

Microstrip Modified Patch Antenna using two different geometries for Bandwidth enhancement

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Abstract

In this paper, a comparative study of performance for Rectangular and Circular microstrip antenna is carried out. The new structure is designed by combining this two geometry. The simulation for three designs done in Zeeland IE3D. The antenna is designed to work in the range of 1GHz to 12 GHz. The different performance parameters such as return loss, bandwidth of these antennas are compared. It is observed that modified design which combines two basic structure i.e. Rectangular and circular is giving high bandwidth than the two.

Key word—Microstrip antenna, Patch antenna, UWB.

Introduction

Wireless technology provides less expensive alternative and a flexible way for communication. Antenna is one of the important elements of the wireless communications systems. Printed microstrip antennas have received increasing attention in satellite and communications applications because of their low profile, small size, light weight, low cost and ease of fabrication. Figure 1 shows basic structure of microstrip antenna. There are different shapes of patch are available for microstrip antenna are rectangular, circular, hexagonal, pentagonal etc.

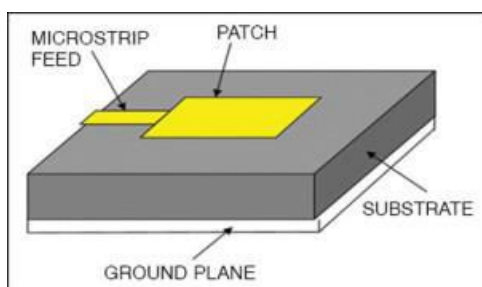


Fig. 1. Basic structure of Microstrip Antenna

I. Antenna design

Circular Patch:

A circular patch is designed on FR4 substrate of thickness 1.6mm. Using design equations for microstrip antenna dimensions are calculated. The radius of patch is 19.2mm. The microstrip feed line of length 22mm and width 3mm is connected to the patch. Ground of length 22mm and width 50mm is flushed with the feed line.

The structure is shown in figure 2.

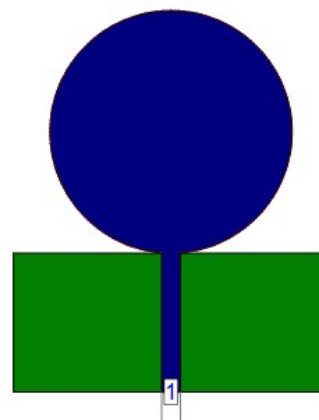


Fig.2 circular patch

Rectangular Patch:

A rectangular patch is designed on FR4 substrate of thickness 1.6mm. The length of the rectangular patch is equal 23.97mm and the width is equal to 30mm. The microstrip feed line of length 22mm and width 3mm is connected to the patch. Ground of length 22mm and width 50mm is flushed with the feed line. The structure is shown in figure 3.

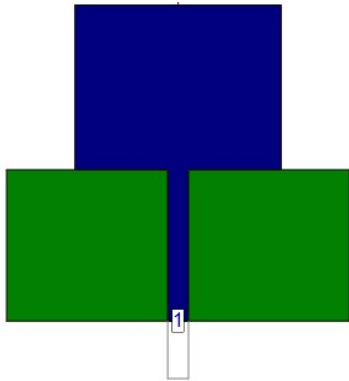


Fig.3 rectangular patch

Modified Patch:

A Modified patch is designed on FR4 substrate of thickness 1.6mm. modified geometry is combination of circular and rectangular shape. The radius of the circular part of this modified patch is equal to 19.2mm. The rectangular part has length of 23.67mm and width of 30mm. The microstrip feed line of length 22mm and width 3mm is connected to the patch. Ground of length 22mm and width 50mm is flushed with the feed line. The structure is shown in figure 4.

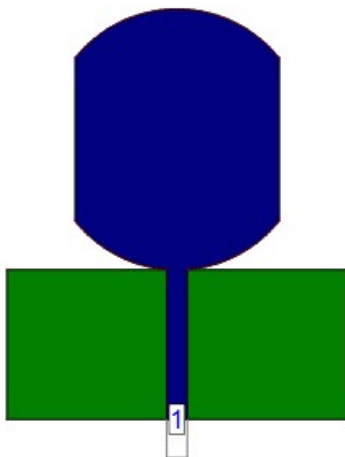


Fig.4 modified patch

II.RESULTS

Figure 5 shows s11 plot for circular patch microstrip antenna. Here three resonant bands are obtained at (4.60 GHz-4.92GHz) ,(5.34 GHz-5.89GHz),(9.29GHz-10.32GHz).Total bandwidth is 1.89GHz.

Figure 6 shows VSWR plot for the same. Return loss at resonant frequency 4.821 GHz is -13.82 dB , for 5.71GHz is -19.61dB and at 9.75GHz is -19.42GHz. Table 1 and table 2 shows bandwidth analysis and return loss analysis respectively for circular patch antenna.

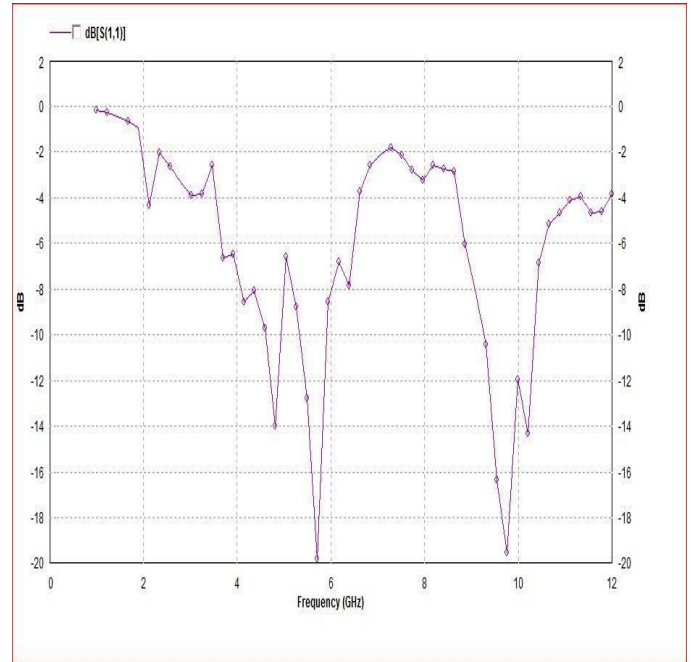


Fig.5 s11 plot for circular patch

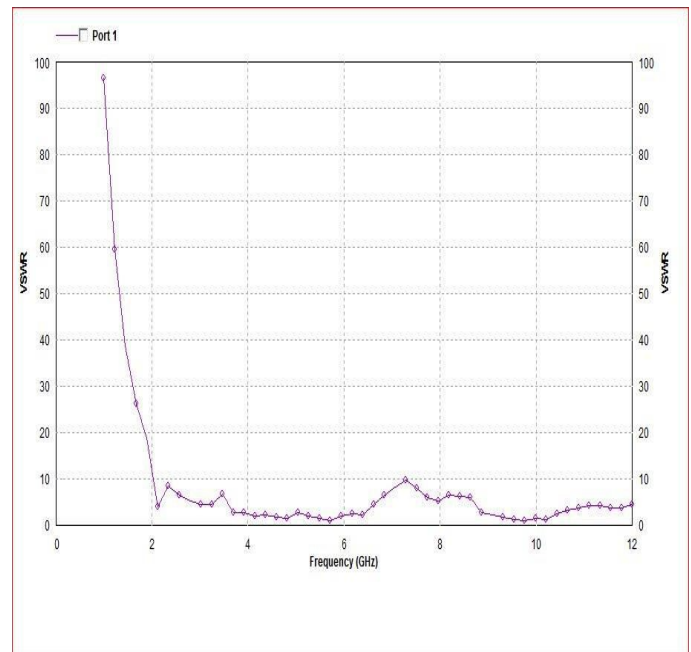


Fig.6 VSWR plot for circular patch

Table 1 B.W analysis OF Circular patch

Resonant freq.(GHz)	FL(GHz)	FH(GHz)	B.W	Total B.W
4.821	4.60	4.92	0.318	1.89
5.71	5.34	5.89	0.55	
9.75	9.29	10.32	1.03	

Table 2 Frequency and Return loss for circular patch:

Frequency (GHz)	Return loss (dB)
4.821	-13.82
5.71	-19.61
9.748	-19.42

Figure 7 shows s11 plot for circular patch microstrip antenna. Here four resonant bands are obtained at (4.62 GHz-5.068GHz) ,(5.068 GHz-5.626GHz),(5.628GHz-6.132GHz) (9.464 GHz-10.192GHz). total bandwidth obtained is 2.24GHz.

Figure 8 shows VSWR plot for the same. Return loss at resonant frequency 4.676 GHz is -11.597 dB , for 5.404GHz is -15.71dB ,for 5.908GHz is -16.45 and at 10.052GHz is -13.69dB.

Table 3 and table 4 shows bandwidth analysis and return loss analysis respectively for rectangular patch antenna.

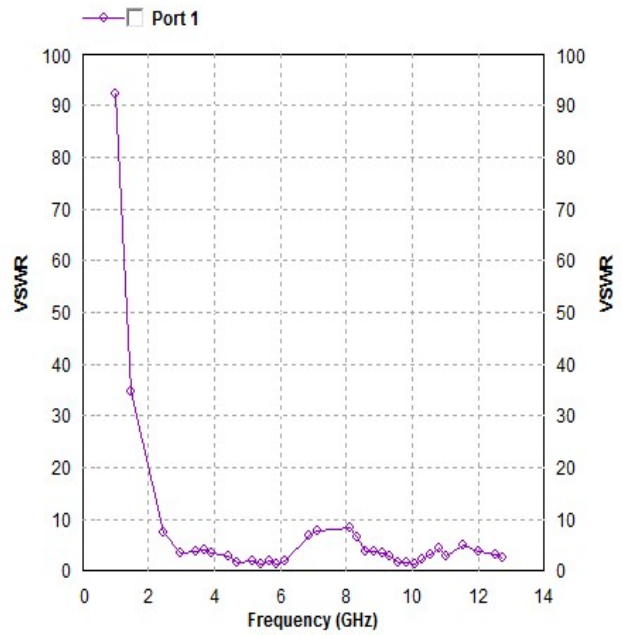


Fig.8 VSWR plot for rectangular patch

Table3 B.W. analysis Of Rectangular patch

Resonant freq.(GHz)	FH(GHz)	FL(GHz)	B.W	Total B.W
4.676	5.068	4.62	0.448	2.24
5.404	5.628	5.068	0.56	
5.908	6.132	5.628	0.504	
10.052	10.192	9.464	0.728.	

Table 4 Frequency and Return loss for rectangular patch:

Frequency (GHz)	Return loss (dB)
4.676	-11.597
5.404	-15.7217
5.908	-16.4525
10.052	-13.6917

Figure 9 shows s11 plot for modified patch microstrip antenna.

Here two resonant bands are obtained at (4.514GHz-5.872GHz) ,(5.872 GHz-10.24GHz). Total bandwidth is 5.728GHz.

Figure 6 shows VSWR plot for the same. Return loss for resonant frequency 5.028GHz is -15.88dB and for 6.57GHz is -25.14dB.

Table 5 and table 6 shows bandwidth analysis and return loss analysis respectively for modified patch antenna.

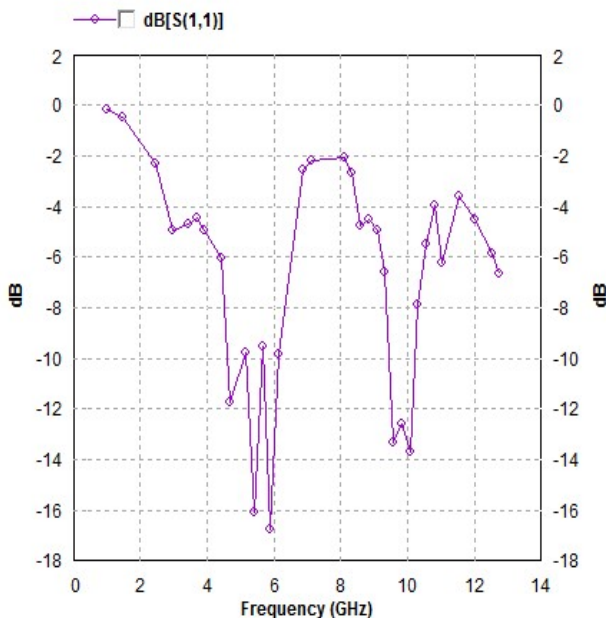


Fig.7 s11 plot for rectangular patch

Table 5 B.W. analysis Of modified patch

Resonant freq.(GHz)	FH(GHz)	FL(GHz)	B.W	Total B.W
5.028	5.872	4.514	1.358	5.726
6.57	10.24	5.872	4.368	

Table 6 Frequency and Return loss for modified patch:

Frequency (GHz)	Return loss (dB)
5.028	-15.883
6.57	-25.141

I. CONCLUSION

For circular patch antenna resonant bands obtained are three and bandwidth is 1.89GHz . Rectangular patch design gives two resonant bands and bandwidth is 2.24GHz. When these two structures are combined the modified patch is designed and it gives 5.726 GHz bandwidth which is more than two design.

It is concluded that by combining two structure i.e circular and rectangular it gives more bandwidth.

Design	No. of Bands	B.W.
Circular	3	1.898
Rectangular	4	2.24
Modified	2	5.726

II. REFERENCES

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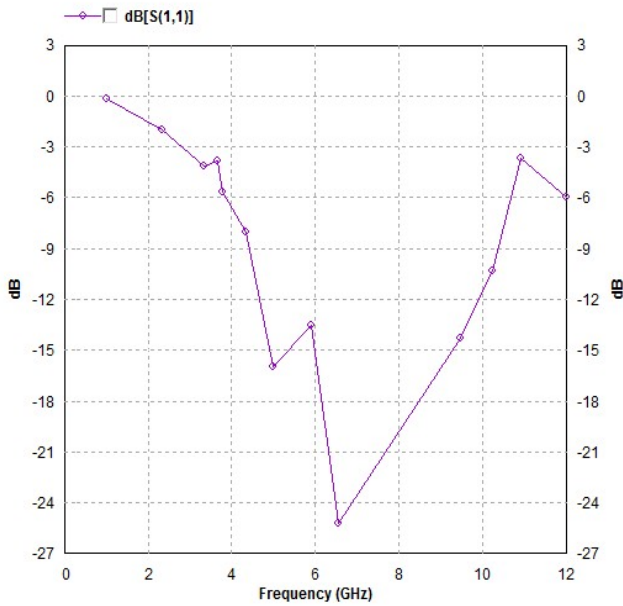


Fig.9 s11 plot for modified patch

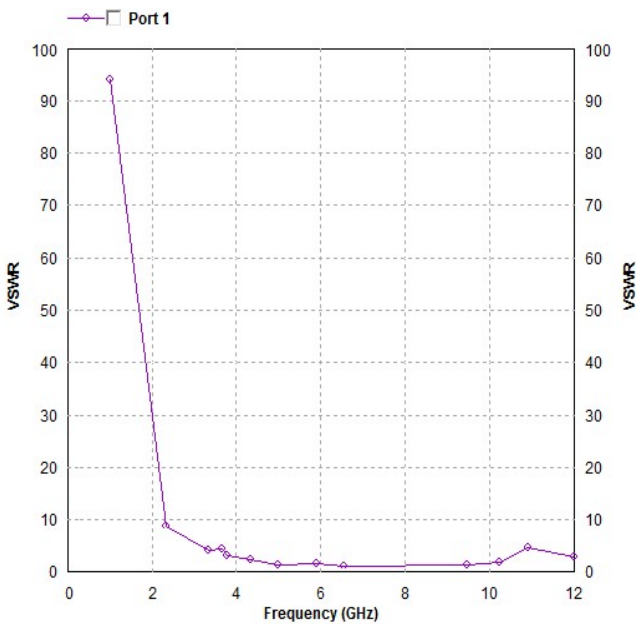


Fig.10 VSWR plot for modified patch