3D Printed Linear and Circular Polarized Magneto-Electric Antenna Covering L1-L5 GPS Bands

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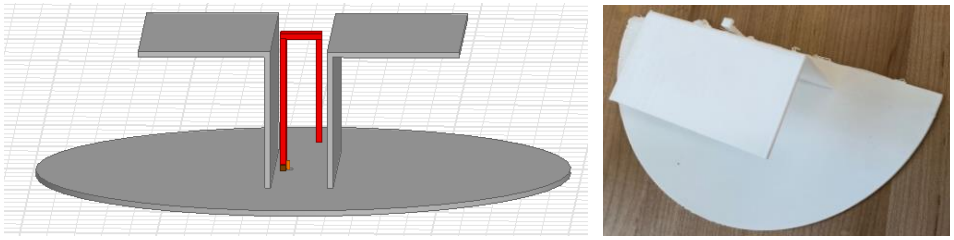
3D printing technology is ideal for rapid prototyping of complex mechanical structures at low cost and less weight. A linear and circular polarized antenna fabricated using 3D printed technology that covers the entire L1-L5 GPS bands are investigated. The linear polarized magneto-electric antenna consists of planar electric dipole and quarter-wave shorted patch antenna. The antenna is fed by Γ-shaped stripline (Fig. 1). Circular polarization is achieved by the orthogonal arrangement of the similar magneto-electric antenna and fed with 90° time phase difference. Polylactic acid (PLA) plastic with ε_r = 3.471 and tanδ = 0.073 is used to 3D print the antenna. The comparison of the antenna performance with copper tape and conductive silver ink coating is carried. The effect of fabrication tolerance, the impurity in silver ink and surface roughness is studied to characterize the cross-polarization, antenna efficiency, front to back (F/B) ratio, radiation pattern symmetry, and realized gain over the matching bandwidth.



(a) (b)

Figure 1. (a) Linear polarized magneto-electric antenna, and (b) Photograph of one half of the fabricated 3D printed antenna without conductive coating.

The proposed antenna provides wide impedance matching bandwidth (S_{11} < -10 dB) from 1.12 GHz to 1.85 GHz and exhibits symmetric radiation patterns for the principal as well as diagonal planes. Also, it provides a high F/B ratio, low cross polarization, and wide axial ratio (AR) beamwidth. Right-hand circular polarization (RHCP) with an AR less than 3 dB is maintained over the entire upper hemisphere. This antenna is advantageous for communication systems that require wide circularly polarized angular coverage and stable gain performance at low cost and ease of fabrication. In addition, it can also be scaled to a higher frequency and used as a feed for reflector antenna due to the symmetric radiation pattern and low cross-polarization, which is part of the future study.

Additional simulated and measured results on the 3D printed linear and circular polarized magneto-electric antenna will be presented during the conference.