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Radiation Beam Configuring by EBGS as Reflecting Planes

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ABSTRACT: The variation in via and gap between metal sheets the electronic steer-ability is obtained by introducing the diodes between the metal patches of EBGS in the earlier stages. Here in this paper the beam configuring of the antenna by placement of EBGS as reflecting surfaces instead of the plane metal sheets around the antenna is analyzed and the beam configuration for different placements including backend of the antenna, back-right ends, back-left ends and all ends leaving front end as open is analyzed and results are illustrated in this paper. For the four proposed models return loss, radiation pattern, Gain in 3D and gain in top view are compared and presented along with some other antenna parameters.

Keywords: Energy band gap surfaces, reflecting surfaces, beam configuring, enhanced radiation, High impedance ground planes

I. INTRODUCTION

In the earlier stages we have seen the electronic beam configuration [2]. And also seen the effect of EBG when it is used as reflecting surface around the monopole antenna in[1]. Here in this paper we mainly concentrate the beam configuration by placing the EBGS as reflecting surfaces around the monopole antenna how the radiation around antenna configures when we place EBGS at back end of the antenna, back-right ends, back-left ends and left-back-right ends by leaving frontend as open. As we know that the conventional plane metal sheet reflectors suffers the minimum distance λ/4 problem so that we use this EBGS or HIGP as reflecting planes. Where the basic agenda is to add the surface currents of EBGS and the antenna currents to enhance the radiation in opposite direction. Here the surface currents from each EBGS plane will add with antenna currents with some phase to configure the beam.

II. ANTENNA AND EBG DESIGNS

For the isotropic antenna a monopole antenna of arm length 3.16EM is taken which is operating at 2GHZ frequency and it's diameter is 0.2cm the ground is of dimensions 10.05*10.05cm and the EBG have placed vertically with a base ground of 8.37*3.5cm in YZ directions. And the patch size for EBG is 3.5*3.5cm in YZ direction and the pin via is of 0.1cm radius and 0.5cm height. And the entire design is shown in figure [1].

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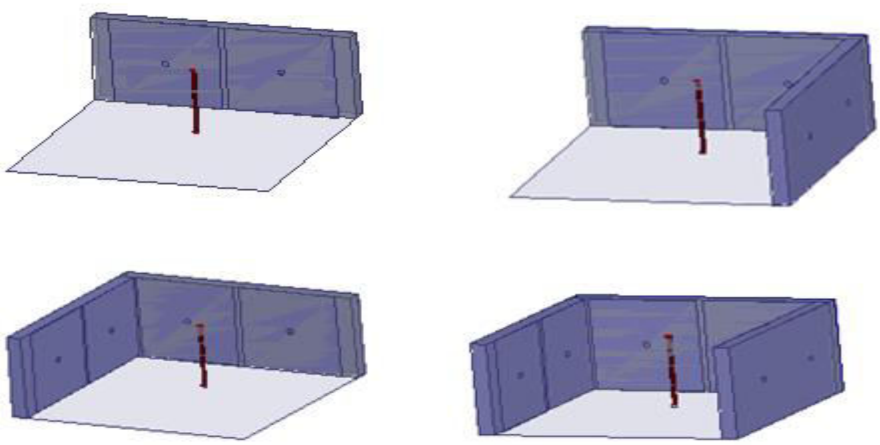

Fig. 1 Proposed models of Antenna along with EBGS a) EBGS at back end b) EBGS at back-right ends c) EBGS at back-left ends d) EBGS at left-back-right ends

III. SIMULATION RESULTS

A) Return loss curves

The below figure [2] shows the return loss curves for all the four designs and the variation in the return loss for each design can be clearly seen in the figure[2].

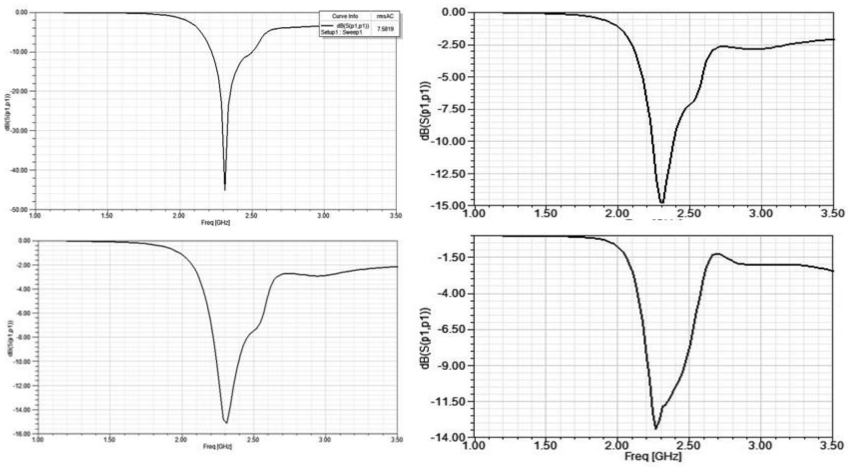

Fig. 2 Return loss curves for Proposed models a) EBGS at back end b) EBGS at back-right ends c) EBGS at back-left ends d) EBGS at left-back-right ends

B) Radiation pattern curves

By the placement of EBGS as reflecting planes instead of plane metal sheets we can configure beam of the antenna which is explained in the following figure [3] where the radiation pattern curves are shown for theta = 0º and 90º where in figure [3] a the beam is configured to front end for theta=90º when EBGS is placed at back end of antenna. In figure[3]b the beam is configured to frontend left side in figure[3]c the beam is configure to frontend right side and

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finally when EBGS is placed in all side except the front side then beam is configured to front side for theta = 90^0 radiation is enhanced to the open side.

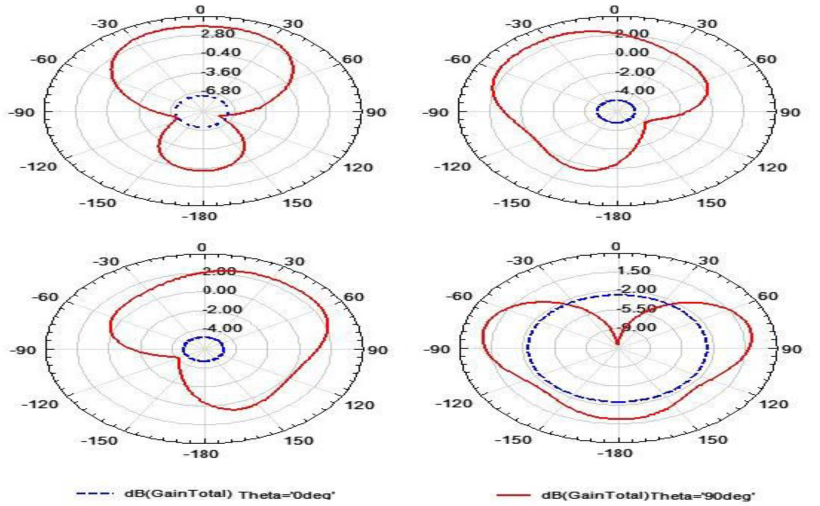

Fig. 3 Radiation pattern curves for Proposed models a) EBGS at back end b) EBGS at back-right ends c) EBGS at back-left ends d) EBGS at left-back-right ends

C) Total Gain in 3D

As we know that the radiation of monopole antenna is Omni-directional. But when we place EBGS as reflecting surface at one end the radiation may enhance in opposite direction or absorbed it is explained in [4]. Here the figure [4]a,b,c, and d shows the EBGS at back end, back-right ends, back-left ends and left-back-right ends.

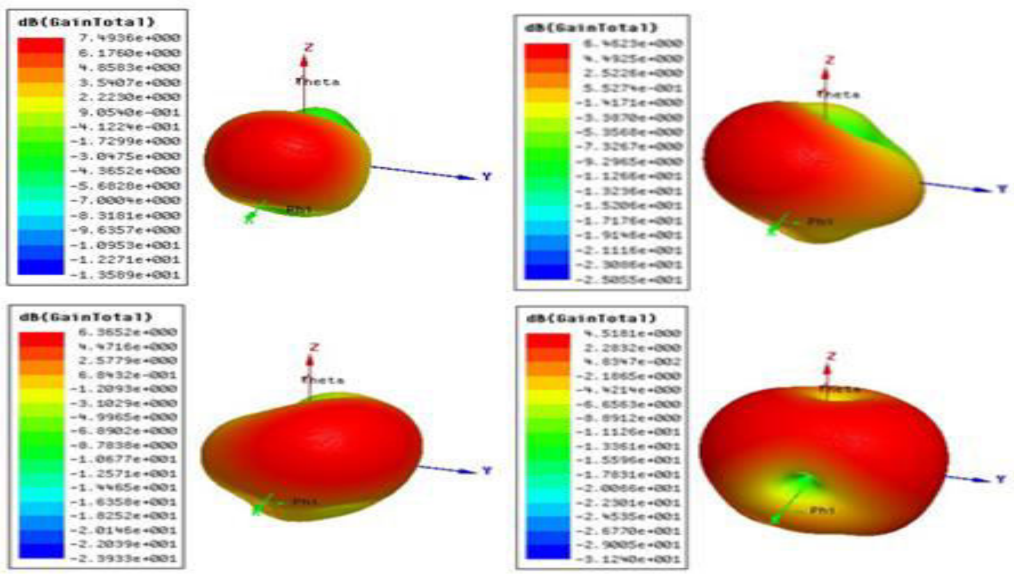

Fig. 4 Total gain in 3D for Proposed models a) EBGS at back end b) EBGS at back-right ends c) EBGS at back-left ends d) EBGS at left-back-right ends

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By seeing the above figure [4] we can say that according to the EBGS existence at each side's the radiation is contributed maximally at opposite side to reflecting planes.

D) Total Gain in top view

For easy understanding the Gain in top view is illustrated in the following figure [5].

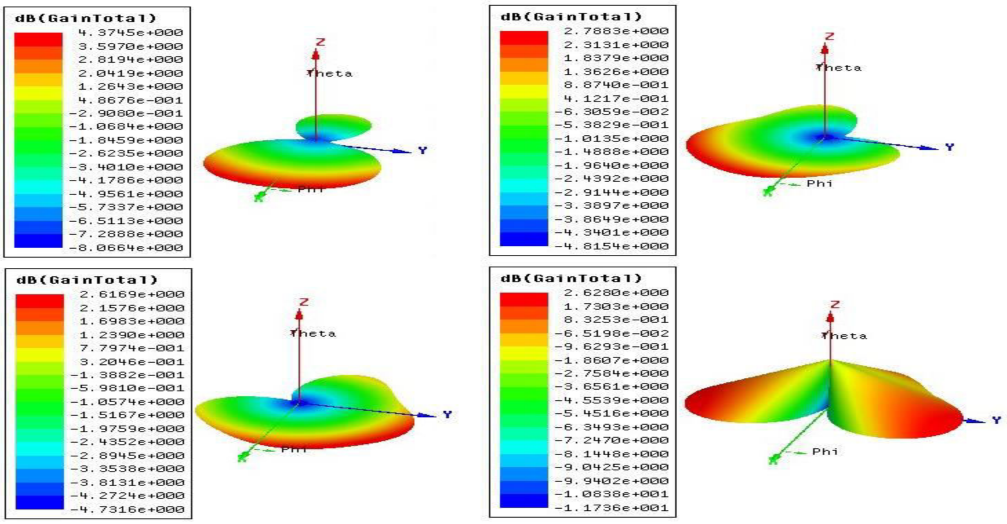

Fig. 5 Total gain in 3D for Proposed models a) EBGS at back end b) EBGS at back-right ends c) EBGS at back-left ends d) EBGS at left-back-right ends

By the above figure we can say that gain is enhanced in opposite direction of the EBGS in figure [5] a and in figure [5] b the EBGS are placed at back-right ends so gain is improved in frontend left side. In Figure [5] c the EBGS are placed at back-left ends so gain is improved in frontend right side. In figure [5] d EBGS are placed in three places so gain is momentarily enhanced in both frontend right and left sides.

TABLE 1. Antenna parameters

Quantity	Value	Value	Value	Value
Max U	0.447706(W/sr)	0.340605(W/sr)	0.334349(W/sr)	0.210299(W/sr)
Peak Directivity	5.59901	4.4138	4.31254	2.82838
Peak Gain	5.62617	4.42824	4.33031	2.83018
Peak Realized Gain	5.62617	4.28027	4.20166	2.64276
Radiated Power	1.00485(W)	0.969747(W)	0.974288(W)	0.934373(W)
Accepted Power	0.999999(W)	0.966586(W)	0.970291(W)	0.93378(W)
Incident Power	1(W)	1(W)	1(W)	1(W)
Radiation Efficiency	1.00485	1.00327	1.00412	1.00064
Front to Back Ratio	3.89904	4.29301	4.2594	2.40044

The above table illustrates the comparison between the antenna parameters for the four designs and by the table we can see that each time when the no. of EBGS around antenna increase the energy from antenna are absorbed by the EBGS up to some extent .

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IV. CONCLUSION

The beam configuration by EBGS reflecting surfaces is analyzed and the possibility of EBGS surfaces currents adding to antenna currents with some phase to form the beam is explained the future scope is to steer or configure the beams with mechanical steering capability instead of varying the via length and gap between the metal sheets each time. We may steer the radiation energy by variation in placement of each individual EBGS cell.

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BIOGRAPHY

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