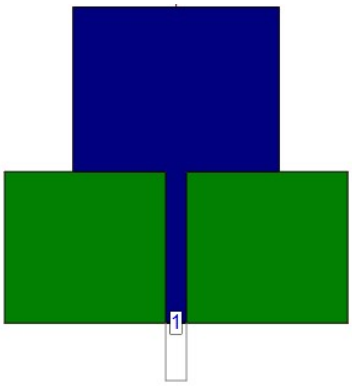

Fig.3 rectangular patch

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 modifies 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.

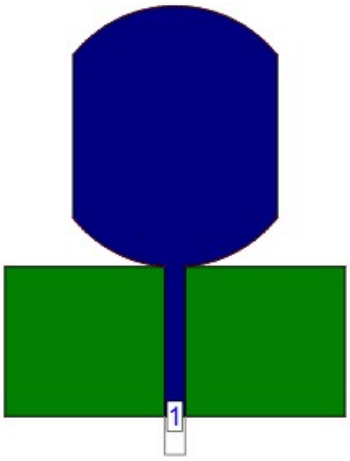

Fig.4 modified patch

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.

Figre 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 respectivelyfor circular patch antenna.

Fig.5 s11 plot for circular patch

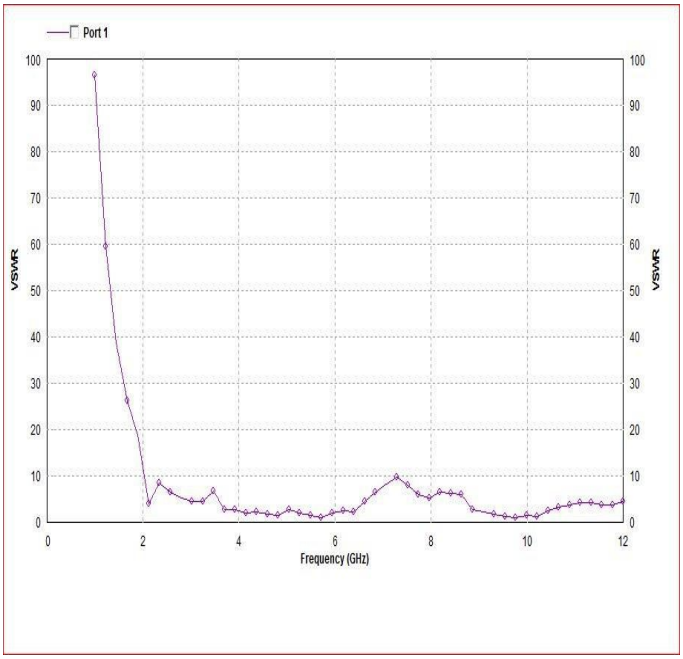

Fig.6 VSWR plot for circular patch

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.

Figre 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 respectivelyfor rectangular patch antenna.

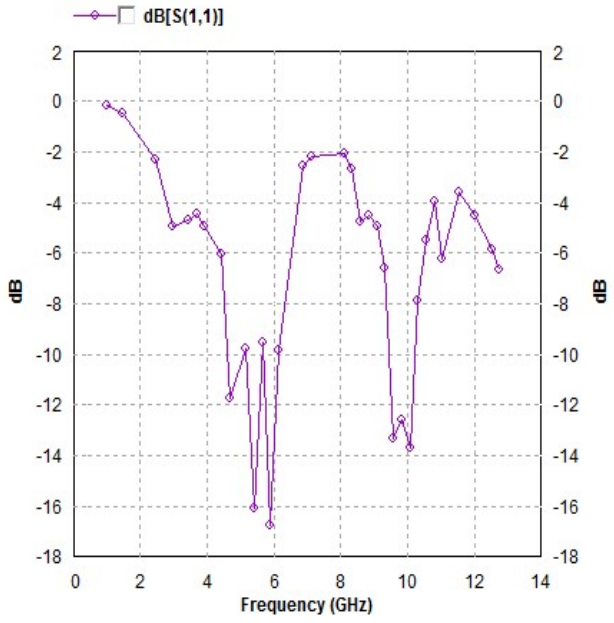

Fig.7 s11 plot for rectangular patch

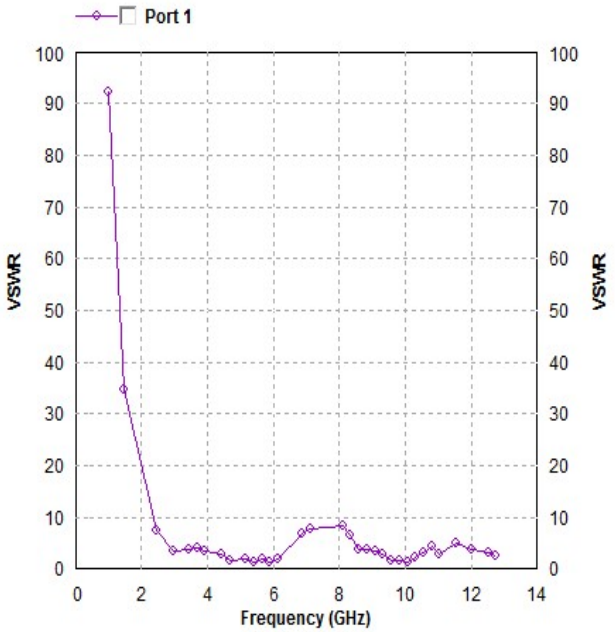

Fig.8 VSWR plot for rectangular patch

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 respectivelyfor modified patch antenna.

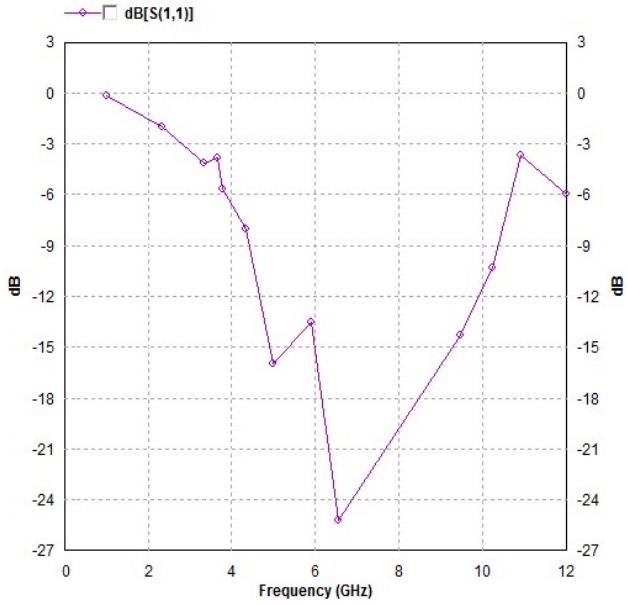

Fig.9 s11 plot for modified patch

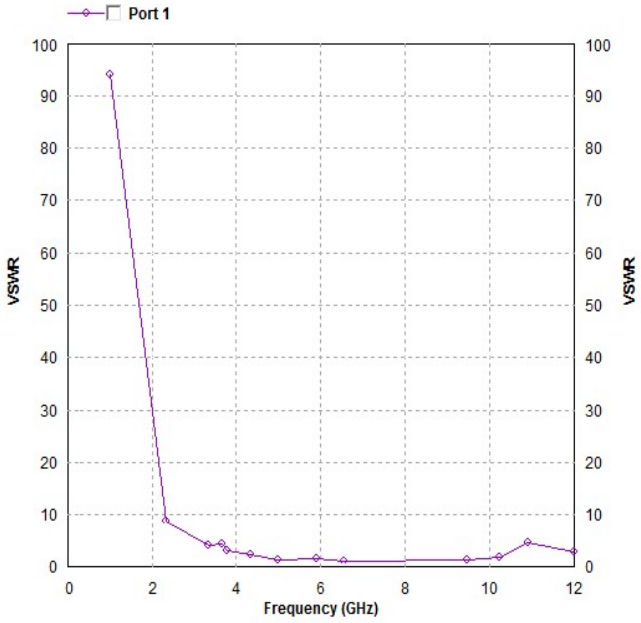

Fig.10 VSWR plot for modified patch

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 four 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

[1] C.A. Balanis, "Antenna Theory, Analysis and Design", John Wiley and Sons, 1997.

[2] K.L. Wong, *"Compact and Broadband Microstrip Antennas"*, John Wiley and Sons, 2002.

[3] Kraus J D. Antennas. 2nd ed. New York: McGraw Hill, 2001

[4] Mohammed Younssi, Achraf Jaoujal, Yacoub Diallo, Ahmed El-Moussaoui, and Noura Aknin, "*Study of a Microstrip Antenna with and Without Superstrate for Terahertz Frequency*," *International Journal of Innovation and Applied Studies*, vol. 2, no. 4, pp. 369–371, April 2013.

[5] M. I. Hasan and M. A. Motin, "*New slotting technique of making compact octagonal patch for four band applications," International Journal of Innovation and Applied Studies*, vol. 3, no. 1, pp. 221–227, May 2013.

[6] Tajeswita Gupta and P. K. Singhal, "*Ultra Wideband Slotted Microstrip Patch Antenna for Downlink and Uplink Satellite Application in C band,*" *International Journal of Innovation and Applied Studies*, vol. 3, no. 3, pp. 680–684, July 2013