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Simulation and Design of Microstrip Antenna for Various Wireless Applications by using SRR's

Sanjeev Kashyap
Student, ECE
Green Hills Engineering College
Solan, India

Shailly Kumari
Assistant Professor, ECE
Green Hills Engineering College
Solan, India

Abstract:- Here in this, development and design of microstrip antenna with SRRs (Split Ring Resonator's) are introduced. To reduce size & for improved better performance of introduced antenna SRR's are used. This Metamaterial method used as for designing SRR's for negative permeability. The SRR's are introduced between two substrate layers of Teflon with relative permittivity 4.9. The return loss and VSWR results are better. The return loss of microstrip antenna operating frequency 5.02 Gigahertz is -23 dB, and VSWR is approximately near to 1.15. CST Software is used to obtained for the simulated results of the antenna which having better performance.

Keywords:- *SRR's (Split Ring Resonator's), Microstrip antenna, Metamaterial, Permittivity, Size Reduce.*

I. INTRODUCTION

At present, Wireless system have grown significantly. Over different wireless services, according to multifunction antennas used to designed for adaptable operations. Also user stipulation indicates the need for reliable, compact, efficient, wireless systems integrating whole receiver & transmitter on single chip [1-2]. The compactness matter of antenna is much important at present. Various design use to reduce patch size in the antenna is iris structure, inserting slot & shorting pin. Due to which, these antennas are designing methods have low performance & complex structures. Currently designed method uses to reduce patch size in antenna are named as SRR's & CSRR's with antennas for better performance & simple structure. Also on other side we can say that with SRR's and CSRR's have a special property which helps for size reduction of proposed antenna [3-4]. Metamaterials used in antennas are exploring scientifically to be the normalized frequency results on electro-magnetic wave propagation. Material used widely is the left handed materials. For the reduction antenna's size with the help of SRR's are introduced in between the substrate layers in this research paper. The introduced antenna take benefits over the past antenna research.

II. METHODOLOGY & DESIGN

The introduced microstrip antenna using substrate Teflon dielectric material with (ε_r) relative permittivity 2.1 and height approximately 1.00 mm used by introducing SRR's between the two substrate layers. The dimensions w and l radiates patch which excited by 50 Ω (ohm) microstrip feed strip, by using it with quarter wave length transformer for impedance match. The ground patch which used in antenna dimensions are l_t & w_t. By introducing SRR's in antenna that operating frequency 5.02 Gigahertz . The 3D model of antenna optimized by using CST software. In 1999, metamaterial was proposed by Pendry having the negative permeability which is SRR's [5]. The Microstrip antenna and SRR's geometry shown in figures below:

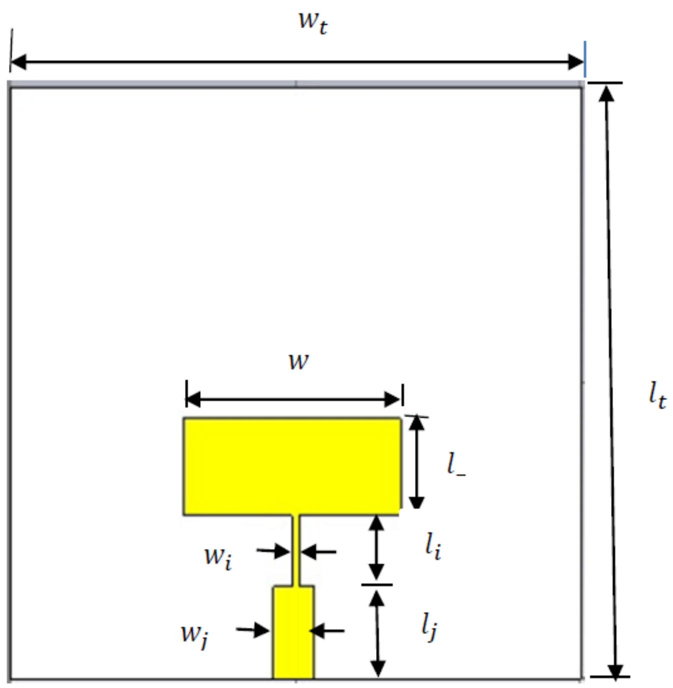

Fig. 1:- Patch Side in antenna

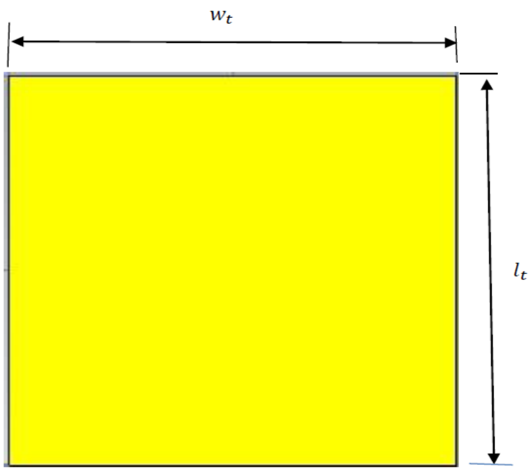

Fig 2:- Ground Side in antenna

As in Table no.1, Shows Parametric representation of antenna is given below:

Parameter	Dimension in mm
l_t	40.00
w_t	40.00
l	11.35
w	15.25
l_i	4.90
w_i	0.50
l_j	6.15
w_j	3.50

Table 1:- Parametric Representation of Antenna

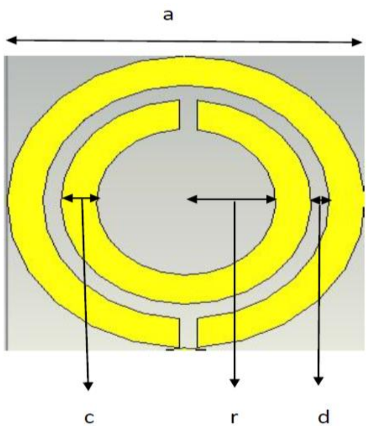

Fig. 3:- Design of SRR's

As in Table no. 2, Split Ring Resonator's parametric representation of is given below:

Parameter	Dimension in mm
a	10.00
c	1.00
d	0.50
r	2.50

Table 2:- Parametric Representation of SRR's

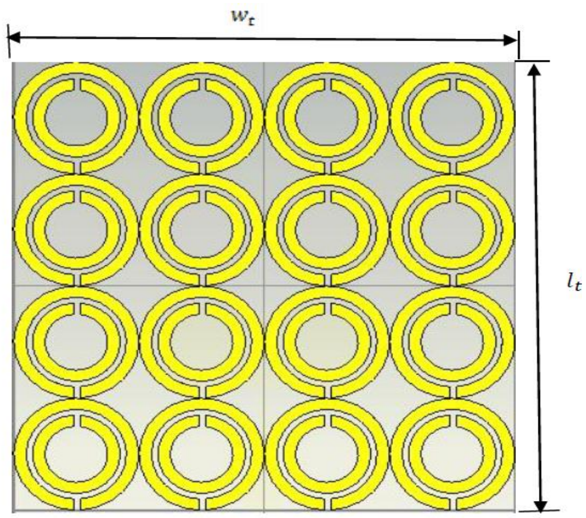

Fig. 4:- Structure of SRR's Array in antenna

In the above figure Structure of SRR's arrays represented in such a way in the antenna.

- *Return loss:-*

The loss of the power in signal reflected/ returned in transmission line or optical fiber by a discontinuity is called Return loss. It is typically expressed as the ratio in dB (decibels),

RL (dB) = $20\ log_{10} \frac{\text{SWR}}{SWR-1}$

Where RL stands for return loss in (dB) decibels, and SWR stands for Standing Wave Ratio.

By using the equation, BW $=\left[\frac{f2-f1}{fc}\right] \times 100\%$, Impedance [8]. return loss which is less than -10 dB can be calculated, in which $f1$ stands for lower cut off Frequency, $f2$ stands for upper cut off Frequency and fc stands for center frequency of $f2$ and $f1$ [8]. The return loss result after simulated characteristics of antenna is -23 dB at 5.02 Gigahertz which is less than the -1.67 dB.

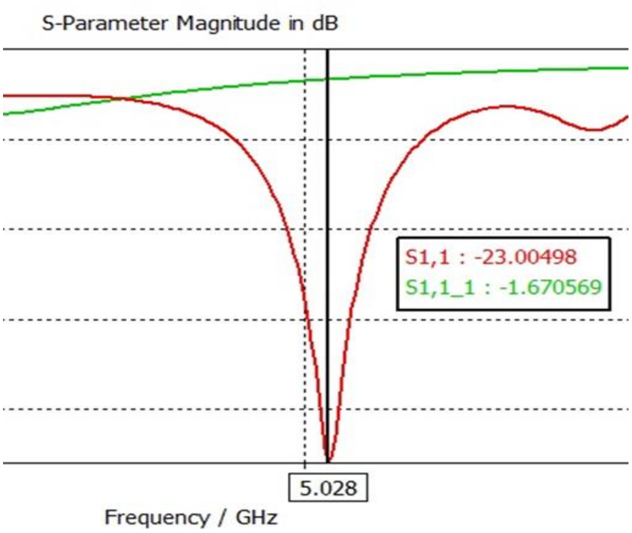

Fig. 5:- Results of Frequency vs Return loss

➢ *VSWR:-*

VSWR stands for Voltage Standing Wave Ratio & its also related to the term Standing Wave Ratio [5]. VSWR is defined as,

$$VSWR = \frac{V_{max}}{V_{min}}$$

The Voltage Standing Wave Ratio (VSWR) of the introduced antenna is approximately near to 1.15 at 5.02 Gigahertz.

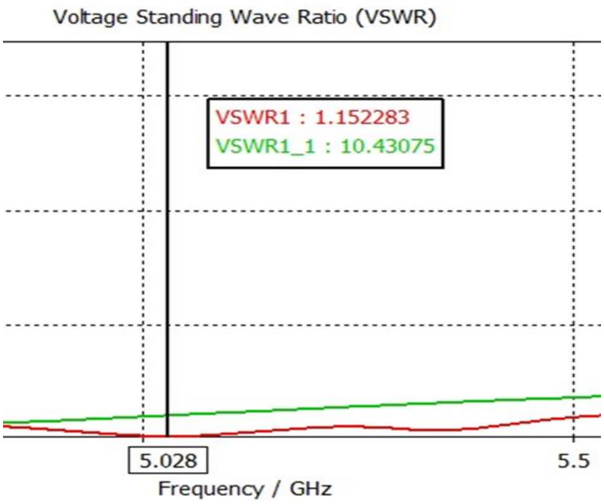

Fig. 6:- Results of VSWR vs Frequency

➢ *Directivity: -*

The maximum value of antenna directive gain is called Directivity. It measures power density in the direction of its strong emission of the antenna radiations.

The Directivity of introduced antenna is 5.02 Gigahertz as results given below:

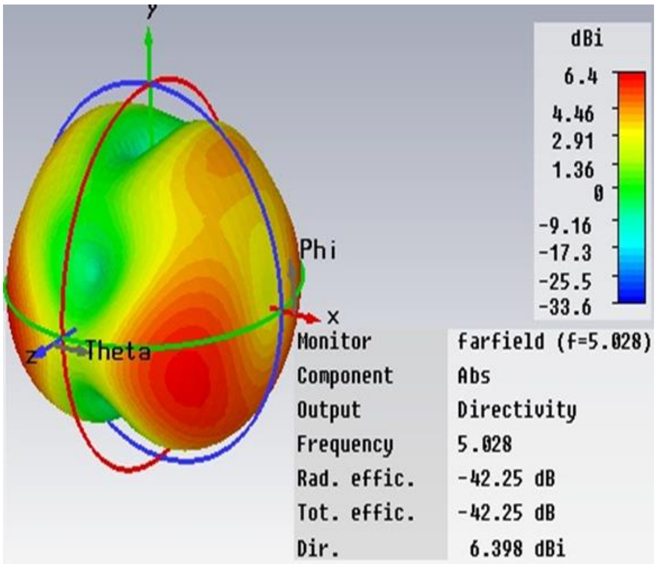

Fig. 7: Simulated Results of Directivity 6.4 dBi at 5.02 Gigahertz

➢ *Radiation pattern: -*

Directional dependence of the strength of radio waves from the antenna is called as Radiation pattern.

The result of radiation pattern at 5.02 Gigahertz is as given below:

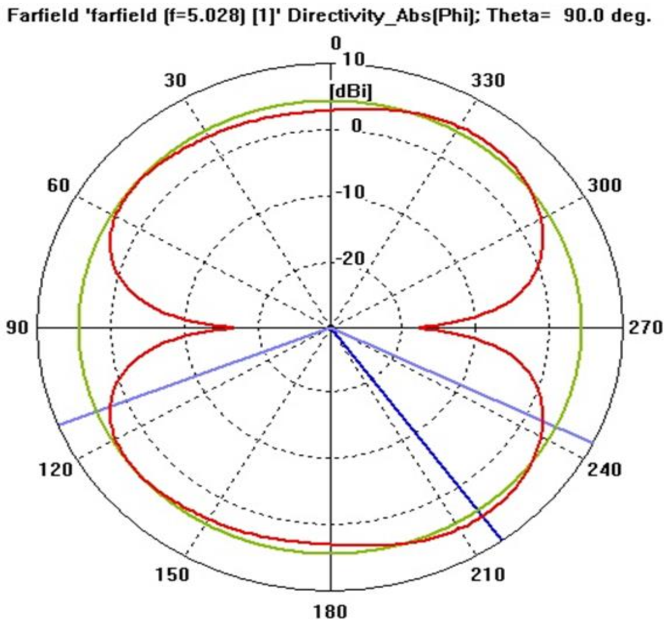

Fig. 8 :- Simulated Pattern Results of Farfield Radiation at 5.02 Gigahertz

III. CONCLUSION

The introduced antenna is simulated and measured for different wireless applications. All the results of the return loss, Farfield radiation & VSWR are given by using the SRR's in the introducing antenna. Due to which it helps to reduce size of antenna. Here substrate used having thickness approximately is 1.00 mm. The simulated results of antennas are return loss with the SRR's is – 23 decibels, the bandwidth for return loss better than 10 decibels and the VSWR of the antenna is nearly to 1.15 in the range of 5-5.5 Gigahertz. As the results compare with VSWR & Return loss are better.

REFERENCES

[1]. Perambur S. Neelakanta, Rajeswari Chatterjee, "Antenna for Information Super Skyways: An Exposition on Outdoor and Indoor Wireless Antenna", Eastern Economy Edition, ISBN-978-81-203-3668-1, 2008, pg. - 255.

[2]. Sunil Kumar Thakur, "Design & Analysis of Microstrip patch antenna using Metamaterial", ISTP research Publication, 2012.

[3]. Mei-Jing Song, Jiu-Sheng Li, "A compact broadband microstrip patch Antenna for wireless Router", IEEE, page 10-11, 978-1-4244-8266, 2011.

[4]. Prashant R.T., Vani R.M, Hunagund P.V., "Design of microstrip patch using Complementary Split Ring Resonator Loaded Ground Plane for Size reduction", IJAREEIE, Vol. 3, Issue 3, March 2014.

[5]. Shulbhi Jain, Pallav Rawal, Neeraj Jain, "Design and Analysis of Miniaturized Compact Microstrip Patch Antenna on a Double Negative Metamaterial",IIJEC, Volume 2, Issue 12, December 2014.
[6]. H. A. Jang, D.O. Kim and C.Y. Kim, "Size Reduction of Patch Antenna Array Using CSRRs Loaded Ground Plane", PIERS proceeding KL, MALASIYA, March 27-30, 2012.
[7]. Prashant R.T, Vani R.M, Hunagund P.V.,"Metamaterial Loaded Microstrip Patch Antenna for Quad-band Operation" IJRET, eISSN: 2319-1163| pISSN: 2321-7308.
[8]. Shalina Garg, Ratish Kumar, "Multi Band U-Slot Microstrip Patch Antenna for WLAN and Wi-MAX Applications", IJEAT, ISSN: 2249 – 8958, Volume-4 Issue-4, April 2015.
[9]. Shalina Garg, Ratish Kumar, "Multiband Microstrip Patch Antenna for Wireless Applications Using Metamaterial", IJARECE, Volume 4, Issue 5, May 2015.
[10]. Ruchi Thakur, Ratish Kumar, "Design and simulation of metamaterial Compact broadband microstrip patch antenna for Wireless router", IJARECE, Vol. 3, Issue 6, June 2015.
[11]. Sanjeev Kashyap*1, Shailly Kumari*2" A SURVEY ON METAMATERIAL USED FOR COMPACT MICROSTRIP ANTENNAS & APPLICATIONS", INTERNATIONAL JOURNAL OF PROGRESSIVE RESEARCH IN ENGINEERING MANAGEMENT AND SCIENCE (IJPREMS) Vol. 02, Issue 05, May 2022, pp : 338-341