HALF WAVE DIPOLE ANTENNA FOR SATELLITE COMMUNICATION APPLICATION

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ABSTRACT
A half wave Dipole antenna is proposed for 3.8GHz satellite communication applications. It is used for live online gaming, real-time video streaming and mobile electronic device high speed data sharing applications. This design half wave dipole antenna is designed and simulated over CST-MWS simulation software. The designed antenna is characterized by measuring return loss, radiation pattern, directivity, gain and efficiency.

Keywords: Half wave dipole Antenna, CST MWS, Far-field radiation

1 INTRODUCTION

A general construction of a half-wave dipole antenna has been shown in the Fig. 1. There is a gap between two arms of the half-wave dipole antenna for feeding purpose. Here L is the total length of the antenna, D is the thickness of antenna arm and g is the feeding gap. Radiation resistance of the half-wave dipole is 73 Ohm which matched with the line impedance.

II DESIGN PARAMETERS

Dimension of an antenna changes based on the resonant frequency. As a resonant frequency 7GHz has been chosen. By taking this into consideration several antenna dimension have been calculated.

Resonant frequency, \( f_r = 7 \) GHz

Wavelength, 
\[ \lambda = \frac{c}{f} = 65\text{mm} \]

Length of half wave dipole antenna, 
\[ L = \frac{143}{f} = 38\text{mm} \]

Feeding gap of antenna, 
\[ G = \frac{L}{200} = 0.143\text{mm} \]
Radius of wire, 
\[ R = \frac{\lambda}{1000} = 0.08 \text{mm} \]

From the first equation, wavelength has been calculated based on which length of the dipole antenna has been found from the second equation. Feeding gap and radius of the wire have been calculated from the equation no.3 and 4 respectively. All dimensions of the antenna are given in the Table 1.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resonant frequency ( f_r )</td>
<td>7</td>
<td>GHz</td>
</tr>
<tr>
<td>Wavelength ( \lambda )</td>
<td>65</td>
<td>mm</td>
</tr>
<tr>
<td>Impedance</td>
<td>73</td>
<td>ohm</td>
</tr>
<tr>
<td>Length of dipole ( L )</td>
<td>38</td>
<td>mm</td>
</tr>
<tr>
<td>Radius of dipole ( R )</td>
<td>0.08</td>
<td>mm</td>
</tr>
</tbody>
</table>

Table 1: Design Parameters of the Antenna

III SIMULATIONS AND RESULTS

3.1. Simulations

According to the design parameters a half-wave dipole antenna has been designed in CST MWS. In the Fig. 2 designed half-wave dipole antenna has been shown.

![Fig. 2: Designed Half-Wave Dipole Antenna](image)

For the simulation purpose the ranges of frequencies have been chosen from 7GHz. For making the simulation fast and more accurate global mesh properties have been optimized. As antenna copper (loss free) has been used and between the two antenna arms a sheet has been selected.

3.2. Results

After the simulation return loss has been observed.
Fig 3: Return loss curve for the designed Half Wave Dipole

From the Fig.3 authors have found that the antenna is resonating at 7GHz. Moreover, the value of return loss has been found as 8.573 dB.

Fig 4: S-parameter magnitude in dB for the designed HalfWave Dipole Antenna

Fig 5: Polar Plot for Input Impedance of Half Wave Dipole antenna

Fig 6: Smith chart for input impedance of Half wave Dipole Antenna
Fig 7: 3-D Far field radiation pattern for Directivity of designed Half Wave Dipole Antenna

Far-field radiation [6] pattern has been shown in the Fig. 5. Directivity has found as 3.483dBi. Obtained directivity was almost identical to the theoretical one. Red color shows the maximum radiation.

Fig 8: 3-D phi far field radiation pattern of Half wave Dipole Antenna

Fig 9: 3-D far field radiation pattern of Half wave Dipole Antenna
Linear Half Wave Dipole Array operated at 2 GHz
IV CONCLUSION

Main objective of this paper was to observe theseveral antenna characteristics for popular wire antenna. As a
popular Practical antenna half-wave dipole antenna wasselected. Obtained results were acceptable for practical
implementation of these types of antennas. As a simulationtool CST Microwave Studio was used which ease the
simulation. Obtained resonant frequency (7 GHz) which isacceptable. There are few scopes to improve the results
byoptimizing several parameters which might be fruitful forresearchers. Author would like to work on these in
future.

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