Analyzing Planar Dipole Antenna with Different Arm Widths Operating at 1 GHz

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Abstract: The planar dipole antenna which is having high compactness is used mainly for UWB. In this paper we consider the dipole antenna having different arms widths and the comparative analysis were illustrated. Here by taking 0.25cm, 0.5cm, 0.75cm and 1cm the proposed antenna analyzed and simulated by using HFSS and antenna parameters like return loss, band width, gain, radiation pattern, directivity and efficiency are compared for different arms widths of dipole.

Index Terms— Planar Dipole, better compactness, change in Arm width, improving parameters.

I. INTRODUCTION

The planar dipole antenna is very useful in antenna applications because of its ease of fabrication and better compactness. In this paper the antenna designed to work at 1 GHz frequency. And the proposed antenna is analyzed at 0.25cm, 0.5cm, 0.75cm and 1cm arm widths and the antenna parameters like return loss, gain, radiation patterns, efficiency etc were compared for these arm widths and the simulation is done by using HFSS software. Here by changing the arm width 0.25cm every time the change in its operating frequency and return loss and some other parameters were illustrated for clear understanding and finally the suitable antenna with better results is obtained through the comparison.

II. ANTENNA DESIGN

The design of proposed antenna is presented in the following figure [1]. This antenna design having compactness.

Fig [1] Antenna design

III. SIMULATION RESULTS

A. Return loss

The below figure[2] shows comparison of return loss curves for arms widths 0.25cm, 0.5cm, 0.75cm and 1cm respectively and the comparative values are listed in table [1].

RETURN LOSS CURVES

B. Gain in 2D

The figure [3] shows the comparison of 2D gain for the proposed antenna with arms width 0.25cm, 0.5cm, 0.75cm and 1cm.
C. Gain in 3D

The below figure[4] shows the comparative analysis of gain in 3D for proposed antenna with different arm widths and the maximum values of gain are 2.1434, 2.1884, 2.2112 and 2.1858 for 0.25cm, 0.5cm, 0.75cm and 1cm arm widths respectively.

D. Gain in Top view

For easy understanding the total gain is represented in top view in the following figure [5].

E. Radiation Pattern

The comparison or radiation pattern curves is illustrated in the figure [6] and there is only slight variations in the radiation pattern curves when the arm width is increased gradually from 0.25cm to 1cm.

F. Mesh Analysis

The below figure [7] shows mesh analysis report in other words the current distribution in radiating element and substrate from the figure [1] we can observe that the
distribution is thick or very concentrated at radiating elements for 0.25 cm arm but the distribution gradually decreases at radiating element for 0.5 cm, 0.75 cm and finally it become less for 1 cm arm width.

**MESH ANALYSIS FOR ANTENNA**

![Mesh analysis images](Fig [7] Mesh analysis a) 0.25cm arm width b) 0.5cm arm width c) 0.75cm arm width d) 1cm arm width)

The above table [1] shows the operating frequency and return loss values for arms width 0.25 cm, 0.5 cm, 0.75 cm and 1 cm from the table we can say that for the arm width of 0.75 cm which is operating at 0.8518 GHz the return loss is very low and is -59.4736 dB.

### Table I: Antenna Specifications

<table>
<thead>
<tr>
<th>S.NO</th>
<th>Width of the arm</th>
<th>Operating freq</th>
<th>Return loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.25 cm</td>
<td>0.8417 GHz</td>
<td>-21.8286 dB</td>
</tr>
<tr>
<td>2</td>
<td>0.5 cm</td>
<td>0.8368 GHz</td>
<td>-30.9700 dB</td>
</tr>
<tr>
<td>3</td>
<td>0.75 cm</td>
<td>0.8518 GHz</td>
<td>-59.4736 dB</td>
</tr>
<tr>
<td>4</td>
<td>1 cm</td>
<td>0.8467 GHz</td>
<td>-34.0583 dB</td>
</tr>
</tbody>
</table>

### Table II: Antenna Parameters

<table>
<thead>
<tr>
<th>Quantity</th>
<th>At 0.25 cm width</th>
<th>At 0.5 cm width</th>
<th>At 0.75 cm width</th>
<th>At 1 cm width</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max U</td>
<td>0.129496 (W/sr)</td>
<td>0.131606 (W/sr)</td>
<td>0.132402 (W/sr)</td>
<td>0.131579 (W/sr)</td>
</tr>
<tr>
<td>Peak Directivity</td>
<td>1.64752</td>
<td>1.66295</td>
<td>1.66834</td>
<td>1.66221</td>
</tr>
<tr>
<td>Peak Gain</td>
<td>1.63811</td>
<td>1.65517</td>
<td>1.66386</td>
<td>1.65416</td>
</tr>
<tr>
<td>Peak Realized Gain</td>
<td>1.62734</td>
<td>1.65384</td>
<td>1.66386</td>
<td>1.65351</td>
</tr>
<tr>
<td>Radiated Power</td>
<td>0.987748 (W)</td>
<td>0.994522 (W)</td>
<td>0.997312 (W)</td>
<td>0.994769 (W)</td>
</tr>
<tr>
<td>Accept Power</td>
<td>0.993424 (W)</td>
<td>0.999198 (W)</td>
<td>0.999999 (W)</td>
<td>0.999609 (W)</td>
</tr>
<tr>
<td>Incident Power</td>
<td>1(W)</td>
<td>1(W)</td>
<td>1(W)</td>
<td>1(W)</td>
</tr>
<tr>
<td>Radiatio</td>
<td>0.994286</td>
<td>0.99532</td>
<td>0.997314</td>
<td>0.99515</td>
</tr>
</tbody>
</table>

The table [2] shows the comparative analysis of antenna parameters for the proposed antenna with different arm width by observing the table we can say that the antenna parameter values are better for the antenna having 0.75 cm arm width.

### IV. CONCLUSION

From this analysis we can see that as the width of the Dipole arm increases the antenna parameters changes but out of the four analysis the antenna gives better results for 0.75 cm arm width so that it is most suitable antenna and also the best thing is that antenna with 0.75 cm Dipole arm width gives least loss which is of -59 dB so that its more reliable to design the Planar Dipole antenna at 1 GHz frequency with 0.75 cm arm width.

### REFERENCES


AUTHOR BIOGRAPHY


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