DESIGN OF H-SHAPE X-BAND APPLICATION ELECTRICALLY SMALL ANTENNA

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Abstract - This paper presents a new small electrically antenna rectangular X- band micro-strip patch antenna loaded with material Rogers RT/duroid 5870 (tm). The present discussion focuses on small Electrically antenna which are electrically small compared to wave length the performance of electrically small antenna are closely related to their electrical size, the gain can be increased to maintain the efficiency of the radiator. Basically micro-strip Patch antennas have been used in satellite communications and for their good characteristics such as lightness, low cost, and so on. Here in the design H-shape folded dipole, which increase the band width of the antenna.

Keywords - Electrically Small Antennas, X-Band Application, Antenna, Micro-Strip Patch, Frequency Antenna, Feed, Gain.

I. INTRODUCTION

Electrically small antennas is small compared with the very long wavelengths are used at very low radio frequencies. There are various regulations in view of the antenna to be electrically small. No large antenna size not more than one tenth of the wavelength. The most common structure in an electrically small antenna short dipole. Three bases for understanding electrically small antennas is Efficiency, Impedance matching and Radiation patterns.

In the patch antennas microstrip telecommunications are widely used in portable electronic devices because of their compact size, low profile and low cost, which can be mounted on the flat surface [1]. The patch typically made of a conductive material such as copper or gold and may take any form possible. Micro-strip patch antenna radiate mainly due to stray fields between the edge of the patch and the ground [2]. For good performance of the antenna, the thickness of the dielectric substrate having a low permittivity is desirable because it provides a higher efficiency, greater capacity and more radiation. To develop a compact Micro-strip antenna higher dielectric the constants should be used, which are less efficient and lead to a narrower bandwidth. Micro-strip patch antenna can be design by different methods, hear all methods can be divided by Contacting and Non-contacting two categories [3].

Hear method 1 Contacting in Radio frequency power is fed directly to the radiating patch using connecting element such as a micro-strip line. Method 2 non-contact system, electromagnetic field coupling is made transfer power between the micro-strip line and the radiating plate [4]. Radar applications use power pulse generators relatively high and sensitive receptors. Since radar operates on bands that are not used for other. Most radar bands in the microwave portion of the spectrum, although some important applications for meteorology use powerful radio transmitters [5].

in the UHF band. Single-frequency phased array radars to be performed as monitoring and control arms for the defense of working at these frequencies, as well as on the S band. This frequency range is well suited for long-range [6], high-precision tracking radars X band of unspecified set about 7.0 to 11.2 gigahertz (GHz). In radar technology, the frequency range is defined by the IEEE [8] [9] [10] standear 8.0 to 12.0 GHz.

Bearing in mind the insertion slot in a patch antenna on a low-profile rectangular coaxial fed antenna with N slots in the upper and down patch center with wavy edges offered. Various antennas for the x-band have been proposed having in consideration WLAN applications.

hear the estimated parameters of the antenna H-band radar X odds as return loss with elliptical polarization, obtained by θ, Ø directions charts in 3D, H field distribution, modern distributions are modeled using HFSS 13 [12], which is highly - performance-wave electromagnetic (EM) field simulator for arbitrary 3D volumetric modeling a passive device which uses a familiar Microsoft Windows, a graphical user interface. It combines modeling, visualization, solid modeling and automation in an easy-to-learn environment in which to solve your problems 3D EM quickly and accurately obtained [14]. Ansoft HFSS uses Finite Element Method (FEM), adaptive traction and brilliant graphics to give you unprecedented performance and analysis of all your problems 3D EM. Ansoft HFSS may be used to calculate parameters such as S-parameters, resonant frequency, and fields.

II. DESIGN COORDINATION

Estimated composition of the antenna shown in Fig. 1. The antenna Rogers RT/duroid 5870 (tm) modeled on a substrate [16] with a dielectric constant of 2.3 and a loss tangent of 0.0012 substrate thickness is 1.5 mm. The size of the antenna length and width of

17.1mm 21.2 mm, which is suitable for most applications radar. Patch with form H slots at the top and bottom, center with wavy edges is proposed for frequency of use X Band.

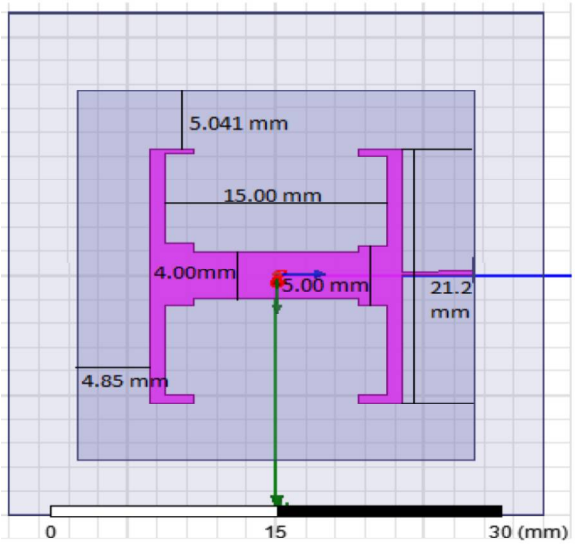


Fig 1: Ansoft-HFSS generated antenna model

The patch may also be fed with a probe through soil plane. The position of the probe can be embedded to match [15] the Patch impedance with the input impedance. This minimizes insertion probe radiation. The ease of Setting and low radiation is advantages of the probe power relative to the power of the micro strip line. The Dimensions of the shaped part H of Fig. (1) That is are designed to 8.3890GHz operating frequency.

III. SIMULATION RESULTS

Return loss:
It is a measure of the energy reflected from a transmitted signal. It is commonly expressed as positive dB's.The higher the value of the energy that is less reflected.

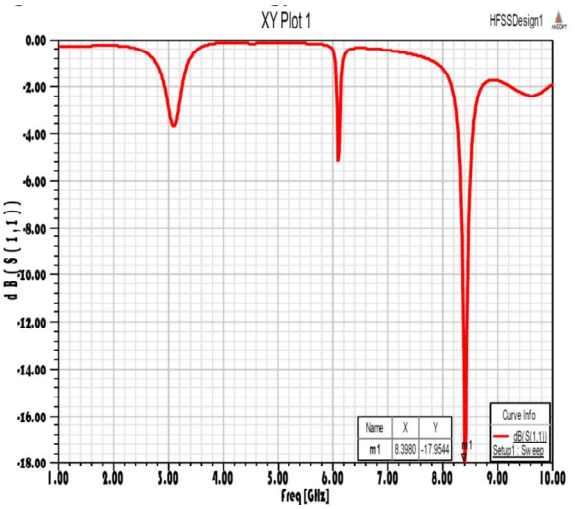


Fig 2: Return loss.

Loss of return -17.958dB is obtained at a frequency of 8.398GHz.
Gain:
The ratio of the intensity, in a given direction to the radiation intensity that would Be there for obtained if the power accepted by the antenna wire radiates isotropically.

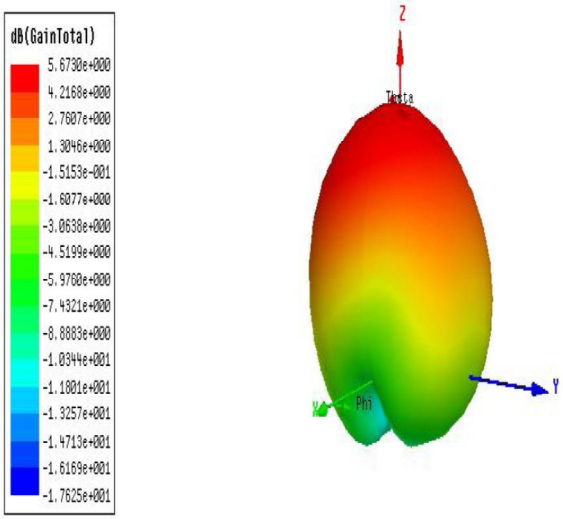


Fig 3: 3D radiation plot

Shows the antenna gain in 3D motifs. The gain of the antenna is provided to 8.398GHz obtained as 5.67dB when the above gain is 4 dB acceptable.
VSWR:
the voltage and the current is constant over the entire length of the feed line. Any deviation from this will lead to a "standing wave" of the voltage and current to exist on the line.
Hear VSWR is 2.2103 Fig 4: VSWR plot and Reflection Coefficient 0.38 and Reflected Power (%)14.2 , Reflected Power (dB) -8.47, and Mismatch Loss(dB) 0.67.

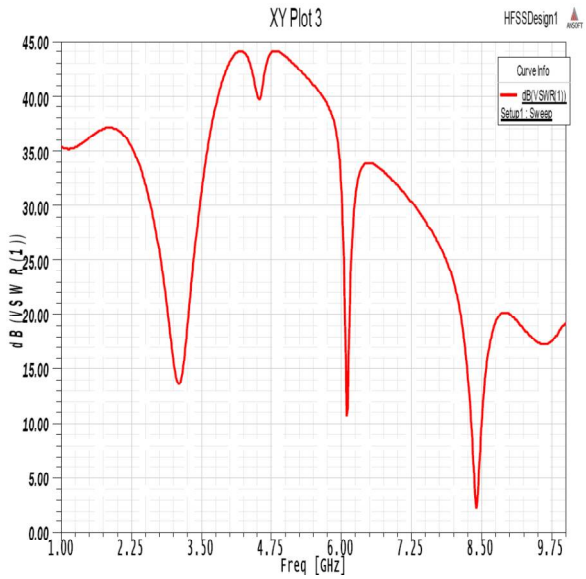


Fig 4: VSWR plot

H plane:

In the case of the linearly polarized antenna, the plane containing the magnetic field vector and the direction of maximum radiation Fig 5: H plane radiation . Or the magnetic field "H" plane is at right angles to the plane "E". For a vertically polarized antenna, the plane H to the H-shaped antenna is generally coincident with the azimuth / horizontal plane. For a horizontally polarized antenna, the H plane generally coincides with the plan / vertical rise [14].

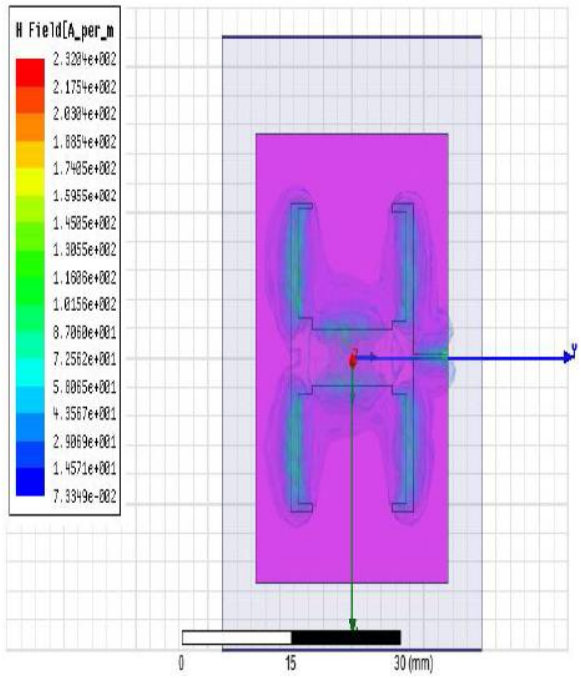


Fig 5: H plane radiation

Surface Loss Density:

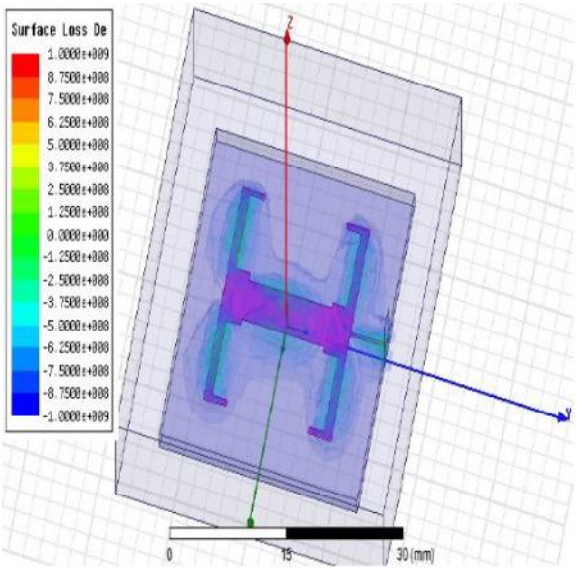


Fig 6: surface3 Loss Density radiation

For thermal simulation, loss densities are mapped from the HFSS ANSYS Mechanical analysis and take the role of heat load. Fig 6: surface3 Loss Density radiation The heat propagates through the entire structure at a rate depending on the thermal conductivity of the materials, and cannot escape in the form of an electric radiation vacuum surrounding space.

IV. ROGERS RT/DUROID 5870 (TM) PROPERTIES

- Low electrical loss
- Low moisture absorption
- Low out gassing for space applications

Rogers RT / duroid high frequency laminates are used in 5870:

- circuits for commercial air phones
- micro strip and strip line circuits
- millimeter wave applications
- military radar systems
- Missile guidance systems
- digital radio point-to-point antennas

Gain:

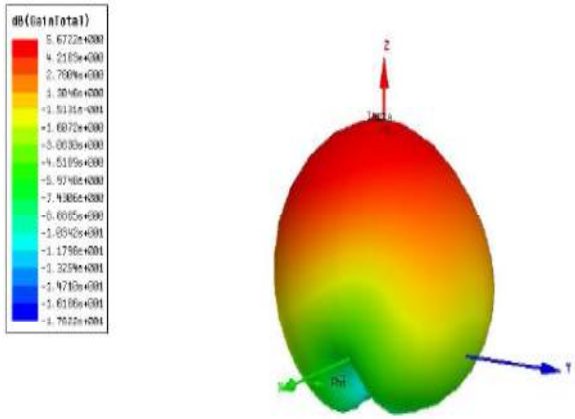


Fig 7: Gain of antenna

Fig 7 in antenna a gain is 5 dbi.

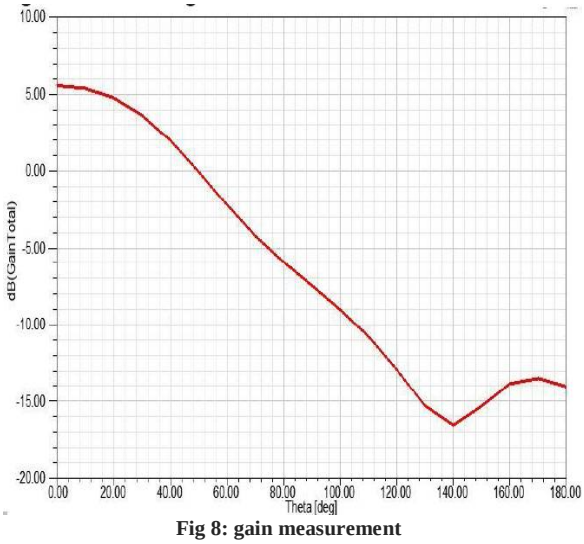


Fig 8: gain measurement

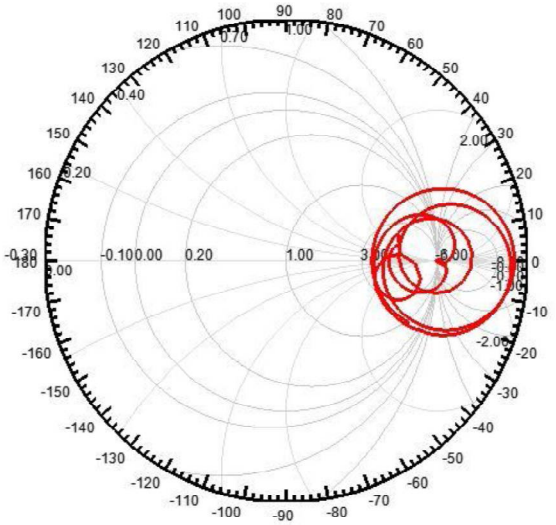


Fig 9: smith chart

Here the given frequency range is 8.3GHz

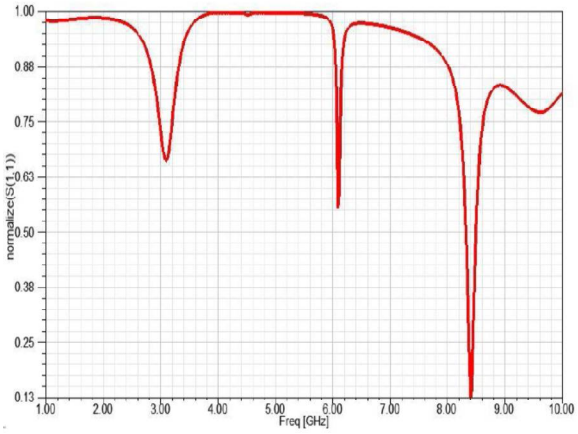


Fig 10: normalize range of frequency

CONCLUSION

Finally, the optimal size of the elliptically polarized patch antenna Rogers RT/duroid 5870 (tm) Substrate for the X-band radar applications was investigated. The performance properties are analyzed for the optimized dimensions and the proposed antenna works well to 8.389GHz frequency band necessary, and also the size of the antenna is electrically small antenna design, low cost, light weight design. Hear increases the height of the substrates so retune the loss will be reduced and the frequency will be the same.

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