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Microstrip Patch Antenna as Dual Bowtie Shaped forX-Band Applications

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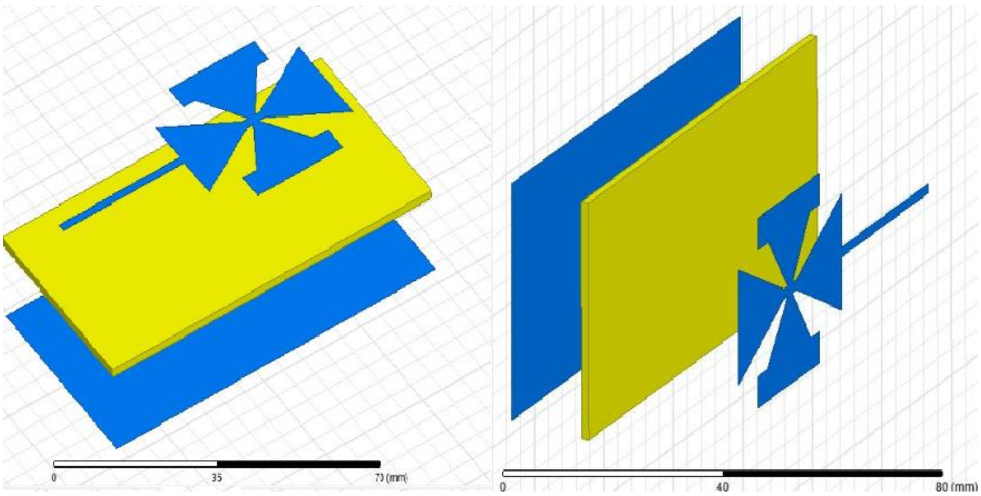
Abstract:*This paper presents a novel compact likea dual bowtie microstrip patch antenna of 82×45×1.6 mm³for X-band applications. This antenna is simulated and analyzed using HFSS based Finite Element Method (FEM). . Microstrip feed line location is optimized to get minimum return loss. Antenna characteristics are simulated using a Finite Element Method (FEM) based High Frequency Structure Simulator (HFSS). Antenna performance in term of return loss, radiation pattern and gain are analyzed. It is found that the antenna is resonant at 10 GHzwith a return loss of -24 dB and a stable radiation patterns. This antenna predict for successful radar and satellite communication.*
Keywords: *X- band, Bowtie, Microstrip Patch, Satellite, Radar, FEM.*

I. Introduction

Compact size, light weight, minimum cost and ease of fabrication is the main coal to be conceder in antenna design [1]. Printed microstrip antennas characterized by these properties [2]. Among the most widely used X-band antennas is printed bowtie that fed by 50Ω feed line [3]. Bowtie slot antennas have the advantage of wide bandwidth. A number of bowtie slot designs are introduced in [4], [5], which show wide bandwidth. Microwave band ranging from 8 GHz to 12 GHz is called X-band which is defined by an IEEE standard for radio waves [6]. It’s worth to mention that this band have many common application such radar and satellite communication for short range tracking, missile Guidance, marine, and airborne intercept [7].

II. Proposed Antenna Design Configurations

The proposed design consists of likedual bowtie copper patch printed on 82×45 mm² of Rogers RT5880 substrate with relative permittivity of 2.2 and a height of 1.6 mm. Patch dimensions and feed line location that illustrated in Fig. 1 are optimized to get minimum return loss.



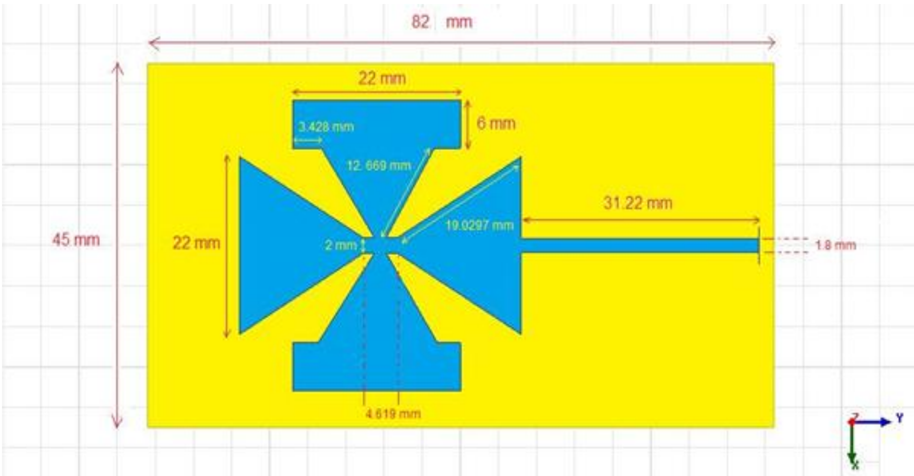


Figure (1): Proposed antenna geometry and dimensions.

III. Result and Discussion

3.1 Return Loss

One of the main parameters in antenna analysis is the return loss or S_{11} in two port network. It measures the antenna's absorption of the fed power over the total power fed. A good antenna should indicate a return loss of less than -10 dB, which indicates that the antenna absorbs more than 90% of the fed power. So from Fig. 2 and according to -10 dB level line it is obvious that the impedance bandwidth is ranging from 11GHz to 11.7GHz with resonant of 11.3GHz with -24dB return loss.

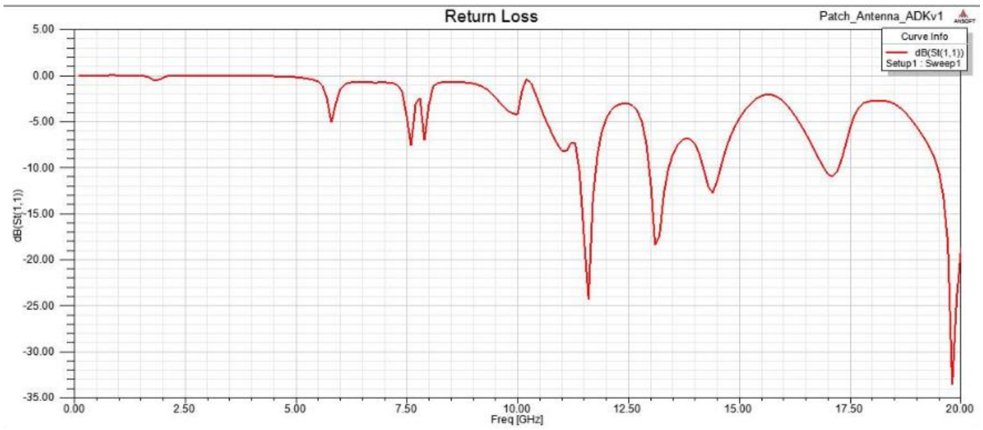


Figure (2) the numerical results, $S_{11,}$ for the antenna.

3.2 Radiation Pattern

Another main parameter in antenna analysis is the radiation pattern since it is determines the distribution of radiated energy in space. Fig (3) show the 2D radiation pattern for different X-band frequencies.

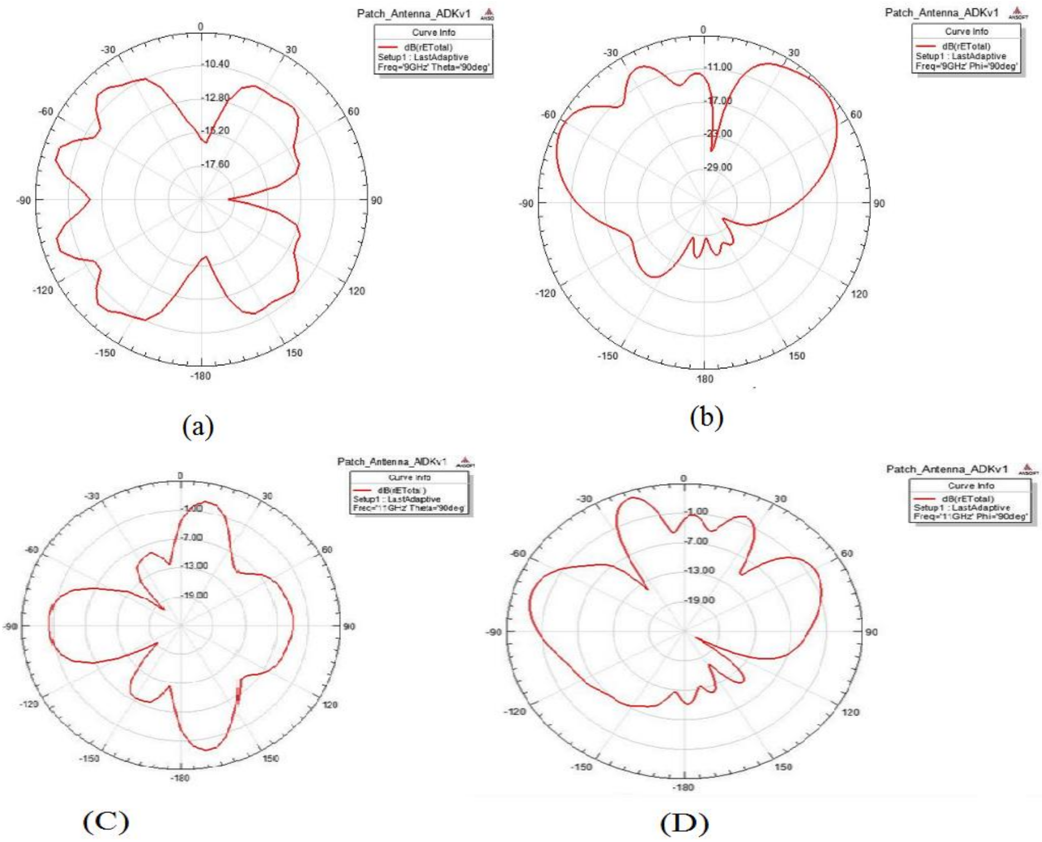


Figure (3):the numerical results of the radiation patterns at differentfrequencies: (a) θ=90° and (b) Φ=90° at 9 GHz. (c) θ=90° and (d) Φ=90° at 11GHz.

3.3 Gain

Another parameter is the gain of the antenna. For the proposed antenna the gain is about 6dBi at 9GHz and 9 dBi at 11 GHz as shown in Fig (4).

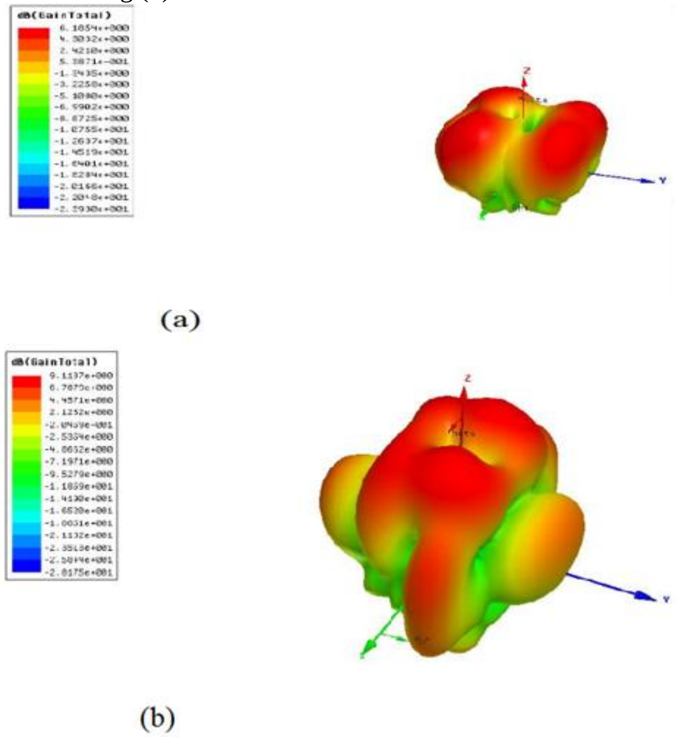


Figure (4): Total antenna numerical Gain at 9and 11 GHZ.

IV. Conclusion

A novel compact dual bowtie microstrip patch antennais presents in this paper. The numerical results including return loss, radiation pattern, and gain for the proposed antenna showing that the antenna is resonant at 11 GHz with bandwidth of relatively to 1 GHz. This antenna is a best solution for different X-band application since its simple structure, and ease of fabrication.

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