Asian Journal of Applied Science and Technology (AJAST)
Volume 1, Issue 3, Pages 133-136, April 2017

Design and Analysis of Corrugated Slot Antenna Using HFSS for Wireless Application

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Article Received: 23 March 2017 *Article Accepted: 03 April 2017* *Article Published: 06 April 2017*

ABSTRACT

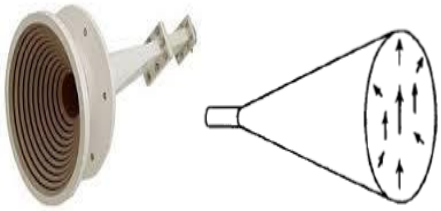
In this paper proposed corrugated slot antenna in Ku band. They are different types of antenna systems are conical horn, flat scalar ring horn then corrugated slot antennas are designed, corrugated slot antenna is having some advantages such as small side lobes, low loss(high antenna efficiency) and radiate linear polarization, low cross polarization, high gain, E-plan and h-plan beam width are nearly same, low return loss. Corrugation is reducing the cross polarization level. The three types of antennas are designed with the software is Ansoft HFSS (High Frequency Structure Simulator), and results are measured. In this proposed antenna using frequency range of 8-12GHZ.

Keywords: Corrugated, HFSS and Flat scalar ring polarization.

1. INTRODUCTION

The antennas are most widely used for military and wireless communication applications. It provides high efficiency and large bandwidth antennas concerns miniaturized planar antennas. Small antennas to reduce the high side lobe levels, slotted antenna arrays simple to fabricate. In short range applications of radar systems are need of linear phase and compact with 3db Beam width. The communications between cables, for example coaxial, optical fibers etc.

There are different types horn antennas are conical horn, flat scalar ring horn, sectoral horn (E-plan and H-plan), exponential horn antenna and pyramidal horn antenna then corrugated slot antenna as shown in fig 1.



(a) (b)

(c)

Fig 1: Various horn antenna systems (a) Corrugated (b) conical horn (c) flat scalar ring horn Slot antenna

Horn antennas to measure high gain, flaring open end of the waveguide widely used in transmitting and receiving and UHF at microwave frequency it provide EM energy in free space. Horn antennas are types of aperture using various applications.

2. ANTENNA SYSTEM DESIGN

(a) Conical horn antenna

A horn antenna with microwave antenna is the conical antenna. It has a circular cross section and circular aperture it fed by circular waveguide. The conical antenna is designed for Ansoft HFSS software it do not good feed horns of reflector because high cross polarization level then patterns are symmetry.

Length L=20cm, dimensions of Horn radius a'= 28cm and horn Flare Length FL=40cm and wall thickness t=0.4cm. The geometrical 3D view of designed Conical Horn Antenna in HFSS is shown below in fig.2.

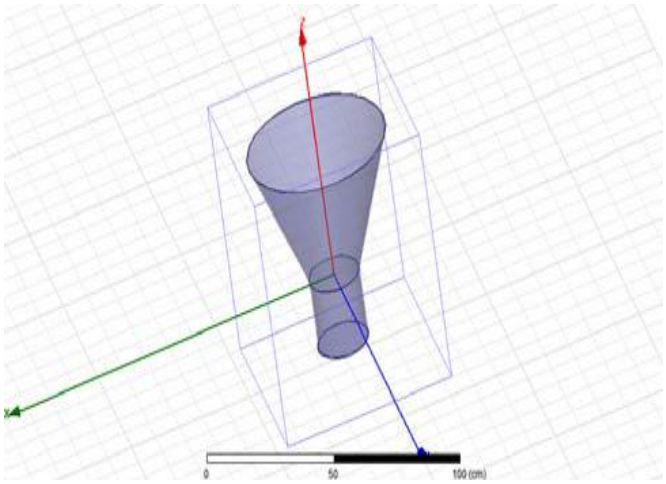


Fig 2: Structure of conical horn

Result and Discussion

The return loss of conical horn is -37.72db and then frequency is 1.32GHZ in first slop and second slop of pyramidal horn return loss and frequency is -35.30db at 1.57GHZ is

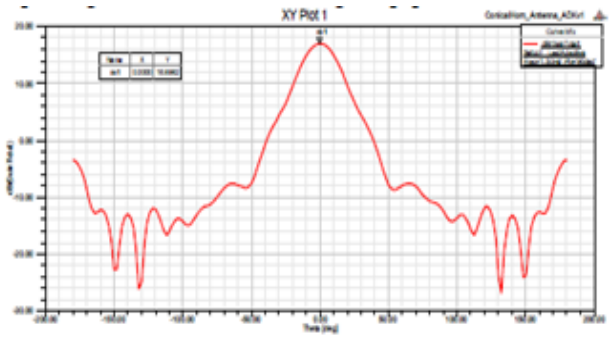


Fig 3: 3D Radiation pattern of an antenna

The 3D design of radiation pattern for conical horn antenna is

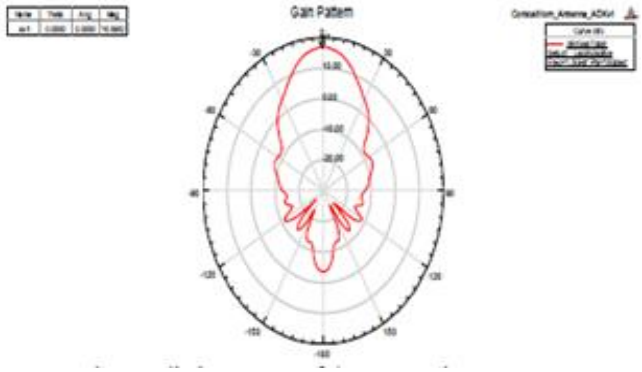


Fig 4: Radiation pattern of the antenna

(b) Flat scalar ring horn antenna

In this type of horn antenna for to improve the signal quality and then to provide a multipath projection .it can operated in a frequency bands are (L and S bands), the size of flat scalar ring horn antenna is small 23.5.The designed antenna is performance in terms of polarization, less weight and small size with 3-db band width.

The application of flat scalar ring horn antenna is wide band ground station receiver antenna was designed by using advance EM simulation software. Waveguide dimensions of diameter a=15cm, length L=18.5cm and radius of scalar ring antenna is a'=15cm, Length L=5cm, thickness t=0.2cm.the 3Dview of flat scalar ring horn antenna is given by

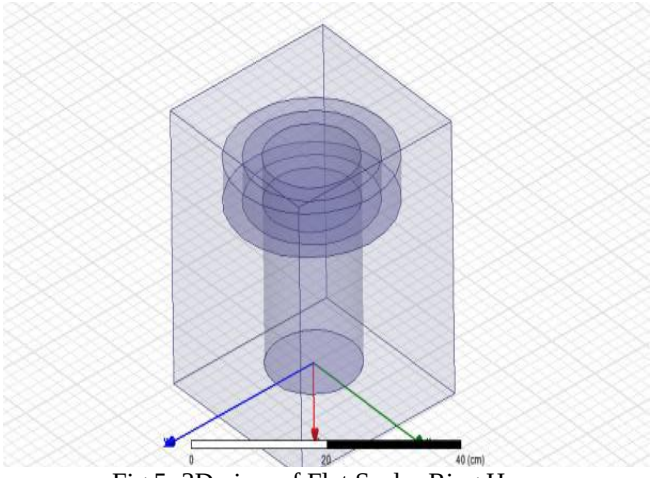


Fig 5: 3D view of Flat Scalar Ring Horn

Results

Return loss and frequency of first curve is -25.64db at 1.39GHZ, Second curve of return loss and frequency is -15.86db and 2.15GHZ then third curve of -13.83db and 2.91GHZ is

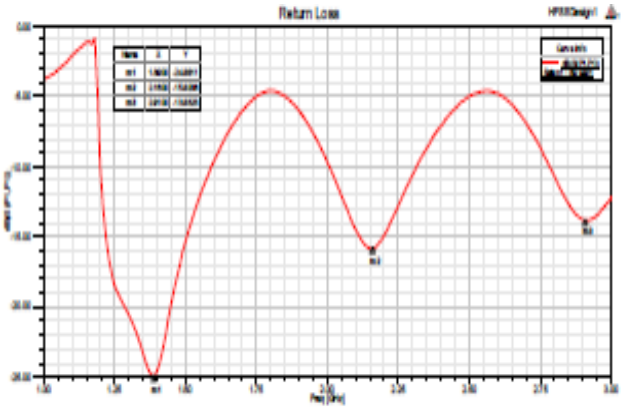


Fig 6: 3D Radiation pattern of an antenna

The 3D Radiation Pattern of flat scalar ring antenna design is

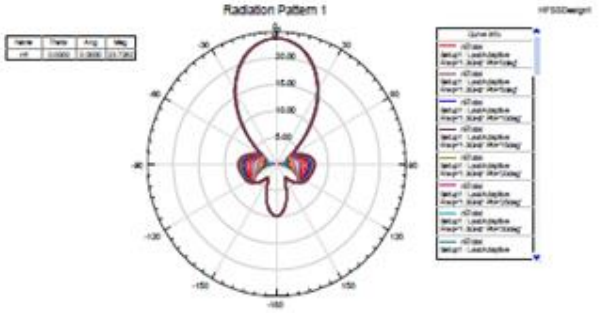


Fig 7: Radiation pattern of the antenna

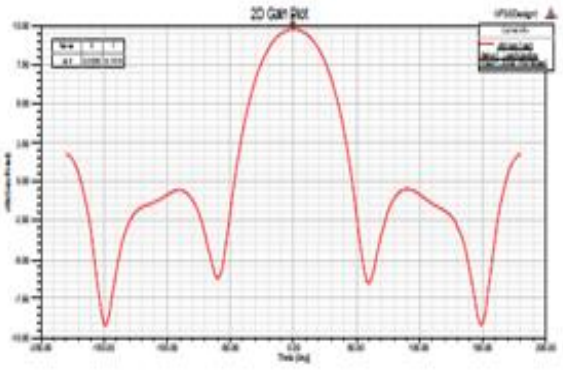


Fig 8: 3D Radiation pattern of antenna

C) Corrugated Slot Antenna

Slot antenna was designed by software AnSoft HFSS it is mostly widely used for microwave antennas applications of feeding reflectors and lenses. Corrugated slot antenna to improve the antenna efficiency and reducing diffraction from aperture edges, it operating frequency range of 12GHZ to 18GHZ. It consist of a flaring corrugated metal wave guide shaped like a horn to direct radio waves in a beam, Near field radiation to reduce the high side lobes In this antenna for

higher relative permittivity dielectric, the size of the antenna will be smaller.

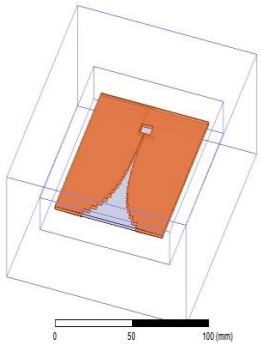


Fig 9: 3D view of corrugated slot antenna

Results

The Return loss and frequency of first curve inn slot antenna for -13.23db at 2.88GHZ second curve of return loss -13.75db at frequency is 4.17GHZ the third curve of -12.77db at 7.5.7GHZ fourth curve is -11.455db at 8.71GHz is shown in Fig: 10.

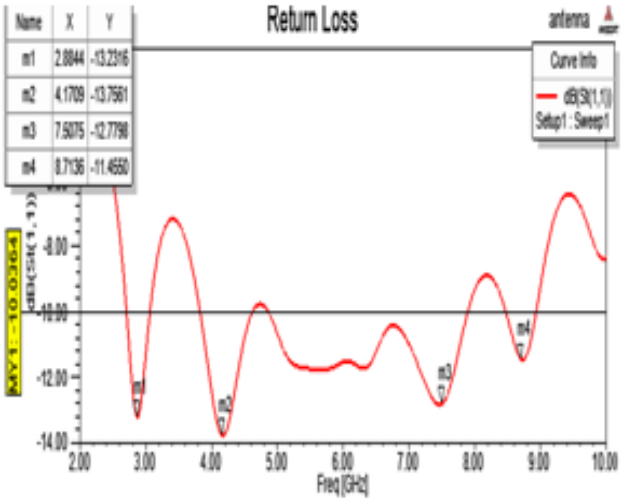


Fig10: Return loss of an antenna

Radiation pattern of slot antenna design

The 2D view of the radiation pattern of corrugated slot antenna shown in Fig: 11

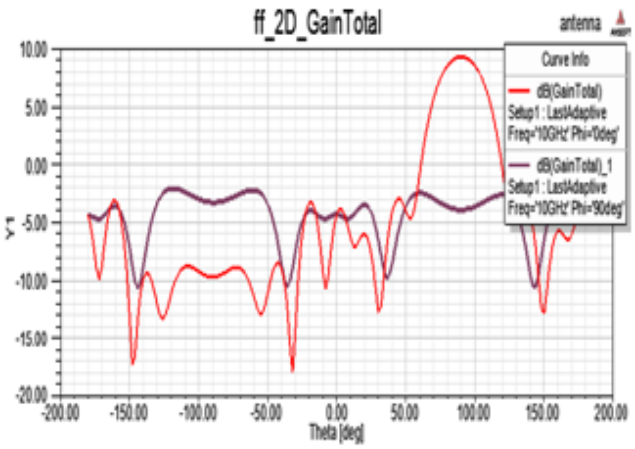


Fig 11: 2D Radiation pattern of an antenna

3. COMPARISON OF ANTENNA SYSTEM

The three different types of antenna system such as conical horn antenna, flat scalar ring horn antenna and corrugated slot antenna they are simulation results are compared is given below

Comparison Table:

Parameter	Conical horn	Flat scalar ring (existing)	Corrugated slot (proposed)
Return loss in db	-37.72db @1.32GHz -35.30db @1.57GHz	-25.64db@1.39 GHz -15.86db@2.15 GHz	-13.23db@2.88 GHz -13.75db@4.75 GHz
band	L-band	L&S-band	Ku-band
gain	16.858	9.7458	9.29

4. ADVANTAGES AND DISADVANTAGES OF PROPOSED SYSTEM

Advantage:

1. Slot antenna of frequency band Ku-band
2. It provides high efficiency and reduces diffraction
3. Low side lobes
4. Low cross polarizations
5. Multi frequency Design

Disadvantages:

1. Gain is less

5. CONCLUSION

The slot antenna was designed and analyzed by using HFSS software. The proposed antenna for corrugated slot antenna was operated by Ku-band frequency and this antenna using from wireless applications because slot antenna for design multi frequency and high beam efficiency slot antenna for small gain and minimum return loss of -13db. These simulation results satisfied then design requirements.

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