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An mm-wave mimo antenna design for 5g applications

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Abstract
This paper presents an array of 2 micro strip slotted patch antenna elements working in the n 5G range (43.24GHz). This range is also called a millimeter wave band. The feed line of array elements has some tapering. The return loss is -23.22dB for the array structure, and the gain is8.11dBi.

Keywords: Micro strip, mimo antenna, millimeter wave band

1. Introduction

The micro strip antenna demand increased in the technology in wireless communication [1]. To fulfill the requirement of high data transfer and low-cost fabrication, the millimeter wave band (3-300GHz) is used for commercial purposes [2]. The millimeter wave frequency bands 24.25-27.5GHz, 37-43.5GHz, 45.5-47GHz, 47.2-48.2GHz, and 66-71GHz for 5G networks [3].

The Rogers substrate is best for the millimeter wave because both dielectric constant and water absorption is low.

2. Antenna Design and Analysis

The Rogers RT 5880LZ is used as a substrate for this design with a dielectric constant of 1.96 and a height of 1.27mm, which is best for the millimeter wave because of the low dielectric constant and low water absorption [4]. The overall dimension of the designed antenna is 17×17mm². The micro strip feeding line technique is used for feeding both the design patches. To achieve 50Ω impedance, perfect matching is calculated according to [4].

The various slots dimensions marked in figure 1 of the one element are given underneath:

A=1.5 mm, B=2.5 mm, C=0.5 mm, D=1.5 mm, L=0.25 mm, P=0.25 mm

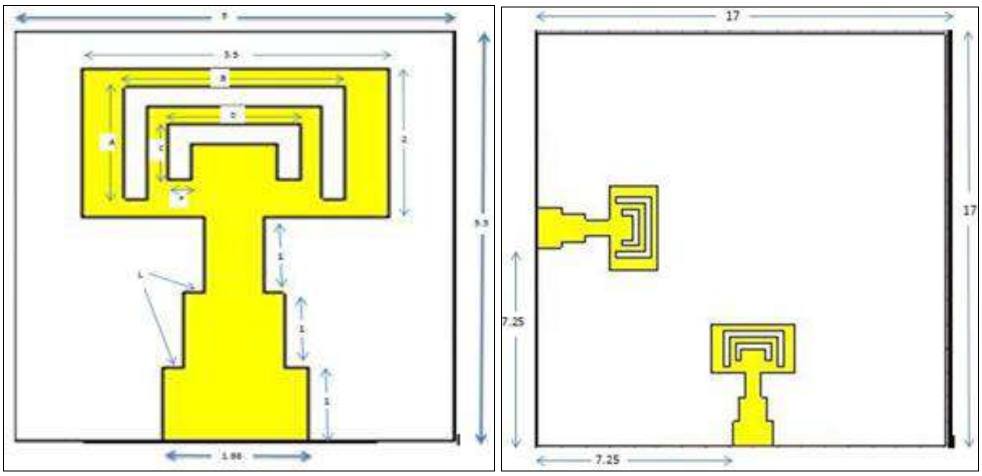

Fig 1: (a) single element (b) MIMO of 2 elements

The return loss is decreased due to the slots, and the bandwidth increases. For future improvement in return loss and bandwidth second type c slot is inserted. The gain is also enhanced. Now for some other enhancements, e. g. gain and impedance bandwidth, tapering of feed was optimized. Four rectangles are cut away from both sides of the feed line. Two rectangles are equal in size that is $0.5\times2mm^2$. And the other two rectangles are similar in length that is $0.25\times1mm^2$.

To improve the gain and performance, use the MIMO of two elements with different feeds. It enhances the yield from 6.44dBi to 8.11dBi.

3. Results and Discussion

Computerized Simulation Technology is used for the simulation. The curve between the return loss and the frequency is shown in figure 2. For the proposed structure, the return losses at both feeds are-23.22dB at the resonant frequency 43.26GHz.

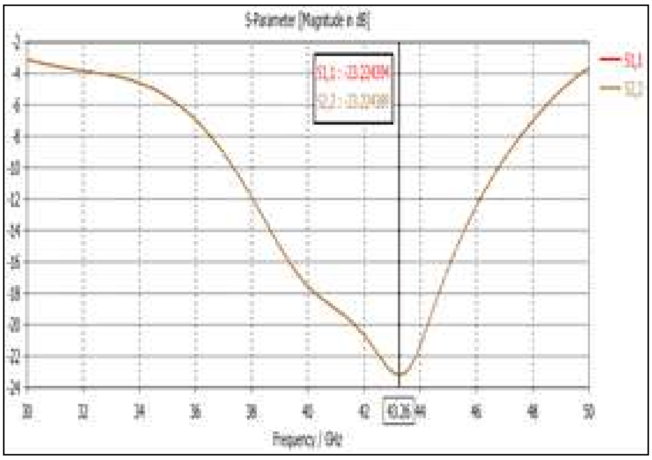

Fig 2: S11 plot of the structure

The bandwidth calculated is 9.40GHz (37.36 to 46.76GHz), which is the difference between higher and lower frequencies.

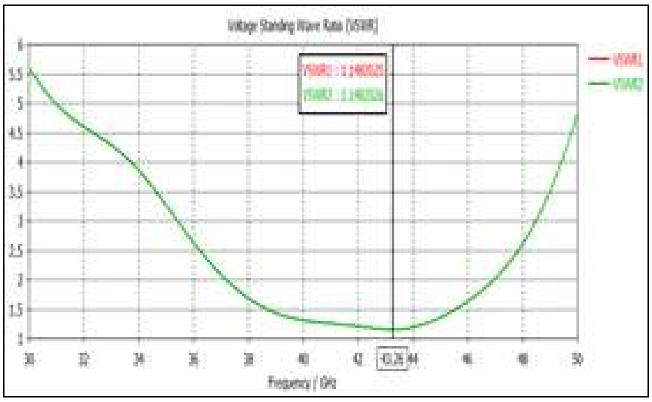

Fig 3: Plot of VSWR of the designed antenna

The next curve is between VSWR and the frequency, figure 3. The value of VSWR should be less than 2 for the entire band; then, there is good matching between the antenna structure and the feed line.

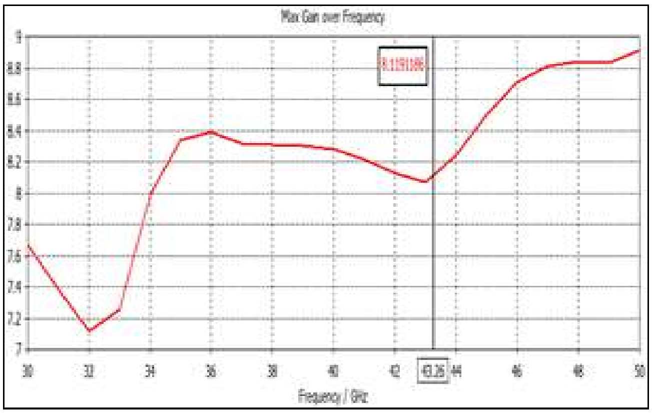

Fig 4: Plot between gain and frequency

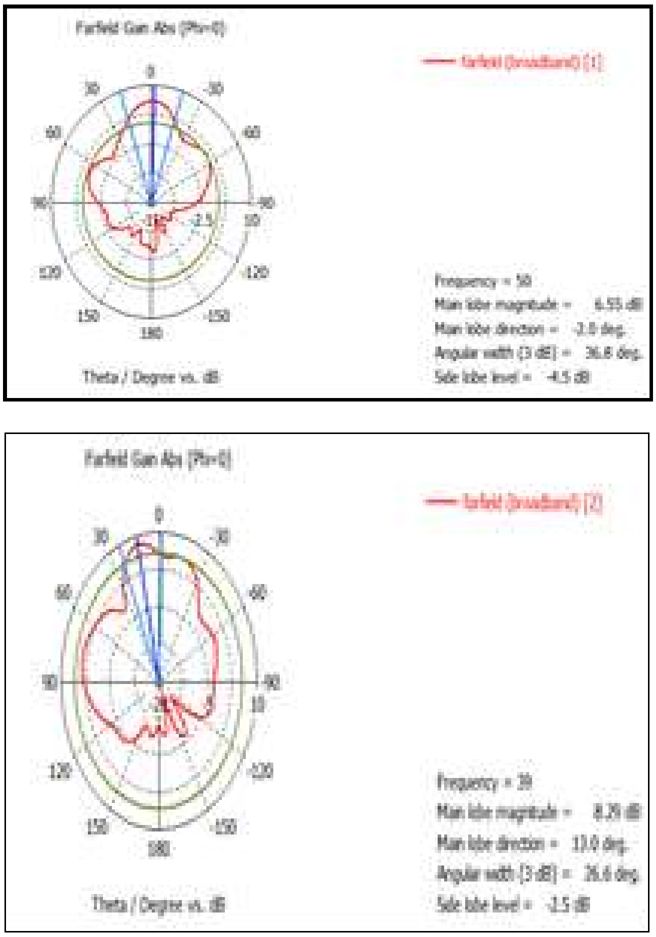

Fig 5: Radiation pattern at port one and port 2

Figure 4 shows the gain that should be positive for the entire band. According to the plot, the proposed antenna shows an 8.11 DBI gain, and Figure 5 shows the radiation pattern at the frequency at which the antenna resonates.

4. Conclusion

The proposed paper uses a simple micro strip patch antenna for 5G wireless communication. This antenna gives 43.26GHz frequency. The return loss at the resonant frequency is -23.22dB. The bandwidth is 9.40GHz. The proposed antenna provides good gain, bandwidth, and directivity, which shows that the antenna is suitable for 5G communication.

5. References

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