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Design of Edge Gap Coupled Truncated C-Shaped Multiband Microstrip Antenna

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Abstract— ***This paper presents the new design of an edge gap coupled multiband microstrip antenna. One of the non-radiating edges is symmetrically truncated with triangular shape. A `C` shaped slot is inserted at the centre of the patch to achieve multiband operation at 3.76GHz,6.54 GHz,8.32 GHz, and 8.76 GHz. The parameters like Return loss, VSWR and Directivity are presented with the help of CST Microwave studio.***

Key words**: Microstrip antenna, Edge gap coupling, multiband, VSWR, Return loss.**

I. INTRODUCTION

A typical microstrip antenna in general has a conducting patch printed on a grounded microwave substrate. They have many attractive features of low profile, light weight and easy fabrication. But, the major disadvantage is its narrow bandwidth [1]. Many methods have been proposed to achieve higher bandwidth [2-6]. Multiband antennas are important in areas such as mobile communication handsets and base station systems [7-8]. Several methods are proposed in order to design multiband patch antennas like slot matching [9-10], slotted ground plane [11]. A patch is placed close to the feed patch gets excited through the air gap known as parasitic patch. When a parasitic patch is placed along one of the radiating edges of the rectangular microstrip antenna, the bandwidth of the antenna increases [12]. This paper uses a truncated parasitic patch and employing a 'C' shaped slot to achieve multiband operation. The EM simulator used is CST Microwave Studio version 12. Initially the rectangular patch with coaxial probe is evaluated. Later by introducing the parasitic patch, EM coupling has been improved. VSWR and Return loss plots are presented with truncated corners, dual band is observed. By introducing the slot 'c' shaped multiband performance is observed.

II. ANTENNA DESIGN

Fig.1 shows the rectangular microstrip patch antenna with a parasitic patch. The patch is printed on Teflon substrate having dielectric constant (ε_r) of 2.55, loss tangent $\tan\delta$ =0.001 and height 1.59mm. The 50Ω coaxial cable with SMA connector is used for feeding the microstrip patch antenna and is considered as design.1 with operating frequency f_o = 2.8GHz. With the same design parameters, an attempt is made to achieve the dual band with truncated triangular shape as shown in Fig.2. In this, air gap of S = 1mm is introduced and parasitic patch of length L = 29mm and width of patch W = 40mm is referred as design2.The design is further extended to insert a '**C**' shaped slot to achieve the multiband operation with the same feed point location = (15, 0) as shown in Fig.3.The different parameters are tabulated in Table.1

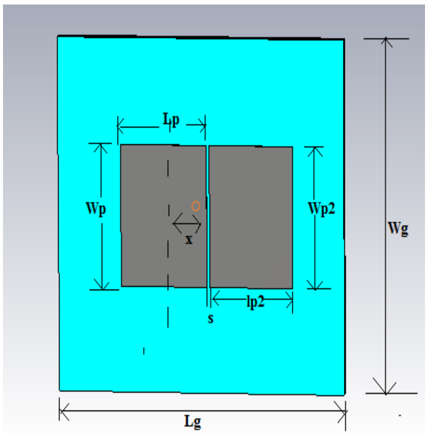

Fig.1 Rectangular Microstrip Patch Antenna of Design.1

Parameter	Value(mm)
Wp	40
Lp	30
Wp2	40
lp2	29
Wg	100
Lg	100
S	1
X	15
K1	5
K2	15

Table-1 the Dimensions of Different Parameters of the Patch

The simulation is carried out using CST Microwave Studio version 12. The initial patch design is according to the procedure explained [13]. The resonant frequency is at 2.86GHz with a return loss of -55dB, but the bandwidth is very narrow and is shown in fig.4. The design-2 is simulated and results are presented in fig.5. Dual band is obtained at 2.89GHz and 4.27GHz with a return loss of -26dB and -25dB respectively. The design-3 with 'C' slot is simulated and results are presented in fig.6. Quad band is achieved at 3.76GHz, 6.54GHz, 8.32GHz and 8.76GHz. The VSWR plots are presented in figures (7-9) and radiation patterns are presented in figures (10-12).

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III. SIMULATION AND RESULTS

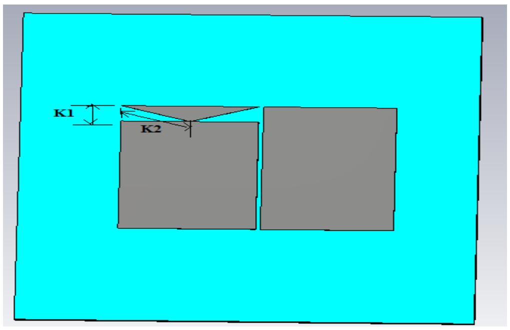

Fig.2 Rectangular Microstrip Patch Antenna of Design.2

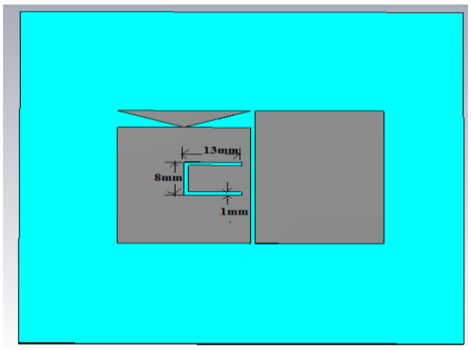

Fig.3 Rectangular Microstrip Patch Antenna of Design.3

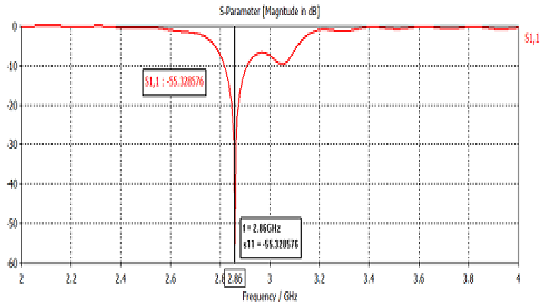

Fig.4 Variation of Return Loss with Frequency for Design.1

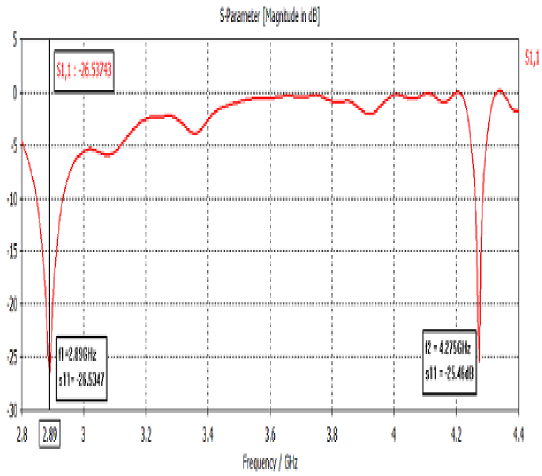

Fig.5 Variation of Return Loss with Frequency for Design.2

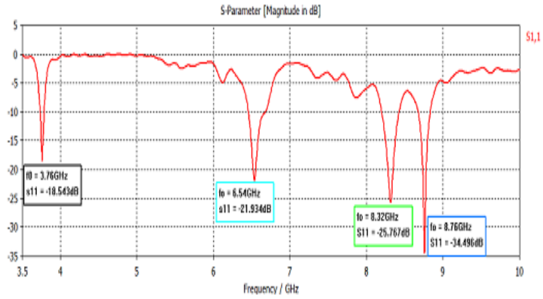

Fig.6 Variation of Return Loss with Frequency for Design.3

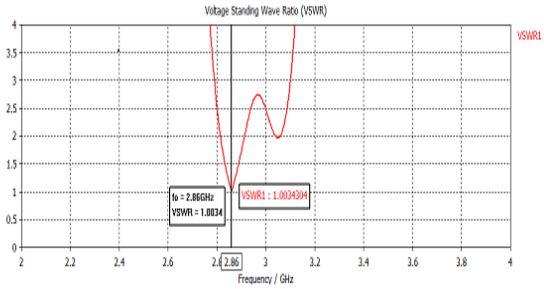

Fig.7 Variation of VSWR with frequency for design.1

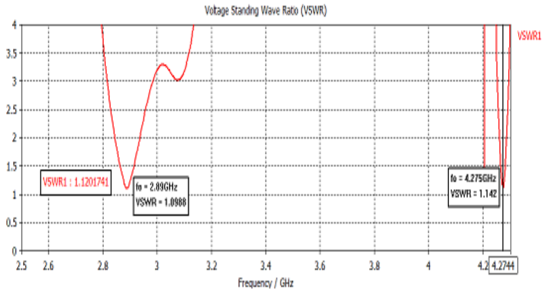

Fig.8 Variation of VSWR with frequency for design.2

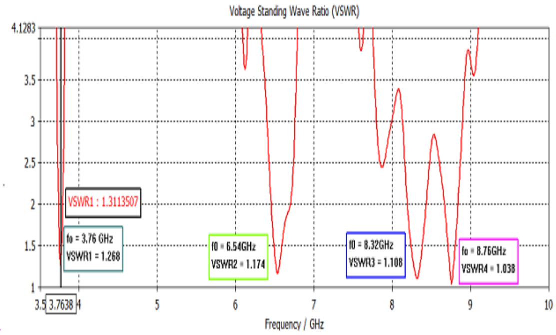

Fig.9 Variation of VSWR with frequency for design.3

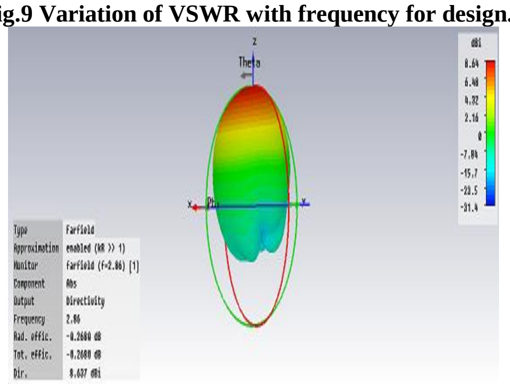
Fig.10 Radiation Pattern for Design.1

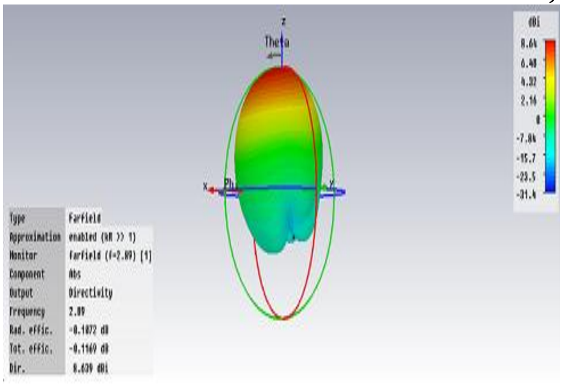

Fig.11 Radiation Pattern for Design.2

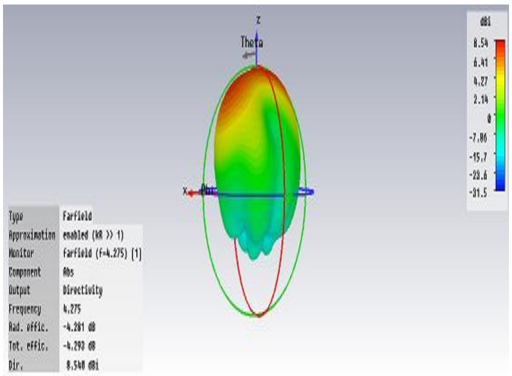

Fig.12 Radiation Pattern for Design.2

IV. CONCLUSION

Edge gap coupled parasitic patch improves the coupling performance. Single band is achieved at 2.86 GHz with a return loss of -55dB.Dual band is obtained at 2.89GHz and 4.27GHz with a return loss of -26.53dB and -25.46dB respectively with truncated corners of half of the patch. With the introduction of `C` shaped slot, multi band operation is possible at 3.76GHz, 5.54GHz, 8.32GHz, 8.75GHz .

REFERENCES

[1] Constantan's. Balanis, Antenna Theory Analysis and Design. III Edn, Wiley-Interscience. A John Wiley sons Inc.Pulication, 2005.

[2] Grag, R.P. Bhatia, I.Bhal, A.Ittipiboon, "microstrip antenna design handbook," attach house, Inc.2001.

[3] Wong, K., "compact and broadband microstrip antennas," A Wiley inter science publication Ione Wiley and Sons, Inc 2002.

[4] Kuo, J.S. and K.L.Wong, "A Compact microstrip antenna with meandering slots in the ground plane" Microwave and Opt. Tech. letter. Vol. 29, 95-97, April 20, 2001.

[5] Ang, B.K and B.K. chung, " A wideband microstrip patch antenna for 5-6GHz Wireless communication, "Progress in Electromagnetic research, PIER 75, 397-407, 2007.

[6] Waterhouse, R.B., "Broadband stacked shorted patch" Electronic Letters, Vol35, 98-100.January 21, 1999.

[7] Gandara, T.R.Urban, L. Fregoli and C.Peixeiro, "Planar inverted- F antennas integrated into small multiband-standard handsets" Automatic, Portugal, ATKAAF, Vol.48, Mo. 1-2, 45-52,2007.

[8] Amari, H., "Pent band antenna based on slot matching", Project at haird Technologies, KTH, France, M ARCH 2007.

[9] Amari, H., "Pent band antenna based on slot matching", Project at haired Technologies, KTH, France, March 2007.

[10] Sheta, A.F., A.Mohra, and S.F Mohmad, "Multi-bamd operation of compact H-shaped microstrip patch antenna" Microwave opt. Techno. Letter, vol.35, no.5, 63-367, DEC.2002.

[11] Chioce, T. And K.Wong, "Design of compact microstrip antennas Propagat. Symp. Vol.2, 732-735, Boston, USA, July 7-13, 2001.

[12] Alok Aggarwal, Siddiqui Nausha Alterm Alok Kushwasha, P.K.Singhal "Truncated Gap coupled wideband rectangular microstrip patch antenna ", IJCSCE, Vol.2. issue.1 Feb.2013.

[13] Ashish Kumar "Rectangular microstrip patch antenna using 'L' slot structure", ISTP-JREEE, vol.2, issue 2, March 2013.

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