ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 2, February 2017

# A 8.7 Ghz Antenna Array based on New Feeding Technique of SIW

Ravi Verma

M.Tech Student, Department of Electronics and Communication, SRMS CET ,Bareilly ,U.P., India

**ABSTRACT**: In this paper, SIW based antenna array are proposed ,a new concept of feeding technique is adopted to implement a slot antenna array .There are four radiating slots cut on patch for radiating antenna.In this all slots are cut symmetrically.A H slot cut on centre of patch. By feeding technique, we excite H slot by which four slots are excited.By this technique we improve bandwidth ranging from 8.09 Ghz to 8.9 Ghz (9.31%)and front to back ratio is approx. 17 dB and peak gain is better than 4 dB.

**KEYWORDS**: SIW, slot antenna, antenna array, feeding network.

## I. INTRODUCTION

In wireless system, both planar printed transmission lines and traditional waveguides encounter the same integration problem.In order to optimize the system integration, a novel guided structure called substrate integrated waveguide (SIW) has been put forward, as shown in Figure 1 (a) and electric field distribution shown in fig. 1 (b)Moreover, the system formed by the SIW not only have the favourable physical characteristic of planar printed transmission lines, but also possess the excellent performance of solid waveguide. The major advantages of SIW technology is the possibility to fabricate a complete circuit in planar form (including planar circuitry, transitions, rectangular waveguides, active components and antennas), using a standard printed circuit board or other planar processing techniques. Moreover, the possibility to mount one or more chip-sets on the same substrate. There is no need of transitions between elements fabricated with different technologies, Due to various advantages SIW based various antennas are proposed [1]-[7].

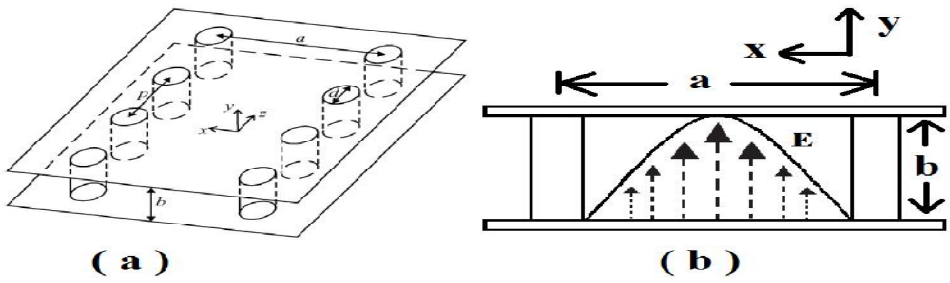



Fig.1(a)&(b) Substrate Integrated Waveguide with Electric Field component.

Antenna array are used to improve the gain and bandwidth of an antenna. A power divider and combiner concept is used for feeding network. Design of antenna and side view are shown in fig a & b.

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 2, February 2017

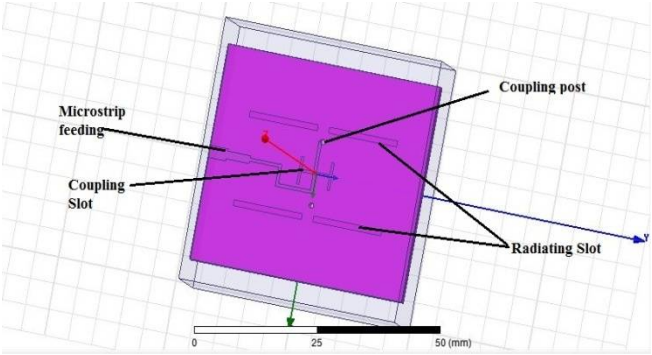



Fig.2. Design of antenna array

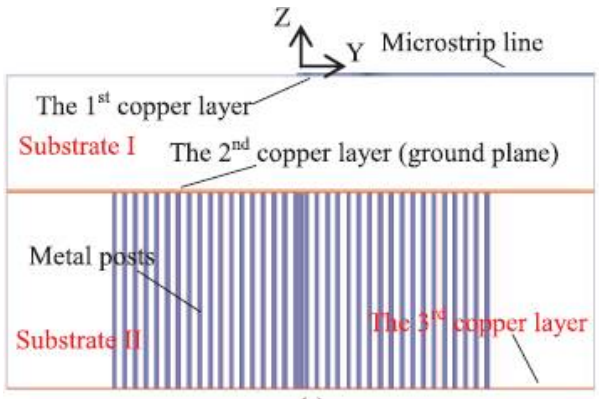



Fig. 3. Side view of antenna array

In this paper, SIW based slot antenna array are simulated on HFSS 14.0. A feeding concept is used to excite the coupling slot i.e. H slot by which all slots which are symmetric excited and antenna starts radiating .

## II. ANTENNA STRUCTURE

The proposed antenna array shown in fig.2.The antenna array is design to operate on 8.7 Ghz.From proposed antenna diagram, it can be seen that the array is symmetric about XZ plane . It consist of four radiating slot, a microstrip feeding line, a coupling H slot and metal post. The SIW [8] structure formed by placing a metal posts, by this it form a cavity.

In this we use double substrate which is shown in figure 3, of thickness 1.575mm and 0.79 mm and dielectric constsnt of 2.33 of RT Duroid 5880. The microstrip feeding mounted on 1st copper layer and main antenna placed on 2nd copper layer. Basically H slot couples the energy from microstrip feeding line to radiating slot.

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 2, February 2017

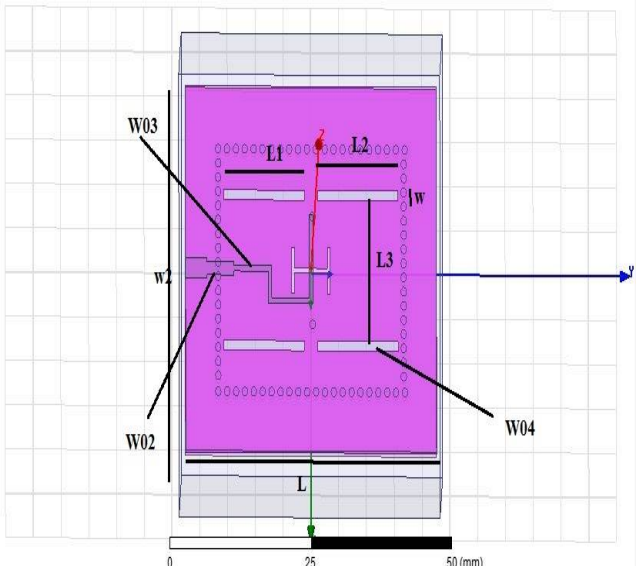



Fig 4 Antenna Array of 2×2

The dimensions of proposed antenna array listed below-

| S.N. | Parameter | Dimension(mm) |
|---|---|---|
| 1 | L | 45.18 |
| 2 | W | 1.6 |
| 3 | L1 | 14.5 |
| 4 | L2 | 14.5 |
| 5 | L3 | 15.86 |
| 6 | W2 | 41.18 |
| 7 | W02 | 1.49 |
| 8 | W03 | 0.6 |
| 9 | W04 | 1.13 |

The metal posts having radious of 0.5 mm and spacing is 1.6 mm which is calculated based on following formula-

Diameter(d)< $\lambda g$

Spacing < 2d

Where,

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

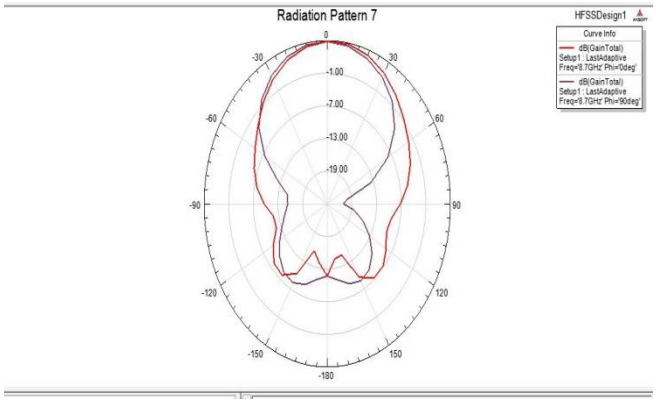
International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

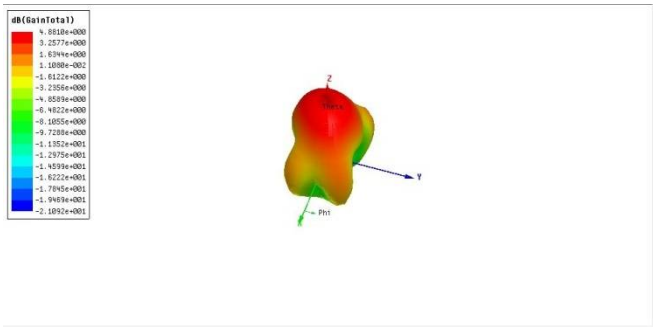
Website: www.ijircce.com

Vol. 5, Issue 2, February 2017

$$\lambda_g = \frac{2\pi}{\sqrt{\frac{\varepsilon_R (2\pi f)^2}{c^2} - \left(\frac{\pi}{a}\right)^2}}$$




5(a)




5(b)

Fig5(a)Radiation pattern of antenna array 5(b)3D Gain of antenna array.

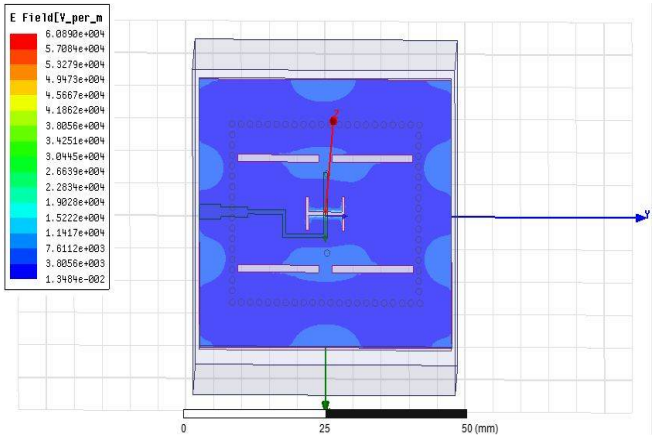



Fig 6 E- field of antenna array

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 2, February 2017

In Fig 5(a), radiation pattern of antenna array shown , by which we can say that it is of directional type antenna whose radiations are directed towards one direction & rejected in other direction, and by fig 5(b) it is observe that gain of antenna is about 4.88 db, fig 5(c) explain the electric field distribution of antenna array.

## III. SIMULATION RESULT

This antenna array is simulated on HFSS 14.0.The length and width of antenna is approx. one and one fourth of wavelength.

The simulated results are shown in fig 5,6,7 and 8.The return loss at 8.7 Ghz is 17.33 dB , bandwidth of proposed antenna array is from 8.09 Ghz to 8.9 Ghz which is approx 9.31% , but it enhances from previous antenna discuss in [9]. The VSWR is approx 1.33 which is shown in fig 8.

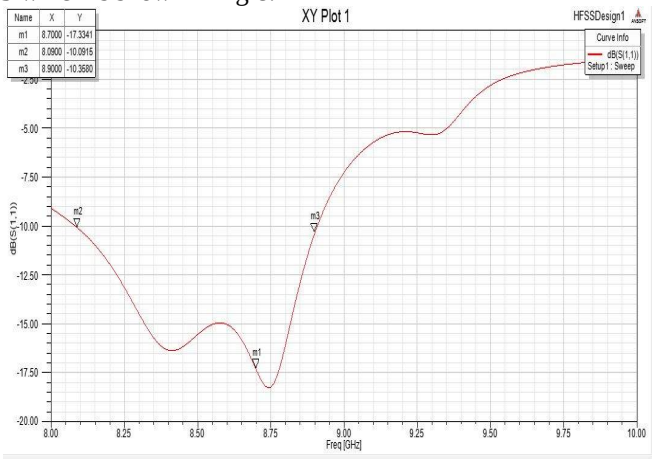



Fig 7 Return Loss of proposed antenna array

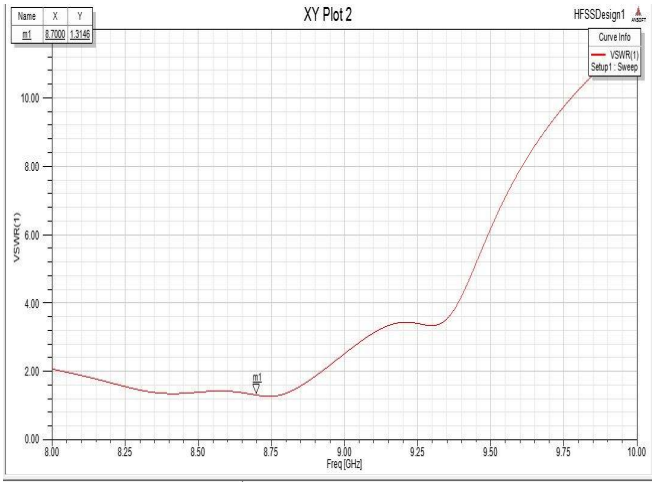



Fig 8 VSWR of proposed antenna array

Very thank to this feeding technique to give us front to back ratio is 17 db.

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

*(An ISO 3297: 2007 Certified Organization)*

*Website: www.ijircce.com*

**Vol. 5, Issue 2, February 2017**

## IV. CONCLUSION

In this paper a new feeding technique is proposed to improve the bandwidth from previous proposed antenna.We obtain 9.31 % of bandwidth .This antenna can be used in various wireless communication system.Thanks to new feeding technique, a coupling aperture slots and metal post. By using this we can reduce number of metal posts which reduces fabrication cost.

The antenna structure exhibits advantages of simple structure, high array gain, and high front to back to ratio.

## REFERENCES

1. K. S. Chin, W. Jiang, W. Q. Che, C. C. Chang, and H. Y. Jin, "Wideband LTCC 60 GHz antenna array with a dual-resonant slot and patch structure," IEEE Trans. Antennas Propag., vol. 62, no. 1, pp. 174–182, Jan. 2014.
2. M. H. Awida, S. H. Suleiman, and A. E. Fathy, "Substrate integrated cavity-backed patch arrays: A low-cost approach for bandwidth enhancement," IEEE Trans. Antennas Propag., vol. 59, no. 4, pp. 1155–163, Apr. 2011.
3. M.Mbaye, J. Hautcoeur, L. Talbi, and K. Hettak, "Bandwidth broadening of dual-Slot antenna using substrate integrated waveguide (SIW)," IEEE Antennas Wireless Propag. Lett., vol. 12, pp. 1169–1171, Sep. 2013.
4. J. F. Xu, Z. N. Chen, X.M. Qing, andW. Hong, "Bandwidth enhancement for a 60 GHz substrate integrated waveguide fed cavity array antenna on LTCC," IEEE Trans. Antennas Propag., vol. 59, no. 3, pp. 826–832, Mar. 2011.
5. J. F. Xu, Z. N. Chen, X. M. Qing, and W. Hong, "140-GHz TE20-mode dielectric-loaded SIW slot antenna array in LTCC," IEEE Trans. Antennas Propag., vol. 61, no. 4, pp. 1784–1793, Apr. 2013.
6. D. F. Guan, Z. P. Qian, Y. S. Zhang, and Y. Cai, "Novel SIW cavitybacked antenna array without using individual feeding network," IEEE Antennas Wireless Propag. Lett., vol. 13, pp. 423–426, Mar. 2014.
7. P. K. Park and I. P. Yu, "Characterization of dumbbell slots in rectangular waveguide by method of moments," in Proc. Antennas Appl. Symp., Sep. 1984, pp. 1–6.
8. D. Deslandes and K. Wu, "Accurate modeling, wave mechanisms, and design considerations of a substrate integrated waveguide," IEEE Trans. Microw. Theory Techn., vol. 54, no. 6, pp. 2516–2526, Jun. 2006.
9. P.Wu and Q. Xue, "A substrate integrated slot antenna array using higher order mode feeding network," in Proc. Asia-Pac. Microw. Conf., 2014, pp. 348–350.