ISSN 2320-9984

Volume 2 Issue 3 | September 2014 ISSN: 2320-9984 (Online)

International Journal of Modern Engineering & Management Research

Website: www.ijmemr.org

Alternate Strip Millimeter Wave Dipole Antenna

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Abstract—*In this paper, we discuss the current demands and challenges of antennas for 60GHz high speed radio systems, research works, as report in open literature, from various research groups are received. We present some of our recent results on 60GHz antenna. In the proposed antenna structure, input impedance can be matched by simply adjusting the width and length of dipole antenna. The designed dipole antenna exhibits more than a 10 GHz bandwidth (54.66 GHz to 67.09 GHz) and high radiation efficiency of greater than 95%.*

Keywords:— *WiGig, omnidirectional, VSWR, HFSS, E-Plane, HFSSv11, FCC*

1. INTRODUCTION

Nowadays, wireless system requires a wider bandwidth to support a high data transmission rate. In the late 1990s, Bluetooth provided a 1Mb/s data transmission rate. Then the IEEE 802.11 standard pushed the rate to 100Mb/s. In recent years, wireless system which provided even faster data transmission rates are emerging for high capacity wireless data transmission, i.e. high-definition video signal transmission[2]. Since the federal communications commission (FCC) has allocated the frequency band from 57-64 GHz for unlicensed wireless system, research and development for short range communication. In this paper, we present our recent work on wideband low-cost, high performance antennas for 60 GHz. Using WiGig technology at the 60GHz unlicensed frequency band allows instant massive data transmission such as uncompressed high-quality multimedia streaming as well as and back up contents[1]. wireless application of WiGig technology using Alternate Strip Millimeter Wave Dipole Antenna.

2. ANALYSIS AND SOME IMPORTANT PARAMETERS DESIGNING OF WIDEBAND ANTENNA

The concept of wideband dipole antenna has been designed and simulated by HFSSv11 software has been used[3]. This software allows efficient and accurate numerical simulation of the electromagnetic becaviour of complex structure using finite element methods. Several steps are required in order to set-up the model, before running simulations. Some of the main steps necessary to create a model are, design or drawing the structure (3D), assign materials to structure and boundry conditions, define excitations, define radiation area, and define proper meshing for each structure (even that an adaptive meshing is running). HFSS is an interactive software package for calculating the electromagnetic of a structure. The software includes post-processing commands for analyzing this behaviour in detail.

Designer is expected to draw the structure, specify the material characterises for each object, and identify ports special surface characteristics. HFSS then generates the necessary field solution and associated port characteristics and S-parameters. In this proposed dipole antenna the length is 1.9756 mm, width 0.6168 mm and thickness is 0.019mm. The feed type Lumped i.e. placed at 45 degree diagonal between two alternate dipole strips. The input impedance of the antenna is approximately 60 ohms (Figure 8).

Antenna is designed for the frequency of 60 GHz. Table 1 shows parameters of design this antenna.

3. SIMULATION RESULTS

The antenna designed for wideband operation is shown in Figure 1 and was simulated. The simulation results show that the proposed design is capable of operating efficiently at wideband. The designed antenna has a VSWR 1.125 (Figure 3), E-plane radiation patterns (Figure 5), gain 1.6 (2.04dB) (Figure 4) and return loss -25dB (Figure 4). As the given antenna is expected to behave as a receiver for WiGig, expected radiation pattern is omnidirectional. Radiation pattern of the proposed antenna is shown in Figure 6 (3D view is given in Figure 7).

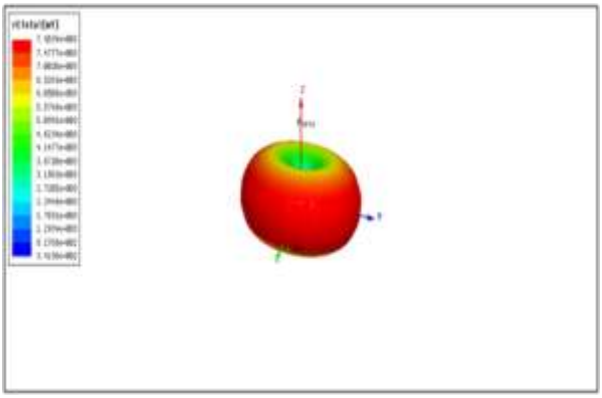

Figure 1: Proposed antenna design

Table 1: Design Parameters

DESIGN PARAMETERS	
Antenna length	1.975mm
Antenna width	0.6168mm
Antenna thickness	0.019mm
Feed Type	Lumped (diagonal)

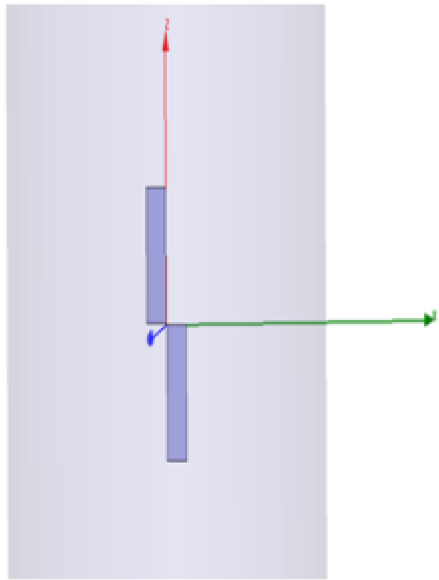

Figure 2: Radiation Patterns

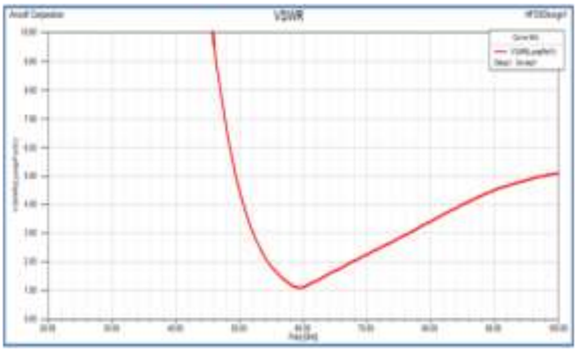

Figure 3: Voltage Standing Wave Ratio (1.125)

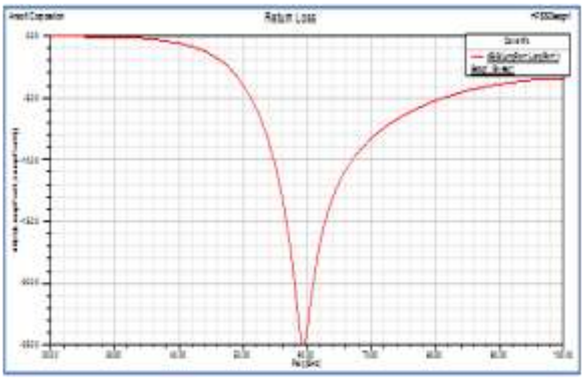

Figure4: Return Loss -25db

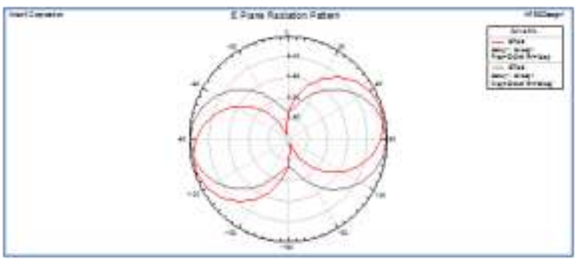

Figure 5.- E-Plane Radiation Patterns

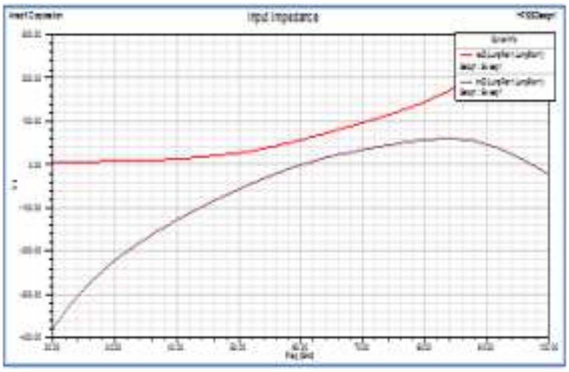

Figure 6 : Input Impedance

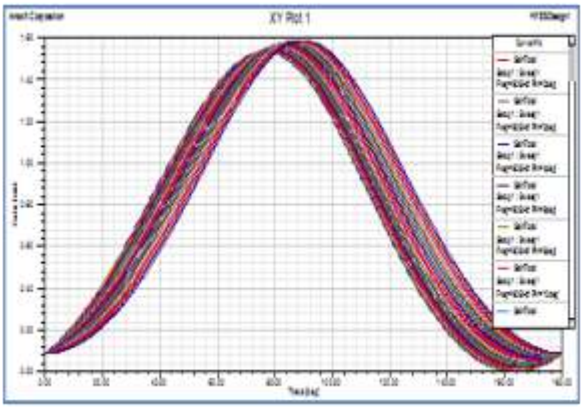

Figure 7: X-Y plot

4. CONCLUSION

In this paper, we have presented our recent work on millimeter wave antennas for WiGig applications. We have presented how a narrow band dipole antenna can be transformed into 60 GHz omnidirectional wideband dipole antenna for WiGig applications. In addition we have demonstrated that our omnidirectional antenna gives a return loss of -25 dB for the frequency range of approximately 12 GHz.

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