

Designing of Textile Antenna for on Body Communication

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Abstract - In this paper we have designed new textile antenna using grounded flannel (100% cotton) and jeans material as a substrate. The designed textile antenna can be integrated with cap or various clothing of different materials for hidden applications. This antenna is wearable and thus it can be used for wireless communication purposes. This paper shows design simulation and fabrication of wearable textile antenna for 2.4GHz frequency and various substrate material.

Key Words: wearable antenna, textile antenna, flannel, jeans, microstrip antenna

1. INTRODUCTION

The wearable textile antenna have big importance in an on body communication purpose like military and biomedical applications. Various wearable antennas can be fabricated using different textile materials. The requirements for designing wearable antennas are light weight, low cost and no need of installation. Cap as a wearable element has many applications like military clothing and workers in a difficult environment conditions and it can also be used for safety purpose. Textile antenna can be incorporated for long distance measurement as well as short distance communication. For this textile antenna communication range varies from 10m to 100m. For short distance communication data can be transmitted using Bluetooth module if the control facility is quite near to the soldiers. This is the main reason here to study the designing of textile antenna for on body communication.

Wearable antenna can be describes as an antenna especially design to work while on one's body as clothing, thus it can be used for hidden application. Designed and printed patch can be implement by using copper sheet. Simple double adhesive fabrication technique can be used for textile material and to supports patch on them. The advantage of using double adhesive tape is, it has negligible thickness as compared with textile material and also has similar dielectric properties. Thus, conducting patch can be placed on textile substrate without changing specification of textile substrate material.

2. DESIGNING OF MICROSTRIP PATCH ANTENNA

It is the most basic form of antenna, microstrip patch antenna contains a radiating patch on one side of a dielectric substrate which has ground plane on the other side. The ground plane is generally made of copper & gold material.

For designing this antenna, copper sheet is used as patch on one side of dielectric substrate which is made up of cotton material and ground plane on the other side.

3. BASIC STRUCTURE

Microstrip patch can be printed directly onto a circuit board because of which they are becoming increasingly useful. Patch antennas have become quite popular due to advantages like low cost, low profile design and easy to manufacturing and modern wireless communication systems requires low cost and high performance multiband antennas.

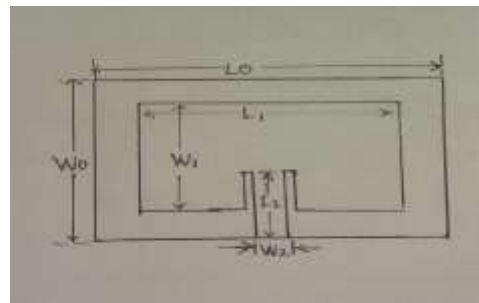


Figure 1. Basic Structure Of Patch Antenna

The patch have length L , width W and substrate have thickness h with permittivity. The thickness of ground plane is not important. The height should not be much smaller than 0.025 of a wavelength for an efficient antenna. Feed line is used to feed the patch. The radiating patch can be of different shapes like rectangular, circular, triangle etc. Rectangular and circular shaped microstrip patch antennas are used most commonly.

4. ANTENNA DESIGN

For designing and simulation of proposed antenna Ansoft HFSS (High-Frequency Structure Simulation)

software is used. Ansoft HFSS is an software package for calculating the electromagnetic (EM) behavior of a 3D structure antenna design perfectly. S-parameters and S-parameter re-normalized to specific port impedance can be generalize by Ansoft HFSS. HFSS software is capable of solving a variety of EM problems.

For designing and construction, the rectangular patch is placed at the top of textile substrate material and ground plane on the other side of the substrate. By using defined antenna formulas length, width and height of the proposed microstrip patch is calculated.

Parameters	values
H	1.5
LO	50
WO	39
L1	38
W1	29
L2	13.85
W2	3

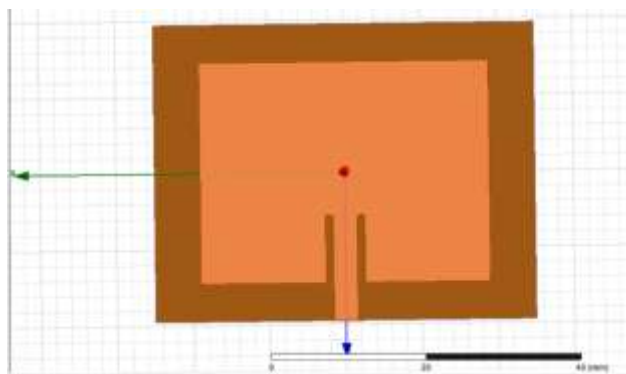


Figure 2. Designed Microstrip Patch Antenna For 2.4Ghz

5. Fabrication of Antenna

There are three different conductive materials that can be used for fabrication of textile antenna: flexible adhesive copper tape, an adhesive conductive fabric and a conductive thread. Multilayered of flannel textile substrate are used to achieve

Required thickness of 3mm. These multilayered textile are connected together by pressing. Then textile substrate is placed on ground plane of copper sheet by using adhesive double tape. This adhesive double tape has negligible thickness. The patch antenna is made of copper sheet. The cotton textile substrate has dielectric constant = 1.6, loss tangent= 0.025 and jeans material has dielectric constant=1.4.



Figure 3. Cotton as a substrate

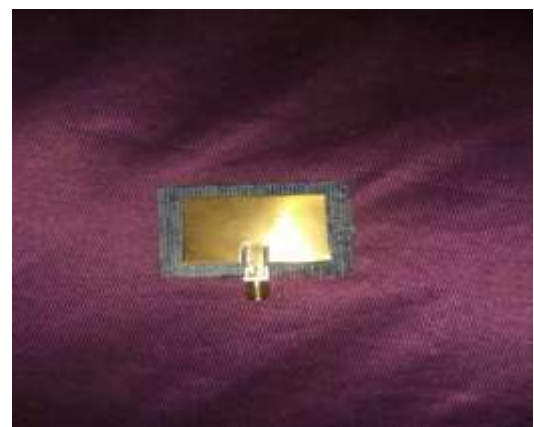


Figure 4. Jeans as a substrate

6. EXPERIMENTAL RESULTS:

1) RETURN LOSS: How much power is delivered from the source to a load is measured as a Return loss and given by S11 parameter. According to simulated result resonant frequency is 2.4GHZ.

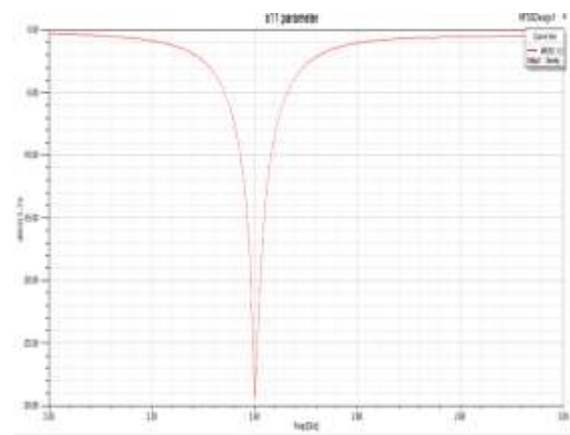


Figure5. S11 Parameter

2)3D RADIATION PATTERN: It represents the energy radiated by an antenna. The gain of the designed antenna is 2.35dB.

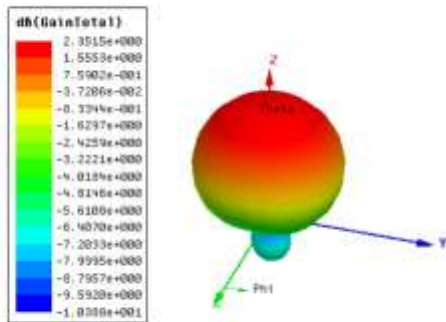


Figure 6. 3D Radiation Pattern

3)3D RADIATION PATTERN FOR DIRECTIVITY:It shows directivity of an proposed antenna.The gain of the designed antenna is 5.88dB.

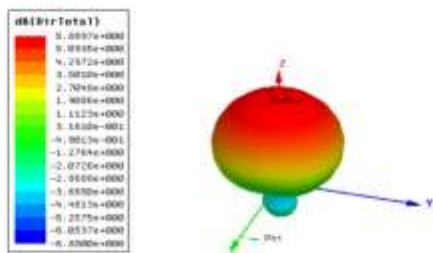


Figure 7. Directivity Graph

7. CONCLUSIONS

We have designed new antenna using different textile substrate material. From this paper we can conclude that wearable antenna is useful for on body communication in personal area network. It can be used in

several applications like military and medical using different substrate materials.

The most important factor for the performance analysis of antenna is return loss, radiation efficiency, total efficiency, VSWR. After analyzing the above factors for the 2 mentioned dielectric materials, better performance at 2.4GHz resonant frequency was observed for both cotton and jeans. If cotton and jeans used in the substrate layer, designed microstrip patch antenna will provide better performance for WiMAX communication system. The antenna is very compact,very easy to fabricate, and is fed by a 50 Ω microstrip line which makes it very attractive for current and future WLAN application.

8. REFERENCES

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