International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 04 Issue14
November 2017

Examination and Outline of a Novel Metamaterial-Based Microstrip Reception apparatus

Kotra.Raghu Rajitha [1], Polagoni Srinivas [2] Banothu Satyanarayana [3]
[1,2,3]. Assistant Professor in ECE dept at Sri indu College of Engineering and Technology (A),Sheriguda,Ibrahimpatnam, R.R.Dist, Telangana,

***Abstract*:-** *Two-layer cross section sort metamaterials unit is stacked over the coaxial sustain microstrip receiving wire keeping in mind the end goal to accumulate electromagnetic wave by utilizing the zero refraction file impact. The - sort metamaterials unit is imprinted on the receiving wire substrate, and the band hole impact is utilized to stifle the regressive rush of the reception apparatus. Test and investigation are made on the two advancement techniques. At last two strategies are consolidated in outlining a microstrip reception apparatus with high directivity and high pick up. Looking at the consequences of the aftereffects of reenactment try different things with those of the genuine test, the rightness of the hypothesis and the outline thought is checked. As joined with the conventional receiving wire, the pickup of the new microstrip reception apparatus has accomplished by 8.94dB, an expansion 51.27% and the directivity is expanded by 48.89%, accordingly accomplishing the objective of the composed examination.*
Keywords:-metamaterials; microstrip antenna; high directivity and gain

I. INTRODUCTION

As of late, microstrip radio wire has been broadly connected in various fields of electronic building due to its favorable circumstances, for example, little size and effortlessness to combination. Notwithstanding, its drawbacks of low directivity and high misfortune limit its utilization. With continually higher necessities for the reception apparatus execution by different gadgets, the plan of high pick up and high-directivity microstrip radio wire has turned into the concentration of studies. Customary improvement strategies can't go past the bottleneck of intelligent restriction between physical size, data transfer capacity and pick up, and so on. Henceforth, since metamaterials were created in 2001, the utilization of metamaterials to enhance the receiving wire execution had pulled in broad considerations [1-4]. A covering layer is stacked over the receiving wire with the zero refraction file highlights of metamaterials or band hole substrate is stacked over the radio wire, which all can enhance the pickup and directivity of reception apparatus to some degree. However, there are few examinations on the investigation of receiving wire execution in light of the blend of two techniques above. In addition, discourses about the impact of separation of the receiving wire covering layer miss the mark. In this paper, a sort of microstrip reception apparatus with both covering layer and substrate made out of metamaterials is outlined; and itemized examination is led on the compelling parameters of the radio wire covering layers. The outcome demonstrates that the pickup and directivity of receiving wire with both covering layer and substrate made out of metamaterials have been clearly improved contrasted and conventional microstrip radio wire.

II. ANTENNA DESIGN AND ANALYSIS

We determine concrete requirements first, then design unit structure and adjust parameters to meet with corresponding demands. Through calculation and the experiment simulation adjustment, FR4 with a dielectric constant and thickness h=1.6mm was selected to be the substrate of the antenna and a kind of coaxial feed microstrip antenna with a central working frequency of was designed. The substrate size is . The size of the antenna radiation patch is . The distance between coaxial feeding point and the center of the patch is L=2.7mm. coaxial feed model is used for the antenna.

A. Metamaterials Unit Design

Fig. 1 and Fig. 2 show structures of the lattice-type and - type metamaterials unit designed in this paper. Table 1 and
table 2 show their respective size.

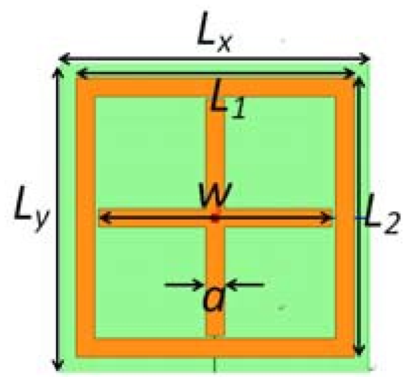

Fig. 1 Lattice-type metamaterials unit structure

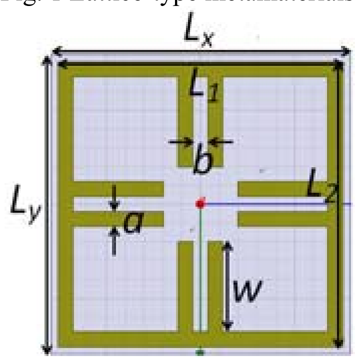

Fig. 2 π-type metamaterials unit structure

TABLE Ⅰ SIZE PARAMETERS OF THE LATTICE-TYPE UNIT

L_x	8mm	L_y	8mm
L_1	7.5mm	L_2	7.5mm
w	6mm	a	0.5mm

TABLE Ⅱ SIZE PARAMETERS OF THE Π-TYPE UNIT

L_x	8mm	L_1	7.5mm
L_y	8mm	L_2	7.5mm
w	2.8mm	a	0.4mm
b	0.4mm		
b	0.4mm		

Six lattice-type metamaterials units were lined in the way of 2*3 and plated on the FR4 substrate with a thickness of 1.6mm as the covering layer of the antenna. HFSS software was used for the simulation analysis of the metamaterials covering layer. See Fig. 3 for S parameter. Smith method was applied to extract data obtained from Fig. 3 [5-6] to obtain the effective refraction index of the covering layer in Fig. 4. It can be seen from Fig. 4 that the refraction rate of the covering layer at the point of 6GHz is close to zero, which is in line with the design need.

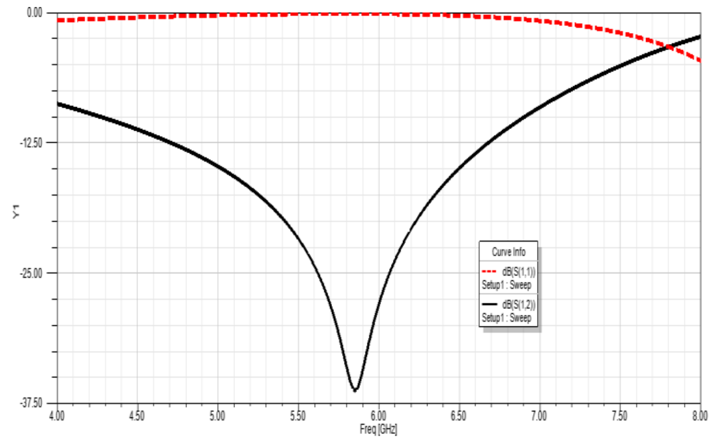

Fig. 3 S parameter of the lattice-type unit

π-type metamaterial is pated around the antenna substrate and the S parameter after simulation is shown in Fig. 5. It can be noted that the peak value of the transmission band gap of the substrate is -24.5dB at the point of 6GHz. It can be used to suppress the backward wave of the antenna and it conforms to the requirements of the designed antenna.

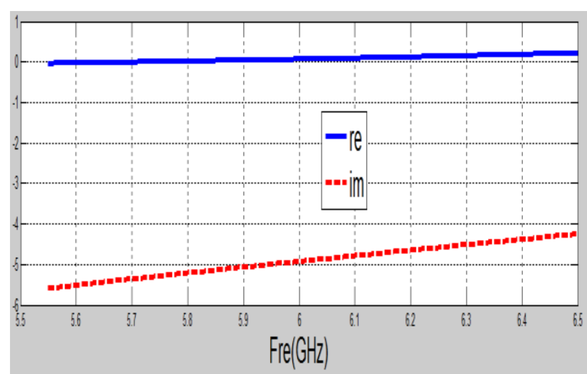

Fig. 4 Refraction rate of the lattice-type unit

B. Metamaterial-based Microstrip Antenna

π-type metamaterial unit is periodically loaded on the microstrip antenna substrate around the patch to obtain the antenna indicated in Fig. 6. Then the two layer lattice-type metamaterials covering layer is supported by foam and placed right above the microstrip antenna. The distance between the lower layer and the antenna is sjuli=25mm, that is, half wavelength. The distance between the two covering layers is B=5mm. See Fig. 7 for the comprehensively designed antenna structure.

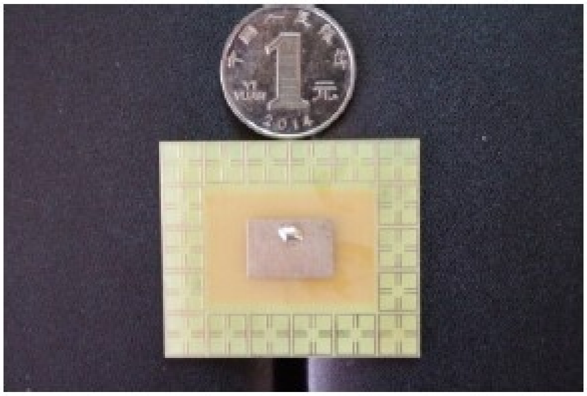

Fig. 6 Antenna with metamaterial substrate

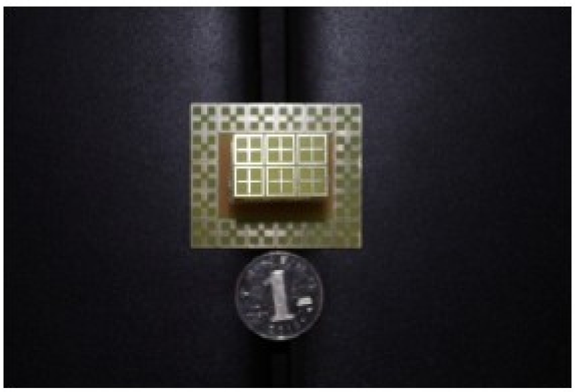

Fig. 7 Comprehensively designed physical antenna

1) Return Loss: The return loss of the original antenna, antenna with metamaterials substrate and comprehensively designed antenna obtained from the simulation and material experiments can be seen in Fig. 8. As indicated in the figure, compared with the original antenna, after metamaterial is loaded, the return loss of the antenna deteriorates because of certain loss of the metamterial itself so small deviation happens in the central frequency.

*2) Analysis of the Gain :*I t can be seen from Fig. 9 that the gain of the antenna increase significantly when it's about

which means the metamaterials substrate can well restrain the backward wave. The designed covering layer area cannot completely cover the antenna surface so sidelobe appears in the directivity figure of the comprehensively designed antenna.

The antenna gain is increased by 51.27%.

3) Directivity: Fig. 10 shows the directivity of the antenna.

It can be noted from the figure that the directivity of the antenna is 10.69dB, an increase of 3.51dB compared with the original antenna and by 48.89%; an increase of 3.11dB compared with the metamaterials substrate antenna and by 41.03%.

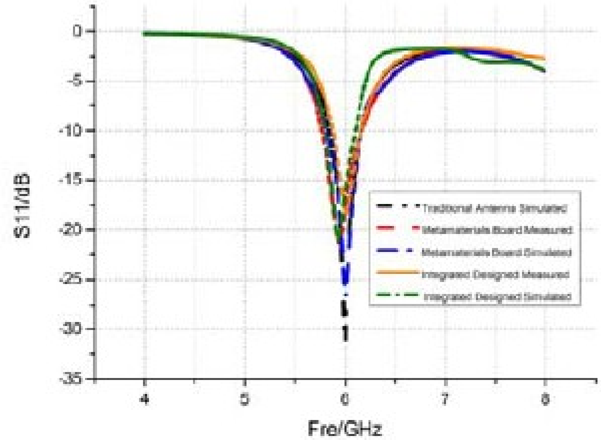

Fig. 8 Return loss of the antenna

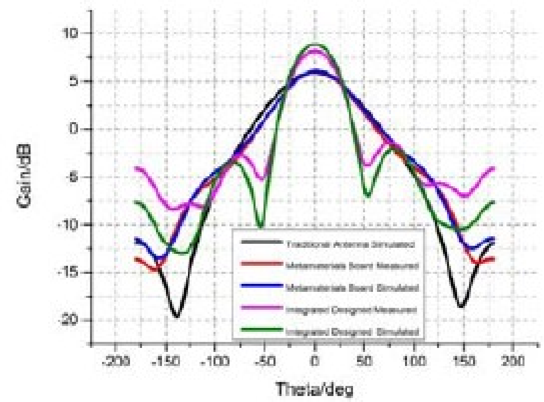

Fig. 9 Gain

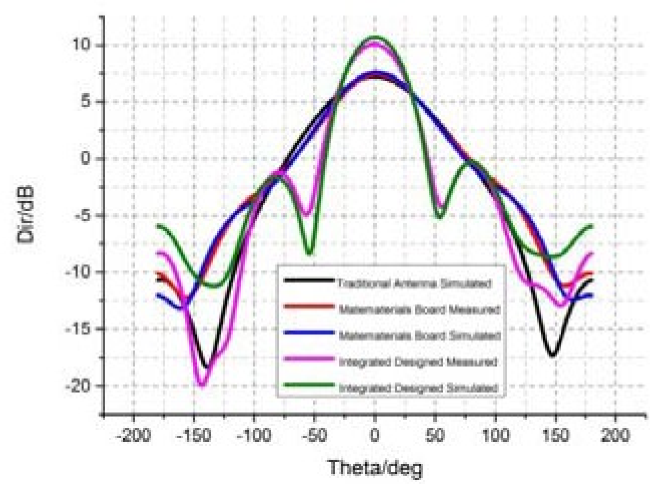

Fig. 10 Directivity of the designed antenna

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 04 Issue14
November 2017

III. CONCLUSIONS

Two distinctive metamateirals units are stacked on the normal coaxial nourish microstrip antenna. The zero refraction file highlight of metamaterials are utilized to work out the receiving wire covering layer to control the surface rush of the radio wire substrate through coordinated radiation of electromagnetic wave and the band hole include and to decrease the back wave vitality loss of the reception apparatus to enhance the receiving wire directivity and pick up. The investigation result demonstrates that the pick up of the thoroughly composed reception apparatus is 8.94dB, an expansion of 3.03dB contrasted and unique radio wire and by 51.27%. Additionally, the half-control bar width (- 3dB) of E surface and H surface is individually and , a particular decline of and contrasted and unique receiving wire. The forward bearing radiation of the reception apparatus increments and the regressive wave radiation are successfully controlled also. The directivity of the reception apparatus is 10.69dB, an expansion of 3.51dB contrasted and the first receiving wire and by 48.89%, with its execution being incredibly upgraded.

REFERENCES

[1] R. A. Shelby, D. R. Smith. "Experimental verification of a negative index of refraction". Science.2001.292 (6): pp.77-79.
[2] YANG R, XIE Y, WANG P, et al. "Characteristics of millimeter wave microstrip antenna with left-handed materials substrates". Appl. Phys. Lett, 2006, 89: 064108(1-3).
[3] MOSALLAEI H, SARABANDI K. "Antenna miniaturization and bandwidth enhancement using a reactive impedance substrate". IEEE Trans Antennas Propag., 2004,52(9): pp. 2403-2414.
[4] LIU Y H, ZHAO X P. "Inveatigation of anisotropic negative permeability medium cover for patch antenna". IET Microwaves, Antennas and Propagation, 2008. 7(2): pp.737-744.
[5] D.R. Smith, J.B. Pendry, and M.C.K. Wiltshire. "Metamaterials andnegative refractive index". Science 305 (2004): pp. 788–792.
[6] D. R. Smith and S. Schultz. "Determination of effective permittivity and permeability of metamaterials from reflection and transmission coefficients". Physical Review B, 65, 195104（2002）.

AUTHOR1

Kotra.Raghu Rajitha received her B.Tech in ECE in Swarna Bharathi institute of science and technology (SBIT)in the year 2009, pakabanda, khammam dist. Telangana. And P.G received in ECE (DECS)in sri indu college of engineering & technology (SICET)in the year 2012, ibrahimpatnam, R.R.Dist. Telangana, India. She is currently working as an assistant professor in ECE dept at sri indu college of engineering & technology (A). Sheriguda, ibrahimpatnam. R.R.dist. Telangana, India. She has 5.5 years of teaching experience
.

AUTHOR2

Polagoni Srinivas received his B.Tech in ECE in Madhira institute of technology and Science (MITS)in the year 2011, chilukuru, kodad, suryapet dist. Telangana. And P.G received in ECE (VLSI)in Netaji institute of engineering & technology (NIET)in the year 2014, Toopranpet,Choutupal, Nalgonda Dist. Telangana, India. He is currently working as an assistant professor in ECE dept at sri indu college of engineering & technology (A). Sheriguda, ibrahimpatnam. R.R.dist. Telangana, India. He has 3 years of teaching experience.

AUTHOR3

BANOTHU SATYANARAYANA received her B.Tech in ECE in VAGDEVI College of Engineering and Technology in the year 2006 ,Bollikunta, Warangal.Dist, Telangana, and P.G.received in ECE (DECS) in Jagruthi College of Engineering and Technology in the year 2012 ,Ibrahim patnam, R.R.Dist, Telangana, India. He is currently working as a assistant professor in ECE dept at Sri indu College of Engineering and Technology (A),Sheriguda,Ibrahimpatnam, R.R.Dist, Telangana, India. He has 5 years experience in teaching.