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Eco-Friendly Dual-Band Wearable Antenna

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Abstract: This innovation presents an hourglass shape microstrip patch antenna with dual-band (1.8GHz and 2.4GHz) with high gain, the cotton (relative permittivity of 1.6) is used as the dielectric substrate for this antenna. It's flexible and lite weight makes it a perfect wearable antenna as it's made up of natural fibres it's also eco-friendly. The antenna is designed and simulated using "Ansys HFSS".

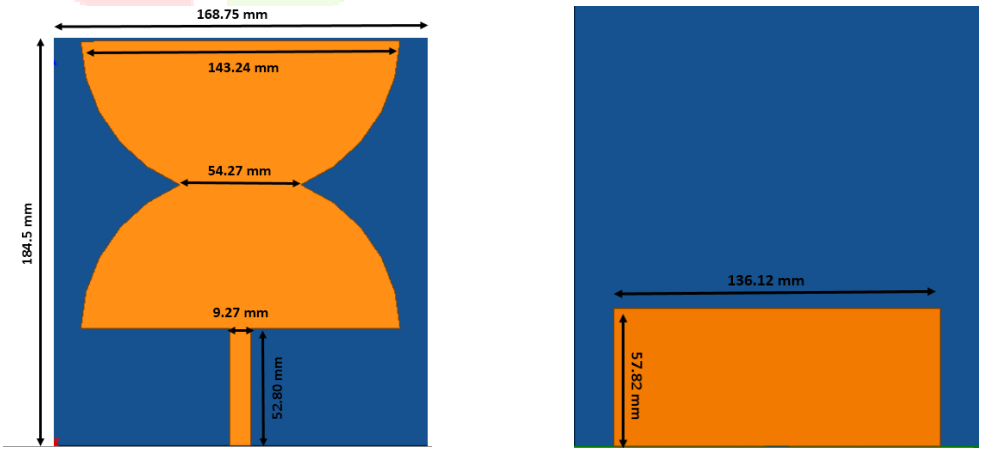
Index Terms **- Eco-Friendly, Dual Band, Wearable Antenna.**

I. INTRODUCTION

As the communication system get advanced day by day the demand of wearable antenna raised, but although there exists varies type of wearable antenna they can't be used for all the application because of variable parameters such as bandwidth, temperature and other operational variables [1-3]. But often they are fabricated using the FR4 or other synthetic material [4-5], these synthetic material are often required harmful chemicals such as Ferric chloride for fabrication process, and after the life cycle, the antenna ends in garbage which required thousands of years to decompose. Hence it's important to find the alternatives to these synthetic materials. The cotton is the one of the most used natural fibre material also has good dielectric property [5-8] and also it's eco-friendly if the heat is increased beyond the safety limit the synthetic material gets meltdown and poses a fire threat but the cotton is safe to use because it burns out quickly. The fabrication process with the cotton is also very simple and doesn't require any harmful chemical such as Ferric chloride [9-10].

II. PROPOSED ANTENNA

The proposed antenna is fabricated on "184.5 mm X 168.75 mm" Cotton substrate, the hour-glass shaped copper patch of measures 143.24 mm at top and bottom and measures 54.27 mm at the middle see Figure.1(a), it also had ground with a length of 136.12 mm and width of 57.82 mm see Figure.1(b). The antenna is fed with transmission line feeding. The antenna patch will be cut in the required shape and glued to the substrate using the special glue.



(a) (b)

Fig.1. (a) Base Design Patch, (b) Ground

III. RESULTS

As the first antenna is designed and simulated the results were not satisfied hence the neck region is modified into different shapes see Figure.2, the parametric results were plotted and analyzed see Figure.3, by the analysis gave the conclusion that the triangle shape gives more satisfying results than any other shape neck. in the triangle shape is the adjacent edge is kept a constant with a length of 6.8mm the base edge is varied see Figure.4 and simulation is carried parametrically. The results were plotted and analyzed see Figure.5, by using this parametric data a table is constructed see table.1 and another multi-curve plot with base length vs frequency vs Return loss (S11) is drawn and analyzed

Figure.6, by the analysis gave the conclusion that the triangle with base length 6.98mm gives return loss of -15.50 dB at the first band(1.82 GHz) and gives return loss of -31.54 dB at Second band(2.37 GHz) see Figure.1(a) and Figure.1(b) and it will have the gain of 10.85 dB Figure.1(c).

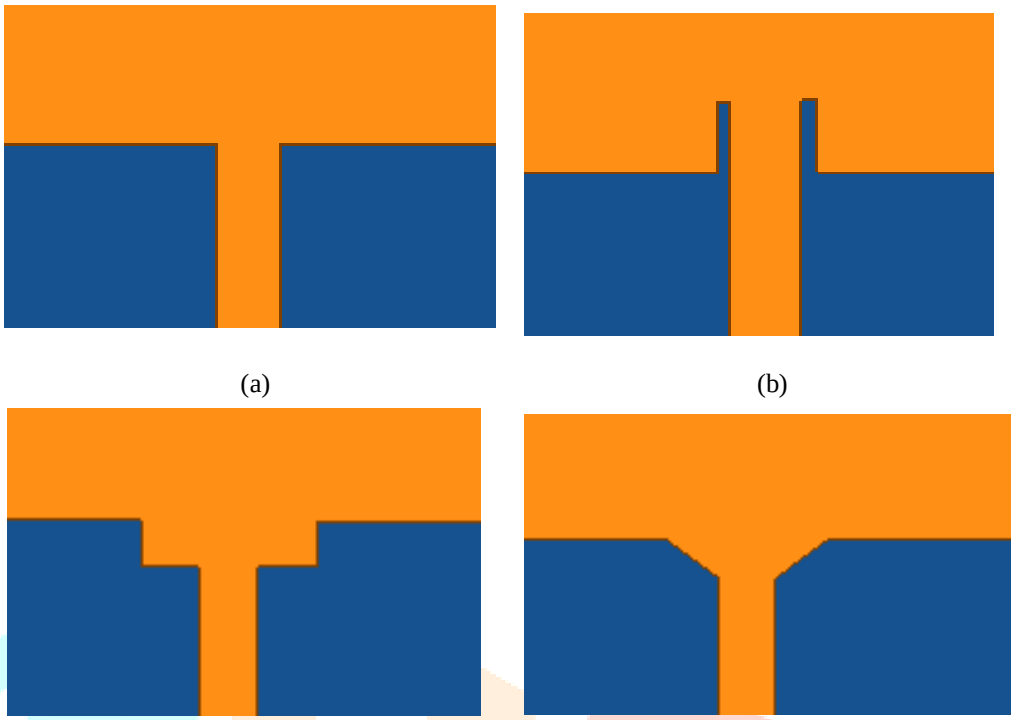


Fig.2. Different Shapes of Neck (a) Basic (b) Slot (c) Square (d) Triangle

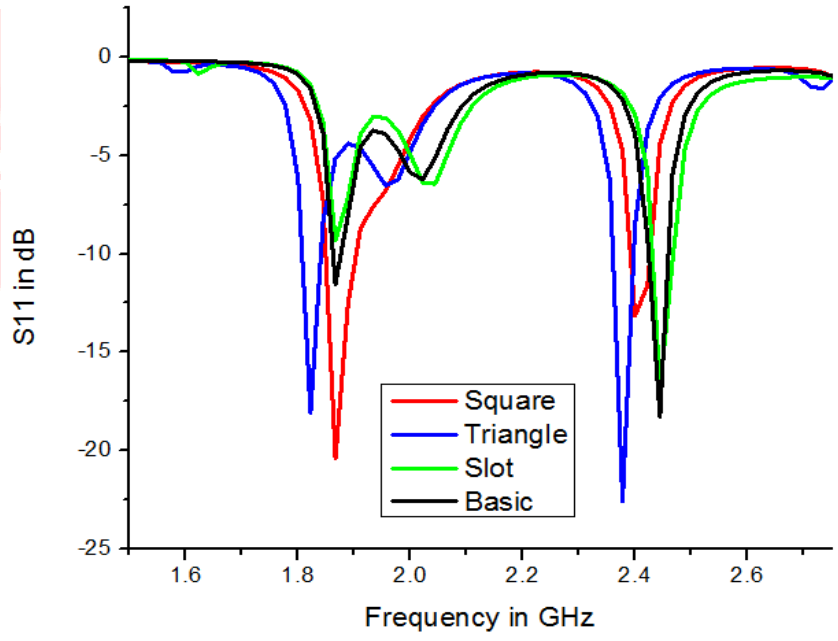


Fig.3. Parametric Results of Different Shape Neck

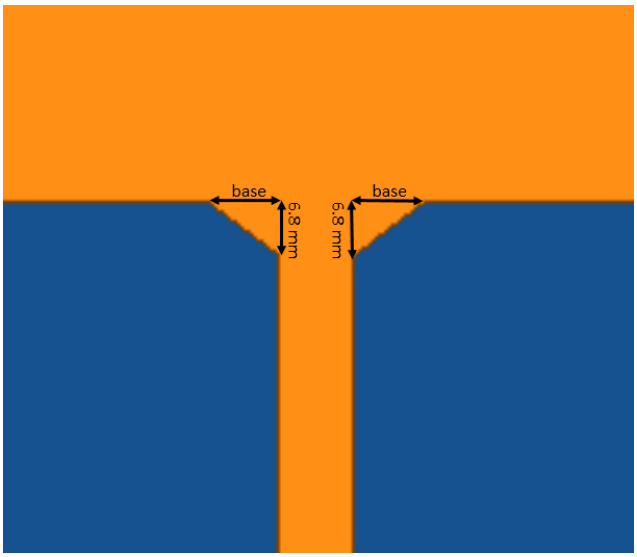


Fig.4. Parametric Consideration Triangle Neck

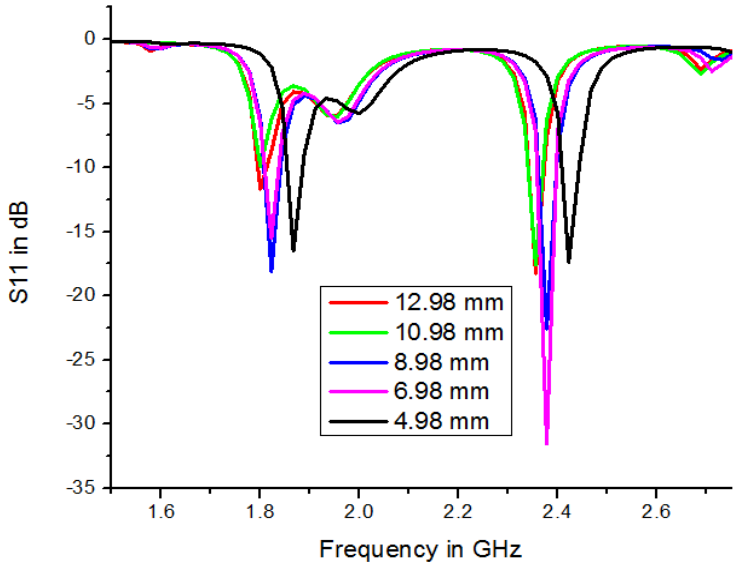


Fig.5. Parametric Results of Different Length of Base

Table 1: Parametric Results of Triangle Base Length Variation

Base Length [mm]	First band f1 [GHz]	Return Loss [dB]	Second band f2 [GHz]	Return Loss [dB]
4.98	1.86	-16.50	2.42	-17.36
6.98	1.82	-15.50	2.37	-31.54
8.98	1.82	-18.08	2.37	-22.58
10.98	1.80	-9.90	2.35	-18.25
12.98	1.80	-11.66	2.35	-18.25

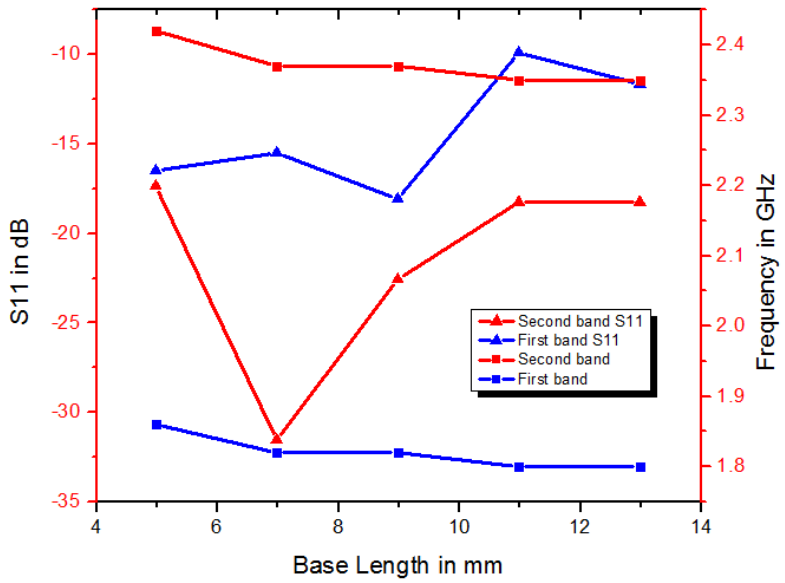
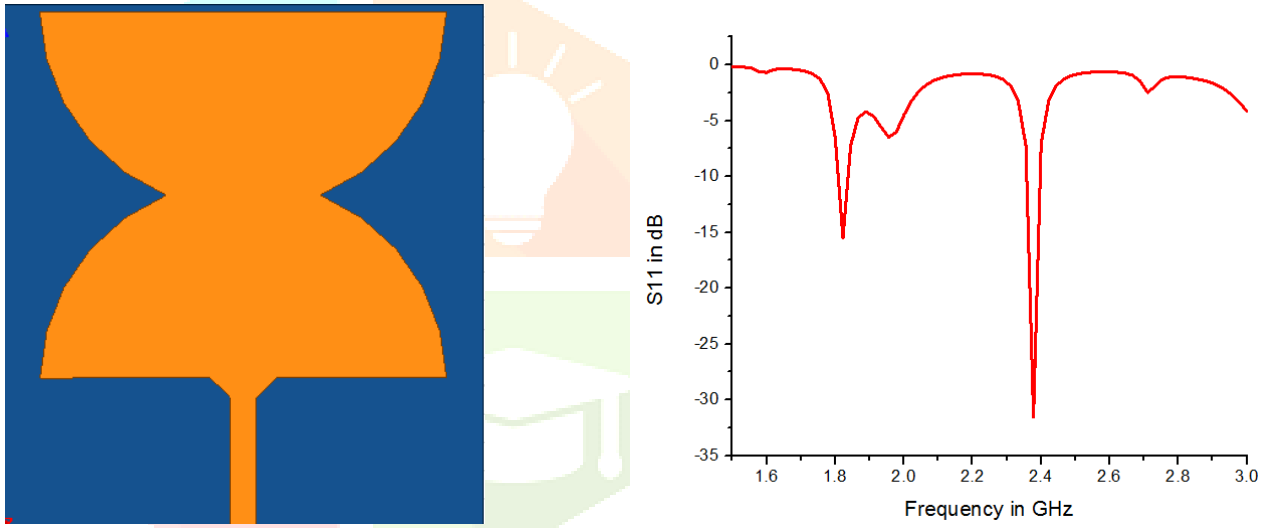
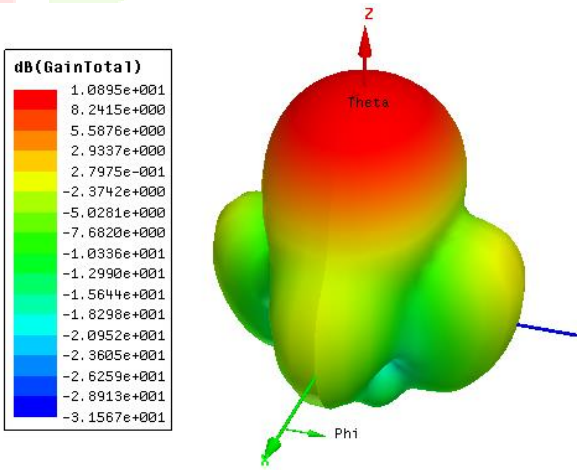


Fig.6. The Multi-Curve Plot of Base Length Vs Frequency Vs Return Loss (S11)



(a) (b)



(c)

Fig.7. Final model (a)Antenna, (b)Return Loss, (c)Gain

IV. CONCLUSION

This innovative work was carried out to make an effort to produce and eco-friendly dual-band wearable antenna. An Hour-glass shaped microstrip patch antenna operating at 1.82 GHz and 2.37 GHz frequency with 100% cotton with the dielectric constant of 1.6 has a dielectric substrate of thickness 1.5 mm has been proposed and designed and qualitative parametric simulations and quantitative parametric simulations were carried out to meet the standard requirements.

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