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Dual band T Shaped Antenna at Millimeter Wave Frequency for 5G Applications

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Abstract: In this paper, there is a t shaped antenna patch on a 12mm X 12mm plane, with another patch which is inverted T shaped patch on the same plane. Its operated in the frequency range of 24GHz to 40GHz. It is a millimeter wave frequency antenna for 5th generation applications. Owing to its compact size it has less complexity, and fed by waveguide on both sides of patch[1]. It gives a bandwidth of 2GHz and 5.6 GHz in the range 24-26 GHz and 30-35GHz respectively. Radiation efficiency is of 83% at 40 GHz and directivity of 5.27 . We get to see two resonating frequencies, one at 28GHz and other at 37 GHz thus creating dual band antenna[2].

I. INTRODUCTION

Till 4G we have been using spectrum less than 3 GHz but due to growing population of the world there is huge need for speed and spectrum[3] , thus to satisfy this demand we have to move to millimeter wave spectrum for next generation that is 5G to accomplish high capacity and throughput[4]. Also gain on this wide spectrum we get lower latency thus serving the purpose[5]. There are various technologies that are used in 5G among which most famous are MIMO(multiple input multiple output) , OFDM , etc.[6]
For 5G antenna geometry should be planar, compact and robust[4]. Thus 5G wireless systems have to have to satisfy major three requirements which are as follows[3] : 1. High throughput 2. Serving many users at the same time simultaneously 3. Less energy must be consumed. 5th generation wireless communication networks mostly use millimeter wave frequencies. In this paper, a compact dual band antenna is proposed for 5G communication in the range 24 GHz to 40 GHz[9].

II. PROPOSED ANTENNA DESIGN

T shaped antenna with waveguide feed have been proposed with a similar inverted structure at the back[9]. In this we have a ground over which we have substrate on both sides and then patch over the respective substrates. Rogers RT Duroid 5880 having dielectric constant of 2.2 and loss tangent of 0.0009, having height 0.8mm has been used as a substrate material for antenna design[9]. The dimensions of substrate are 12mmX12 mm[9]. At first a simple T shaped patch has been designed. Antenna simulation and designing and all analytical evaluations are carried out on CST Studio Suite. Fig1. Shows the front structure of the patch and Fig2. Shows the back structure of the antenna.

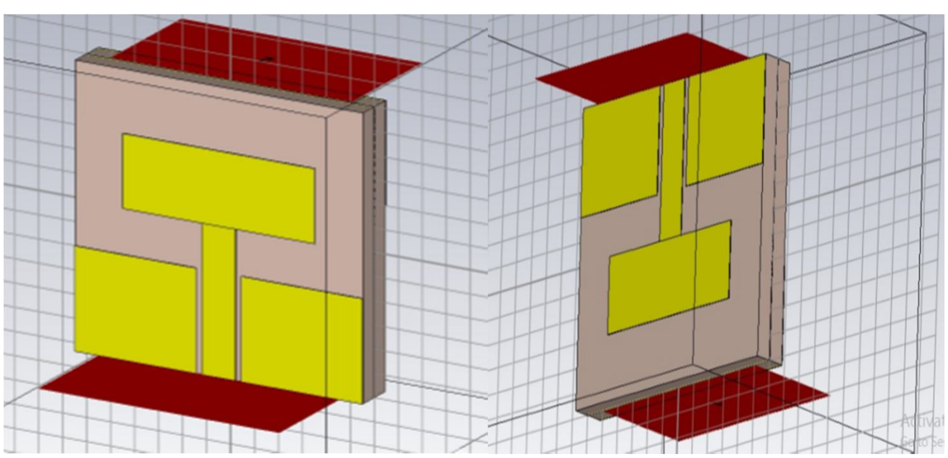

Fig1. Front side Fig2. Back side

Below is shown table consisting of dimensions of parameters with their symnols table1.

PARAMETERS	SYMBOLS	Mm
Patch width	W	8
Patch length	L	3.1
Width of one side	w	3.3
Gap	G	1.9
Length of waveguide feed ground	l	4.35

Table1. dimensions of T shaped antenna

III. RESULTS AND DISCUSSION

Simulated results of antenna are summarized in this section to evaluate its performance. Various distinct features such as high bandwidth, high efficiency and high gain shows the effectiveness of the proposed antenna. The S parameter , radiation patterns and VSWR has been examined.

Below Fig3. shows the S parameter curve for the proposed antenna design. S11 is -19.6 dB .

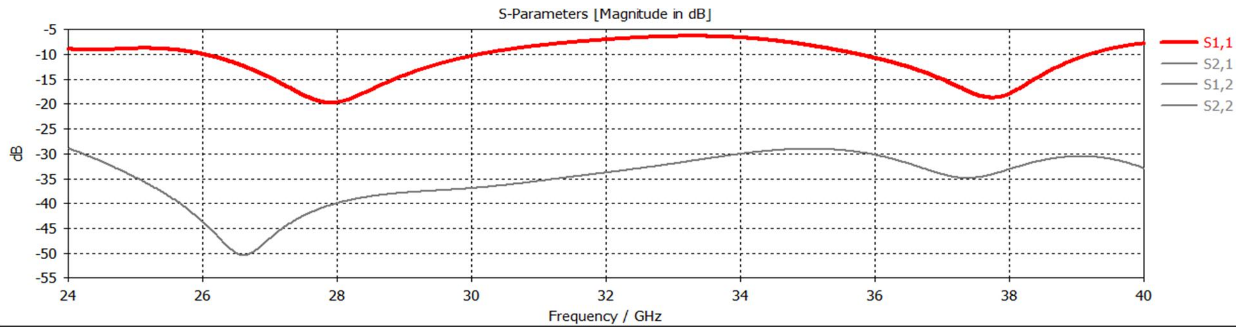

Fig3. S parameter curve for proposed design.

Below is Fig4. Showing the VSWR curve.

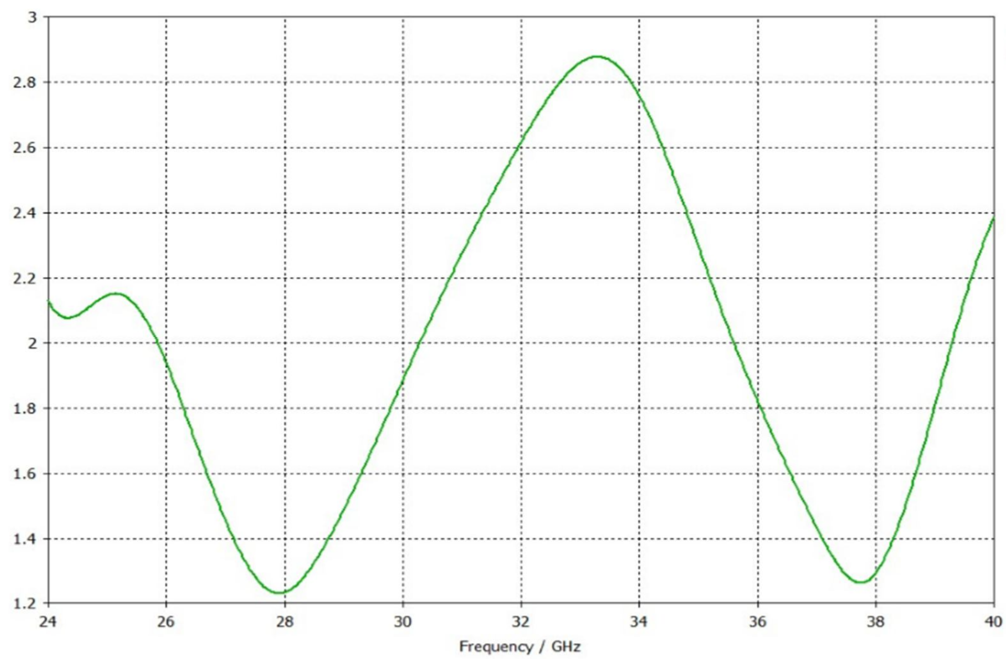

Fig4. VSWR curve for the proposed design.

IV. CONCLUSION

A high performance millimeter wave antenna has been presented which shows a high bandwidth of 2GHz and 5.6 GHz , which is suitable for 5G applications. This paper covers the design methodology and performance analysis of proposed antenna. In order to compact the size another element is put at the back in inverted form, thus achieving two resonating frequencies. One is at 28 GHz and the other resonating frequency at 37GHz, thus creating a dual band antenna at millimeter wave frequency. Thus the aspects suggest that the proposed design of dual band millimeter wave antenna is promising for 5G applications.

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