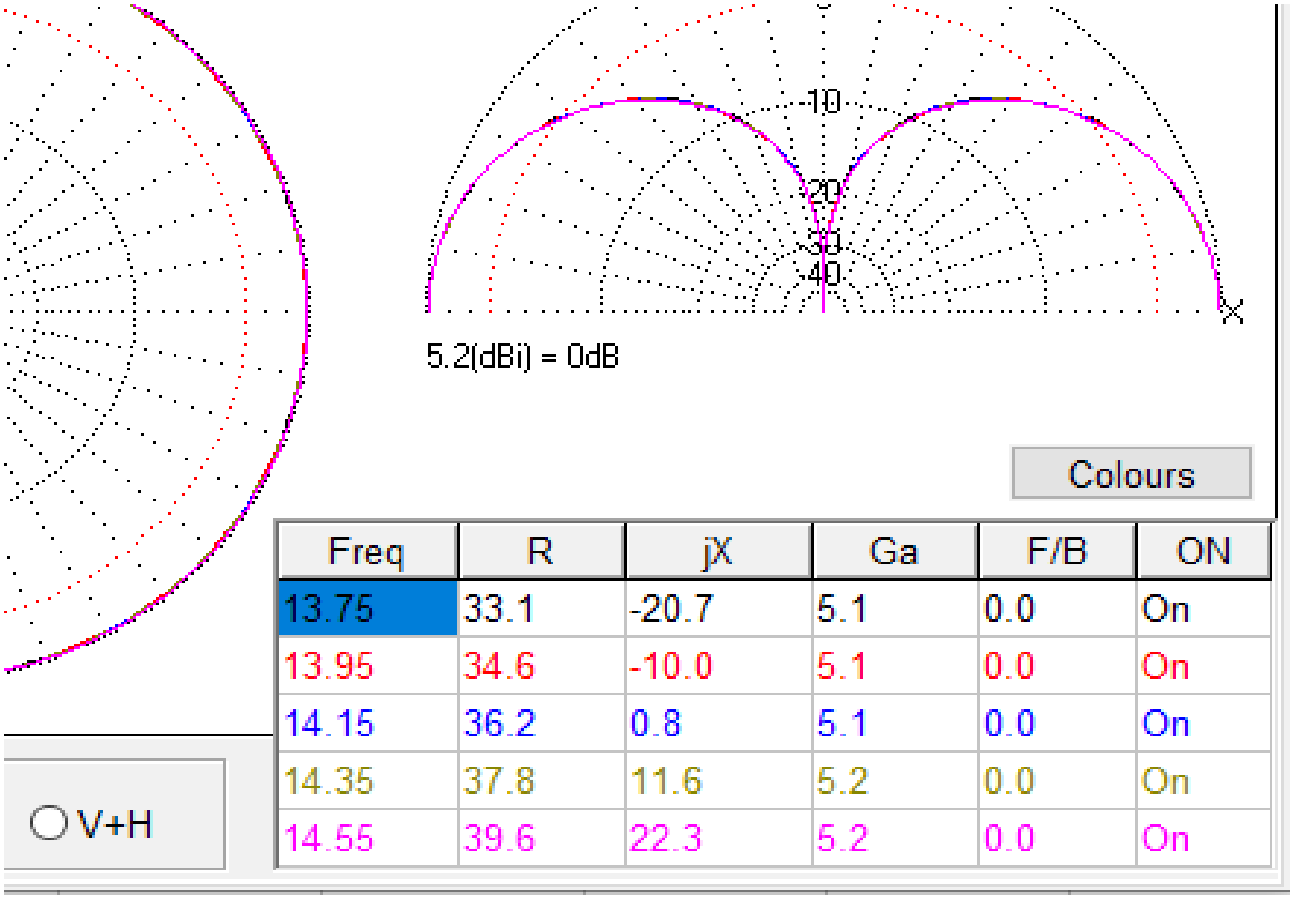
$$Lp = \frac{Rp}{\omega \cdot \grave{Q}}$$

$$Cp = \frac{\grave{Q}}{\omega \cdot Rp}$$

$$\omega = 2 \cdot \pi \cdot f$$

Eksempel med 1/4 λ, f=14.15 Mhz.



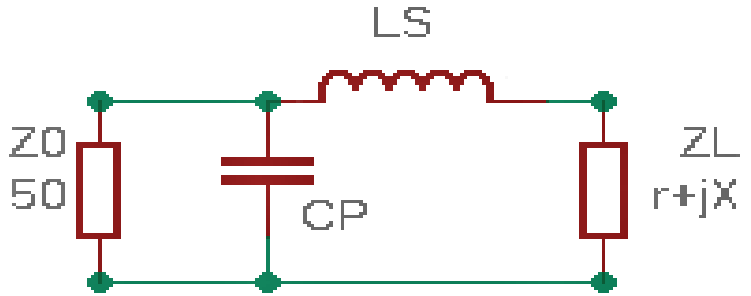


Freq	R	jX	Ga	F/B	ON
13.75	33.1	-20.7	5.1	0.0	On
13.95	34.6	-10.0	5.1	0.0	On
14.15	36.2	0.8	5.1	0.0	On
14.35	37.8	11.6	5.2	0.0	On
14.55	39.6	22.3	5.2	0.0	On

R + jX = 36.2 +j0.8 Ω

$$SWR = \frac{Z0}{RL} = 1.39$$

Beregn L og C vha Q

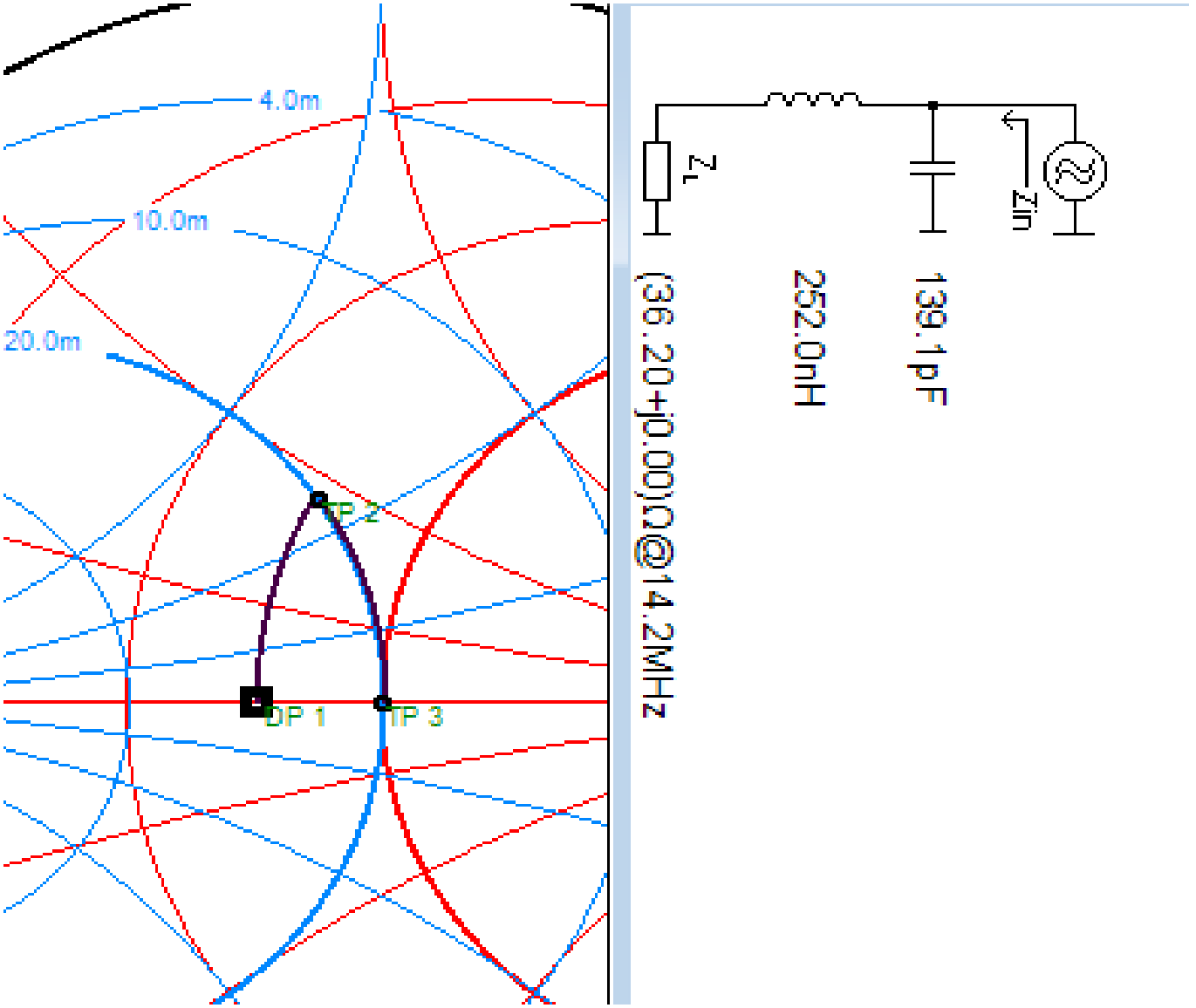


$$\grave{Q} = \sqrt{\frac{Rp}{rs} - 1} \qquad \sqrt{\frac{50}{36{,}2} - 1} = 0{,}617$$

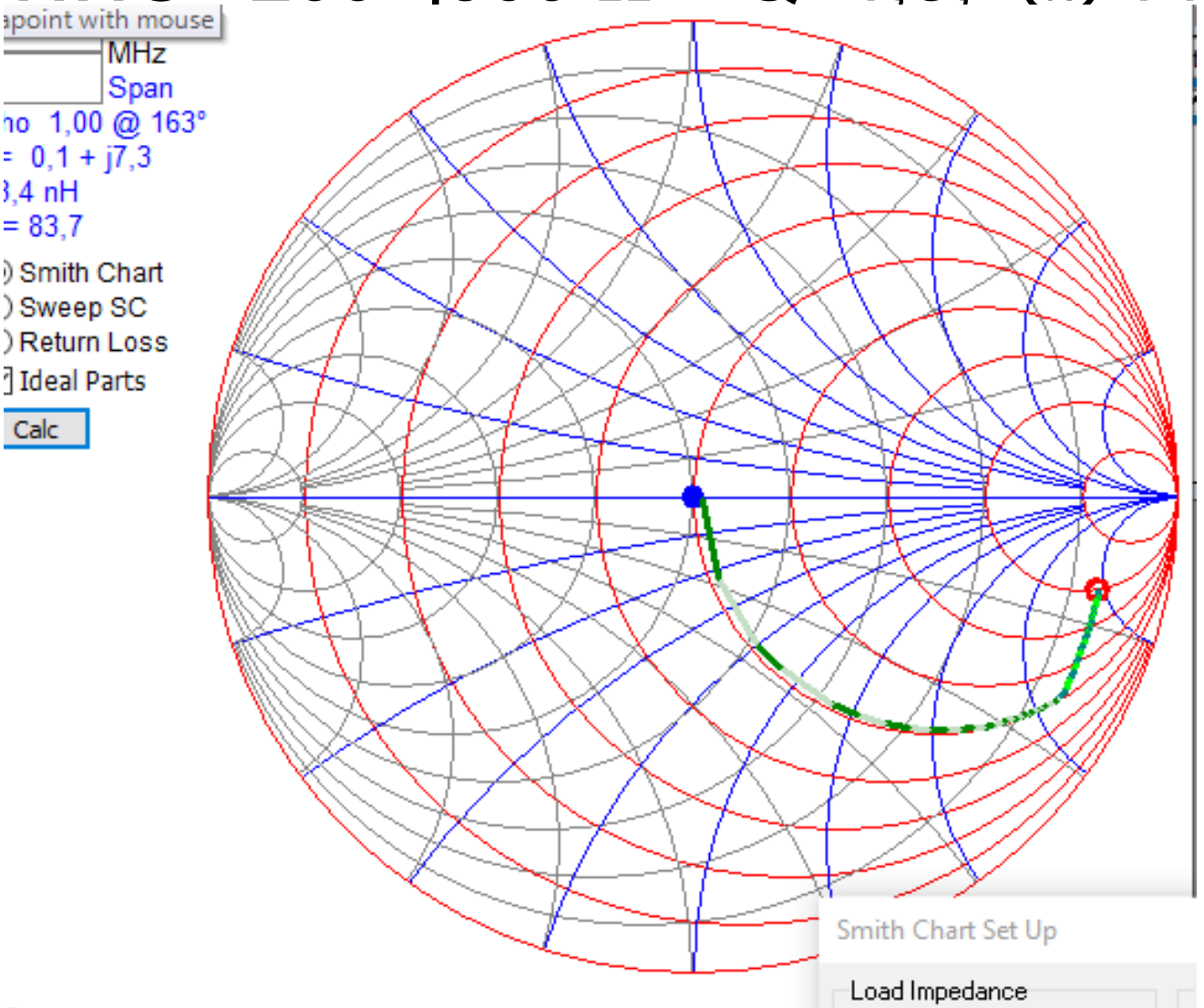
$$Ls = \frac{\grave{Q} \cdot rs}{\omega} \qquad \frac{0{,}617 * 36{,}2}{2 * \pi * 14.15\text{E}6} = 251\, nH$$

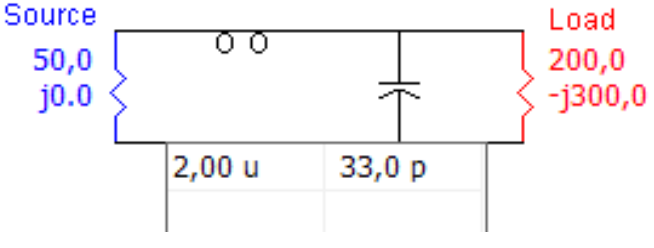
$$Cp = \frac{\grave{Q}}{\omega \cdot Rp} \qquad \frac{0{,}617}{2 \times \pi \times 14.15\text{E}6 \times 50} = 139\, pF$$

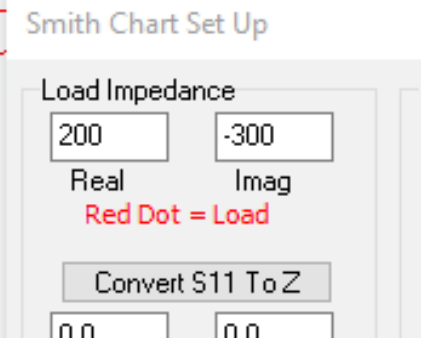
Kontrol i Smith kortet



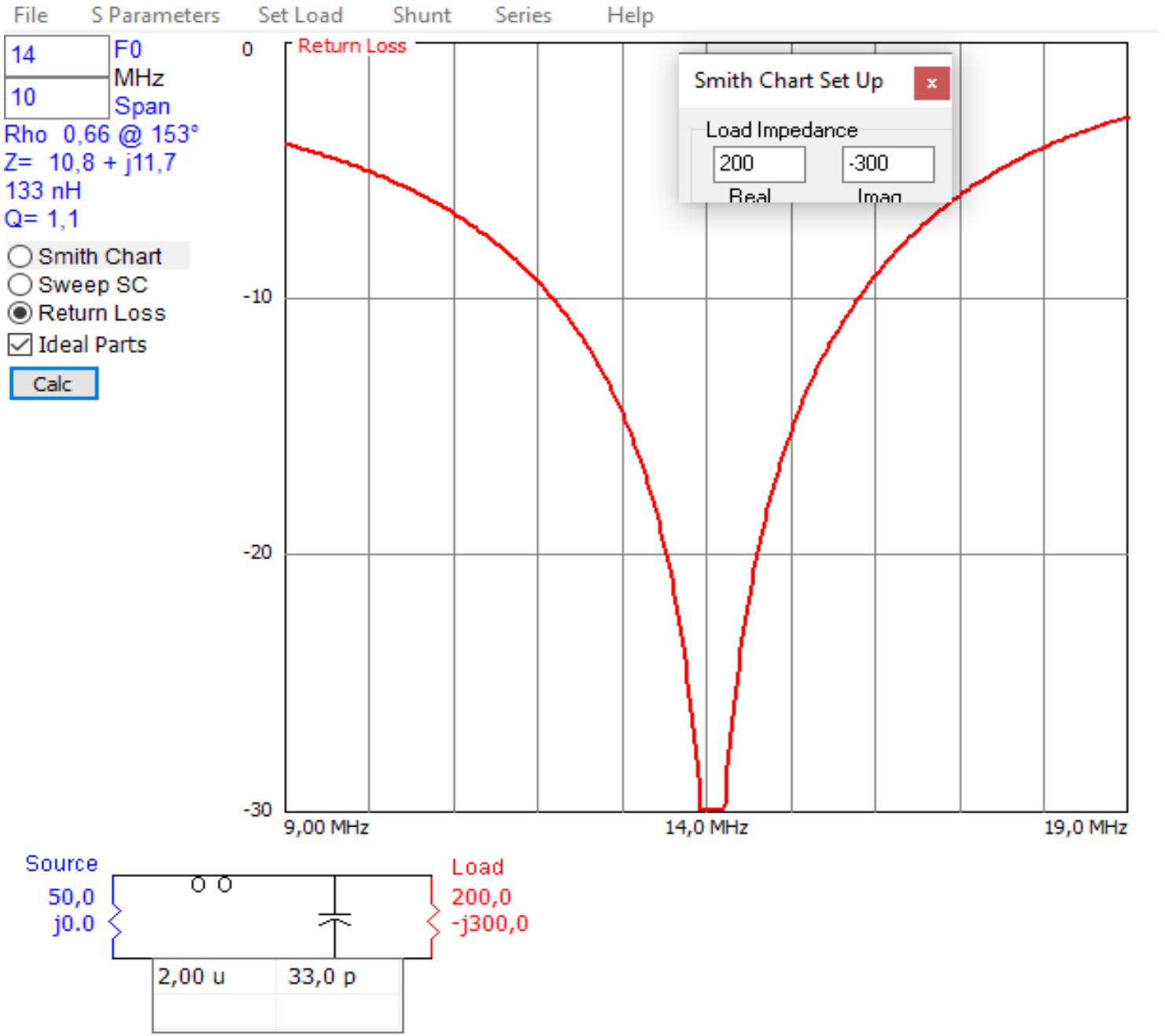
Antenne 200 -j300 Ω Q=1,5; @ 14 MHz





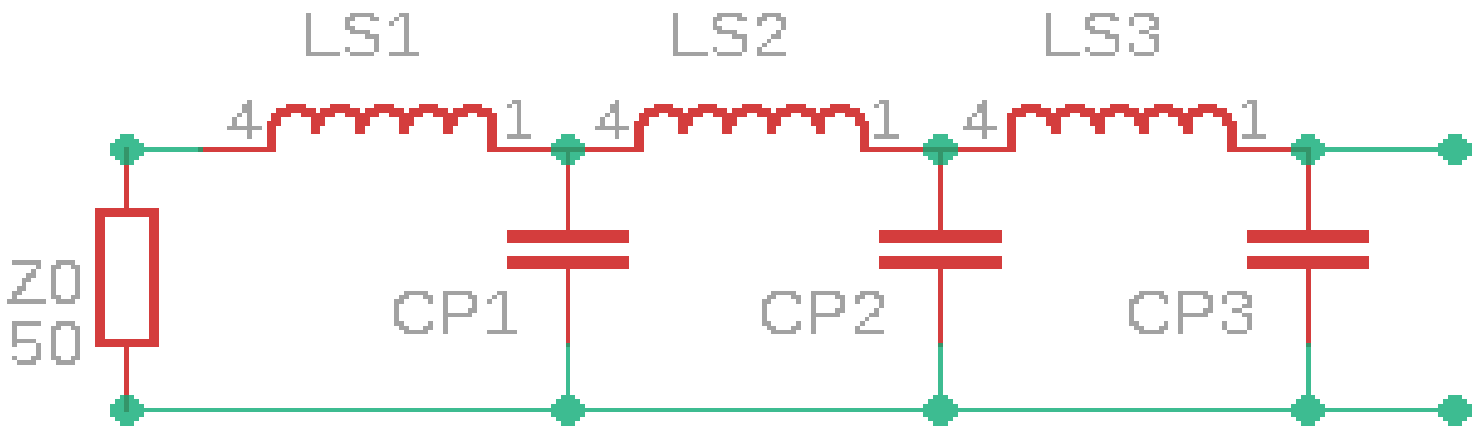


Antenne 200 -j300 Ω Q=1,5; @ 14 MHz

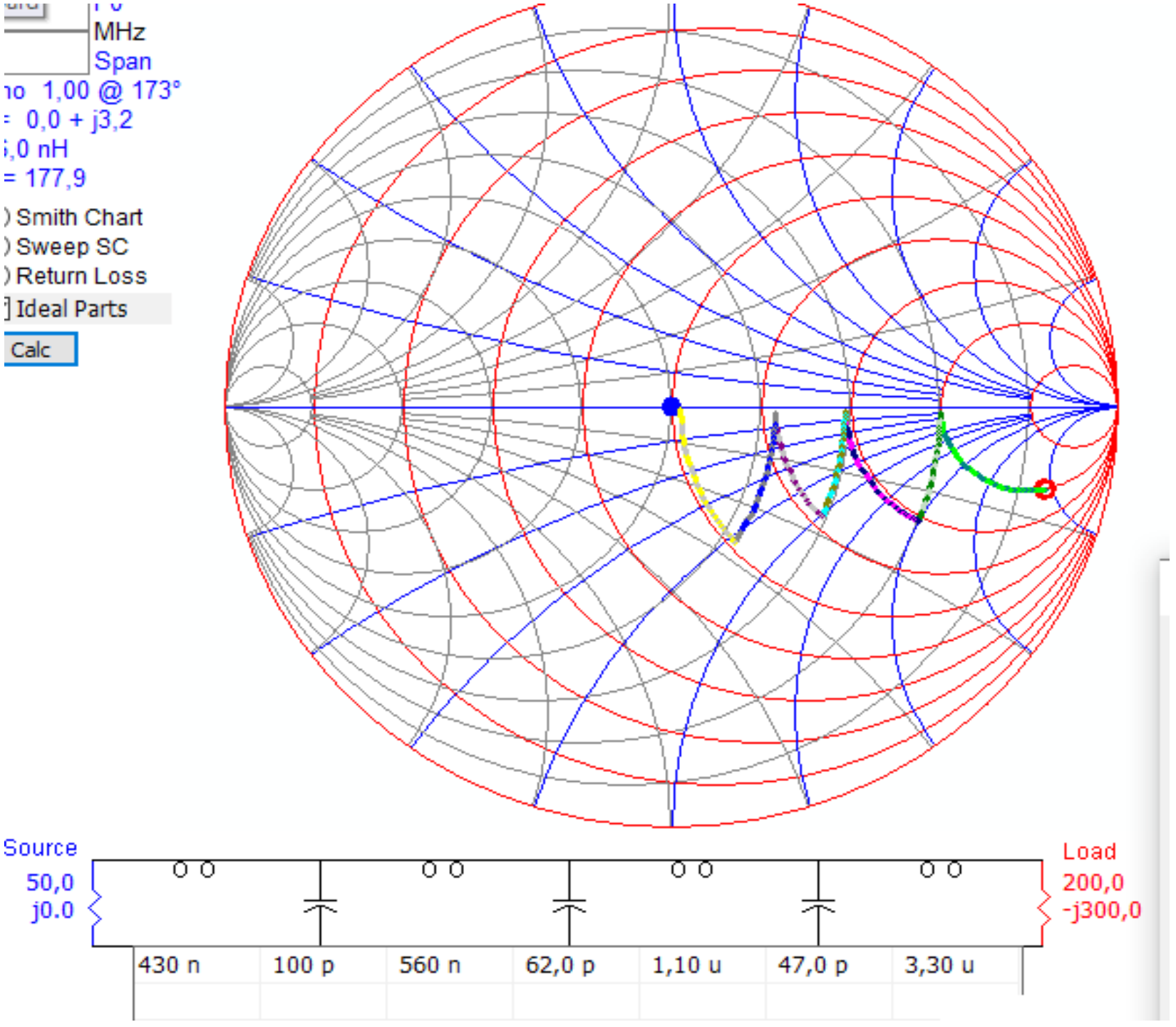


Bredbåndstilpasning med flere LC led

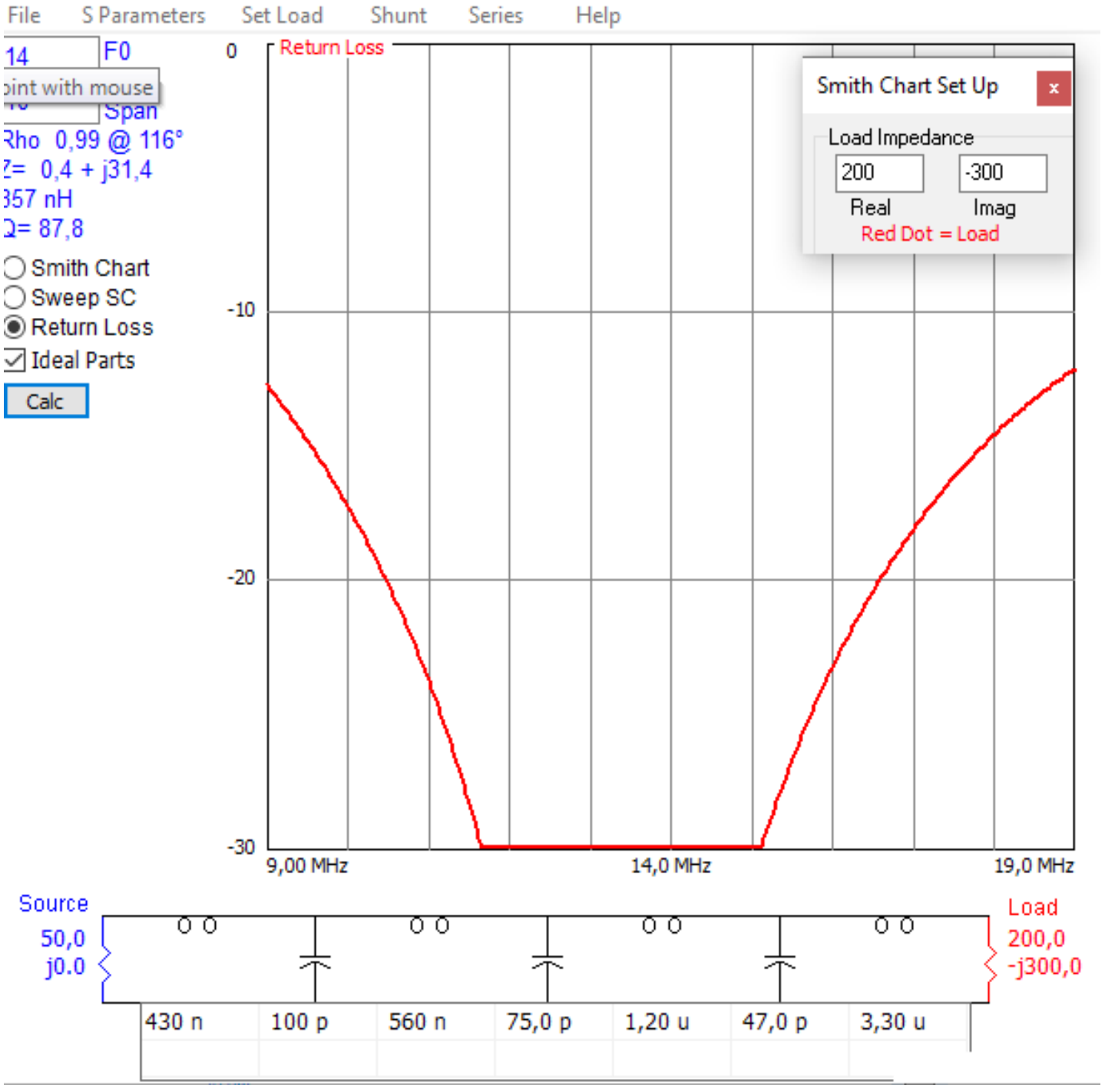
- Vælg en ”mellemimpedans” mellem de enkelte led.



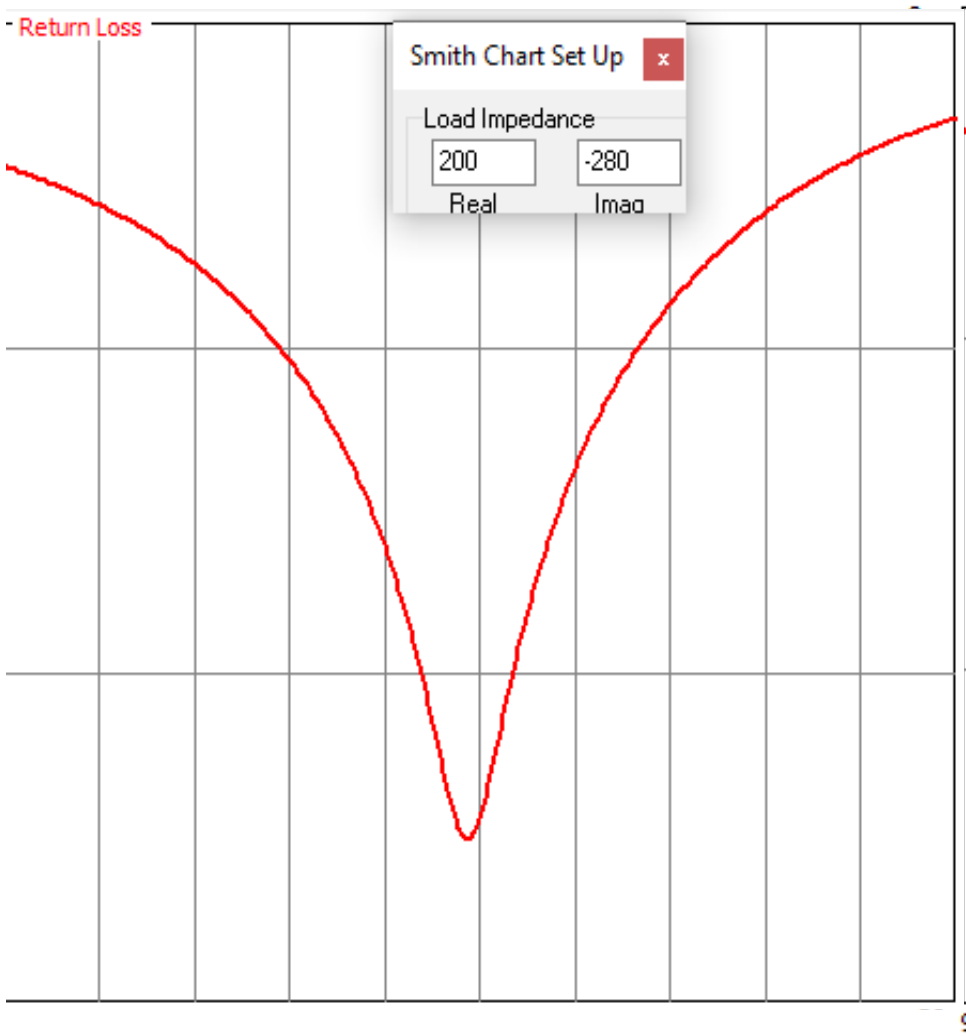
Nu med med flere LC led

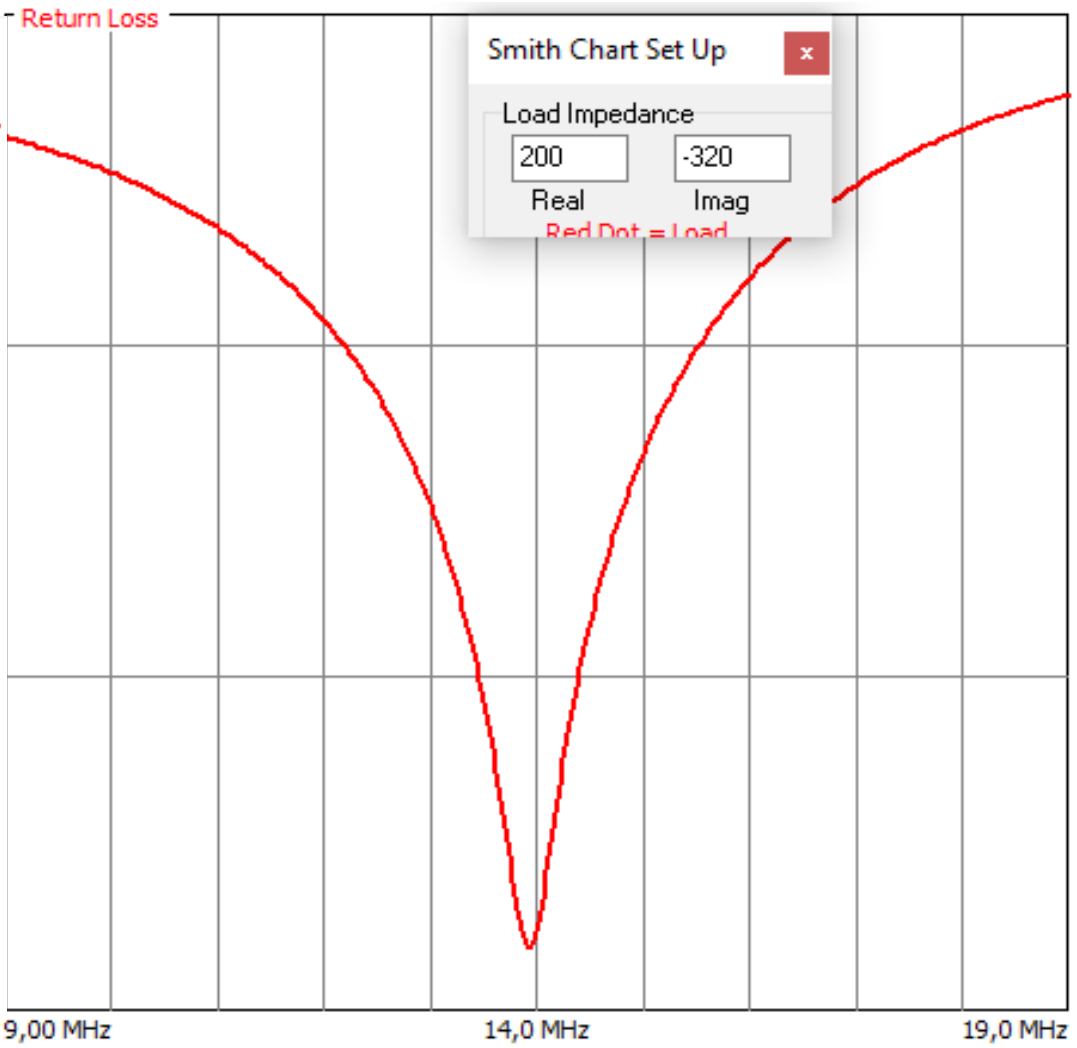


Nu med med flere LC led



Men antennen ændrer jo impedans med frekvensen ?





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