Journal of Engineering and Applied Sciences 3 (3): 225-227, 2008
ISSN: 1816-949X

Textile Antenna for Wireless Applications

[1]A. Murali, [1]P. Muthu Kannan and [2]V. Palanisamy
[1]Sri Venkateswara College of Engineering, Sriperumbudur-602 105, Chennai, India
[2]University of Alagappa, Chennai, India

Abstract: During recent years the wireless communication has been improving very rapidly. Along with it, the theory of antennas and the implementation of antennas for various applications have also been improving. With the advent of handheld devices there is a requirement for antennas of small sizes but can operate at microwave frequencies. We have micro strip antennas as the perfect answer for the above purpose. This type of antenna is built upon rigid structure, which is considered as a handicap when this antenna is expected to be placed on curved and flexible surfaces. To solve this problem we have the concept of textile antenna (Tanaka and Jang, 2003), which can be placed on wearable objects. This study discusses on such a textile antenna design for WLAN applications.

Key words: Textile antenna, wireless application, communication, WLAN microstrip antenna

INTRODUCTION

The wireless communication has been on an improving side day by day. A part of this credit should go to the antenna, which is being used for wireless communication. We have found varieties of antennas in this respect. But the micro strip antennas are considered to be the best of those antennas because of its high gain and small size. But this antenna cannot be used at surfaces, which are very flexible as its substrate is a rigid one. To facilitate this we have the textile antenna, which is using the concepts of microstrip antenna but can be fabricated on the flexible substrates. In this study we are presenting a design of such an antenna. We design the antenna with the resonant frequency of 2.4 Ghz such that it can be used for WLAN applications (Izquierdo *et al*., 2006). Textile antenna means that it is meant to be as part of the clothing (Massay, 2001). The requirements of the Textile antenna are lightweight small and robust. Microstrip antenna is proposed as a antenna solution for most small hand held devices. The basic configuration of a microstrip an tenna is a metallic patch printed on a thin, grounded dielectric substrate (Pozar, 1992). Originally, The element was fed with either a coaxial line through the bottom of the substrate, or by coplanar microstrip line. In this study the textile antenna has been fabricated by using coaxial cable feed with SMA connector.

ANTENNA'S FOR WIRELESSLAN

Wireless applications have undergone rapid development in recent years. One particular wireless application that has experienced this trend is the Wireless Local Area Network (WLAN). The microstrip antenna for wireless application that is selected to be studied is the 2.5 GHz frequency range which is based on the 802.11 b WLAN standard. This frequency is very popular due to its low cost. WLAN antenna requires being low profile, light weight and broad bandwidth. The microstrip antenna suits the features very well except for its narrow bandwidth. The WLAN antenna should have a minimum bandwidth of 100 MHz to fully utilize the WLAN band based on the 802.11b standard. The conventional microstrip antenna could not full this requirement as its bandwidth usually ranges from less than 1% to several percent (Massay, 2001). Although, the required operating frequency range is from 2.4 to 2.5 GHz, at least double the bandwidth is required to avoid expensive tuning operations and to cause uncritical manufacturing. Therefore, there is a need to enhance the bandwidth of the microstrip antenna for WLAN applications.

The band width enhancement techniques are available nowadays to enhance the bandwidth of microstrip antenna This study investigates a technique to which fabricate the microstrip antenna in textail material has acting in dielectric substrate. The fabricated antenna of a frequency range of 2.5 GHz. Many antenna designs are already present in the market that will successfully meet the broadband requirement. For example an Omni-directional discone antenna is able to transmit in all direction and perform extremely well over a very large bandwidth. These antennas are usually large metallic cumbersome objects and extremely indiscreet. Aside from the appearance, directivity and security are important

Corresponding Author: P. Muthu Kannan, Sri Venkateswara College of Engineering, Sriperumbudur-602 105, Chennai, India

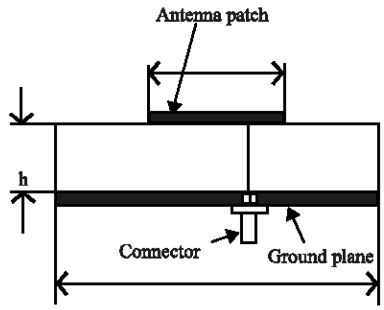

Fig. 1: Structure of wearable microstrip antenna

features of WLAN systems. The system coverage often needs to be limited to designated areas and since the 802.11x systems use the ISM bands, there are transmitted power limitations to reduce interference. It is important for the system to be highly directive in order to reduce coverage in unwanted areas. Primarily, it is due to possible LAN security breaches in case the LAN's coverage extends outside the property and received by unwanted parties. The outside parties may then gain access to documents and other resources. Besides the security issue, there is also possible interference from neighboring WLAN systems. Where earlier WLAN systems perform very poorly due to interference from neighboring systems. As a result the demand has increased for broadband WLAN antennas that meet all the desired requirements. The Broadband antennas are required to be compact, low-profile, directive with high transmission efficiency and designed to be discreet. Due to these well met requirements coupled with the ease of manufacture and repeatability makes the Microstrip patch antennas very well suited for Broadband wireless applications. In this study we have designed the microstip antenna using the substrate material is polyester (Fig. 1).

CONSTRUCTION OF ANTENNA

Generally, the substrate of a micro strip antenna is fabricated using rigid substrate having its own dielectric material. When we design a wearable antenna the substrate is a flexible one. Even to say, the cloth materialwe wear acts as the substrate where the dielectric constant gets changed. With this dielectric constant value, we can carryout the design of textile antenna (Salonen *et al*., 1999). The construction of the antenna is given here. The above construction shows a micro strip antenna but with the above substrate is made up of textile material, this antenna is known as the Textile antenna. It is having a ground plane and the patch is made up of conducting material and its length is given as 'l'.The height of the substrate is given as 'h'. This antenna is generally fed with coaxial connector but with the idea of reducing the reflection loss smaller size of connector can be provided. The patch is a conducting material (Antenna), which may be continuous, or it can have few cut which can be formed vertically or horizontally.

RESULTS

The software used to model and simulate the textile microstrip patch antenna is Zeland Inc's IE3D software. IE3D is a full-wave electromagnetic simulator based on the method of moments. It analyzes 3D and multilayer structures of general shapes. It has been widely used in the design of Mics, RFICs, patch antennas, wire antennas and other RF/wireless antennas. It can be used to calculate and plot the S parameters, VSWR, current distributions as well as the radiation patterns. An evaluation version of the software was used to obtain the results for the above design. The antenna was designed for the frequency range of 2.5 Ghz. the shape of the antenna is rectangle and the dimensions of the antenna are lenth of the patch is 22.8 mm, width of the patch is 31.1 mm obtained radiation pattern, Return loss, elevation pattern and gain are shown in the study.

Radiation pattern: This is the 3D radiation pattern of the designed textile patch antenna in the frequency range of 2.5 Ghz. A textile patch antenna which is designed for WLAN application employs vertical polarization and high efficiency. Polarization is the sum of the E-plane orientations over time projected onto an imaginary plane perpendicular to the direction of motion of the radio wave (Fig. 2).

Return loss vs frequency: In Fig. 3 shows measured radiation pattern of the designed textile patch antenna. When the return loss is low for the designed frequency. this value have been achieved in the feed position of x = 4, y = 0.

Elevation pattern and gain: Figure 4 Elevation Pattern and gain The elevation pattern and the gain of the textile patch antenna shown in Fig. 4. The maximum gain is obtained in the broadside direction and this is measured to be 1.87dBi for both, ö = 0 and ö = 90°. The backlobe radiation is sufficiently small and is measured to be -5.3 dBi for the above plot. This low backlobe radiation is an added advantage for using this antenna in a WLAN application, since it reduces the amount of electromagnetic radiation which travels towards the users head.

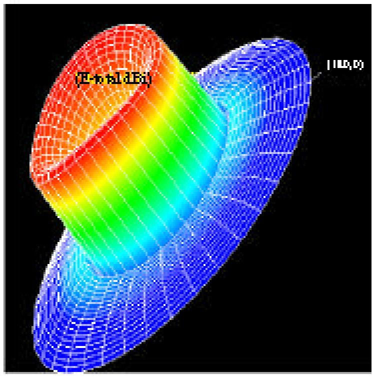

Fig. 2: 3D radiation pattern

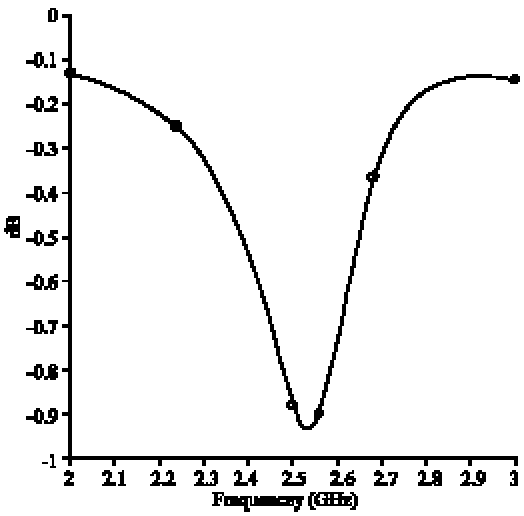

Fig. 3: Return loss vs frequency

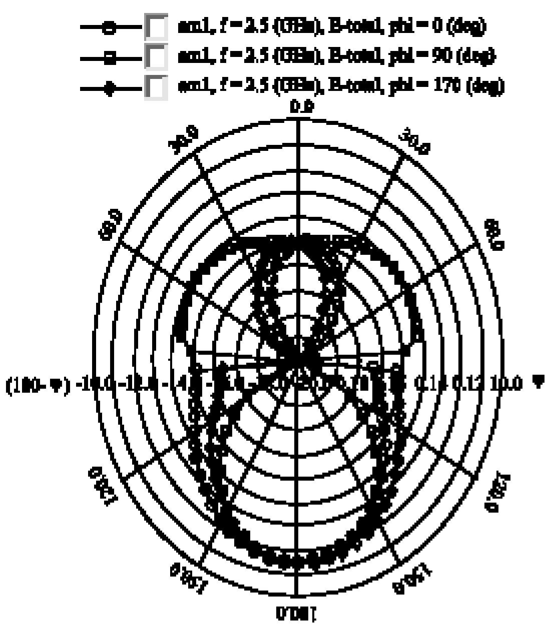

Fig. 4: Elevation pattern and gain

CONCLUSION

The design of the textile antenna has been carried out in this study and we can see good results with the simulations obtained using Zeland software. These results clearly indicates this antenna can be used as an effective receiving antenna for WLAN applications. The advantage of the textile antenna is the flexibility of its surface. It can be fabricated along with cloth material. We can also place this antenna at the neck or cuff portion of a shirt. It can also be fabricated with leather jackets. Another improvement in this antenna is the usage of array of antennas. The array of textile antennas can be used in ats and also in shirts at various locations. The array of antennas will further improve the directivity. It is possible to check the effect of the textile antenna subjected to the bending of its substrate.

With the increase in the angle of bending, the directivity gets reduced slightly. But this directivity is strong enough to have proper operation of WLAN. As this antenna can be wearable, it can be carried anywhere quite easily. Particularly the people who are using hotspots are much benefited from this type of antenna. As a modified version of this antenna, we can fabricate a button antenna, which can be used as button to the shirts and also do the operation of an normal antenna. As this antenna is to be wear on dressing material, the human body which is very close to the antenna is expected to degrade the performance of this antenna.

REFERENCES

Izquierdo, B.S., F. Huang and J.C. Batchelor, 2006. Dual Band Button Antennas For Wearable Microstrip Antenna. IEEE. AP-S Symp. Dig., 06: 132-134.

Massay, P.J., 2001. GSM fabric antenna for mobile phones integrated within clothing. IEEE. AP-S Symp. Dig., 3: 452-455.

Pozar, D.M., 1992. Microstrip antennas. IEEE. Proc. Antennas and Propagation, 1 (80): 179-191.

Salonen, P., L. Sydanheim, M. Keskilammi and M. Kivikoshi, 1999. Plannar Inverted-F Antenna for Wearable Application. 3rd Int. Symp. Wearable Computers, Sanfrancisco, pp: 95-98.

Salonen, P. and H. Home. A Novel Fabric WLAN Antenna For Wearable Application.

Tanaka, M. and J.H. Jang, 2003. Wearable Microstrip Antenna. IEEE. AP-S Symp. Dig., 3: 704-707.