Microwave Absorption in the Brain at 5G Using Realistic Computational and In Vitro Head Models

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The next generation of wireless networking commonly known as 5G is on the track to becoming the universal mobile network in the near future to keep up with the ever increasing demand for more data and speed. FCC recently announced opening up 11GHz of spectrum for 5G. These new frequencies include 27.5-28.35 GHz, 37-40 GHz and 64-71 GHz. Although data rates are higher at such high frequencies, the electromagnetic waves attenuate more rapidly. As a result, more Rx/Tx systems need to be deployed for an efficient 5G network. As we deploy more and more Rx/Tx systems one has to be wary of the potential health effects of such systems. Unfortunately, the research and regulations regarding the microwave interactions with humans are not moving at the same pace as the technology.

In order to provide a preliminary study towards understanding the electromagnetic absorption at 5G, we have experimented with realistic computational human models as well as in vitro head models. We used standard gain multiple horn antennas to excite the tissue of interest in order to represent transmitted signal emitted from various different directions. We have also performed a parametric study using multiple power levels with varying incident angles. Our experimental study focuses on the specific absorption rate (SAR), penetration depth, and temperature changes using a 3D printed head model integrated with tissue mimicking gels to represent the brain and other connected tissue. The study then discusses the data found in comparison to virtual simulations and highlight current findings and future challenges.