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DUAL BAND OPERATING RADIATOR LOADED WITH RSRR FOR WIFI & X BAND ITU APPLICATION

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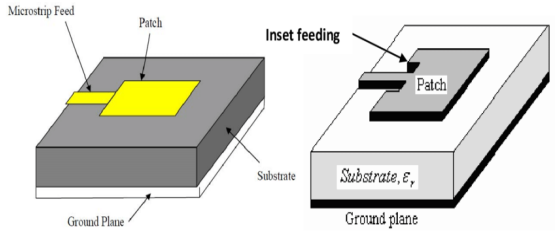
***Abstract*— Multiband operating spectrum have impacted Wireless communication technologies with greater accuracy and accessibility.proposed radiating patch antenna contains the rhombus shaped patch loaded with SRR metamaterial(RSRR) structures in a distinctive manner in order to provide increased gain, directivity, bandwidth .The main objective of this work is to design a dual band radiating patch antenna resonating at 6.199 GHz & 8.362GHz with a peak realized gain of 6.06dBi & 4.87dBi is proposed to operate in desired applications like WIFI (wireless home automation) & X band ITU application, respectively.**

I. INTRODUCTION

Antenna is a specialized transducer that converts the radio frequency fields into alternating current. An antenna plays an important role in modern wireless communication systems. In recent years, the miniaturization and multi-functionalization of communication devices require that the internal antenna has strong integration capabilities. In many wireless applications it is required to design a patch antenna for multiple frequency band operation. The most common type of microstrip antenna is commonly known as patch antenna . Antenna is narrow band, wide-beam, antenna fabricated by etching the antenna element pattern in metal trace bonded to an insulating dielectric substrate with a continuous metal layer bonded to the opposite side of substrate which forms a ground plane .There are many merits of microstrip patch antenna such as low profile, light weight, simple realization process and low manufacturing cost. .They are mostly used at microwave frequencies . Most microstrip antenna consists of multiple patches in a two dimensional array. The antenna is usually connected to the transmitter or receiver through microstrip transmission lines. The radio frequency current is applied between the antenna and ground plane. Microstrip antenna have become very popular in recent decades due to their thin planar profile .The most common type of microstrip antenna is commonly known as patch antenna . Antenna is narrow band, wide-beam, antenna fabricated by etching the antenna element pattern in metal trace bonded to an insulating dielectric substrate with a continuous metal layer bonded to the opposite side of substrate which forms a ground plane The dielectric loading of microstrip antenna affect both its radiation pattern and impedance bandwidth as the dielectric constant of the substrate increases the antenna bandwidth decreases which increases the Q factor of the antenna and therefore decreases the impedance bandwidth. The radiation from a rectangular miucrostrip antenna may be understood as a pair of equivalent slots.

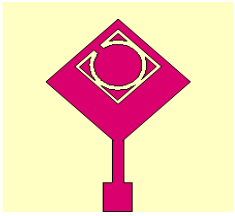


The Microstrip Patch antennas are generally narrow band antennas and the design of Microstrip patch antennas for wideband applications is an area of extensive research. generally, microstrip patch antenna consists of a radiating patch, dielectric substrate and a ground plane. As the antenna is loaded with dielectric as its substrate the length of the antenna decreases as the relative dielectric constant of the substrate increases There are several types of patches like rectangular, square, circular, pentagon, hexagon, etc. The proposed antenna is designed using a rectangular patch. Hight (h) should be greater than 0.025 of a wavelength otherwise, the antenna efficiency will be degraded. The WiMAX Forum has published three licensed spectrum profiles: 2.5 GHz (2.5-2.69 GHZ), 3.5 GHz (3.4-3.69 GHZ) and 5.5 GHz (5.25-5.85 GHZ)

II ANTENNA DESIGN

The proposed antenna is designed by using CST studio suite software. For the better performance of the patch antenna, it requires impedance matching circuits. Input impedance of the patch antenna is associated with (w/l) ratio. The dual band radiating patch which has been conceived utilizing the substrate ROGERS of dielectric constant is 3.86. low dielectric constant is used in the prototype design because it gives better efficiency and higher bandwidth, and lower quality factor Q. The low value of dielectric constant increases the fringing field at the patch periphery and thus increases the radiated power .the dimension of radiating patch is (24×25×0.708)mm.

PARAMETERS	VALUES
HEIGHT OF SUBSTRATE(h)	0.708 mm
DIELECTRIC CONSTANT	3.5
WIDTH(W)	25 mm
LENGTH(L)	24 mm
LENGTH OF PATCH(Lp)	10.31 mm



A. Effective length:

$$L = \frac{c_o}{2 f_r \sqrt{\varepsilon_{re}}} \quad \text{mm}$$

B. Dielectric constant:

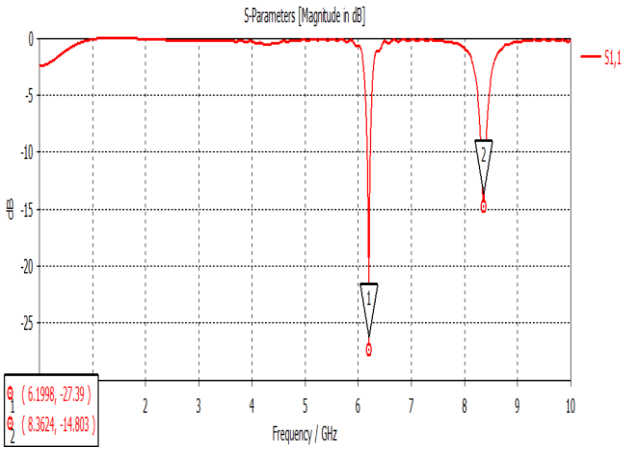
$$\varepsilon_{reff} = \frac{\varepsilon_r + 1}{2} + \frac{\varepsilon_r - 1}{2\sqrt{1 + \frac{12h}{W}}} \quad \text{F/m}$$

C. Effective Width:

$$W = \frac{c}{2 f_r \sqrt{\frac{\varepsilon_r + 1}{2}}}$$

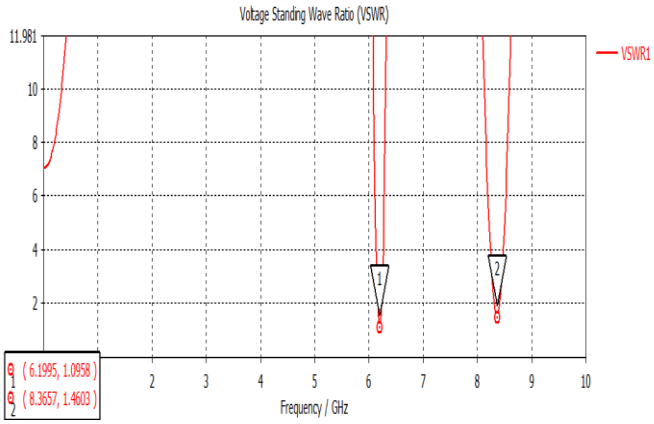
III.RESULTS AND DISCUSSION

RETURN LOSS(S11): The return loss is the proportion of a signal that is reflected as a result of an impedance mismatch. In order to get the effective output return loss should be less than -10dB.The proposed antenna exhibits resonant frequency at 6.199GHz with a return loss of -27.39dB and 8364GHz with a return loss of -14.80dB . The s11 vs frequency curve for the optimized parameters is shown below.



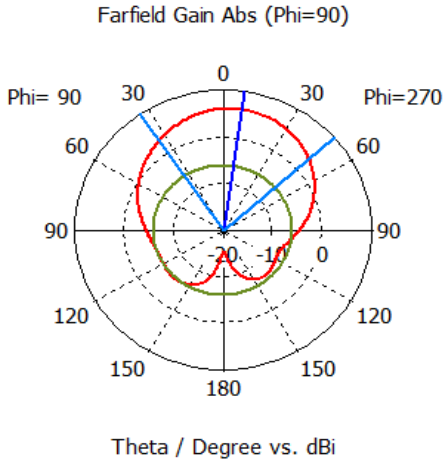
VSWR: VSWR stands for Voltage Standing Wave Ratio. "The ratio of the maximum voltage to the minimum voltage in a standing wave is known as Voltage Standing Wave Ratio." It is also called as SWR. The higher the impedance

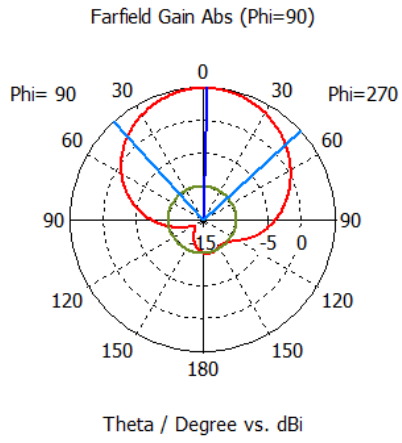
mismatch, the higher will be the value of VSWR. the value of VSWR should be less than 2. Here we got two values of VSRW 1.09 and 1.46



FREQUENCY RANGE	RESONATING FREQUENCY	RETURN LOSS(S11)	VSWR
(6.17-6.23) GHz	6.199 GHz	-27.39 dB	1.09
(8.31-8.41) GHz	8.365 GHz	-14.80 dB	1.46

FAR FIELD: The field, which is far from the antenna, is called as far-field. It is also called as radiation field, as the radiation effect is high.





CONCLUSION

We can say that there are many aspects that affect the performance of the antenna such as dimensions, selection of the substrate, feed technique and also the Operating frequency can take their position in effecting the performance. ,The microstrip patch antennas with rhombus-shaped patch antenna has an improved bandwidth and size reduction compared to the conventional microstrip patch antenna. After simulation, the obtained results are the proposed antenna exhibits resonant frequencies at 6.199GHz and 8.365GHz which is invaded in various wireless applications such as WIFI (wireless home automation) & X band ITU application, respectively.

REFERENCES

[1] N. Herscovici. 1998. New considerations in the design of micro strip antennas. IEEE Transactions on Antennas and Propagation, AP-46, 6 (Jun. 1998), 807-812.

[2] D. Sanchez-Hernandez and I. D. Robertson. 1996. A Survey of Broad band Micro strip Patch Antennas. Microwave Journal, (Sep.1996), 60-84.

[3] Dipak K. Neog, Shyam S. Pattnaik, Dhruba. C. Panda, Swapna Devi, Bonomali Khuntia, and Malaya Dutta, "Design of a Wideband Micro strip Antenna and the Use of Artificial Neural Networks in Parameter Calculation", IEEE Antennas and Propagation Magazine, Vol. 47, No.3, June 2005.

[4] C. A. Balanis, Antenna Theory, Analysis and Design, John Wiley and Sons, New York.