### XFDTD v6 Example: Radiation from a Shielding Enclosure

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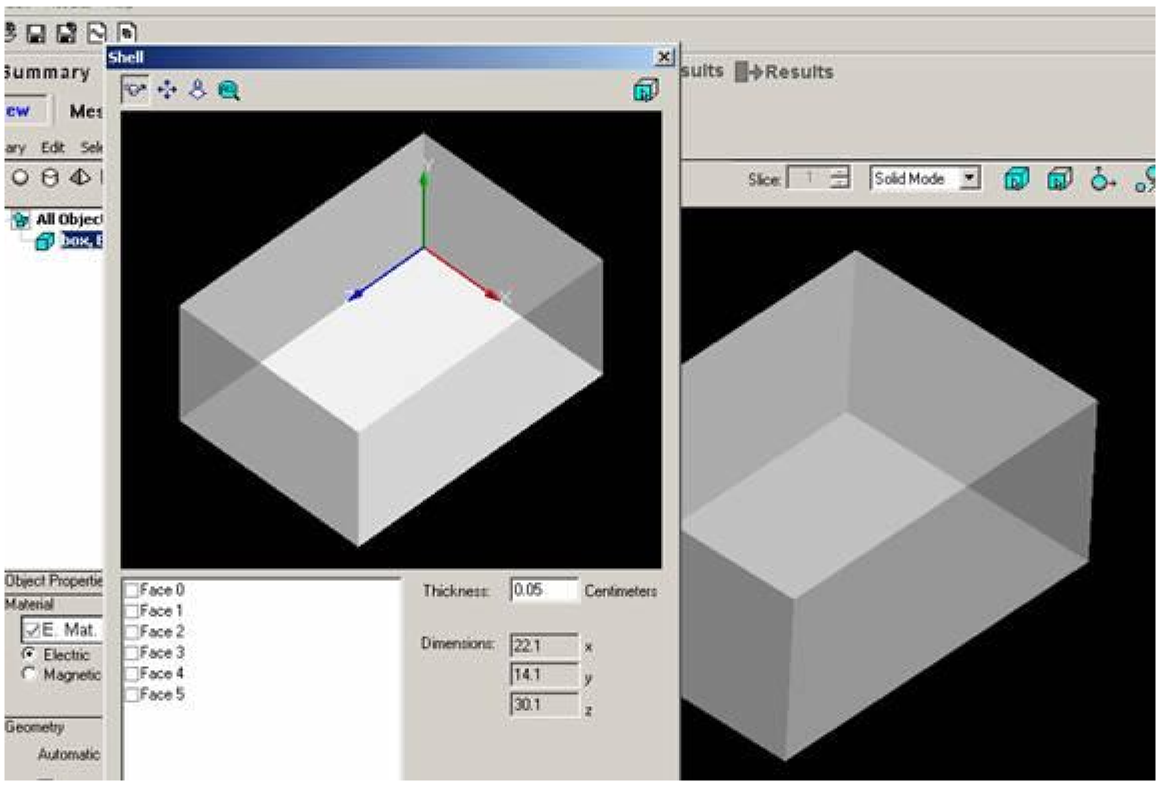
**Application of XFDTD to a classic EMI/EMC Problem**

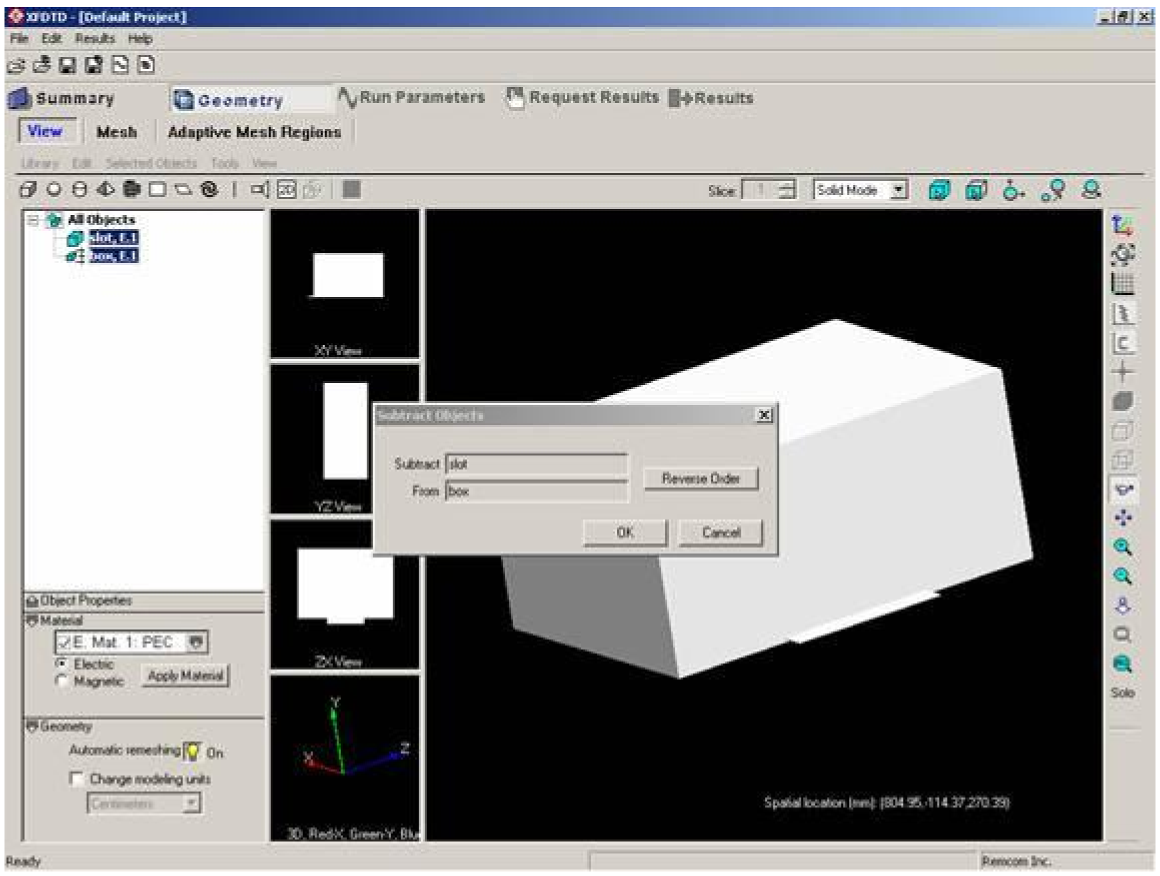
**In this example XFDTD is applied to the classic problem of a thin metal shielding enclosure perforated by a slot. XFDTD is used to determine the power delivered to the enclosure and the electric field radiated from the slot. Results are compared with those in the paper 'EMI from Cavity Modes of Shielding Enclosures - FDTD Modeling and Measurements' by Li, Nuebel, Drewniak, DuBroff, Hubing, and Van Doren. The paper appeared in the February 2000 issue of IEEE Transactions on Electromagnetic Compatibility.**

**The first step in applying XFDTD to the problem is to form the box, slot, and wire geometry. The interior dimensions of the box and slot are given in the paper as 22 x 14 x 30 cm and 12 x 0.1 cm with the slot located 0.2 cm above the lower inside surface of the conducting box. The slotted wall of the box is 0.05 cm thick.**

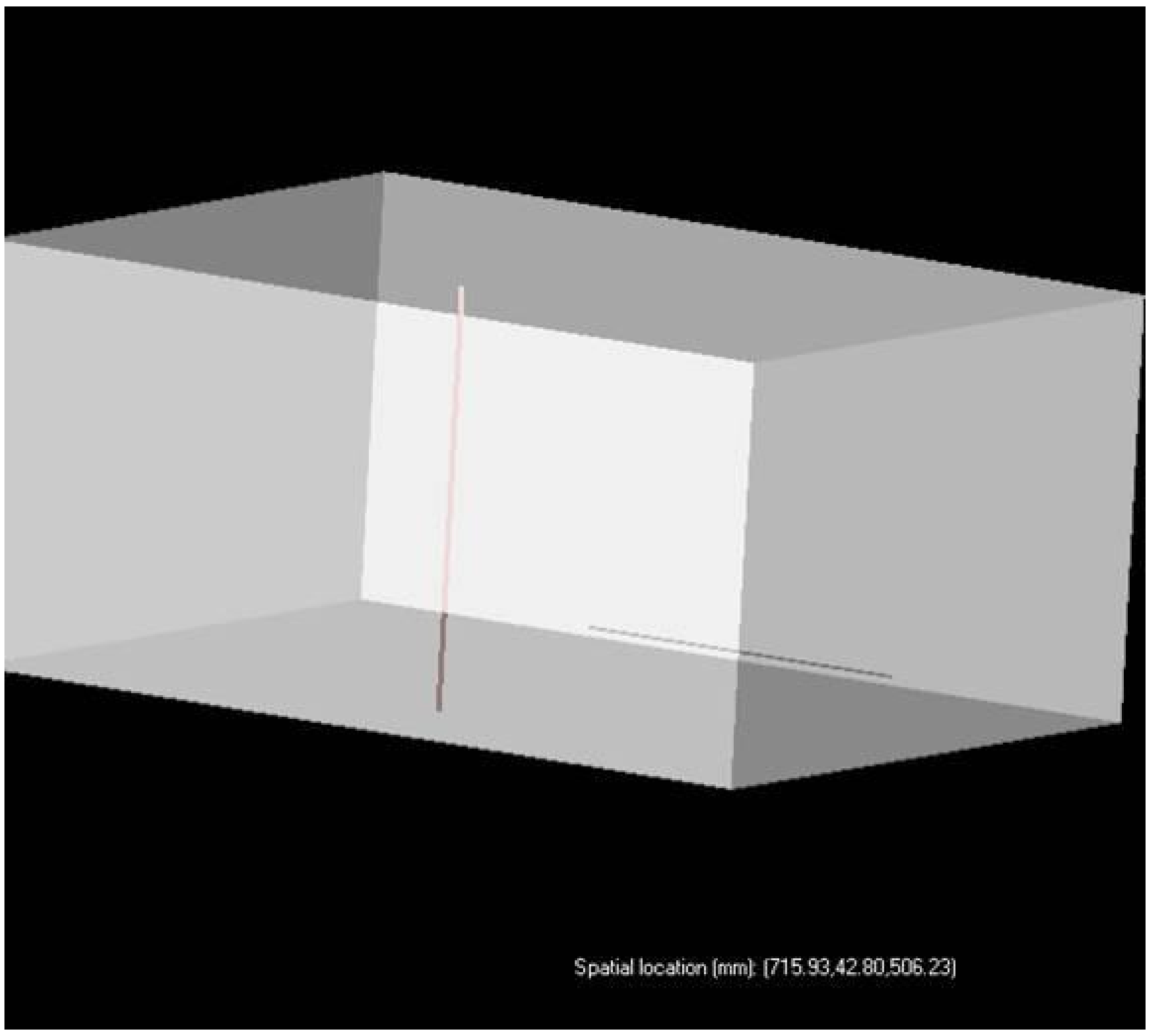
**To form the hollow box use the XFDTD Geometrical Modeler to create a solid box 22.1 x 14.1 x 30.1 cm, which is 0.05 cm x 2 walls larger in each dimension than the inside dimensions of the desired box. Then use the XFDTD Geometric Modeler Shelling capability to shell the box with walls of 0.05 cm thickness, thus producing the correct inner dimensions and wall thickness. The shelling operation is shown in the following figure.**



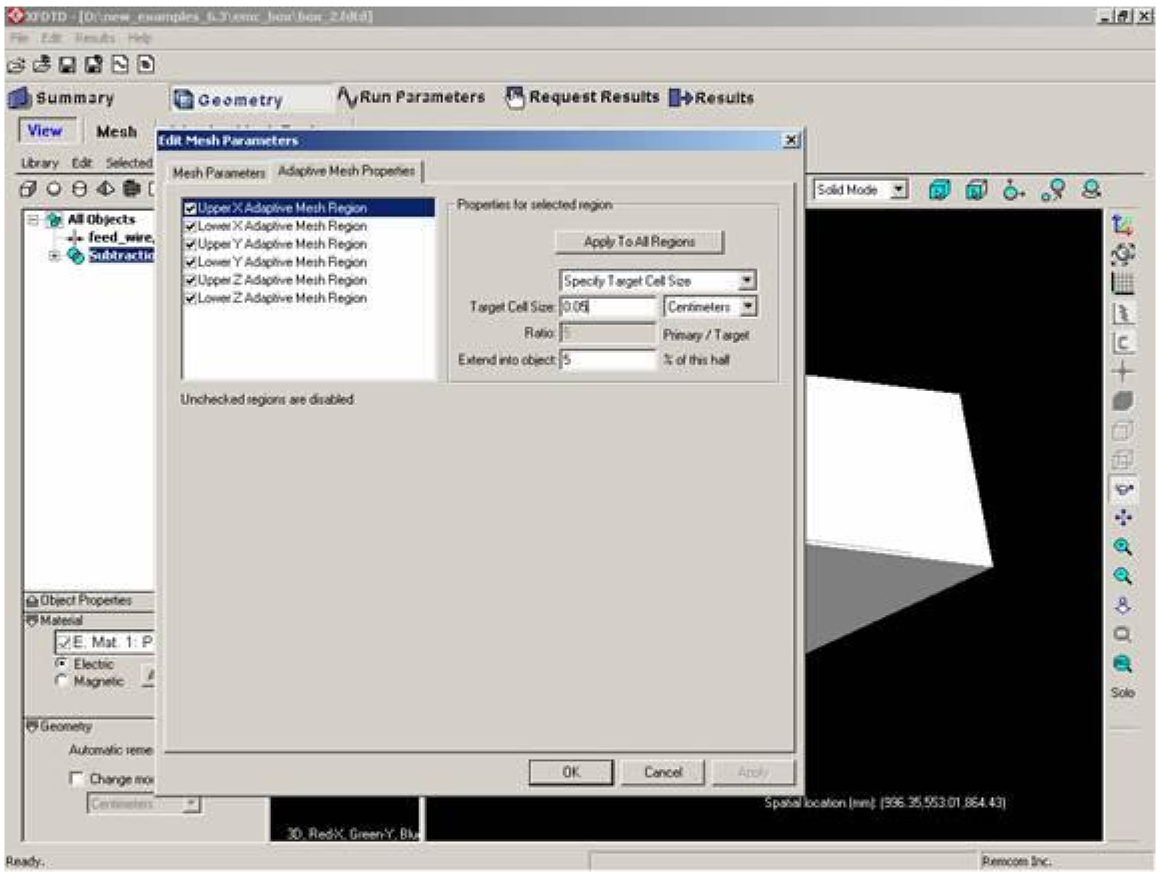

**After the hollow box is formed the slot is added. This is a two step process. First a small rectangular box of the width and thickness of the slot, located to intersect the box wall at the slot location, is generated using XFDTD. Then the small box is subtracted from the larger box to form the slot. The Boolean subtraction operation is shown in the next figure.**




**Finally the wire is added inside the box using the XFDTD wire primitive, as shown next.**



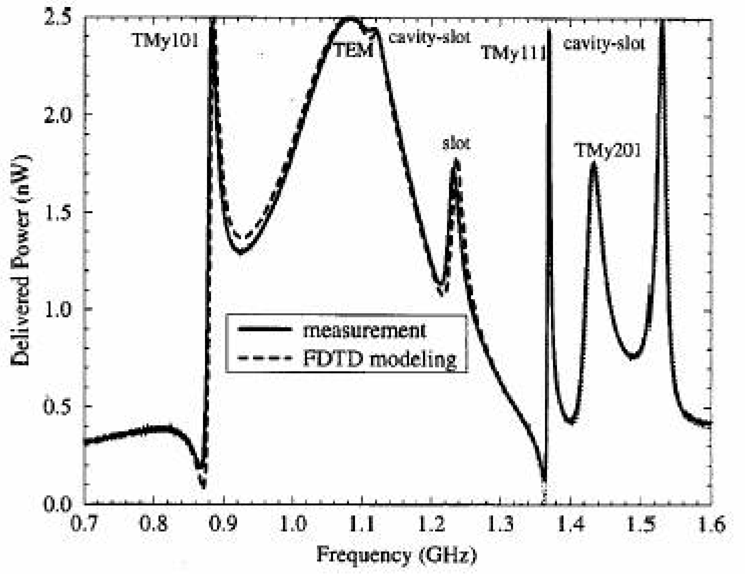

**In order to accurately mesh the 0.1 cm wide slot in the 0.05 cm thick wall of the box XFDTD's adaptive meshing capability is used. This automatically adjusts the main mesh to accurately include small features of the geometry. The adaptive mesh is specified for the large box in the following figure.**



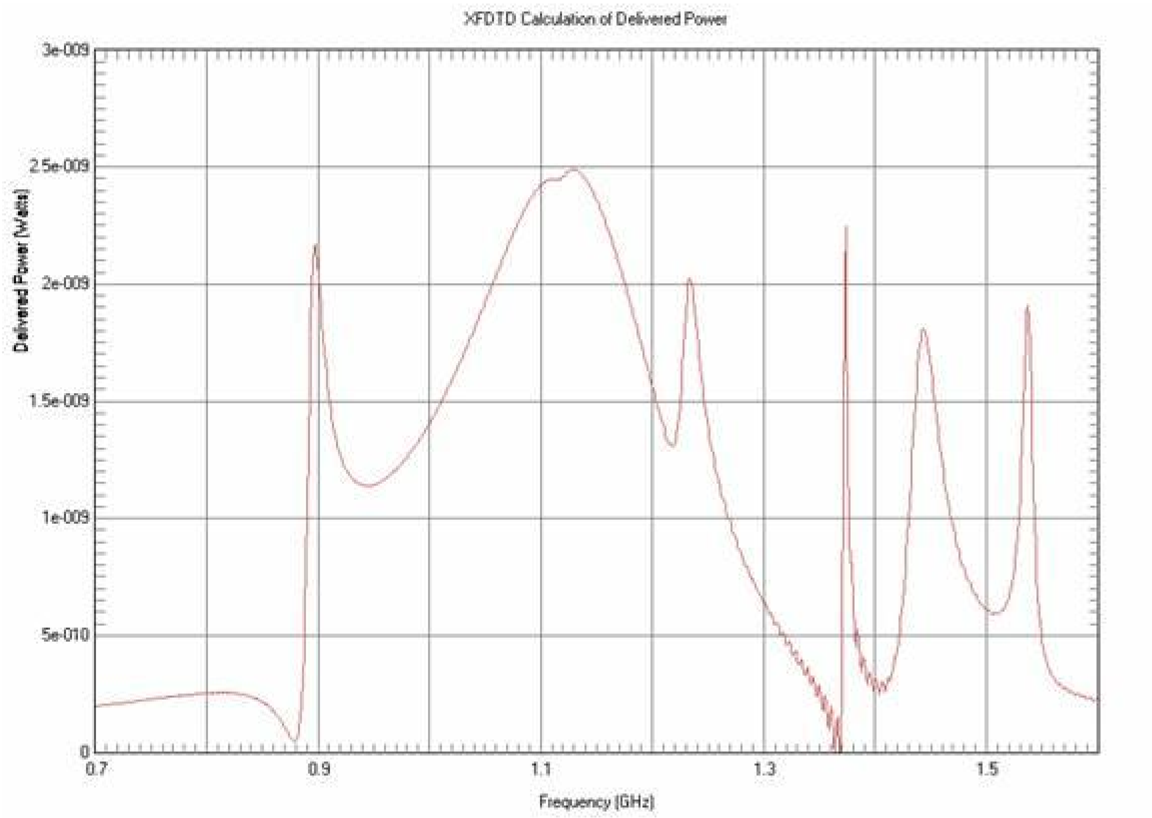

**Then user specifies a 1 cm x 1 cm x 1 cm main mesh and XFDTD adaptively meshes the box walls to produce an accurate description of the box and slot. The resulting mesh is only about 21,000 cells.**

**To make the calculation a pulsed voltage source with a 50 Ohm source resistance is placed at the top of the wire and a 47 Ohm resistor at the base of the wire. The voltage source is adjusted to correspond to the source used in the paper.**

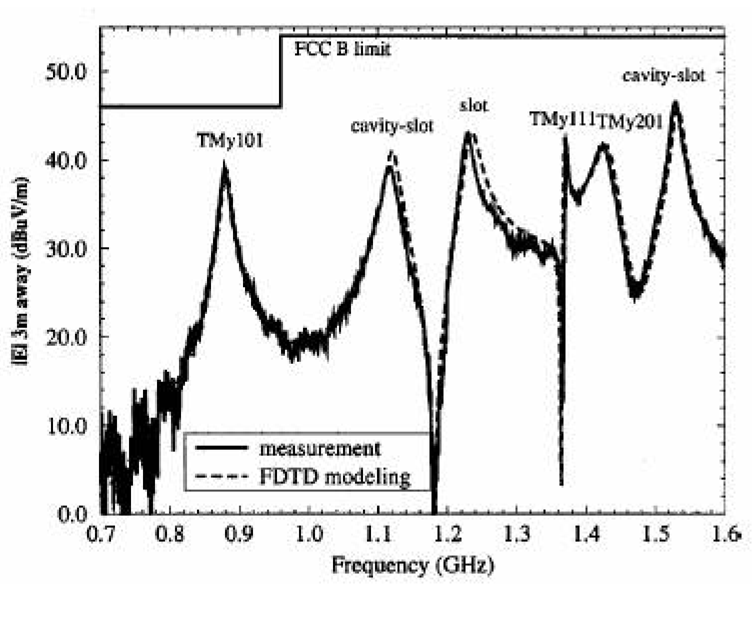
**The paper shows two results for this geometry. First is the power delivered to the box geometry vs frequency. The results from the paper are shown in the next figure.**



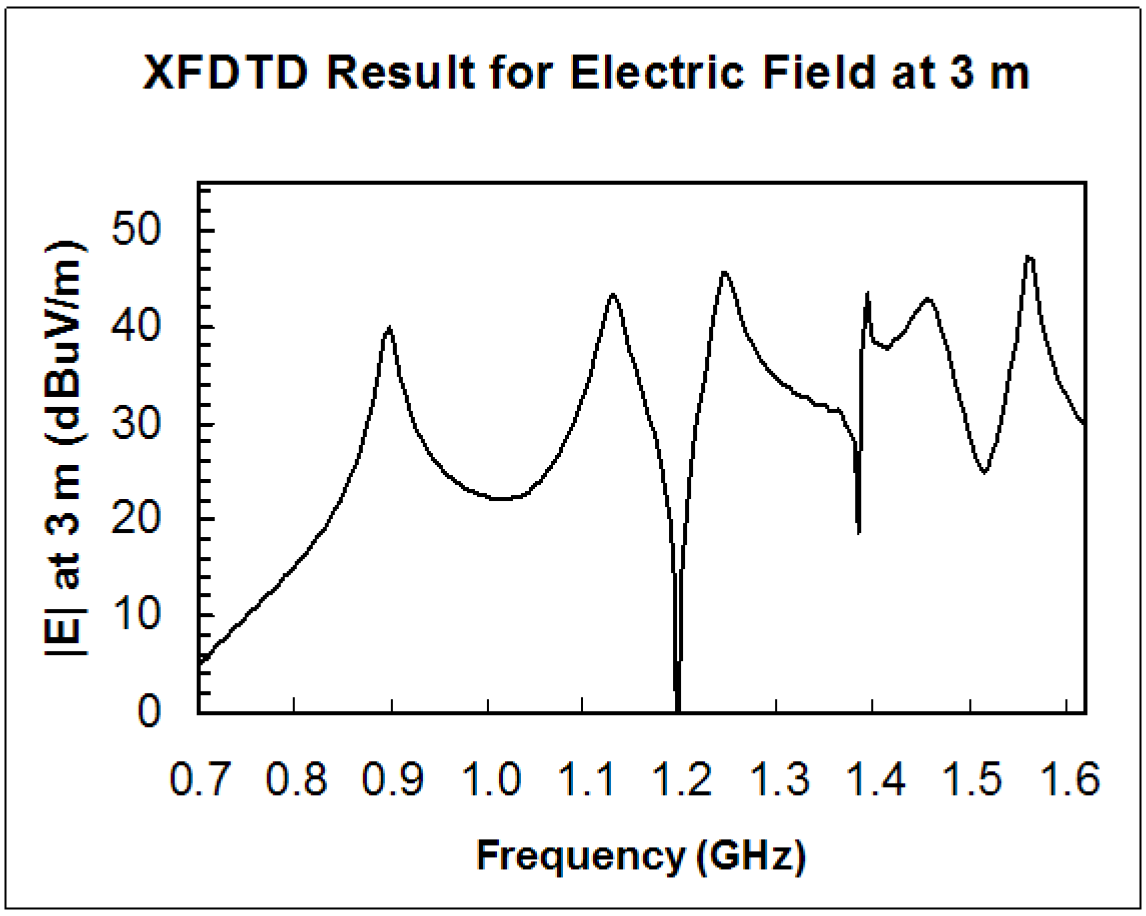

**The following figure shows the corresponding XFDTD result for power delivered. The agreement with the result from the paper is excellent.**



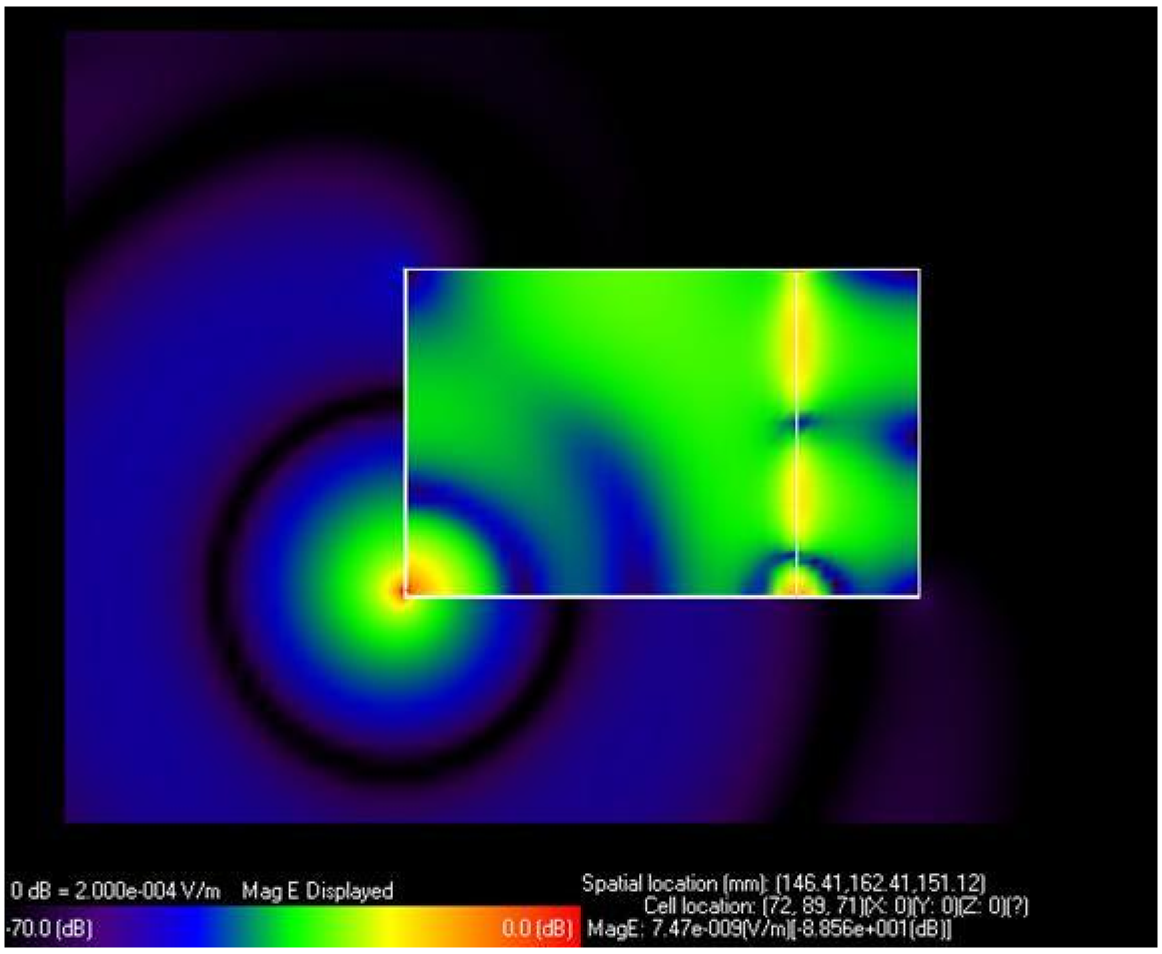

**The other result provided by the paper for this geometry is the Electric Field vs Frequency at 3 meters from the box surface shown in the following plot.**




**The plot from the paper is at 3 m from the surface of the box plotted in dBμV/m rms. XFDTD provides results normalized to 1m from the center of the box and relative to peak values not rms. The XFDTD results are easily converted to compare directly with those in the paper. The result is shown in the following plot which agrees very well with the results from the paper.**




**A view of the transient electric field magnitude after a few time steps is shown in the following figure. The waves traveling along the wire and the intense fields excited by the slot are clearly evident.**



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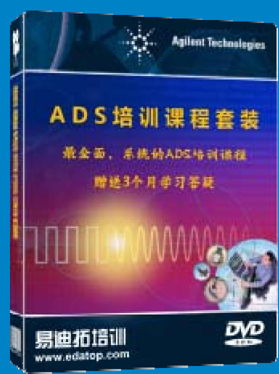


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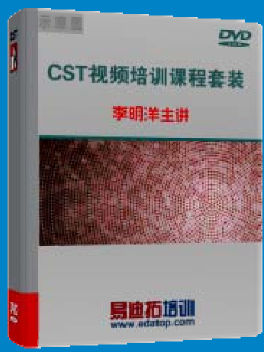


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