Compact Tapered Fed Dual Band Monopole Antenna

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***Abstract*— This paper presents a compact tapered feed dual band monopole antenna based on complimentary split ring element for WLAN (2.4GHz)WIMAX applications. The proposed complimentary split ring resonator antenna(CSRA) has novel design which provides 35% and 71% impendence bandwidth at operational frequency bands. This antenna have good radiation pattern at resonant frequencies 2.4 GHz & 5 GHz. The design and analysis of the proposed antenna have been carried out by means of Ansoft HFSS 14.0.**

Keywords*— CSRMA, WLAN, Tapered Fed, Monopole antenna

I. INTRODUCTION

Rapid development of various wireless local network(WLAN) applications have forced researchers to use novel antenna for mobile and base station called miniaturised dual band and wideband antenna . Today the most popular wide spread WLAN protocols have been IEEE 802.11 b/g, which is used the 2.4 GHz ISM band(2.4-2.484 GHz),IEEE 802.11y, which is used the 3.6 GHz band(3.6-3.7 GHz) , IEEE802.11y Public Safety WLAN ,which is used 4.9GHz band(4.94-4.99 GHz), and IEEE 802.11a which employs the 5 GHz U-NII band and ISM band(5.15-5.35 GHz) and 5.725-5.850 GHz).In this context preferably all those bands are achieved using a single antenna. To achieve this planar monopole antenna is good antenna for dual band applications. It is suitable as it exhibit very wide impendence bandwidth in addition having compact and simple[1-3].In addition the ominidirectional property of planar monopole antenna in H-plane makes it suitable for indoor application such as air plane shopping centre and hospital.

In this paper, a novel WLAN planar monopole antenna is proposed which is based on complimentary split ring resonator. These element can be used to implement negative permittivity[4] or LH[5] (Left Handed) lines .CSRR must be excited by means of dynamic electric field with a non negligible components in the axial direction and these particles makes the artificial line where they are inserted to behave as negative permittivity medium[4,6].In this study the novel antenna is fed by two stage(microstrip feed and followed by elliptical tapered feed). It is observed that CSRMA (Complimentary Split Ring Monopole Antenna) can cover all required band widths of WLAN with satisfactory radiation characteristics.

II. DESIGN

In this section, the design steps of proposed CSRMA are presented and optimum antenna performance is evaluated. A series of parametric study was carried out to achieve desired antenna performance, particularly tuning the resonant frequency and return loss characteristics. In this process, optimized critical antennas parameters were the substrate's thickness and permittivity, dimension of the complimentary ring elements as well as the partial ground plane, a slot in ground plane, tapered feed dimension.

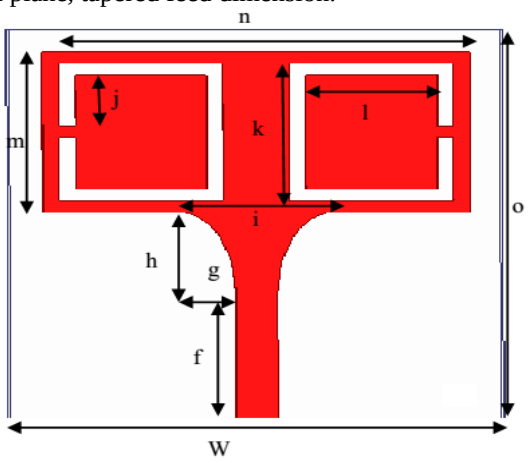

Figure 1.
Top view
w=30,o=34,n=26,m=14,f=11,g=3.5,h=7,i=9,j=4.5,k=12,l=8.(All dimensions are in mm)

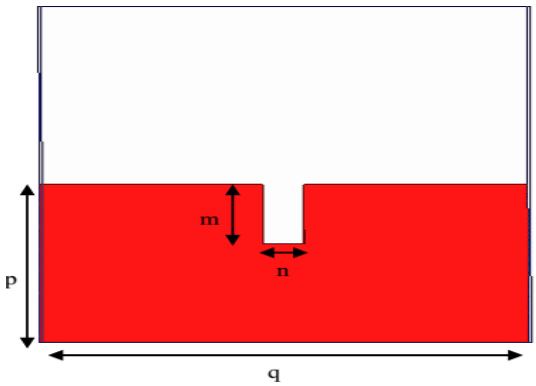

Figure 2.
Bottom view
p=16,q=30,m=6,n=2.5(All dimensions are in mm).

Fig 1 is composed of two side by side CSRR whose dimension is 26*14 mm^2 and placed on a partial grounded Rogers TMM3 with dielectric constant ε_r=3.27.A 50Ω transmission which consists of one microstrip line of dimension 2.5*11 mm^2 and followed by an elliptically tapered feed can be designed by taking a rectangle of dimension 9*7 mm^2 and taking two ellipse with major axis 7 mm, minor axis 3.5 mm .The ellipse are placed at the bottom

of the two vertex of the rectangle. Then ellipses are subtracted from the rectangle.

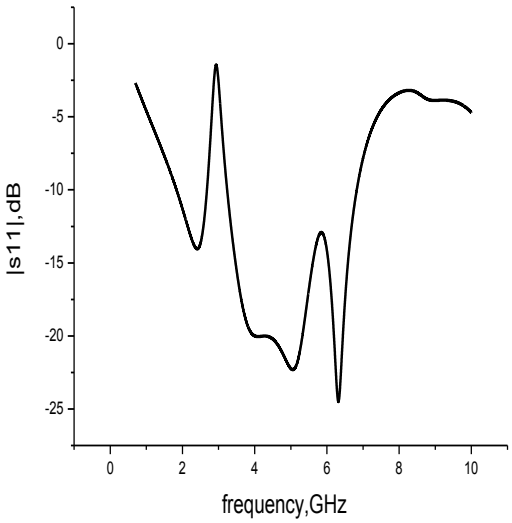

Figure 3. Simulated return loss characteristics for the CSRMA design .

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III. RESULTS

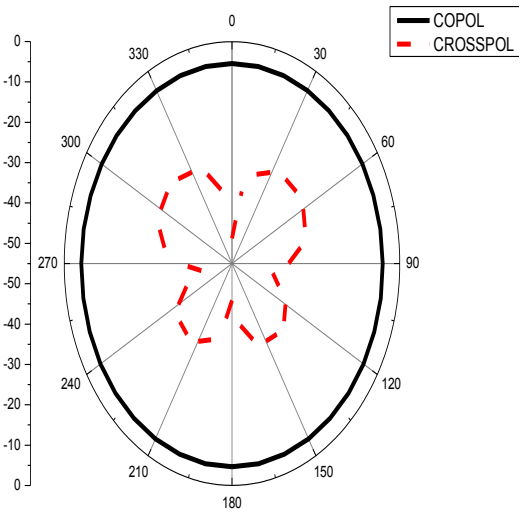

Figure 4.H-Plane at 2.4 GHz.

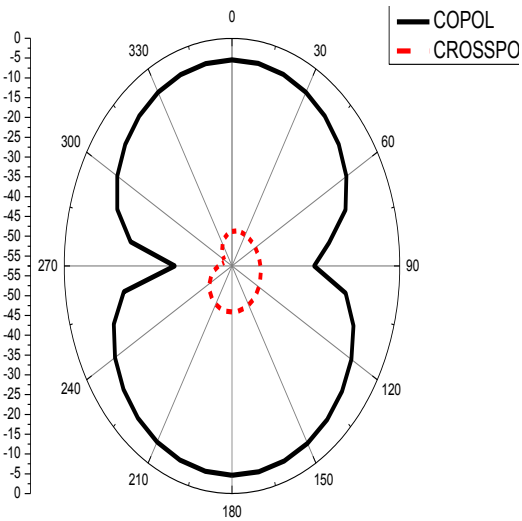

Figure 5.E-Plane at 2.4 GHz.

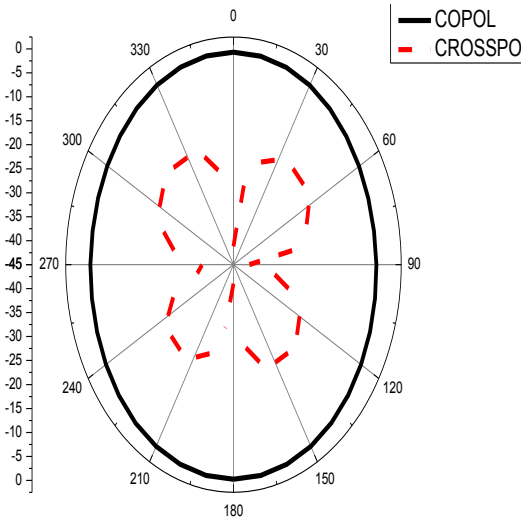

Figure 6.H-Plane at 5 GHz

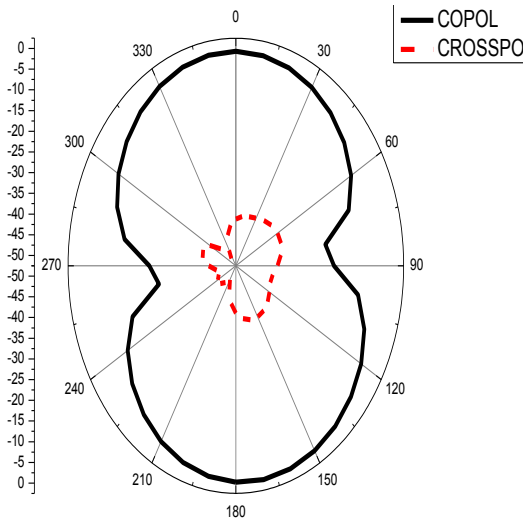

Figure 7. E-Plane at 5 GHz

Based on the designed parameter the simulated results are shown. Here our desired resonant frequency are 2.4 GHz with 35% & 5 GHz with bandwidth 71% respectively. Hence the proposed CSRMA almost covers all WLAN bands in 2.4 GHz, 3.6 GHz, 4.9 GHz, 5.2 GHz and 5.8 GHz.

Radiation Patterns of the CSRMA design also computed and the corresponding polar plots of 2.4 GHz, 5 GHz are displayed.

IV. CONCLUSION

In this paper a dual wideband complimentary split ring resonators monopole antenna for WLAN applications is presented. The proposed antenna is fed by two stages(Microstrip line feed and Elliptically tapered feed).It is simulated and observed it can cover almost all WLAN operation bandwidth. And at every resonant frequency the planar monopole antenna ominidirectional property are preserved. So it can fully meet the requirements of ISM band or indoor wireless application.

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