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Slotted Circular Microstrip Patch Antenna Designs for multiband Application in Wireless Communication

Hemant Kumar Gupta, P.K.Singhal,Pavan Kumar Sharma,Veerendra Singh Jadon

Department of Electronics, Madhav Institute of Technology &Science Gwalior (M.P) 474005-India
Email:
hmnt_gpt@yahoo.co.in,pks_65@yahoo.com,Sharmapavan.0511@gmail.com,veermtech@gmail.com

Abstract

The paper present the Circular Microstrip Patch Antenna designs with slit-slot for multiband purpose in wireless communication. We have designed a circular microstrip patch antenna (CMPA) for 1.3GHz used in wireless communication. We have designed CMPA with 2slit slot, 3slit-slot, and 6slit-slot and observed results for different designs, and finally it is shown that as slit-slot increases to six slit-slots bandwidth is initially increased up to 3 slit-slots and finally reduced for six slit-slots. The multiband antenna uses for wireless communication in different applications. Bandwidth improvement is about 63.3%, 72.10% and 37.5% respectively in two, three and six slit-slotted patch when compared to their basic design bandwidth band. Antenna is changed to multiband by slit-slot Circular Microstrip Patch Antenna (CMPA).

Keywords: Circular Microstrip Patch Antenna (CMPA), CST (Computer Simulation Technology).

1 Introduction

Circular Microstrip Patch Antenna is very useful because of its small-size, ease of fabrication.

Sirpenski design for 2.45GHz is presented in this paper found very efficient because the antenna efficiency is very high about 82%.sirpenski design has numerous advantage like having a lesser return loss and lesser size of antenna [1].

Antenna for efficient rectenna is presented on this paper at ISM band.DGS structure are also used in this paper, because of the DGS design antenna do not shows any Harmonics at particular band [2].

Circularly polarized microstrip antenna is proposed in this paper which also found efficient for rectenna design. Antenna radiation pattern is also independent of the radiation pattern of antenna [3]

A new design technique of microstrip patch antenna is presented in this paper. The proposed antenna design consists of inverted patch structure with air-filled dielectric, direct coaxial probe feed technique and the novel slotted shaped patch. The maximum achievable gain is 9.41 dBi. The achievable experimental 3-dB beam width (HPBW) in the azimuth and elevation are 60.88± and 39± respectively at centre frequency [4].

The enhancing bandwidth and size reduction mechanism that improves the performance of a conventional microstrip patch antenna on a relatively thin substrate (about0.01 0λ) is presented in this research. The design adopts contemporary techniques; L-probe feeding, inverted patch structure with air-filled dielectric, and slotted patch [5].

In this study, the design and analysis of a (2x2) microstrip patch antenna array is introduced. It is designed to function in the 5.25 GHz which corresponds to IEEE 802.11a (VSWR<2, data rate 54Mbps/ B.W 20 dB and S-parameters, Sij <-20dB where i≠ j) wireless LAN application [6]

2 Antenna Design

Different Slit-Slotted Circular Microstrip Patch Antenna (CMPA) Designs shown in this paper for multiband applications.

The height and dielectric constant of the substrate chosen according to the design frequency of the antenna. The design frequency used here is a 1.3GHz for the designs. Substrate parameter is given as:-

Dielectric constant of the substrate=4.3

Height of the substrate=1.6

Loss tangent of the substrate=.02

2.1 Circular Microstrip Patch Antenna Design

First we design a circular microstrip patch antenna for at 1.3GHz.all design parameters are calculated by a reference book of antenna design [7]. All parameter related to the design of antenna given in the table below:-

Table: 1 Circular Patch Parameter

Radius of circular patch	Cut width	Cut depth	Continue path length	Continue path width
32.61mm	16.50mm	20mm	53.95mm	2.32mm

Although only radius of patch is calculated by a reference book and all the calculation find out by iteration on CST-MWS software and find out the data for a best results all the graphs or figures related to design of patch given below:-

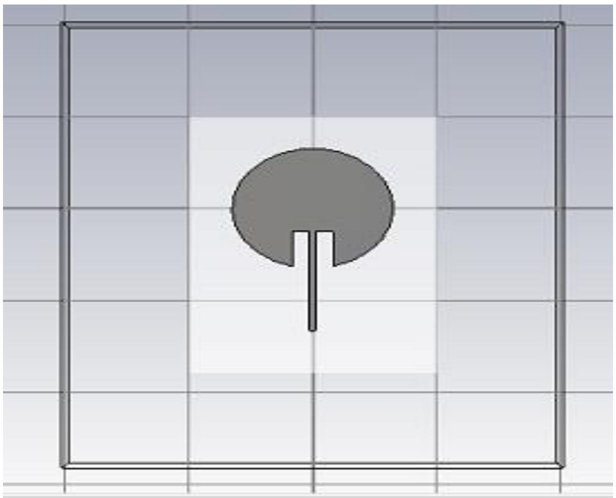
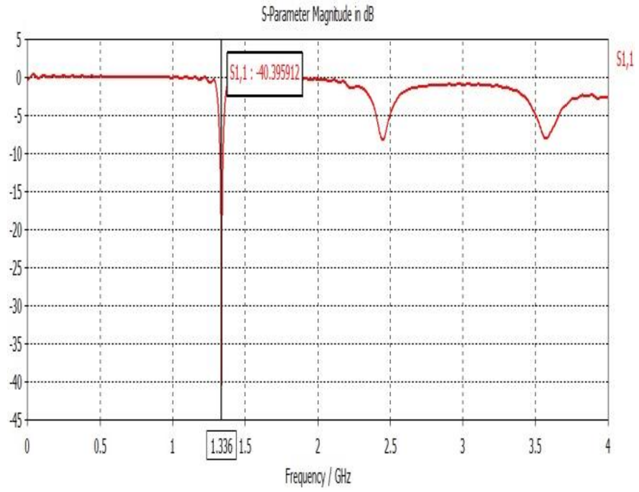


Fig. 1 Circular microstrip patch



Fig, 2 Return losses vs. frequency for circular patch without slot

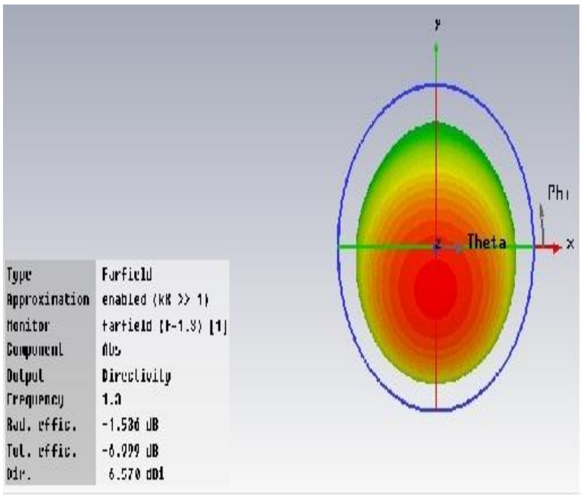


Fig. 3 Radiation pattern of simple circular patch at 1.3GHz

Practical Design of Circular Microstrip patch AS shown in fig. below:-

Circular Microstrip patch Antenna Designed at 1.3GHz

Fig.4 Circular Microstrip Patch Antenna Design at 1.3GHz

2.2 Circular Microstrip Patch Anteena with 2 Slit-Slot

Circular microstrip patch antenna with 2 slit-slot is also design by CST-MWS software at 1.3GHz and Simulation results of return loss and radiation pattern by CST-MWS software are shown in the figure below:-

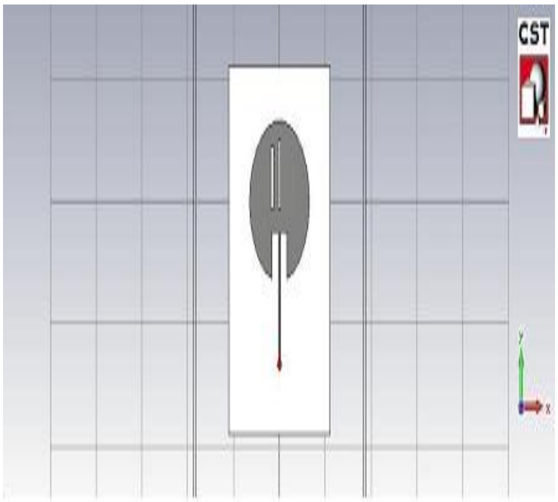


Fig.5 CMPA With 2slit-slot for Multiband Application

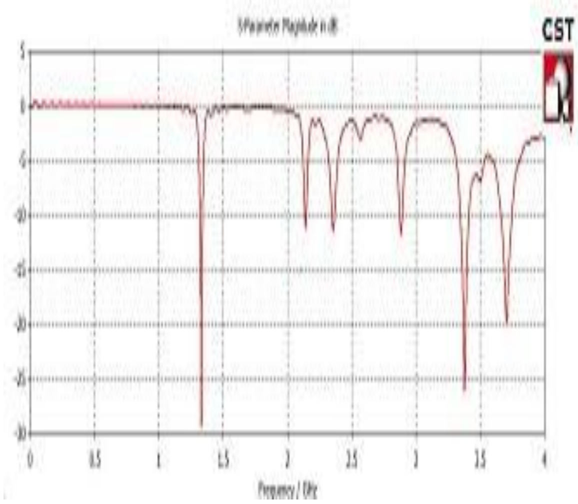


Fig. 6 Radiation pattern of CMPA with 2 slit slot- structure

Table 2: Two slit-slots Band of Circular Microstrip Patch Parameter

S.NO	Frequency(GHz)	Return loss(dB)	Bandwidth(MHz)
1	1.328	29.312	23.2
2	2.142	11.065	12.1
3	2.3529	11.205	24.4
4	2.88	11.78	20.3
5	3.3793	24.97	60.8
6	3.7039	19.88	63.3

It is very clear from the table2 that antenna with two slit become multiband antenna in 0-4GHz Span and bandwidth is increased approximately 63.3% as compared to Bandwidth for Designed Frequency and antenna become useful for multiband purposes

2.3 Circular Microstrip Patch Antenna Design for 3 Slit-Slots

Design Antenna and its Return loss Charactestric is find out by a CST-MWS Software shown below

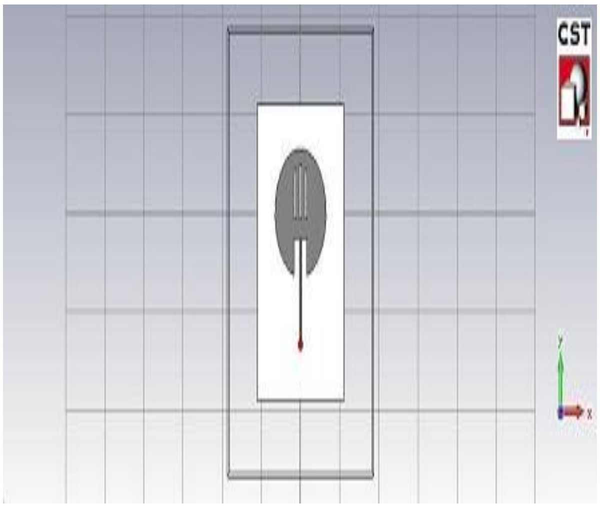


Fig.7. CMPA With 3Slit-slot for Multiband Application

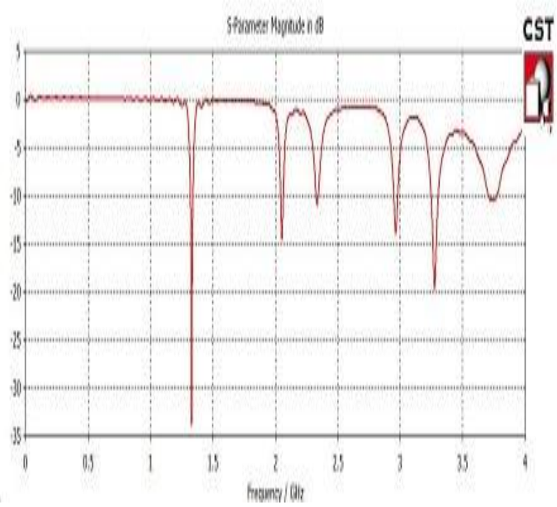


Fig.8 Radiation pattern of CMPA with 3 slit slot- structure

Table 3:Three Slit-Slot Band of Circular Microstrip Patch Parameter

S.NO	Frequency(GHz)	Return loss(dB)	Bandwidth(MHz)
1	1.328	33.822	24.3
2	2.05	14.60	23
3	2.3408	10.765	24.4
4	2.9665	13.87	40.6
5	3.2779	19.31	51.1
6	3.7444	10.54	87.1

As it is Very clear from the Table three Data that Maximum B.W is achieved 87.1MHZ so improvement in Bandwidth is about 72.10% this is a tremendous improvement in bandwidth of antenna. Antenna is working on 6 different frequencies and it is proving multiband charactestric property of antenna

2.4 Circular Microstrip Patch Antenna Design for 6-Slit-Slots

Design Antenna and its Return loss Charactestric is find out by a CST-MWS Software shown below:-

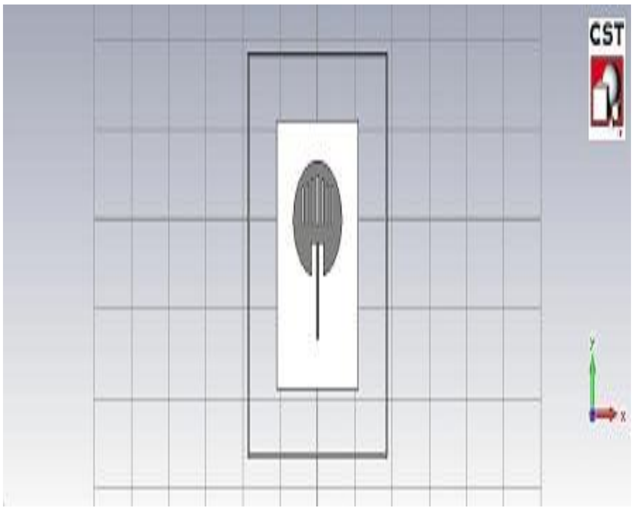


Fig.9. CMPA With 6 Slit-slot for Multiband Application

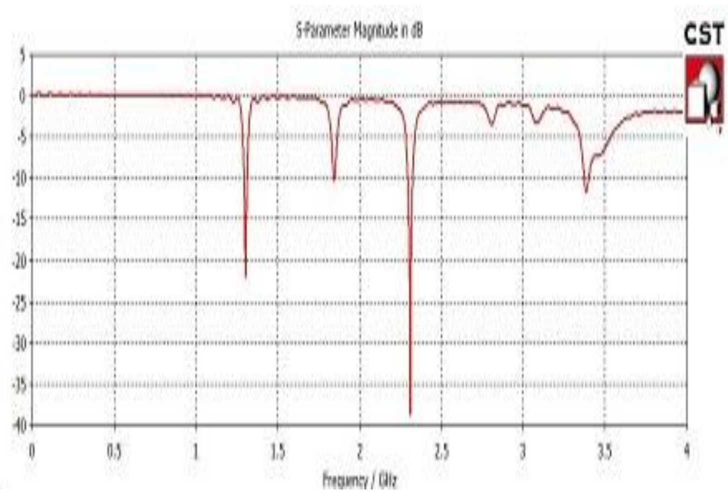


Fig. 10 Radiation pattern of CMPA with 6 slit slot- structure

Table 4: Six Slit-Slot parameter of Circular Microstrip Patch Antenna

S.NO	Frequency(GHz)	Return loss(dB)	Bandwidth(MHz)
1	1.304	21.996	20.3
2	1.8458	10.020	17.3
3	2.312	38.58	28.4
4	3.388	11.62	32.5

As it is very clear from the Table-4 that 6 peaks reduces to 4 peaks and retrunloss and bandwidth is also reduced, although Bandwidth improvement from designed frequency is only about 37.5%.

3 Discussion

As we can easily see in Table 2, 3 and 4 and compared it from Table-1 that Bandwidth is increased by two slit slot patch is about 63.3% as compared to its basic design frequency. Antenna is working for six different frequencies may be used for multiband in different wireless communication. Antenna with 3-slit slot is also working fine for different six frequencies bandwidth is increased about 72.10% as compared to its basic designed frequency bandwidth. Antenna with six slit-slots is also designed and it is working only for 4-band instead of 6, Bandwidth is increased about 37.5% compared to its basic designed frequency bandwidth. There is less improvement in six-slot patch as compared to two and three slit-slot patches.

4 Results

Finally it is shown from the above discussion that as we increases slit-slot from one to three bandwidth and multiband charactestric introduced, but as slit-slot increases to six working band are reduced and bandwidth is also reduced to compare from two and three slit-slot. There is drastic improvement in bandwidth by slit-slot patches compared with it designed frequency peak about 1.3GHz.There is improvement in bandwidth about 63.3%,72.10% and 37.5% respectively in two, three and six slit-slot patches compared to their basic design frequencies band which is about 1.3GHz.

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