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Design and Development of Wideband Patch Arrays using Disparate Arms for E-Band Applications

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Abstract- This paper presents a wideband patch antenna array in E-band for wideband operation. The proposed patch arrays are designed by using disparate resonance arms fed by microstrip. This proposed antenna covers the frequency ranges (S11<=-10 dB) from 40 to 80 GHz. The main purpose of designing the proposed antenna to enhance the impedance bandwidth. By varying the length of the disparate arms, To broadening the impedance bandwidth. Microstrip feed is introduced for improving its impedance bandwidth and radiation performance. The proposed antenna arrays have some features suchas resonance tuning ability, low-fabrication cost and enhanced bandwidth. This antenna is simulated using HFSS and fabricated, tested for S-parameters and the performances is used forwideband applications. The proposed antenna mainly used for satellite communication.

Index Terms- Antenna Arrays,Micro strip Antenna.

1. INTRODUCTION

AMAJOR hurdle in the micro strip patch antenna array design is its limited band width. The substrate-integrated waveguide (SIW) technology is used to design a cavity-backed micro strip patch antenna array at low cost multilayer printed circuit board process and Co-axial feed line is used in this antenna [1]. However, at low frequencies where the radiation performance tends to poor due to strong mutual coupling between separated elements, The patch array covers offer as a lower profile and light weight matching structure[2]. Asymmetric coplanar waveguide(ACPW) series feed network is used to design a 2×2 rotated patch antenna array [3]. The implementation of 2×2 patch array Using polystrata process [4]. The large array are the main issue limiting its efficiency and application e.g., T/R modules and phase shifter [5]. They enhance the isolation in micro strip patch antenna array. The resonant frequency of the two patch antennas Coupled along H-plane at a frequency 4.8 GHz [6]. The 2×2 micro strip line fed U-Rectangular antenna implemented by place the feeding network and patch array in same layer. It give frequency range from 5.65 GHz to 6.78 GHz [7]. They provide a advantage of mutual coupling between array element, Then cost of antenna is decreased [5]. It improve the isolation by 16 dB [6]. They design the wide band micro strip patch antenna for ultra wide band applications. It achieved by using folded-patch feed's technique [8]. The 2×2 patch array is implemented by using sequencial-phase feeding network. Both axial ratio and impedance bandwidth is enhanced and wider than previous published sequencial -fed single layer patch arrays [9]. The patch antenna are used to generate millimetre-wave hermite-gaussian beam at E-band [10]. antenna for ultra wide band applications. It achieved by using folded-patch feed's technique [8]. The 2×2 patch array is implemented by using sequencial-phase feeding network. Both axial ratio and impedance bandwidth is enhanced and wider than previous published sequencial -fed single layer patch arrays [9]. The patch antenna are used to generate millimetre-wave hermite-gaussian beam at E-band [10].

ANTENNA DESIGN AND PERFORMANCE

The geometry of the proposed 1×2 patch array is used. This antenna is composed of two radiating patches with three disparate resonance arms resonance which made up of FR4 substrate with

SIDE VIEW

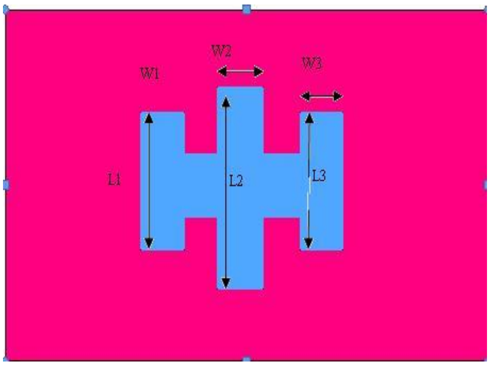
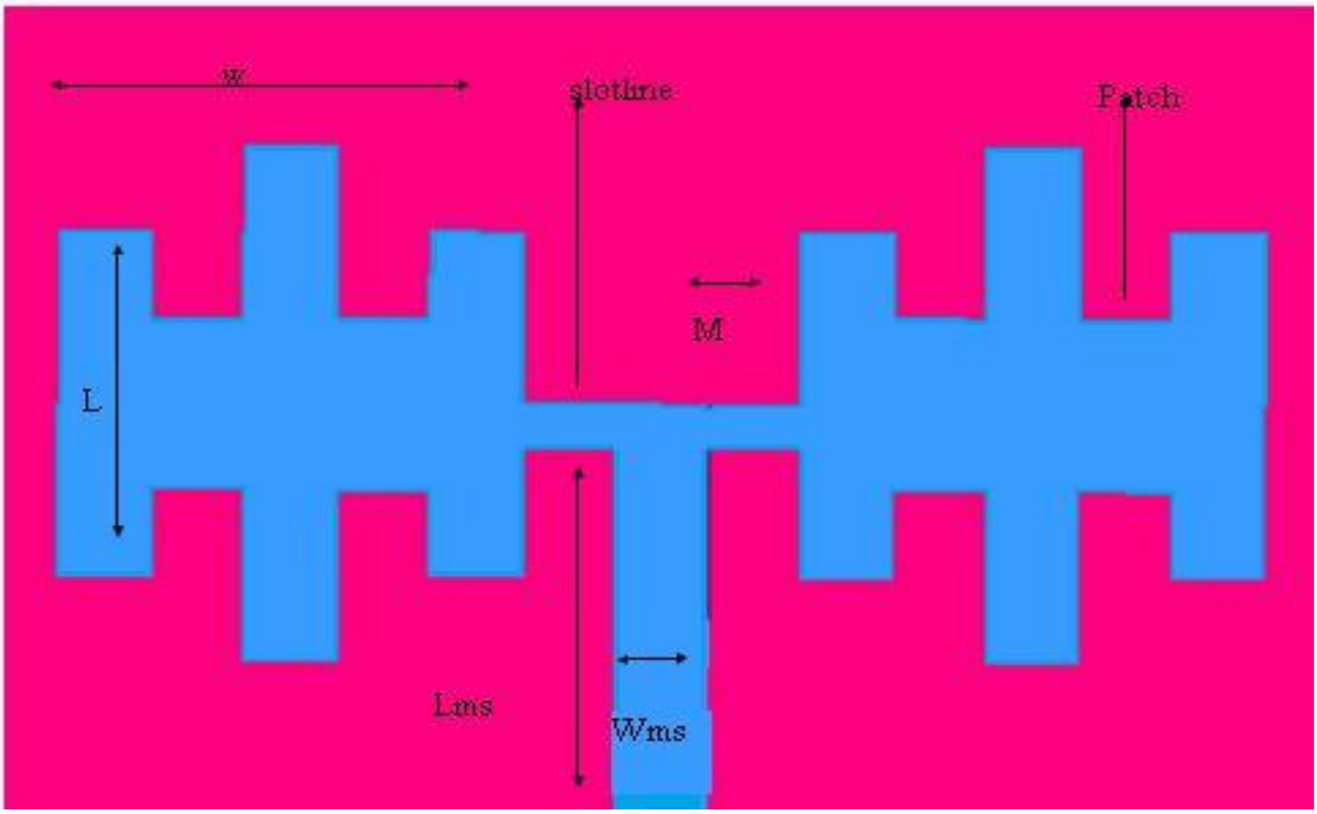


Fig1(a1

the dimensions of 15×10mm^2. Patches are fed by the microstrip, which excite by slot line transitions with the T-shape slots on the opposite side of the substrate. The thickness and relative permittivity of FR4 substrate are chosen to be h=1.6 mm and 2.2respecyively connect to the ground plane with slot line sections. Both total width and length patches are 24mm.

W	5mm	L	5.5mm	Lms	5.5mm
Wl	1mm	Ll	2mm	Wms	1mm
Wm	1mm	Lm	4mm	T1	5.5mm
Ws	0.5mm	Ls	2mm	T2	1mm
W1	0.5mm	L1	9.5mm	T3	5.5mm
W2	0.5mm	L2	6.5mm	S	15mm×10 mm
M	0.2mm	L3	4.5mm	h	1.6mm

TOP VIEW



GAIN

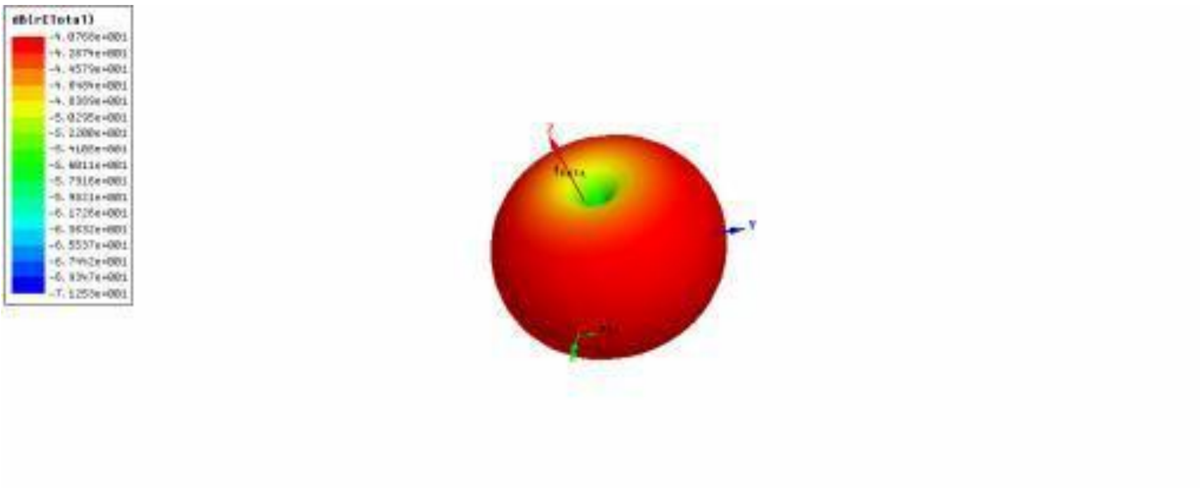


Fig1(b)

SIMULATION AND EXPERIMENTAL RESULTS

RETURN LOSS

Fig2(a)

RADIATION PATTERN

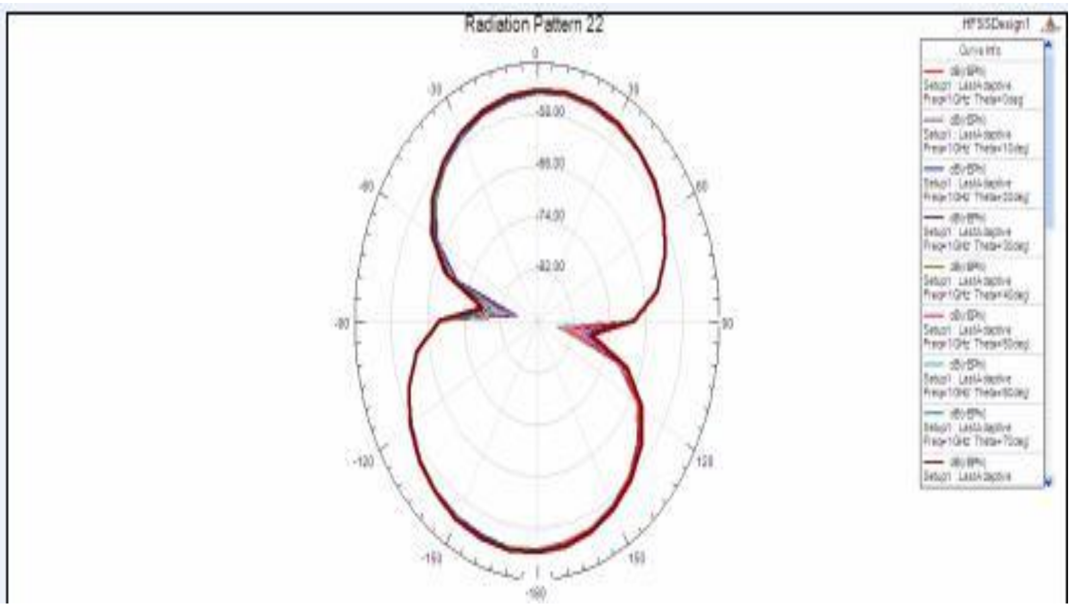


Fig2(b)

III. SIMULATION AND EXPERIMENTAL RESULTS

The simulation results are made sing the Ansoft HFSS with the finite element method. Fig.1, displays the proposed 1×2 patch array is designed. It mainly fabricated to cover the measured frequency range from 40 to 80 GHz for S11<=-10 db. It includes the wide bandwidth in E-band. Fig.1, domonstrates that the proposed patch array operates at 40 to 80 GHz for measured -10-Db impedance bandwidth. The proposed design indicates better performance compared to other wide band patch arrays. The measured and simulated radiation patterns in the xz-plane(H-plane) and yz-plane(E-plane) at 9.5 and 9.8GHz for the proposed array shown in Fig.1, The gain of the 1×2 and 1×4 patch arrays with in the operational bandwidth is 7 and 8 dB, respectively. The 1×2 and 1×4 patch array are shown in Fig.9

VSWR

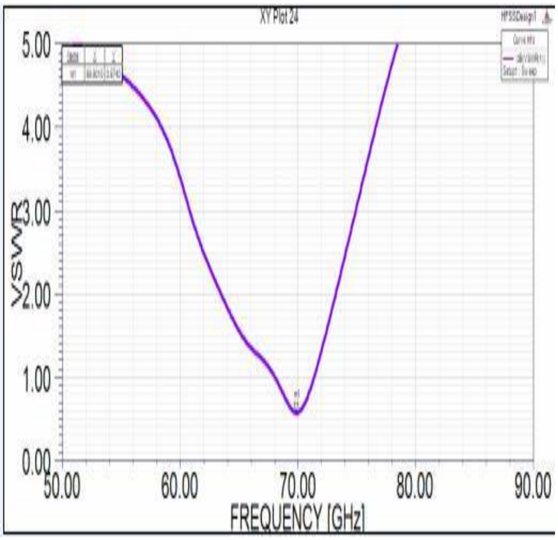


Fig2(c)

1V CONCLUSION

In this paper, an attempt has been made to enhance significantly. The bandwidth of the suggested 1×2 and 1×4 patch array by introducing the pattern with disparate arms and microstrip-to-slot line feeding technique. The 1×2 and 1×4 patch arrays include 40 to 80GHz for wideband operation in E-band. The wide band operation shows that it can predict and explain the broad band properties of the proposed antenna.

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