



# MODELING OF TOROIDAL CHOKE WITH FERRITE CORE

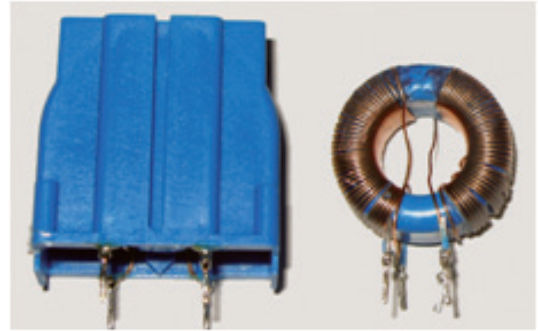
## Introduction

This application note demonstrates modeling of toroidal choke with ferrite core in EMCoS PCB VLab environment. Model is constructed based on sample of EPCOS 2 x 6.8 mH current-compensated choke (B82724J2202N001).

EPCOS 2 x 6.8 mH choke sample is considered in three connection modes: common-mode, differential-mode and open circuit mode.

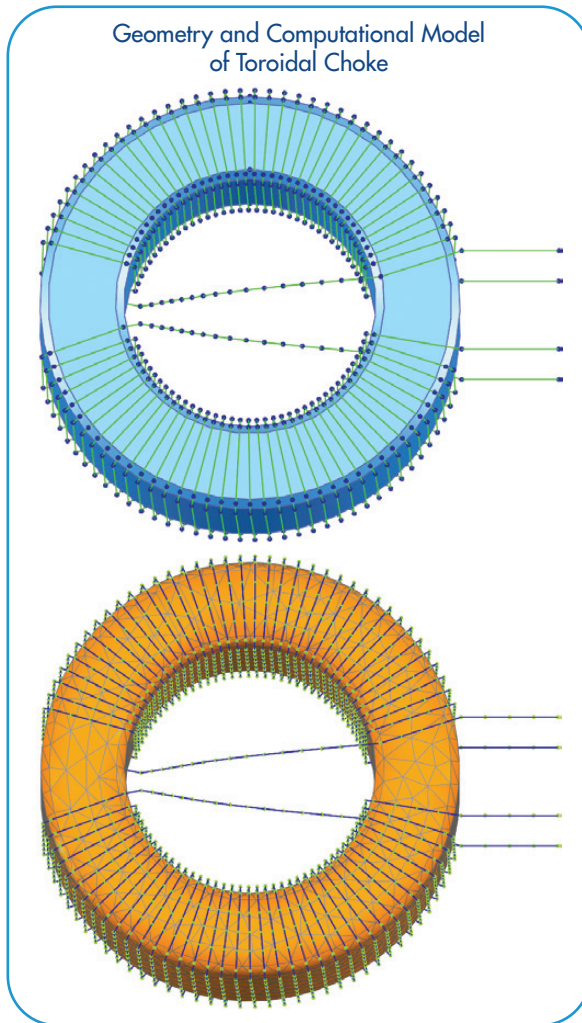
Calculated input impedance of toroidal choke for all modes is compared to measured data obtained by HP 8752 network analyzer.

Sample of EPCOS 2 x 6.8 mH Toroidal Inductor



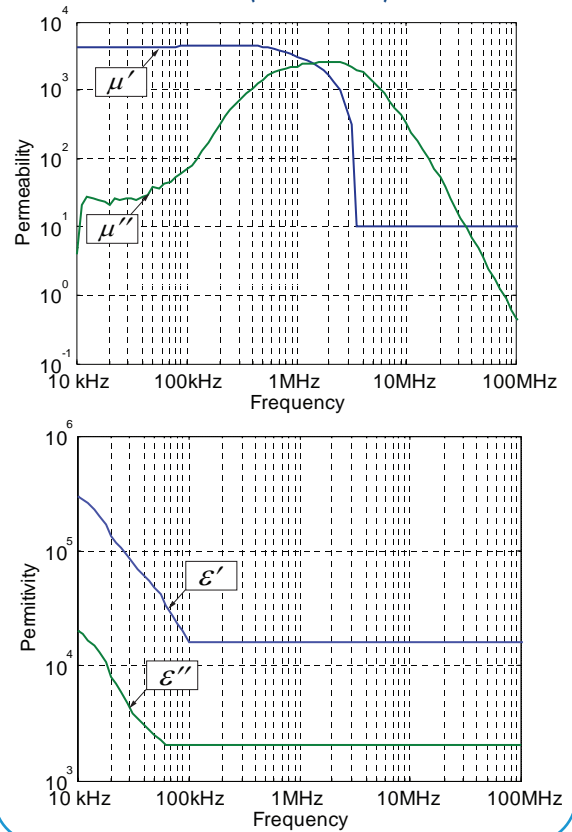
## Simulation Model Description

Geometry model of toroidal chock was generated using CAD operations and special filter components construction tools.



Geometry and Computational Model of Toroidal Choke

Dielectric and Magnetic Parameters of EPCOS N30 (MnZn Based) Material



### Geometry Parameters

Inner radius of toroid	7.25 mm
Outer radius of toroid	12.5 mm
Height of toroid	10.5 mm
Number of turns for one coil	38
Length of pins	0.44 mm
Diameter of coil wire	6 mm
Diameter of pins	0.7 mm

Dielectric and magnetic parameters of EPCOS N30 (MnZn based) material were used for modeling of toroidal ferrite core.

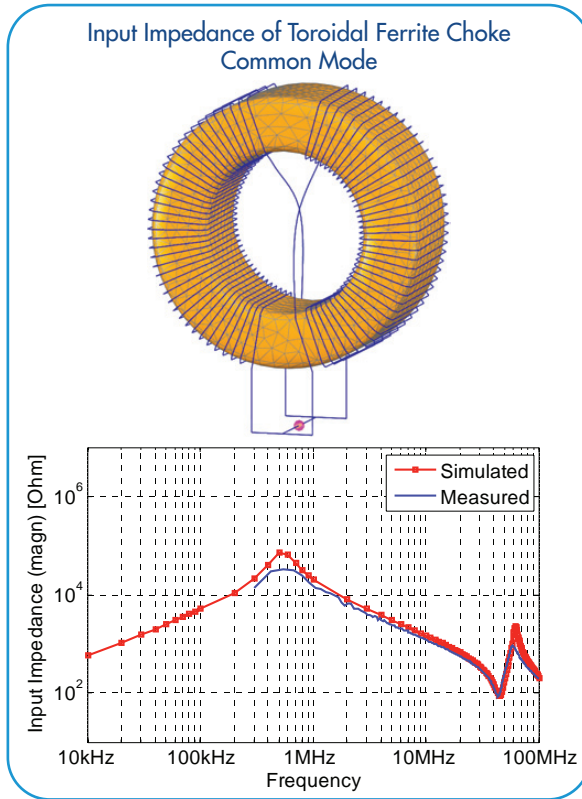
Frequency range is from 10 kHz up to 100 MHz.



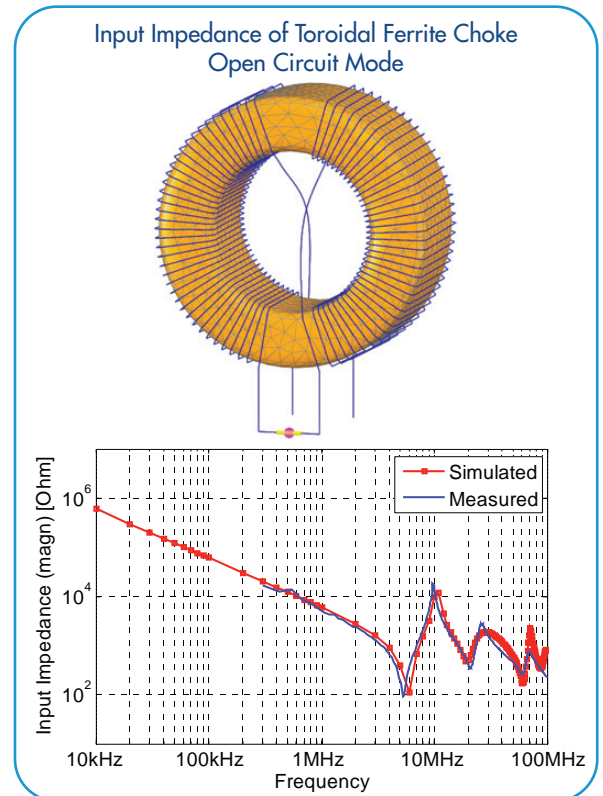
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## Results

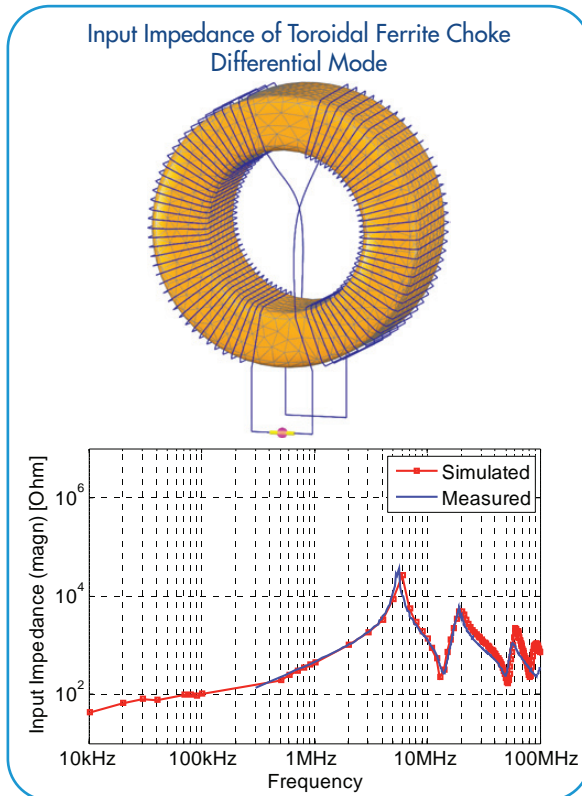
EPCOS 2 x 6.8 mH current compensated choke is considered in three modes: common-mode, differential-mode and open circuit mode. The comparison of simulation and measurement results is shown below. There is a good agreement between simulation and measurement results in considered frequency range.



- Measurements of input impedance for EPCOS choke were performed with HP 8752 network analyzer in EMCos laboratory in frequency range from 300 kHz up to 100 MHz.
- Simulations were performed with MoM based TriD solver in frequency range from 10 kHz up to 100 MHz



Calculation time for one frequency on Cluster (2 dual core CPU 3 GHz, RAM = 16 GB) is 45 sec.



## Conclusions

- EMCos PCB VLab provides convenient interface for fast generation of different filter components with various shapes of cores and windings
- Definition of dielectric and magnetic parameters of ferrite core with frequency dependent data can be easily done with help of advanced materials library supported in EMCos PCB VLab
- The comparison shows good agreement between simulation results for input impedance of toroidal ferrite choke and measured data in all modes

## References

- A. Gheonjian, B. Khvitia, D. Yeremian, Z. Kut Chadze, R. Jobava, X. Bunlon "FULL WAVE MOM SIMULATIONS OF EM INTERACTIONS IN EMC FILTERS FROM 10 KHZ TO 50 MHZ", 17th International Symposium on ElectroMagnetic Compatibility (CEM 2014), 1-3 July, 2014