A Dual Band Implantable Antenna for Wireless Medical Telemetry Service (WMTS) and ISM Band Communication

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Chronic diseases, such as diabetes, cancer, and heart disease, account for approximately 70% of deaths per year. In 2015, approximately 23 million Americans patients had diabetes and approximately 7.2 million more went undiagnosed. Worldwide, chronic diseases account for approximately 60% of all deaths. Managing such diseases accounted for 86% of the $2.7 trillion health care costs in the US. Often the management and monitoring techniques are uncomfortable and only offer data for practitioner and patients at limited time intervals. As a result, there is a demand from both diagnosees and doctors to have continuous monitoring systems for chronic diseases. Implantable sensors offer the capability to broadcast chronic health data (such as glucose levels) from inside the human body and display this data to the patient and medical professionals. Traditionally, such devices utilize Med Radio bands (401 MHz – 406 MHz) for medical telemetry. Although the MedRadio band is excellent for deep tissue communication, it limits antenna miniaturization for implanted sensors. Recently, the Federal Communications Commission freed up several frequency bands for medical telemetry Wireless Medical Telemetry Service (WMTS): (608 MHz – 614 MHz, 1.395 GHz – 1.4 GHz, 1.427 GHz – 1.432 GHz). This frequency band better facilitates antenna miniaturization and data speeds for subcutaneous medical devices.

This paper presents the design, simulation, fabrication, and testing of a dual band implantable antenna that operates at the WMTS Band (1.395 GHz – 1.432 GHz) and 2.4 GHz ISM Band (2.4 GHz – 2.5 GHz). The antenna was designed to be implanted subcutaneously and was tested *in vitro* (via skin mimicking gel), *ex vivo* (via porcine skin), and *in vivo* (via porcine animal models).