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Design and Implementation of Smart Watch Textile Antenna for Wi-Fi Bio-Medical Applications in Millimetric Wave Band

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Abstract : This paper is devoted to the design and implementation of a smartwatch textile antenna for Wi-Fi bio-medical applications in millimetric wave bands. The antenna is implemented on a leather textile-based substrate to be embedded in a smartwatch. It enables the watch to pick Wi-Fi signals without the need to be connected to a mobile through Bluetooth. It operates at 60 GHz or WiGig (Wireless Gigabit Alliance) band with a wide band for higher rate applications. It also could be implemented over many stratified layers of the body organisms to be used in the diagnosis of many diseases like diabetes and cancer. The structure is designed and simulated using CST (Studio Suite) program. The wearable patch antenna has an octagon shape, and it is implemented on leather material that acts as a flexible substrate with a size of 5.632 x 6.4 x 2 mm3, a relative permittivity of 2.95, and a loss tangent of 0.006. The feeding is carried out using differential feed (discrete port in CST). The work provides five antenna implementations; antenna without ground, a ground is added at the back of the antenna in order to increase the antenna gain, the substrate dimensions are increased to 15 x 30 mm2 to resemble the real hand watch size, layers of skin and fat are added under the ground of the antenna to study the effect of human body tissues human on the antenna performance. Finally, the whole structure is bent. It is found that the antenna can achieve a simulated peak realized gain in dB of 5.68, 7.28, 6.15, 3.03, and 4.37 for antenna without ground, antenna with the ground, antenna with larger substrate dimensions, antenna with skin and fat, and bent structure, respectively. The antenna with ground exhibits high gain; while adding the human organisms absorption, the gain is degraded because of human absorption. The bent structure contributes to higher gain.

Keywords : bio medical engineering, millimetric wave, smart watch, textile antennas, Wi-Fi
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