A Flexible Lungs Shape Radiator Structure Printed on a Textile Materials

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Abstract

This study aims to design a wearable antenna suitable for security purposes, namely preventing crime and spy mission and also to communication devices affixed to the body, especially on the arms, for example for surveillance purposes, monitoring vital parameters on the body. The antenna device can be used in a flexible, lightweight, and comfortable manner that works on the 2.4-2.5 GHz ISM band frequency. The antenna was designed using the CST Studio Suite electromagnetic 3D simulation software. The size of the antenna used is 71.50 mm x 98.81 mm, made of flannel layer textile with a dielectric constant 1.47 and a loss tangent 0.02 and a thickness of 1.36 mm. This is used as a substrate. Meanwhile, the copper tape was applied as a radiator layer and ground plane conductor, respectively. The simulation results of the off-body condition exhibited the excellent output, such as VSWR) value 1.09, the return loss −26.90 dB, and an impedance bandwidth 89 MHz. On the other hand, for the simulation results of the on-body condition for the center distance of 5 mm, the VSWR is 1.112; the return loss and bandwidth are −25.49 dB and 80.6 MHz, respectively. While the results of the fabrication of the off-body condition, the VSWR value is 1.14, the return loss is −25.55 dB, and an impedance bandwidth of 82.32 MHz. Moreover, for the results of the fabrication of the on-body condition for the center distance, which is 5 mm, the VSWR is 1.32; the return loss and bandwidth are −22.65 dB and 75.8 MHz, respectively. The simulation results also show that the designed antenna can work at a frequency of 2.4 GHz and is perfectly safe to use on the human body, especially on the wrist, by considering at all the values from antenna's simulation and measurement results.

Keywords: Flexible Radiator, Wearable Antenna, ISM band, Textile material, Copper Tape, Security Application