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Triple Band Mime Antenna for Modern Commercial Applications

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ABSTRACT- The article presents the analysis and design of MIMO monopoly Antenna along with split ring resonator to get frequency notch characteristic in the wide band. Frequency notch characteristics are achieved by keeping the split ring resonators on one side of the substrate and on the back of the substrate at deficient ground structure a complementary split Ring resonator with respect to microstrip feeding. Between 2.5-9.5GHz and 12.548-20GHz the dual notch band characteristics are acquired. The inspected conformal characteristics of the antenna hold eminent unceasing reflection coefficient characteristics at different angles in the overall band. Analyzed the unit cell of the SRR and also examined the antenna impedance and radiation characteristics of the model.

KEYWORD- Band Notch, Rectangular Monopoly. Complementary Split Ring Resonator (CSRR) Detected Ground Structure (DGS), Split Ring Resonator (SRR)

I. INRODUCTION

Mohan Reddy SS, [1] proposed an antenna for various broadband applications. With the extent of tapered step ground in the geometry of the monopoly antenna there is an increase in the bandwidth of antenna. The peak gain of the proposed antenna is 5 dB with broadband of 3.1 to 16GHz with average gain of 3.5 dB. When compared to other broadband antennas the size, cost and manufacturing of the antenna is much less. FR-4 is used as a substrate in this antenna. In this paper [2] the performance analysis of CPW fed antenna for different broadband applications is proposed and based on tapered step ground and ebg structure. These antennas are suitable for microwave communication applications. The average gain and efficiency of the antenna is 2.5 Db and 80% and 70% is displayed respectively. [3] presented the design and analysis of Bow-tie antenna on liquid crystal substrate which is useful for various applications which include Bluetooth/WLAN-2.4/WI Bree/ZigBee. The material that is used as a substrate in this design is liquid crystal. Mallikarjuna Rao P [4] illustrated a model for Broadband uses where the antennas are asymmetric defcient ground-structured monopole antenna. In this paper [5] new compact asymmetric fractal aperture notch band antenna is analyzed and simulated using HFSS software, exhibits various broadband characteristics of the antenna. This paper [6] proposes an antenna for ultra-wide band uses which is sketched on log-periodic dipole antenna. In this the antenna [7-9] provides very stable radiation patterns. Various features of the antenna are suitable for various applications which includes different wireless communication system and for UWB applications. In [10], The writer proposed an microstrip patch antenna for the sake to differentiate the performance of microstrip antenna by using different substrate materials. In this paper the antenna works at 60GHz to 60. 5GHz.Lakshmi MLSNS [12] proposed an antenna that operates on s-band. The antenna is manufactured on RT-duroid substrate. By using sequential rotation technique, the antenna is giving an impedance bandwidth of more than 40% and 3dB axial ratio band width of 15% in the operating band with peak gain around 13 dB. The various characteristics of the antenna is with good impedance matching, stable radiation patterns. Ultra-wide band extended from 1.85 GHz to 11 GHz obtained, while the average antenna gain is about 5.5 dBi over the operating band frequency with peak gain around 6.5 dBi and average radiation efficiency of about 70%.

In this paper [14-16] the design and analysis of rectangular patch antenna with parasitic stubs whose edge has been cut has been proposed and near the feed line two slots are used. The substrate that are used for the design of the antenna is Epoxy_kevlar_xy and FR4_epoxy, two substrates are used to design the antenna. The performance of the antenna is studied using two different substrates, they vary from one substrate to another. The analyzed results from antenna gain, return loss and radiation patterns are observed for each substrate. [18] presented the design of Co planar waveguide fed circularly polarized microstrip patch antenna is analyzed. By placing a slot on the lower side of the design of the antenna asymmetric perturbation is introduced. The present reception apparatus is encouraged by a wide tuning stub can give circular polarization and impedance bandwidth.

II. DESIGNING OF ANTENNA

In The first iteration shows the monopole antenna. In the second iteration shows a small gound is poistioned at geometry of antenna. In the third iteration the SRR rings are kept in the frot side of the design. The last Iteration demonstrates regarding the iteration having the partial ground along with Rectangular SRR's.The dimensions of the rectangular monopole will be 47X40.The dimensional of the defcient ground plane is 19. 3mm.The proposed SRR AND CRR antenna based model holds the dimensions of 47x40 having on LCP substrate of 0. 6mm.For the SRR the slotted gap is 0. 5mm.The various periods on the ground plane complementary split resonator is placed on the back side of antenna. The proliferation of EM wave with the feed line which work up electro-motive force in SRR and the oscillating currents between rings of SRR will be created by assistant. An oscillating current invented with resonance is resolved from SRR geometry and which stops the signal spreading at that frequency. From [18] resonance frequency can be explained along with proportional circuit model by taking circulated capacitance and complete inductance between SRR rings. For the rectangular SRR the resonance frequency is

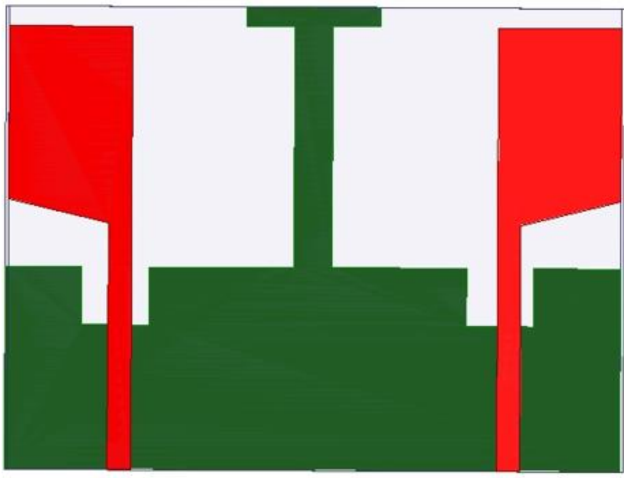

Figure 1: MIMO Antenna Models

where the total amount of equivalent capcity by regarding the distributive capacity between two rings of SRR and LT is total equivalence induction. The proposed antenna dimensions are located in Table 1.

A. Unit cell analysis

The split ring resonator is used to build the left hand material. An unusual magnetic resonator is an SRR unit that resonates at a frequency greater than the length of the SRR. When the resonance occurs, a period shifting magnetic field is connected opposite the plane that contains the SRR units. The results in inducing circulating surface currents on its rings, and the dissipation of these currents gives that variations of reverse sign collected over the holes and structure a substantial conveyed capacitance, which brings up about delivering very high negative and positive of strong permeability at the magnetic plasma frequency region in which SRR resonates. The SRR structure is made up of two circular loops made of metal material such as copper with a small gap between them. The SRR is modelled using an LC resonant circuit and a resonance frequency that depends on the length of the external ring, the width of the strips, and the spacing between parallel strips.

The extracted parameters, such as the permeability and permissiveness of the circular SRR, are simulated using the S11 and S21 parameters. Given below are the equation for defining the strong permissivity, permeability and the calculation of capacitance, inductance, and the SRR resonant frequency are also included.

$$n = \pm \frac{1}{kd} \frac{\cos^{-1}(1 - S_{11}^2 + S_{21}^2)}{2S_{21}} \quad (2)$$

$$z = \sqrt{\frac{(1+S_{11})^2 - S_{21}^2}{(1-S_{11})^2 - S_{21}^2}} \quad (3)$$

$$\in_{eff} = n/z \quad (4)$$

$$\mu_{eff} = nz \quad (5)$$

where 'z' denotes the impedance, 'k' denotes the wave number, 'n' is the refractive index and 'd' is the unit cell dimension

$$c_t = \frac{1}{c_s + c_g + c_c} \quad (6)$$

$$L = \mu_0 r(\log(\frac{2r}{w}) + 0.9 + 0.2(\frac{w}{2r})^2) \quad (7)$$

$$W_0 = \frac{1}{\sqrt{(L_s + 4L_M)(C_s + C_c + C_G)}} \quad (8)$$

Where

L_S = self-induction

L_M = Mutual Induction

C_S = Surface Capacity

C_c =Coupling Capacitance

C_G = Gap Capacitance

To find the absorption loss with the numerical calculation transfer matrix method is used.

$$A = 1 - (S_{11}^2 - S_{21}^2) \quad (9)$$

Figure 7 shows that when split rings are used as complementary split rings, Neagtive Peramabaility of CSRR occurs at the resonance frequency.

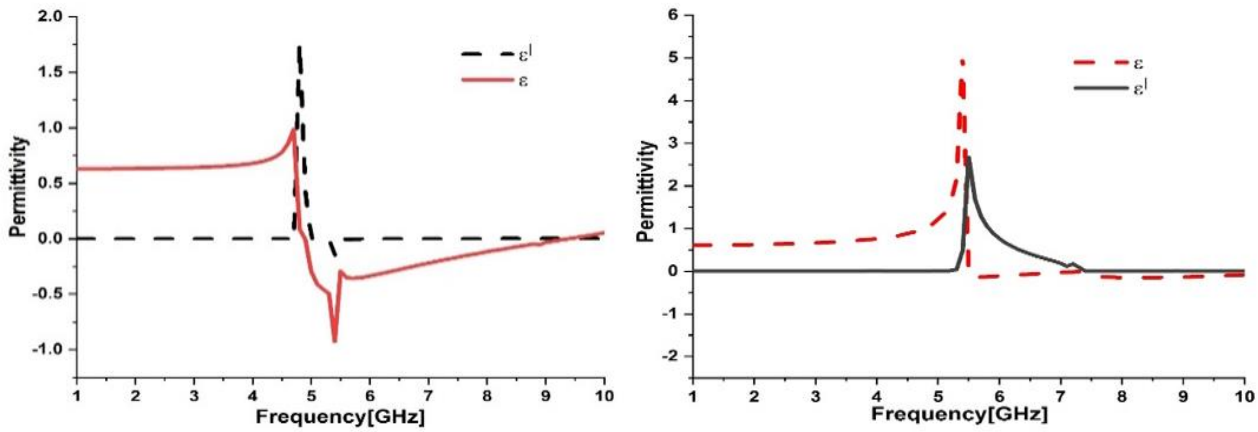

Figure 2: SRR Frequency and CSRR Frequency Vs Realtive permitivity

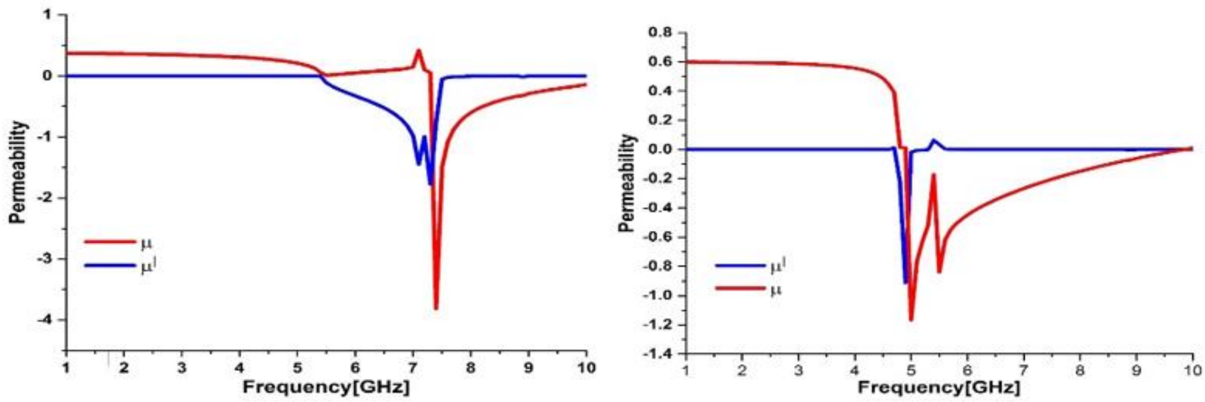

Figure 3: SRR Frequency and CSRR Frequency Vs Permeability

III. RESULTS

A. Reflection coefficients

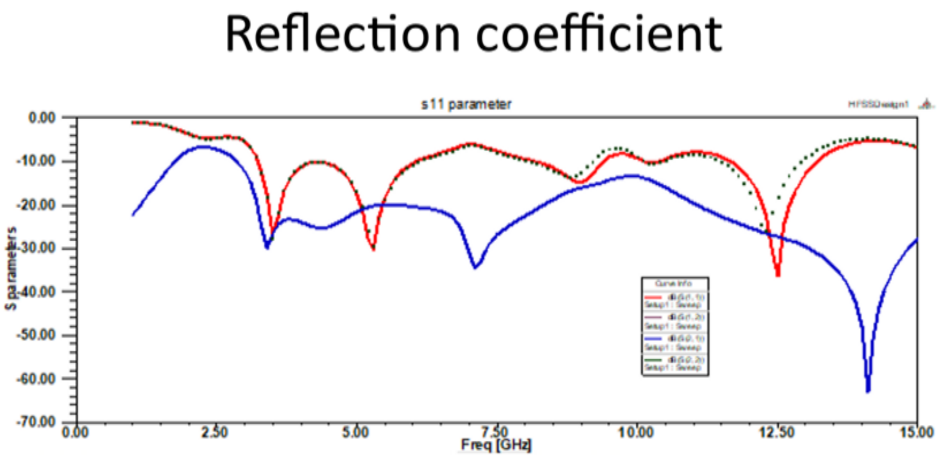

Figure 4: Reflection coefficients

From fig 4 it has been observed that the frequency vs reflection coefficients of both measured results and simulated results. By the simulated results it has get the triple bands that are 3.4GHz, 6.7GHz and 14.1GHz. By comparing with measured results there will be a slight difference with simulated results as shown in Fig.7.

B. Radiation patterns

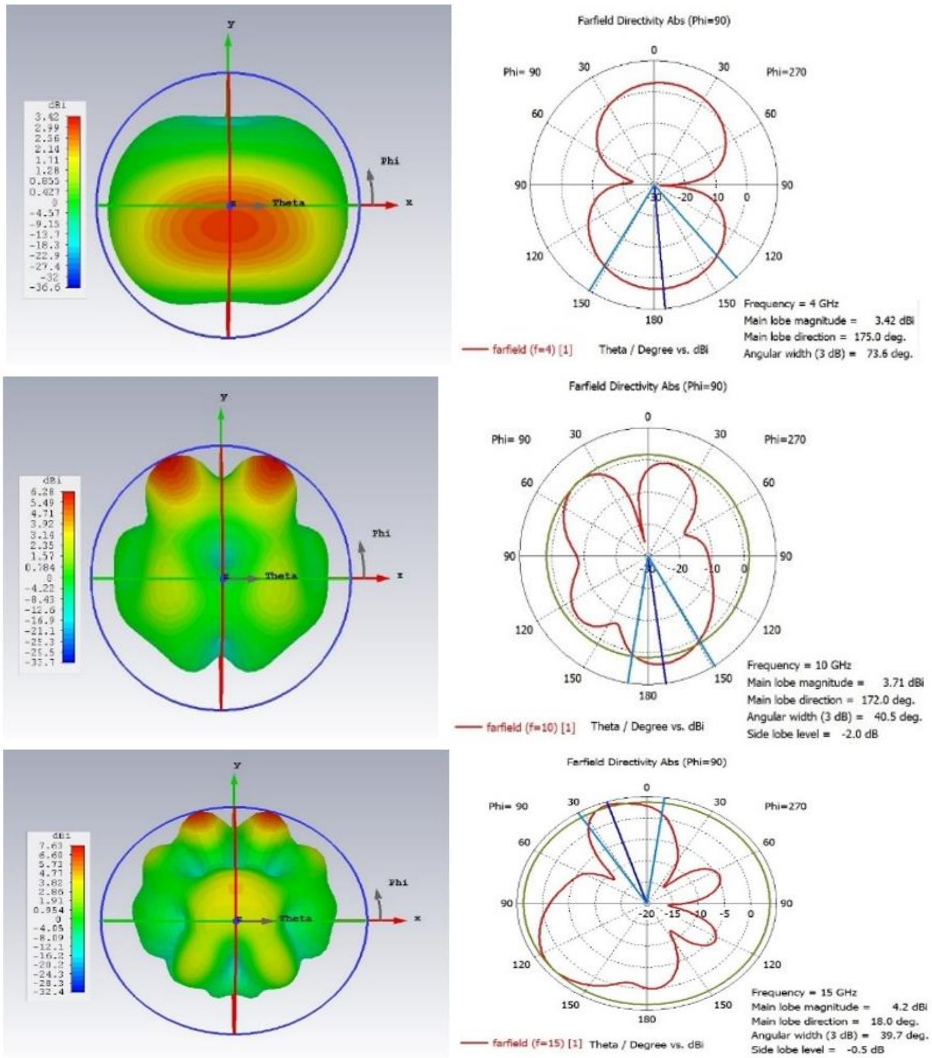

Figure 5: Radiation patterns of Proposed antenna

The radiation patterns of presented antenna have been observed at 0 degrees and 90 degrees. We get the first band at5GHz, second band at 10GHZ and final band is at 15GHz

IV. CONCLUSION

The proposed antenna is discussed in 4 different iterations. Fig 4 represents the reflection coefficient of antenna iteration from 10 db with return loss 2 db in operating mode. From antenna model 4, in wide operating band, the proposed geometry with csrr and srr is providing dual band notch characteristics figure 7 shows the notch band characteristics from 2.5 – 9.5ghz and 12.548 – 20ghz. Iteration 1 provides operating band range from 2.5 to 20 ghz. This antenna is good candidate for the commerical appplications

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interes*t*.

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