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PATCH ANTENNA FOR 3G APPLICATIONS

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Abstract: This paper presents a novel low profilehigh Gain Antenna with side band suppression by minimizing the return loss in Patch antenna. A "Patch antenna" is mounted on a flat surface and it is a type of low profile radio antenna. It consists of a flat rectangular sheet or large sheet mounted on a metal patch of metal called ground plane.The existing material to design the antenna is normal metals. Those metals have positive refractive index. It may leads to various problems such as high return loss and poor directivity. To mitigate these problems our paper focus on usage of meta material for antennas and to measure the performance of antennas such as gain, directivity , radiation pattern and return loss.This design consists of Waveguide as input,substrate with metamaterial loaded and microsrtrip line patch.The proposed antenna design work as about 75% miniaturization compared to the conventional patch antenna. The usage of metamaterial has following advantages. It has negative refractive index and so the directivity can be improved and the return loss can be decreased.The tool used in this project is HFSS software (High Frequency Structure Simulator).

Keywords : Meta material ,Patch antenna, Size , Gain, Feeding technique and HFSS

I INTRODUCTION

In early days Communication between humans was sound via voice. With the desire for slightly remote communication came, devices such as drums, then visual methods such as signals flags and vapor signals were used. One of the greatest natural resource is the electromagnetic spectrum and the antenna has been instrumental in harnessing this resource.

Microstrip patch antenna is used to send on base parameters of feature to the ground while under intervening conditions.Telemetry and communication antennas need to be appetite and of the same form and are often in the form of Microstrip patch antennas.This paper presents the study and design of Microstrip Antenna with suppressed side lobe.By suppressing the side lobe the Gain and Directivity will be increased.Ithas conducting patch on a ground plane isolated by dielectric substrate. This concept was behindhand until the revolution in electronic circuit denigration and large-scale integration in 1970.After that many authors have portrayed the radiation from the ground plane by a dielectric substrate for different configurations. The early work of Munson on microstrip antennas for use as a low profile flush ascended antennas on rockets and missiles conveyed that this was a practical conception for use in numerous antenna system problems.

The microstrip antennas are contemporary antenna designer's choice. Substrates with Low dielectric constant are generally preferred for smallest radiation.A microstrip antenna is distinguished by its length, width, input impedance, and Gain and radiation patterns. The length of the antenna is nearly half wavelength in the dielectric, it is a very critical parameter, which governs frequency of the antenna.

One of the possible passageway of gain enhancement is the employment of Metamaterial structure in the substrate of the constructional antenna.It has been manifested that low impedance metamaterial in the superstrate of an antenna elevated by magnetic dipole increases directional beam at broadside.The usage of Metamaterial for the design of patch antenna has major advantage of having negative refractive index and so the directivity can be ameliorated and the return loss can be abated.

II LITERATURE SURVEY

High efficiency electromagnetic wave controlling with all dielectric Huygens metasurfaces by Zheng bin wang et.al.,this paper contains the thickness varying subwavelength dielectric blocks are introduced to visualise 0-2 phase change .The incident waves in a broadband are refracted completely using the Huygens metasurface with unreliable building blocks. As reported by the same physical mechanism the electrically thin lens are fabricated with coordinated subwavelength dielectric blocks and organizers it with a patch antenna to develop a 3D ultra low profile lens antenna system.the simulation of full wave validates the lens antennas sterling achievement s in huge broadband,directivity,low loss and depresses side lobe levels.

A low profile high gain substrate integrated waveguide slot antenna with suppressed cross polarization using metamaterial by Soumen Pandit,et.al.,This paper presents a novel cross-polarization (x-pol) suppression of low-profile high-gain antenna in substrate integrated waveguide fed slot antenna (SIW-SA)using cross circular loop resonator (CCLR) metamaterial (MTM) slab . The operating frequency of SIW-SA antenna is 9.73 GHz, which is the reference antenna. The CCLR MTM slab is a low-impedance slab .Mounted on the substrate of the reference antenna at the height of $\lambda 0/10$, where $\lambda 0$ is the antenna's free space wavelength at the resonance frequency . In broadside direction, the antenna obtains 5.8 dB more gain, 10 dB less x-pol level (in both radiation planes), and 9.1 dB large front-to-back (FB) ratio than the reference antenna, whereas the presence of low-impedance slab.

Miniaturized dual-band Cpw-fed antennas loaded with U-shaped metamaterials bySeyed Amir Hossein Saghanezhad et,al.,It deals with the new dual band miniaturized planar antennas Burdened with 4-cell metamaterial is conferred. The antenna structure abide of coplanar waveguide at input, microstrip line, patch, metamaterial loaded substrate under patch and back conductor. U-shape and inverted u-shaped metamaterial loaded substrate below the patch is made in two layers for the simpler construction procedure.These antennas performed as a wideband monopole antenna beside 35% miniaturization related to the folded monopole antenna in the first band, , and In the second band as a wideband patch antenna beside 77% miniaturization related to the conventional patch antenna.

A design and gain enhancement of metamaterial loaded loop antenna with tightly coupled arc shaped directors: An enhanced and stable gain is presented in a loop is loaded with theree mu-negative(MNG) metamaterial unit cells to reduce the size of the antenna. It cinsists of a series gap capacitor and a shunt floating inductor. The series gap- conductor and floating inductor is used to excite the zeroth order resonance(ZOR) of a nit cell and improve impedance matching respectively. The antenna achieves a compact size and with a wide factorial bandwidth.

Analysis of a new dual band microstrip factral antenna: This is presents a novel design of a microstrip factral antenna based on the use of sierpinski triangle shape. By using of FR4 substrate in the operating frequency bands are simulated. The dual band microstrip factral antenna is simulated and validated by using CST microwave studio software. It presents good performance in term of radiation pattern and matching input impedance in the simulated result.

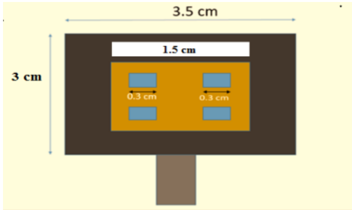
III PROPOSED SYSTEM

A novel way of overcoming the limitations of existing models and improving some features is by using artificial materials (Metamaterials) whose permeability and permittivity are derived from their structure which is properly engineered. The antenna is designed on a uniplanar epoxysubstrate. Metamaterials are artificially organized composite materials that can be engineered to have craved electromagnetic properties. In this present work, it is proposed to use Metamaterial with existing antennas to improve the performance.
The principal radiator of the antenna is the Microstrip antenna consist of four patches that has a side length of *l* on each side with a width of 3cm. The antenna is fed using a coplanar waveguide shape using a very small version A from the bottom side of the substrate. The central pin is attached to the upwards of the loop and the side pins are attatched to the downwards of the loop. The effect of connector it is included in the design process for the performance of antenna.Each of the patch structure is loaded with four MNG metamaterial unit-cells. Each unit-cell consists of a series capacitor and an open-ended floating inductor. The capacitors are simply devised by creating gaps on the horizontal arms of the material.The initial antenna parameters such as shape, dimensions, material, layers and feed position are taken from the existing papers. The performance of antenna such as gain, directivity, VSWR and radiation parameters are examined using the commencing parameters.

The dimensions of the patch are obtained by,

$$W = (\nu / 2 f r) \times 2 (\mu r (\varepsilon r + 1))$$

$$L = q \times \nu 0 (2 fr \varepsilon r \mu r)$$



IV EXPERIMENTAL VERIFICATION:

HFSS is a high-performance full-wave electromagnetic(EM) field simulator for arbitrary 3D volumetric unresistive device modeling that get hold to favour of Microsoft Windows graphical user interface. It combines simulation, visualization, solid modeling, and automation in an easy-to-learn environment where solutions to your 3D EM problems are quickly and accurately obtained .Finite Element Method(FEM), adaptive meshing, and brilliant graphics to takes place in HFSS. Parameters such as S-Parameters, Resonant Frequency, and Fields are also calculated using HFSS.The results of simulation of triangular patch antenna made by software Ansoft High Frequency Structure Simulator (HFSS) Element return loss,VSWR,Radiation pattern plots are as shown in the below

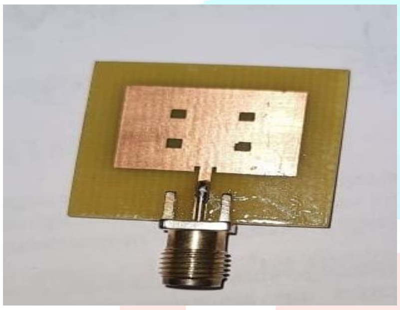


Figure 2: Hardware of Metamaterials Patch Antenna

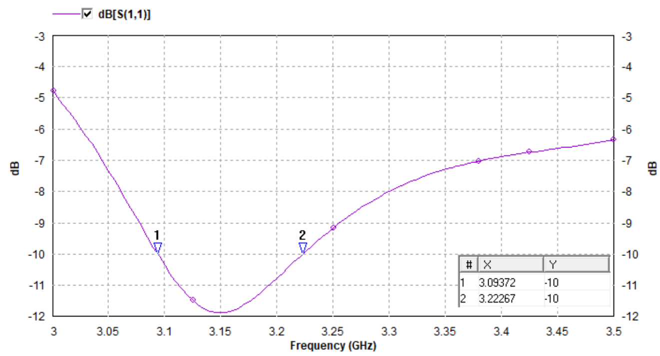


Figure 3: Return loss

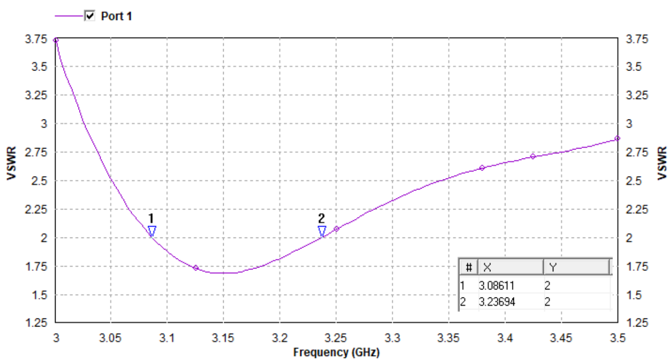


Figure 4: VSWR

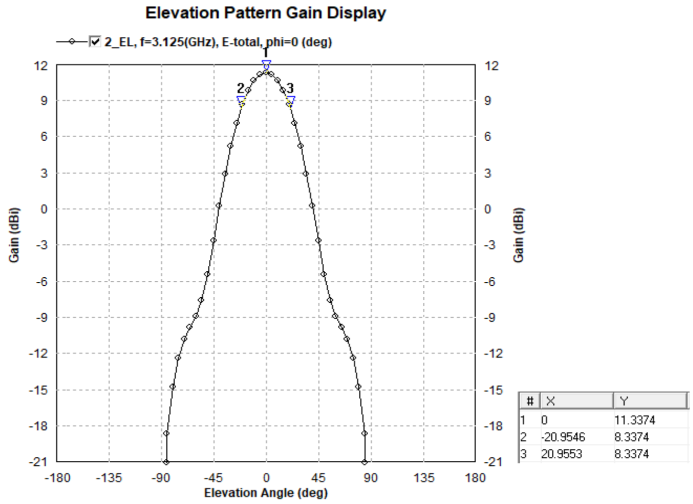


Figure 5: Radiation pattern for PHI=0^{0}

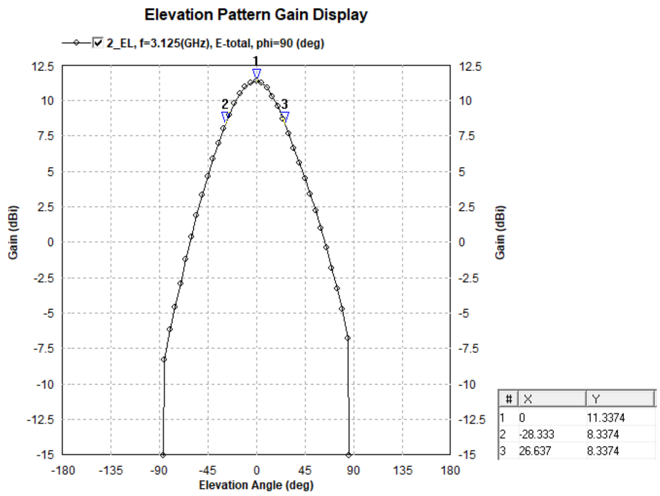


Figure 6: RADIATION PATTERN FOR PHI=90^{0}

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S.NO	ANTENNA TYPE	RADIATING FREQUENCY
1	PROBE FED PATCH ANTENNA	1.80GHz
2	CONICAL HORN ANTENNA	10GHz
3	METAMATERIAL PATCH ANTENNA	7.5GHz

RESULT COMPARISION

V CONCLUSION

A rectangular microstrip patch antenna coupled to microstrip line through a small rectangular aperture in ground plane has been designed and optimized. The GA is very accurate and fast contrast to other techniques because it encodes the parameters and the optimization is done with the en-coded parameters. It can be finalized that the optimized patch antenna using Genetic Algorithm manifest better return loss and radiation properties as collated to the un -optimized patch designed using conceptual formulas. The optimized patch reveals 29 % more gain and 17.14 dB better return loss as compared to un-optimized patch antenna layout. Future research work should focus at utilizing Genetic Algorithm escalation technique to improve the performance of the patch antenna array.

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