

A Wearable Textile Bed Sheet Cotton Substrate Material Micro Strip Antenna in the ISM Band

Bivas Roy

Electronics & Instrumentation Engineering Department, JIS College of Engineering Kalyani, Nadia, West Bengal,
Pin-741235, India

Abstract: In this paper the design fabrication and measurement of an ISM band (5.8GHz) wearable cotton textile patch antenna is presented. The substrate of the designed antenna was made by bed sheet cotton textile material while the radiating element and ground plane was made by thin film copper foil. The copper foil was pasted by using synthetic resin adhesive on the textile (cotton) material. Cotton textile antenna impedance characteristics and radiation pattern characteristics were studied.

Keywords: Micro strip wearable textile antenna, cotton substrate, radiation pattern.

I. INTRODUCTION

In future garments will be more informatics, because the integration of electronics into textile material. In future garments will not only protect the human body against the extremes of nature but also give information about the wearer's state of health and environment [1]. Those input information will be very valuable input for rescue work, fire fighter, military application, health care monitoring, astronauts etc. Now a day flexible textile antenna has a very high demand for the requirement of protective garments [1, 2]. To become garments more comfortable, the antenna should be embedded [3] on the garments. Wireless communication with the environment require textile antennas. Textile material is environment friendly materials. Micro strip antenna is a suitable candidate for design and fabrication of wearable smart protective electro textile antenna. The advantage of microstrip antenna are (1) Light weight (2) Easy to design (3) inexpensive to manufacture (4) mechanically robust, etc. 5.8 GHz Industrial, Scientific and Medical (ISM) radio unlicensed band is utilized for the development of wearable cotton antennas is presented in this paper.

II. ANTENNA DESIGN PROCEDURE

The first step in the design of textile antenna consists of choosing appropriate material for the antenna substrate and the conducting part.

2.1 Choice of Substrate:

Selection of most suitable substrate of micro strip antenna is a matter of prime importance. Here we choose bed sheet cotton textile material as a substrate.



Fig 1 Textile bed sheet cotton Substrate.

2.2 Choice of Ground Plane and Patch:

For the conducting part we choose thin copper foil because of its low surface resistivity and its large temperature range which enable us to solder the connector without burning holes in the electro textile.



Fig: 2- Copper foil for Ground plane and Patch

2.3 Antenna Design:

Here we design a rectangular micro strip antenna on bed sheet cotton textile substrate. For antenna design purpose we cut the copper foil whose width is 45 mm and length is 36 mm. The feeding position was $X=0$, $Y=-8$. This rectangular copper foil was pasted on bed sheet cotton substrate. Another Copper foil whose dimension 120mm X 120mm was pasted on the other side of the substrate which act as a ground plane. The adhesive used was synthetic resin adhesive. We made the design antenna substrate thickness was 2.7 mm. In order to achieve desired thickness we made the substrate using a stack of textile material. The textile materials were pasted using synthetic resin adhesive.



Fig 3:- Textile bed sheet cotton antenna

III. ANTENNA PERFORMANCE

The textile bed sheet cotton antenna shows 5.8 GHz Industrial, Scientific and Medical (ISM) radio unlicensed band . The impedance properties of the antenna was measured by agilent E5071B vector network analyser and the result was shown in fig :-4

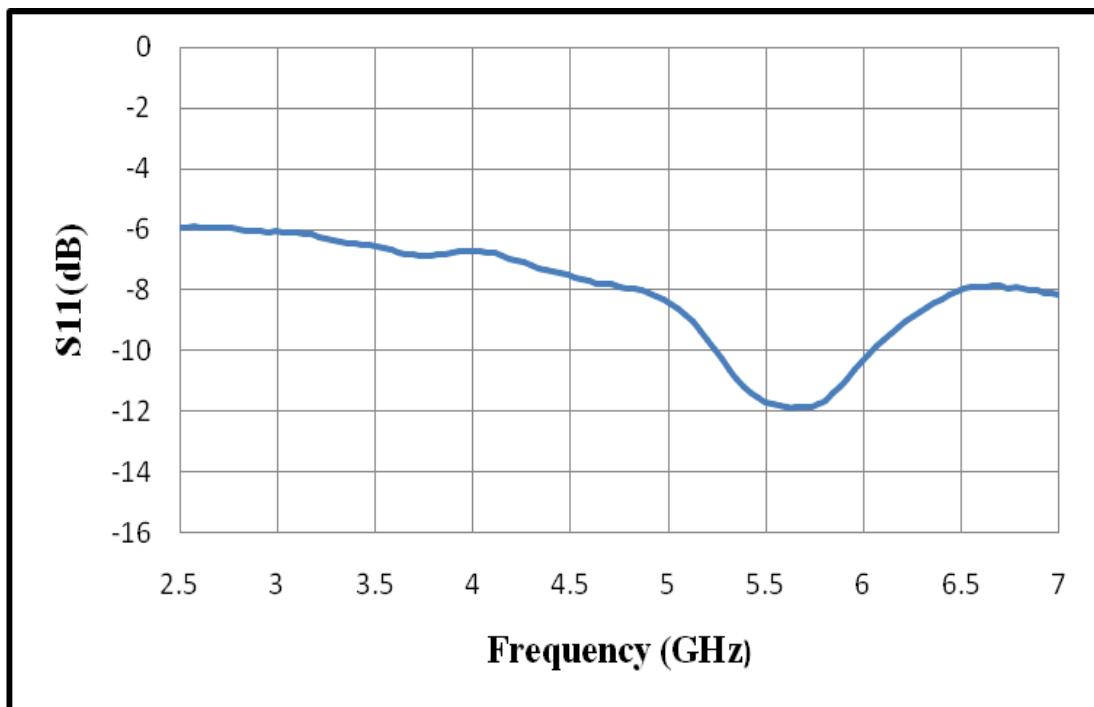


Fig 4:-Measured S₁₁ curve of the bed sheet cotton antenna

The radiation patterns of the antenna given in figure 5 . Radiation pattern was measured in the E-plane and were broad beam in nature.

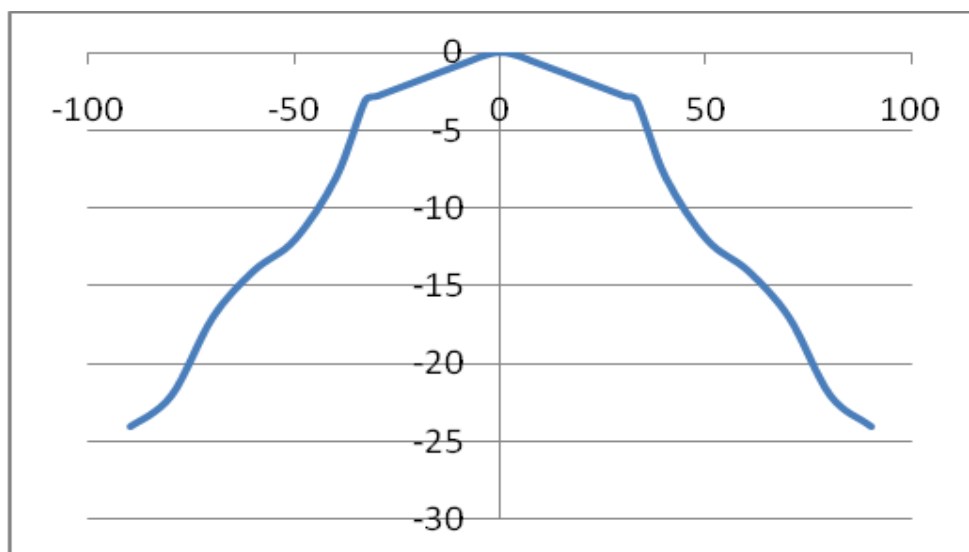


Fig5:- Measured E-plane radiation pattern of bed sheet cotton textile antenna.

IV. CONCLUSIONS

In this paper bed sheet cotton textile rectangular patch antennas have been designed, fabricated and tested in order to get their impedance and radiation characteristics. The use of commercial textiles (bed sheet cotton) antenna substrate at microwave frequency range for the design and fabrication of wearable smart protective textile micro strip antennas has been demonstrated.

ACKNOWLEDGMENT

The author would like to acknowledge TEQIP –II, JIS College Of Engineering, Kalyani, Nadia, India. For sponsoring the work.

REFERENCES

- [1] Bivas Roy; Partha Pratim Sarkar; Santosh Chowdhury; "Wideband Rectangular Wearable Jeans Antenna" Microwave And Optical Technology Letters / Vol.55:1270–1273, No. 6, June 2013.
- [2] Hertleer, C.; Rogier, H.; Vallozzi, L.; Van Langenhove, L., "A Textile Antenna for Off-Body Communication Integrated Into Protective Clothing for Firefighters ", Antennas and Propagation, IEEE Transactions on : 2009 , Page(s): 919 - 925
- [3] Hertleer, C.; Rogier, H.; Van Langenhove, L., "A Textile antenna for protective clothing," Antennas and Propagation for Body-Centric Wireless Communications, 2007 IET Seminar on 2007 , Page(s): 44 – 46
- [4] Klemm, M.; Troester, G., "Textile UWB Antennas for Wireless Body Area Networks", Antennas and Propagation, IEEE Transactions on 2006 , Page(s): 3192 – 3197

BIOGRAPHIE



Mr. Bivas Roy obtained his M.Tech from University Of Calcutta in the year 2008. He earned his B.E degree in Electronics and Instrumentation Engineering from The University of Burdwan in the year 2004. He is presently working as Asst. Professor at the Dept. of Electronics and Instrumentation Engineering, JIS College of Engineering Kalyani. His area of interest includes, Microstrip Antenna, Frequency Selective Surfaces and Instrumentation.