論文 / 著書情報
Article / Book Information

題目(和文)	
Title(English)	Influence of Electromagnetic Wave Absorber to Body Area Measurement in Anechoic Chamber
著者(和文)	ThournKosorl
Author(English)	Thourn Kosorl
出典(和文)	学位:博士(工学), 学位授与機関:東京工業大学, 報告番号:甲第11261号, 授与年月日:2019年9月20日, 学位の種別:課程博士, 審査員:青柳 貴洋,髙田 潤一,山下 幸彦,西方 敦博,秋田 大輔
Citation(English)	Degree:Doctor (Engineering), Conferring organization: Tokyo Institute of Technology, Report number:甲第11261号, Conferred date:2019/9/20, Degree Type:Course doctor, Examiner:,,,,
学位種別(和文)	博士論文
Category(English)	Doctoral Thesis
種別(和文)	要約
Type(English)	Outline

Thesis Title: Influence of Electromagnetic Wave Absorber to Body Area Measurement in Anechoic Chamber

Thesis outline

1. Introduction

1.1. Electromagnetic Anechoic Chamber

1.2. Electromagnetic Wave Absorber

1.3. Wireless Body Area Network

1.4. BAN Propagation Characteristics

1.5. Research Motivation

1.6. Research Objective and Methodology

1.7. Contributions and Organization of Thesis

- 1.7.1. Contributions
- 1.7.2. Organization of Thesis

2. Relevant Techniques for Modeling Absorber and BAN Measurement

2.1. Dielectric Permittivity

2.2. Dielectric Relaxation Model

- 2.2.1. Single Pole Debye Relaxation Model
- 2.2.2. Multi-pole Debye Relaxation Model

2.3. FDTD Field Solver for Modeling Absorber and Body Area Propagation

- 2.3.1. Formulations
- 2.3.2. Absorbing Boundary Conditions
- 2.3.3. Periodic Boundary Conditions
- 2.3.4. Implementation of FDTD Field Solver
- 2.3.5. Validation of FDTD Field Solver

2.4. Summary

3. Modeling of Dielectric Absorbing Material for Time-Domain Broadband Simulation

3.1. Brief Description of EPS Mixed with Graphite Powder

3.2. Modeling of $\dot{\varepsilon}_{meas,r}$ for a Time Domain Broadband Simulation

- 3.2.1. Two-Variable Multipole Debye Relaxation Model with Static Conductive Term
- 3.2.2. Modeling Procedure

3.2.3. Fitting Results
3.3. Numerical Demonstration of the Effectiveness of the Proposed Permittivity Model
3.3.1. Calculation Model Description
3.3.2. Multi-layer Planar Wave Absorber
3.3.3. Pyramid Absorber
3.4. Summary
4. Effect of Unexpected Reflections from Absorbers on BAN Propagation Measurements
4.1. Description of BAN Propagation Measurements Situation in Anechoic Chamber and the Issue Caused by Absorber
4.2. Description of Simulation Models for Absorber Performance near Transmitter and Its Influence on BAN Propagation Measurement
4.2.1. Electromagnetic Wave Absorber Modeling
4.2.2. Human Body Modeling
4.2.3. Simulation Models
4.2.4. Simulation Condition
4.3. Evaluation Method for Absorber Performance near Transmitter and Its Influence on BAN Propagation Measurement
4.4. Numerical Results and Discussion
4.4.1. Performance of Wave Absorber near Transmitter
4.4.2. Effect of Wave Absorber to Wave Propagation Around Human Body
4.5. Summary
5. Conclusion

To remove the influence of multipath interference due to local surrounding environment from the on-body propagation channel, a body area propagation measurement has been conducted in an anechoic chamber. However, unexpected measurement results have been occasionally reported which is possibly caused by reflections from electromagnetic wave absorber installed on chamber surfaces. Therefore, the purpose of this research is to investigate the issue observed in body area propagation measurements in anechoic chambers caused by electromagnetic wave absorber. The finite-different time-domain method is applied to model several conditions such as structures of

wave absorber (planar and pyramid with various periodic lengths), receiver-transmitter antenna directions, and relative transmitting source position above a tip of pyramid. The influence of reflections was evaluated by the absolute error of root-mean-square time delay between the model with and without absorber. It was found that the pyramid wave absorber with periodic length smaller than an operating signal wavelength gives very low significant effect. Also, the body-normally polarized receiver-transmitter mostly produces less influence of reflections from the wave absorbers than the body-tangential one. Of all conditions, the pyramid wave absorber with the periodic length larger than two times of the operating signal wavelength and the relative transmitting position above tip of pyramid have stronger effect on the body area measurement. Finally, some suggestions are drawn to mitigate the influence of reflections from absorber.