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Design of a TEM-Cell with Increased Usable Test Area

Kresimir MALARIC, Juraj BARTOLIC
Faculty of Electrical Engineering and Computing,
Unska 3, HR-10000 Zagreb, Croatia
e-mail: kresimir.malaric@fer.hr

Abstract: Transversal electromagnetic mode cells (TEM-cells) are used for electromagnetic compatibility measurements (emission and immunity), and for biomedical applications. Over the years, higher and higher frequencies are being used, which demands smaller transmission structures in order to obtain the homogeneous field distribution due to resonance. Such resonance destroys the TEM field, introducing higher order modes. The goal was to design the TEM-cell for GSM frequencies that will have a larger area with a homogeneous field used for testing, while still obtaining the characteristic impedance. Commercial TEM-cells used for frequencies of 900 MHz have only 2 cm in height available for testing, while the proposed TEM-cell has 5 cm in vertical dimension suitable for EMC testing. The problems regarding characteristic impedance, resonance, higher order modes, dimensions and usable test area are discussed. Numerical modeling with the ``Quickfield", which uses finite element method (FEM), and ``MAFIA", which uses finite integration technique (FIT) gave the electromagnetic field distribution and calculation of the higher order modes. The measurements of VSWR and insertion loss showed good correlation with the model. At 935 MHz, the VSWR is 1.1 which makes the cell applicable for GSM frequencies. The higher order modes appear at 490 MHz and 740 MHz, but another frequency area is usable. The TEM-cell has a characteristic impedance of 75 Ω and an increased usable test area. It can be utilized for EMC measurements and biomedical applications from DC to 1 GHz.

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