# Dual Band Antenna for Future Applications

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***Abstract -- This paper presents a design 0f dual-band antenna for future applications. The proposed MIMO antenna consists of array of eight antennas which operates at 2.3- 2.4GHz and 7.2-7.4GHz. The antenna is designed using FR4 substrate with thickness 0.8mm. It has relative permittivity 4.4 and loss tangent 0.02. Then the antenna will be fabricated and tested using spectrum analyzer.***

***Indexed Terms: antenna, MIMO, antenna parameters, spectrum analyzer***

## I. INTRODUCTION

In this modern world people are passionate in using fast network. With drastic increase in demand for high speed network, to reduce latency problems (delays in processing data that lead to lagging connection), gives rise to upcoming applications. The design of MIMO antenna is carried out with monopole antenna using ADS software. A monopole antenna is 1/2 a dipole antenna. The most common kind could be a quarter-wave monopole antenna. The radial asymmetry of a monopole antenna is double the radial asymmetry of a dipole antenna which is of double the length. The reason for this can be just because no radiation happens below the bottom plane; therefore, the antenna is effectively double as directive. There are many types of antenna technologies such as SISO (Single Input Single Output), MISO (Multiple Input Single Output), SIMO (Single Input, Multiple Output), and MIMO (Multiple Input Multiple Output). Among these MIMO is the most commonly used technology. MIMO (multiple input, multiple output) is associated with antenna technology for wireless communicationsduring which multiple antennas are used at each transmitter and receiver terminals.

In conventional wireless communications, one antenna is employed at the transmitter, and another single antenna is employed at the destination. In some cases, this offers rise to issues with multipath effects. When associated, electromagnetic field (EM field) is met with obstructions like hills, canyons, buildings, and utility wires, the wave fronts are scattered, and so they take several ways to reach the destination. The late arrival of scattered parts of the signal causes issues like attenuation, cut-out (cliff effect), and intermittent reception (picketfencing).

In digital Communications systems like wireless network, it will cause a discount in speed and a rise within the variety of errors. The use of two or additional antennas, in conjunction with the transmission of multiple signals (one for every antenna) at the transmitter and the destination, eliminates the difficulty caused by multipath wave propagation. For designing the antenna ADS software is used. This software is mainly used in communication side for simulating antenna, filters, etc. It focuses on RF and microwave signals. The most of the components on its library are microwave devices.

## II. RELATEDWORKS

The antenna is designed with 4×4 MIMO antenna which operates at a frequency of 3300-3600MHz and 4800-5000MHz. The antenna is placed perpendicular to the edge of the system circuit board. The area of each antenna is 3.9×17mm and the size of circuit board is about 130×74mm. The fabrication of the design is carried out using FR4 substrate, which has a relative permittivity of 4.4 and tangent loss of 0.02. The simulation is performed using HFSS software. It covers a frequency band of 3.5GHz and the envelope correlation co-efficient is less than 0.1 in the operating band. In-order to achieve a high-speed data transmission miniaturization and multi-cell array antenna are used and antenna efficiency is also above 50% L-shaped braches and front bend line contribute

to high frequency impedance matching. The antenna can be located in line with the trend for a full screen smart phone antenna design.

Here the array of eight antenna is designed which is operating at 3.5GHz and 2- 4G antenna and capable of covering a band of 3400 – 3600 MHz. It has a good ergodic channel capacity of about 40Bps/Hz. They uses decoupling technique between antenna elements for MIMO system. The novel neutralization and protruded ground techniques is applied to gain high efficiency. It is also used to reduce mutual coupling which affects the antenna efficiency. The envelop correlation co-efficient is 0.4 for 4G antenna and 0.2 for 5Gantenna.

Design of 1×8 MIMO Antenna+ for Future 5G Applications", Presented the design of MIMO 1×8 antenna, which operates at a frequency of about 38Ghz for future applications. They discussed the comparison between the performance of MIMO 1×4 antenna and MIMO 1×8 antenna and states that both have similar radiation patterns. The return loss of -15.76 dB is obtained. The Rogers RT/duroid 5880 substrate with the thickness of 0.787mm and a dielectric constant of 2.2 where used to fabricate the design. They concluded that the increase in number of elements affect the gain and frequency of the system.

## III. THE ANTENNA DESIGN AND ITSCHARACTERISTICS

The proposed system consists of array of monopole antenna which is operating under 2.3-2.4GHz and 7.2-7.4GHz. The array of eight antennae is designed with dimension of 16×3mm. The antenna is designed using FR4 substrate with 0.8mm in thickness. The relative permittivity and the loss tangent of FR4 substrate is 4.4 and 0.02 respectively. FR stands flame retardant. It is common material used in printed circuit board. The composition of FR4 substrate composed of fiber glass with epoxy resin which is flame resistant. It is most commonly used as an electrical insulator possessing considerable mechanical strength.

The array of eight antennas is simulated. In ADS software, EM simulator is used to simulate the antenna. It also states the presence of the error.

The each antenna is separated by 17mm apart to avoid radiation interference between each antenna. The design of 2×2, 4×4 and 8×8 antenna is designed and their results are compared. From the simulated result the parameter such as directivity, gain, radiated power and efficiency of the antenna is found. Also using the spectrum analyzer the parameter of the fabricated antenna will be tested. Then both the simulated result and practical results are compared. The S-parameter, return loss, efficiency, directivity and gain is analyzed using ADS software simulator. The practical results are obtained by testing the fabricated design using spectrum analyzer.

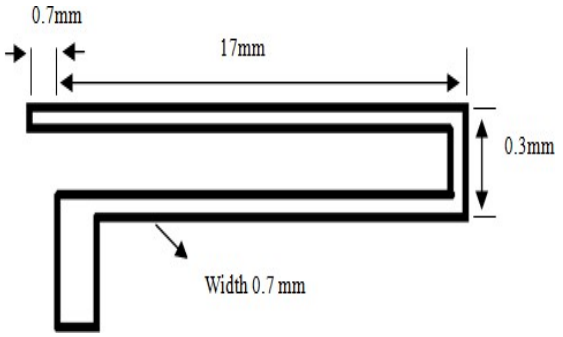



Fig. 1: Dimension of antenna

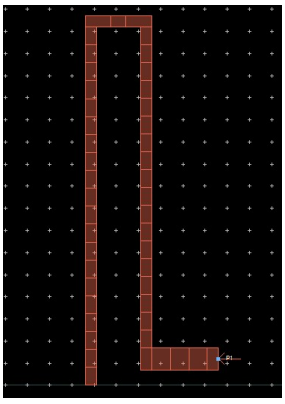


Fig. 2: Design of single monopole antenna

The design of 8×8 Monopole antenna is made in ADS software.

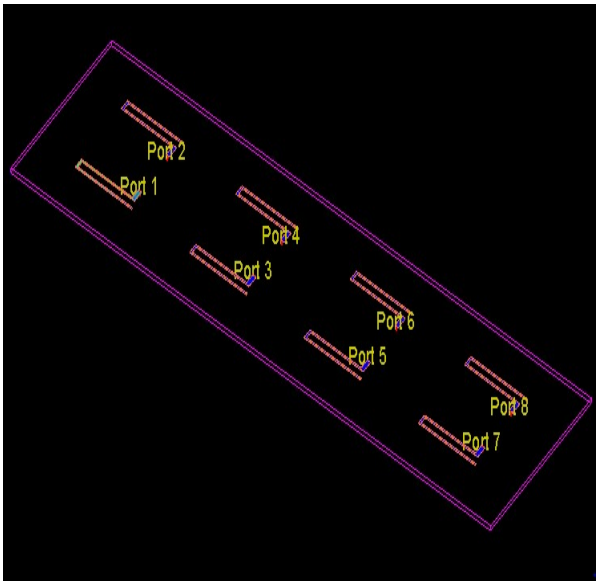



Fig. 3: 3D view of array of eight antennas

## IV. SIMULATION AND RESULT OFTHE PROPOSEDSYSTEM

The antenna is simulated in ADS software using EM simulator. The parameter of the antenna such as S-parameter, return loss, efficiency, directivity and gain is analyzed.

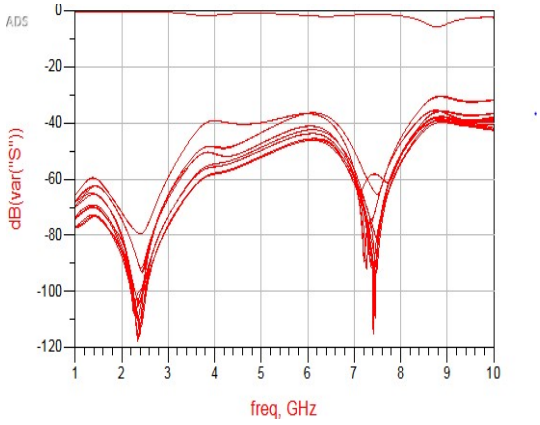
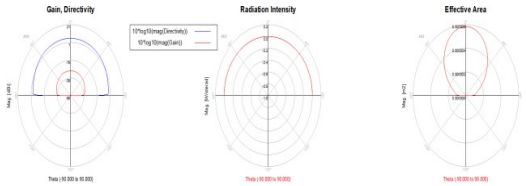



Fig. 4: S-parameter



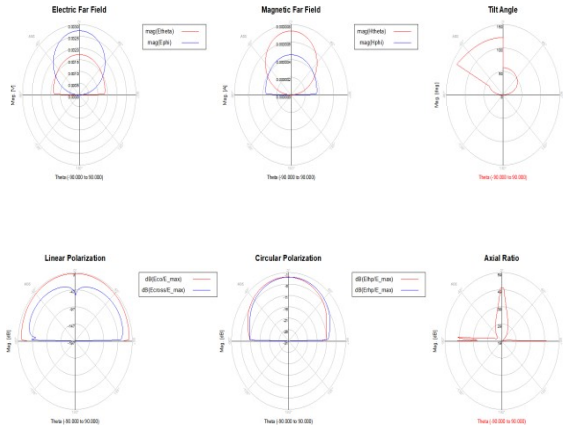




Fig. 5: Simulated result of parameter

Fig: Simulated result of parameter gives the detailed view about the gain, directivity, effective area, magnetic far field, linear polarization and circular polarization.

The S- parameter graph shows that the designed system is capable of covering a frequency band of 2.2 – 2.4 GHz and 7.2 – 7.4GHz.

The comparison of the gain, directivity and efficiency of 2×2, 4×4, and 8×8 antenna design are made with the results obtained from the simulation.

| PARAMETER | ANTENNA DESIGNS | | |
|---|---|---|---|
| MODEL | 2×2 | 4×4 | 8×8 |
| DIRECTIVITY | 5.837 | 5.740 | 5.576 |
| GAIN | 30.891 | 30.892 | 30.894 |
| EFFICIENCY | 2.124E -4 | 2.172E -4 | 2.255E -4 |

Table 1: Comparison table

Table 1 show that 8×8 antenna design is better than the 2×2 and 4×4 antenna design model.

## V. CONCLUSION

A dual band antenna for future applications is proposed. This 8×8 antenna will have great influence in the future generation as we cover two wide operating bands 2.2-2.4GHz and 7.2- 7.4GHz. Antenna parameters such as S- parameters, radiated power, antenna gain, efficiency, directivity were

studied and measured. It is capable to meet the requirements of MIMO system. The antenna size is relatively small, ideal for today's ultra thin smart phone communications. It achieves high efficiency. This proposed model will meet the future requirement of multi-mode applications.

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