The Review of Antenna and Radio Propagations Solutions for Body Centric Wireless Communication System

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Abstract - This paper gives review of different type of antenna solutions for body centric wireless communication system. For the body area networks very flat, small and bendable antenna is required, in this paper also give brief description of antenna sizes, their materials and design. Also give idea of antenna efficiency, power availability, dielectrically losses. Also discuss different types of UWB and Narrow wide band antenna.

Keywords - *Body Area Network, Body centric wireless communication, Antenna, Radio propagation*

I. INTRODUCTION

The minimize sensors, health electronics devices, biomedical instruments, digital software, nano materials, biomedical technologies[1] all are new wireless centric network devices, which can easily carried and used for human. Body-centric wireless communications (BCWCs) is a new concept for the next generation wireless communications. Body-centric wireless networks [2] used for body area network, mobile device and smart network system. They all are newer technologies that have so many applications in defense area, sports, education, entertainment, medical science and in spy filed. The main difference between body centric wireless communication and conventional wireless systems is the radio channels communication by which the communication set up [3].

The human body is a medium by which the radio propagation take place and so it is important to know and understand the effects of the human body effect by the antenna materials, the radio channel measurements and system performance. This paper gives the view of antenna and radio propagation effect on body area network with the help of body centric wireless communication system [4].

Since the human body is hostile in regards to attenuating, delaying and distorting the transmitted signal, the design of a power and spectrum efficient wireless system requires accurate analysis and understanding of the radio propagation channel including the human body. Furthermore, the characteristics of body-centric radio channel are subject-specific, and depend on many factors, such as the posture of the body, the frequency of operation and the antenna polarization. All these issues, if not accurately examined, can lead to error in transmission increased or, in high cases, increased loss of a communication link. The design of body-worn and hand-held devices has many other aspects to take into account, including the safety for the user, the dimensions, and the cost. For body-centric antennas, the presence of the human body in proximity of the radiating structure reduces the radiation efficiency due to electromagnetic absorption in body tissues [5], causes frequency detuning and radiation pattern destroy These all effects are system-specific, and mainly depending on the environment of propagation, and the type of antennas [6].

The performance parameters of different narrowband and UWB body-wearable antennas are investigated and compared in the presence of human body [7]. This entire antenna was performed by a many type of numerical solutions and parameters campaigns [8]. Studies of parameters and statistical solutions, [9] given help for the human body effects on the performance solution of narrowband and UWB antennas have been given. The main focus of this paper is to understand the human body effects by the different type of antenna and chose the best antenna in BCWCs at both narrowband and UWB frequencies.

II. ANTENNA DESIGN AND MATERIAL USED

Antennas play a vital role in optimizing the radio system performance, since they are used to transmit/receive the signal through free space as electromagnetic waves from/to the specified destination. Wearable antennas are mainly designed to operate in GSM/PCS band, the unlicensed ISM band (2.45 GHz) and UWB (3.1 GHz -10.6 GHz). First of all, for wireless BAN to be accepted by the majority consumers, the radio system components need to be somehow hidden, conformal to the body, small in size and light weight. This requires a possible integration of these systems within everyone's daily clothes. Therefore, the antennas for body area networks need to be compact, light weight, smart, conformal, low-cost and easily integrated with body worn devices and low-power consuming, to maximize battery life and promote green radio systems. For on-body applications, the antenna needs to be immune to the effect of the human body; a low mutual influence between antennas and body is required in order to get better performances. In BCWCs, communications among on-body devices are required, as well as communications with external base stations, which therefore require antennas with different radiation characteristics and possibly multi-band functionality.

The miniaturization of the antenna presents a problem, as it is mainly related to its physical size, involving a tradeoff between design parameters, such as efficiency, bandwidth, and radiation characteristics. To design body-mounted antennas, an understanding of how the presence of human body affects the behavior of the antenna (in terms of frequency detuning, radiation pattern modification, and changes of input impedance, variation of bandwidth and gain and efficiency reduction) must be utilized. It is accepted that antenna performance is affected by close related to the man body; its that, radiation pattern distortion (varying propagation conditions), antennas suffered from reduced efficiency due to bulk power absorption, resonance frequency shift (antenna detuning) and variations in impedance at the feed due to antenna-body capacitive coupling as reported in [10- 12]. These effects will change between different antennas, ground plane sizes, distances, and near field coupling [13-14]. For on-body applications, the antenna must be more immune to the human body**,** with low mutual influence between antennas and body for high radiation efficiency, low specific absorption rate (SAR) and radiation omni directional to the body surface for minimized link loss in on-body communications.

Many studies have been made on the operation of antennas located in close proximity of the body [12-17], as well as on the SAR [18-19]. The antennas with full ground plane have minimum sensitivity to the body presence, due to the effects of the ground plane, which acts as a shield between the antenna and the body. In [13], a parametric study to evaluate how the antenna-body spacing affects the antenna performance has been presented. The further the antenna is from the body, the lower is the absorption from the human body. The use of a lossy material to keep this spacing is beneficial, as it leads to SAR reduction, since part of the power is dissipated in the lossy material rather than in the body tissues. In different applications, printed antennas also offer good performance, such as physical robustness, lower profile construction, low cost, easy of construction, and, in some cases, conformability.

There are two primary requirements for antennas for on-body links. First, the antenna needs to be insensitive to the proximity to the body; and second, the antenna needs to have a radiation pattern shape that minimizes the link loss. There has been no fixed breakthrough in the design of small profile narrowband antennas for body-centric wireless communication [13-14, 17-24].

For on-body applications and found that, for communication over the body surface, wire monopole antennas shows good performances with respect to path loss, due to their omnidirectional radiation pattern in the azimuth plane. In [12, 14] a dual-band (2.4 GHz, 5.2 GHz) button antenna for WLAN applications was presented by John Batchelor. The antenna has the size of a standard metal button used in denim jeans, and can be easily integrated in clothes.

Fig.1: Body Patch Antenna showing top plane

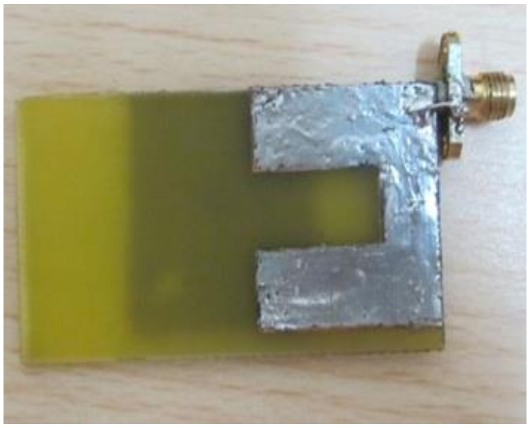

Fig.2: Body Patch Antenna showing bottom plane

Fig.3: Dual Band Body Antenna showing top plane

Fig.4: Dual Band Antenna showing Bottom plane

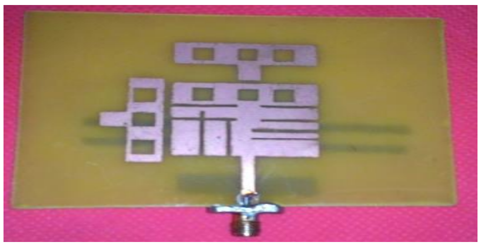

Fig.5: Body Phased Array Antenna showing top plane

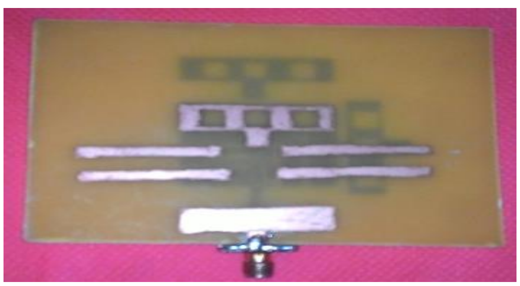

Fig.6: Body Phased Array Antenna showing Bottom plane

III. RESULTS AND ADVANTAGES

In this review work, the performance parameters at 2 GHz to 10 GHz of three different UWB antennas in the presence of a human body is investigated and compared. The performance of the UWB antennas is investigated by placing the antenna at various distances away from the body, where results show that, having no ground plane or a partial ground plane has limited effect on the on-body performance parameters, but the antenna size seems to be more significant. However, it is possible that having a full ground plane on the back of the antenna may improve the on-body performance for the UWB antenna. For UWB system, the optimum distance to place the antenna from the body is recommended to be 4 mm.

The frequency shifting of the UWB antennas is studied placing them at different locations on the body, where results indicate that the frequency shifting is very much dependent on the on body location for the antennas without ground plane.

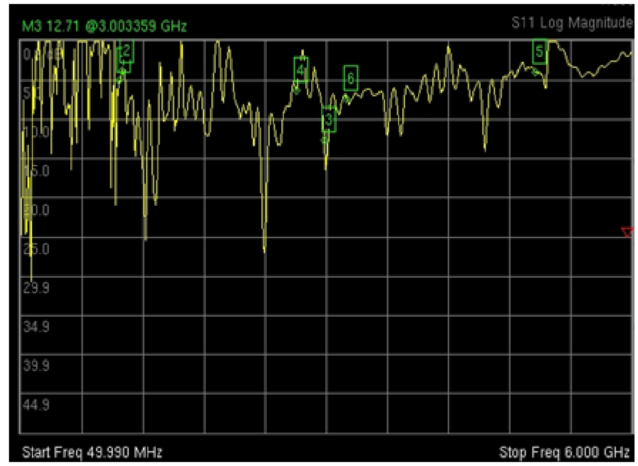

Fig.7: Measured return loss for the first antenna at 3 GHz

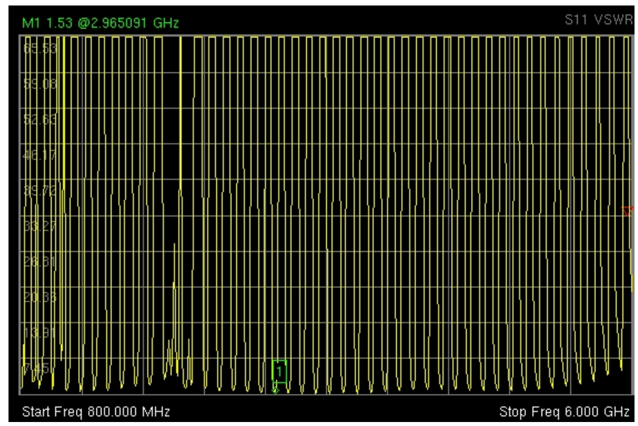

Fig.8 Measured VSWR for the VSWR antenna at 3 GHz

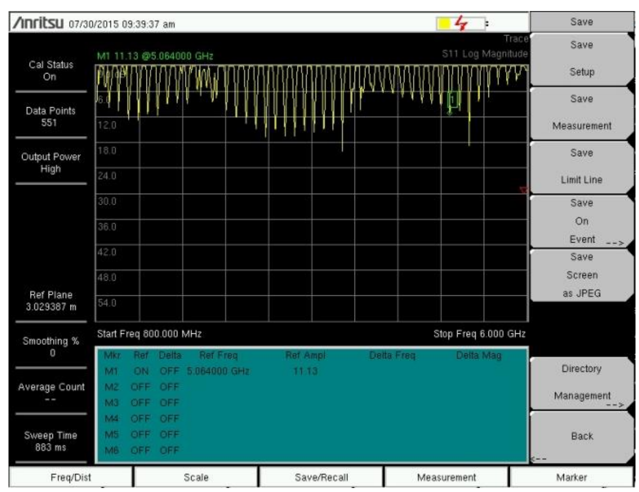

Fig.9: Measured return loss for the second antenna at 5 GHz

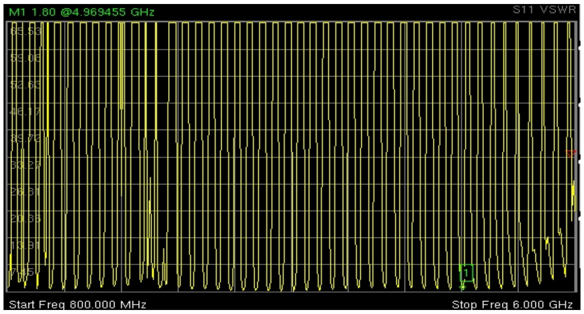

Fig.10 Measured VSWR for the proposed antenna at 5 GHz

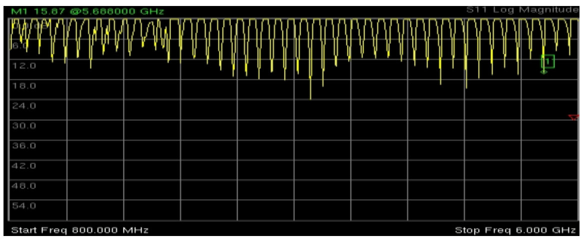

Fig.11 Measured return loss for the proposed antenna at 5.6 GHz

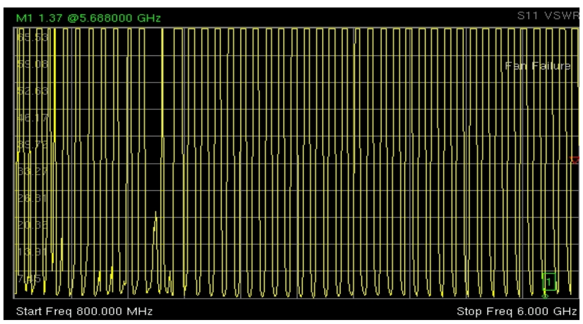

Fig.12 Measured VSWR for the proposed antenna at 5.6 GHz

IV. CONCLUSION

Body Centric Wireless Communication will be the future of wireless communications research is going on many possible wings of BCWC, research approaches in designing and performance of antennas for Body Centric Wireless Networks need to be more specific to cope up with the challenges and to achieve the goals of this 4G standard.

V. FUTURE WORK

The size of the UBW antenna can be reduced. The operating frequency of UWB antenna can be increased 2.45 GHz to 15 GHz. Design best body wearable antenna for higher efficiency and reliable also use low power. Investigating the antenna on different humans and also do many tests.

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