FEM antenna model verified against measurements

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Abstract **This article is a continuation of work on adequate numerical model for E-field antenna EFG-3B used in EMC tests. So far the model built using Method of Moments has been described [2]. Authors' main goal is to verify results obtained from COMSOL Multiphysics environment against measurements. To simulate anechoic chamber Perfectly Matched Layer had been used.**

Keywords **EFG, FEM, antenna, COMSOL, PML.**

I. Introduction

Antennas analysis described in this paper had been used to examine an EFG-3B antenna working as a part of system for EMC testing. Authors have conducted series of numerical experiments to extract influence of different simulation parameters on final result's quality. In order to gain more confidence in those results, different methods of such analysis had been used.

Following sections describe briefly different approaches that authors had taken while creating the most appropriate model. In their work authors had examined influence of shunts, floor and type of PML on result's quality. Preliminary summary can be found in Section IV. In our research frequency range starts from 10kHz and ends on 100MHz.

II. Half-Spherical PML simulation

The most straightforward approach to simulate radiation boundary condition is to use Perfectly Matched Layers. Many sources suggest using spherical PML. Absorbing ferrite cones on anechoic chamber's walls can be seen as an approximation of PML. In our simulation we've also taken into account floor made of perfectly electric conductor. Final model before meshing can be seen in the Fig. 1.

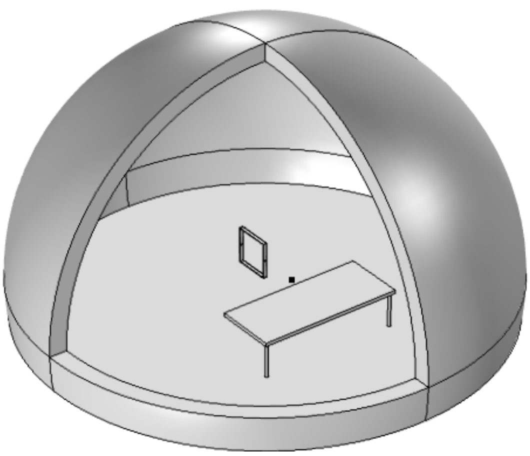

Fig. 1. Frame antenna model with table and shunts (spherical PML)

III. Cartesian PML simulation

Authors wanted to test how cartesian PML will influence results of the analysis. Numerical antenna model had been enclosed in cuboid resembling in dimension the anechoic chamber used for reference measurements (see Fig. 2). It should be noted that both models are not taking advantage of any symmetry.

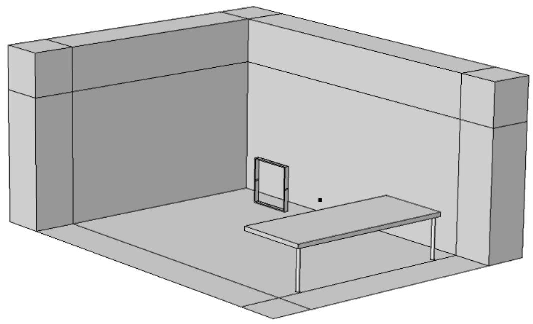

Fig. 2. Alternative model with table and shunts (cartesian PML)

IV. Conclusion

Using models from both II and III authors managed to achieve satisfactory results. Overall characteristic of the near electric field matches results from MoM simulation and measurements as could be predicted [1]. However, from numerical point of view model using spherical PML was characterized by much better convergence in the frequency spectrum. Whereas model with cartesian PML had troubles with converging to the solution at high frequencies (above 80MHz). Increasing mesh density improved the situation but after examination of results from both models no significant differences had been noticed. On the other hand, shunts and floor existence had an visible impact on electric field values generated by the antenna.

References

[1] Davidson, D. B.: "Computational Electromagnetics for RF and Microwave Engineering", Second Edition, Section 5.4, page 176, Cambridge University Press, 2005.

[2] Chaber, B., Starzyński, J.: "MoM antenna model verified against measurements", Electrical Review, 2012.