PLANAR YAGI-UDA ANTENNA FOR GPS APPLICATION

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Abstract— A simple planar Yagi-Uda antenna especially suitable for the mobile devices with GPS functions is proposed. Through the innovative design, the simple Yagi-Uda antenna can achieve a high bandwidth of 500 GHz. This proposed antenna uses the method of feed transformation to obtain such a high bandwidth .Here micro strip to slot line transformation is used. The physical size of the antenna is comparatively low so that these can be used in mobile devices for GPS application [1].

I. INTRODUCTION

Antennas are the basic components of any electric system that act as connecting links between the transmitter and the receiver. An antenna converts the electronic signals in to electromagnetic-waves. Yagi Uda antenna is an important type of antenna consisting of multiple parallel dipole elements in a line. It consists of a single driven element , a reflector and one or more directors. Reflector element is slightly longer than the driven dipole, whereas the directors are a little shorter [2]. The demand of global positioning system (GPS) functions for portable devices are increasing. The directivity property of the Yagi Uda antenna makes them suitable for directive wireless communication. The proposed planar antenna is particularly useful to the GPS functions in the mobile devices[3].

PRINCIPLE

As shown in Fig. 1, this novel planar antenna consists of a driven dipole, a single director, and a single reflector. The total physical dimension of the structure is 50 mm * 60 mm. The antenna structure has a low physical dimension so it can be used in mobile devices for GPS applications .FR4 is the dielectric material used. The FR4 has a dielectric constant of 4.4 [4]. FR4 is a grade designation assigned to glass-reinforced epoxy laminate sheets, PCBs; etc .It is composed of woven fiberglass cloth with an epoxy resin binder that is flame resistant. The feed transformation structure in the antenna is used for bandwidth enhancement. A high bandwidth can be obtained by using feed transformation without increasing the size of the antenna.

Here the method of feed line transformation is used to enhance the bandwidth. A micro-strip to slot-line feed transformation is employed .A micro-strip feed is a two conductor transmission line .The structure is open at top .The micro-strip feed is used when discrete devices are to be mounted on the device .using these kind of feed small adjustments or tuning can be incorporated after the circuit has been fabricated .Slot-line feeds are planar transmission structure suited for its usage in microwave integrated circuits. It is a dielectric substrate with a narrow slot etched in the metallization .It can be included in micro-strip circuits by etching in the ground plane of the substrate .Additional circuit elements can be achieved using slot-line feeds.

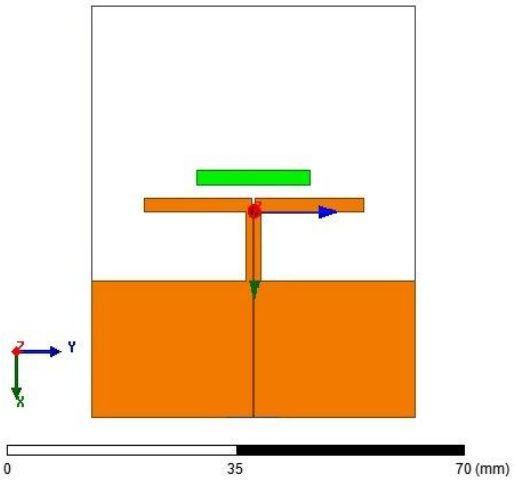

Figure1 .Structure of the Proposed Antenna Designed in HFFS Design

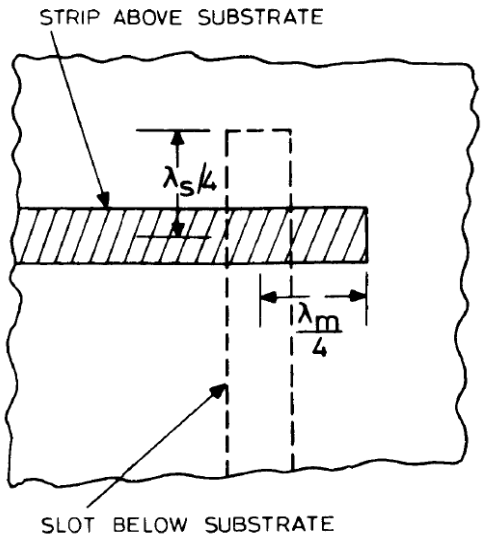

Figure 2. Micro-strip to slot-line feed transformation

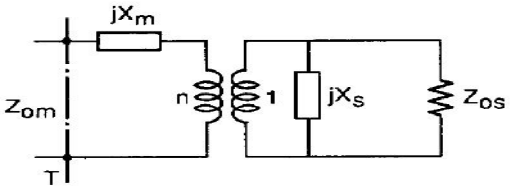

Figure 3. Electrical equivalent of micro-strip to slot line feed transformation

II. SIMULATION RESULT

Simulations of this proposed design are performed by the simulator Ansoft HFSS [6] – [9]. The return loss is shown in Fig. 4. From the plot we can see that the antenna has a maximum negative return loss at the desired operating frequency i.e. at 1575 MHz .The 3D directivity pattern and the 2D radiation patterns with co-polarization and cross-polarization components on E-plane and H-plane are shown in Fig. 5 to Fig. 6, respectively. From these figures, the 10 dB return loss bandwidth is about 500 MHz . The high bandwidth is obtained as a result of the feed transformation introduced in the antenna. Feed transformation method enhances the bandwidth without increasing the physical size of the antenna.

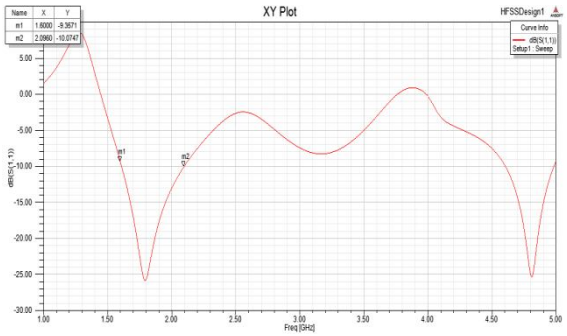

Figure 4 .Return Loss Of The Antenna

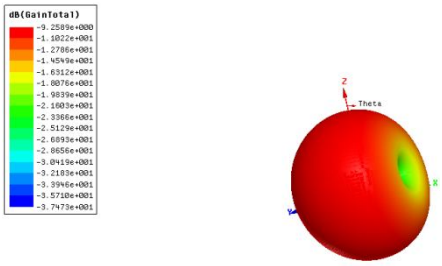

Figure 5. 3d radiation pattern of the antenna

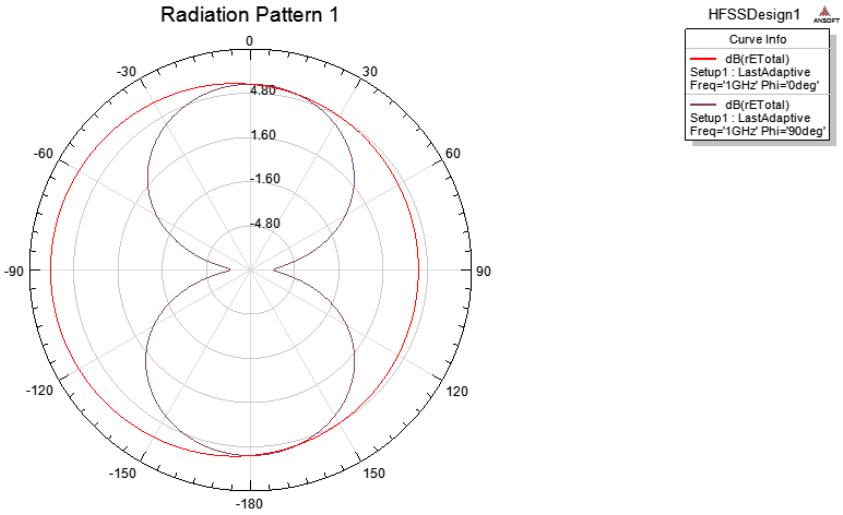

Figure 6. 2D Radiation Pattern of the Antenna

CONCLUSION

The performance of the proposed simple planar Yagi-Uda antenna for GPS application with has been tested. The feed line transformation method enabled the antenna to achieve a high bandwidth. Proper matching between the feeds and the antenna elements resulted in high bandwidth .The physical size is the antenna is considerably low and this enables the antenna to be used in mobile GPS application.

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