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# Circularly Polarized Microstrip Array Antenna for UHF application

Guruprasad V.Burshe
*Department of Electronics and Telecommunication Engineering*
*Rajendra Mane College of Engineering and Technology;Ambav*
*Deorukh 415804,India*
burshegv@rmcet.com

Sandip S. Bhandare
*Department of Electronics and Telecommunication Engineering*
*Rajendra Mane College of Engineering and Technology;Ambav*
*Deorukh 415804,India*
bhandaress@rmcet.com

*Abstract*— **This Array consists of flower shaped five Microstrip patch antennas with a element feeding the outer patches through a straightforward network of resonant Micro strip lines. For circular polarization the central patch is fed by a pair of coaxial probes. Finite element method (FEM) is used as a method of analysis and Preliminary numerical results are obtained.**

***Keywords-Microstrip lines, polarization, FEM, UHF.***

## I. INTRODUCTION

By using single Microstrip patch antenna highly directive pattern cannot be obtained. However by means of an array of antennas, it is possible to obtain a pattern that is highly directive in one direction.

Microstrip antennas have been widely used owing to their distinct advantages such as light weight and small size.

Multi-polarized operation can be achieved by aperture coupled Microstrip patch antennas, whose many desirable features are well surveyed in the literature such as in A. Vallechi [1] however among the feeding techniques, coaxial feed is one of the most popular methods for electrically thick substrate.

The direct feeding of individual elements in planar multi-polarization antenna arrays is an involved matter and implies complex feed networks, crowded with phase- switching circuits and suffering from unwanted mutual coupling between the various sections pertinent to different polarizations, and reduced antenna efficiency. To overcome these difficulties it is convenient to arrange the radiating elements into sub arrays, so as to streamline the array design, decrease losses, and simplify RF control circuitry. Particularly, planar cells with a central patch could be very advantageous since they can provide pencil beam radiation patterns with low side lobes. Indeed, single polarized two- dimensional Microstrip patch sub arrays have been demonstrated in Legacy et al. [2] and Duffy et al. [3], where two similar designs with probe and slot feed, respectively, are described.

The geometry and design approach of the antenna is outlined in next section.

## II. ANTENNA DESIGN ANd CONFIGURATIOSN

Figure1 shows the bottom view of the fabricated Antenna array. The antenna comprises 5 dice flower-shaped patches.

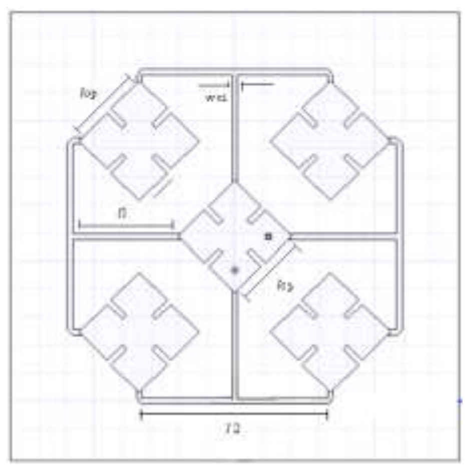

Figure 1.Bottom view of the dice five antenna array showing the flower shaped patches, the two coaxial feed lines. The central patch side (*l*cp) is 28.5 mm long, whereas the side length of the outer Patches (*l*op) is 30 mm. The other antenna dimensions are as follows:
*l*1 = 38.4 mm; *l*2 = 66.2 mm; *wcl* = 2mm

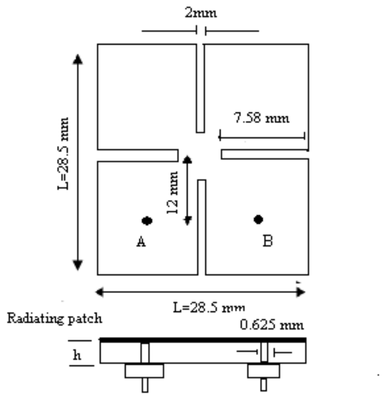


Figure 2.Geometry of proposed square-fed flower -shaped Microstrip patch antenna

The radiating part includes five microstrip square patches etched on the substrate, whose thickness is 2.286 mm. The central patch is coupled to orthogonal pair of 50 ohm Coaxial Probes having diameters of 0.625 mm. This solution has proved to yield a more symmetrical excitation of the sub array and, thus, improved radiation characteristics with respect to two off-centres separated orthogonal l slots.

Microstrip T line sections are used to propagate a resonant standing wave to feed the surrounding flower shaped patches. Specifically, these latter elements are connected to the central patch by the pair of their outer corners so as to realize a dual feeding arrangement. A dual corner feed has been adopted for the patches since it provides higher isolation than the standard dual edge feed as shown in Zhong et al. [4]. Each connecting Microstrip line is one wavelength long on the whole to deliver an excitation signal to the external patches with phase equal to that of the central patch. The narrow width of the connecting Microstrip lines, corresponding to 100 Ohm impedance, minimizes the discontinuity effects at bends and at the corners of the central patch. The excitation amplitude for the outlying patches is controlled by the impedance levels of these elements and the central patch. The input impedance of the outlying corner-fed patches can be estimated through the closed form expression derived in Lim et al. [5].As a result, the loading effect of the outer patches can be included in the design and impedance matching of the central patch by using a full-wave approach in conjunction with basic circuit theory as in Duffy et al. [6]. It is noted that the central patch turns to be smaller than the external ones due to the loading of the Surrounding elements which tend to increase its resonance frequency.

The above antenna geometry allows obtaining any kind of linear or circular polarization of the radiated field by appropriately driving the two input ports quadrature excitation of the feeds results in circularly polarized radiation.

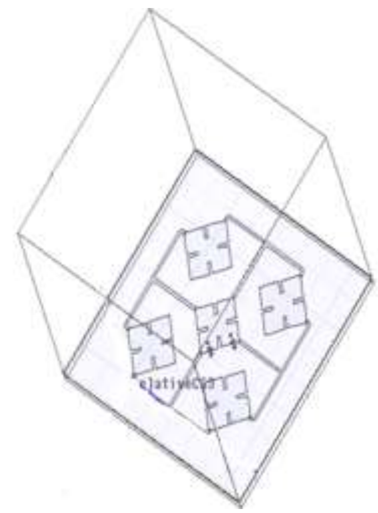

Figure 3.Perspective view of the antenna in its single layer feed version

Particularly, quadrature excitation of the feed lines results in circularly polarized radiation whose sense is determined by the lead-lag phase relationship between the aperture excitations. Fairly low cross-polarization levels are obtained by virtue of the symmetrical arrangement devised for the antenna, which implements a sort of antiphase feeding technology.

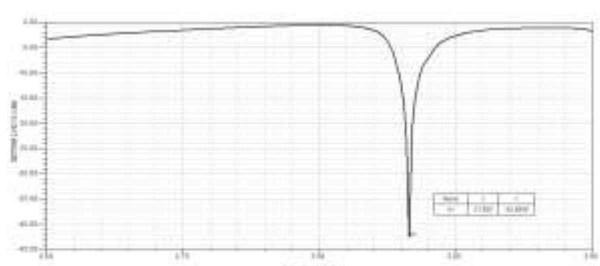

Figure 4. Return loss VS Frequency

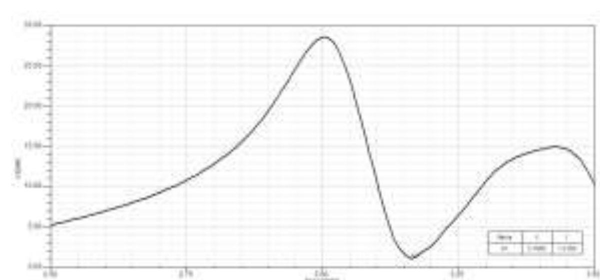

Figure 5.VSWR Vs Frequency

## III. Result And Discussion

A new compact array antenna with a coaxial feed patch distributing the power to four surrounding dual corner-fed patches by a simple network of Coaxial Feed has been presented. The antenna can operate either in linear or circular polarization and exhibits good gain and enough low cross-polarization level which make it suitable for being used both in a stand-alone configuration and as the basic component of large planar arrays with the advantage of reduced complexity feeding networks.

The return loss and the isolation at the inputs of the antenna are shown in Fig.4 and indicate operational frequency is nearly 3GHz with Return loss is -43 dB. Fig. 5 shows VSWR=1.01 which shows exact impedance matching at the desired frequency..

## IV. Conclusion

As above results shows this antenna array has exact impedance matching at 3 GHz with Return loss of -43 dB. This Antenna Array can be used for UHF Applications.

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