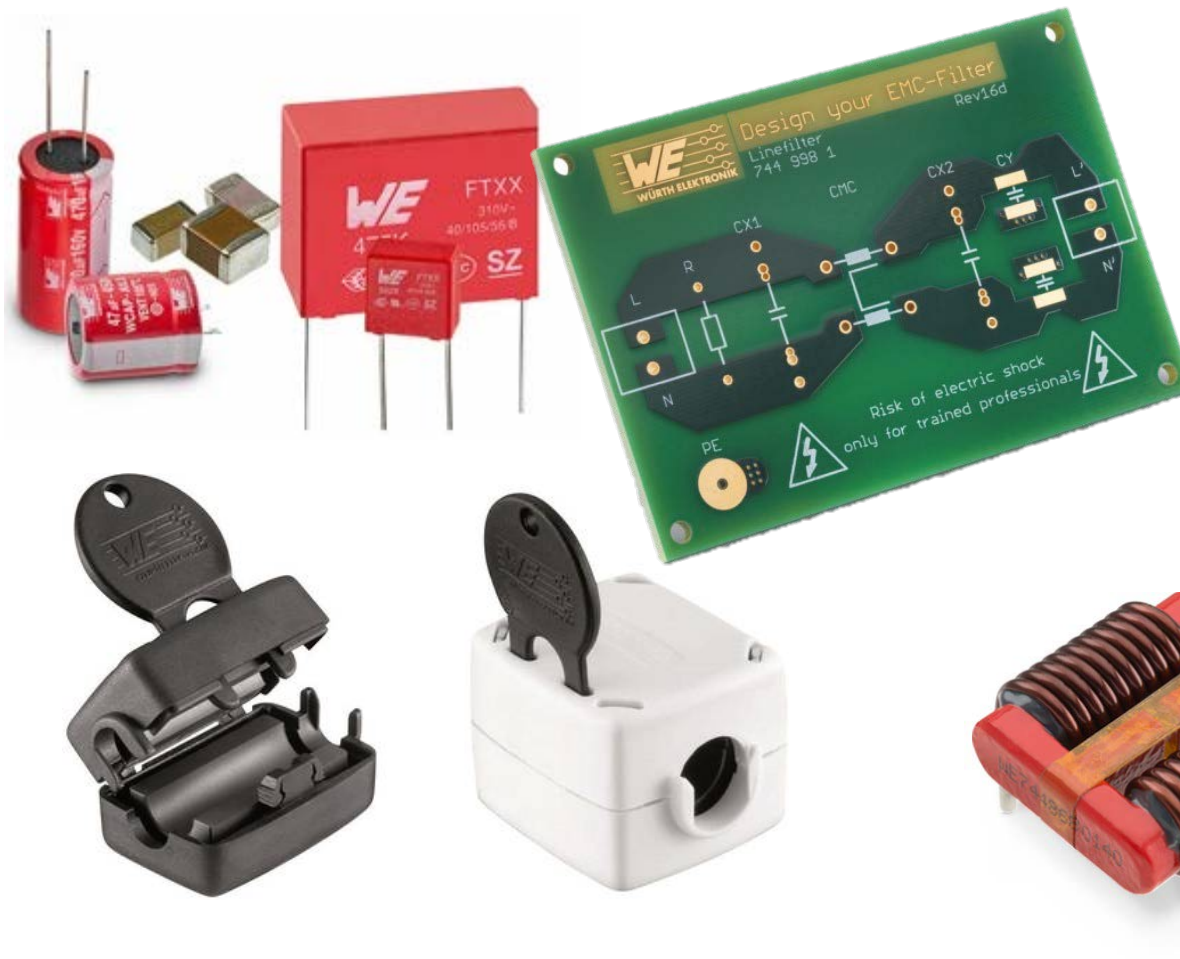


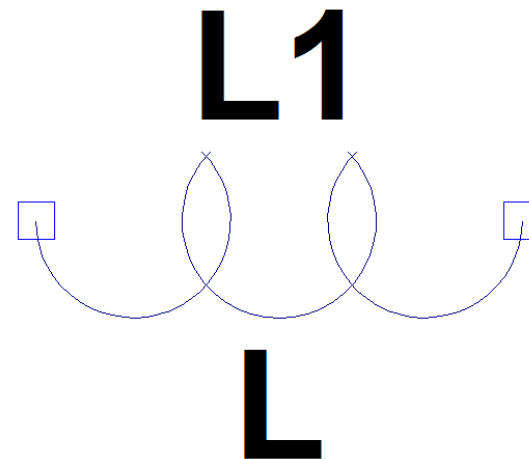
Ismael Molina Alba
Stefan Hellwig



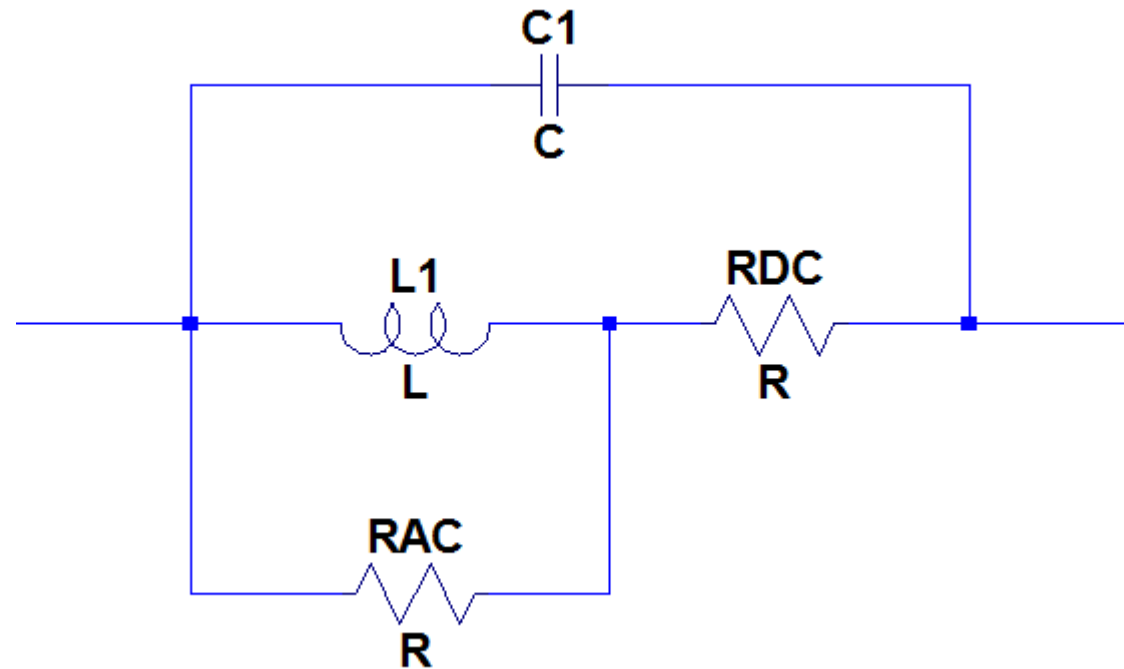


FILTER AS SOLUTION

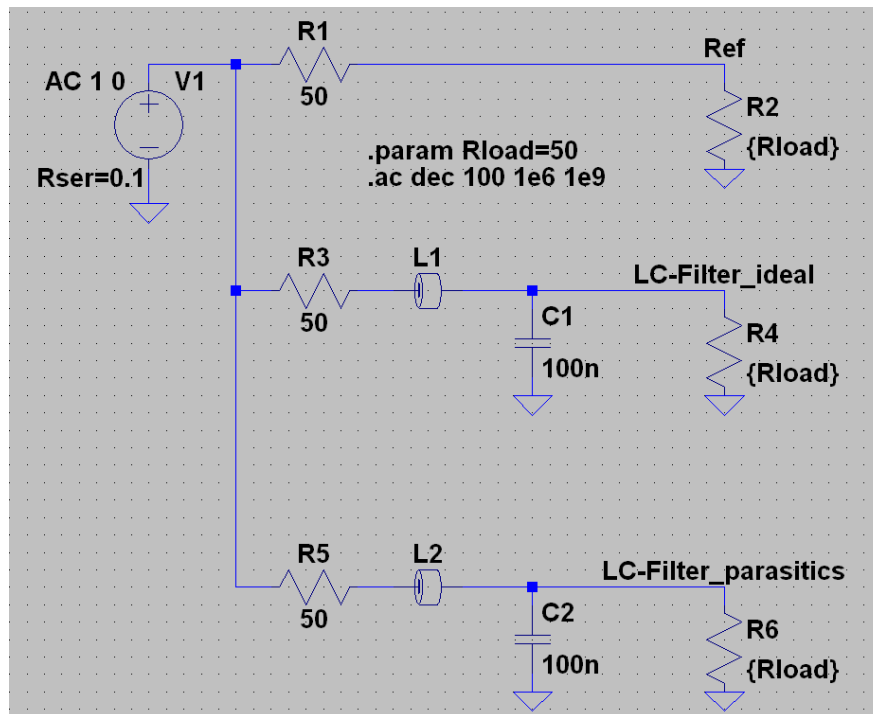
Filter - Ideal



Filter - Ideal



Parasitic Effects - Simulation

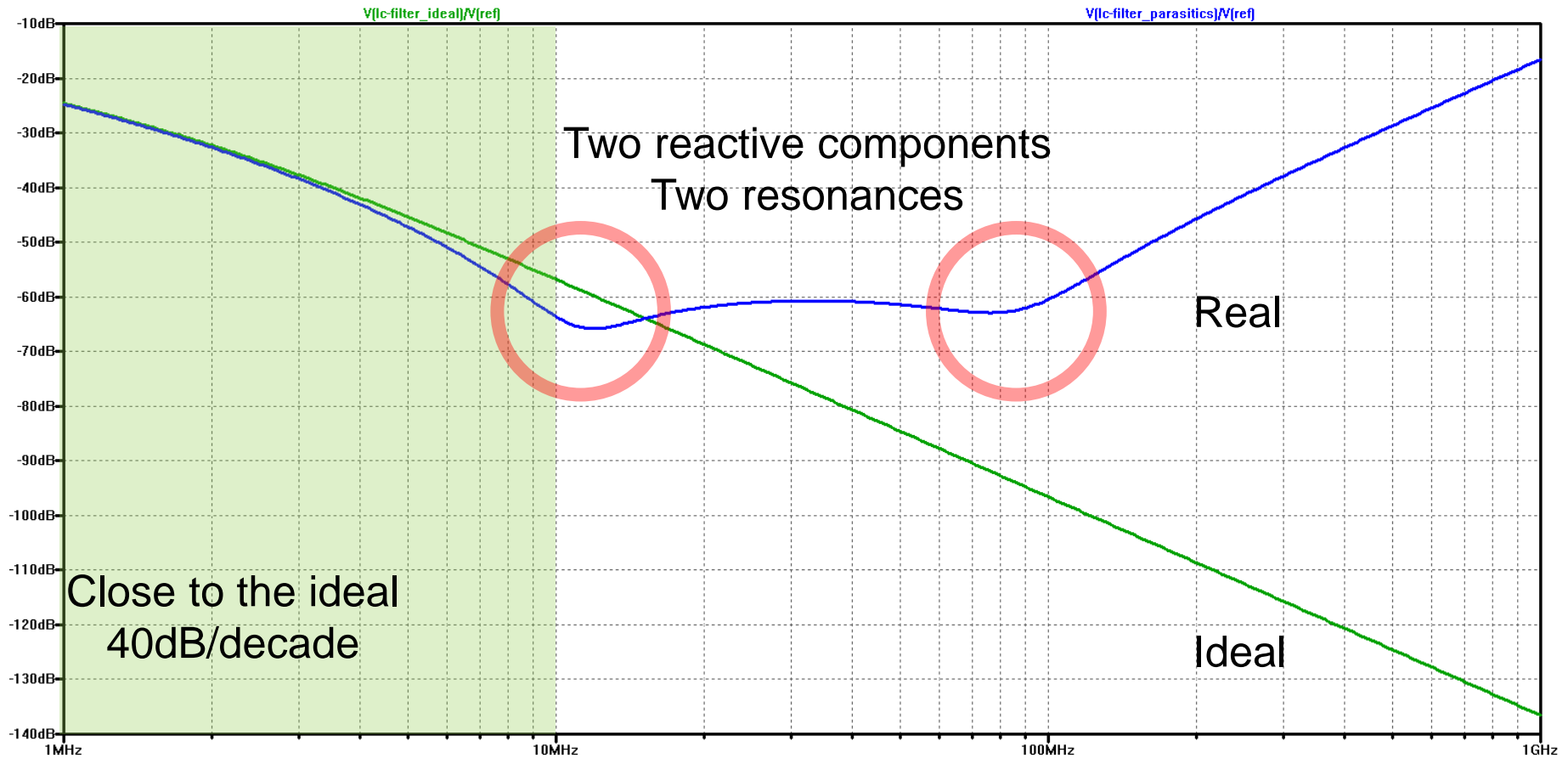


← Reference

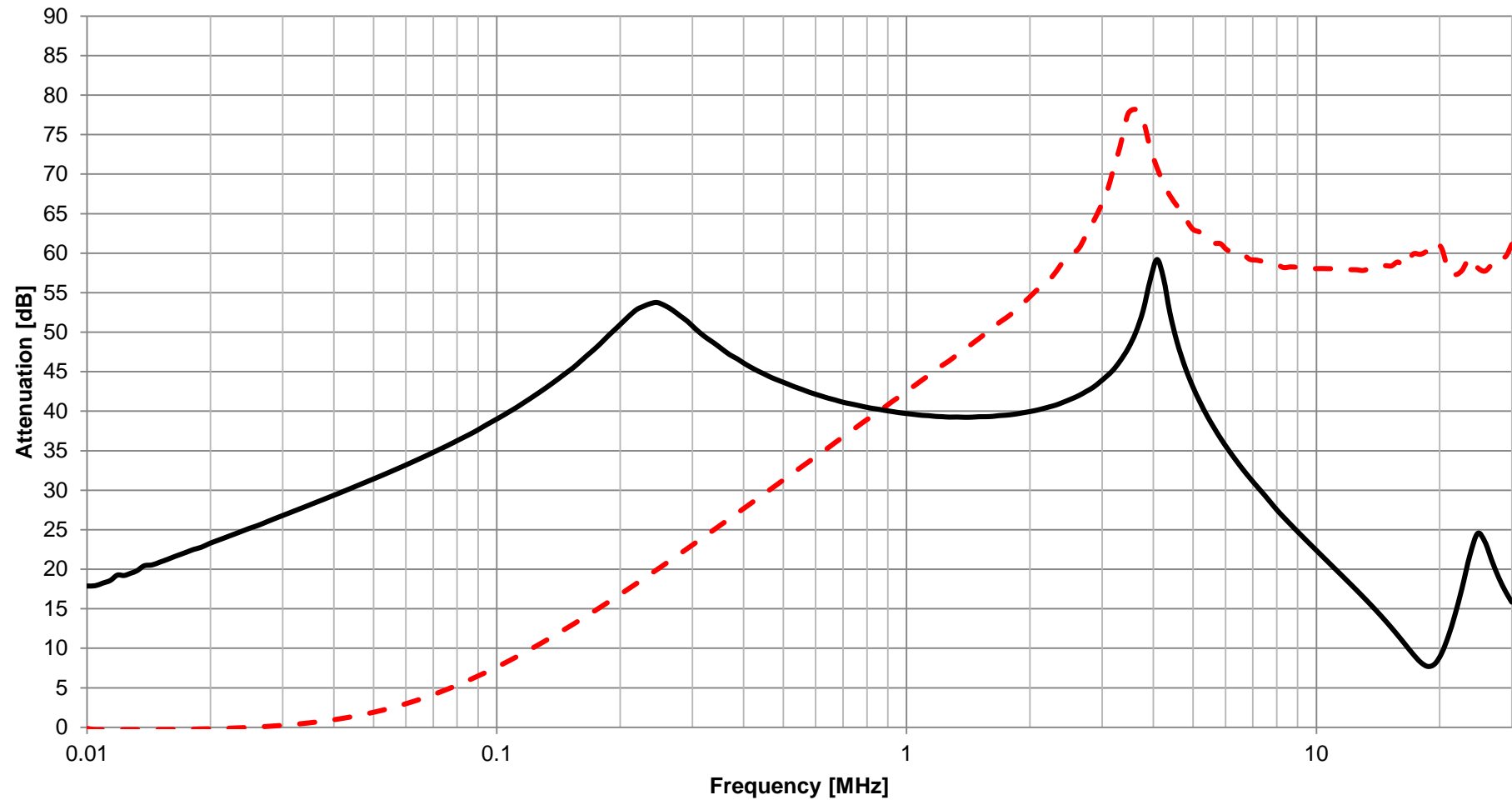
← Ideal LC filter

← Real LC filter

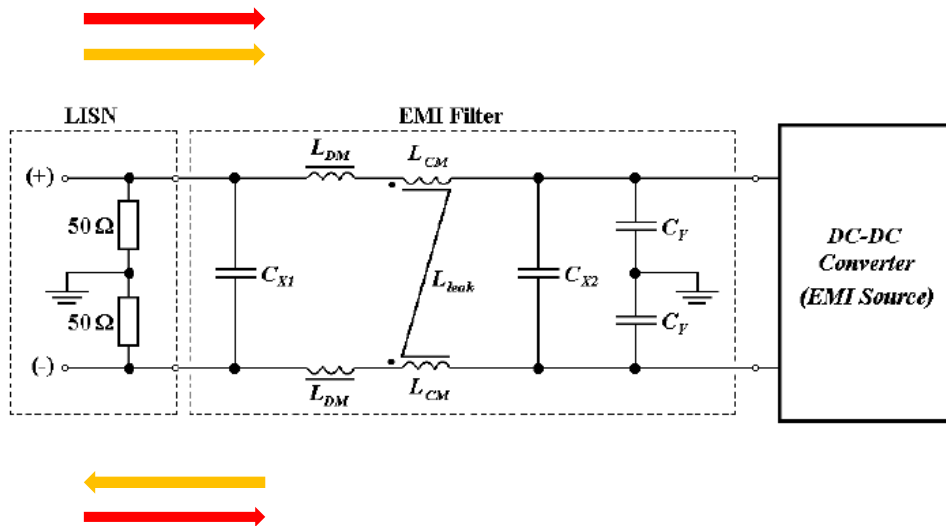
Parasitic Effects - Simulation



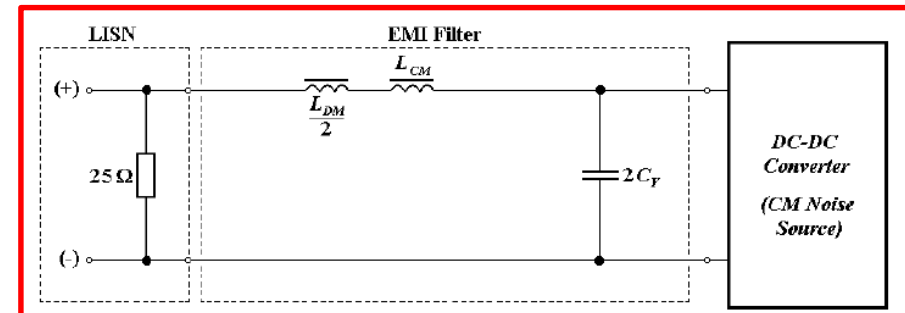
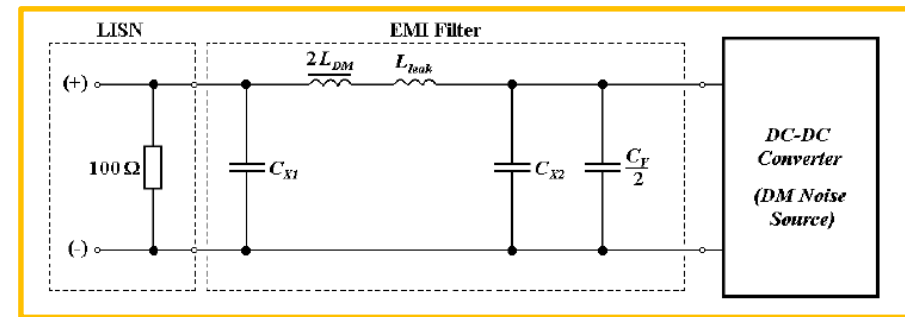
Real measurements – EMC Filter



EMC Filter Design

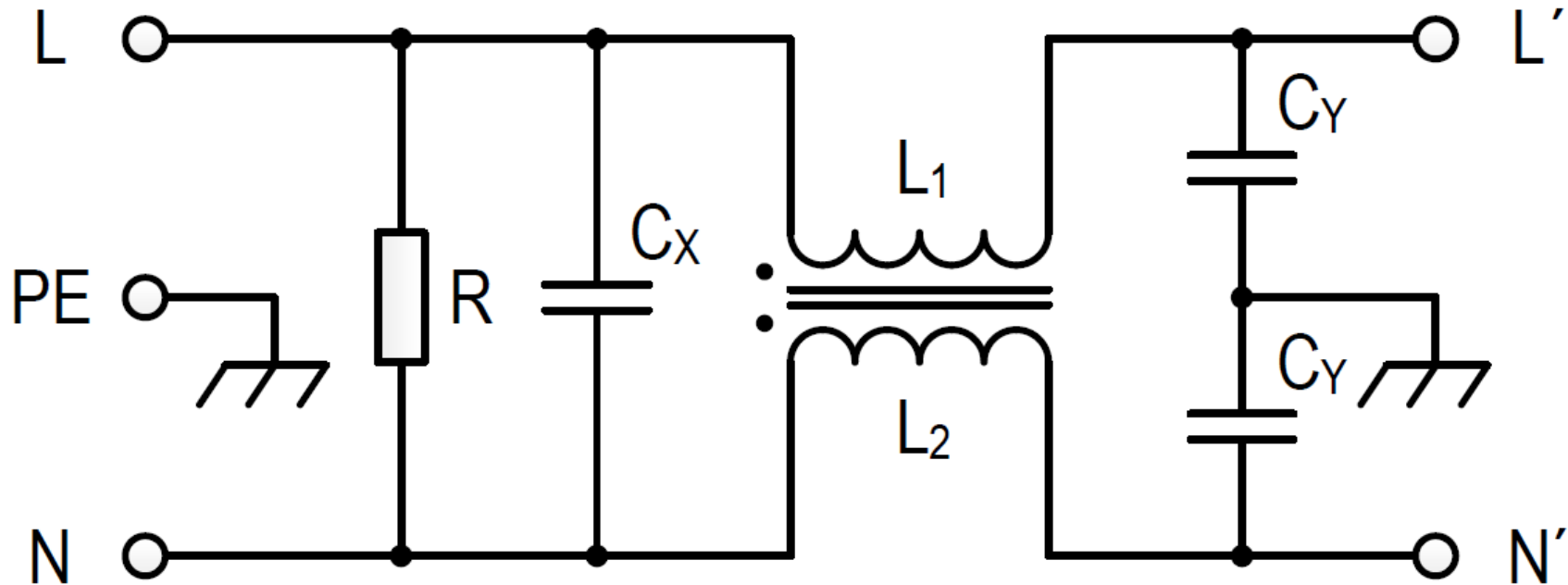


Differential mode

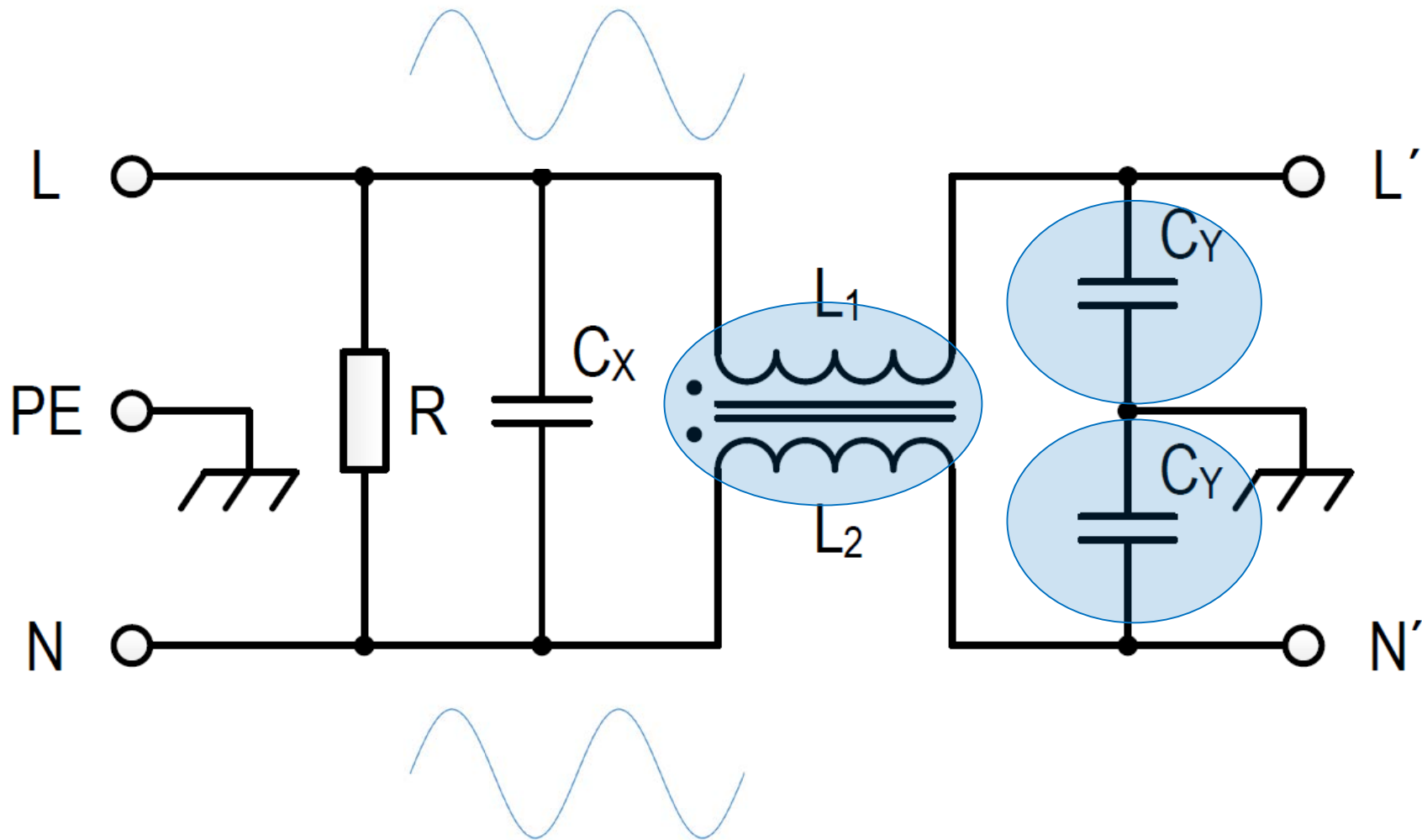


Common mode

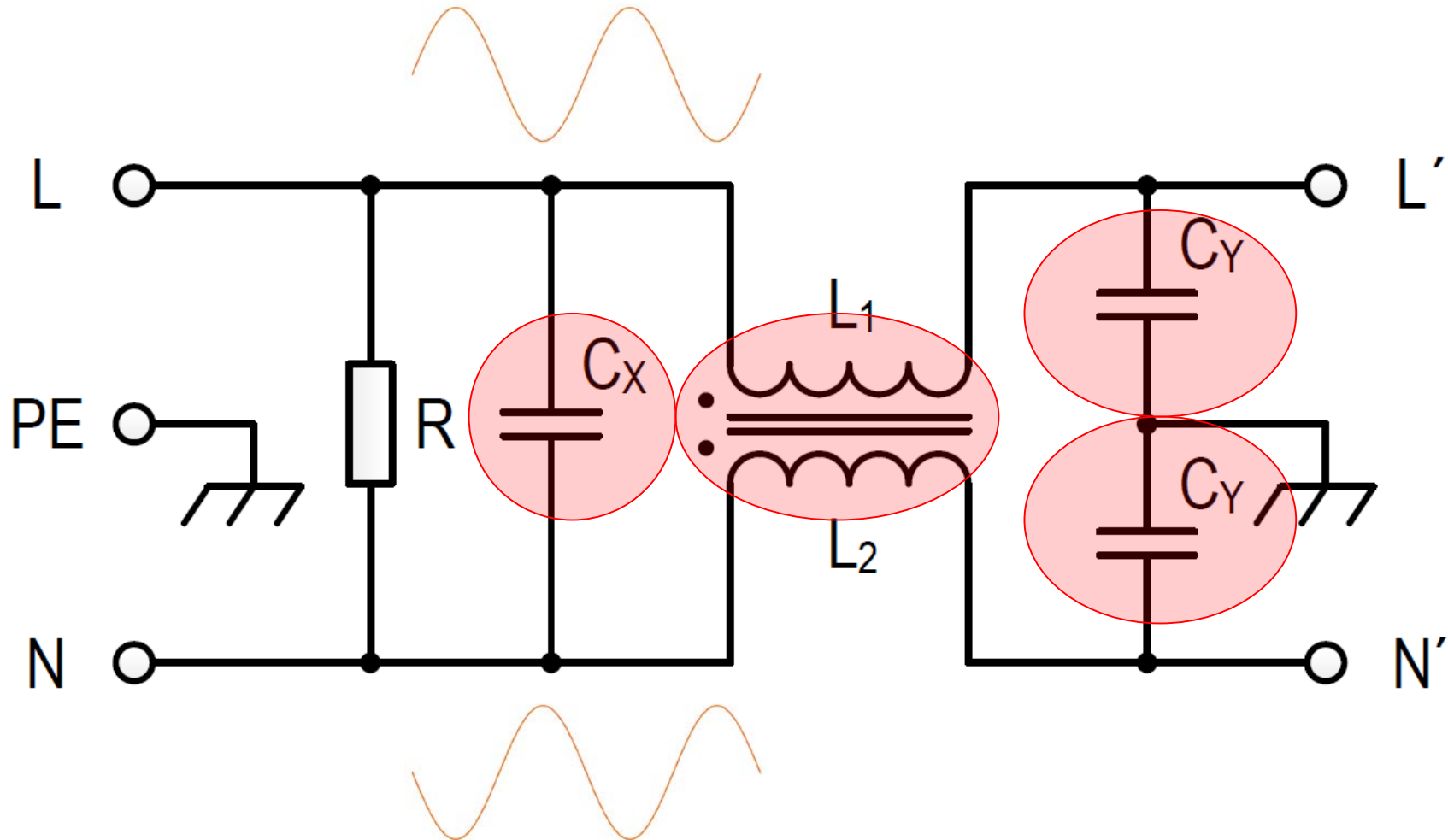
EMC Filter - Topology



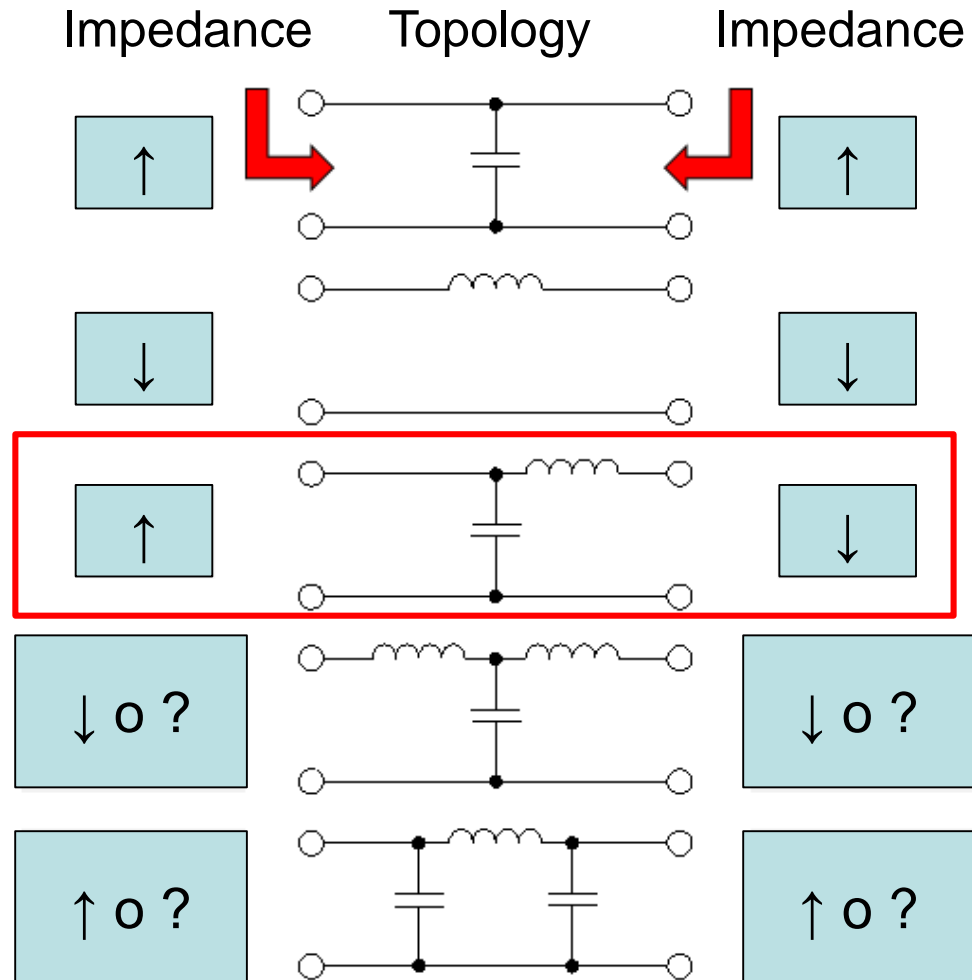
Common mode



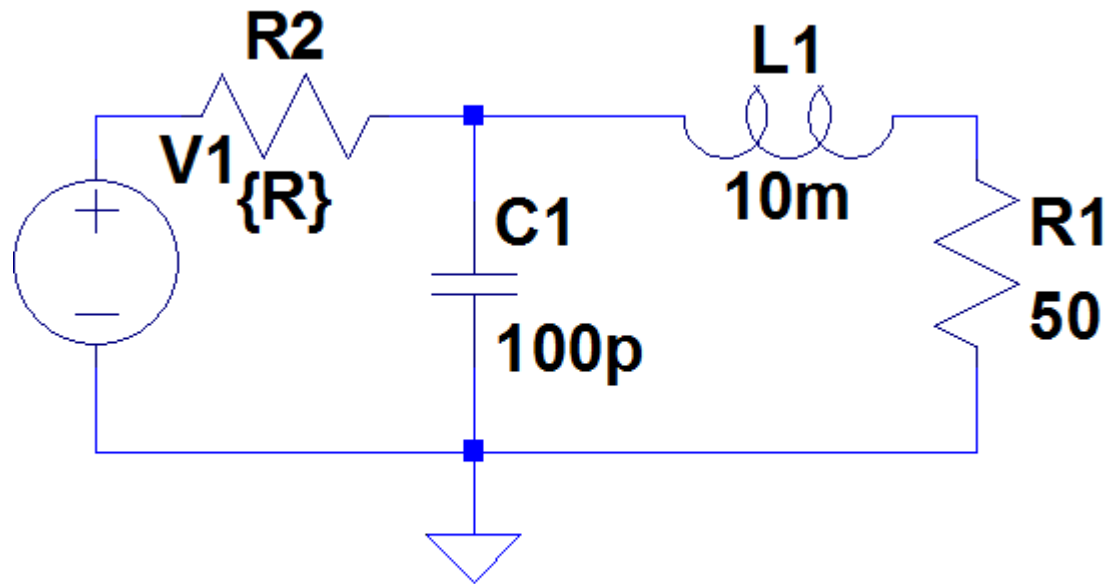
Differential mode



Topology

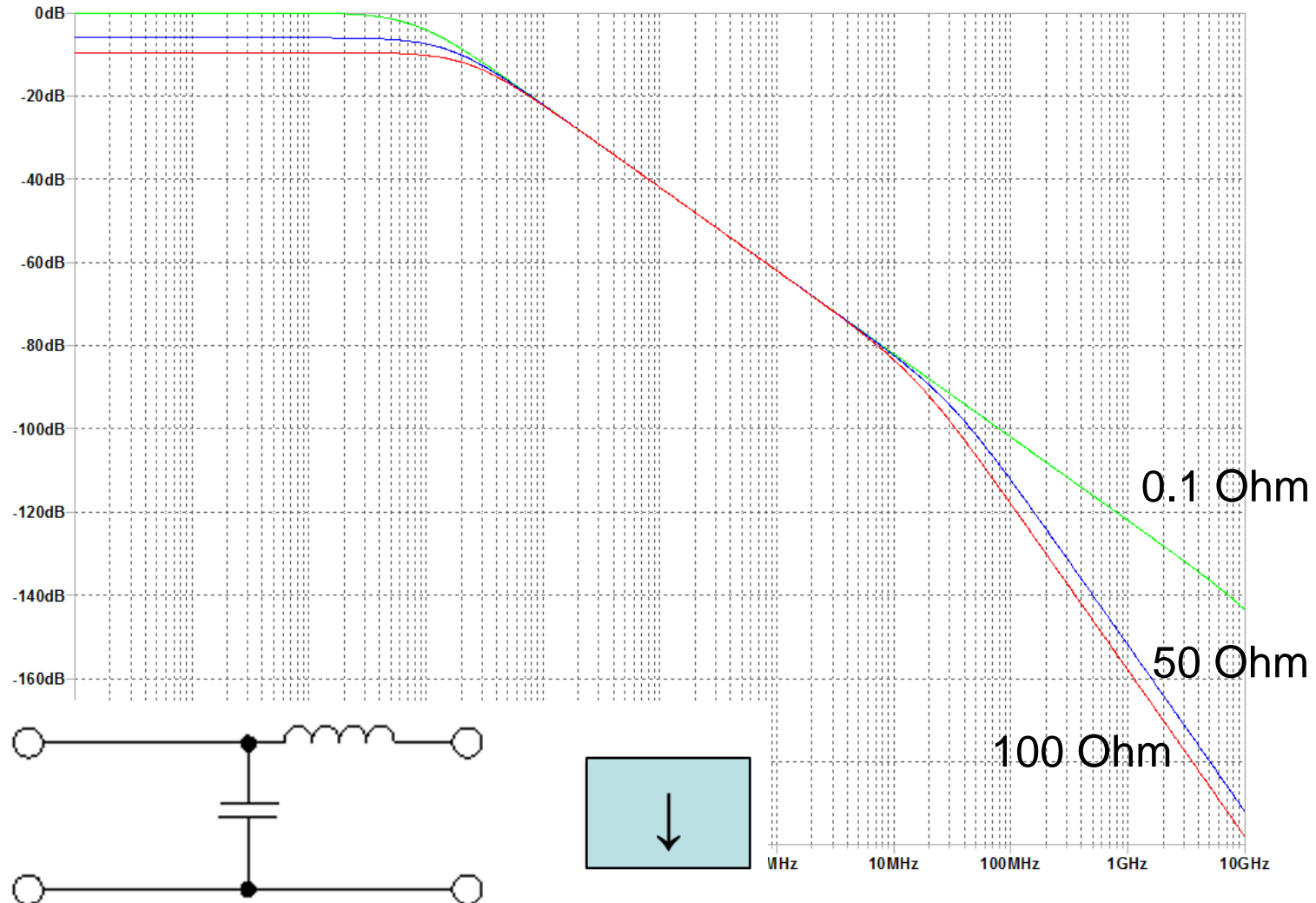


Simulation – Source impedance

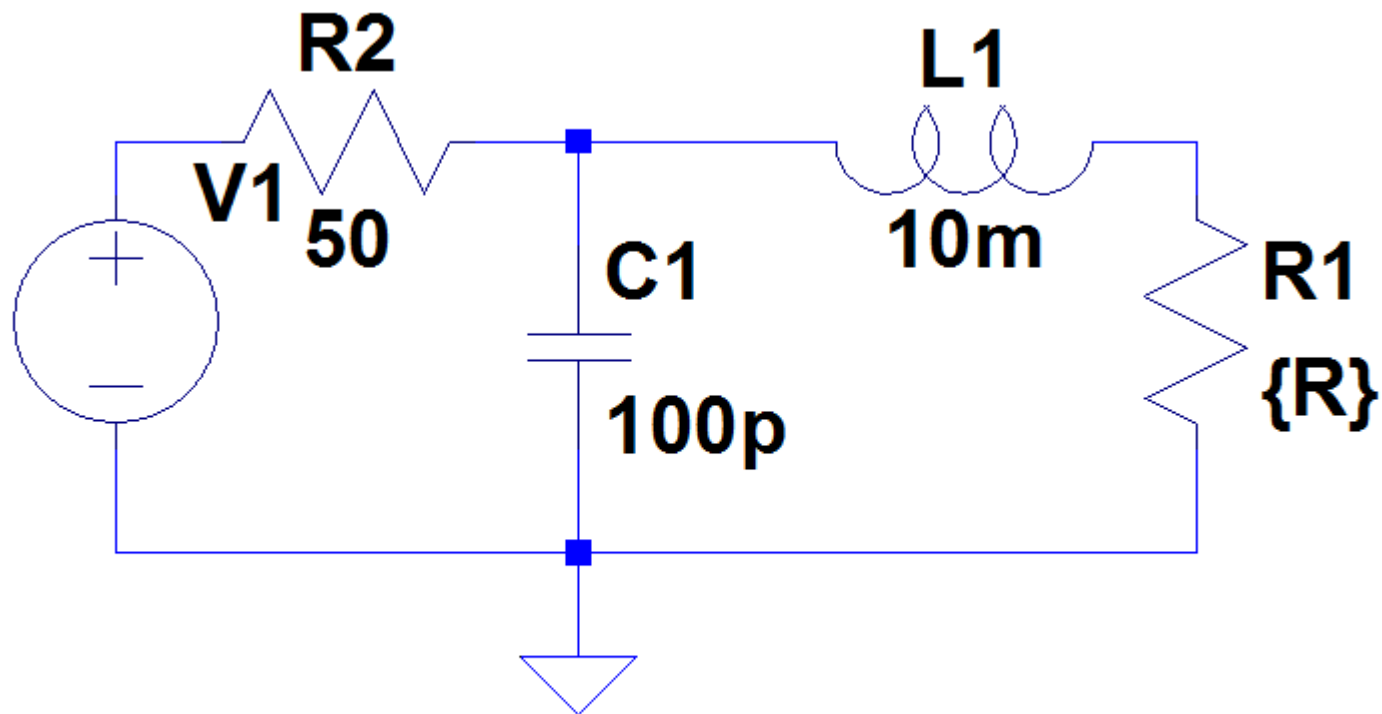


.STEP param R list .1 50 100

Simulation – Source impedance

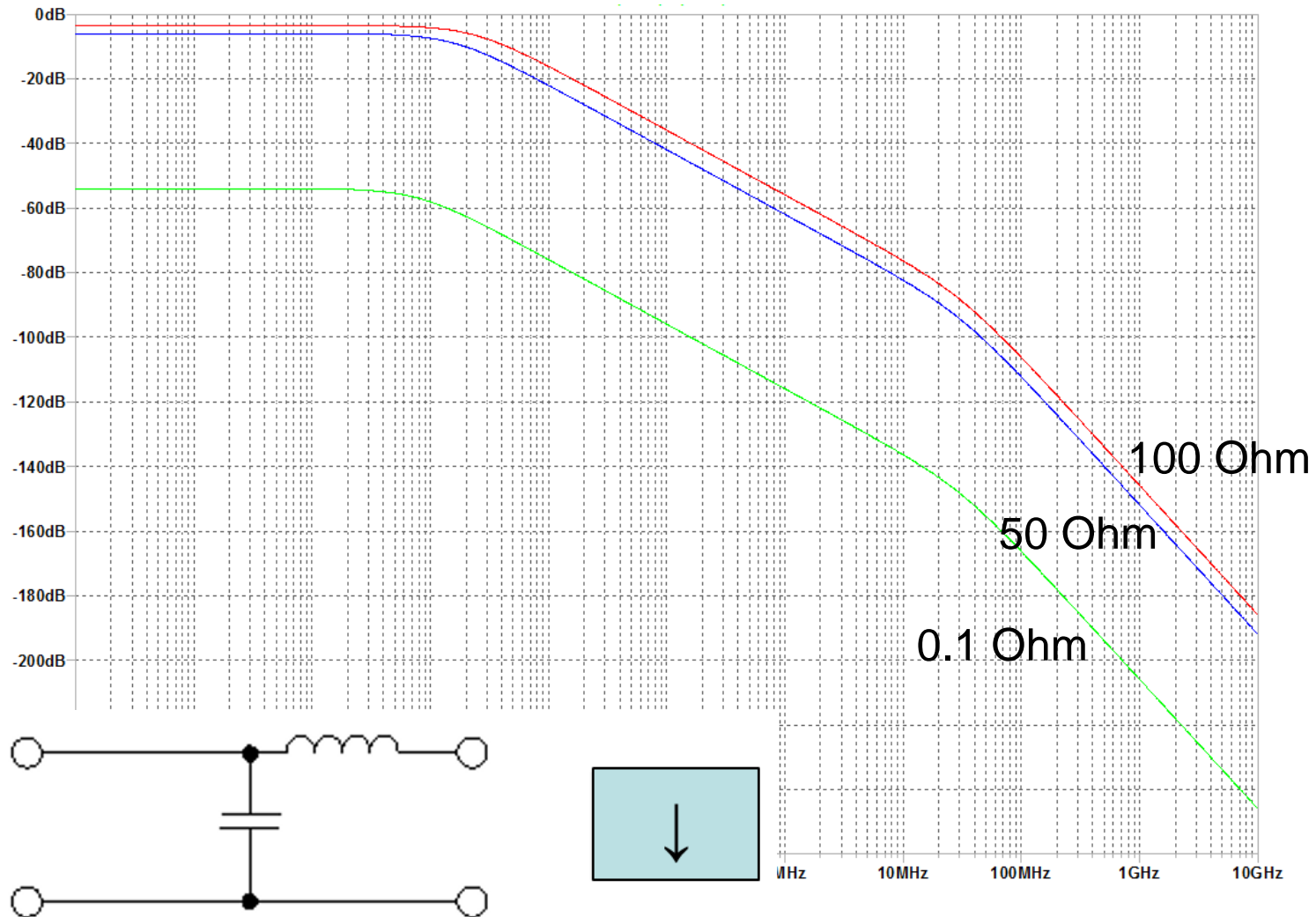


Simulation – Load impedance



.STEP param R list .1 50 100

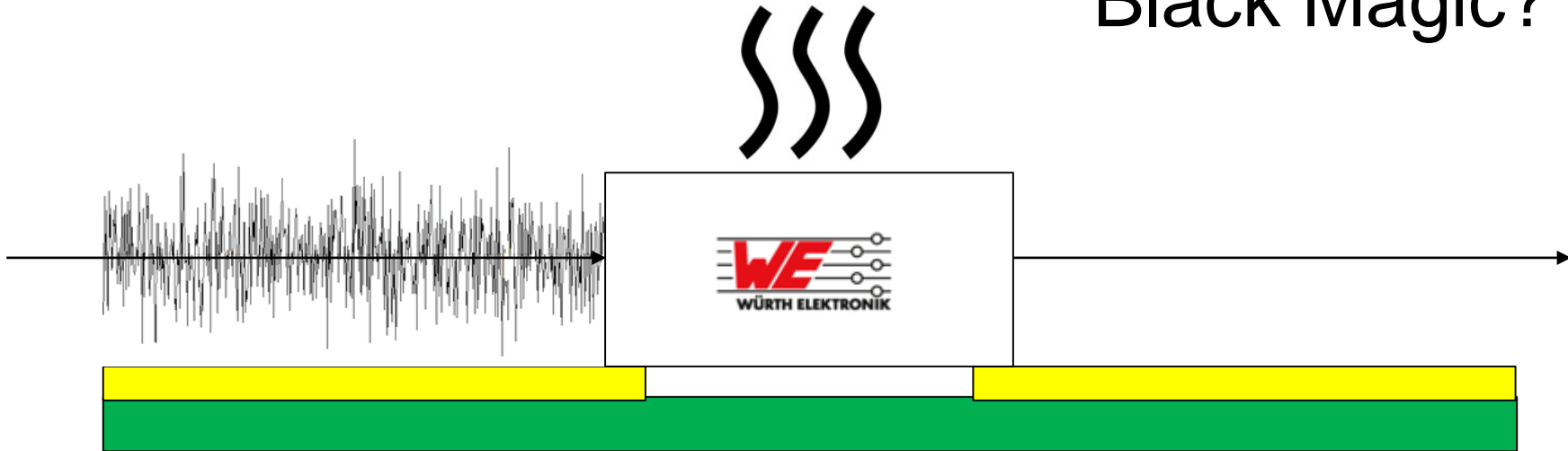
Simulation – Load impedance



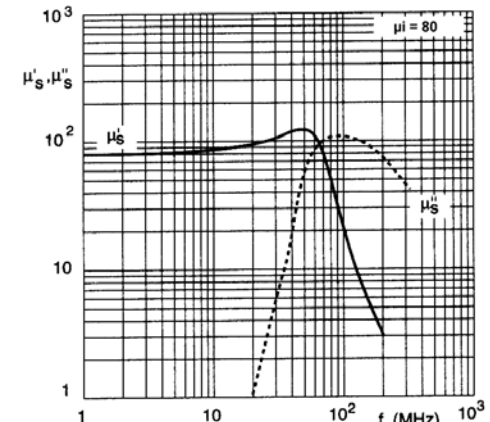
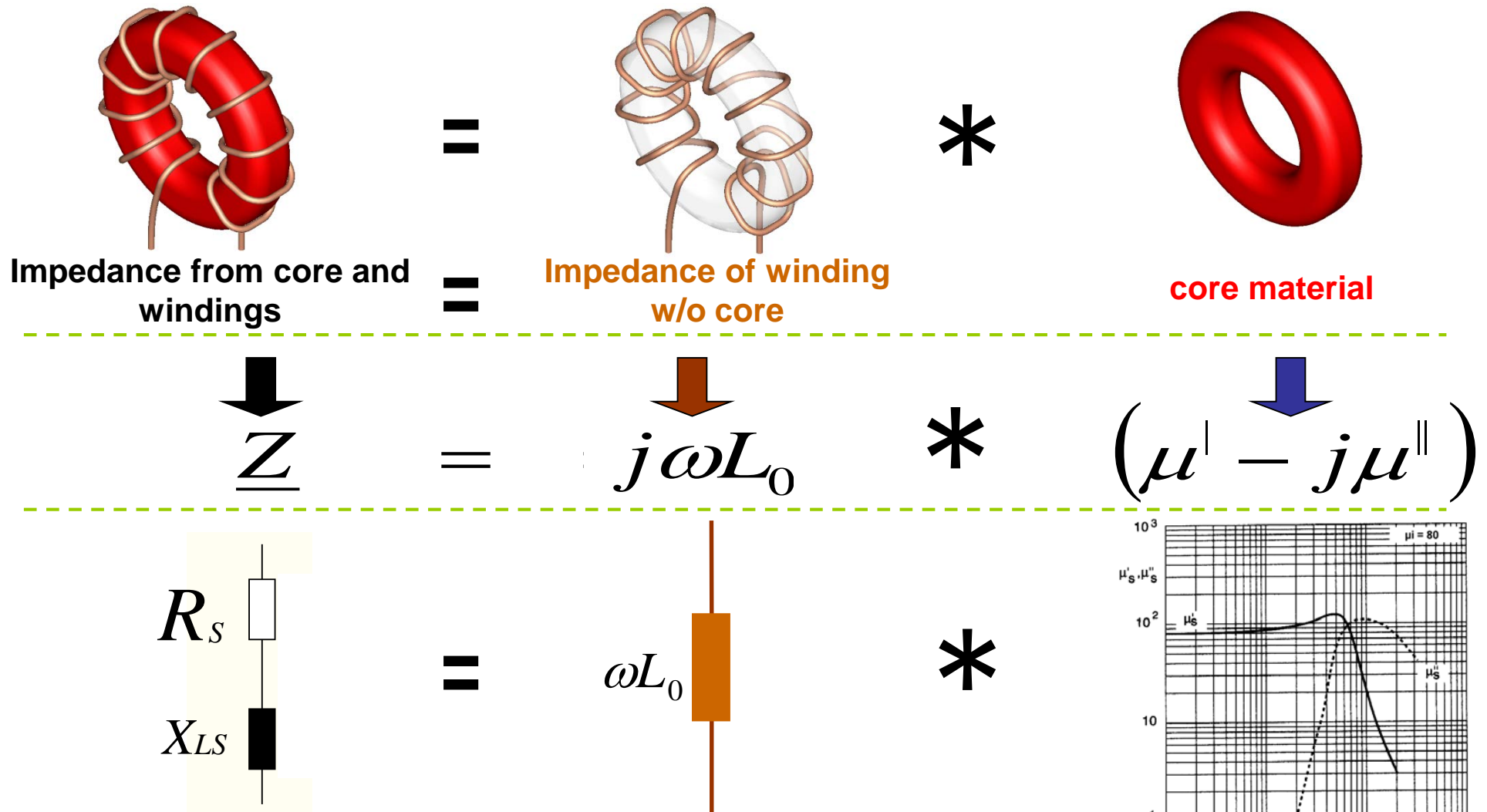
Filtering



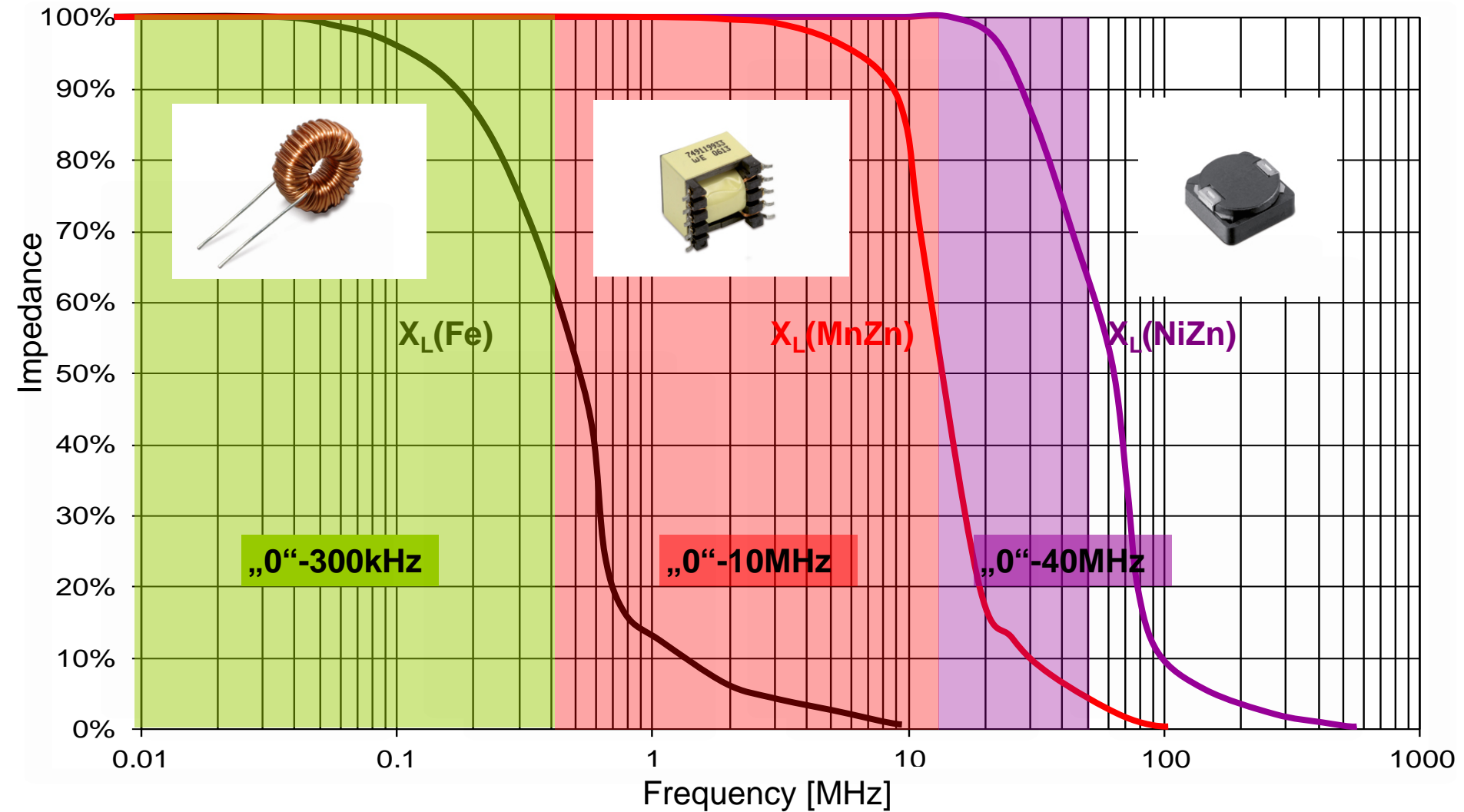
Black Magic?



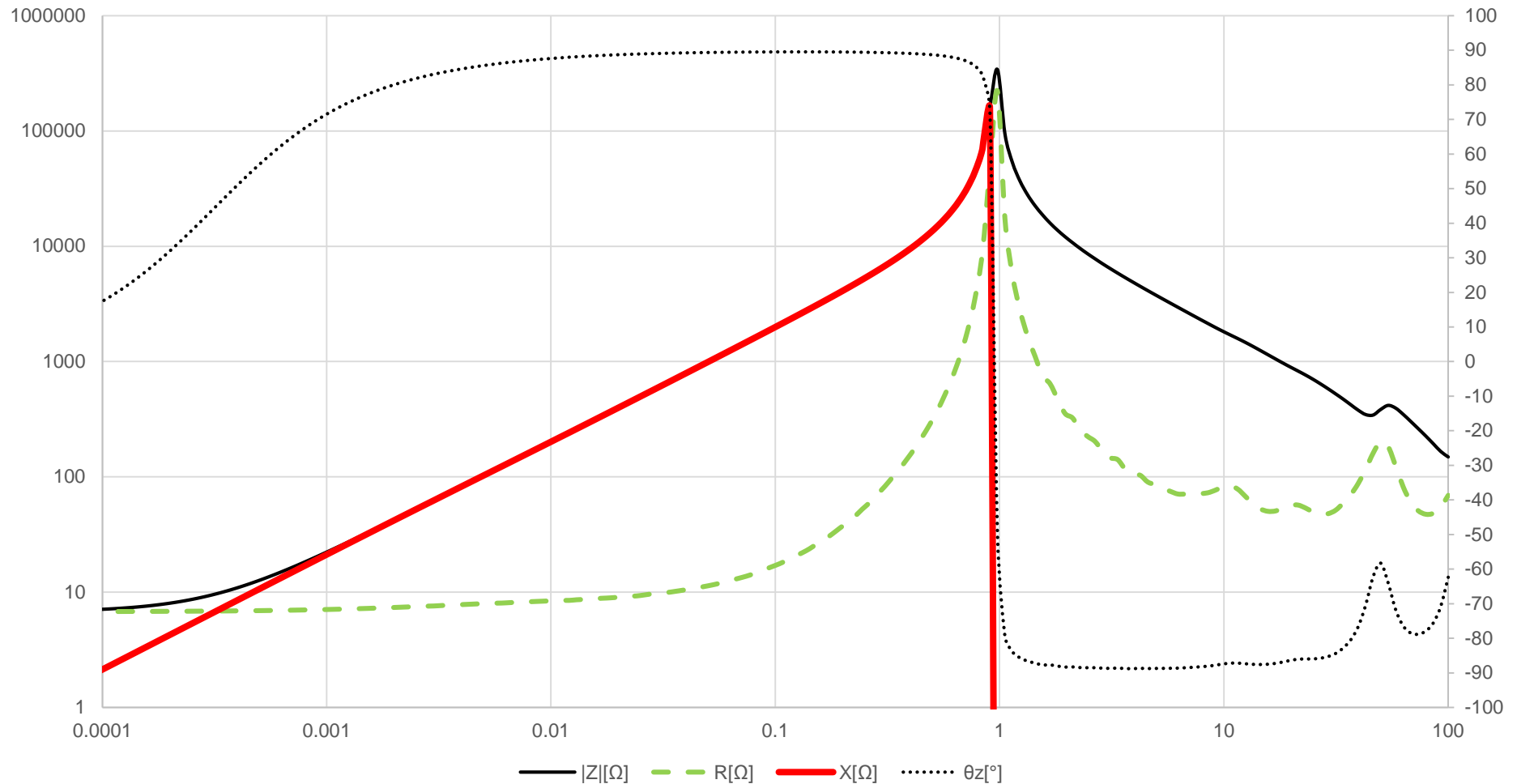
Permeability – complex permeability



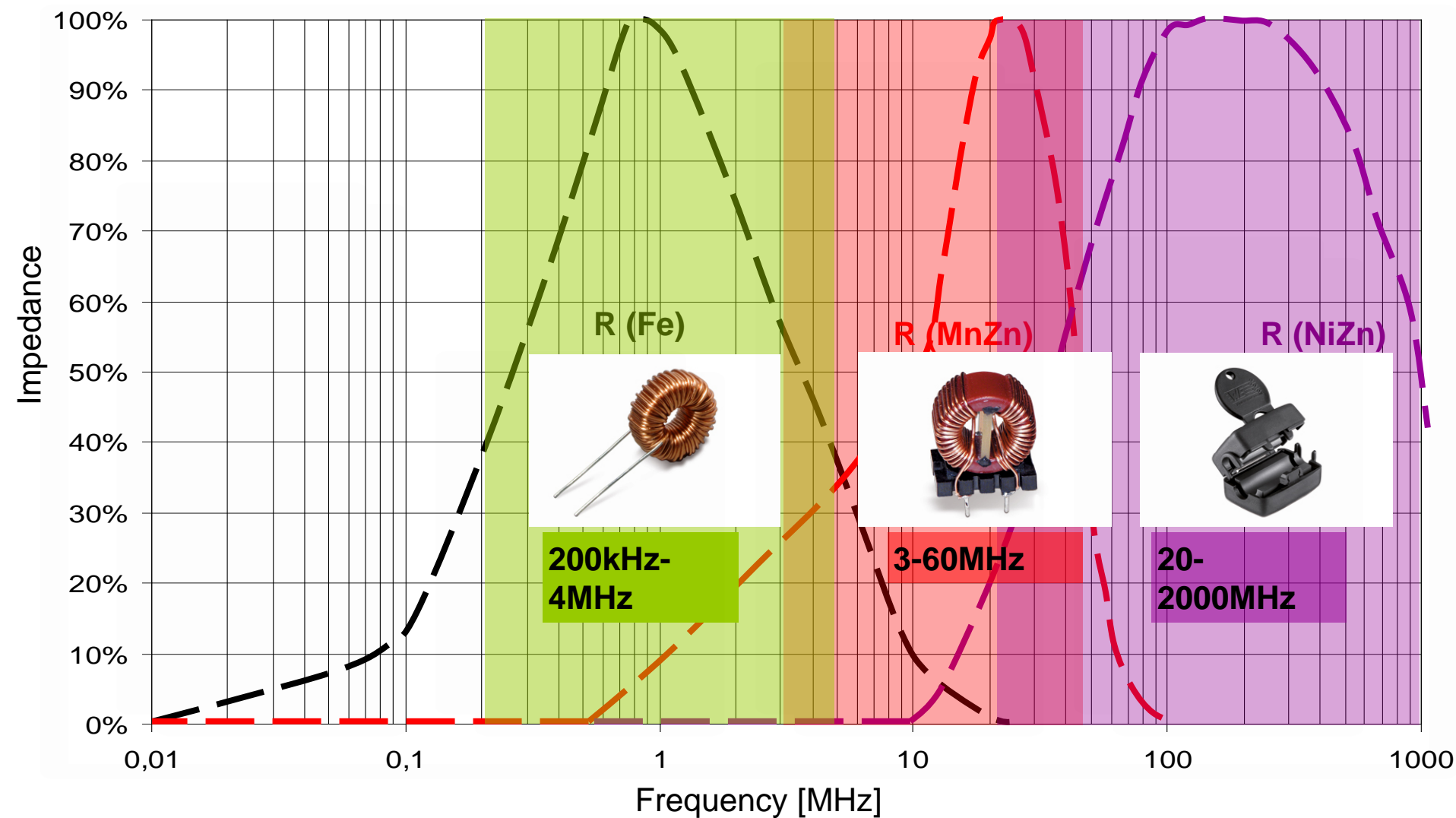
Materials – Inductors (storage)



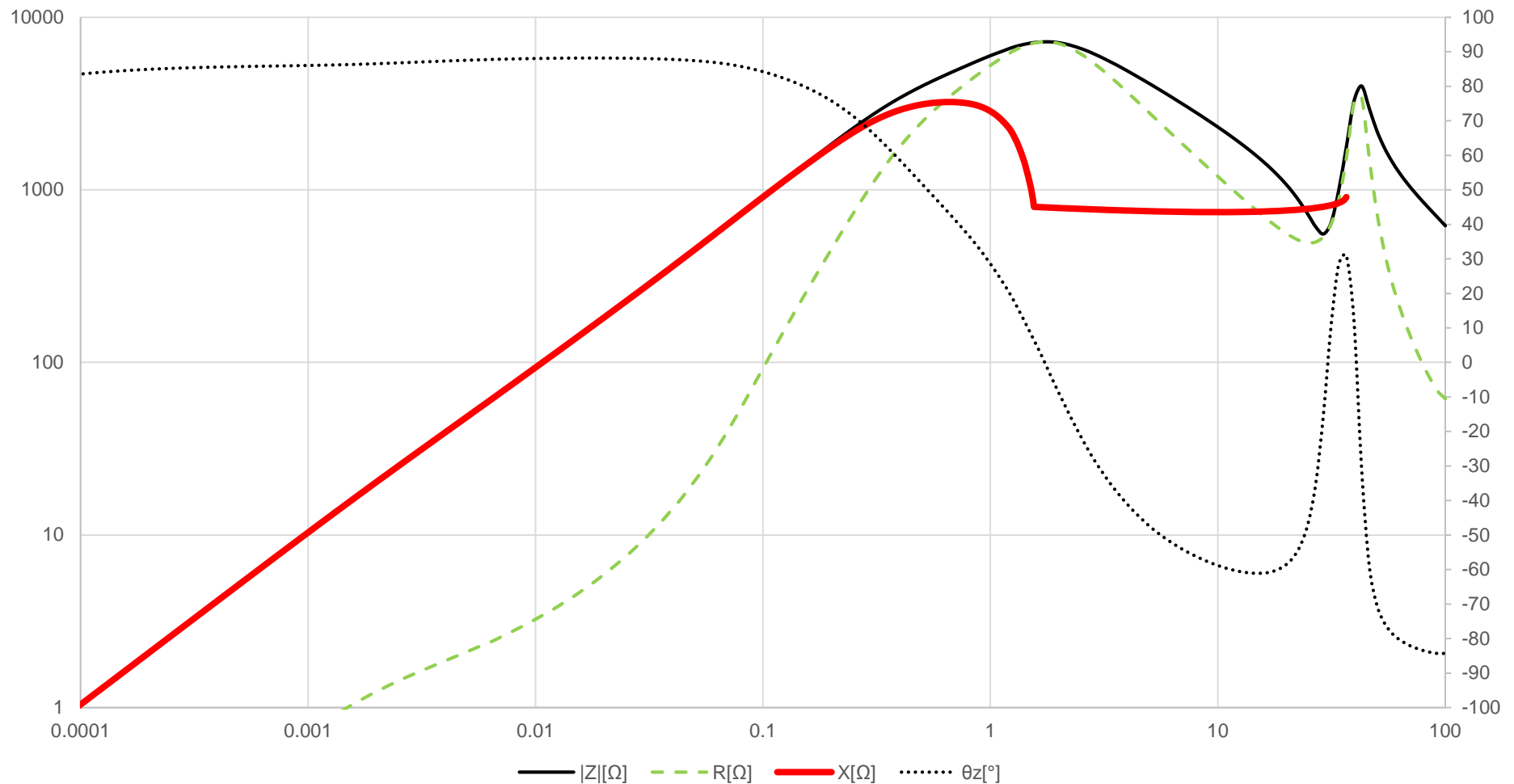
Materials – Inductor (Storage)



Materials – Choke (filter/dissipation)



Materials – Choke (filter/dissipation)



Common mode choke – construction

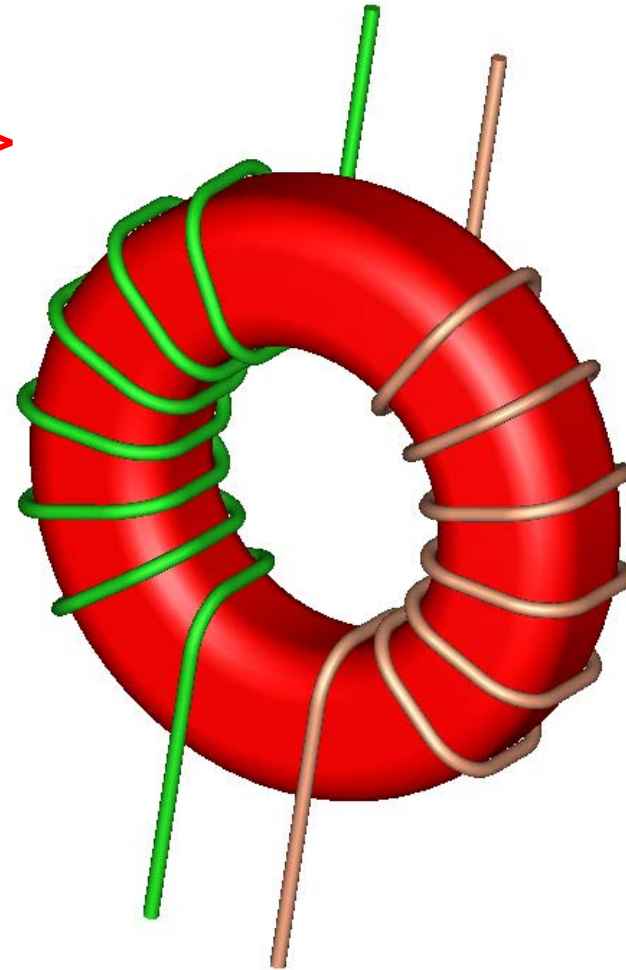
bifilar



$$L_{\text{leak}} \sim 0,01 \dots 0,1 \% * L_R$$

< Advantage? >

sectional

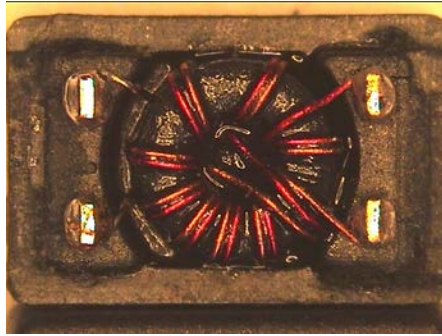


$$L_{\text{leak}} \sim 0,5 \dots 2\% * L_R$$

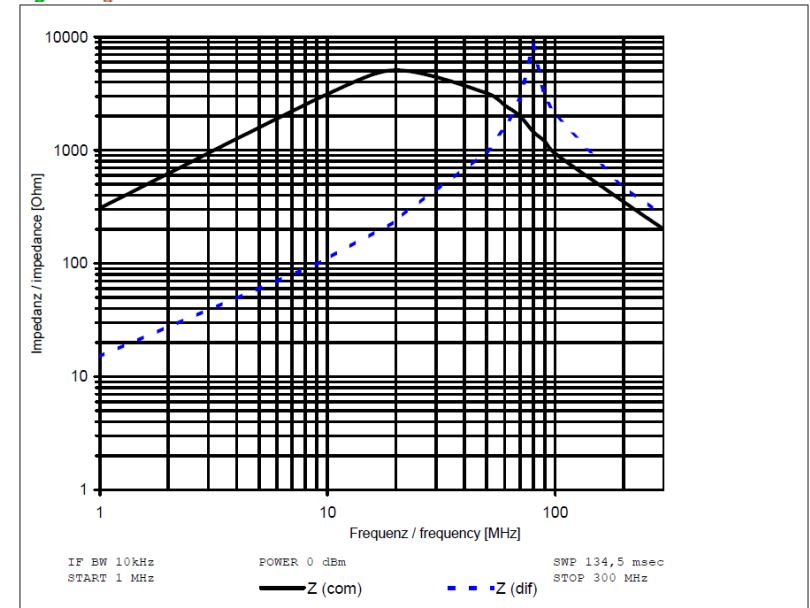
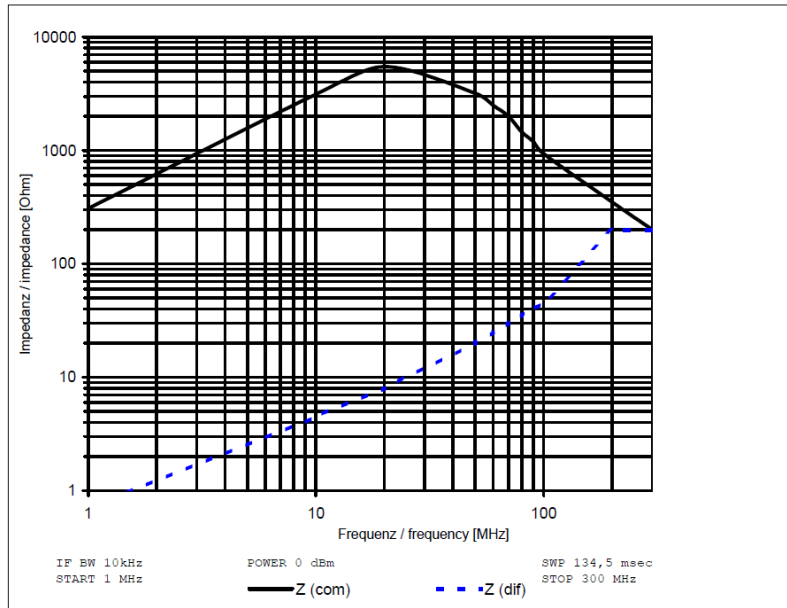
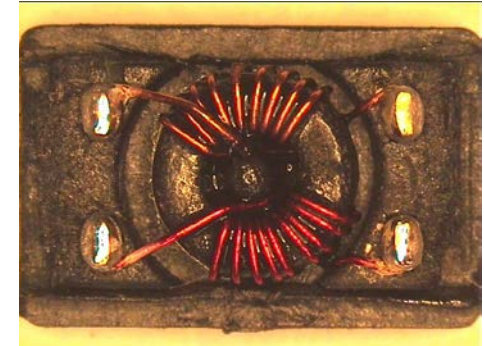
Common mode choke – construction



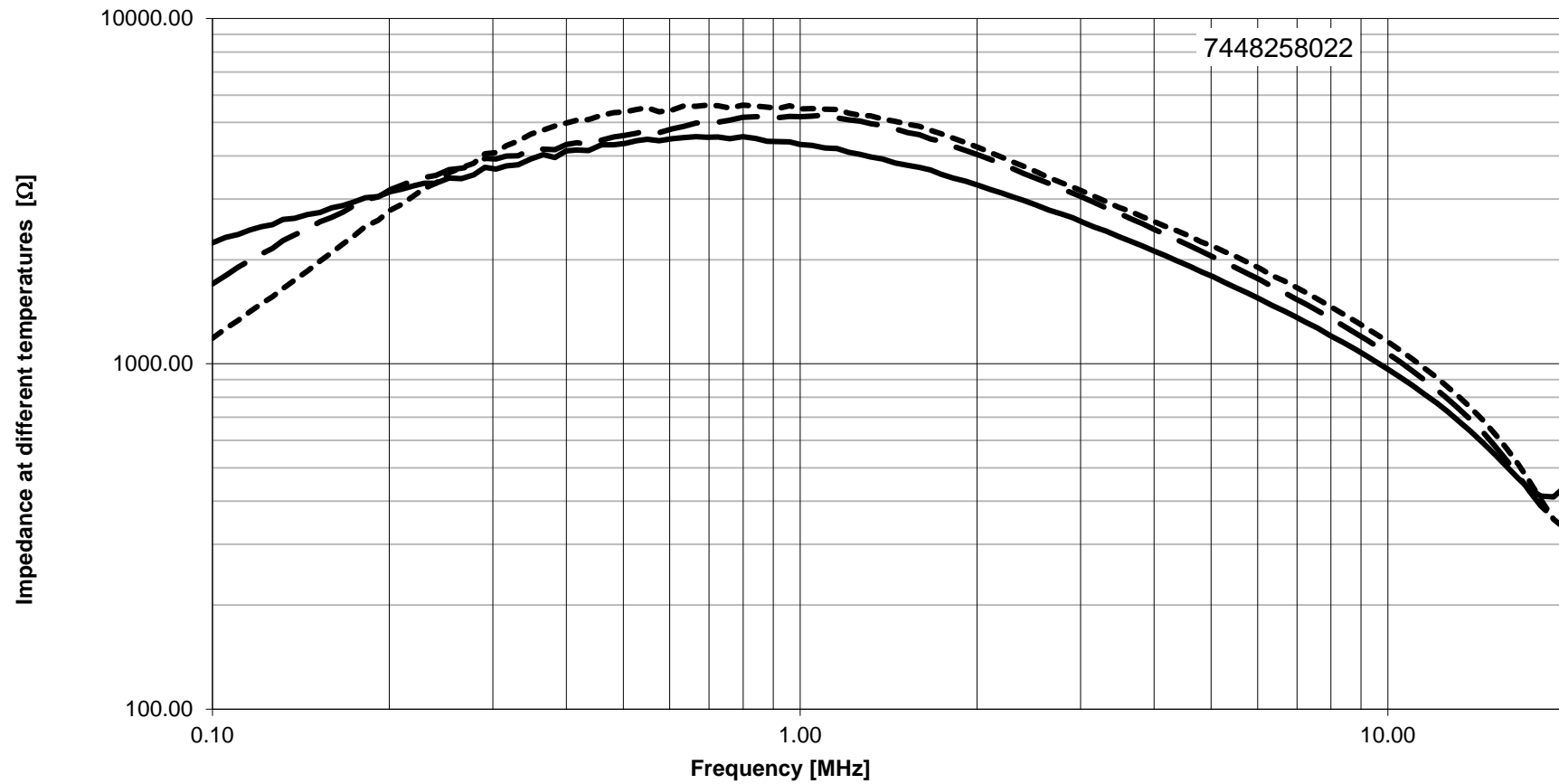
bifilar



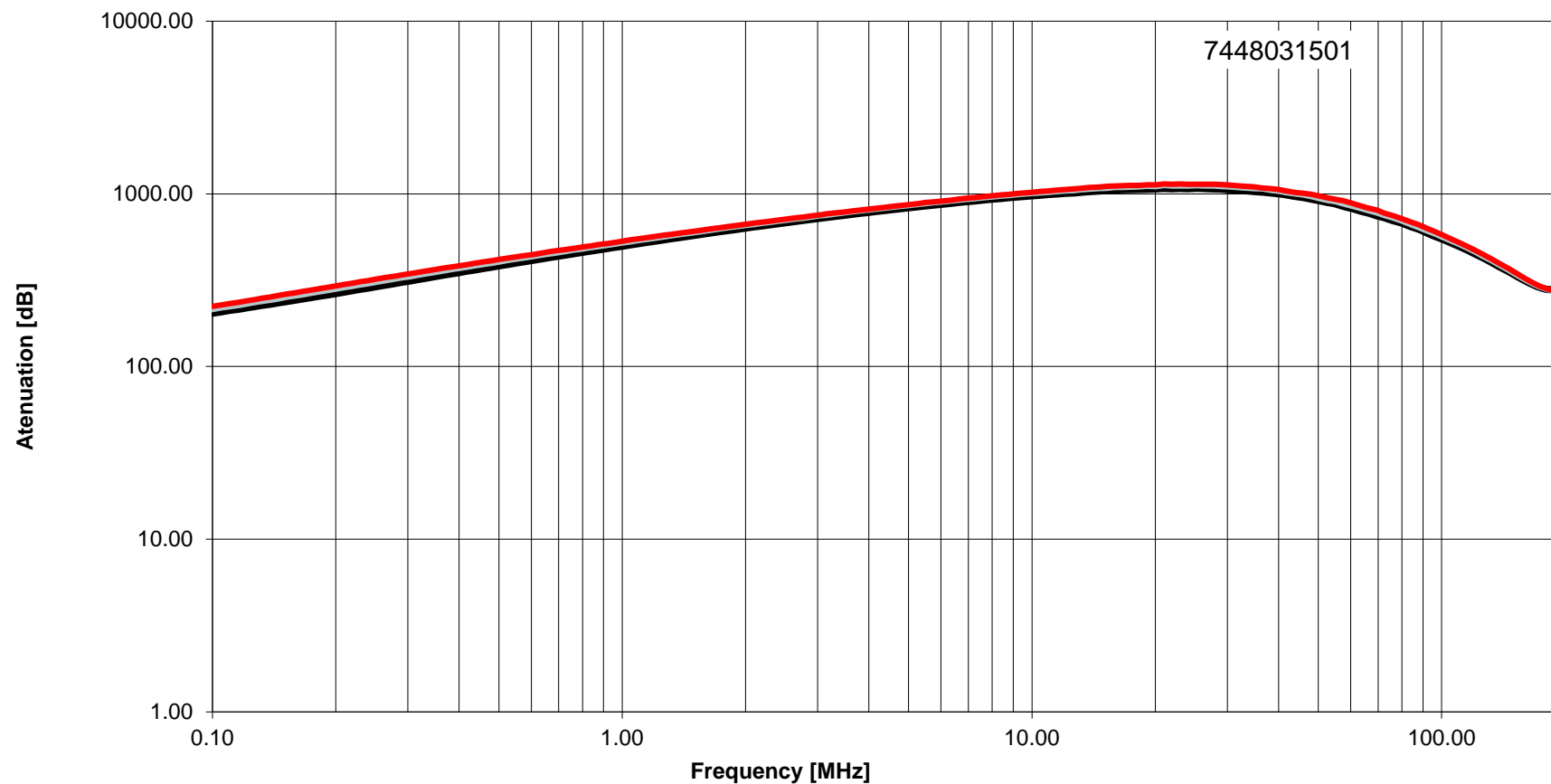
sectional



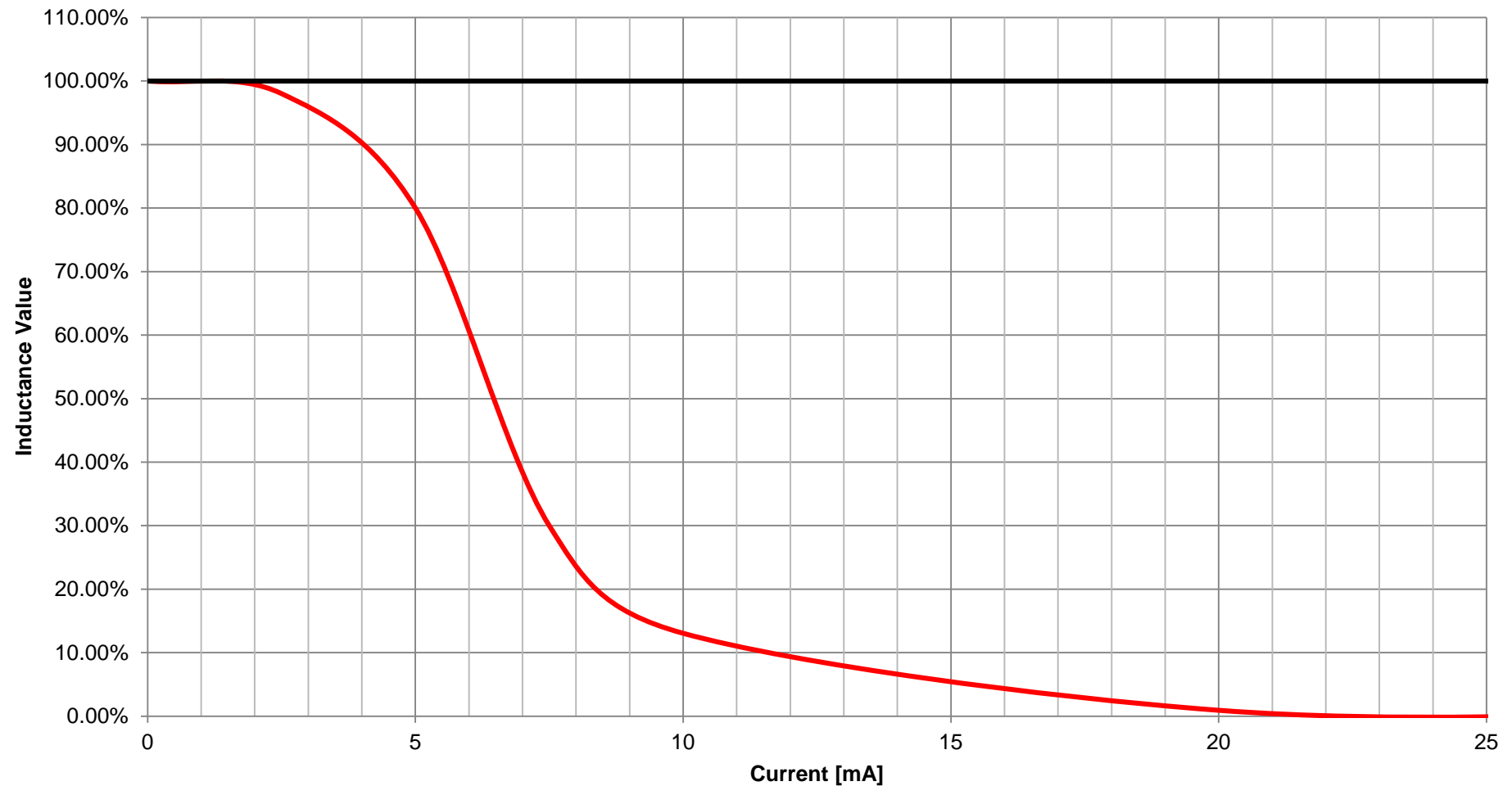
Temperature effect on the core - MnZn



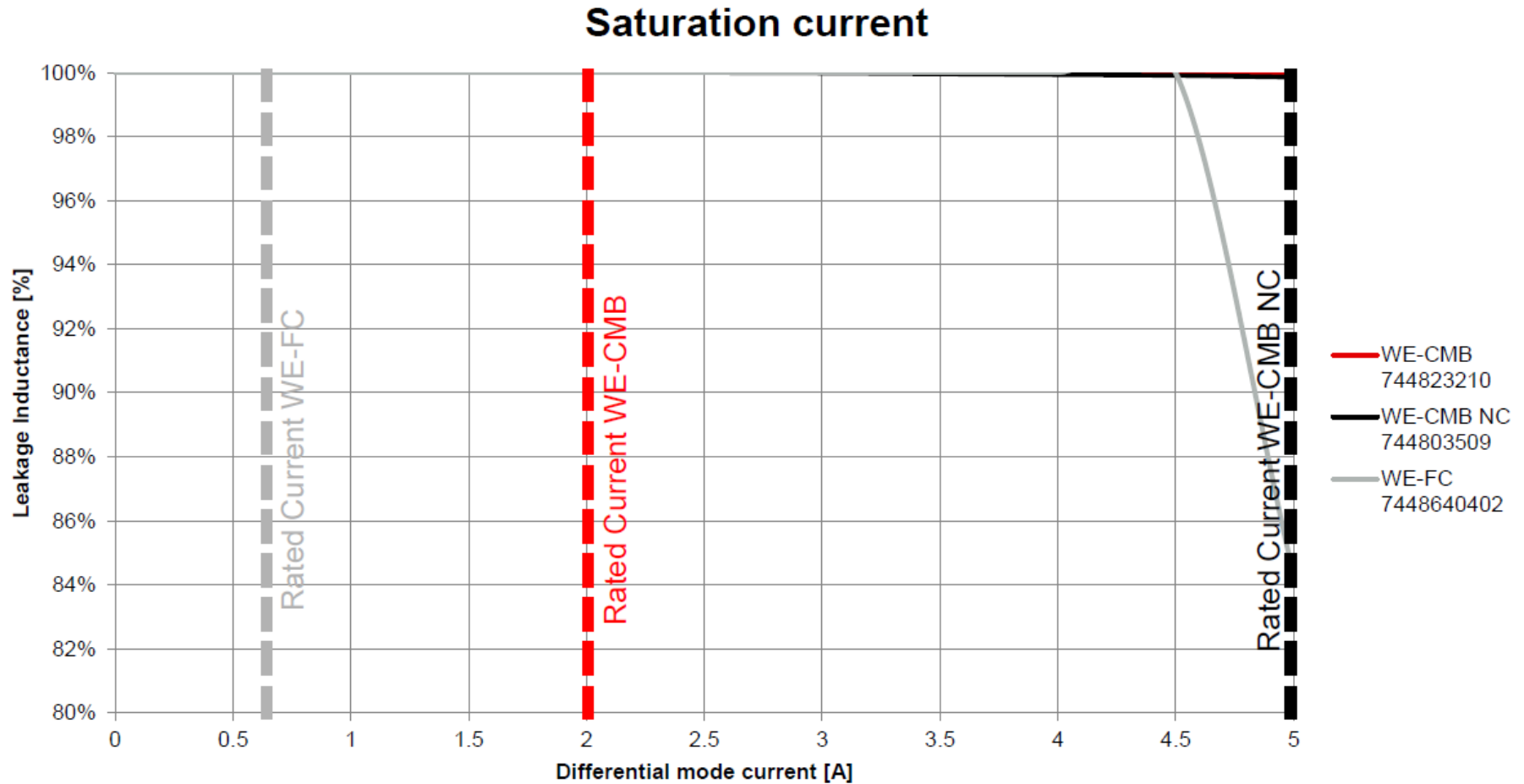
Temperature effect on the core - Nanocrystalline



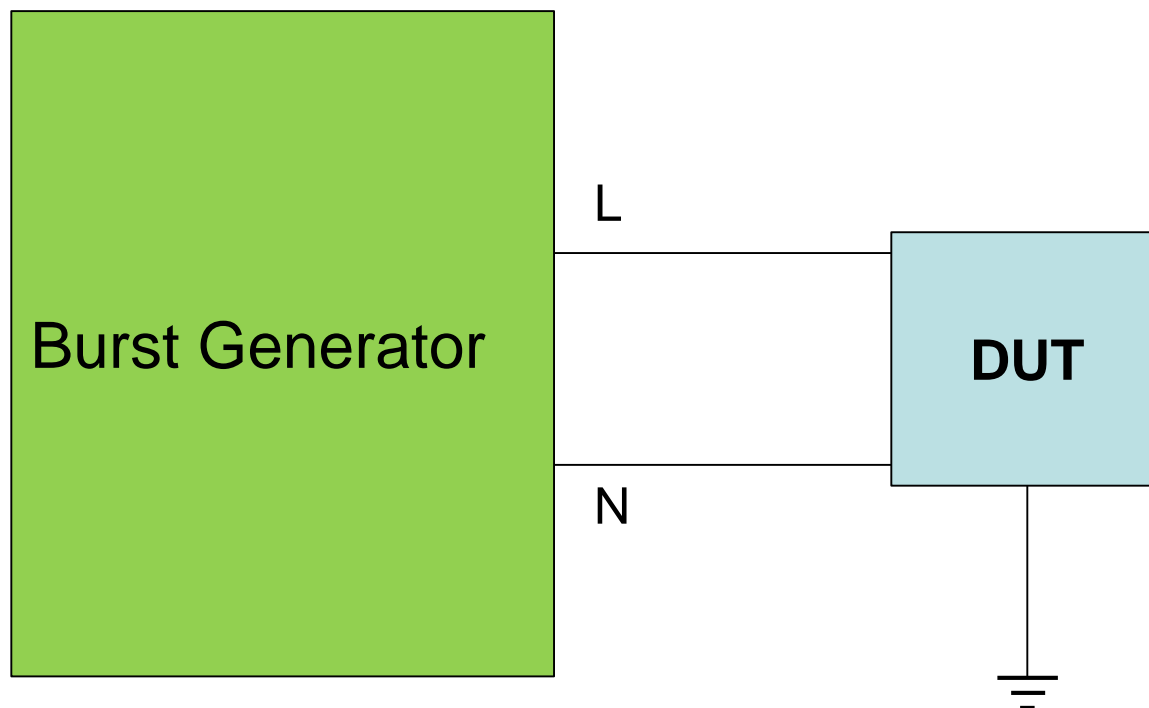
Saturation of the core



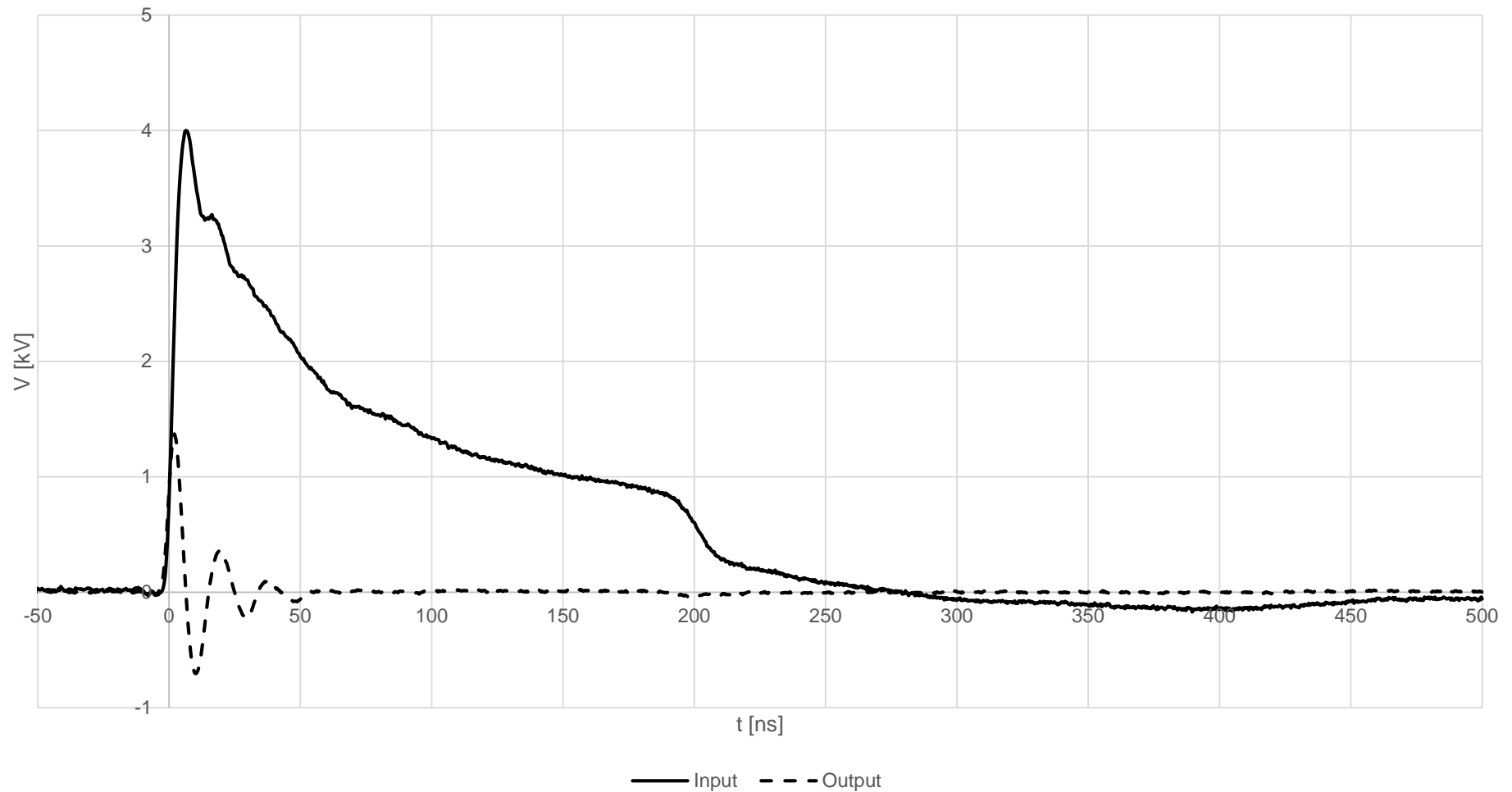
Saturation of the core



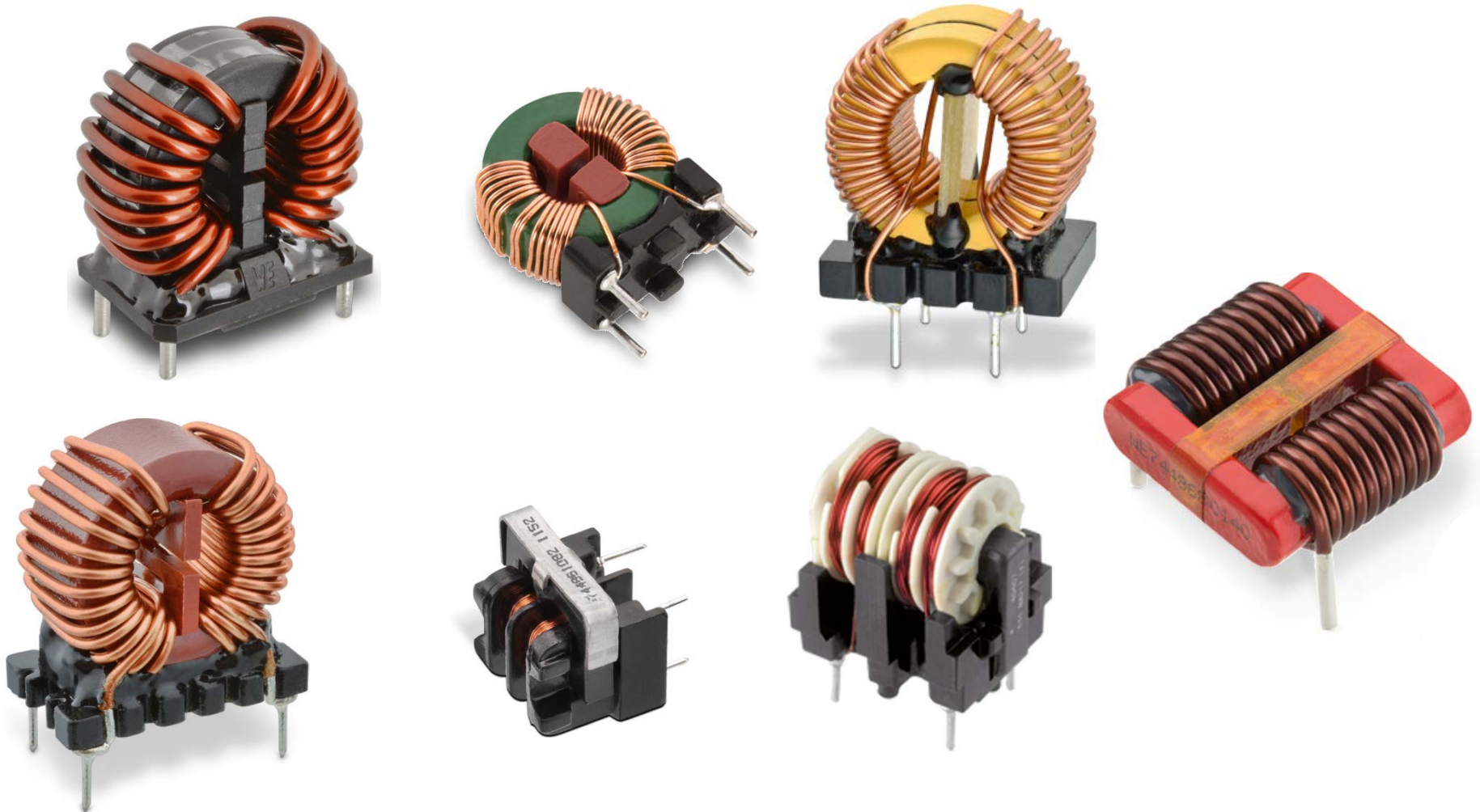
EFTB Test setup



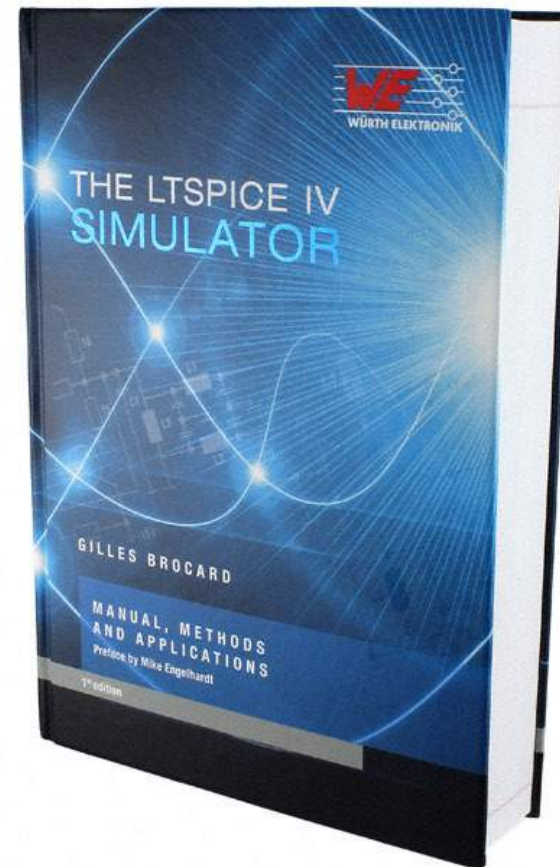
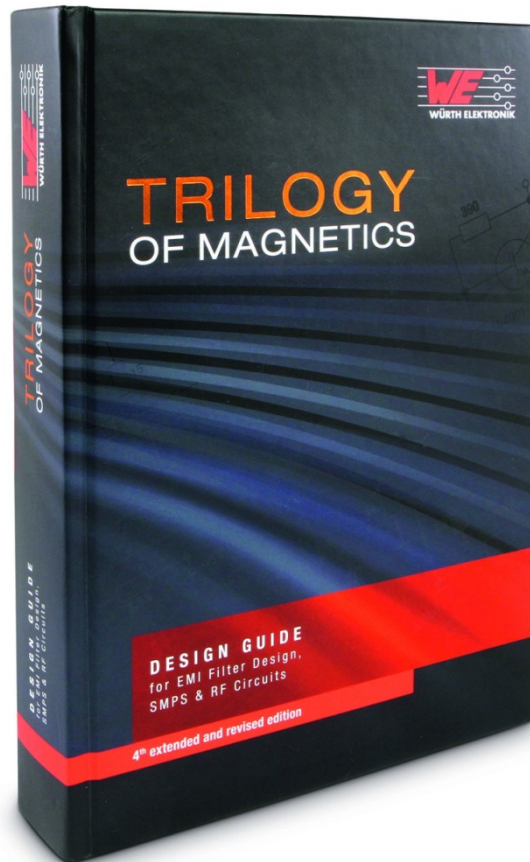
EFTB



Different core materials & Constructions



Sources



Дякую gràcies arigato obrigado ač ū grazzi terima
 kiitos dhanyavād dēkuji paldies diolch
 takh Xièxiè danke khun teşekkür
 tēch Dakujiem
 Благодарам merci dziekuje
 tānan dank thanks choukrane
 tak hvala nandri
 kop ederim תודה faleminderit
 dankie grazie gracias Баярлалаа
 kasih mulţumesc mahalo
 shukran благодаря спасибо ngiyabonga
 ευχαριστώ köszönöm Mh' gōi



WÜRTH ELEKTRONIK