Challenges in Multiple Propagating Mode Wearable Antennas for Medical Applications

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The wireless communication performance of close fitting wearable devices is one the limiting factors in real world application. Wearable antennas continue to strive to meet the requirements of healthcare technology applications, which have the potential to improve patient healthcare through new wireless diagnostic and monitoring solutions. For medical applications, wearable antennas are required to perform reliably and efficiently in various bodycentric propagation modes, namely: On-body, Off-body and Into-body. In low-multipath environments, On-body modes are favorable for communicating with devices distributed across the body surface, while Off-body modes are for communicating with remote devices. On the other hand, Into-body modes are used for communicating with implantable devices placed inside the body. In medical applications, it could be expected that the wearable device would be suitable for communication in several or potentially all of these modes, yet remain physically small and unobtrusive to the user.

This work investigates the challenges and requirements of antennas to meet future medical healthcare applications, which critically require high performance and adaptable solutions. Researchers have approached this problem using multiple antenna elements, some with the capability of switching between individual elements. But is this the right approach for industry compatible solutions? This work investigates surface worn wearable antennas, which use multiple modes to provide reliable and robust communication to deep tissue implantable devices from a single antenna element. The antennas operate in the 2.38 GHz ISM band, which is becoming more popular for future medical applications. Antennas are proposed which can improve the path gain by 15 dB - 30 dB, depending on antenna orientation and polarization of the implanted device in comparison to existing wearable antenna designs.

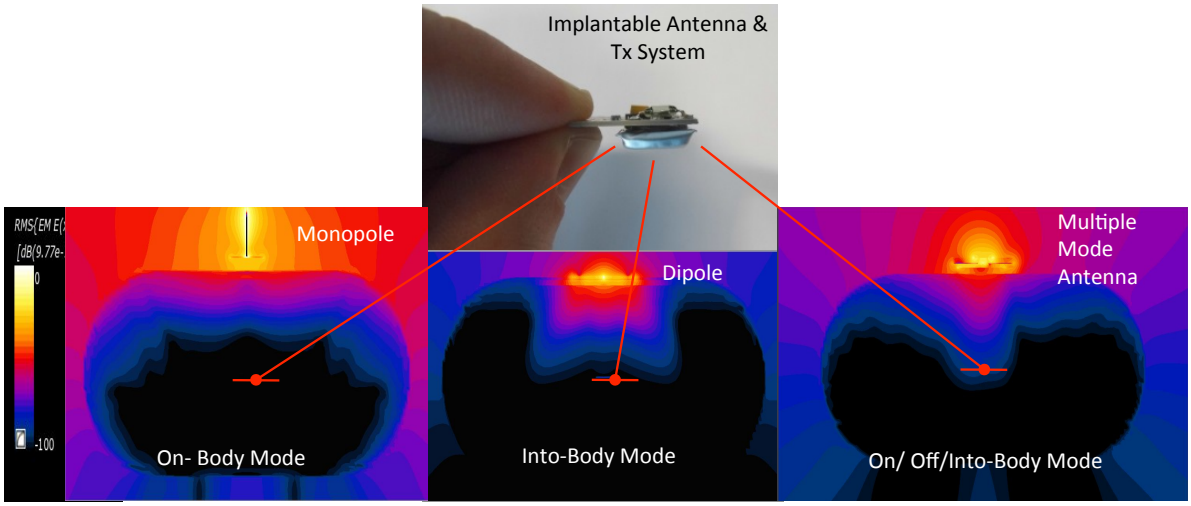

Figure 1. A comparison of antenna radiation characteristics using RMS E-field magnitude through the cross-section of human muscle tissue at 2.38 GHz to an implantable device in the center of the tissue.