SAR Mitigation of Textile Antenna via an Artificial Magnetic Conductor (AMC) Plane

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An artificial magnetic conductor (AMC) plane is a type of two-dimensional metamaterial, which are widely used in the design of planar antennas. Its current corresponds to an in-phase image and its ability in suppressing parallel plate modes is also favorable in forming a reflecting structure near a magnetic dipole. This is beneficial in mitigating electromagnetic coupling in textile antennas when operating on-body, besides ensuring a conformant Specific Absorption Rate (SAR). However, the need for these textile antennas to operate across a wide/multiple frequency bands calls for the design of AMC planes with similar resonant characteristics, which can either be realized by exciting the higher modes of the structure, or by integrating different shapes of AMC unit cells. Yet, the implementation of more complicated AMC shapes are limited due to the use of the textile materials and its fabrication technology.

This work further evaluates a simple dual-band AMC plane which operates in the IEEE 802.11 (2.4 and 5 GHz) bands implemented on a textile antenna (see Fig. 1) in terms of the contribution of the AMC plane to SAR mitigation/reduction. This is performed numerically by placing the AMC-integrated antenna structure over a simplified three-layer human tissue model, consisting of a 3 mm thick skin layer, 7 mm thick fat layer and a 60 mm thick muscle layer (J. Gemio, J. Parron and J. Soler, *Prog. in Electromag. Res.*, **110**, 2010, pp. 437-452). Despite expecting a more accurate result from a co-simulation using a Hugo body model, this process is time- and resource-consuming. Moreover, truncation of this model to save resources might result in SAR inaccuracy. The antenna is placed at 10 mm away from the simplified body model to emulate practical distances in clothing. The input power to the antenna is 0.5 W (rms), and SAR are calculated based on the IEEE C95.1 standard. The European SAR limit is used as reference, which is not more than 2 W/kg averaged over 10g of tissue.

Numerical SAR levels calculated using the simplified model are 0.0464, 0.0232, and 0.03 W/kg at 2.45, 5.2 and 5.8 GHz, respectively, which are far below the European regulatory levels. This indicates the effectiveness of the AMC plane in SAR mitigation. Additional SAR simulations and comparison will be discussed during the presentation.

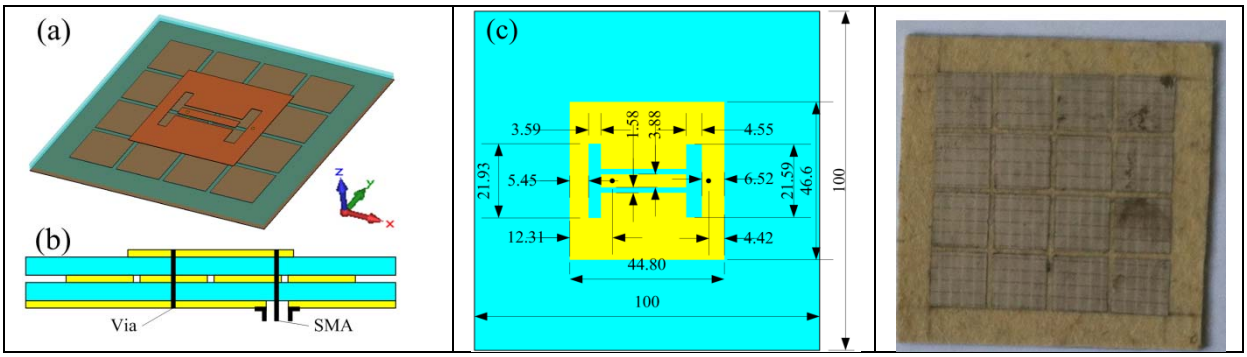

Fig. 1: (a) Overall antenna/AMC plane structure, (b) side view, (c) top view and dimensions of the antenna, and (d) the fabricated AMC structure.