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Single-Feed Triple Band Microstrip Antenna for High Frequencies

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ABSTRACT

This project presented a Design of a Single feed microstrip antenna has proposed for the Triple band operations and at the same time it mainly designed for satellite communication and the applications in K/Ka/Ku bands it is easy to fabricate, and high flexibility and improved antenna improved efficiency. The antenna has small dimensions of 70×29×0.787 and operates at 1GHz. This antenna mainly consists of a microstrip line in the center, two slot-loaded rectangular patches on the lateral sides, with two thin microstrip lines. The antenna is designed and simulated on High-Frequency Structure Simulator (HFSS) platform using Rogers RT/Duroid 5880 substrate with 0.787 dielectric constant and 0.002 loss tangent. The radiation pattern, return loss, vswr and gain results reveal that the antenna performs quite well at all frequencies.

Keywords : Triple band, return loss, microstrip insert feed, VSWR,5G Wireless communication

I. INTRODUCTION

Now a days wireless Technologies are increasingly popular. However, he technologies for wireless communications still need to be improved further to satisfy the higher resolution and data requirements. The development of large bandwidth antennas that can handle a wide range of applications with MW and MMW, antenna is required to keep up with the rapid growth of wireless communications. Antenna is one of the major component communications. The Antenna which is used mainly to transmit and receive electromagnetic wave signals using some frequency bands. By Using of single frequency for single antenna the frequency band will not be utilized sufficiently. So multiband antennas came into existence where a single antenna can use multiple frequencies. There are the different sizes and shapes of antenna used in communications systems. Antennas come in all shapes and sizes from little ones that can be found on your roof to watch TV to big ones that capture signals from satellites millions of miles away. The most used antenna is patch antenna which is easy to design and fabricate with lost cost. The proposed antenna is also a patch antenna which has insert feed structure and is printed on a Rogers RT/Duroid 5880 substrate using a microstrip feed line. The multiband 5g antenna has many more applications in the communications.

II. DESIGN GEOMETRY OF PROPOSED ANTENNA

The proposed antenna design with parasitic patches on the lateral sides of the antenna to improve the gain, with microstrip feed line, with lumped port. The dimensions of proposed antenna are 70*29mm^2 with substrate height of 0.787mm.

The projected antenna is designed with Rogers RT/duroid substrate dimensions of width= 5.3 mm, length= 20.1mm and. Here we use Rogers RT/duroid 5880 substrate with thickness of H=0.787 mm with relative dielectric constant 4.4. The proposed designed antenna resonating at three centre frequencies at 15Ghz, 22 Ghz and 37Ghz. This antenna is made up of a coplanar ground plane, a radiating structure. To improve the frequency spectrum, by using of insert feed is placed.

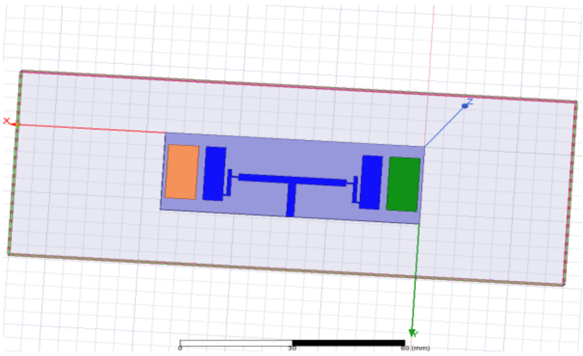

Fig.1: Front view of proposed antenna

III. RESULTS AND DISCUSSION

The design and simulation results are performed using Ansys electronics desktop version 19.2. The HFSS model is a terminal type with the operating frequency 15GHz. The terminal S parameter and terminal VSWR are plotted using rectangular plot in terminal solution data report. The gain parameter and radiation patterns were plotted using far field report.

S PARAMETER

S parameters is also referred as return loss. The S parameter is used to calculate how much the input power is transmitting to the output power. The ideal or theoretical value of S parameter should be -10dB, whereas in the practical case the S parameter value should be -20dB. If the value is less than -20dB it indicates that more input power is transmitting from the antenna.

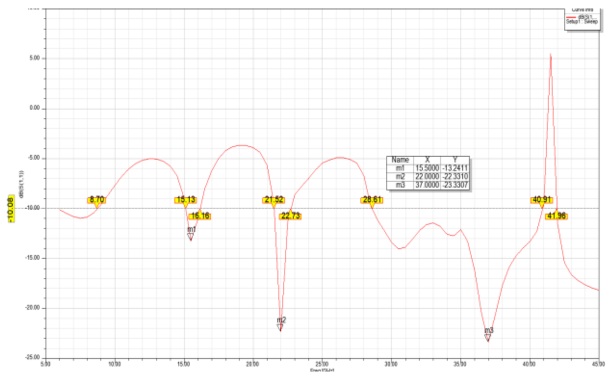

Fig 3: S parameter plot of proposed antenna

The proposed antenna achieved a return loss of -13.2411dB, -22.3310dB, and -23.33dB at 15.50, 22.00, and 37Ghz respectively. The S parameter values of proposed antenna satisfies the theoretical values.

VSWR (VOLTAGE STANDING WAVE RATIO)

The voltage standing wave ratio is measured to check whether the feed line can match the antenna or not. i.e., the microstrip feed line should be able to transmit the power from the source to antenna efficiently. The value of VSWR should be in between 1 and 2.

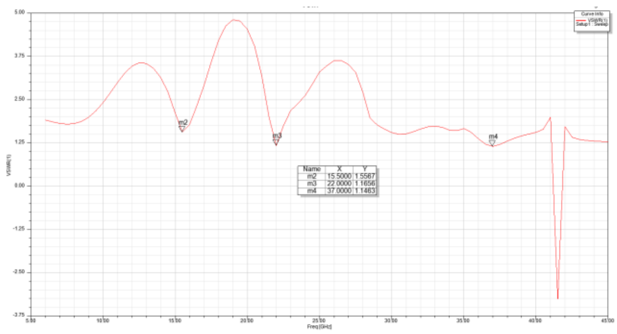

Fig 4: VSWR plot of proposed antenna

The proposed antenna has VSWR values 1.5567, 1.1656, 1.1463 at 15.5GHz, 22GHz, 37GHz respectively.

GAIN

The gain of the antenna indicates the ability of antenna how much it radiates in the free space. The gain is measured in decibels.

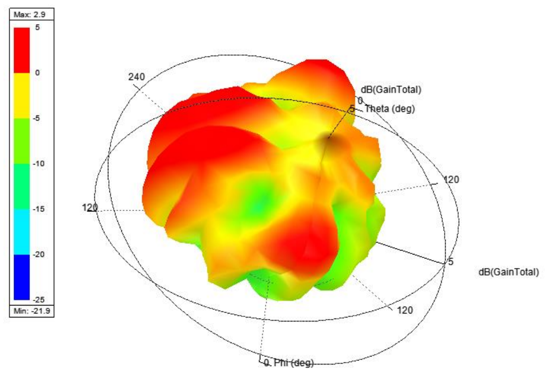

Fig 8: Gain of antenna at 15.5 GHz

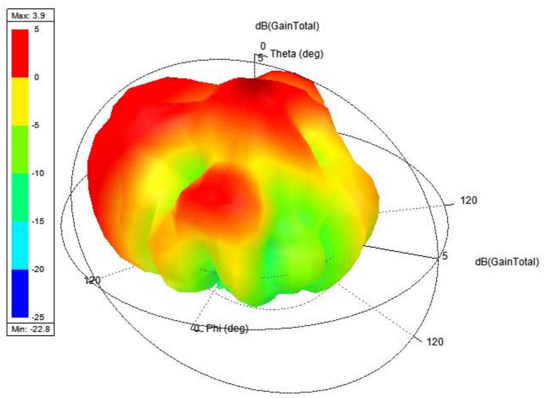

Fig 9: Gain of antenna at 22 GHz

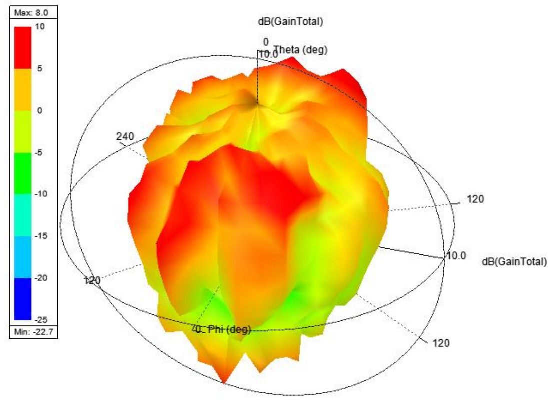

Fig 10: Gain of antenna at 37 GHz

The overall gain of antenna is calculated at the operating frequency and achieved a gain of 3.9dB at 22GHz. The proposed antenna achieves gain of 2.9dB, 3.9db, 8dB at 15.5, 22, and 37GHz respectively.

IV. CONCLUSION

The proposed microstrip insert feed antenna is applicable to use in multiple frequencies which has low return loss, with good gain, high bandwidth, and low VSWR. In future the proposed antenna can be modified to work in multiband with more gain by sing of arrays. The proposed antenna is very simple to design, and it is a compact size of 70*29mm2 with thickness 0.787mm. The results shows that the return loss values are less than -10dB, and VSWR values is in between 1 to 2. The proposed antenna has achieved wide bandwidth where it will be allows more data to be transmitted.

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