Dual Band Paper Substrate CPW Antenna for Wireless Applications

Kaliyamurthie K.P, Sundar Raj B, R.Velvizhi, K.Shanmugapriya

Abstract: ***In this paper, a 15* 80 sized antenna is designed over a paper substrate to test its flexible properties. The proposed antenna feed by a grounded coplanar waveguide(GCPW) is stimulated and the measured results show the operating Dual Band of the antenna cover(3.34-3.62 GHz) and (5.92-6.24 GHz) with the reflection coefficient |S11|< -15dB.These frequency bands operate over SHF bands and hence supports Fixed Mobile Communication and WLAN applications.***

Keywords : Dual band, GCPW,SHF-Super high frequency,WLAN.

I. INTRODUCTION

Paper substrate is chosen as it is thin and rigid while simultaneously reducing the cost of production of the antenna. But a major drawback is that paper is not compatible with outdoor environmental conditions. Hence the antenna is developed on a substrate known as KODAK. In article [5] the paper substrate has been coated with hydrophobic substances to exhibit good electrical/dielectric properties. A circularly polarised reader antenna with square slot exhibiting omni directional radiation patterns has been seen in article [3].

Similarly reader antennas has been designed [4] using elastic materials to prevail hostile environments.

Per Meandered line printed dipole antenna are very flexible and moreover stable outputs are observed both electronically and thermally [6]. formance and compactness are considered in designing the antenna. Therefore a thin microstrip planar antenna has been selected to get a narrow bandwidth to mitigate surface wave losses. Some techniques [2] such as creating slot in ground plane, using short-circuit stub and imprinted metamaterial are proposed. It has been achieved to attain wide-band and minimise the dimension of microstrip patch antenna.

This paper is organized as follows. Section II provides detailed design, and construction of the antenna. Results are analyzed and discussed in Section III while Section IV concludes the paper.

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II. ANTENNA DESIGN

The proposed dual band flexible antenna front view is given in Fig. 1. The parametric chart for the prototype design given in Fig. 1 is given in Table 1.

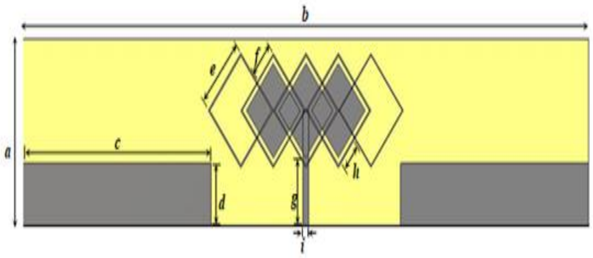

Fig. 1. Stimulated proposed prototype model (Front View)

TABLE 1

PARAMETRIC CHART FOR THE FRONT VIEW OF THE PROPOSED PROTOTYPE IN FIG 1.

Parameter	Dimension (mm)
A	15
B	80
C	26.6
D	5
E	6.2
F	3.2
G	5.05
H	2.6
I	0.8

The proposed dual band flexible antenna rear view is given in Fig. 2. The parametric chart for the prototype design given in Fig. 2 is given in Table 2.

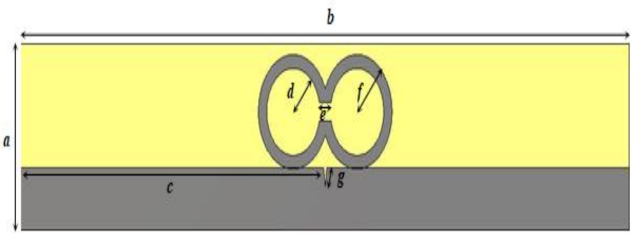

Fig. 2. Stimulated proposed prototype model (Rear View)

TABLE 2
PARAMETRIC CHART FOR THE REAR VIEW OF THE PROPOSED PROTOTYPE

Parameter	Dimension(mm)
a	15
b	80
c	39.8
d	3.5
E	1.56
F	4.6
g	1.5

The sign is bolstered by a 50ω microstrip line. This line isn't just a sustaining line yet in addition a section to coordinate the impedance of emanating component. The microstrip line innovation is presented in grounded coplanar waveguide plan (GCPW). Thickness varieties affect the presentation of GCPW. [41]Hence the recieving wire is planned with the goal that the absolute thickness is just 0.35mm.The emanating component which is made by copper metal which reverberates at frequencies 3.4 GHz and 6.07 GHz. A corresponding split ring resonator (CSRR) with and without transfer speed altering openings give particular stopband attributes, which can be balanced by adjusting the space lengths, offering incredible structure flexibility[17-23]. The CSRR is put in the ground plane for better emanating qualities. The parametric scope investigation of the ground plane was done and the ideal size of 5 mm is chosen for the ground plane by which we accomplish a decent impedance coordinating. The physical contemplations as far as choosing directing plane and dielectric plane is outlined in Table.3

TABLE 3
PHYSICAL CONSIDERATIONS

SUBSTRATE	KODAK PHOTOPAPER
THICKNESS(SUBSTRATE)	0.28MM
THICKNESS(PEC)	0.035MM
DIELECTRIC CONSTANT	3.3
IMPEDANCE	50 Ω
CONDUCTIVITY	0.077

III. RESULT AND ANALYSIS

All the simulated results are obtained by using the transient solver function in Computer Simulation Technology (CST 2011) microwave studio.. The surface current distribution with the intensity of waves is depicted in Fig. 3 and Fig. 4 respectively for 3.4 GHz and 6.07 GHz.[36-40]

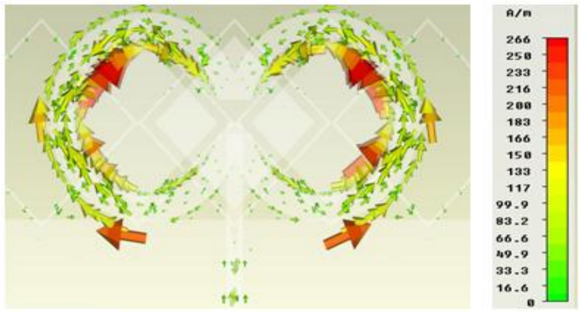

Fig. 3. The surface current distribution at 3.4 GHz

The above 3D result in Fig. 3 shows maximum current of 266.328 A/m and magnetic field is uniformly distributed over the structure.

A. Reflection Coefficient

The reflection coefficient for the proposed prototype is given in Fig. 5.

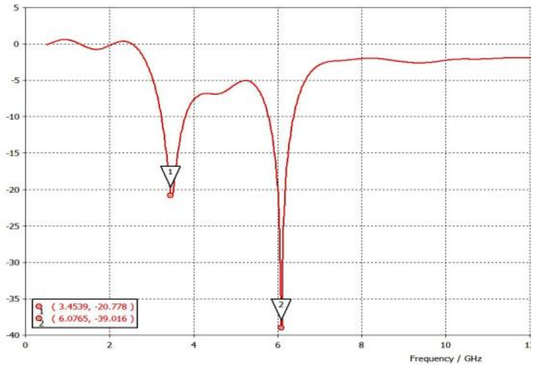

Fig. 5. |S11| Parameter expressed in dB

This shows two peak values at frequencies 3.4 GHz and 6.07 GHz (dual Band) .The magnitude of reflection coefficient at 3.4 GHz is -20.78 dB and 6.07 GHz is -39.02 dB which is under the acceptable range. The return loss obtained is due to the reflection of the wave caused by standing waves on termination[30-35].

B. Far Field Radiation

Fig. 6 and Fig. 7 show the recorded stimulated far field radiation patterns (polar plot) while Fig. 8 and Fig. 9 are the three dimensional views of the far field radiation at resonant frequencies 3.4 GHz and 6.07 GHz respectively.

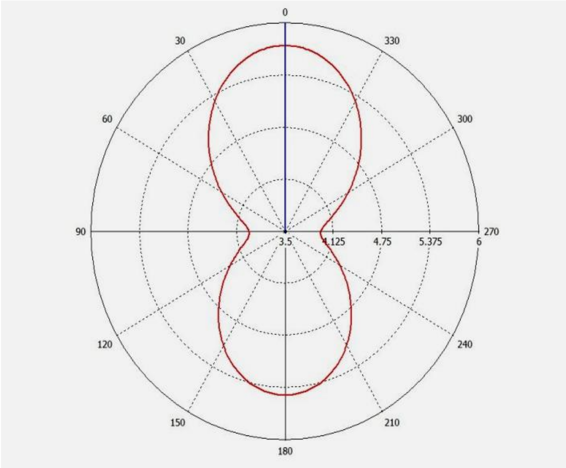

Fig. 6. Directivity of the proposed antenna at 3.4 GHz (Polar Plot)

The plot displays the magnitude of the main lobe which is equivalent to 5.729 dBi while the direction of the radiation is equal to 0 degrees (when phi=0).

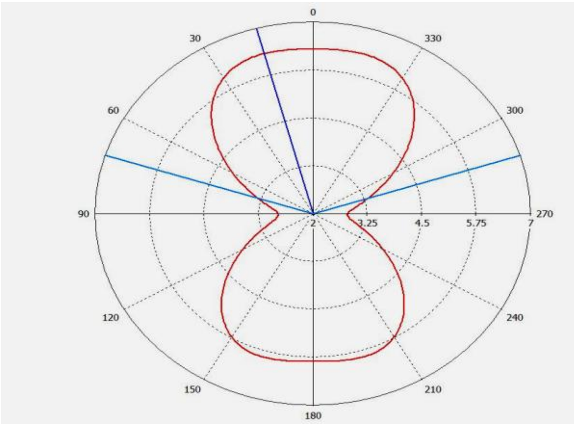

Fig. 7. Directivity of the proposed antenna at 6.07 GHz (Polar Plot)

The plot shows the main direction of the far field radiation at 15 degrees which contains an angular width of 144.6 degrees. The magnitude of the main lobe is 6.3dBi.

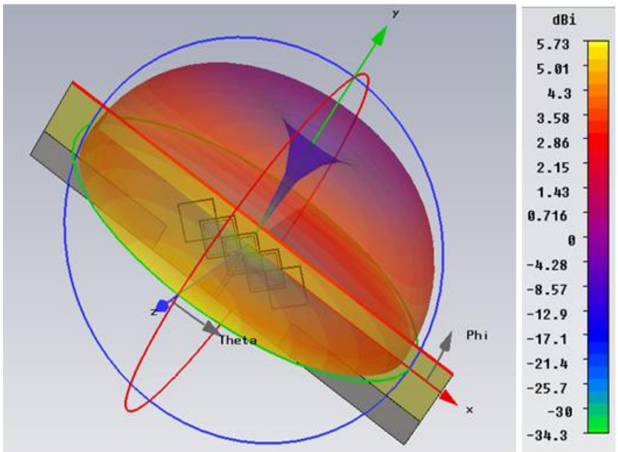

Fig. 8. Directivity of the proposed antenna at 3.4 GHz (3-D View)

The directivity obtained from the stimulated result is 5.729 dBi the radiation and total efficiency is -2.330dB and -2.397 dB respectively.

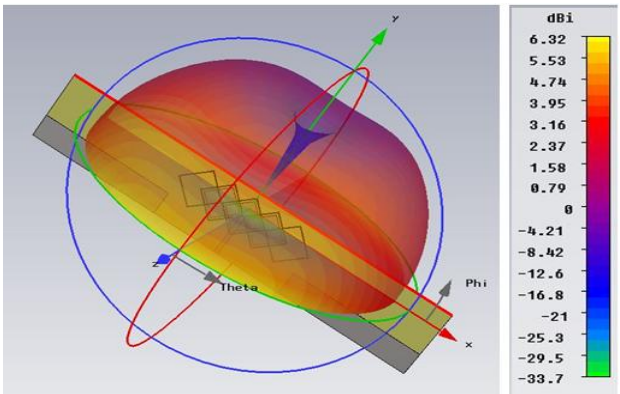

Fig. 9. Directivity of the proposed antenna at 6.07 GHz (3-D View)

The conveyed result shows us that the Radiation efficiency is -5.062 dBi and the Total efficiency is -5.063 dB. The Directivity of the far field radiation pattern at 3.42 GHz is 6.323 dBi.

TABLE 4
SUMMARIZED RESULTS

Antenna Parameters	3.4 GHz	6.07 GHz
|S11| (dB)	-20.778	-34.016
Gain (dB)	5.56	6.321
Directivity (dBi)	5.729	6.323
Efficiency (no unit)	97.2	99.98

IV. CONCLUSION

A flexible antenna with grounded coplanar waveguides has been developed on a paper substrate. Dual Band applications are observed (ie).Fixed mobile communication for 3.4 GHz and WLAN applications for 6.07 GHz. The obtained bandwidth covers some real time applications of this antenna that are remote sensing, ad hoc network for multiuser games and intelligent travel guide with location dependent information. The numerical results confirm that this design is well suited for use in wireless LAN.

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