

Evaluation of Wearable and Implantable Wireless Medical Devices

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Abstract: Recently, various types of wearable as well as implantable wireless medical devices have been developed and tested, for example, to monitor physiological parameters, to deliver drugs and to stimulate nervous systems. One of the key technologies for R&D of such wireless medical devices is body-centric wireless communications. It is not so easy to utilize a real human body to evaluate performances of the devices experimentally. Instead, computer simulation is usually performed with sophisticated digital or numerical human-body phantoms. Today, many commercial softwares and phantom models are available. Various types and shapes of human-body phantoms are used, e.g., head, hand, abdomen, torso, whole-body, etc. The size and shape of the phantoms sometimes affect radiation characteristics of the devices.

However, experiments with human-body physical phantoms are indispensable to validate the results of numerical simulation or to avoid animal experiments for implantable devices. Many different types of physical human phantoms have been developed and utilized for their purposes in the experimental investigations. Typical physical human phantoms are liquid, gel, semi-hard (semi-solid) and solid phantoms. Particularly, semi-hard (semi-solid) phantoms are suitable to the experiments for implantable medical devices because it is easy to embed devices at the right position in the phantoms and to fix them without any support.

Bio: **Koichi Ito** received the B.S. and M.S. degrees from Chiba University, Japan, and the Ph.D degree from Tokyo Institute of Technology, Japan. He is currently a Professor Emeritus and Visiting Professor at the Center for Frontier Medical Engineering (CFME), Chiba University. From 2005 to 2009, he was Deputy Vice-President for Research, Chiba University. From 2009 to 2015, he served as Director of the CFME, Chiba University.

His main research interests include small antennas for mobile communications, microwave antennas for medical applications, research on evaluation of the interaction between electromagnetic fields and the human body by use of phantoms, and antenna systems for body-centric wireless communications.

Dr. Ito is a Life Fellow of the IEEE and a Fellow of the IEICE, Japan. He served as Chair of the Technical Committee on Human Phantoms for Electromagnetics, IEICE, an Associate Editor for the *IEEE Transactions on Antennas and Propagation*, an AdCom member for the IEEE AP-S, a Distinguished Lecturer for the IEEE AP-S, General Chair of IEEE iWAT2008, a member of the Board of Directors, the Bioelectromagnetics Society, a Councilor to the Asian Society of Hyperthermic Oncology, General Chair of ISAP2012, a Delegate to the European Association on Antennas and Propagation, a Vice-President of the Japanese Society for Thermal Medicine, and IEEE AP-S President for 2019. He currently serves as Vice-Chair of Commission K, URSI (International Union of Radio Science), and as IEEE AP-S Immediate Past-President for 2020.