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MIMO Smart Antenna – A Review

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Abstract:- MIMO technologies serves a multipath characteristic by using various, "smart" transmitters and receivers with an added "spatial" dimension to enhance efficiency and operating frequency of a normal antenna structure. MIMO basically serves the function to send and receive signals stream with n number of antennas at the same particular time. In this paper, distinct types of MIMO smart antennas were presented such as isolation techniques between ground layer and the patch, split ring resonator MIMO antennas, MIMO antenna on Half mode SIW, MIMO antenna design with Defective Ground Structure etc.

The purpose of presenting all this Paper is to come on the novel design of MIMO antenna with the help of Substrate Integrated Waveguide (SIW) and Defective Ground Structure (DGS) both so that both the advantages of SIW and DGS can be incorporated in the proposed antenna such as compactness, low loss, planar etc.

I. INTRODUCTION

➢ *MIMO Antenna*

MIMO (numerous information, different result) is a receiving wire innovation for remote interchanges in which various radio wires are used at both the input end which is our transmitter and the output end which is our collector. By supporting the limit of radio recurrence (RF (Radio Frequency)) frameworks, MIMO makes a steadier association and less clog. Various info numerous results, or MIMO, is an remarkable invention in the field of RF communication that is being perfectly utilized in the numerous applications of RF communication in present era. Wi-Fi; Long Term Evolution, and numerous other radio, remote and RF advancements are utilizing the new MIMO remote innovation to give expanded interface limit and unearthly effectiveness joined with further developed connect unwavering quality utilizing what were recently viewed as obstruction ways. Indeed, even presently numerous MIMO remote switches are available, and as this RF innovation is turning out to be broader, more MIMO switches and different things of remote MIMO gear will be seen.

II. TYPES OF MIMO ANTENNAS

➢ *MIMO Antenna Based on Split-Ring Resonators*

We already know that the fifth generation is emerging and becoming a hotspot for the global market in the field of communication. In this antenna A two-component MIMO microstrip antenna with two varied SRRs are studied. The development of the antenna connection is achieved in this way. Studies show that interoperability in the middle, SRR-loaded MIMO antenna is well pressed, and the improved MIMO antenna works better. The limited results indicate a good deal. Ensures efficient operation of MIMO antenna. The separation between the antenna material is better than –25.1 dB over all required frequency bands. Simple, compact, inexpensive design makes it ideal for applications such as mobile terminals in FFH mobile generation connections.

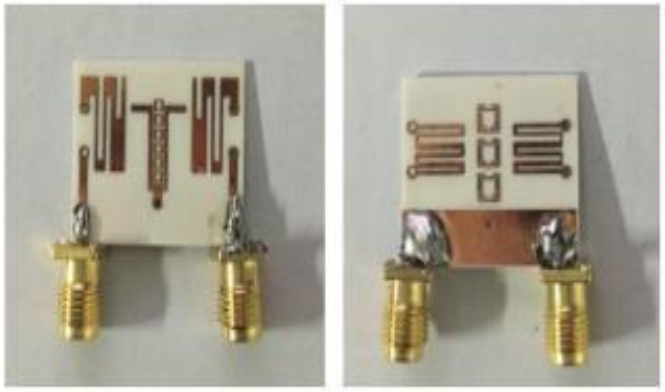
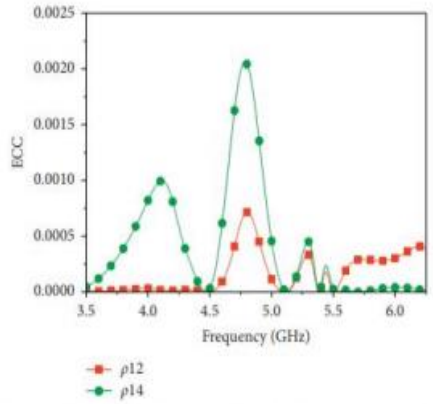


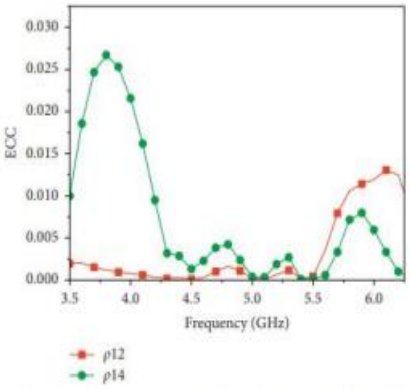
Fig. 1- MIMO Antenna Based on Split-Ring Resonator

➢ *Duo-Band MIMO Antenna with small Size and great Isolation Based on Half-Mode SIW*

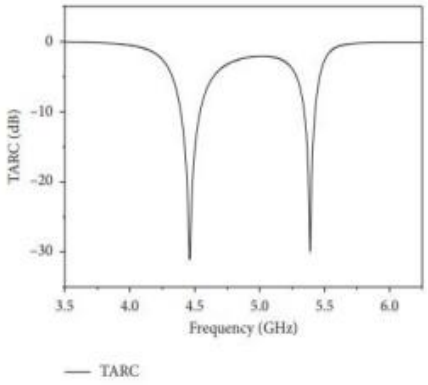
Good separation was obtained by means of spatial variability and polarization. Enhancement of approximately 10 dB separation was achieved by inserting SNLs into the MIMO antenna between ra antenna material without increasing the size of the original MIMO antenna. At only 0.036 λ0 from the edges to the edge between the objects, the average separation in both bands was more than 35 db. In addition, the various performance of the proposed MIMO antenna is ideal for a high-level MIMO antenna system.



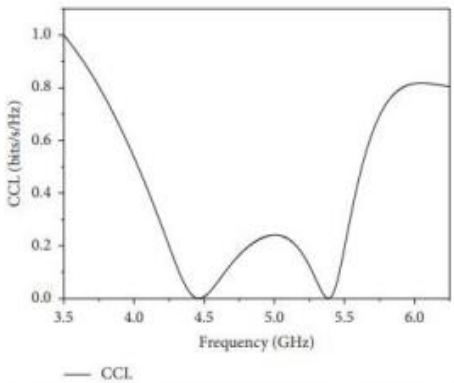
A- Computed ECC of the proposed MIMO antenna using S-parameters.



B- Computed ECC of the proposed MIMO antenna using three-dimensional far fields.



C- Computed total active reflection coefficient (TARC) of the proposed MIMO antenna

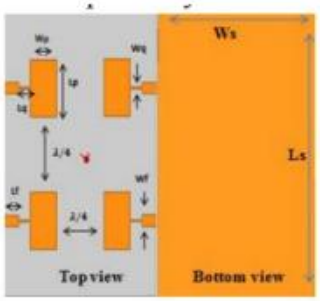


D- Computed channel capacity loss (CCL) of the proposed MIMO antenna.

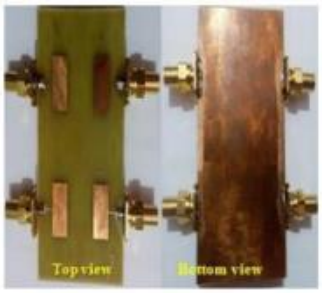
Fig 2

➢ *MIMO Antenna for upcoming Generation Wireless Applications*

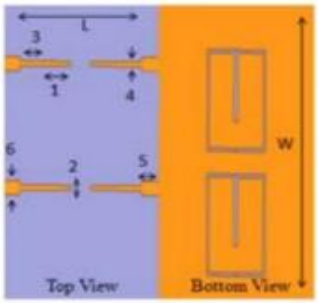
Integrated MIMO microstrip antenna with wide bandwidth, high data flow, low integrated integration and enhanced visual and imaginary size reduction using RSRS-DGS projects based on the degraded land structure plan has been introduced. The proposed MIMO antenna integrated antenna therefore can meet the requirements of the upcoming generation wireless communication device when the total device size less than 0.5 0. (0 wavelength wave).



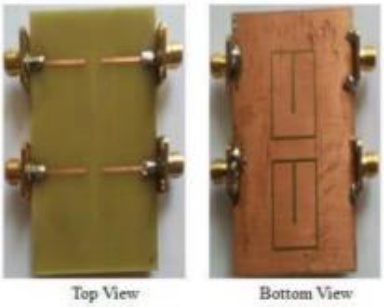
A- A simulated CMMA top and bottom view



B- A fabricated CMMA top and bottom view



C- A simulated PCMMA top and bottom views



D- A fabricated PCMMA top and bottom views

Fig 3

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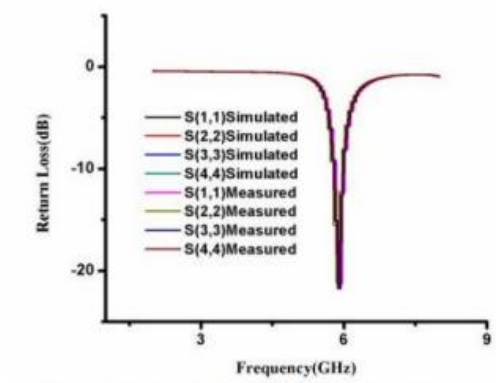
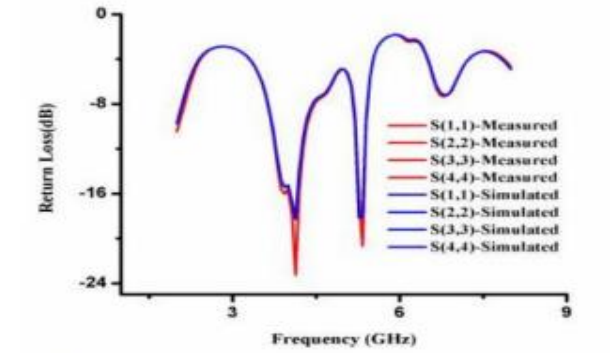
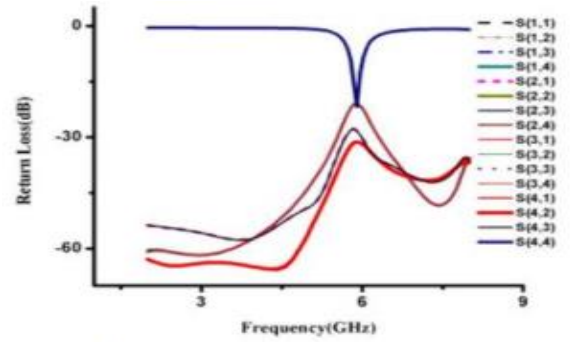


A- The Simulated and Measured Return loss characteristics of CMMA

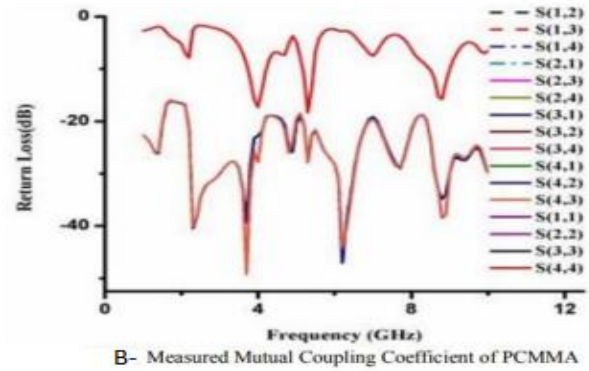


B- The Simulated and Measured Return loss characteristics of PCMMA

Fig 4



A- Measured Mutual Coupling Coefficient of CMMA



B- Measured Mutual Coupling Coefficient of PCMMA

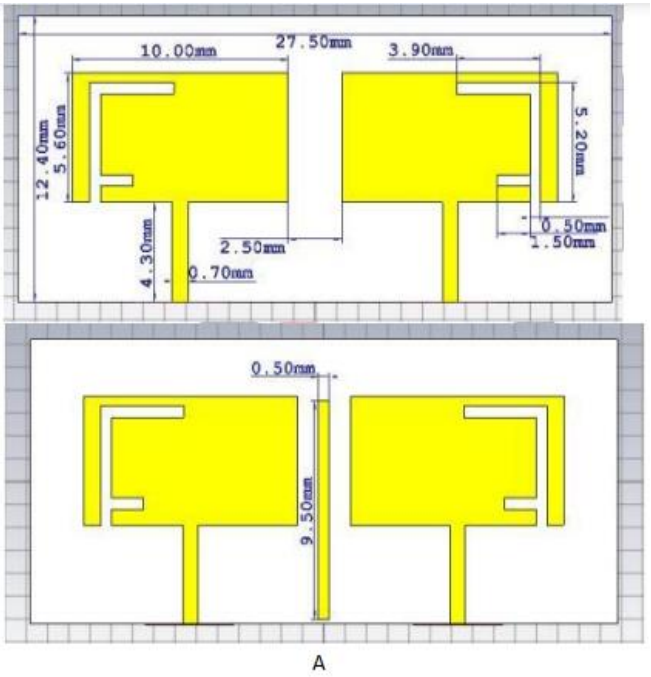
Fig 5

➢ *MIMO Antenna with Flawed Ground Structure*

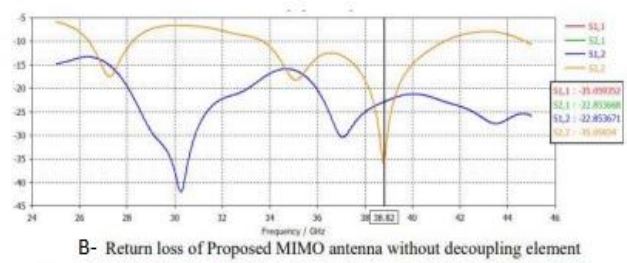
This type of MIMO antenna consists of radioactive emissions, a substance with a dielectric constant and a low plane. Research is underway to use the design and development of new models for radiation exposure and to develop the design and development of new optical pool systems. MIMO antenna emission depends on the feed line paths. The MIMO antenna reduces errors, increasing data flow and channel capacity compared to SISO (Single Input Single output), SIMO (Single Input Multiple output), and MISO programs (Multi-output).

➢ *A MIMO antenna for 5G band*

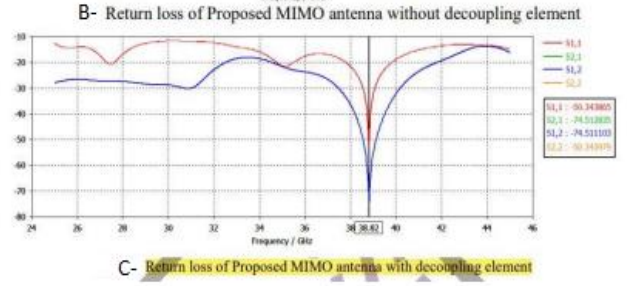
We know the main disadvantage of any MIMO antenna is the "Mutual Coupling". Many researchers provided various solutions which worked to some extent but were found to be extremely hard to understand or complex. To ease the solution to this and to use it for modern technology like 5G band the researcher produced a solution to add the decoupling element which were named as "I shaped resonator". After this supply was given to antenna and for this purpose Microstrip Line Feeding was used. Toget a clear idea, here are the outcomes before and after adding the decoupling element.



A



B- Return loss of Proposed MIMO antenna without decoupling element



C- Return loss of Proposed MIMO antenna with decoupling element

Fig 6

➢ *MIMO Prototype in C-band frequency*

Creating a MIMO stack to reduce the size of the future wireless connection is a growing challenge that leads to similar integration. Microstrips and annular parasitic twins of rectangular and open ribs are put in front of each microstrip despite a low round area to minimize the impact of the joint assembly. The antenna design was started with a 30 * 30 mm2 material consisting of three layers such as) a layer b) a layer divider c) a layer of soil. For a clearer view of the design results here is the S- parameter.

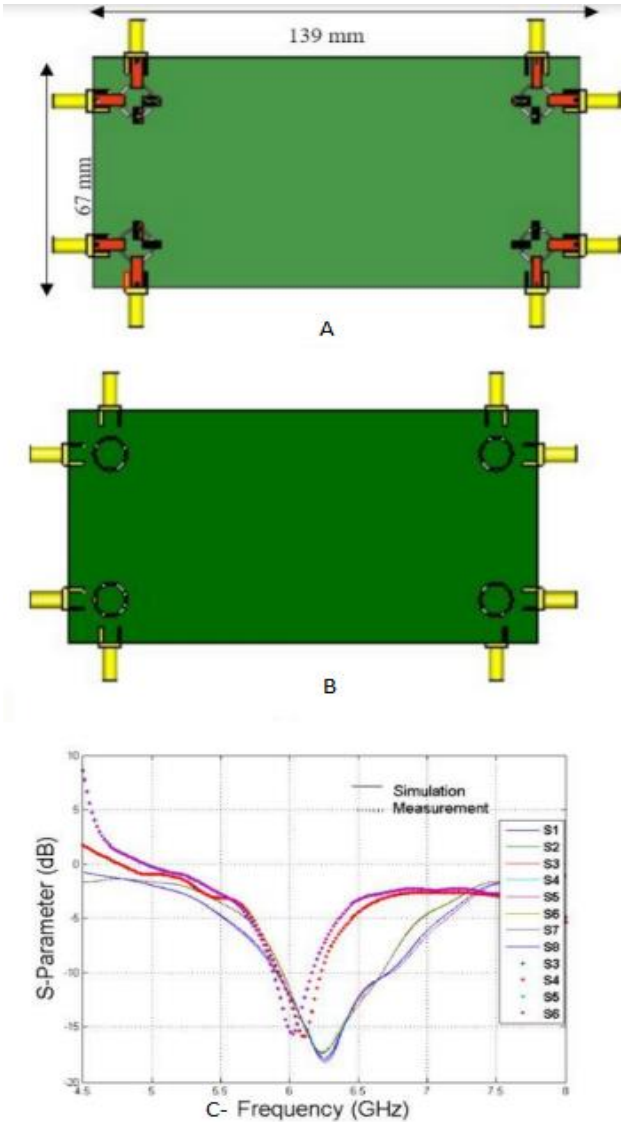


Fig 7:- A- upper view , B- bottom view and C- S-parameter

➢ *MIMO Antennas for Mobile Communication*

This antenna was designed for mobile communication in which at the center 4 F-shaped elements were placed faded from top and bottom using feeding method. Feed, feedline and the patches were designed just to have an impendence of not more than 50 ohms. The results of this antenna were like it provided a better return loss and radiation characteristics which suits mobile communication. The design can be extended to its multiples to enhance the performance. Also, by increasing the channel capacity, the range of transmitted signal can be increased.

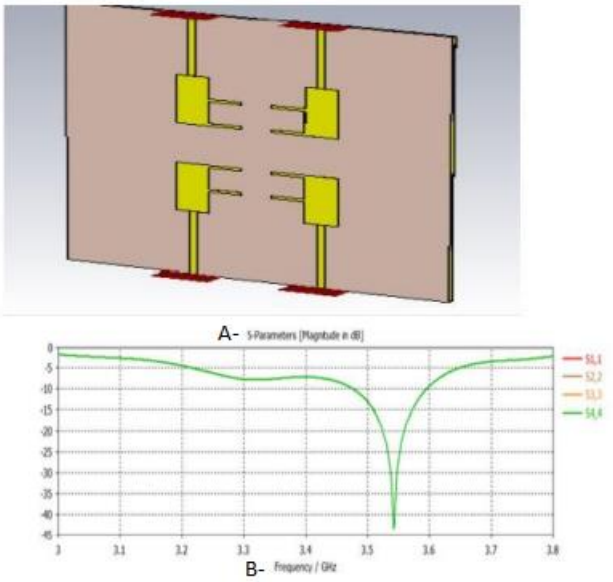


Fig 8:- A- design B- S-parameter

➢ *Antenna System for High Order MIMO Device*

This is said to be designed for four- or six-component mobile devices. The main purpose of this was to obtain better separation, wider band width, and simultaneous simplification in the densest area with the FR4 substrate. The design covers the smallest volumes to date and includes the LTE2300, GSM1900, 2.43-GHz LTE2500 and WLAN. One of the notable features about this antenna is that it does not include any separating circuit and has a good contrast between using different patterns. With these results the results showed that the t-coefficient of t-relationship between any two parts of the MIMO stack was less than 0.56; the maximum gain is more than 1.2 dB; the difference which is present between the average operating benefits about the antenna components is less than 3.2 db.

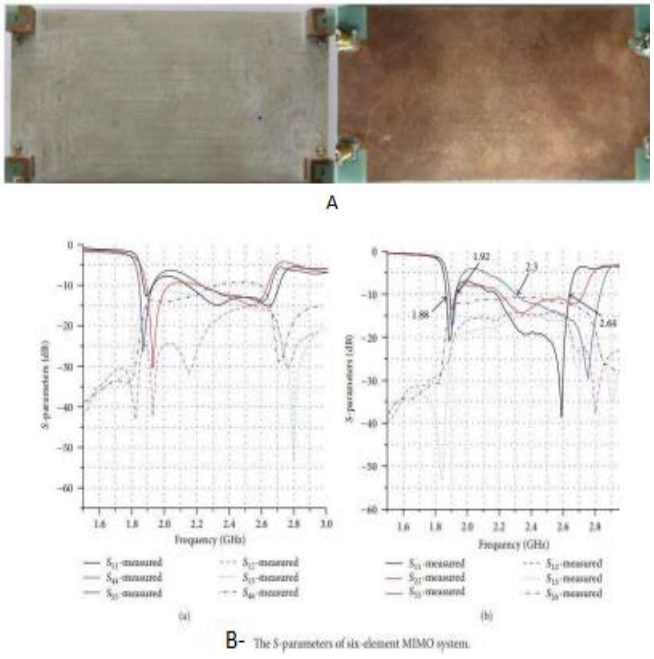
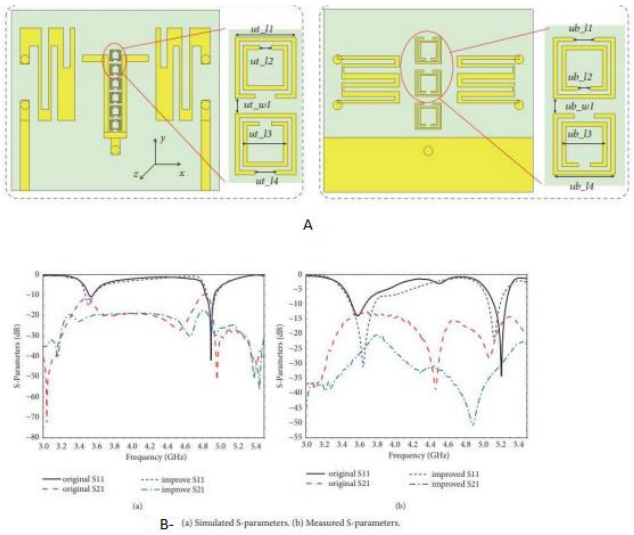


Fig- 9 element MIMO system, S-Parameter

➢ *Condensed size 5G Decoupling MIMO Antenna consisting Split-Ring Resonators*

5G MIMO antenna with SRR is recommended. A dual-component MIMO microstrip antenna with various SRR sizes is ready. The development of the antenna connection is achieved in this way. Studies show that interoperability in the middle, SRR-loaded MIMO antenna is well pressed, and the modified MIMO antenna works closure to the expected results. The limited results indicate a good deal. Ensures efficient operation of MIMO (Multiple input and multiple output) antennas. The space inside the antenna material is about - 25dB over all necessary bands of frequency. Simple, condensed size,affordable structure which makes it ideal for important usage such as mobile terminals for ffh mobile generation connections.



(a) Simulated S-parameters. (b) Measured S-parameters.

Fig 10

III. CONCLUSION

Throughout this paper we have seen many designs of MIMO antennas and we also came across the fix of every issue that arises with the advancement of technology such as mutual coupling, size of the antenna etc. We also learned that the requirement of modern technology is to keep all the networks to be as compact as possible and to keep the things handy such as in the case of antennas having 4f shaped networks. To all the given problem statements and the fix for all those can be seen in condensed 5G Decoupling MIMO Antennas which was based on Resonators (Split-ring) in which the outcomes were the nearest match to solution of the modern problem.

REFERENCES

[1]. Asif Khan, Suiyan Geng, Xiangwen Zhao, Zahoor Shah, Mishkat Ullah and Mohamed Abdelkarim Abdelbaky. Design of MIMO Antenna with an Enhanced Isolation Technique. MDPI.

[2]. Ziyu Xu, Qisheng Zhang, and Linyan Guo. A Compact 5G Decoupling MIMO Antenna Based on Split-Ring Resonators. Hindawi , Volume 2019, Article ID 3782528.

[3]. Abubaker Ahmed Elobied ,Xue-Xia Yang, Ningjie Xie, and Steven Gao. Dual-Band 2 × 2 MIMO Antenna with Compact Size and High Isolation Based on Half-Mode SIW, Hindawi.

[4]. Shiddanagouda.F.B, Dr. Vani. R.M, Dr.P.V.Hunagund, Design and Analysis of Printed MIMO Antenna for Next Generation Wireless Applications

[5]. Shrenik Suresh Saradea , Sachin Ruikar, Development of Multiband MIMO Antenna with Defective, Science Direct.

[6]. Sudakshina Tiwari, Nitesh Kumar, A MIMO antenna for 5G band, ISSN: 2455-2631.

[7]. Nada M. Khalil AL-Ani, Oras A. Shareef AL-Ani, Mahmood F.Mosleh. A Design of MIMO Prototype in C-Band Frequency for Future Wireless Communications. Advanced Electromagnetics, Vol 9, No. 1, March 2020.

[8]. D.S.Bhargava, T.V.Padmavathy, Yadhamuri Vinitha Reddy, Neelapareddy Kavitha, Vuppalapati Hema, Design and Simulation of MIMO Antennas for Mobile Communication. et al 2020 IOP Conf. Ser.: Mater. Sci. Eng. 994 012033.

[9]. Zhaoliang Chen,1 Wen Geyi,1 Ming Zhang,2, and Jun Wang2, A Study of Antenna System for High Order MIMO Device, Hindawi Publishing Corporation International Journal of Antennas and Propagation Volume 2016, Article ID 1936797.

[10]. Ziyu Xu, Qisheng Zhang, and Linyan Guo. A Compact 5G Decoupling MIMO Antenna Based on Split-Ring Resonators, Hindawi International Journal of Antennas and Propagation Volume 2019, Article ID 3782528