



Numerical Estimation on Indoor Propagation Characteristics for RF Wireless Power Transfer

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This study aims to develop an accurate and reliable method of estimating propagation channels and propagation modeling in order to advance radio link design of radio frequency wireless power transfer systems (RF-WPT). This report focuses on the effects of human body blockage on RF-WPT-band propagation characteristics in an indoor environment. Since literature concerning evaluation of shadow fading due to human body for RF-WPT was limited, we modeled a typical indoor propagation environment including some humans and evaluate propagation characteristics by using a large scale 3-dimensional numerical analysis based on FDTD method [1].

We calculate electromagnetic field distributions inside an office environment created by a 915 MHz RF-WPT transmitter, and obtain propagation characteristics considering human body blockage. Some numerical human [2] developed by National Institute of Information and Communications Technology (NICT) that can be applied posture change are used in the simulations.

Accurate simulation results, 2-dimensional electric field distributions inside an office room with humans present, were obtained. Based on our numerical simulations and statistical analyses, we found that the field intensity established by one transmitter in the RF-WPT band is about 3-8 dB lower when humans are present. We intend to conduct other estimations that consider different indoor propagation models, more humans, and new RF-WPT transmitters including multiple antennas. In addition, there will also be further investigations regarding safety issues for human exposure in cases where many wireless transmitters are present.

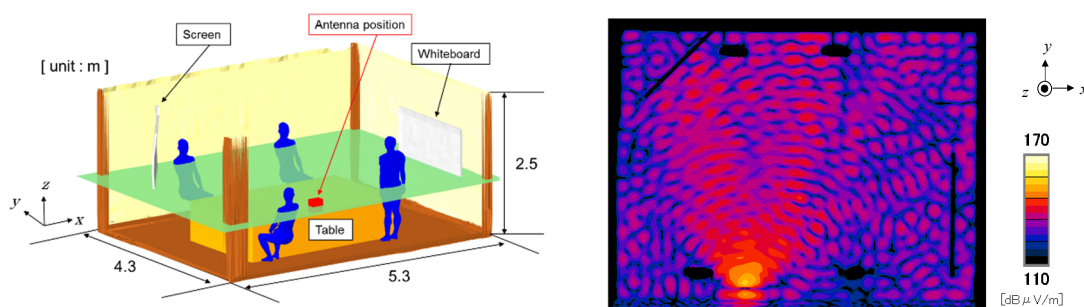


Figure 1. Numerical Estimation on Indoor Propagation Characteristics for RF Wireless Power Transfer

1. L. Harris et al.: "Using Large-Scale FDTD Method to Obtain Precise Numerical Estimation of Indoor Wireless Local Area Network Office Environment," IEICE Trans. on Fundamentals, Vol.E92-A, No.9, pp.2177-2183, Sep. 2009.
2. T. Nagaoka et al., "Development of Realistic High-Resolution Whole-Body Voxel Models of Japanese Adult Male and Female of Average Height and Weight, and Application of Models to Radio-Frequency Electromagnetic-Field Dosimetry" Physics in Medicine and Biology, Vol.49, pp.1-15, 2004.