EMI filter design

Hints and tricks

Reducing conducted coupling

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Organized by:

ROHDE&SCHWARZ
Make ideas real

Nov 2021

EMI/EMC/SI Design and Troubleshooting

Two exciting days: ... for EMI/EMC!

DAY 1: 9th November

9:30 to 12:00 (CET) – Roots of EMI (Part 1)
> Challenges and Early Review of Your Design! (Presented by Arturo Mediano, University of Zaragoza - 45min)
> EMC Testing from First-Level Debugging to the Compliance Stage (Presented by Christian Reimer, R&S - 45min)
> Practical and Early Testing Showcases (Presented by Jan Spindler, MPS - 45min)

Register Now

13:00 to 16:30 (CET) – Roots of EMI (Part 2)
> EMI Troubleshooting and Debugging (Presented by Arturo Mediano, University of Zaragoza - 1h)
> DC/DC Conversion Workshop – DUT Troubleshooting (Presented by Jens Hedrich, MPS - 1h)
> Pre-Compliance Set-Up (Presented by Alexander Küllmer, R&S - 1h)

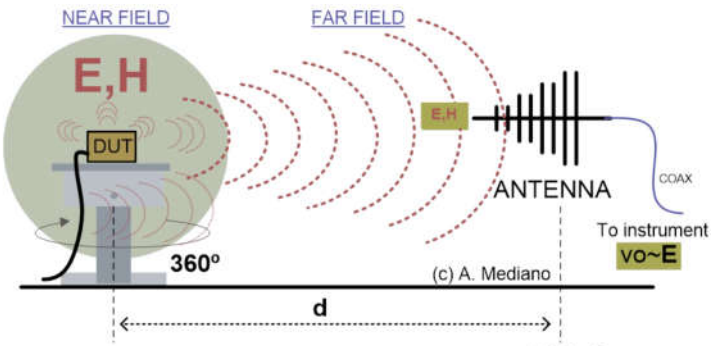
Register Now

DAY 2: 10th November

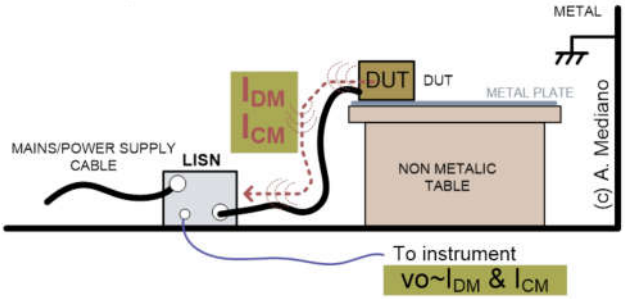
8:30 to 12:00 (CET) – Power Applications
> Filter Design Hints and Tricks (Presented by Arturo Mediano, University of Zaragoza - 45min)
> Stability in Converters: Control Loop & Load Step Design (Presented by Christian Kueck, MPS - 45min)
> Power Integrity Can Cause EMI Challenges (Presented by Arturo Mediano, University of Zaragoza - 45min)
> Mythbusting EMC Techniques in Power Converter Design (Presented by Francesc Estragues, MPS - 45min)

EMI/EMC: tests

RADIATED EMISSIONS



CONDUCTED EMISSIONS



EMI filters: four critical ideas

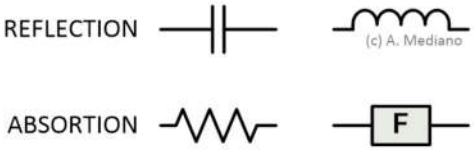
Idea 1: reduce coupling mechanism ....

Idea 2: usually low pass and passive

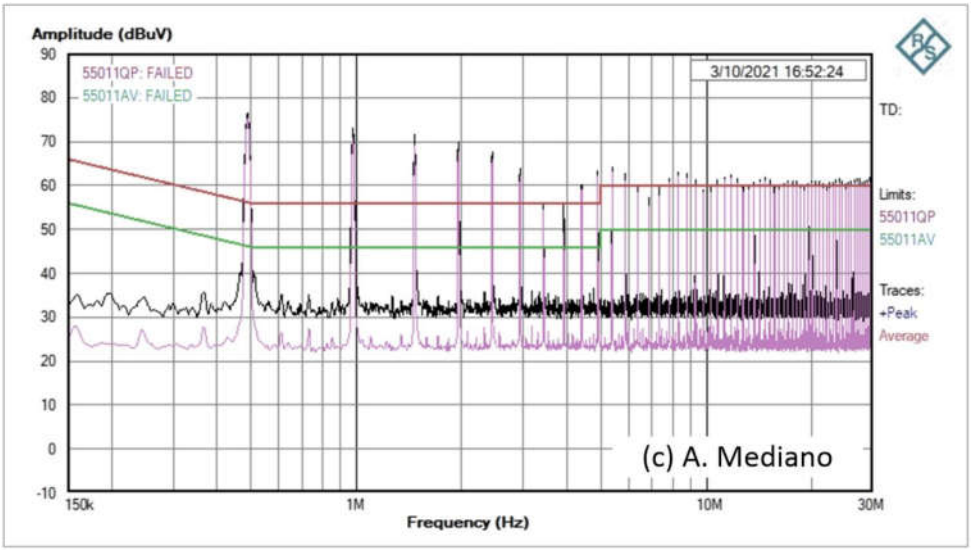
Idea 3: a lot of applications

EMI in cables, conducted emissions filters, decoupling and bypass, filtered connectors, feedthrough components, …

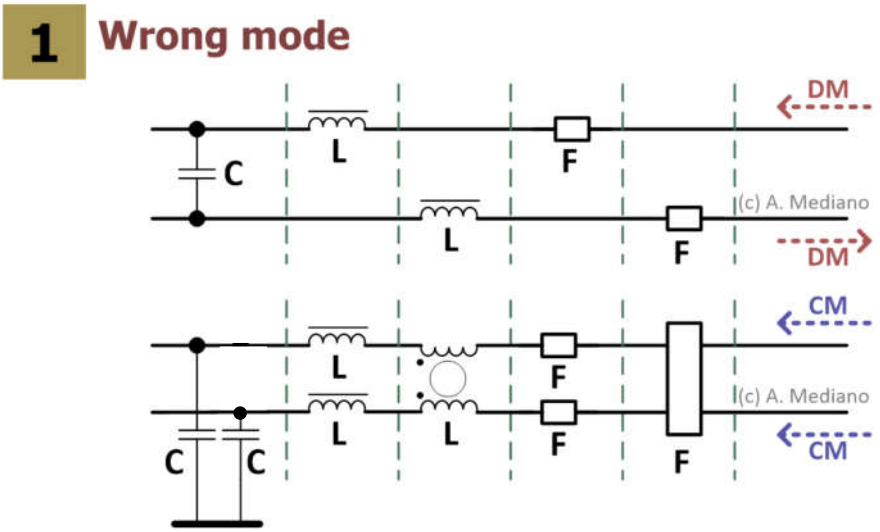
Idea 4: working principle



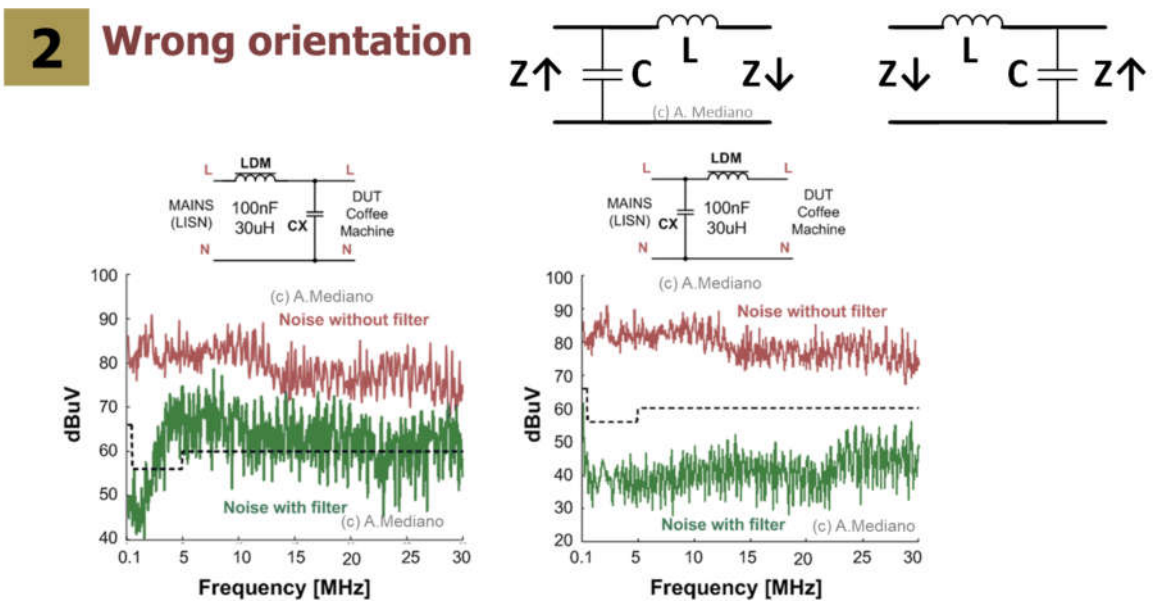
Problem: failing in conducted emissions.



Why filters fail: Reason 1

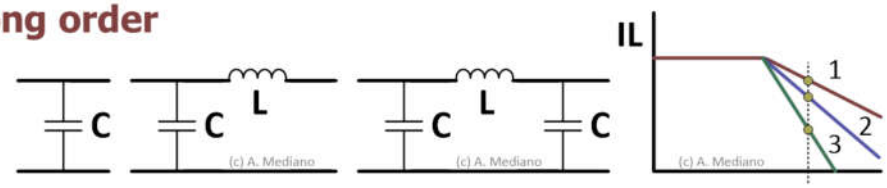


Why filters fail: Reason 2



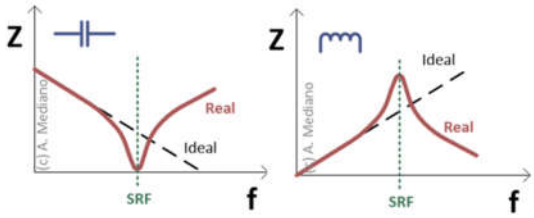
Why filters fail: Reason 3 & 4 …

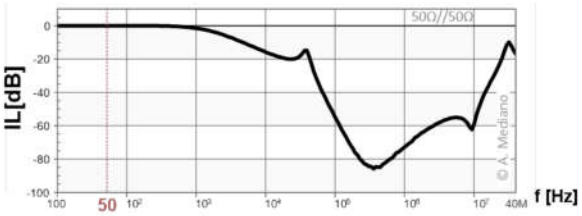
3 Wrong order



4 Parasitics in components

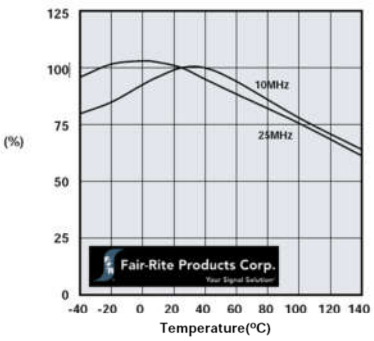
Be careful increasing nominal values !!!!





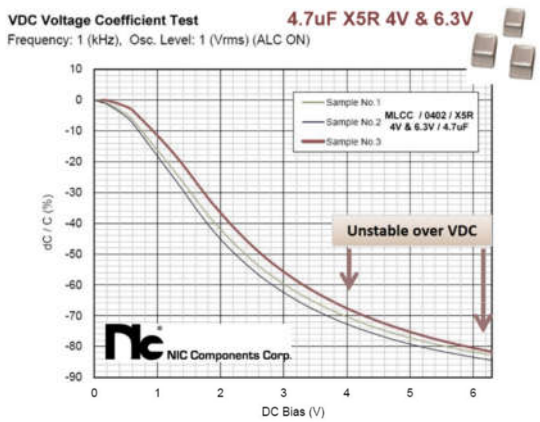
Why filters fail: Reasons 5 and 6 …

5 Temperature dependence in ferrites/cores



73 material
1 –25 MHz

6 Voltage dependence in capacitors



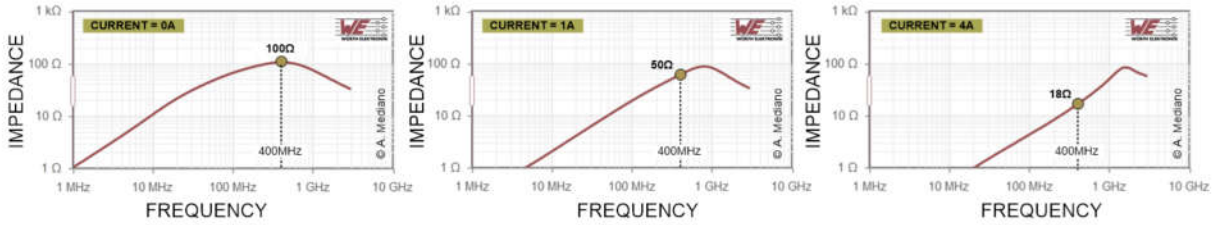
X5R dielectric most popular for high capacitance (>1µF) MLCCs in small sizes
2VDC applied can result in 35~45% capacitance value decrease

Why filters fail: Reasons 7 and 8 …

7 Current dependence in inductors (core)

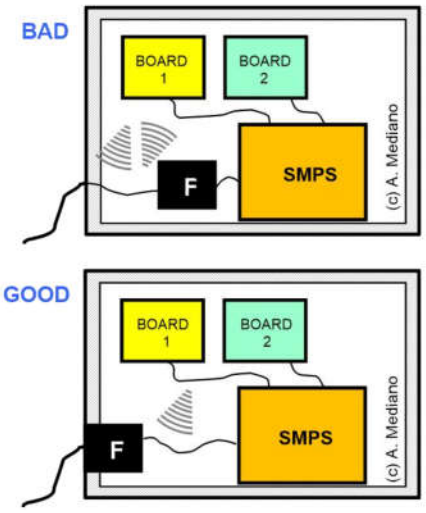
8 Current dependence in ferrites

74279228600 WE-MPSB 0603 Ferrite bead



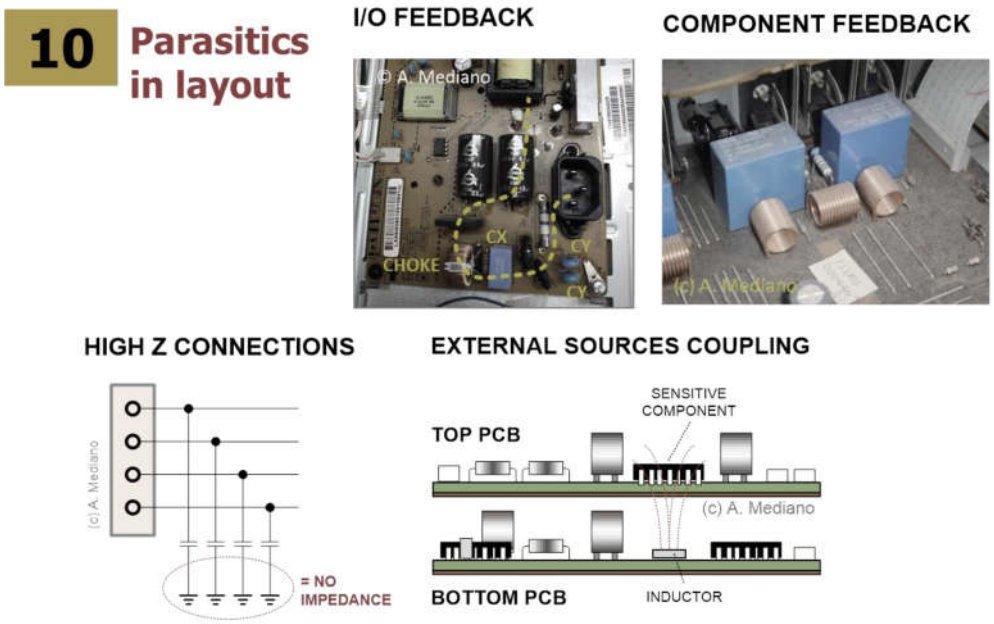
Why filters fail: Reason 9 …

9 Wrong location



Be careful with resines!!!!

Why filters fail: Reason 10.



THANK YOU!

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