HORN ANTENNA FOR ULTRA WIDE BAND APPLICATION

S.K. Sahu, K.Sethi, S.K. Nayak, G.Palai

Department of Electronics & Communication Engineering

Gandhi Institute for Technological Advancement (GITA), Bhubaneswar-752054 Odisha, India

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Abstract:

In this paper, design of horn antenna for ultra wide band application is presented. The antenna consisting of a wave guide with a pyramidal structure and is made up of cupper material. Though the antenna can be used for the entire UWB range but a very good result is observed at 5.8 GHz, the upper WLAN band (5.15-5.85 GHz).The performance of the antenna is evaluated by investigating few important parameter such as $S_{11,}$ voltage standing wave ratio and radiation pattern.

Key points: Horn antenna, UWB, VSWR

Introduction:

In the contemporary world, wireless technology has become the indispensable tool for advancement communication. In all wireless systems, antenna is always resides in the front end. In this context, some factors influencing the design of antenna are the performance, size and cost [1-4]. This design is quite suitable for the above said criteria which are commonly used to feed parabolic reflector antennas. The fields created due to excitation normally radiates from the end of an open waveguide, but the flaring mechanism do the the transition of the signal to free space. The waveguide is a hollow kind of structure usually used in the microwave range above 4GHz. The electromagnetic waves are being guided along the tube. Usually the waveguide is rectangular in shape, the width being one half of a wavelength and the height assumes quarter of a wavelength [5-7]. The propagation of the waves through the structure is such that the electric field is aligned across the short dimension of the rectangle, while the magnetic field forms a close loops just orthogonal to this. Thus, the plane which is parallel to the E field is known as the E plane, while that which is parallel to the H field is known as the H plane.

Concept of Horn and Field Variation:

Figure.1 represents the proposed horn antenna with a rectangular wave guide at the tell end.In case of horn antenna the electric field lines will propagate along the waveguide and they suddenly encountered the end. Infect it must keep going at the same frequency into free space beyond the end. But the behaviour of electric field lines suggest that it cannot just end in mid air, they must either be terminated at a conductor or be in loop. Figure.2 showing horn antenna with lobes. The front lobe appears to be elliptical shape, indicating maximum power flow in that direction.

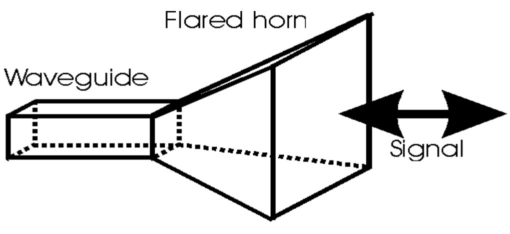

Figure 1 Proposed Horn Antenna structure

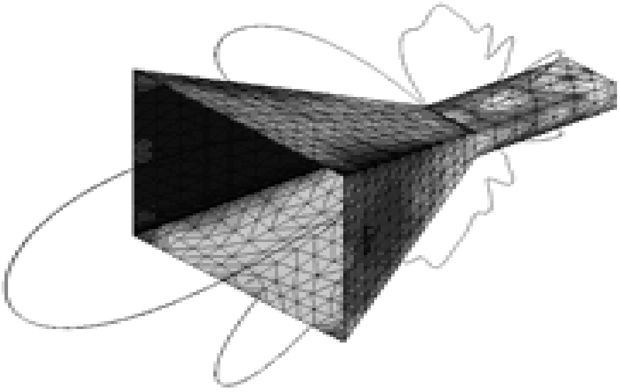

Figure 2 Power flow in terms of lobes

The theoretical gain **G** of a horn antenna is provided by the following relation:

$$G = \frac{10A}{\lambda_o^{\,2}} \cong \frac{6.4A}{\lambda_o^{\,2}}$$

Where

λg = wave-length in guide

λo = wave-length in free space

A = surface (**a, b**) of the horn antenna opening.

If a flared horn is used at the end of the waveguide, then the field is launched more gently and there is less diffraction at the edges. This results in lower side lobe levels and a more focused beam. i.e. higher gain. In fact the broad sight gain can be calculated as if the antenna was an aperture with an overall efficiency of 81%.

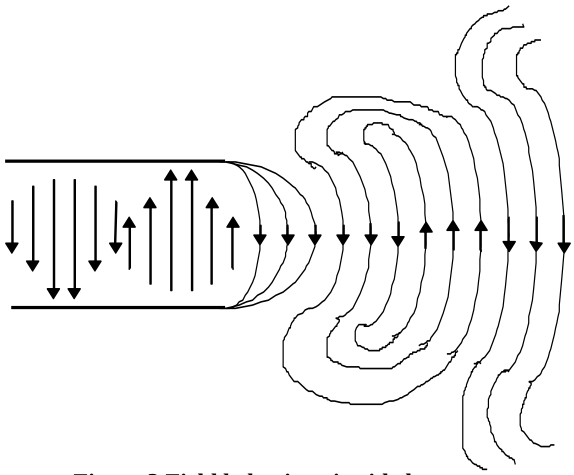

Figure 3 Field behaviour in side horn antenna

There is some additional loss due to the mismatch between the spherical waves within the horn and the assumed plane waves in free space. These losses can usually be ignored if the flare angle is kept small (less than about 45 degrees).

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Result and Discussion:

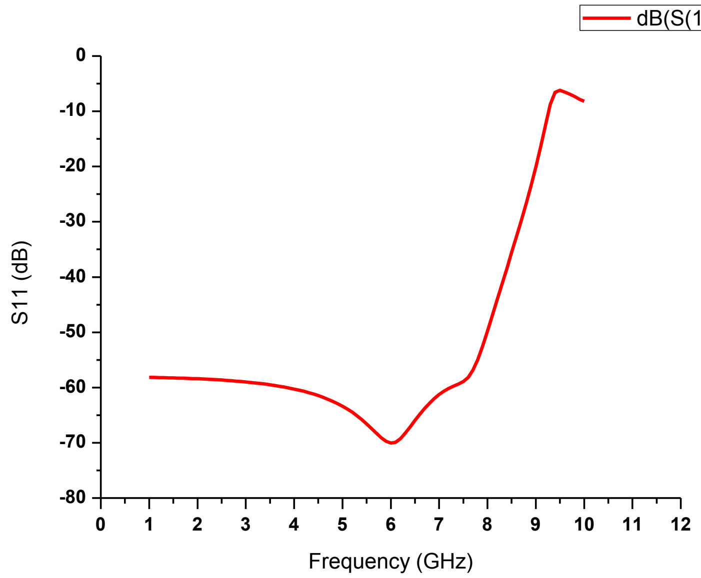

Figure 4 Simulated S-Parameter results for proposed Antenna

Figure.4 explains about S-Parameter result. This graph is a plot between return loss vs frequency. From the graph it is inferred that the antenna can function perfectly for good range of frequency nearly covering UWB band. Not only a better S11 result is found here but also an excellent VSWR value results (unity) and the related result is reflected in Fig.6.

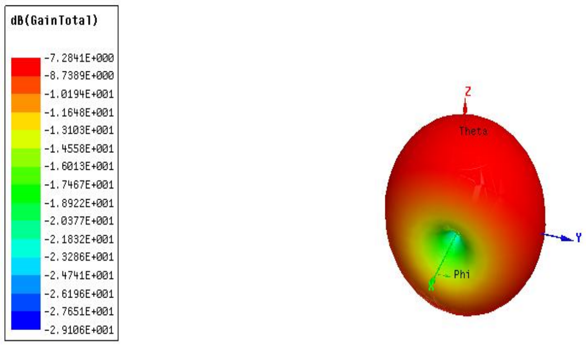

Figure 5 Radiation Pattern

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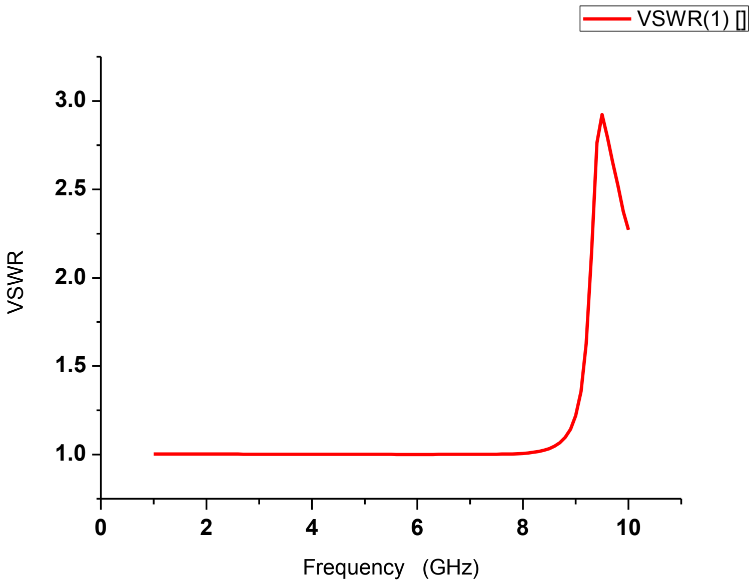

Figure 6 VSWR at resonating frequencies

Conclusion

In this paper a horn antenna has been designed for UWB application. Simulation results conform that the antenna can be used for UWB application. Though it is a perfect candidate for entire UWB range still we prefer to use for WLAN application as highest S11 result is obtained at 5.8GHz.

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