A NEW YAGI-UDA MICROSTRIP ANTENNA WITH GOOD F/B RATIO

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***Abstract*-The Mobility of a common man has increased drastically in last decade requiring communication system to be highly directive and most efficient. This paper has proposed a design of Yagi-Uda Ultra Wide Band Micro strip antenna with very good performance at operating frequencies 7 GHz. This antenna is very much similar to conventional Yagi antenna with good front to back ratio and good return loss. Simulation results of our design reasonable good return loss at the frequency of 7 GHz and VSWR less than 1.7 at these frequencies. The antenna design is proposed to have two sections of reflector element and one driven element and one director. The antenna has been fed with micro strip line. The simulation of this antenna has been done with ANSOFT HFSS-13 design software. The antenna design is suitable for various wireless applications.**

Keywords: Micro strip Yagi antenna, Wide Band, Ultra Wide Band.

I. INTRODUCTION

In present times many research activities are being carried out on wireless communications, which use the microwave or millimetre band [1, 2].In this paper we have structure of antenna which has a no of element consist of director and reflector as well as parasitic element. The roll of elements is same as it is in case of TV Yagi Uda antenna. These types of antennas find their use in many applications such as industrial, medical, radar and wireless communications. The micro strip Yagi-Uda array consists of a driven micro strip antenna along with several parasitic micro strip antennas which are arranged on the same substrate surface in a way that the overall antenna characteristics are enhanced [3]. It is clear that in array applications, the effect of mutual coupling is usually undesirable, because it reduces the antenna gain, raises the side lobe level etc.But in some applications mutual coupling enhances the antenna performance. For example, in the case of micro strip antenna, parasitic patches can be placed around a driven element to increase the gain of this single driven element by several decibels [4]. Also, it is interesting those parasitic patches with open circuit Stubs can shape the beam of antenna so that it is tilted in a desired direction. A new type of micro strip Yagi- Uda antenna was introduced which achieved high gain and high F/B ratio. Although this antenna has been designed for working on spot frequency at 7 ghz.This paper presents a design of Ultra Wide Band Micro strip Yagi antenna with very good gain. Simulated results of our design show approximately -10 dB return loss. The antennaVSWR $\leq$ 1.5 that make it to be suitable for various wireless applications.

II. ANTENNA DESIGN AND SIMULATION

Wide-band operations of antenna have presented to satisfy various wireless applications. In this section, we demonstrate the validity of our proposed designed antenna through considering ground , substrate , patch1, patch2, patch3 and patch4 as well as strip line and rectangle dimensions. The simulation has been done with Ansoft HFSS version 13 software. .

II. SYSTEM FORMULATION

From the standard equation of Length and width of patch we calculate by taking the operating frequency at 7 Ghz. The width is selected as half of the value calculated from the equation. The effective dielectric constant is calculated from relative dielectric constant to further calculate the fringe factor to find out exact value of length and width of patch.

The effective relative permittivity is calculated as follows:

$$\epsilon_{eff} = \frac{(\epsilon_r + 1)}{2} + \frac{(\epsilon r - 1)}{2} \frac{1}{\sqrt{1 + 12\frac{h}{w}}}$$

The length of the patch is

$$L = \frac{3*10^8}{2*7*10^9\sqrt{2.33}}$$

= 0.014038 meter

= 14.038 mm

The actual size of Director therefore is

L= size of L – fringe factor

= 14-3.26= 10.74 mm

Hence PD=10.74mm

The reflector size is 5% more than director

Hence

PR= 10.74+ 10.74*0.05

= 10.74+0.537

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=11.277 mm
PR1=5.6385 mm
PR1=5.6385 mm
And parasitic element
PP =10.74-0.537
= 10.203 mm
The spacing between two elements is 0.1* wavelength
The width of element is calculated as

$$W = \frac{C}{2f_r}\sqrt{\frac{2}{\epsilon_r + 1}}$$

Hence the width is calculated as
0.016595 meter
= 16.595 mm

As the no of parasitic element increases the length of the element go on increasing so the shift in However the width of patch is less than what it is suppose to be. We have selected width as half of the length of patch. There are active and non active elements in the antenna elements. The active (radiating or receiving radiation) portion of the antenna effectively shifts with frequency as one stage becomes 'more resonant' than the next. The lowest operating frequency is determined by the longest element and the highest operating frequency is set by the shortest element. As the frequency of the transmission (or reception) increases, the active region of the antenna shifts

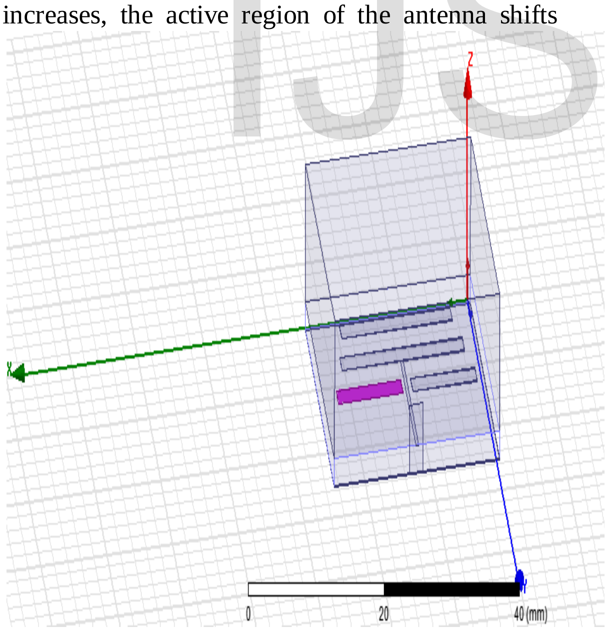

Fig1: Structure of Yagi-Uda Micros trip antenna

V. SIMULATION

forward to the shorter 1/2 λ dipole elements or vice versa as the frequency decreases. This type of structure can be used for a band of frequency to operate for wider range.

III. SELECTION OF MATERIAL

The material for ground has been taken as aluminium; the material for substrate is RT Duroid 5880 which has relative permittivity 2.23. The four patches of copper material have been selected. A micro strip line is used to form dipole structure of micro strip and connected properly. A rectangular port is selected to feed the current. The input impedance of 50 ohm is selected. Looking at the physical structure of our proposed antenna in the shown figure.1, one would see that it is comprised of multiple elements working together to provide a wide bandwidth of usable frequencies. The patch 1 and Patch 2 are of same size to make pole structure and Patch 3 is driven element and patch 4 is parasitic element direct the wave in desired direction.

IV. DESIGN SET UP

The frequency band is set as 7 GHZ with lumped port of 50 ohm resistance. The step of 0.1 GHZ is applied to show the result, which clearly indicates the radiation loss, return loss and VSWR.

A. RETURN LOSS

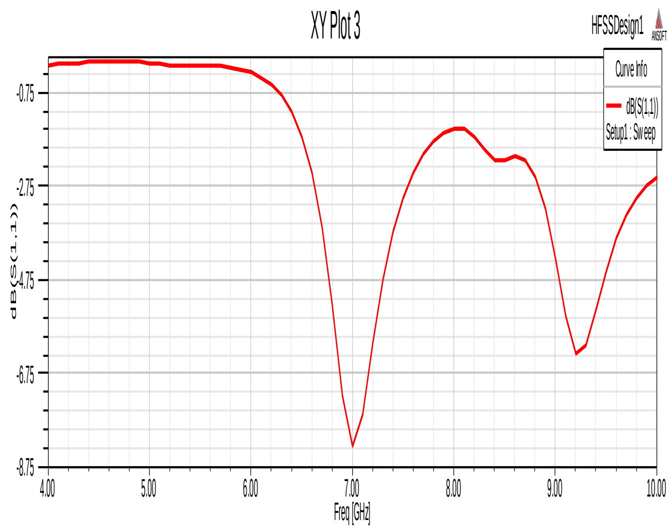

Fig:2 – Simulation result of Yagi Uda Microstrip antenna

Simulation results show that return loss of our design performed using Ansoft HFSS, approximately -10 dB at the frequency band of 7 GHZ. The iteration has been done by decreasing the width and increasing the coupling factor. The radiation field clearly indicate the radiation taking place in desired direction.

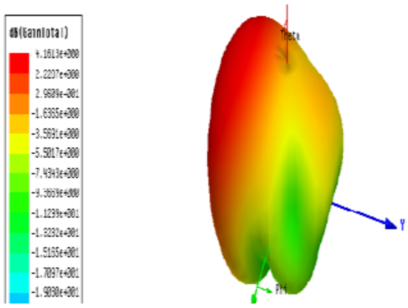

Fig: 2 Gain of Prototype Yagi Uda Antenna

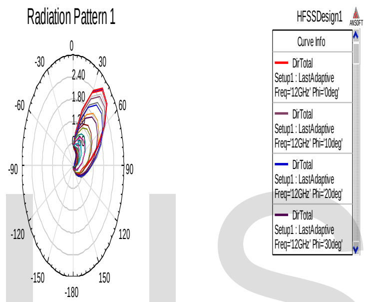

Fig: 3 Directivity of Proposed antenna

VI. CONCLUSION

The above proposed design of Yagi Uda structure has given the reasonable S [1, 1] parameter, a good gain, directivity which can be utilised for various wireless applications.

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