THINK INDIA JOURNAL

ISSN:0971-1260
Vol-22- Issue-14-December-2019

Tri-band Rectangular Patch Antenna for UWB Applications

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Abstract*— The rectangular patch antenna is designed with a compactable size of 21×19×1.6 mm^3 for UWB applications. To achieve tri-band operating frequency the original rectangular radiation patch is modified by cutting a ring slot at the centre of the original patch and additional slots are made both from inside and from outside of the original rectangular patch diametrically. The proposed antenna observed with good directivity characteristics The analysed results are observed with three different frequencies 4.14GHz,6.5GHz and 11.45GHz with bandwidth of 7.31GHz and return loss is below 2 for all resonating frequencies with good radiation because of above characteristics and simplicity of the design.

Index Terms- Rectangular patch antenna, UWB technology.

I. INTRODUCTION

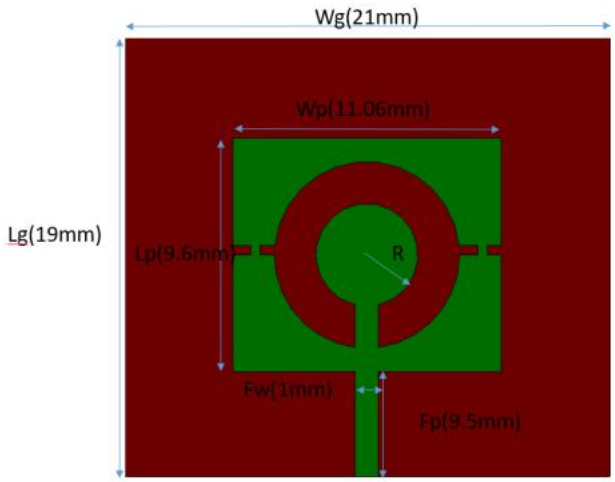
UWB technology offers a promising solution for many wireless communication areas such as Wi-Fi wireless local area networks (WLAN) and other cellular wide area communications. The UWB signal band is spread over a wide bandwidth of 7.5GHz(3.1-10.6GHz allocated by FCC) .which transmits high data rate using a low power narrow radio pulse without using any high frequency carrier to deliver data over a long distance communications . The advantages of the UWB technologies are low interference ,secure, low cost and low complexity[1-2].UWB patch antenna could designed with different geometries,i.e triangular,rectangular,square.several methods are used to enhance bandwidth by using DGS [3] and other different arrangements in the patch structure.

In designing [4] the low cost compact size patch antenna on 3cm×5.1×cm printed circuit board (FR_4) with T-shape ground plane with the presence of the diagonal cuts at the top corner and the rectangular slits can increase the bandwidth,

In this article we report how the for all intents and single rectangular patch antenna resonates with tri-band frequencies modifying by cutting a ring at the center of the original patch with additional slots very contrary to popular belief.

II. ANTENNA DESIGN

The proposed triple band antenna is shown in fig:1 .The antenna for all intents and purposes is fabricated on a low cost substrate sort of material FR-4 with sort of relative permittivity 4.4 actually low loss basically tangent of 0.02andsubstrate thickness of 1.6mm .The overall dimensions of the antenna size actually is 21×19×1.6mm With a feed line and really finite ground plane. The proposed antenna for the most part offers many advantages generally such as compact, inexpensive and light Weight, which is quite significant.



Fig,1 Geometrics of the Rectangular micro strip patch Antenna.

The proposed antenna consists of three radiating elements ,one is rectangular patch ,which is placed on top of the substrate and another one is acquired by cutting ring slot at the center of the original radiation patch and additional slots are made both from inside and from outside of the original rectangular patch diametrically. Each radiating element is fed by a 50Ω microstrip line.Table-1 shows all the dimensions of the antenna.

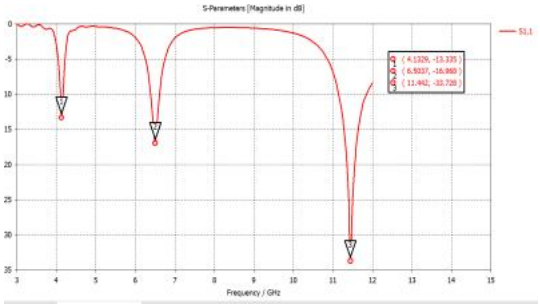
ISSN:0971-1260
Vol-22- Issue-14-December-2019

Parameters	Dimensions(mm)
Total dimensions of the antenna	21×19×1.6 mm^3
Circular radius	4mm
Width of the ground(wg)	21mm
Length of the ground(lg)	19mm
Width of the patch(Wp)	11.06mm
Length of the patch(lp)	9.6mm
Feed line of the patch(Fp)	9.5mm
Width of the feed (Fw)	1mm

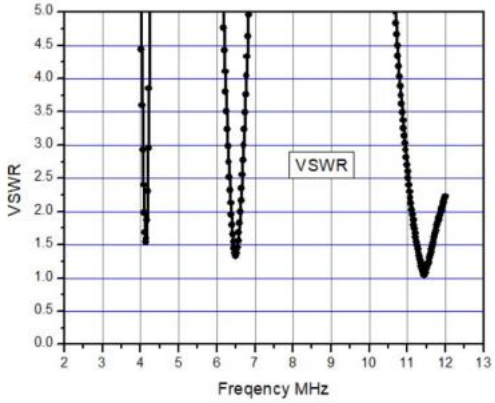
Table.1 Dimensions of the antenna

III. RESULTS AND DISCURSIONS

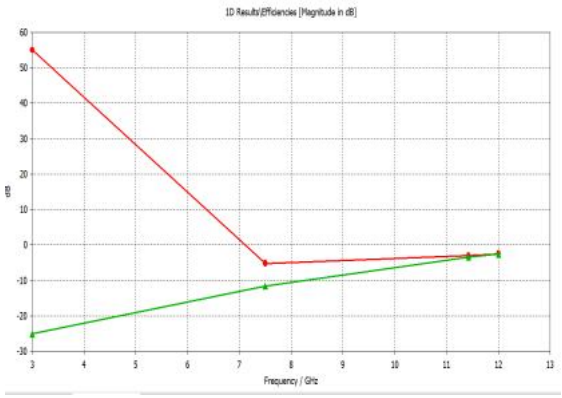
The simulation software was used to design the proposed antenna. The result of the return loss, VSWR ,gain ,directivity and efficiency of the patch is shown in Figure-2-5.Thebtri-band patch antenna resonates at 4.14GHz,6.5GHz and 11.45GHz with a return loss of -13.33dB,-16.96dB and -33.72dB as shown in fig .2.The result ofthe VSWR shown in fig-3.The antenna achieved high directivity 6.094dB at 11.45GHz,6.36dB at resonating frequency 6.5GHz and 2,84dB at 4.14GHz.



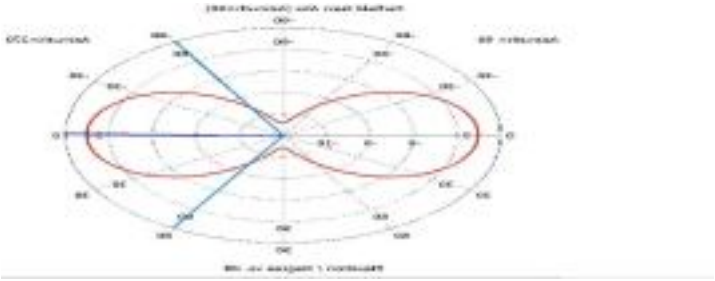
Fig, 2 Tri-band micro strip patch antenna using CST



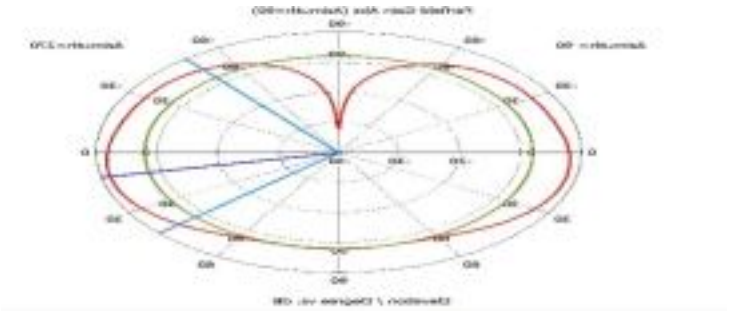
Fig, 3 VSWR of the Tri-band micro strip patch antenna using CST



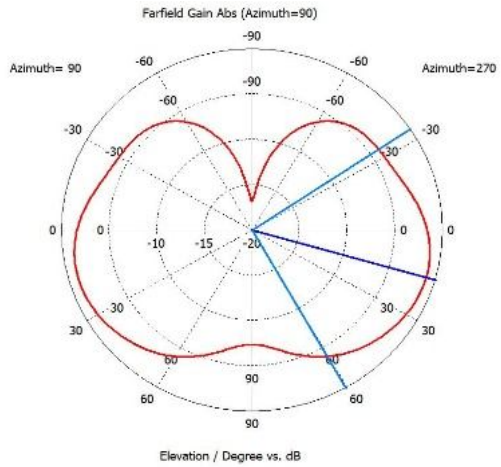
Fig, Fig:4 Efficiency of the Tri-band antenna



Fig,6Radiation pattern of the Tri-band antenna at 4.14GHz



Fig,6Radiation pattern of the Tri-band antenna at 6.5GHz



ISSN:0971-1260
Vol-22- Issue-14-December-2019

Fig,6Radiation pattern of the Tri-band antenna at 11.45GHz.

The summary of the result is shown in Table 1.The obtained results shows that the proposed antenna is well suited for UWB applications.

Frequency	Return loss	Gain	Directivity
4.14GHz	-13.33dB	2.09dB	2.84dB
6.5 GHz	-16.96dB	3.02dB	6.36dB
11.45 GHz	-33.12dB	3.96dB	6.09dB

Table 2 Summary of Results

CONCLUSION

The compact tri-band antenna have been proposed and implemented .For UWB applications, the proposed antenna validated through CST software simulation frequencies md results shows that it is operated with three resonsent 4.14GHz, 6.5GHz and 11.45GHz with bandwidth of 7.31GHz with considerable return loss and good gain and directivity respectively.

REFERENCES

[1] Tale sahedi, idris ismail Adam RH alhawari "Ultra-Wideband Antennas for Wireless Communication Applications" International Journal of Antennas and Propagation, Volume 2019, Article ID 7918765.

[2] N. Prombutr,P. Kirawanich and P. Akkaraekthalin "Bandwidth Enhancement of UWB Microstrip Antenna with a Modified Ground Plane" Hindawi Publishing Corporation International Journal of Microwave Science and Technology Volume 2009, Article ID 821515, doi:10.1155/2009/821515.

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[3] Sundar, P.S., Kotamraju, S.K., Ramakrishna, T.V., Madhav, B.T.P.: Novel miniatured wide band annular slot monopole antenna. Far East J. Electron. Commun. 14(2), 149–159. ISSN: 0973-7006 (2015)

.

[4] Ritu, K.S.: Microstrip antenna design for UWB applications. Int. J. Adv. Res. Comput. Commun. Eng. 2(10), 3824–3828 (2013) .

[5]Singh, Y., Singh, D., Gill, G. S.: Design of wideband microstrip antenna for UWB applications. Int. Res. J. Eng. Technol. 2(5), 995–998 (2015) .

[6]Madhav, B.T.P., Kaza, H.: "Novel printed monopole trapezoidal notch antenna with S-band

Rejection" J. Theor. Appl. Inf. Technol. 76(1), 42–49. ISSN: 1992-8645 (2015)

[10]Singh, P., Tomar, R.: The use of defected ground structures in designing microstrip filters with enhanced performance characteristics. Proc. Technol. 17, 58–64 (2014) .

[7] Mohan Reddy, S.S., Mallikarjunarao, P., Madhav, B.T.P.: Asymmetric defected ground structured monopole antenna for wideband communication systems. Int. J. Commun. Antenna Propag. 5(5), 256–262. ISSN: 2039- 5086 (2015).