Master Proposal M61:

EMI Filter Design and Verification using RF Simulation Tools and Measurements

Area:	Microwave Engineering,
Supervisors:	Prof. Dr. Sören Peik
Duration:	6 Month
Prerequisite	Microwave Engineering, MW Office, EMC

Outline:

Even though not recommended, EMC compliance [1, 2, **?**, 5] is often implemented in electronic circuits during the last design cycle. When compliance is not reaches, EMC filters have to be integrated [7]. The proper selection of a filter is tricky and often done by a trial and error method. Filter solutions of the well-known EMC filter manufacturers are attempted until a proper suppression of the disturbances is reached.

The objective of this thesis is the systematic analysis and selection of EMC filtering solutions based on CAD simulations with AWR Microwave Office. The disturbance signal of the equipment under test (EUT) shall be recorded by a software defined radio and then synthesized for the use in a CAD simulation program. Now the disturbance can be analysed and suppressed using the PC based simulations. For countermeasures the often provided filter models of the manufacturers, e.g. [8] shall be implemented.

The following steps have to be completed:

1. Analysis of the project requirements and project flow (project planning)
2. Simulation of filter circuits in MWO common mode and differential mode as shown in [6][4] using frequency domain simulation
3. Simulation of filter circuits in MWO as shown in [**?**] using time domain simulation
4. Simulated filtering using filters as in [8] .
5. Verification by manufactured circuit board
6. Integrating of measured signals in the simulation[3]
7. Documentation (Thesis Report, Presentation, Data-CD and Poster)

References

[1] T. Williams, in *EMC for Product Designers (Fourth Edition)*, fourth edition ed., T. Williams, Ed. Oxford: Newnes, 2007, pp. xi–xiv. [Online]. Available: https://www.sciencedirect.com/science/article/pii/B9780750681704500001

[2] C. Kathalay, *A PRACTICAL APPROACH TO ELECTROMAGNETIC COMPATIBILITY(WITH AN INTRODUCTION TO CE MARKING)*. EMC Publications, Pune, 2014.

[3] J. Deng, “In-circuit rf impedance measurement for emi filter design in switched mode power supplies.”

[4] S. YALCIN, S. OEZEN, and S. HELHEL, “Emi filter design based on the separated electromagnetic interference in switched mode power supplies,” vol. 26, pp. 3034–3044.

[5] R. L. Ozenbaugh, “Emi filter design,” Boca Raton, FL, 2012, includes bibliographical references. [Online]. Available: http://site.ebrary.com/lib/alltitles/docDetail.action?docID=10508914

[6] EMC Filter Design Part 1: Understanding Common Mode and Differential Mode Noise, https://youtu.be/JQkNqY0I02Y

[7] EMC Filter Design Part 8: EMC Common Mode Filter Design and Component Selection

[8] Würth Common Mode Filter WE-SL3, https://www.we-online.de/katalog/de/WE-SL3