Bending and Stretching Effects on the 3D Printed Wearable Flexible Antennas

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In today's world of wireless communication systems, wearable electronics continues to expand in support of emerging commercial applications for future wireless networks. Wearable antennas with light-weight and small form factor are increasingly necessary for applications such as wireless body area networks. Skin and muscle tissue dielectric constants, bending and stretching due to body movement can affect the performance of the antenna for these applications. Flexible millimetre-wave frequency reconfigurable wearable antenna for in 5G networks applications was proposed in (S. F. Jilani, B. Greinke, Yang Hao and A. Alomainy, *URSI International Symposium on Electromagnetic Theory (EMTS)*, Espoo, 2016, pp. 846-848). The proposed antenna is designed on liquid crystal polymer (LCP) substrate and Inkjet printing for antenna fabrication. In another study (A. Afyf, L. Bellarbi, A. Achour, N. Yaakoubi, A. Errachid and M. A. Sennouni, *International Conference on Electrical and Information Technologies (ICEIT)*, Tangiers, 2016, pp. 425-429) flexible antenna for a non-invasive and highly sensitive method to detect malign tumors in the early stages was proposed.

Additive manufacturing (AM) technology as one of the emerging technologies for the fabrication of radio frequency (RF) products has a great potential to find great solutions for the fabrication of the next generation of flexible and wearable electronics. Recently, NinjaFlex™ introduced a flexible filament to the market. This filament is made from a specially formulated thermoplastic polyurethane (TPU) material (https://ninjatek.com/products/filaments/ninjaflex/). In this work NinjaFlex™ flexible filament is used for the fabrication antennas at 2.45 GHz using three dimensional (3D) printing technology. The effect of bending and stretching is studied and will be presented when the antenna is placed on the human body. Figure 1 shows a dipole antenna fabricated using NinjaFlex™ flexible filament and silver ink.

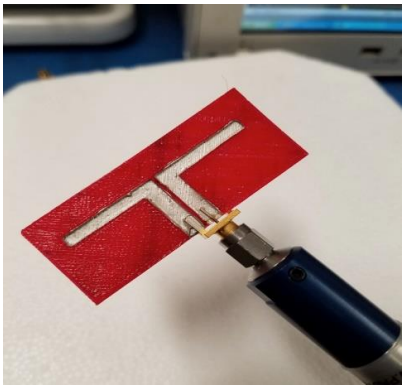

Figure 1. 3D printed dipole antenna using NinjaFlex™ flexible material and silver ink.