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Design and Analysis of 2 X 2 UWB Dumbbell Shaped Microstrip Patch Antenna for 5G Communication Application

Neetu Oad¹, Dr. Anuj Garg², Dr. Soheb Munir³

Research Scholar, Dept. of ECE, Lakshmi Narain College of Technology Excellence, Bhopal, India¹

Associate Professor, Dept. of ECE, Lakshmi Narain College of Technology, Bhopal, India²

Associate Professor, Dept. of ECE, Lakshmi Narain College of Technology Excellence, Bhopal, India³

ABSTRACT: Wireless communication application is not possible without using the antenna. Now a day's Microstrip patch antenna (MPA) is using broadly due to its major advantages than others. Most of the electronics device is using MPA. There are various shapes and pattern is proposed by antenna researchers. Microstrip patch antenna provides better performance in wireless communication applications. This paper proposed a novel design of microstrip patch antenna array for 5G wifi, wi-max applications. The CST microwave studio software is used to make a proposed antenna design and simulation. The resonant frequency of this antenna is 6.9 GHz. Overall bandwidth achieved by proposed antenna is 903 GHz. The large bandwidth is required for 5G communication applications..

KEYWORDS: Attack, NN, Routing, WSN, DOS, DDOS, MAC, CAN.

I. INTRODUCTION

It is widely used in portable wireless devices because of the ease of fabricating it on printed circuit boards. Multiple patch antennas on the same substrate called microstrip antennas, can be used to make high gain array antennas, and phased arrays in which the beam can be electronically steered. With the advancement of remote correspondence advances, it has gotten progressively alluring for present day specialized gadgets to coordinate different correspondence guidelines, for example, 2G/3G/4G/5G. Hence, radio wires with broadband execution are popular for multi-standard inclusion. Microstrip antenna is generally utilized in remote correspondence frameworks. To accomplish broadband activity, different plans of microstrip reception apparatuses have been accounted for, for example, altering the state of the microstrip arms, improving taking care of strategies, stacking parasitic radiators, and utilizing magnetolectric reciprocal structures [1].

Moreover, radiation execution is additionally required for some remote correspondence applications, for example, indoor sign inclusion, remote passages, and small scale base stations. In view of the multi-mode PFDA, a straightforward and powerful structure to accomplish radiation execution is created by setting two of the proposed PFDA's consecutive. The subsequent reception apparatus displays great radiation designs in the even plane with level increase variety of under 1.27 dB. The introduced conservative broadband radio wire is a decent contender for indoor sign inclusion.

Three resounding modes are gotten by utilizing a changed planar collapsed microstrip and its coupled taking care of structure. Consolidating the shorting pins and parasitic patches, numerous resounding modes in the antenna are controlled, moved, and afterward joined to build the impedance data transmission. Utilizing this idea, a model of a multimode collapsed microstrip is planned, manufactured, and estimated [1]. Common coupling between two microstrip antenna with various measurements put at self-assertive equal positions is broke down utilizing synchronous indispensable conditions with definite parts and limited hole feeds[2]. A tale plan technique for a wideband double enraptured reception apparatus is introduced by utilizing shorted microstrips, incorporated baluns, and crossed feed lines. Reenactment and proportionate circuit investigation of the antenna are given. To approve the plan technique, a antenna model is planned, upgraded, manufactured, and estimated [3]. An epic ultra-wide-band firmly coupled microstrip reflects array radio wire is introduced in this work. This reflects array antenna comprises of a wideband feed and a wideband reflecting surface. The feed is a log-occasional microstrip cluster reception apparatus. The reflecting

surface comprises of 26×11 unit cells. Every cell is made out of a firmly coupled microstrip and a defer line. The base separation between nearby cells is 8 mm, which is around 1/10 frequency at the most minimal working recurrence. By joining the benefits of reflect array reception apparatuses and those of firmly coupled exhibit radio wires, the proposed TCDR antenna accomplishes ultra wide transfer speed with decreased unpredictability and creation cost [4].

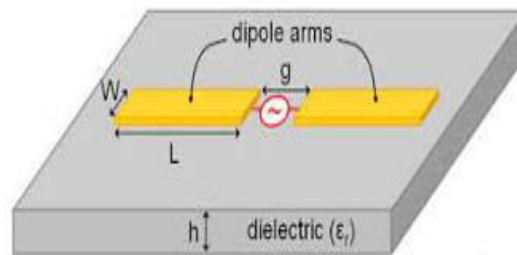


Figure 1: Microstrip Antenna

Microstrip radio wire is exceptionally well known in light of the fact that the data transmission of smaller scale strip microstrip antenna is high when contrasted with the miniaturized scale strip fix reception apparatus. Small scale strip microstrip reception apparatus will be the principle focal point of this work. A miniaturized scale strip microstrip is a usage of the customary microstrip radio wire on a dielectric chunk, which can be effortlessly created with existing PCB strategies. In contrast to regular small scale strip reception apparatus, that utilization one side of the chunk as the ground plane, the smaller scale strip microstrip essentially utilizes the dielectric section as the host material. This antenna is picked in light of the fact that it is straightforward but then has potential for future improvement. A conservative wideband double spellbound antenna with improved upper out-of-band concealment is introduced in this work. The proposed reception apparatus is a proportional arrangement of two electric microstrips and two attractive microstrips utilizing the crossed shunt circles. The fuse of the electric and attractive microstrips empowers the radio wire to accomplish wide impedance transmission capacity and a conservative radiator size. What's more, four parasitic strips are embedded close to the internal edge of the four circles to upgrade the antenna upper out-of-band concealment at 3.5 GHz with improved impedance data transfer capacity.

II. RELATED WORK

A. Yadav et al., presents a design of 2×1 microstrip patch array antenna for 5G C-band access point applications. The array uses the element of rectangular microstrip antenna with U slot on parasitic patch for 5G C-Band (3.4 - 3.8 GHz) application. A microstrip feed network is used to feed the antenna array is also implemented in the design. The antenna is two layered antenna array and low profile is a good candidate of antenna for 5G C band access point applications. the paper shows results of analysis: such as return loss, efficiencies, radiation pattern, etc of both single element and array antenna [1].

N. Ojaroudi Parchin et al., presents another numerous info/various yield (MIMO) reception apparatus configuration is presented for future cell phones. The proposed structure contains four sets of twofold took care of round ring resonators situated at various edges of the cell phone printed circuit board (PCB) with a FR-4 substrate and a component of 75×150 mm². A decent recurrence data transfer capacity ($S_{11} \leq -10$ dB) of 3.3-3.9 GHz has been gotten for the cell phone receiving wire cluster. In any case, for $S_{11} \leq -6$ dB, this worth is 3.1-4.3 GHz. In excess of 3 dB acknowledged increase and 80% complete proficiency are accomplished for the single-component radiator. The structure gives not just adequate radiation inclusion supporting various sides of the mainboard yet additionally the polarization assorted variety [2].

B. Feng, et al., presents double directly captivated (LP) high-request mode radio wire with high increase and high disconnection is proposed for 5G millimeter-wave (mm-wave) applications. To get high increase and wide data transfer capacity, a 2×2 space took care of magneto-electric (ME)- cluster receiving wire components are energized by a high-request mode TM₄₃₀ cavity. Estimation results show that a covered recurrence transfer speed of 14.6% (36.8–42.6 GHz) with a pinnacle increase of 25.8 dBi and a seclusion of more noteworthy than 45 dB for the 8×8 double LP reception apparatus cluster are accomplished, which ensure solid rapid information transmission and against impedance limit with respect to 5G interchanges [3].



S. Hussain et al., presents reproduction and estimation consequences of a wideband planar staged cluster for 5G. The ideal wideband activity is accomplished utilizing a firmly coupled cluster exhibit (TCDA). The cluster has a stature of just 0.144λ , and it displays high increases, high productivity $> 71\%$ (biggest output point) and great cross-polarization. The reenactments are approved by manufacture and estimation of an exhibit model, which shows consent to recreated esteems. The proposed double enraptured radio wire cluster can be sent later on bar checking applications for 5G [4].

I. Serhsouh et al., presents novel reconfigurable opened defective wave reception apparatus (LWA) in light of a substrate incorporated waveguide (SIW) with a fixed-recurrence bar controlling ability is introduced in this paper. The pin diodes are tunable by changing the DC predisposition voltage, which brings about pillar checking at a fixed recurrence of around 27 GHz. In this way an electronically controlled steerable SIW radio wire has been structured and tentatively checked that the radiation edge shifts from -33° to $+33^\circ$ [5].

J. R. Pérez et al., presents concerning the structure and arranging of new radio interfaces for the fifth-age (5G) frameworks, this paper presents a helpful commitment to the portrayal of the wideband indoor radio divert in the 3-4-GHz recurrence band. An estimation crusade has been done in two distinctive indoor situations to examine the absolute most significant wideband boundaries of the proliferation channel, including a careful examination of its conduct to meet the new radio innovation challenges [6].

X. Shen et al., presents scaled down two-component microstrip radio wire exhibit is proposed for the millimeter-wave band of fifth era (5G) remote correspondence frameworks. A surface of electromagnetic bandgap structures (EBG) is applied as the ground for two firmly pressed fix receiving wires working in 5G New Radio (26 500-29 500 MHz) recurrence band [7].

Y. Kim et al., presents a novel strategy for planning moderate 28-GHz transmit cluster radio wires using FR4 substrates, which are minimal effort yet lossy. It is exhibited that low addition misfortune can be accomplished by utilizing proper mixes of spatial channel unit cells, where every unit cell is chosen to limit the misfortune factors characterized by lossy spatial channel demonstrating. The misfortune factor with between layer couplings was seen as more factor than that without between layer couplings, in spite of the fact that between layer couplings have recently been used to expand the tunable scope of the stage move [8].

H. T. Chattha et al., presents a minimized, low-profile four-port, two-component reception apparatus for the 5G Web of Things (IoT) and handheld applications with tallness $h = 3.0$ mm is introduced. The receiving wire structure contains two planar modified F radio wire (PIFA) components having similar shapes. Most extreme disengagement accomplished among ports is not exactly -25 dB, and envelope relationship coefficient is beneath 0.009 in groups of intrigue. The base recurrence extend secured by the four ports of this radio wire is from around 2.7 to 3.6 GHz for $S_{11} < -10$ dB, in this way covering anticipated future 5G band (3300-3600 MHz), and might be utilized for little versatile and handheld the IoT and cell applications as a decent variety/MIMO receiving wire [9].

A. Li, et al., presents double straightly enraptured radio wire exhibit with end-fire radiation of the 60-GHz band is proposed by consolidating two sorts of magneto-electric dipoles (ME-dipole), which work in vertical polarization (V-pol) and flat polarization (H-pol), individually. In light of the substrate coordinated waveguide structure, two sorts of ME-exhibit are put intently by having a similar metallic post divider between them, accomplishing a component space of $0.77\lambda_0$. Additionally, shared coupling between the nearby components is numerically investigated and afterward smothered by making adjustments to the radio wire structure. The proposed double energized component accomplishes transfer speeds of 26% and 32% ($|S_{11}| < -14$ dB) for the V-pol and H-pol, separately [10].

R. Khan, et al., presents follows: 1) to feature the various frequencies of portable terminal radio wires for various applications; 2) to feature versatile terminal receiving wires that have been created for 5G application; 3) to consider and talk about the impacts of client's hand on 5G portable terminal reception apparatuses; and 4) to examine the exploration hole, issues, and difficulties in the field of client's consequences for versatile terminal radio wires for 5G applications.[11].

A. Mukhopadhyay et al., A world leader in telecommunications, Bose was a significant figure behind the creation of modern radio and sonic technology. In 1896 his work was commemorated by IEEE as the oldest "milestone

achievement" from Asia. In 1997 the Institute of Electrical and Electronic Engineers of America named Bose as a "Father of Radio Science." Royal Society of England was impressed by a research paper of Bose on electro-magnetic waves [12].

III. PROPOSED ANTENNA DESIGN

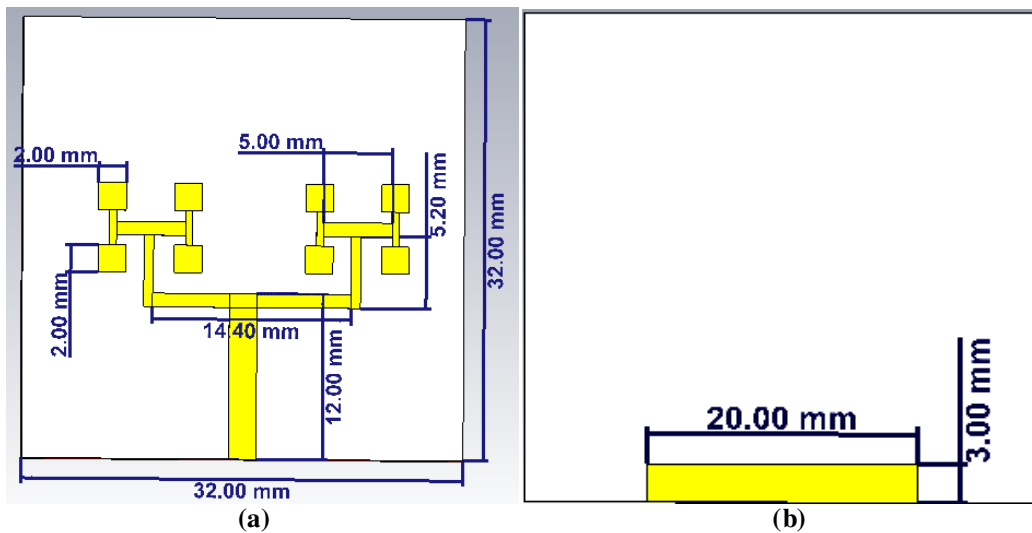


Figure 2: (a) Top view (b) Defected Ground Structure of proposed microstrip antenna array

Figure 2 is indicating proposed microstrip antenna of plan. The top and ground layer is made by lossy copper material and substrate is made by FR4 material which having 4.4 dielectric steady worth.

IV. SIMULATION AND RESULT

The geometry of the proposed structure of microstrip for C-band applications is appeared in figure 2. The general size of the structure is 32mm × 32mm × 1.64mm (L × W × H) and imprinted on fire resistant 4 (FR4), with an overall permittivity of 4.4, and a loss digression of 0.024. Table 1 records the element of the proposed antenna. The antenna is taken care of by 50-Ω and 0.5W coaxial link or straightforward. The antenna utilizes the microstrip structure with one opening for C-Band applications.

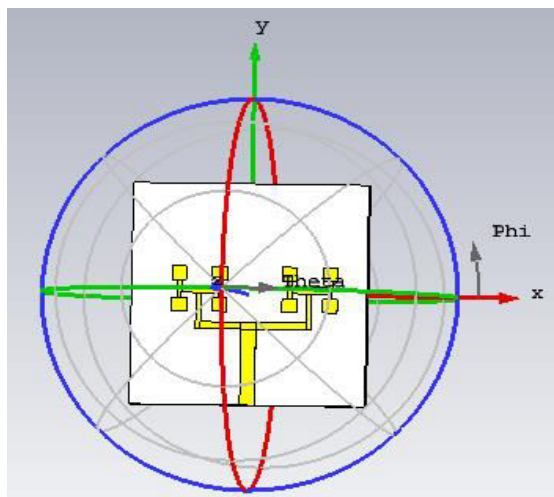


Figure 3: Simulation and fields of proposed antenna



CST microwave studio used to recreate the proposed plan. Figure 3 is demonstrating reenacted electric and attractive field in round organize framework.

Table 1: Design parameters for proposed Antenna

Sr No.	Parameter	Value
1	Lower Frequency(f_L)	4 GHz
2	Higher Frequency(f_H)	8 GHz
3	Dielectric constant(ϵ_r)	4.4 / FR4
4	Ground (LxW)	3 mm X 20 mm
5	Ground height	0.035mm
6	Substrate(LxW)	32mm X 32mm
7	Substrate Height(h)	1.57 mm
8	Line Impedance	50 Ω
9	Tangent Loss	0.06
10	Input watt	0.5W

Return loss

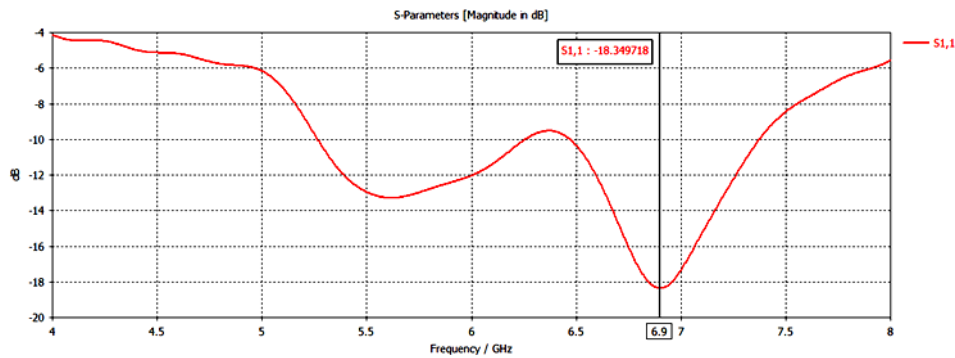


Figure 4: Return loss

Figure 4 presents return loss of proposed structure. It is obvious to see this chart, the return loss estimation of proposed antenna is – 18.34 dB with 6.9 GHz resonant frequency.

Bandwidth

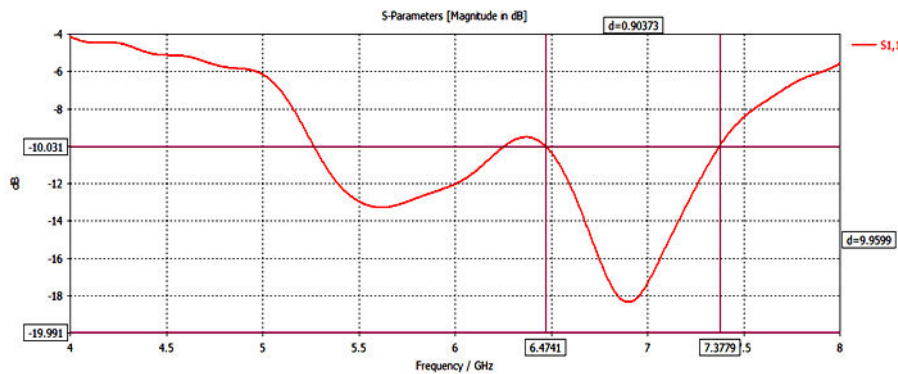


Figure 5: Bandwidth



For broadband antennas, the bandwidth is communicated as a level of the recurrence contrast (upper less lower) over the inside recurrence of the bandwidth. The bandwidth of proposed antenna is 903.73MHz, (7.3779GHz-6.4741GHz), for optimized band.

Voltage Standing Wave Ratio (VSWR)

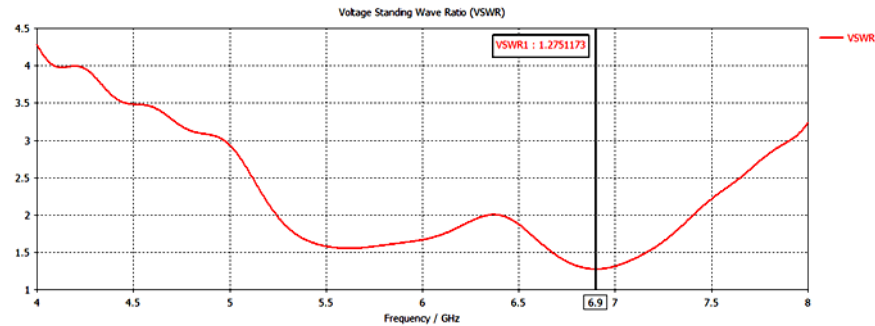


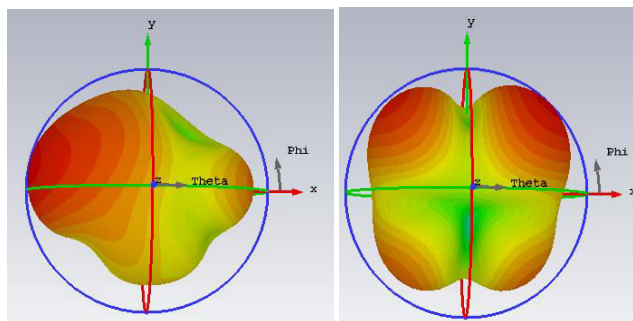
Figure 6: VSWR

Figure 6 shows VSWR esteem, it is voltage standing wave proportion, and is likewise alluded to as Standing Wave Proportion (SWR). VSWR is an element of the reflection coefficient, which portrays the force reflected from the antenna. The VSWR estimation of this antenna is 1.27.



Figure 7: Current density

Figure 7 presents current thickness of proposed antenna. It is a real electric flow that is initiated by an applied electromagnetic field.



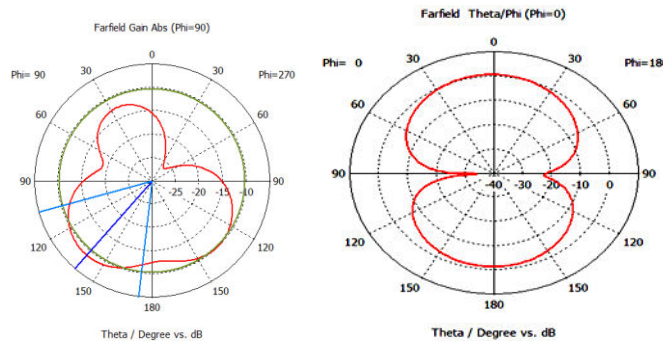


Figure 8: Radiation pattern

Figure 8 shows radiation pattern of proposed antenna at 6.9GHz band. It is a variety of the force transmitted by an antenna as an element of the heading ceaselessly from the antenna.

Table 2: Simulated Results of Proposed Antenna

Sr No.	Parameter	Value
1	Return loss or S11	-18.34 dB
2	Bandwidth	903.73 MHz
3	VSWR	1.27
4	Resonant Frequency	6.9 GHz

Table 2 shows about terms of every vital parameter like return loss, bandwidth, VSWR and resonating recurrence. It is clear by observing reenacted values from table 2, proposed antenna accomplish significant improved outcome.

V. CONCLUSION

A microstrip antenna array is planned and recreated utilizing CST reenactment programming. The reproduction results are introduced and examined. Structure of proposed antenna is basic and reduced in size of 32 x 32 x1.6 mm³. Reenacted results exhibit that the antenna bandwidth covers S band and C-band, at full recurrence 6.9 GHz for VSWR under 2, and S11 beneath - 10 dB. The bandwidth is huge accomplished better than micorstrip fix antenna structure. Micorstrio antenna array configuration is recently exploring theme among specialists. The general bandwidth is 903.73 MHz. Subsequently proposed antenna is reasonable and meets to current correspondence requests.

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