

## Development of 3D Human Tissues Phantoms for Analysis of Frequency Dispersion and Human Body Interaction at 60GHz

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Dispersive propagation could result of particular importance in the case of technologies involving human tissues. High-resolution systems as employed in medical imaging require the use of ultra wide band waveforms and for such pulses the medium is inherently dispersive. This will unavoidably lead the Brillouin or Sommerfield precursors to emerge even if they are not explicitly visible. However its analysis is not considered in body-centric radio channel characterization and models. For intra-body communications, the form and shape of the information-bearing transmitted signal is also an important factor to consider (Alejos, et al., JEMWA, 27(17), 2213-2220, 2013). Since the transmitted signal influences the formation and performance of the resulting precursor, we can conclude that a medium-matched signal can lead to optimal performance by combining the benefits of the precursor formation (larger amplitude) with minor impairments (lesser time duration broadening).

Additionally, the interaction of the human body with antennas can lead to consider mitigation techniques such as precoding that was proposed for 5G communications at 60GHz due to the likely blockage of the radio link due to the human body presence.

In this contribution we present the design of 3D phantoms which imitate the human body tissues and parts. We characterized dielectrically these phantoms to find them valid up to 60GHz and analyzed the fitting of the dielectric features to Debye and Cole-Cole based models. We studied the effect of the frequency dispersion at the millimetric band. We have also measured the interaction of the 3D phantoms with an array antenna developed at 60GHz. (Grant EMR2012/138)

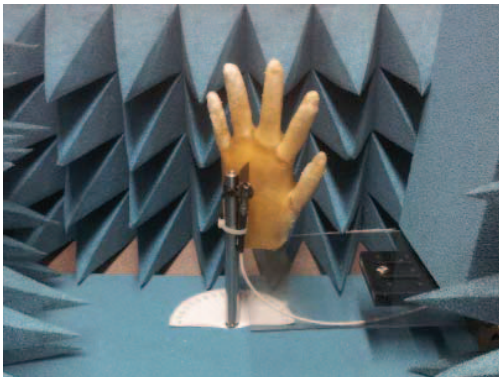


Fig. 1. Setup for 3D hand phantom and 60GHz array antenna.

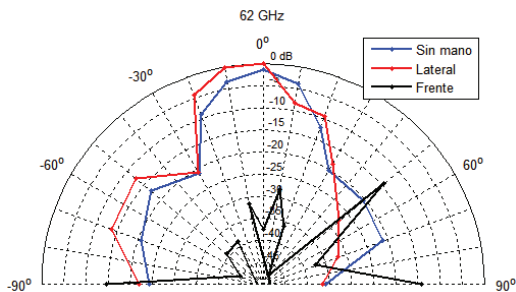


Fig. 2. Measured radiation pattern.