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Design of a Circular Slotted Triangular Antenna for Ultra Wide Band Application

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***Abstract*- We know that Wide Band Antennas are these days are on high demand as it has many Applications Here we are designing a Triangular antenna which can support wide band at different range of frequencies i.e. at multi frequency bands. This antenna can be operated at three different bands like Ka and millimeter bands and bandwidth ranges from 1GHz to 10GHz. The Gain is also considered and trying to get high gain . The Performance of this antenna is Analyzed by various parameters like Return loss, Gain and VSWR etc. HFFS Software is used to Design and Simulate. The corresponding Design and simulation results have been presented in this paper.**

Index terms- Gain, VSWR, HFSS, Return loss, HFFS

I. INTRODUCTION

These days' communication is going beyond our imaginations due great Research. This is in context to wireless communications we use this as the best way of communication as it has high data carrying capacity with more reliability. We know that an antenna is characterized by factors like input impedance, radiation pattern, gain, VSWR etc. There are different feeding techniques available for design of an antenna there are line feed, coaxial feed, micro strip feed etc. Here we use micro strip feeding due to its less cost and more efficient as well as it uses less space. Wide band antennas show up their importance in many applications like Radio Astronomy, Aerospace Communications etc. This will carry huge amount of data. Now we are designing and simulating an antenna for showing its wide band applications with better gain and return loss.

II.ANTENNA DESIGN

Microstrip patch antenna is modelled by using the below considerations. Then proposed antenna structure is given below in Fig 2.

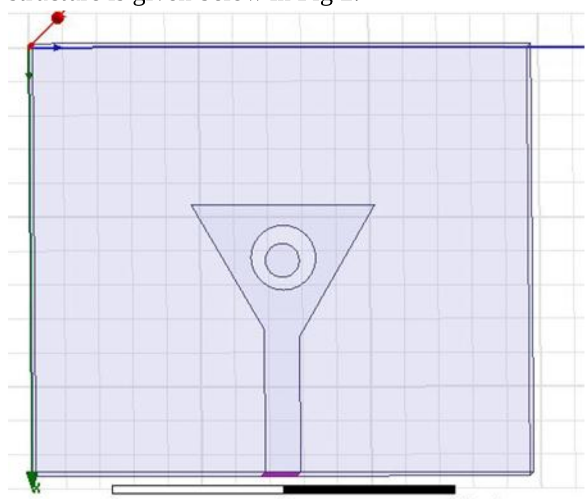

Table 2.1 Antenna design parameters:

Parameter	Notation	Value
Relative Permittivity	ε_r	3
Operating Frequency(GHz)	f_r	35.5
Height of Substrate(mm)	H	1.43
Width of Substrate(mm)	W	14.662
Length of Substrate(mm)	L	12.638

2.1 Operating frequency: The frequency at which the total bandwidth fall under it. Here the operating frequency is 22.8HGhz.

2.2 Substrate Material and Height: The substrate material Rogers Duroid 3003 with $\in_r$ =3 this was taken for better efficiency may be the cost may increase but stability will be more. The height of the substrate is taken as 1.43mm and length=12.638, width=14.662.

2.3 Design Equations:

For patch:

Width of the patch is given as:

$$w = \frac{c}{2 f_r}\sqrt{\frac{2}{\varepsilon_r + 1}}$$

Change in length is given as:

$$\nabla L = 0.412h \frac{(\varepsilon_{reff} + 0.3)[\frac{w}{h} + 0.264]}{(\varepsilon_{reff - 0.258})[\frac{w}{h} + 0.8]}$$

Where

$$\varepsilon_r = \frac{\varepsilon_r + 1}{2} + \frac{\varepsilon_r - 1}{2}[1 + 12\frac{h}{w}]^{\frac{-1}{2}}$$

Effective length of patch is given as:

$$L_{eff} = \frac{c}{2 f_r)\varepsilon_{reff}}$$

Length of the patch is given as:

$$L = L_{eff} - 2\Delta L$$

Radius of the two triangles is given as:

$$a = \frac{F}{[1 + \{\frac{2h}{\pi \varepsilon_r F}\}\{\ln(\frac{\pi F}{2h}) + 1.7726\}]^{\frac{1}{2}}}$$

$$F = \frac{8.791 * 10^9}{f_r)\varepsilon_r},$$

Effective Radius is given as:

$$a_e = a[1 + (\frac{2h}{\pi a \varepsilon_r})(\ln(\frac{\pi a}{2h}) + 1.7726)]^{\frac{1}{2}}$$

III.SIMULATION RESULTS

3.1 : - Return loss:

The loss which calculated with respect to the reflected signal. The reflection coefficient is responsible for reflection loss. The return loss is calculated as

$$RL = -20\log_{10}^{|\Gamma|}(dB)$$

The Simulated results S_{11} of the designed antenna are -18.5dB,-10.5,-12.96, at 35.5 GHz, 47.1 GHz and 50.9 GHz Respectively.

Figure 3.1: Return loss

3.2 : -VSWR

It shows how much power is reflected back from the antenna. It is a function of .It is Expressed as

$$VSWR = \frac{1 + \Gamma}{1 - \Gamma}$$

The Simulated results of VSWR are given below

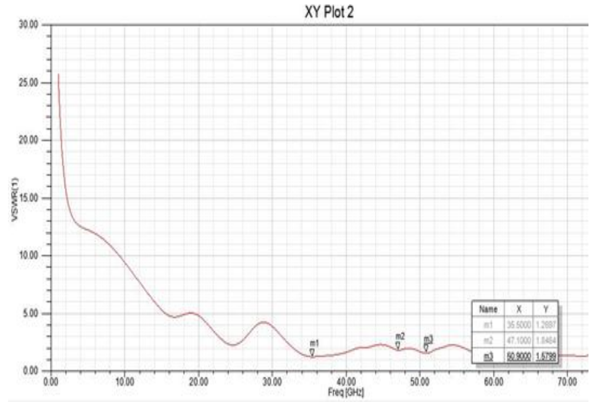

Figure 3.2: Voltage Wave Standing Ratio

3.3: - Gain:

It is nothing but amount of power transferred in that direction.

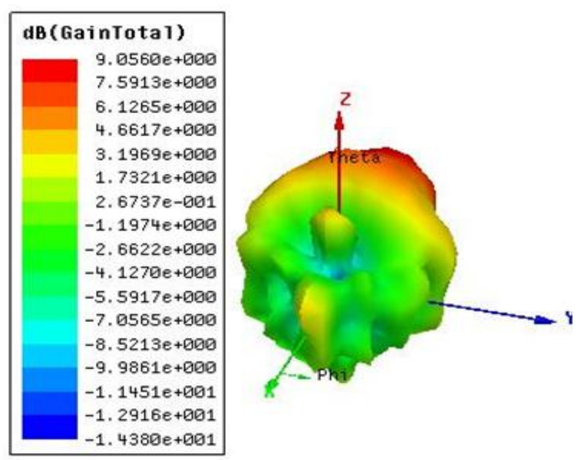

Figure 3.3: Total Gain of this Antenna

IV.CONCLUSION

The designed Ultra-Wide Band antenna occupies less volume and has better gain and return loss compared to other recently designed antennas. These are capable of operating at ,Ka band and millimeter band bandwidth ranging 1 GHz, 10.5 GHz and 3.5 GHz with Operating frequencies at 35.5 GHz, 47.1`GHz and 50.9 GHz Respectively. The designed antenna is mostly preferred for Space Mobile services, Earth exploration satellite etc.

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