Sensors and Materials, Vol. 26, No. 8 (2014) 581–589
MYU Tokyo

S & M 1024

Analytical and Experimental Studies on Human Body Communication between Wristwatch and Handheld Devices Using Muscle Homogenous Phantom at 10 MHz

Dairoku Muramatsu*, Fukuro Koshiji[1], Kohji Koshiji[2] and Ken Sasaki

Department of Human and Engineered Environmental Studies, Graduate School of Frontier Science, The University of Tokyo, 5-1-5 Kashiwano-ha, Kashiwa-shi, Chiba 277-8563 Japan
[1]Program in Electrical Engineering, Graduate School of Engineering, Kokushikan University, 4-28-1 Setagaya, Setagaya-ku, Tokyo 154-8515 Japan
[2]Department of Electrical Engineering, Graduate School of Science and Technology, Tokyo University of Science, 2641 Yamazaki, Noda-shi, Chiba 278-8510 Japan

(Received April 7, 2014; accepted August 6, 2014)

Key words: human body communication, wearable device, sensor network, electrode, electromagnetic field analysis, phantom

In human body communication, it is important to investigate the input impedance characteristics of electrodes and transmission characteristics between transceivers for improving the qualities of communication and reducing power consumption. In this work, we studied the input impedance characteristics and transmission characteristics between a wristwatch device and a handheld device using both a three-dimensional electromagnetic field simulation and experiment at 10 MHz. The input impedance and transmission characteristics obtained from the simulation using a muscle homogenous model and those obtained from the measurement using a muscle-tissue-equivalent phantom showed good consistency. The calculated electric field around a human arm decreased as it moved away from the surface of the arm. This distribution of the electric field showed the advantages of human body communication, which are confidential communication and electromagnetic compatibility (EMC). Moreover, power consumption at the feeding point of the system was calculated from the transmission characteristics obtained from the simulation. This result indicated that human body communication achieves low-power consumption.

*Corresponding author: e-mail: muramatsu@ems.k.u-tokyo.ac.jp