IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

DESIGN OF V-SHAPE ANTENNA FOR 16 - ARRAY ELEMENT STRUCTURE

[1]K Suresh, [2]V Venkata Sravanthi

[1]PG Student, [2]Assistant Professor

[1]Digital Electronics and Communication Systems,

[1]Shree Institute of Technical Education, Tirupati, India

Abstract: Wireless communication plays important role in current technology. Antenna plays key role in working of communication one from another. Using high frequency is a new trend in present experimental world. Designing an Array antenna is quite different way to project into society. It's challenging way to implement & fabricate a V shaped antenna.The proposed antenna is a 4 by 4 patch array simulated for antenna characteristics. This work shows how the patch array can be characterized and how the circuit simulation is made to control feeding each patch element with different phase and magnitude changes to steer the main lobe of the antenna.

Index Terms **– Wireless communication, antenna, array antenna**

I. INTRODUCTION

Micro strip antennas are used in arrays as well as single elements [1, 8, and 13]. By using array in communication systems we enhance the performance of the antenna like increasing gain, directivity scanning the beam of an antenna system, and other functions which are difficult to do with the single element.

Feeding of micro strip array antenna is by series-feed network figure (a), or corporate- feed network figure (b).

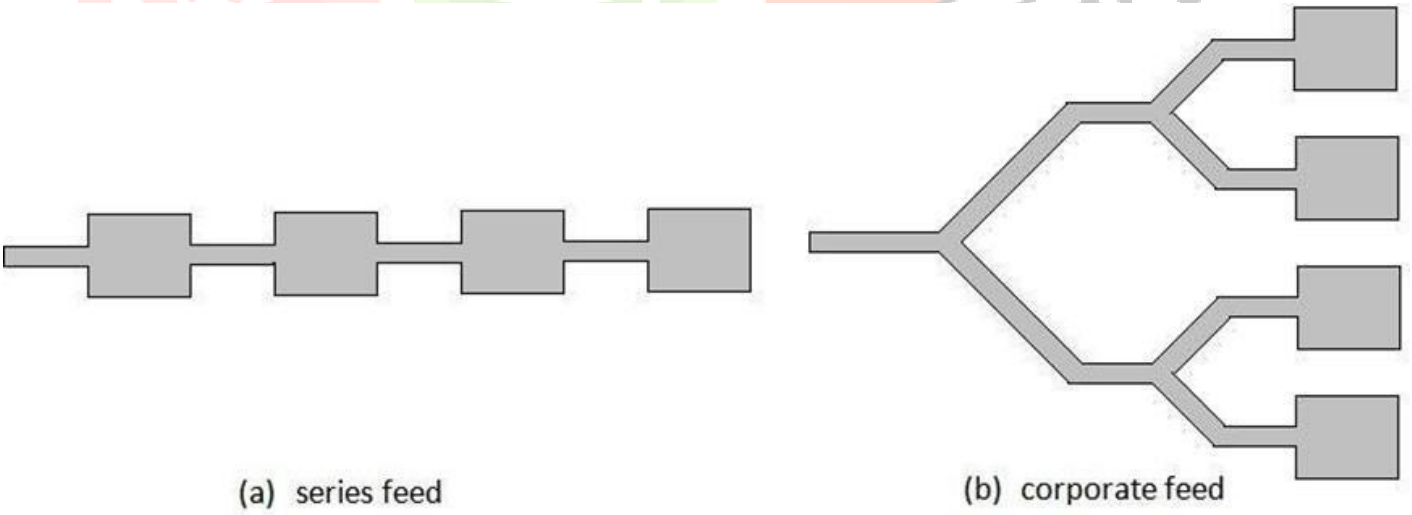


Figure 1. (a) & (b) Feed arrangement for micro strip patch array

The figure (2) shows the method of using the λ/4 impedance transformer lines to match the 100Ω patches to a 50Ω transmission line [1].

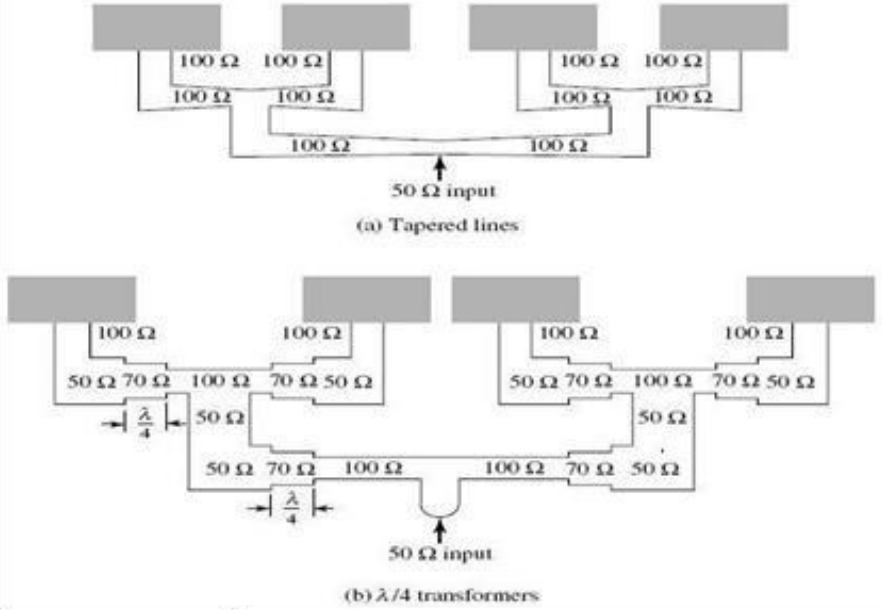


Figure (2) : $\frac{\lambda}{4}$ impedance transformer matching from

II. TWO ELEMENTS ARRAY:

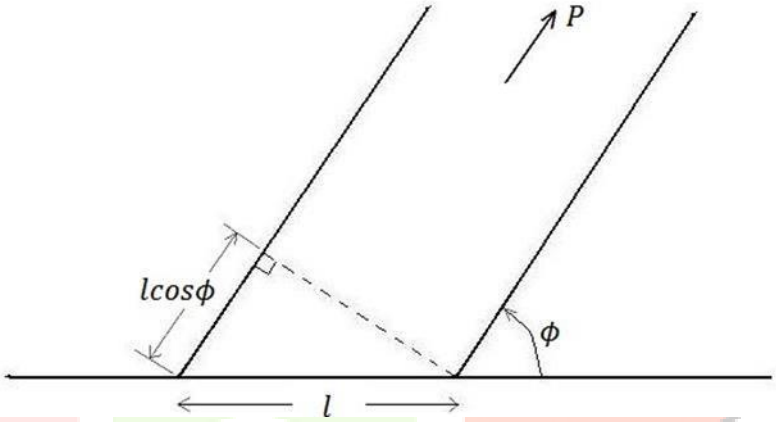


FIG (3) TWO- ELEMENT ARRAY

Suppose two antenna elements to make an array as in figure (3) above. The two elements are fed with current I1 and I2. I1 and I2are equal in magnitude but out of phase:

$I1 = I1^{2}\alpha$ (2.1)

The point of observation is in the far field, the path length difference is lcosα, where l the distance between the two elements is. As it is defined in [1, 9, and 13], the radiation of element l at P will lead the radiation of element 2 with angle where

$$\psi = \beta l cos\phi + \alpha$$

β = phase constant of the transmitted wave.

The total field at P is

$$E = E_1[1 + exp(j\psi)]$$

Where E_1 is the field at P due to element 1.

The magnitude of the field at P is

$$|E_\phi| = 2E_1 cos\left(\frac{1}{2}\psi\right)$$

$$= 2E_1 cos\frac{1}{2}(\beta l cos\phi + \alpha)$$

$$= 2E_1 cos(\frac{\pi l}{\lambda} cos\phi + \frac{\alpha}{2})$$

From above equation we can see that for a given phase difference and a given distance we can change the radiation pattern by changing l/λ.

III. LINEAR ARRAY

We have studied a simple array consist of two elements, now if we put more elements in the line of our two elements array, we build a linear array, figure (4).

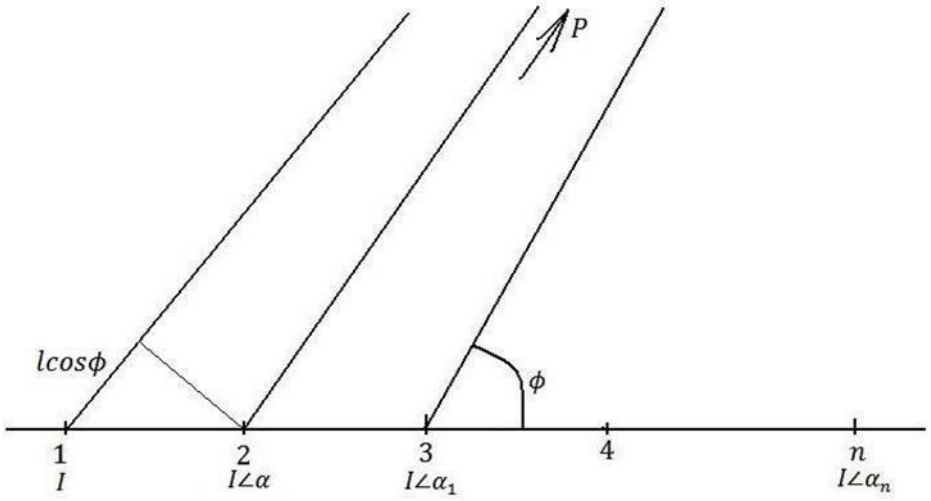


Figure (4) Uniform linear array of n elements

Now consider figure (4) of a simple linear array with equal separation between elements l and equal current in magnitute and equal difference in phase I

$$I, I\angle\alpha, I\angle\alpha_1, I\angle\alpha_2, \ldots\ldots I\angle\alpha_n$$

Field at point P is:

$$E = E_1[1 + e^{j\psi} + e^{j2\psi} + e^{j3\psi} + \cdots e^{jn\psi}]$$

The magnitude of E is:

$$E = E_o \left| \frac{\sin\frac{n\psi}{2}}{\sin\frac{\psi}{2}} \right|$$

$$\text{Where } \psi = \beta l cos\phi + \alpha$$

The quantity in above eauation is known as the array factor and it determines the shape of the radiation pattern. The other equation has a maximum when

$$\psi = 0 \text{ so } \beta l cos\phi = -\alpha$$

IV. IMPLEMENTATION

In this paper, we avoided the complex mathematics and used instead tools to test the antenna in different values of spacing between patches to obtain the desired pattern.

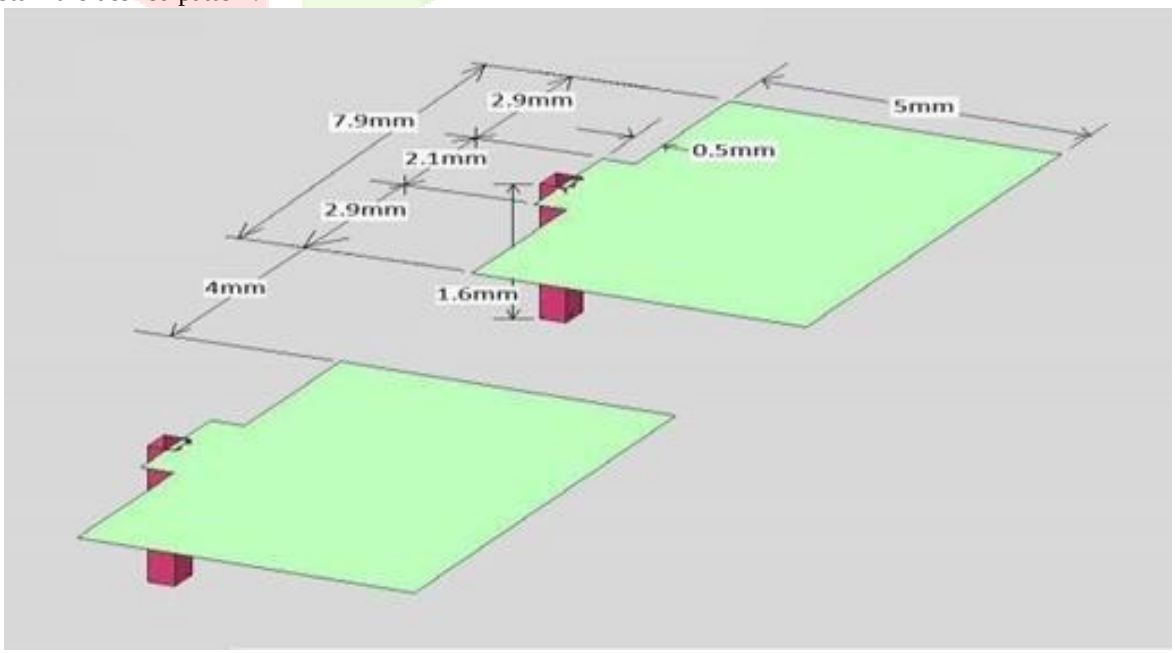


Figure (5) real dimensions of two-element array

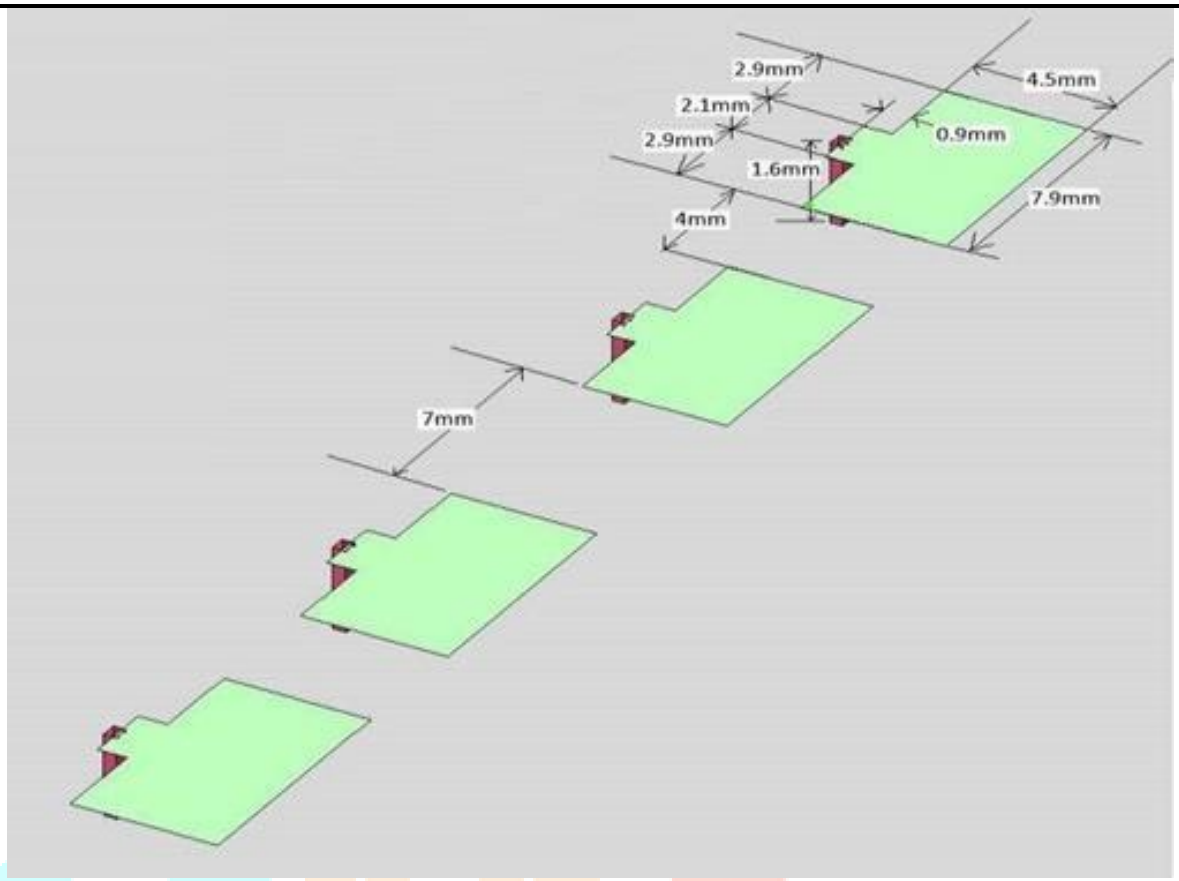
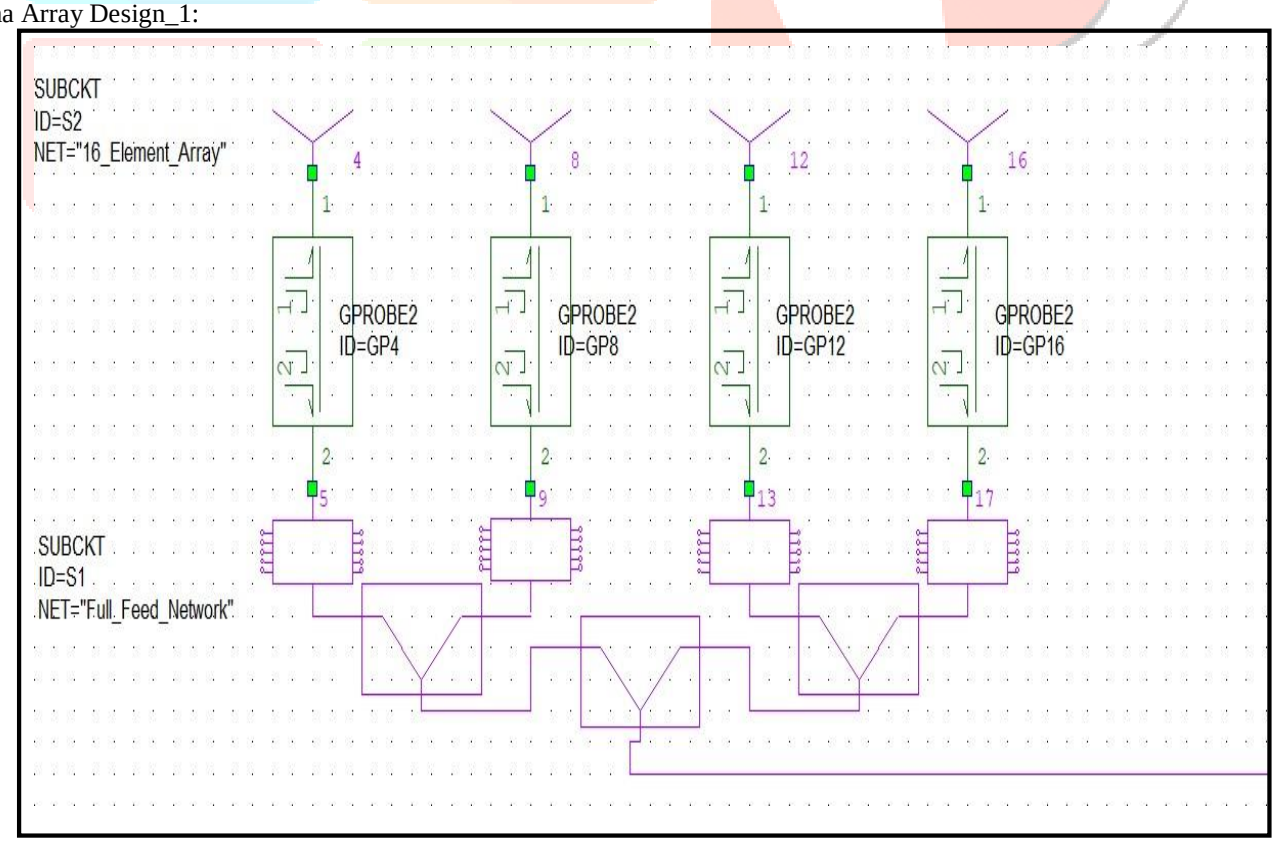


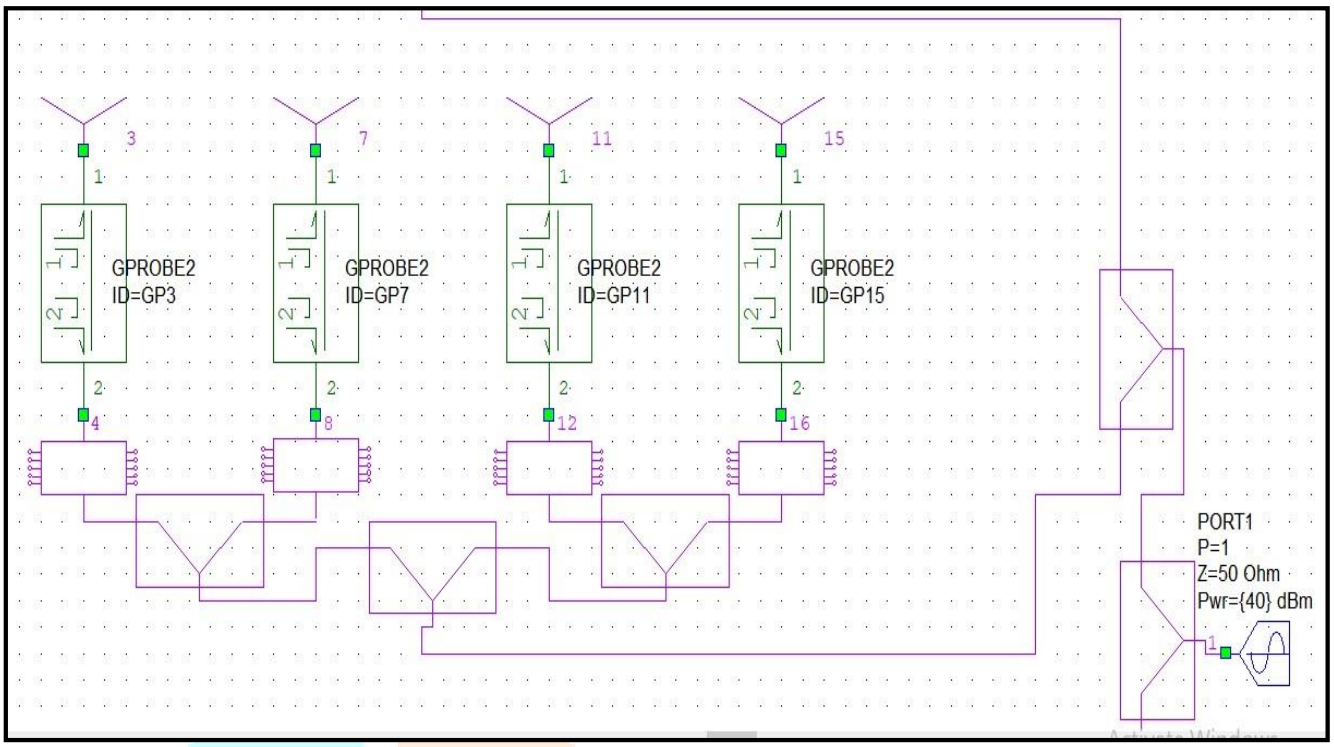
Figure (6) the real dimensions of the four-element array

We can now place the maximum as we wish by choosing α correctly [12]. The phase of each element in this array can be controlled by phase shifter, and the amplitude of the elements is adjusted by an amplifier or attenuator.

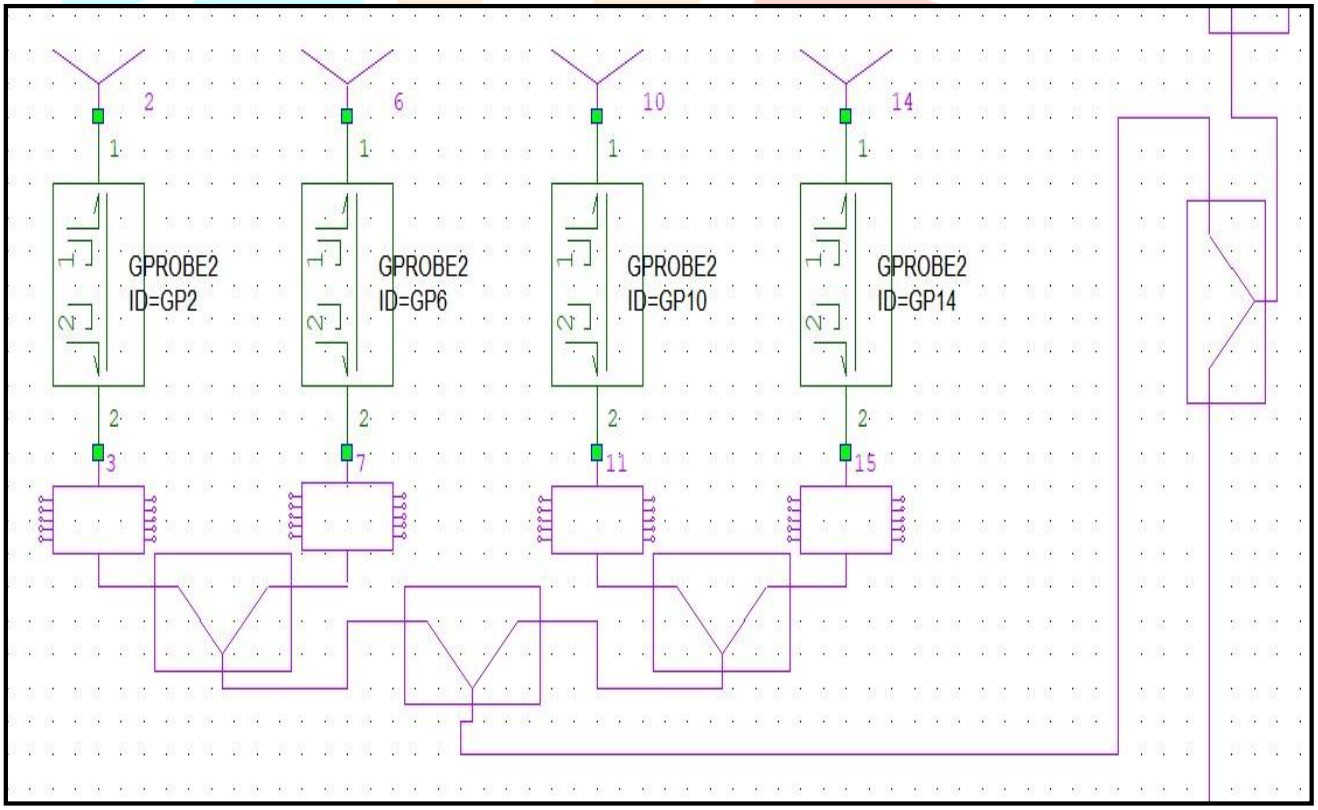
Antenna Array Design_1:



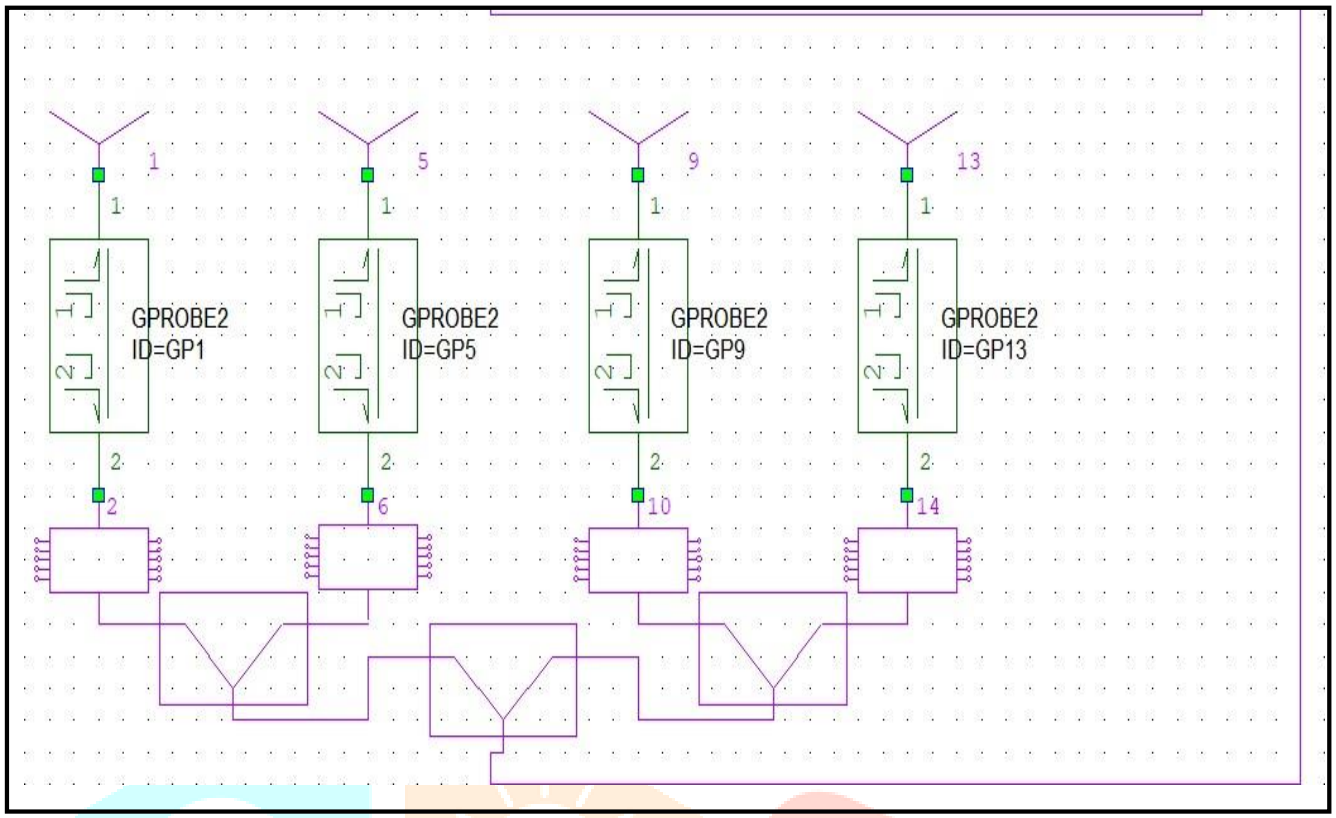
Antenna Array Design_2:



Antenna Array Design_3:

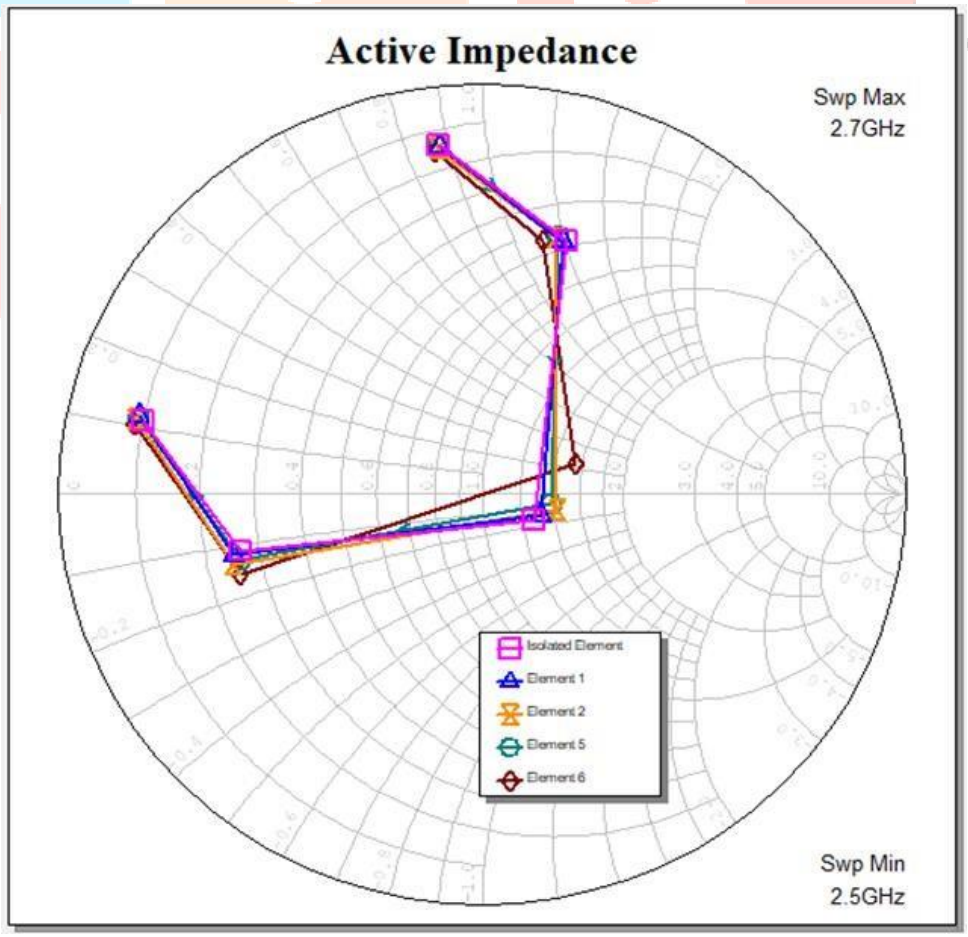


Antenna Array Design_4:

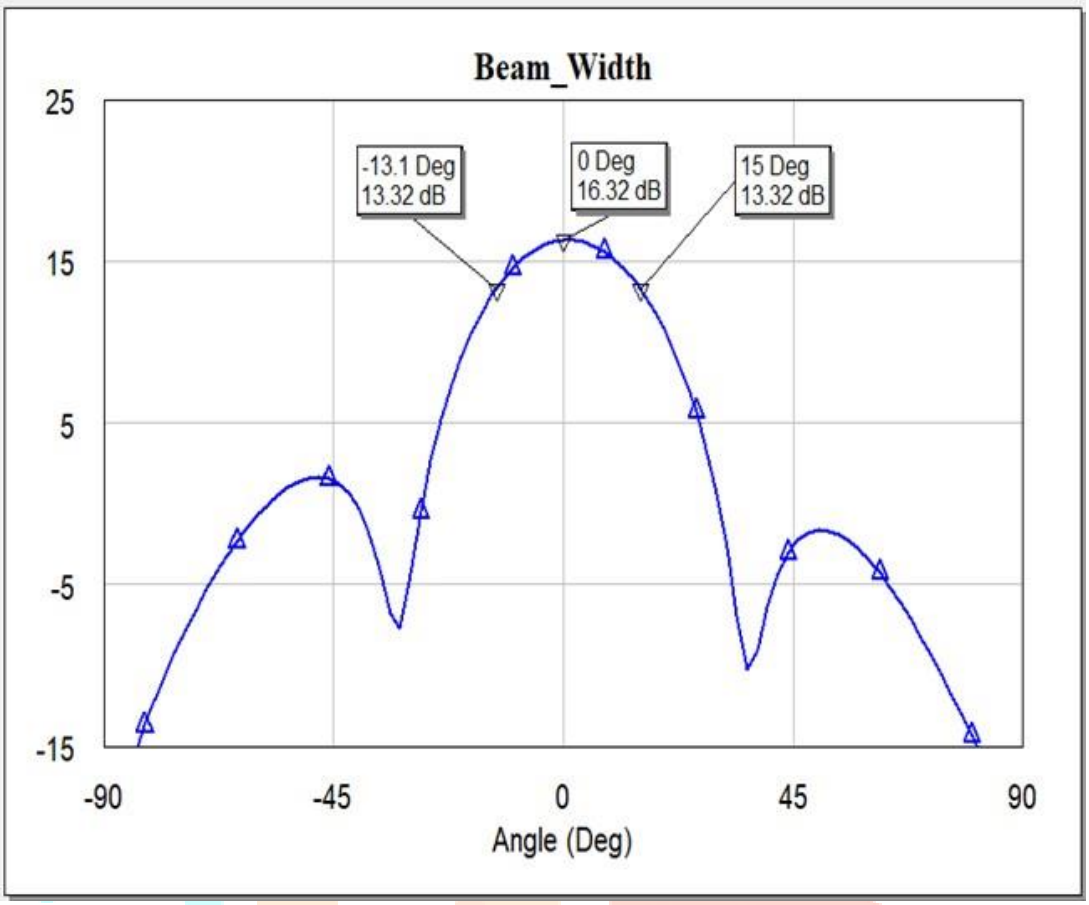


V. RESULTS

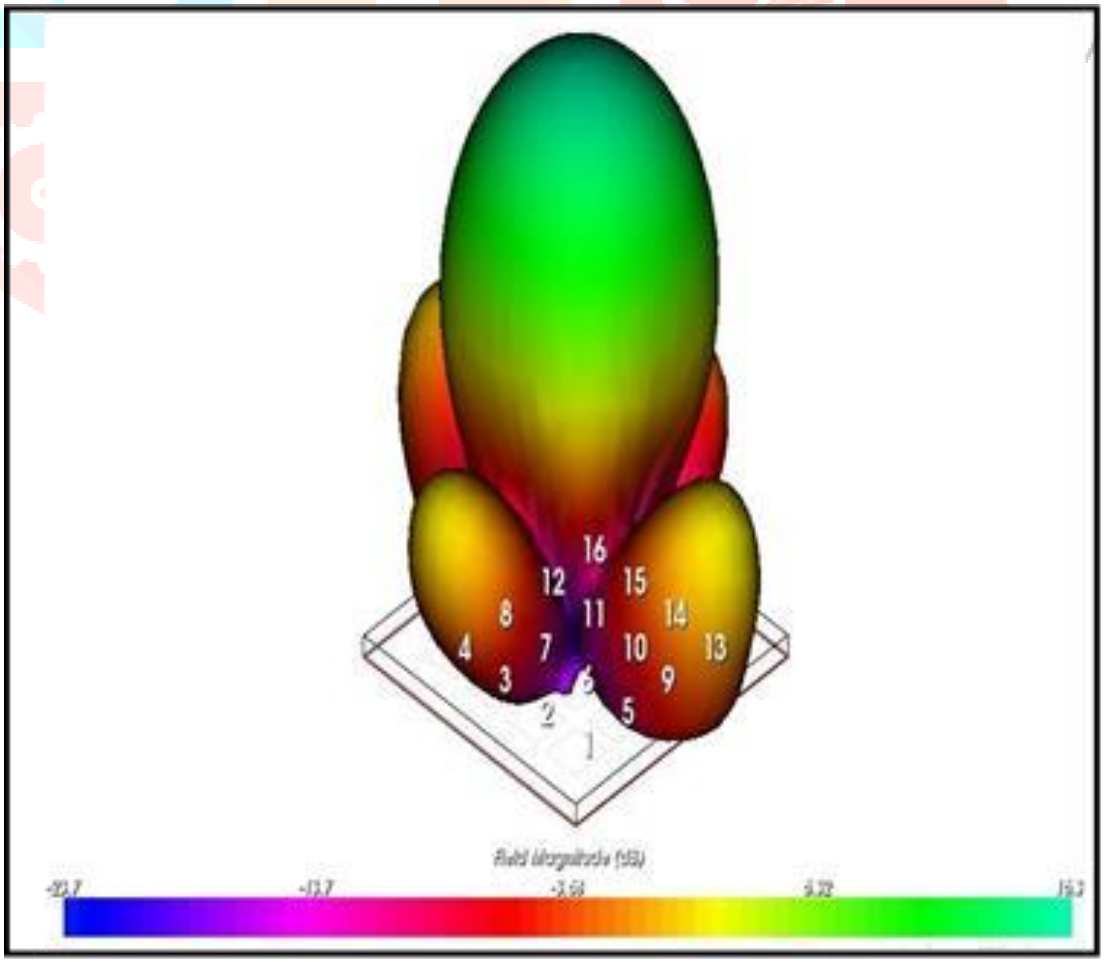
1. Active Impedance Smith Chart



2. Beam Width



2. 3D view of Radiation Pattern 3.



VI. CONCLUSION

The Performance of the micro strip antenna depends on its dimension, the operating frequency, radiation efficiency, directivity, return loss and other related parameters are also influenced. In the micro strip array, elements can be fed by a single line or multiple lines in a feed network arrangement. The radiation pattern of an antenna is important in determining most of the characteristics which include beam width, beam shape, directivity and radiated power. After fabrication completed network analyzer is used to measure the antenna parameters. After that comparison between stimulation result and measured result will be takes place.

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