Compact Uniplanar Antenna for Multiband Applications

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Abstract—**A dual band RFID applications in 800 - 900 MHz and 2400 MHz band is presented. The Asymmetric Coplanar Strip (ACS) fed antenna consists of inverted L shaped monopole with a capacitive loading to provide necessary impedance matching and current distribution. The antenna has wide bandwidth from 790 MHz to1050 MHz and from 2350 MHz to 2640 MHz coving the RFID UHF and Microwave frequencies. The uniplanar antenna having overall dimensions of 48 mm x 14 mm is printed on one side of a substrate of dielectric constant 4.4 and height 1.6 mm.**

Key words - **Asymmetric Coplanar Strip, Capacitive loading, Dual band, RFID**

I. INTRODUCTION

RFID technology has seen tremendous development in the recent years. Antennas intended for RFID application has to be compact, should have comparatively larger bandwidth and must be economically viable. The CPW fed antenna-slot antenna mentioned in [1] has an overall dimension of 30mm x 30 mm at 5.8 GHz applications. Other designs include meandered dipoles and patch antennas [2,3]. In this paper we present a compact uniplanar antenna which is highly suitable for RFID and related applications. Asymmetric coplanar strip [5] is chosen as the feed and the signal strip is a folded to achieve a compact structure. The compactness and uniplanar nature of the proposed design makes it highly suitable for compact wireless gadgets. Ansoft HFSS is used for the simulation and analysis of the structure. Details of design along with experimental and simulation results are presented in the following sections.

II. ANTENNA DESIGN AND ANALYSIS

Figure 1 shows the geometry of the asymmetric coplanar strip fed inverted L shaped monopole antenna from which the final design is derived. The above antenna resonates at 1.05 GHz with poor impedance matching. The reactive part is found to be inductive in nature.To tune the resonance to 900 MHz and to compensate for the inductive reactance an additional arm L3 is with a 1 mm slot is inserted in the ground plane. The resultant antenna is shown in fig.2.

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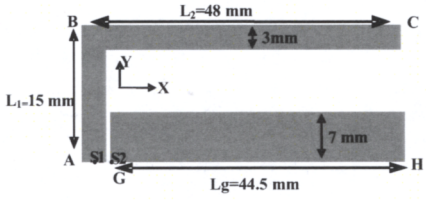
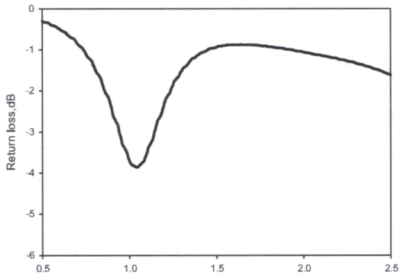


Fig.1.a.The geometry of the ACS fed inverted L antenna



1.b. Return loss of the inverted L antenna

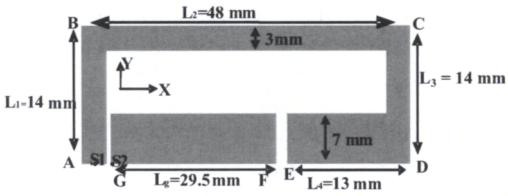


Fig.2.The geometry of the proposed antenna is shown in Fig.1

The final capacitively loaded ACS fed antenna exhibits two resonances as shown in fig.3.

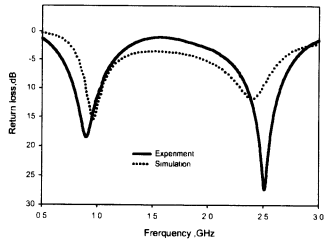


Fig.3.Return loss characteristics of the antenna

The antenna is tested using HP8510C Network Analyzer. Experimental Bandwidth of the antenna is

from 790 MHz to 1050 MHz and from 2350 MHz to 2640 MHz

Analysis shows that the first resonance is due to the total length of the structure and it is equal to half of the dielectric wave length at that resonant frequency. The second resonance is also due to the total length of the antenna and there exists a full wavelength variation corresponding to that resonant frequency The current distribution in the two bands are shown in fig.4.It has to be noted that the second resonance is not the next harmonic of the first resonance. This may be due to the capacitive slot which perturbs the field inside the structure thereby shifting the resonance to higher frequencies. The lengths L1, L2, L3 and L4 are optimized for compactness and good impendence matching.

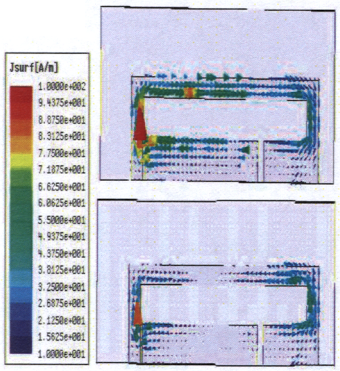
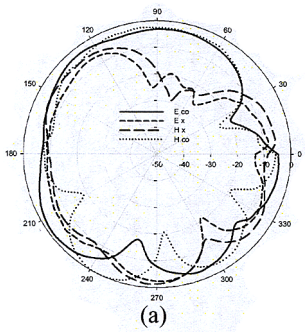
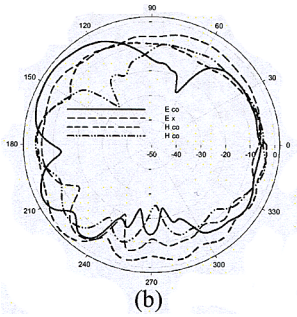


Fig.4.Current distribution in the antenna (a) At 890 MHz (b) At 2400 MHz

Figure 5 shows the radiation pattern of the antenna for the two bands. The antenna is polarized along the Y axis for the two bands. The gain of the antenna is measured to be 0.6 dBi at 900 MHz and 2.1 dBi at 2400 MHz



(a)



(b)

Fig.5.Radiation patterns of the antenna (a)At 900 MHz (b) At 2400 MHz

III.CONCLUSION

Design and radiation characteristics of an uniplanar RFID antenna is reported. The antenna has wide bandwidth from 790 MHz to1050 MHz and from 2350 MHz to 2640 MHz within a compact dimension of 48mm x 14 mm on a substrate of dielectric constant 4.4.The uniplanar nature, compact size and dual band nature of the antenna makes it ideal for RFID applications.

ACKNOWLEDGEMENT

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REFERENCES

[1] S.-Y Chen and P.Hsu "CPW-fed folded slot antenna for 5.8 GHz RFID tags", IET Electronics Letters , vol.40, No.24 ,November 2004.

[2] H-E Nilsso J Siden, T Osslo, P Jonsson and A Kotioung, "Evaluation of a printed patch antenna for robust microwave RFID tags", IET microw. Antennas Propag, 2007, 1, (3), pp.776-781

[3] K.V.Seshagiri Rao,Pavel V.Nikitin and Sander F .Lam, "Antenna Design for UHF RFID Tags:A review and a practical application, Vol.53, No.12 December 2005.

[4] Deepu.V, Rohith K. Raj, Manoj Joseph, Suma M.N, and P.Mohanan, " Compact Asymmetric Coplanar Strip Fed Monopole Antenna for Multiband Application", IEEE Transaction on antennas and propagation, Vol 55,No.8, August 2007, pp. 2351-2357