

Broad Band Propinquity Coupled Feed Line Micro-strip Blotch Antenna for 5G Applications

Haleema Sadiya, Harbinder Singh, Mamta Arora

Abstract— In this research based paper, as the need of capacity is increasing very frequently so the demand of smart mobile phone and other wireless communication devices are increasing. The only technology that would be able to fastly fulfill the increasing communication capacity is 5G. For the establishment of communication between the devices of wireless on the higher band of frequencies like mm wave (mili-meter) there is much demand of such type of antennas that are lesser in size, not much expansive, compact and also main easy to fabricate as well as simulate. So, according to all these requirements the antennas that can fulfill all the requirements are only the patch antennas. The Micro-strip blotch Antenna and the authentic viewpoint are shown with high gain millimeter-wave antenna. The micro-strip blotch Antenna has high gain more prominent ground as of late. The Antenna has a good return-loss, gain up-to 11.91dB and the directivity 12.62dB at 28GHz frequency with 6×5 micro-strip planar array configuration with Propinquity coupled planar array Feeding method & line feed method procedure, it gives advantages over traditional conventional Antennas and benefits for 5G applications. In this research work for the implementation the designing and simulation work done on CST TOOL. This simulation is basically performed for coup-led propinquity and line feed for 5G application in future work together.

Keywords- Micro strip blotch Antenna (MPA), Return-loss, Feeding techniques etc.

I. INTRODUCTION

Antenna is an most important fundamental invention for remote applications. Underground bug that changes more than one structure into another and transmits or get the electromagnetic waves. Littler scale strip antenna contains oozing smear on one face of pass on electric ground-plane, real face and substrate. One more diminutive scale strip radio wire includes a rectangular fix on one side of ground plane parted by fail horrendously dielectric substrate [1]. Fix inside the transmitter device is made of an organizing element it can be Copper or Gold and these can adopt any state of rectangular, backhanded, triangle shape twisted or any corresponding customary design. Inside the fundamental structure, a micro strip blotch Antenna as appeared in Fig.1 includes a transmitting smirch on a face of a fail miserably dielectric substrate and have a ground plane despite what might be expected side. The transmitting smear and the feed lines are generally photo scratched on the fail horrendously dielectric substrate [2].

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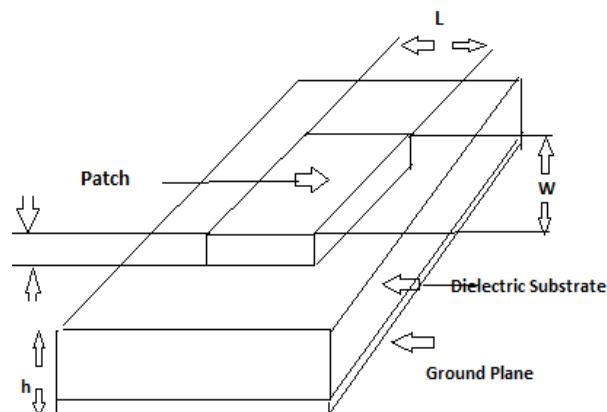


Fig.1. Micro strip Blotch Antenna

There are larger number of physical parameters in Micro-strip patch antenna and a wide range of geometrical shapes and measurements. There are four classes: the classes are given below.

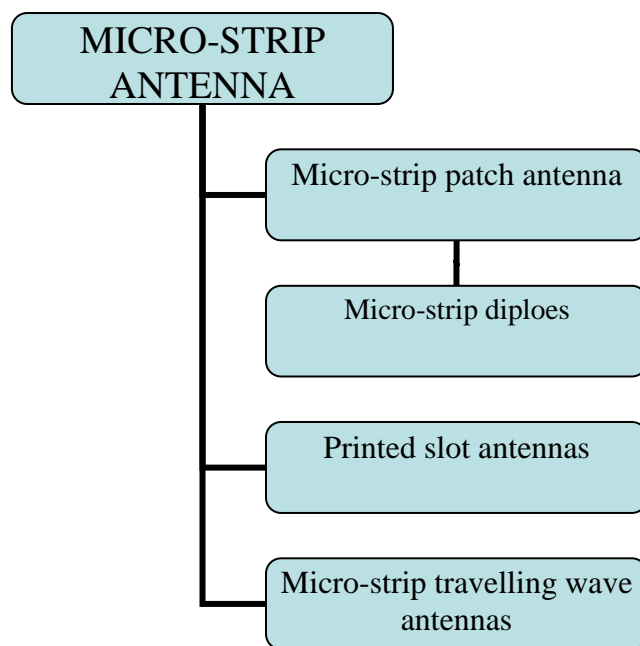


Fig.2. Micro strip Antennas categories

The Micro strip blotch antenna has double frequency agility, double and circular polarizations, recurrence nimbleness, costly band-width, Feed line adaptability, and also beam scanning omni-directional designing [2]. In [3] structure is proposed had the two band-width capabilities a series configuration and coupled Antenna that of a direct feed Antenna. The merits

and demerits; micro strip patch antenna are very famous and favorites reduce weighted, profile, dimension, simplicity, congruity (Table I). It will help for planar based rectangular array pro-posed antenna. These antennas are helpful for 5G applications in future work which is based on satellite communications.

TABLE I
Advantages And Disadvantages

Advantages	Disadvantages
Reduce weight	Reduce efficiency
less profile	Less gain.
Thin profile	Large ohmic losses
Required no cavity backing	Low power handling capacity
Linear and circular polarization	Surface waves excitation
Equipped for both operations: Double as well as for triple frequency	Purity of polarization much hard to accomplish.
Coordinating system and the lines of feed can be fabricated.	High performance of feed is needed for complex feed structure

II. DIFFERENT FEEDING TECHNIQUES

Many distinct systems for feeding little scale strip Antennas are there. These can be coming to and non-achieving techniques. In accomplishing strategy, RF control urged genuinely towards the radiating smear utilizing accomplice portion (littler scale strip line). In the non-achieving approach, control is exchanged between the littler scale strip line, also the radiating smear through electromagnetic coupling. Four strengthening systems are there: scaled down scale strip line and coaxial test (both accomplishing plans), opening coupling and closeness coupling (both non-achieving plans) [5].

- Micro-strip Line of Feed: Coordinating strip is attached really to the corner of the scaled down scale strip smear is little in measurement. Feed’s benefit is that it may be scratched on similar substrate to give planar design [4].
- Coaxial Feed: Coaxial connector’s inner conductor extends and attached with transmitting smear, also to the ground plane the outside conductor is coupled. Upside of this is it may be insert at any of the 26 zones in the fix so as to organize also with its information Impedance and also shortcoming moreover it gives confined transmission limit and is stunning to structure [6].
- Aperture Coupled Feed: The transmitting smear and scaled down scale strip line of field are restricted with the ground, also jointed through an opening in the ground face. Space is locked in underneath the smear, driving polarization of low cross also the radiations are constrained.

III LITERATURE SURVEY

- K. Ming et. al.[7] Structured a 5G wideband patch antenna with anti symmetric L-formed Probe Feeds, in which a couple of hostile is used to symmetric L-molded tests & it is vertically sandwiched in fix receiving wire and the proposed radio wire for double straight polarization is adequate to cover a wide working recurrence
- M.S. Sharawi et. al [8] Proposed four-component MIMO reception apparatus framework for 4G/5G portable applications. The proposed plan is low profile, minimized and basic it additionally gives two-component MIMO framework to every standard. The incorporated radio wire framework is multiband and secured 1975–2080, 2160–2230, 2350–2620, 3060–3140, and 3480–3540 MHz for 4G groups and 16–17GHz band for 5G. MIMO execution measurements were determined with high addition and great proficiency esteems.
- J. Bang et. al [9] Presented a SAR (explicit assimilation rate) diminished 28 GHz shaft guiding cluster reception apparatus with a double mode task utilizing two sub exhibits for completely metal secured 5G handsets. The proposed plan is demonstrated to have an adequate impedance coordinating, an adequate addition level, reasonable bar inclusion, and a diminished SAR level. The proposed exhibit radio wire is a decent possibility for the mm-wave 5G cell handset applications.
- L.H. Trinh et. al [10] Structured a reconfigurable-multiband receiving wire for the present portable models and expected range reallocations for 5G correspondence, This radio wire is utilized in cell phones, and particularly for different information various yield (MIMO) frameworks in which more than one reception apparatus must be coordinated in an extremely little volume.
- P. Dzagblete et. al [11] Presented a 42-component smaller scale strip parasitic fix receiving wire in the milli-meter-wave band for fifth-age (5G) portable correspondence base stations, The examination into the mm Wave recurrence band for 5G has been centered around different sign preparing improvements to discover the practicality of the band for cell correspondence. The 5G mm Wave BSA (Base station reception apparatus) works inside 27.5 to 28.5 GHz with SLL (side projection level) of <-19.1 dB, receiving wire gain of>21.4 dBi, and cross polarization of superior to - 12 dB in both the planes

IV DESIGN AND SIMULATION OF MICRO-STRIP PATCH ANTENNA

Parameters for the designing of antenna: Here the parameters list of design of linear antenna array



configuration is presented and also the dimension that are taken for the designing and simulation of micro strip patch antenna the width of patch, length of patch, thickness of substrate and ground[12], width & length of ground 32& 47mm..

**TABLE II
PARAMETERS**

Symbol	Value(mm)
Pl	3
pw	1.5
Sx	0.6
Sy	0.5
Sw	1
Sl	0.5

Design of single element of array rectangular patch antenna (Fig.3) with the thickness of 0.508mm each and two stacked Taconic TLY-5 substrates are used for designing ($\epsilon_r=2.2$), length of patch (p_{l1})=3, width of patch (p_{w1})=1.5, $s_{w1}=1$, $s_y=0.5$, $s_l=0.5$ (Table II).

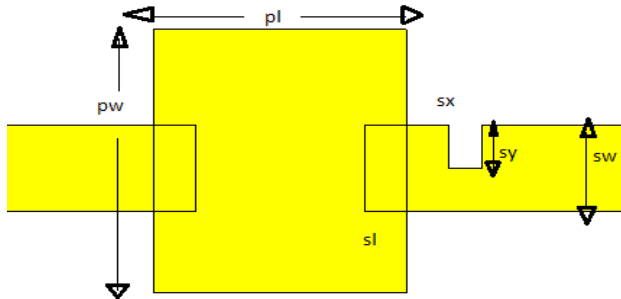


Fig.3. Design of linear element of array Antenna

A. Design and simulation of planar array configuration of the micro-strip patch antenna with proximity feed technique

By using the CST (computer simulation technology) tool the design of 6x5 planar array configuration of the micro-strip patch antenna is simulated and the dimensions are in (Table III). It is a 6x5 planar array configuration that means the combination of many antennas for the better result and efficiency, Now the simulation is done with a different technique i.e. proximity feed technique, in this technique two substrate are used and feed is applied in between them. The ground plane is made up of Cu (copper) material having thickness of 0.035, the patch simulated at the top of the structure and it is made up of copper (Cu) all the patches of array configuration's dimensions are shown Fig.5 (from CST tool), And there are two substrate are used, the substrate material is Taconic TLY-5 (lossy material), as this design simulation is of proximity technique so the feed is applied in between the two substrates the design is shown as in Fig.4. The six lines are symmetrical and separated by $s=7.3$ to the feed-lines.

**TABLE III
PARAMETERS**

Symbol	Value(mm)	Description
t	0.35	Thickness of ground

Pw5	1.5	Width of patch 5
Pw4	3	Width of patch 4
Pw3	3.67	Width of patch 3
Pw2	3	Width of patch 2
Pw1	1.5	Width of patch 1
Pl5	3	Length of patch 5
Pl4	3	Length of patch 4
Pl3	3	Length of patch 3
Pl2	3	Length of patch 2
Pl1	3	Length of patch 1
h	0.508	Thickness of substrate

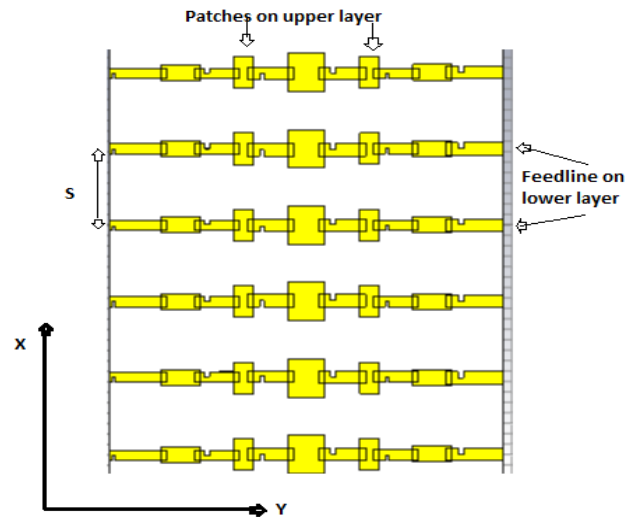


Fig.4. Design of planar array configuration with Proximity Feed technique

Design of planar array configuration with proximity feed technique patches (Table III) on the upper layer are shown along with Feed-line on lower layer [Fig.4].

B. Result of planar array configuration of the micro-strip patch antenna with proximity feed technique.

An epic insignificant exertion, high-gain millimeter-wave Projection is been shown. The 6 x 5 region coupled planar group fitting for 5G cell solicitations. Extra-ordinary comprehension among impersonated and assessed output comes that the analysed antenna structure is capable in achieving broad-band appearances and low side flap levels with a diminished size. From CST tool the results are shown further in below figures are of return loss, gain, directivity, VSWR.

- The s-parameter simulation

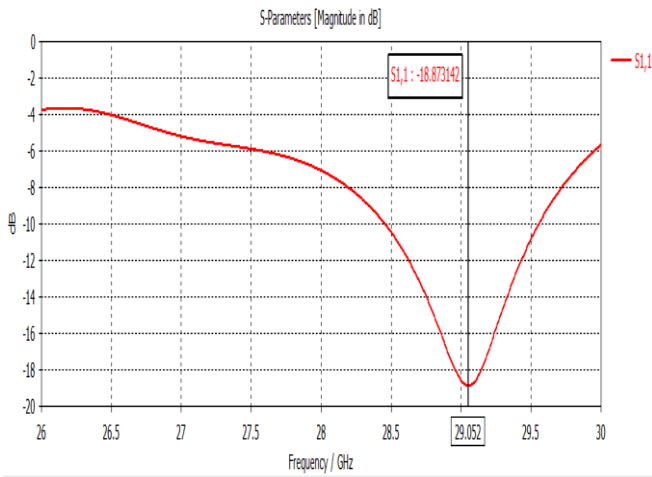


Fig.5. S-parameter at 29.05GHz frequency

The value should be less than -10dB, the value of s-parameter (Fig.5) achieved is -18.87dB.

• The 3D plot of directivity

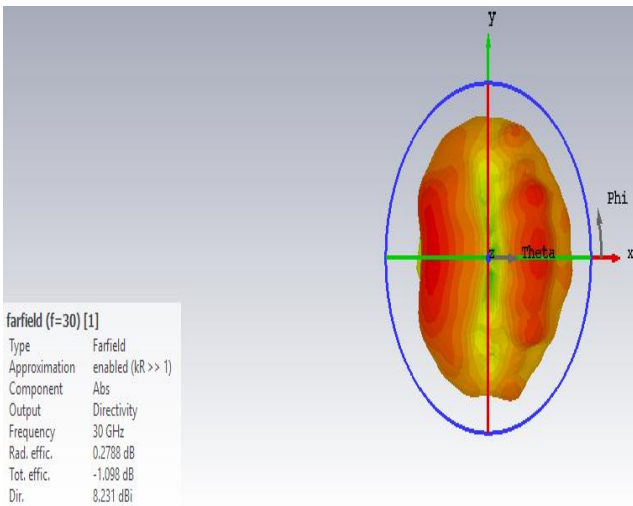


Fig.6. 3D plot of directivity at 30GHz frequency

The gain is achieved 8.231dB at 30GHz frequency for planar array configuration (Fig.6)

• The 3D plot of Gain

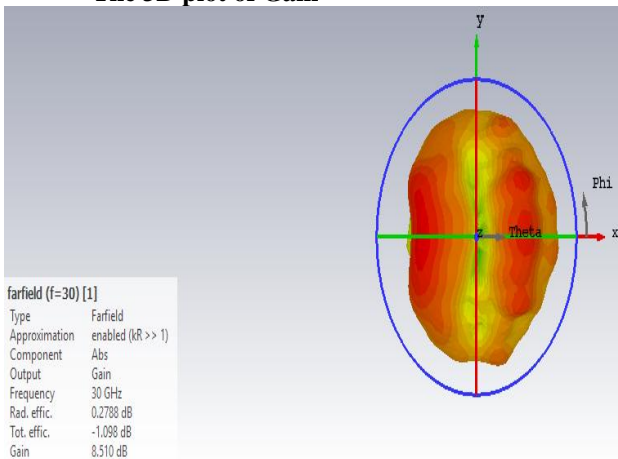


Fig.7. 3D plot of gain at 30GHz frequency

The gain is achieved 8.510dB at 30GHz frequency for planar array configuration (Fig.7)

• VSWR simulation

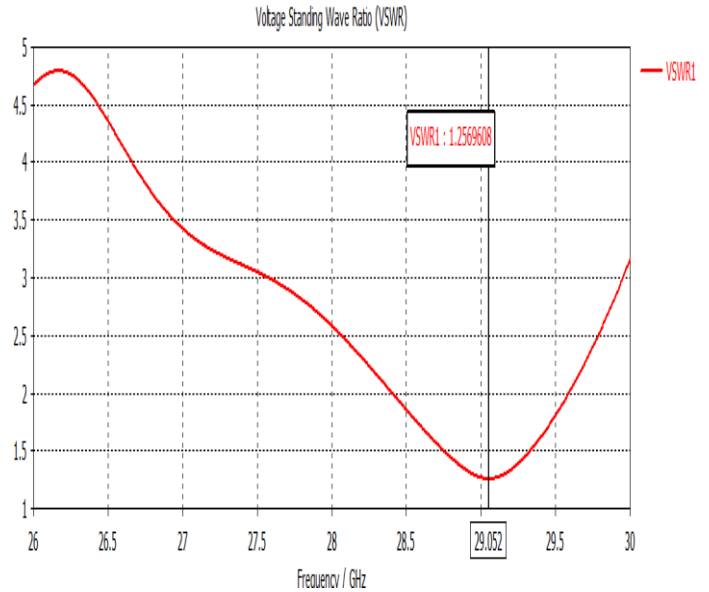


Fig.8. VSWR at 29.05GHz frequency

The value of VSWR should be less than 2, in simulated work (Fig.8) the value achieved is 1.25 at 29.05GHz frequency.

V. MODIFIED RESEARCH WORK WITH LINE FEED METHOD

Design and simulation of 6x5 planar array configuration of the micro-strip patch antenna with direct feed method instead of proximity feeding technique. Now for this method of direct feed one substrate is removed that means only one substrate will be used instead of two and the feed is direct applied to the design/simulation. The dimension's (Fig.4) sizes get reduced due to reduction in the thickness while designing by using only one substrate and the substrate material is Taconic TLY-5 the ground and patch are of Cu (copper) material.

A. Result of 6x5 planar array configuration of the micro-strip patch antenna with line feed technique.

By applying the micro-strip line feed technique instead of propinquity feeding method [12] on (Table III). Fig.4 structure and analysed outputs as;

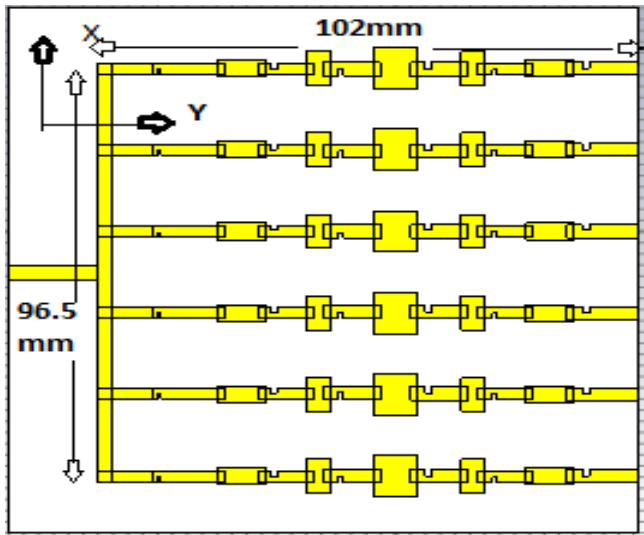


Fig.9. Design of planar array configuration of the micro-strip with line Feed technique structure

B. Result of planar array configuration of the micro-strip patch antenna with line feed technique.

The simulation outcomes are shown further as how much gain is increased, the achievement of directivity of the proposed antenna, the VSWR (Voltage standing Ratio), the s-parameter value, all the simulation is done by using the parameters (Table III) and the designed for proposed micro-strip antenna (Fig.9) is simulated all work is simulated on a CST Tool.

• **The result of s-parameter simulation**

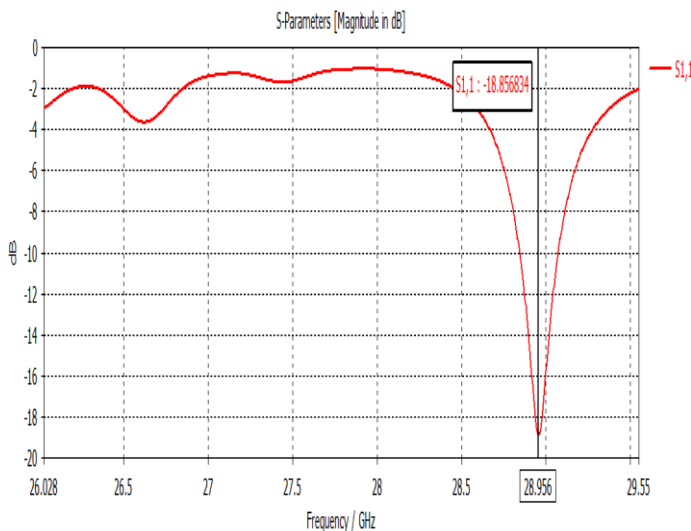


Fig.10. S-parameter at 28.956GHz frequency

The value should be less than -10dB, the value of s-parameter (Fig.10) achieved is -18.85dB, and it is measured as the good value the gain and directivity values are ;

• **The 3D plot of Gain**

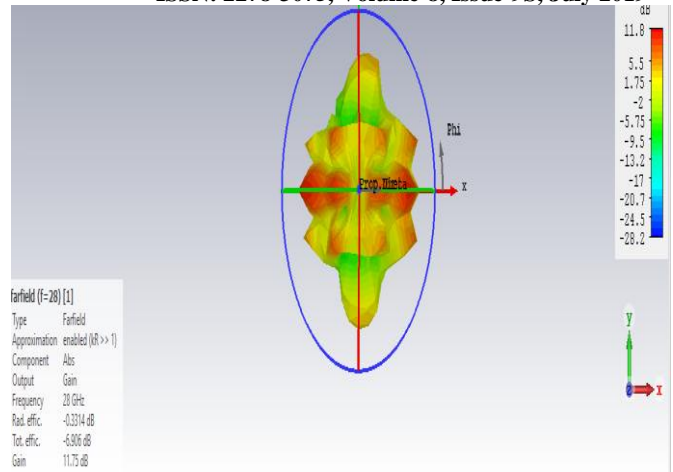


Fig.11. 3D plot of gain at 28GHz frequency

The gain is achieved 11.75dB at 28GHz frequency for planar array configuration (Fig.11)

• **The 3D plot of directivity**

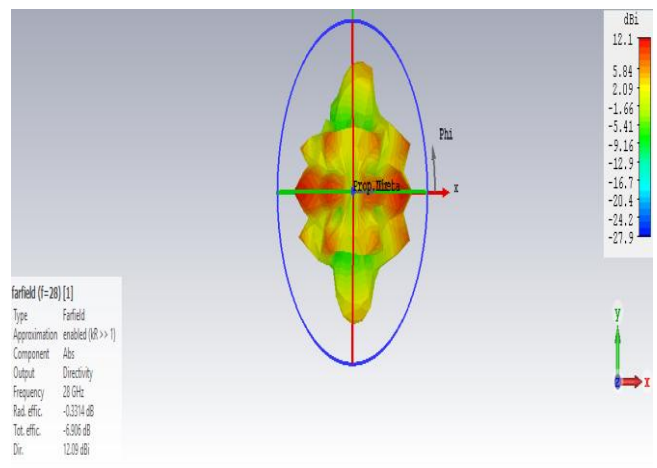


Fig.12. 3D plot of directivity at 28GHz frequency

The directivity is achieved 12.09dBi at 28GHz frequency for planar array configuration (Fig.12)

• **VSWR simulation**

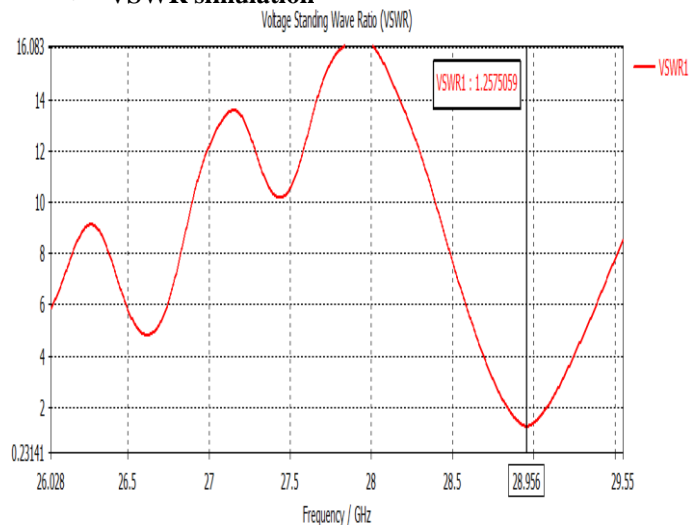


Fig.13. VSWR at 28.95GHz frequency

The value of VSWR should be less than 2, in simulated work (Fig.13) the value achieved is 1.25 at 28.92GHz frequency.



VI. E-FIELD AND H-FIELD

The E field and H field are also shown here, according to the simulation of 6x5 planar array configuration of the micro-strip patch antenna with line feed method both fields (E Field and H Field) are also observed in this simulation at 26-30GHz frequency and simulated by CST software. For the E-Field the main lobe magnitude is 9.88dBV/m, main lobe direction is 0.0 deg. With angular width (3dB) is 11.1 deg (Fig.14) with side lobe level -2.1dB and for the H-Field the main lobe magnitude is -41.6dBA/m, main lobe direction is 0.0 deg. With angular width (3dB) is 11.1 deg (Fig.15) with side lobe level -2.1dB.

• **E-Field**

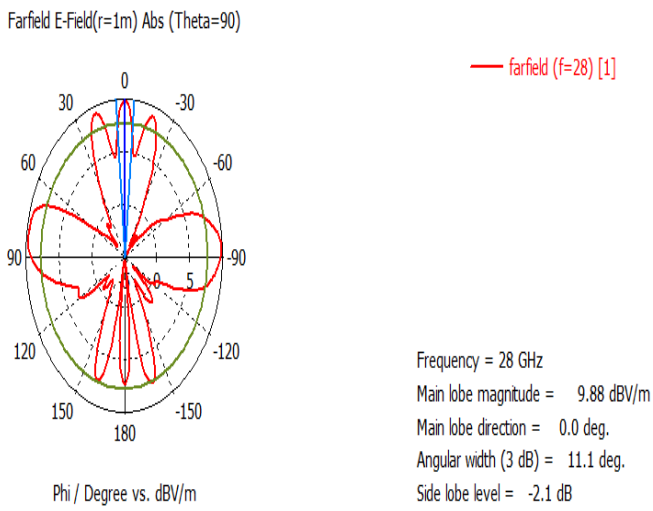


Fig.14. E-Field at 28GHz frequency

• **H-Field**

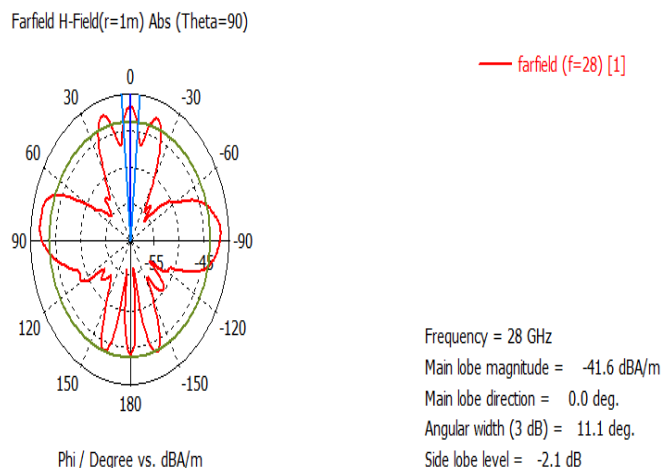


Fig.15. H-Field at 28GHz frequency

The angular width (3dB) of planar array configuration of the micro-strip patch antenna with line feed technique work is near to 11deg. in the E-field and H-field and the half-power beam width is near to 15 deg. in the E-field and H-field for planar array [13] configuration of the micro-strip patch antenna with proximity feed technique.

VII. COMPARISON OF TECHNIQUES

Comparison and simulation result of planar array configuration of the micro-strip patch antenna simulation with two different techniques:

- Proximity feed technique
- Line feed technique

Comparison shown as in the tabular form under (Table IV)

TABLE IV: COMPARISON OF TECHNIQUES

Micro-strip patch antenna array	Micro-strip patch array antenna with proximity feed technique	Micro-strip patch array antenna with line feed technique
Resonant frequency	26-30GHz	26-30GHz
s-parameter	-18.87	-18.85
Gain	8.510 dB	11.75 dB
Directivity	8.231 dBi	12.09 dBi
VSWR	1.25	1.25

VIII. CONCLUSION

A design of a novel-Proximity coupled micro-strip planar Antenna has been presented with low cost. It consists of high gain mm wave Antenna it gives the advantages over traditional microwave Antenna & benefits for 5G applications. The proposed Antenna has Gain of over 11.75dB with Directivity 12.09dB at 28GHz with good Return-loss. The antenna can discover potential application for future wireless communication based antenna propagation determined. The structure of a novel coupled smaller scale strip planar antenna is proposed and manufactured. The designing depends upon an arrangement sustaining procedure that takes into consideration a tight planar cluster design to be effectively developed. These antennas are extremely valuable in applications where reduced dimensions noteworthy prerequisite. It might additionally be upgraded for staged cluster applications, the proposed 6 x 5 cluster has an angular width is very near to 11 deg. at 28 GHz with an impedance data transfer capacity of 9.8%. The soundness of the structure is outlined by the likenesses in the recreated and estimated outcomes, making it truly appropriate for combination in 5G applications. The design added with line feed technique that can be easily simulated and because of the results of this work like wide radiation pattern and good directivity it may considered as the efficient antenna having better efficiency, good return loss, good VSWR value as well achievement

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