A Technical Review: Design Issues of Wearable Antennas

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ABSTRACT

The objective of this work is to find out different designing issues for wearable antennas. Wearable antennas are designed to work in the complicated body centric environment. Mechanical requirement of wearable antenna are light weight, low profile, compactness, flexibility, un-obstructive and rugged. Then, from an electromagnetic point of view, human body affects the antenna performance. Effects are reduction of antenna gain, cross polarization level growth, radiation pattern fragmentation, and decreased antenna efficiency.

Key Words: *Wearable antenna, Bent antenna, Antenna performance under wet condition, Biological effect of wearable antenna.*

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1. Introduction

Unlike, antennas embedded in portable devices, wearable antennas are designed to work in the complicated body-centric environment. The factor under this environment can make significant influence on antenna performance. Wearable antennas are meant to be worn on human body so that it must be light weight, low profile, flexible, un-obstructive and rugged.

2. Review of papers

2.1. N.H.M. Rais , P. J. Soh , F.Malek, S.Ahmad, N.B.M. Hashim, P.S Hall. "A Review of Wearable Antenna" IEEE - Loughborough Antenna & Propagation Conference. November 2009.

This literature review paper disclose the unconventional antenna technology and provides background of the wearable antenna that includes specification of the antenna, material for the antenna and required analysis for wearable antennas. Electromagnetic properties for the textiles that used in the wearable antenna are not readily available. So, Electro-magnetic properties of textile materials should be found first [1].

2.2. S.Sankaralingam, Sayantan Dhar and Bhaskar Gupta Department of Electronics and Telecommunication engineering, Jadavpur University, kolkata, India. "Preliminary Studies on Performance of a 2.45 GHz Wearable Antenna in the Vincinity of Human Body." International conference on communications, Devices and intelligent systems-2012 IEEE

Three rectangular micro strip antennas namely wash cotton antenna, polyester antenna and polyester combined cotton antenna are discussed in this paper. Each of these antennas are placed near vicinity of human torso and results

are obtained. Changes in Resonance frequency, Impedance bandwidth, Gain, directivity and radiation pattern is shown [2].

2.3. S.Sankaralingam and B.Gupta Department of Electronics and Tele-Communication Engineering Jadavpur University Kolkata 700032, India. "DEVELOPMENT OF TEXTILE ANTENNAS FOR BODY WEARABLE APPLICATIONS AND INVESTIGATIONS ON THEIR PERFORMANCE UNDER BENT CONDITIONS" IEEE Progress in Electromagnetics research, Vol. 22, 53-71, 2010.

Wearable antennas are made by flexible textile materials. The wearable antenna is bent frequently due to human body movement. The performance of a wearable antenna is analyzed under bent condition in this paper. Effect of bending can affect performance of the wearable antenna. Change in resonant frequency, radiation characteristics and gain is observed [3].

2.4. Tommi Tuovinen, Markus Berg, Kamya Yekeh Yazdandoost, Matti Hämäläinen, Jari Iinatti Centre for Wireless Communications University of Oulu ,Oulu, Finland. "On the Evaluation of Biological Effects of Wearable Antennas on Contact with Dispersive Medium in Terms of SAR and Bio-Heat by Using FIT Technique." International symposium on Medical information and communication technology 2013.

Biological effect of wearable antennas can be executed as bio-heat and bio-thermal simulation, in terms of a specific absorption rate (SAR) and temperature rise in human body tissues. The effect of the antenna input power on the temperature and maximum SAR over 1 g and 10 g averaging masses are discussed. This paper shows how much power can be fed to the wearable antenna in order to cross maximum SAR limits or in order the antenna start to heat the tissue significantly [4].

2.5. Mai A.R.Osman, M.K.A.Rahim, N.A.Samsuri, M.K.Elbasheer, and M.E.Ali. "Textile UWB Antenna Bending and Wet Performances." International Journal of antennas and propagation Volume 2012, Article ID 251682.

The performance of textile UWB antenna under bent condition and wet condition is discussed in this paper. Textile based wearable antenna can absorb liquid material around it. Dielectric constant of absorbed material can affect the resonant frequency. Comparison of completely dried antenna, approximately dried antenna, immediate wet antenna and antenna inside water is shown in this paper [5].

2.6. Pekka Salonen , Peter de Maagt. " Practical Design Aspects for Textile Antennas." AP-S 2013.

Requirements for the materials include the temperature tolerance, durability, physical abrasion and stress with the structural characteristics of the fabric to maintain the electrical functionality under the environmental condition. Textile cover can be used to protect antenna in real life system[6].

3. SUMMARY OF LITERATURE REVIEW

Conventional techniques for the designing and characterization of antenna should be modified to account for the dependence of antenna parameters on a number of random phenomena: human body posture, natural movement of human, distance between antenna and human body, and mechanical deformation.

4. REFERENCES

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