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A NEW MULTISLOT MULTIBAND PATCHANTENNA FOR WIRELESS COMMUNICATION APPLICATIONS

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Abstract: A compact printed slot monopole antenna using multi slotted method is proposed designed and simulated. The proposed multiband antenna covering the GSM, PCS, WLAN ISM band, satellite DMB and WIMAX Bands. The designed antenna dimensions 25*25*0.5 mm.The simulated return loss gain, directivity and radiation patterns of the multi slotted patch antenna presented. The use of multi slotted concept in rectangular patch antenna makes it flexible in terms of bandwidth control.

Keywords: multi slotted , multiband , patch , WLAN , GSM , WIMAX

I. INTRODUCTION

Recent 10 years many slot antennas has been implemented that cutting the printed slot at rectangular patch and ground plane , A monopole antenna can be achieved [1]-[3] . monopole antennas perfectly operate at h/2 resonant structure [4]-[5] . in this slotted monopole antenna has many attractive features such as broad bandwidth, smaller size, perfect radiation characteristics ,high gain and low loss[7]-[10].This feature of the monopole antenna promising for wireless communication applications such as laptop ,mobile etc.,[11] .many promising monopole slot antennas for wireless communication application have been implemented [2][9]-[12 in this monopole slot antennas perfectly suitable for printed MIC boards because of its compact size and low cost of practical implementations.

The monopole slot antenna has a many advantages over a ordinary patch antennas that have been applied in many laptop and mobile devices [12] .many monopole antennas has been implemented with good bandwidth[13]-[19] but that antennas are size is large and thickness is large ,in addition implemented monopole slot antennas[10]-[19] coplanar wave guide feed line used in [8]-]15] makes the configuration of the monopole slot antenna make complicated for better performance .

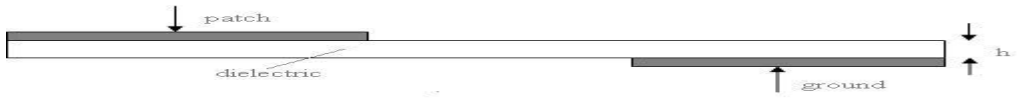

Fig .1 Substrate Configuration Of The Patch And Ground Plane Of New Irregular Multislot Multiband Patch Antenna For RFID Applications

The proposed monopole antenna formed by multi irregular slots arranged in a planar configuration and single-fed by a square shaped microstrip line feed which excites the irregular monopole slots at their optimal feeding point .Fine wide operating bands at about 800 and 3.6GHz are achieved for the proposed irregular multislot antenna to cover the fine resonant frequencies of GSM(840) (824-894MHz) GSM 1800(1710-1880MHz) WLAN 2.4GHz (2.4-2.45GHz) ,satellite DMB 2.6GHz(2.6-2.9GHz) and 3.6(3-47)GHz WIMAX for wideband wireless area network (WWAN)

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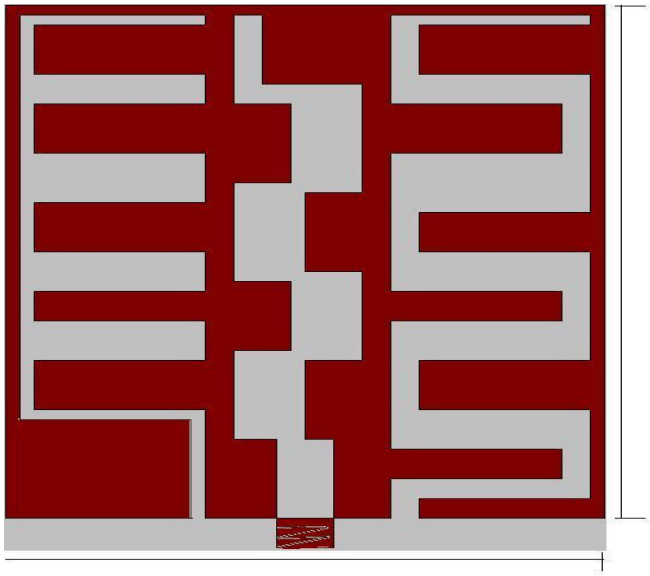

Fig.2Configuration Multislot Multiband Patch Antenna For RFID Applications

The proposed multiband irregular monopole slot antenna have advantageous features compared to the reported antennas [1]-[20] for wireless applications .In this paper using microstrip fed line to reduce the size of the antenna and increase the bandwidth ,gain and efficiency .However the proposed antenna need 25*25 m small area .
Design characteristics of the proposed irregular monopole slot antenna are described in detail in the paper ,and simulated results of the designed antenna presented and discussed .Radiation pattern of the antenna are also analyzed.

II. ANTENNA CONFIGURATION

Geometry and dimensions of the proposed irregular multislot monopole slot antenna shown in fig 2.The proposed antenna shape is irregular slot shape .In order to excite resonant modes for a broad operating band ,a rectangular shaped patch slotted in irregular pattern and square shaped microstrip feed line fed in this design .

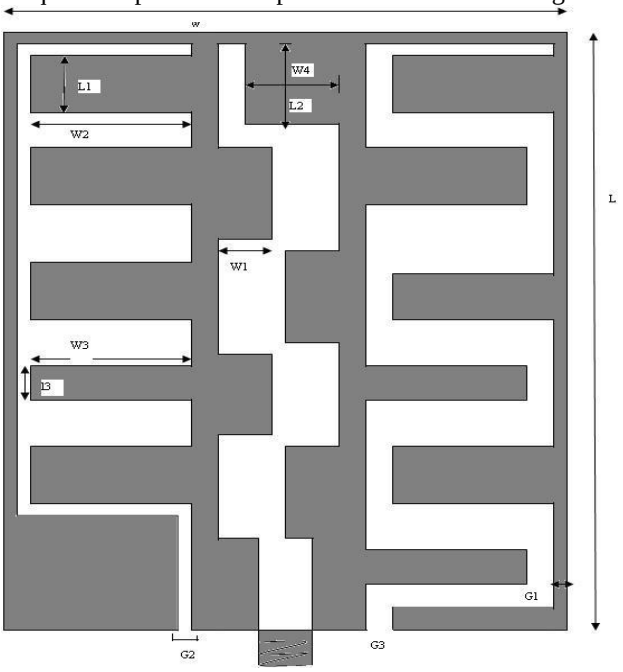

Fig.3 Proposed Configuration of Multislot Multiband Patch Antenna For RFID Applications

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For resonating the operating frequencies around 3.8GHz the printed irregular slot monopole patch hs L=25mm and W=25m and it is printed on an Rogers Ro4003 substrate with thickness 20mil and relative permittivity 3.38 .The proposed antenna dimensions L1=5mm, L2=7mm, L3=3mm, W1=3mm, W2=7mm, W3= 7mm, G1=1.5mm, G2=1mm,G3=1mm. The proposed antenna is by microstrip line with 50 Ωand simple transmission line excitation probe .The excitation probe below or bottom of the substrate which length is 3mm. The irregular slots and microstrip feed line with 50 Ωis increase the excitation of the proposed antenna around at 3.6GHz simulated results obtained from method of momentum(MOM) ADS EM simulator . By tune the geometry of the antenna properly achieve resonant frequencies around 3.6GHz with enhanced bandwidth and gain.

III. RESULTS AND DISCUSSIONS

In this paper ,simulated results of return loss ,radiation ,impedance gain and efficiency characteristics of the proposed irregular slots monopole antenna presented .The ADS method of momentum(MOM) EM simulator software is used for determine the impedance and radiation characteristics of designed antenna .

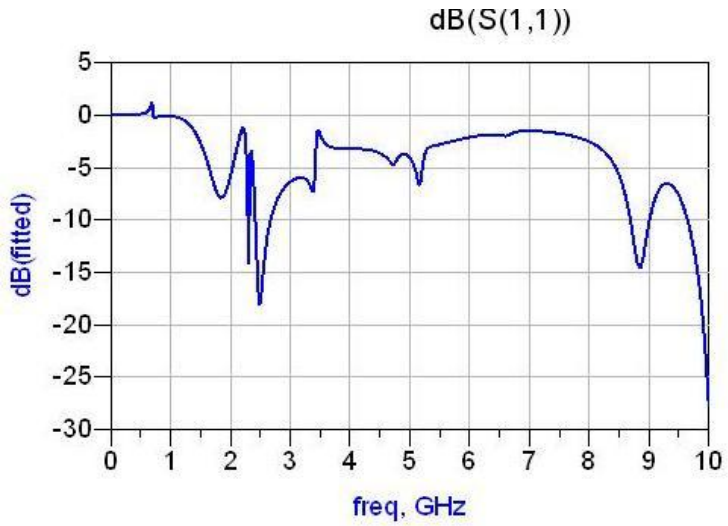

Fig.4 Return loss of Multislot Multiband Patch Antenna For RFID Applications

Basically a irregular multislot antenna can operate broad multiband wireless operations.Distance between the strip and feed line is 2mm to achieve coupling with the microstrip feed line shown in fig 4 .The simulated results it is achieved that the optimum width and length (25*25)mm.By tuning the parameters L and W ,L1 ,L2 ,G1 ,G2 ,W1 ,W2 can obtain fine resonant frequencies .The resonant frequencies .The return loss for the proposed antenna at fine resonant frequencies shown in fig .4 which is for first resonant frequency f_1 is -10db at 800MHz

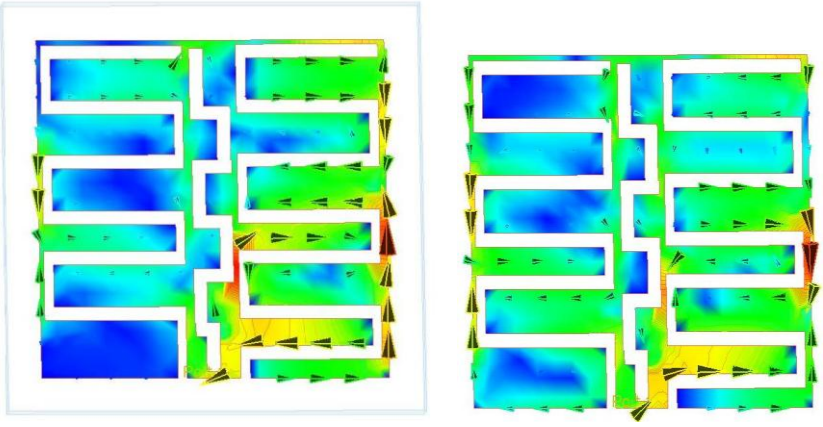

Fig.5 Forward and Reverse Direction Current Distribution Of Multislot Multiband Patch Antenna For Rfid Applications

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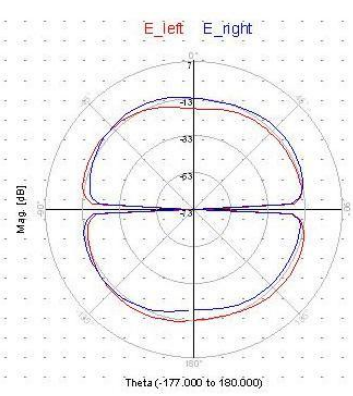

Fig .6(a) at 840 MHz

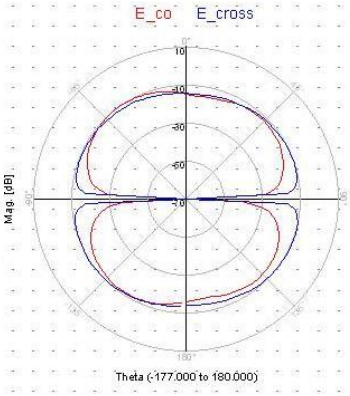

Fig .6 (b) at 840 MHz

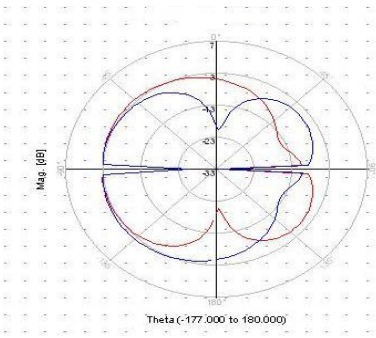

Fig .6(b) at 1.92 GHz

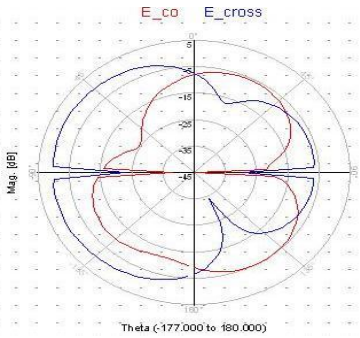

Fig .6 (d) at 1.92GHz

V

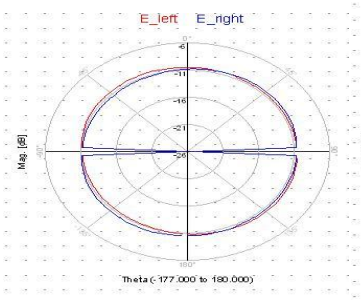

Fig .6(e) at 2.40GHz

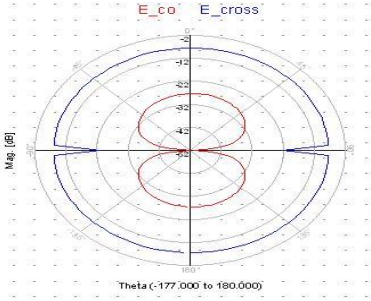

Fig .6 (f) at 2.40 GHz

Fig. 6(a),6(b),6(c),6(d) and 6(e),6(f) E and H Radiation Pattern Multislot Multiband Patch Antenna For Rfid Applications at 840 MHz,1.92 GHz ,2.40 GHz

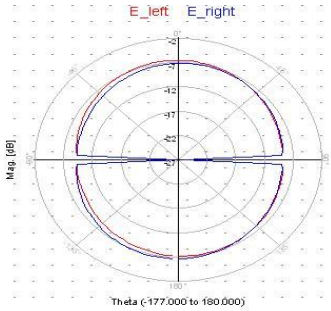

Fig .6(g) at 2.63 GHz

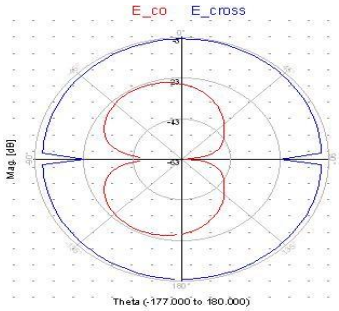

Fig .6 (h) at 2.63 GHz

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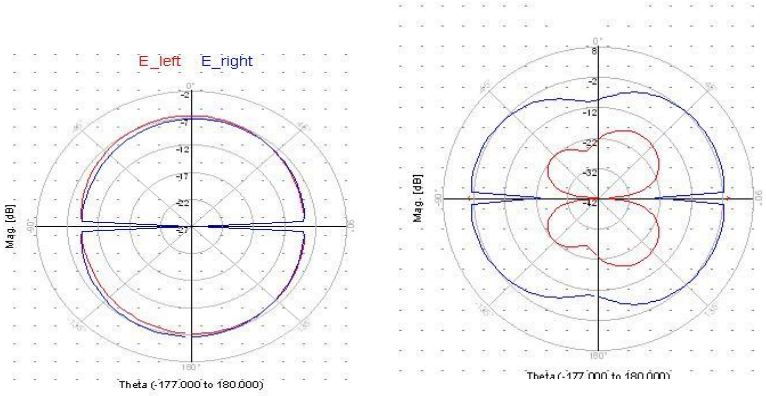

Fig .6(i) at 3.629GHz Fig .6 (j) at 3.629GHz

Fig. 6(i),6(j) E and H Radiation Pattern Multislot Multiband Patch Antenna For Rfid Applications at 2.63 GHz and 3.629 GHz .

Fig .4 shows the simulated resonant frequencies of the proposed antenna agreement withoperating band of the GSM (840 MHz) UMTS(1.92 GHz),WLAN(2.4GHz) ,satellite DMB(2.6 GHz), WIMAX(3.17-4.17 GHz)For the proposed irregular slot antenna dimension L =25 mm , W=25mm , G1=10mm , G2=10mm ,L2= 4mm, stimulated E plane and H plane radiation pattern of the proposed antenna in the GSM , UMTS ,WLAN , Satellite DMB and WiMAX bands shown in fig 6(a) , 6(b) , 6(c) , 6(d) ,6(e),6(f),6 (g),6(h) ,6(i) and 6(j) respectively . The monopole antenna is bidirectional radiator without reflecting plate , so the radiation patterns of the irregular multislot monopole antenna both E and H are similar and omnidirectional radiation which is clearly shown in the fig 6(a) , 6(b) , 6(c) , 6(d) ,6(e),6(f),6 (g),6(h) ,6(i) and 6(j) from the simulated results operating impedance bandwidth at GSM 890MHz with -13.796 dB return loss 1.92242 GHz (UMTS) with -7.354 dB return loss 2.404(WLAN)GHz with -9.946 dB return loss , 2.639 GHz (satellite DMB) with -13.190 dB return loss and 3.62(WIMAX) with -14.585 dB return loss . The stimulated proposed antenna gain of the antenna is observed less than 4dBi with maximum 3.86 dB at 840MHz (GSM) ,3.82 dBi at 1920 MHz (UMTS) , 3.88 dBi at 2.639GHz(satellite DMB) and 3.2dBi at 2.42GHz and 3.9dBi at 3.624GHz(WIMAX) . Hence the irregular multislotted monopole antenna suitable for the multiband wireless communication applications.

IV. CONCLUSION

A compact printed multislot patch monopole antenna with multiband frequencies covering PCS , GSM , WLAN , WIMAX , Satellite DMB applications has been proposed antenna impedance bandwidth significantly increased and thickness of the antenna decreased . The proposed antenna exhibits prefect radiation characteristics in all resonant frequencies, high gain and directivity. Improved radiation pattern achieved by the proposed design . It should be suitable for GSM,PCS,and satelliteDMB,WLAN, and WIMAX application.

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