INTERNATIONAL JOURNAL OF PURE AND APPLIED RESEARCH IN ENGINEERING AND TECHNOLOGY

A PATH FOR HORIZING YOUR INNOVATIVE WORK

DESIGN OF MICROWAVE FREQUENCY ANTENNA FOR BODY AREA NETWORK

SUPRIYA VENKATESH, GAUNS DESSAI

Electronics and Telecommunication Department (Masters in Industrial Automation and Radio Frequency), Goa College of Engineering Farmagudi-Goa, India

Accepted Date: 05/03/2015; Published Date: 01/05/2015

Abstract: In recent advances there have been a growing demand for ultra wide technology. One of the most promising areas in UWB applications is Wireless Body Area Network (WBANs). Flexible fabric antennas are best suited in WBANs, which can be easily attached to a piece of clothing. For flexible antennas, textile materials form interesting substrates, because fabric antennas can be easily integrated into cloths. Textile materials generally have a very low dielectric constant, which reduces the surface wave losses and improves the impedance bandwidth of the antenna. If the antenna is made of textile material they will not make any harm to human body and will be totally wearable. This paper presents the design a flexible fabric textile antenna for (WBANs) operating in the frequency band of 2.39GHz to 2.5 GHz. The antenna consists in a simple metallic circular ring with slots in between. The performance investigation of circular ring microstrip patch antenna on three different dielectric substrates of same thickness or height (0.3mm).All these antennas are having different feeding port placement. The three dielectric materials which are investigated are cotton, cordura, 100%polyester. The output parameters of all these antennas are simulated using IE3D software. Among the three metallic circular ring antenna, antenna with cotton as a dielectric substrate gives optimum results in terms of Directivity, Gain, Bandwidth and Efficiency.

Keywords: Microwave Frequency, Body Area.

Corresponding Author: MS. SUPRIYA VENKATESH

Access Online On:

www.ijpret.com

How to Cite This Article:

Supriya Venkatesh, IJPRET, 2015; Volume 3 (9): 16-25

PAPER-QR CODE

INTRODUCTION

Microstrip patch antennas are used in many applications due to their small size, low cost, ease of fabrication, dual frequency operation and support of linear and circular polarization. However, their gain and bandwidth are very low. Several techniques are suggested by different authors for gain enhancement. Bandwidth is directly proportional to the patch dimension and inversely proportional to the dielectric constant of the substrate. Gain of the antenna is also largely depends on the dielectric constant of the dielectric substrates. Dielectric material must have very low water absorption capability as it increases the gain of the antenna.

This paper presents the design a flexible fabric textile antenna for (WBANs) operating in the frequency band of 2.39GHz to 2.5 GHz. The antenna consists in a simple metallic circular ring with triangular shapes slots in between. The performance investigation of circular ring microstrip patch (copper) antenna on three different dielectric substrates of same thickness or height (0.3mm).All these antennas are having different feeding port placement. The three dielectric materials which are investigated are cotton, cordura, 100% polyester. The geometry is drawn and simulated using IE3D simulator as it is an integrated full wave simulation and optimization package for the analysis and design of 3D microstrip antenna.

2. **DESIGN SPECIFICATION**:

The optimized parameters of the circular ring are given as follows

Parameter	value
Inner Radius	22.83mm
Outer radius	31.96mm
Dielectric substrate thickness	0.3mm

3. ANTENNA GEOMETRY

The figures below shows the geometry of the proposed antenna that metallic circular ring with four triangular slots in between.

3.1Cotton

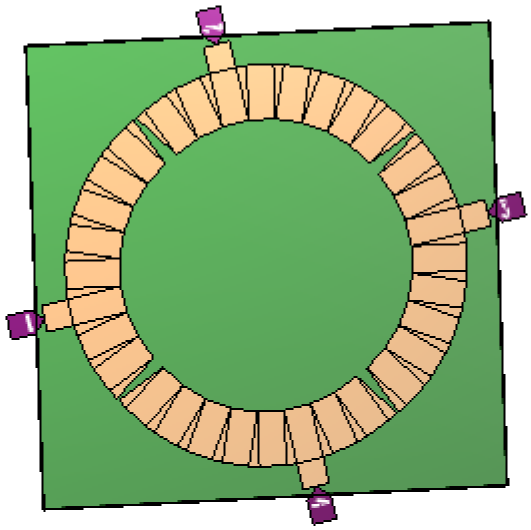


Fig.1circular ring patch of copper on Cotton. The cotton has a dielectric constant of 1.708 and loss 0.0598

3.2Corduar

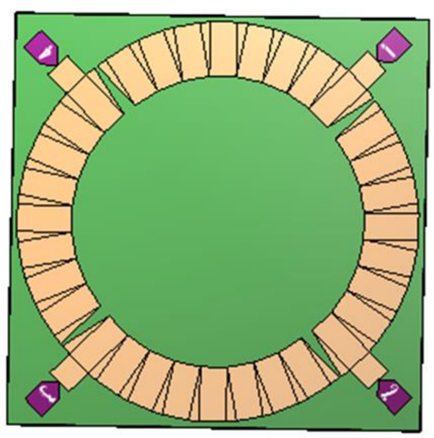


Fig 2 circular ring patch of copper on corduar the corduar has a dielectric constant of 1.90 and

Tangent of 0.0098. Loss tangent of 0.0098[2]

3.3 100% polyester

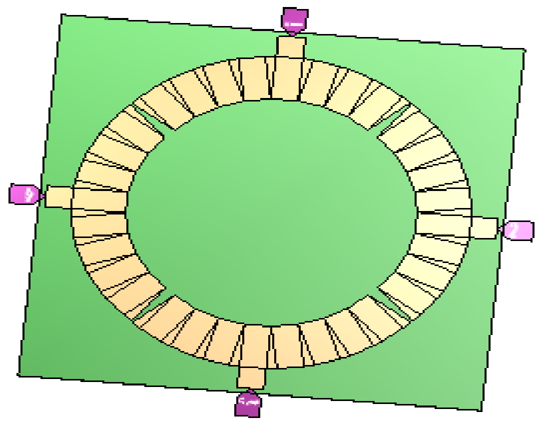


Fig 3 circular ring patch of copper on 100% polyester

The polyester has a dielectric constant of 1.90 and loss Tangent of 0.0045 It can be observed that the placement of feeding port is different in each antenna.

4. SIMULATED RESULTS

4.1 Bandwidth Calculation

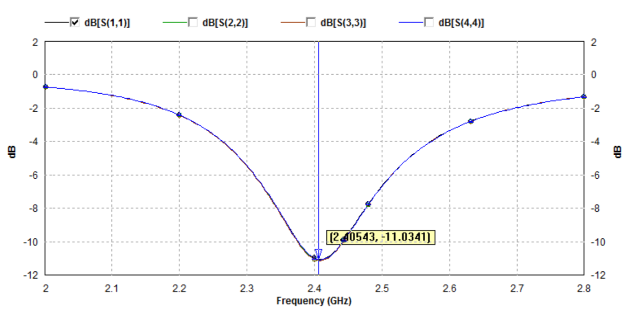
The bandwidth can be calculated from the following formula: BW= $\frac{f_2-f_1}{\frac{f_2+f_1}{2}} \times 100$

Where, BW is bandwidth, and $f_2$are highest and f_1 lowest frequency.

4.2 RETURN LOSS VS FREQUENCY

Considering a reference value of -6dB for return loss

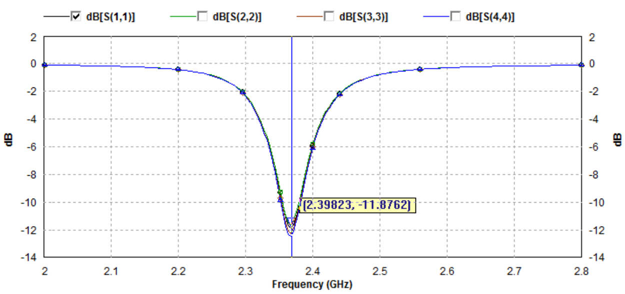
4.2.1 Cotton



The return loss for cotton is -11.0341dB, the

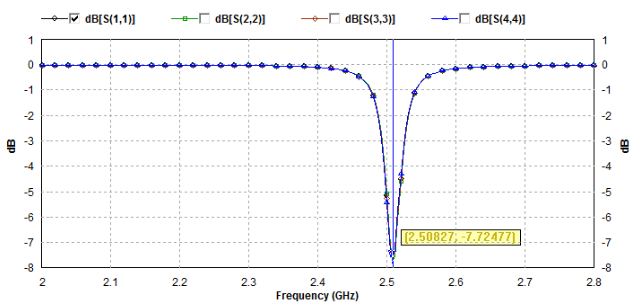
Fractional bandwidth is 8.33% and the antenna the resonates at 2.40543

4.2.2 Cordura



The return loss for Cordura is -11.8762 Fractional band width is 2.6% and the antenna resonates at 2.3923 Ghz

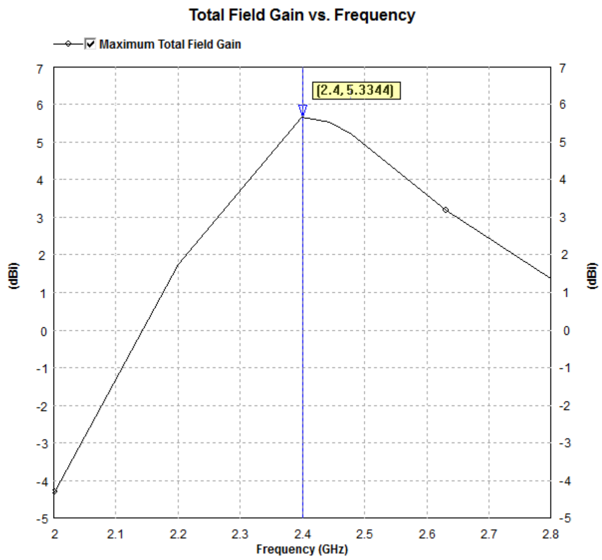
4.2.3 100% polyester



The return loss for polyester is -7.72477 dB, the fractional Bandwidth is 2.1% and the antenna resonates at 2.50827 GHz

4.3 Gain vs. Frequency Graph

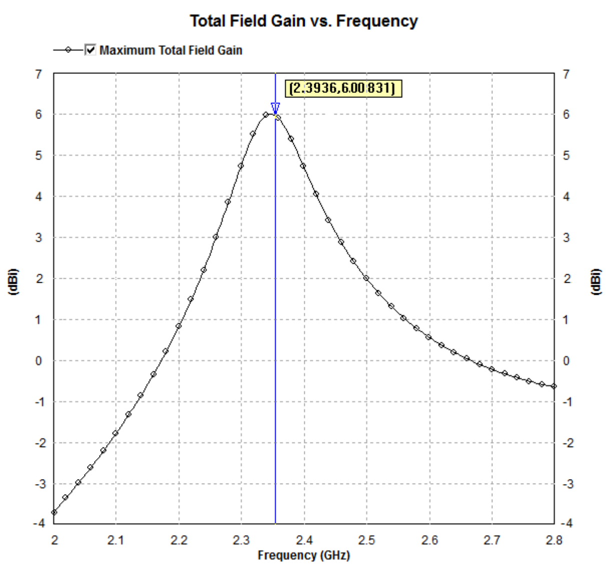
4.3.1 Cotton 4.3.2 Cardura



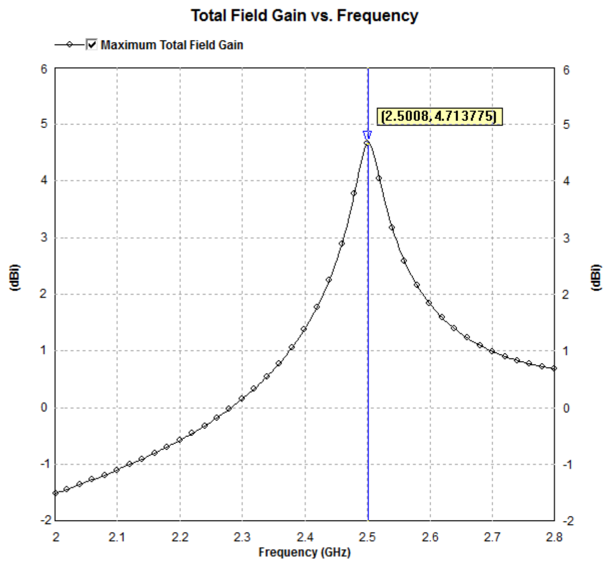
The Gain of cotton is 5.33dBi at 2.4 GHz frequency

4.3.2 Cordura

The Gain of cordura is 6dBi at 2.39 GHz frequency



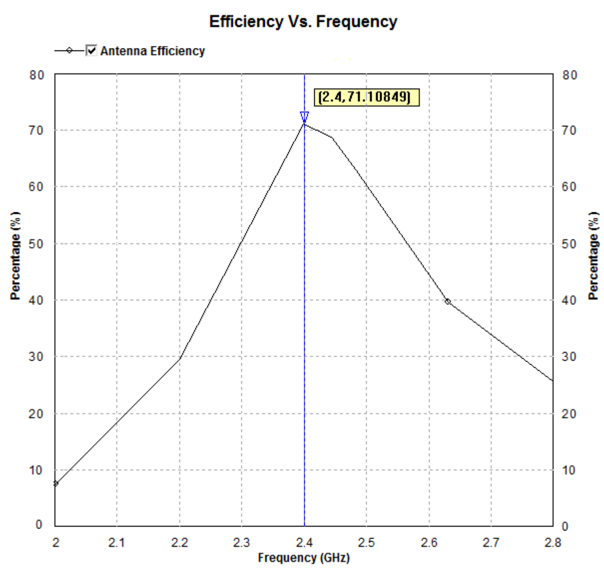
4.3.3 100% polyester



The Gain of 100% polyester is 4dBi at 2.5 GHz frequency

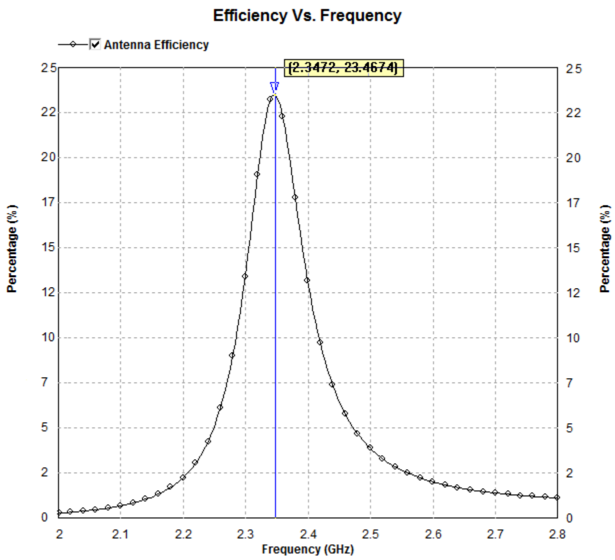
4.4 Efficiency vs. Frequency Graph

4.4.1 Cotton 4.4.2 Cardura



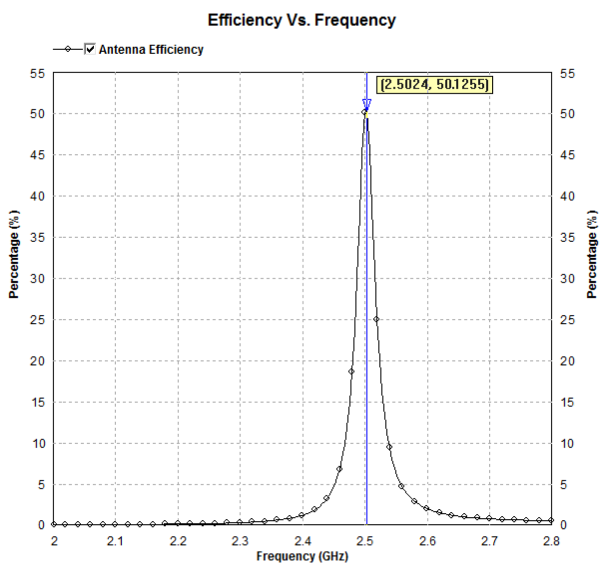
The Efficiency of cotton is 71.10849% at 2.4GHz

4.4.2 Cordura



The Efficiency of Cordura is 23.4674% at 2.39Ghz frequency.

4.4.3 100% polyester



The Efficiency of 100% polyester is 50.1255% at 2.5GHzfrequency

5. **FINAL TABLE**

Parameters	Cotton	Cardura	100% polyester
Return loss(dB)	-11.0341	-11.8762	-7.72477
VSWR	1.78564	1.93516	1.37833
Directivity(dBi)	6.41846	6.13848	6.28715
Gain(dBi)	5.33	6	4
Band width (%)	8.33	2.6	2.2
Efficiency (%)	71.10849	23.4674	50.1255

6. CONCLUSION

Three different circular ring patch antennas are investigated using three different dielectric substrates cotton, Cardura and Polyester. Results are found to be best in the case of cotton as it gives 71% efficiency with a bandwidth of 8.33%. Cotton has lowest dielectric constant among the three substrates which increases the bandwidth because bandwidth is inversely proportional to dielectric constant or permittivity. Cotton gives a Gain of 5.33 dBi as compared to first best Gain of 6 dBi of Cardura, but Cardura has lower band width compared to cotton. Also, the Directivity is 6.41846dBi, more than Cardura and polyester.

7. REFERENCES

1. C. Waldschmidt and W. Wiesbeck, “Compact Wide-Band Multimode Antennas for MIMO and Diversity”, IEEE Trans. Antennas Propagat., Vol. 52, no. 8, pp. 1963-1969, August 2004.

2. E. Antonino, M. Cabedo, M. Ferrando, M. Gallo “Design of a Multimode MIMO Antenna Using the Theory of Characteristic Modes“, Radio engineering, vol. 18, no. 4, pp. 425-430 December 2009

3. Bappadittya Roy, A. K. Bhatterchya , S. K. Choudhury, “CHARACTERIZATION OF TEXTILE SUBSTRATE TO DESIGN A TEXTILE ANTENNA ’’@2013 IEEE

4. R. F. Harrington and J. R. Mautz, "Theory of Characteristic Modes for Conducting Bodies," IEEE Trans. Antennas Propagat., AP-19, 5,September 1971, pp. 622-628

5. J. Santiso Bellón, M. Cabedo-Fabrés, E. Antonino-Daviu, M. Ferrando-Bataller1, F. Penaranda-Foix” Textile MIMO Antenna for Wireless Body Area Networks” Institute of Telecommunications and Multimedia Applications (iTEAM), Edificio 8G, Universidad Politécnica de Valencia, Camino de Vera s/n, 46022, Valencia, Spain,pp428-432

6. Bappadittya Roy, A.K.Bhatterchya , S. K. Choudhury, "CHARACTERIZATION OF TEXTILE SUBSTRATE TO DESIGN A TEXTILE ANTENNA ''@2013 IEEE

7. Pekka Salonen, Peter de Maagt "Practical Design Aspects for Textile Antennas"@2013IEEE

8. Hendrik Rogier, Sam Agneessens, Arnaut Dierck, Bart Spinnewyn, Gert-Jan Stockman, Frederick Declercq, Patrick Van Torre, Luigi Vallozzi and Dries Vande Ginste "Active Textile Antennas in Professional Garments for Sensing, Localization and Communication" @2013 EuMA

9. Haider R. Khaleel, Hussain M. Al-Rizzo and Ayman I. Abbosh, "Design, Fabrication, and Testing of Flexible Antennas" © 2013 http://creativecommons.org/licenses/by/3.0

10. Rita Salvado, Caroline Loss, Ricardo Gonçalves and Pedro Pinho "Textile Materials for the Design of Wearable Antennas: A Survey", @2012 www.mdpi.com/journal/sensors,pp.15841-15851.

11. B. Sanz-Izquierdo, J.C, Batchelor and M.I. Sobhy: Department of Kent, Compact UWB Wearable Antenna; @2011The University of Kent, Canterbury.

12. B. Sanz-Izquierdo, J.C, Batchelor and M.I. Sobhy: UWB Wearable Button Antenna;@2012 Department of Kent, the University of Kent, Canterbury, Kent.