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Survey Paper on Circular Aperture Slot Antenna with Defected Ground Structure for Broad Band

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Abstract: ***This paper introduces the survey on the circular Aperture Sot Antenna with defected ground structure. A novel system composed of a circular aperture slot antenna and a Common-Mode (CM) noise rejection filter is presented. This antenna is differentially fed by microstrip coupled transmission lines. In order to eliminate CM noise, a notch filter based on three non-periodical defected ground structures (DGS) is considered. The whole system achieves a fractional impedance bandwidth of about 127%. Radiation patterns in E and H planes for different frequencies were obtained for the system The Wide Broad band can be achieved by using Circular Aperture Slot Antenaa With defected Ground Structure***
Keywords: ***Microstrip , Microwave filters,Noise measurement***

I. INTRODUCTION

As Wireless Technology has Grown-up, Between the varieties of Microwave devices, the systems with differentially fed are of Great Interest. There are many applications which requires the Bandwidth excess than 100% like radio Astronomy, Millitary Applications. The Basic necessity of these applications is very broad band for observation with decreased noise.The component of CM current is inherently introduced as noise. There are many ways of designing the antenna for Broadband.The Large antenna arrays, Vivaldi antenna arrays, Microstrip antenna, are the antennas which gives wide band. Also in All antennas Common-Mode currents get introduced, to remove or to minimize CM noise. the DGS technology is used in digital Application Also Broad band can be obtained by differentially fed antenna systems which has the advantages of higher gain &signal can travel to longer distance also it rejects the influence of cross-talk coupling. For wide operational Bandwidth Tappered Slot Antennas are used.This Survey paper contains Survey on Circular Aperture Slot Antenna & DGS Technology.

II. APPROACHES FOR WIDE BANDWIDTH

As wireless technology has grown-up between the variety of microwave devices, differentially fed system are of abundant curiosity The main advantage of differential system is higher gain, signal can travel longer distances also it rejects the influence of cross-talk coupling [2]. Also they monitor common mode currents which will subsidize more than differential mode currents. The defected ground plane structures(DGS)below a pair of coupled microstrip transmission lines have been used in digital applications to remove CM currents without influencing DM currents[4]-[8].There are some applications like radio astronomy which require bandwidth more than 100%.

The basic necessity of these applications is wide band for observation with decreased noise.The CM current component naturally introduced as noise when we use Vivaldi antenna fed by differential signal given by rat race coupler [13]

III. DIFFERENTIALLY FED ANTENNA COMMON MODE NOISE RADIATION

It is difficult to design digital circuits at high frequencies due to CM noise.as shown in fig 1 electric field produced in an omnidirectional mode by the two wires which are transversal to the direction where the transmission lines are placed By Half wave dipole theory electric field produced by a wire conductor will be L=λ/2.The resultant electric field produced by two wire conductors which are placed close to each other will be product of superimposing the field of each metallization. This is similar to the linear array, where the total electric field (E) is the sum of the other two electric fields

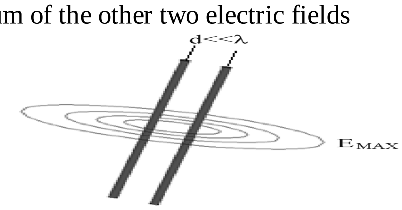

Fig 1. Electric field lines produced by CM currents in nearby wires

$$E_T=E_1+E_2 \qquad (1)$$

$$|EDmax| = 1.316 \times 10^{-14}\frac{|ID|f^2}{d} \times L \qquad (2)$$

$$|ECmax| = 1.257 \times 10^{-6} \frac{|Ic| f}{d} \times L \qquad (3)$$

Where L is Length of conductor wire is frequency, $_{ID}$ differential current,I_C common mode current,s is separation between two conductors,and d is distance where filed is measured [3].

The electric field of common mode increases linearly as frequency increases. Also this field does not depend on the separation between the conductors.By observing (2) & (3) it is clear that total E is conquered by CM Current moderately than DM current

IV. CIRCULAR APERTURE SLOT ANTENNA

The Technique used to get Broad Band is Circular Aperture Slot Antenna,thse are Tapered slot antennas. For broad operational Bandwidth tapered slot antennas are used [20].In this system Circular Aperture Slot Antenna is presented. To construct aperture of this antenna two quarters of (different radii)of circles is used. It also maintain narrow beam in Plane B.The Space between two antennas is filled by rectangle C.As P1 & P2 must be fed by differential currents to achieve this width & separation between microstrip lines calculated also to achieve odd mode propagation of 50**Ω.**The rectangle D is required for optimization on each line. The optimization is done in full wave simulator.

The calculation of S parameter and Reflection coefficient will be simple. The reflection Coefficient (**S_{11dd}**)is given for **DM** by (4)

$$S_{11dd} = \frac{1}{2}(S_{11} - S_{12} - S_{21} - S_{22}) \qquad (4)$$

The S parameter can be obtained by preparing Matrix of Port 1 & Port 2.The advantage of this CASA is in results In Radiation Pattern there is high level symmetry. Cross Polarization result of Balanced current more than antipodal. As we are using this antenna with the common mode noise rejection filter which is DGS

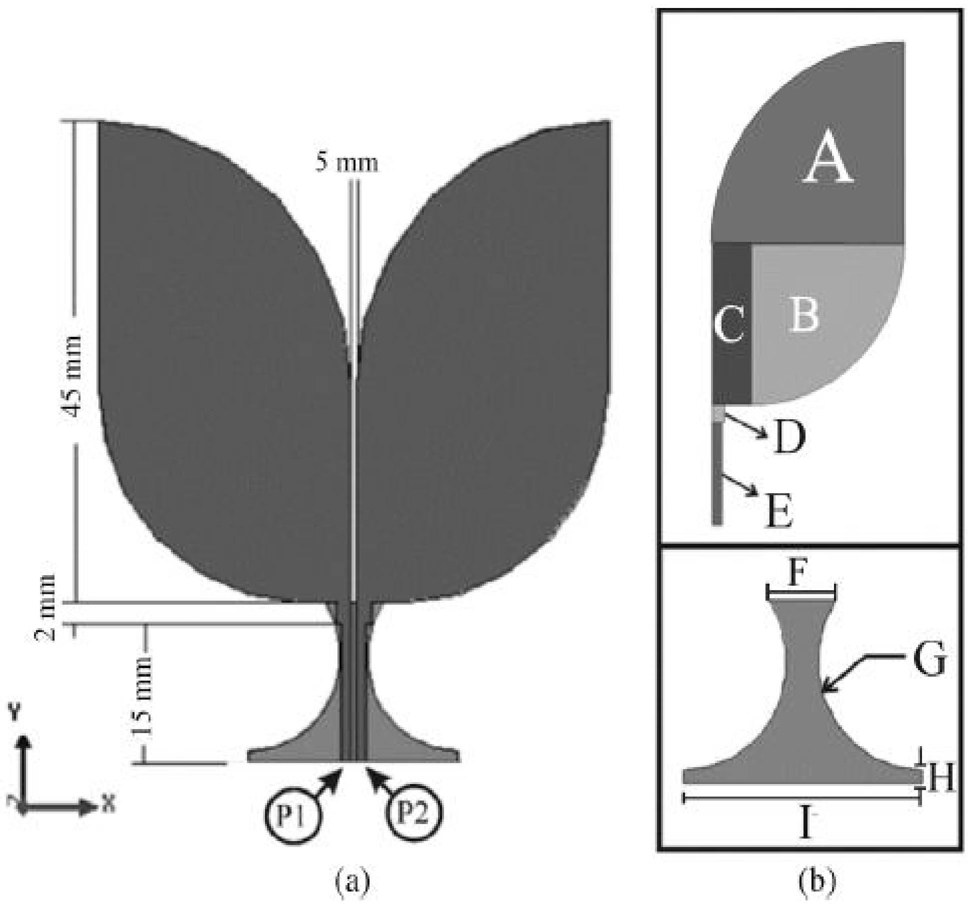

Fig.2 Circular Aperture Slot Antenna

LETTER	BRIEF DESCRIPTION	DIMENSION (mm)	DIMENSION (λ_G)

A	Radius of major quarter	25	.83
B	Radius of minor quarter	20	0.66
C	Rectangle C	10 × 20	0.33×0.66
D	Rectangle D	1.5×32	0.04×1.06
E	Rectangle E	1× 68	0.03×2.25
F	Minor base of ground plane	5.7	0.18
G	Radius of curved slot in ground plane	8.9	0.28
H	Height until curved slot of ground plane	1.1	0.03
I	Major base of ground plane	20.5	0.68

Table.Dimension of CASA

V. DGS TECHNOLOGY

Conventional microstrip antennas had some limitations, that is, single operating frequency, low impedance bandwidth, low gain, larger size, and polarization problems. There are number of techniques which have been reported for enhancing the parameters of conventional microstrip antennas, that is, using stacking, different feeding techniques, Frequency Selective Surfaces (FSS), Electromagnetic Band Gap (EBG),Photonic Band Gap (PBG), Meta material, and so forth. Microwave component with Defected Ground Structure(DGS) has been gained popularity among all the techniques reported for enhancing the parameters due to its simple structural design. Etched slots or defects on the ground plane of microstrip circuits are referred to as Defected Ground Structure. Single or multiple defects on the ground plane may be considered as DGS. Initially DGS was reported for filters under neath the microstrip line. DGS has been used underneath the microstrip line to achieve band-stop mutual coupling. After successful implementation of DGS in the field of filters, nowadays DGS is in demand extensively for various applications. This paper presents the evolution and development of DGS. The basic concepts, working principles, and equivalent models of different shapes of DGS are presented. DGS has been used in the field of microstrip antennas for enhancing the bandwidth and gain of microstrip antenna and to suppress the higher mode harmonics, mutual coupling between adjacent element, and cross-polarization for improving the radiation characteristics of the microstrip antenna. Applications of DGS in microwave technology are summarized in this paper and the applications of DGS in the field of antennas are discussed.Lowcost, high performance, compact size,wideband, and low profile antennas often meet the stringent requirements of modern wireless communication systems. Modern communication demands the availability of efficient, compact, and portable devices that can be operated at high data-rates and at low signal powers. Researchers have been working towards the development and advancement of RF front ends to meet *4.1. Working Principle*. DGS has been integrated on the ground plane with planar transmission line, that is, microstrip line, coplanar waveguide, and conductor backed coplanar wave guide [12–24]. The defects on the ground plane disturb the current distribution of the ground plane; this disturbance changes the characteristics of a transmission line (or any structure) by including some parameters (slot resistance, slot capacitance, and slot inductance) to the line parameters (line resistance, line capacitance, and line inductance). In other words, any defect etched in the ground plane under the microstrip line changes the effective capacitance and inductance of microstrip line by adding slot resistance, capacitance, and inductance.

A. Unit DGS

The first DGS model has been reported as a dumbbell shaped defect embedded on the ground plane Underneath the microstrip as shown in Figure 1 [12]. The response of its return loss is also shown in the figure. DGS has some advantages over PBG. (1) In PBG, periodic structures occupy a large area on the circuit board. On the other hand a few DGS elements may create similar typical properties. Hence, circuit size becomes compact by Introducing DGS. (2) DGS is comparably easy to design and fabricate and its equivalent circuit is easy to realize. (3). Higher precisions are achieved in comparison to other defect embedded structures. Two aspects for utilizing the performance of DGS are DGS unit and periodic DGS.

	PBG	EBG	DGS
Definition	Photonic Band Gap (PBG) structures are periodic structures etched on the ground plane and have the ability to control the propagation of electromagnetic waves	The EBG technique is based on the PBG phenomena and also realized by periodical structures but compact in size	Single or few compact geometrical slots embedded on the ground plane of microwave circuits are referred to as Defected Ground Structure (DGS)
Geometry	Periodic etched structure	Periodic etched structure	One or few etched structures
Parameter extraction	Very difficult	Very difficult	Relatively simple
Size	Larger	Smaller than PBG and larger than DGS	Much more compact than PBG and EBG
Fabrication	Difficult	Difficult	Easy

Table 2.Comparison Between PBG,EBG & DGS

VI. CONCLUSIONS

Survey of Circular Aperture Slot Antenna with DGS Design is proposed. The system has main two components a circular Aperture Slot Antenna & non Periodical DGS .with this system we can achieve bandwidth excess of 100%.That is Bandwidth is extended which is used for Radio Astronomical Application. The circular aperture slot Antenna and DGS can be used to enhance the Bandwidth.

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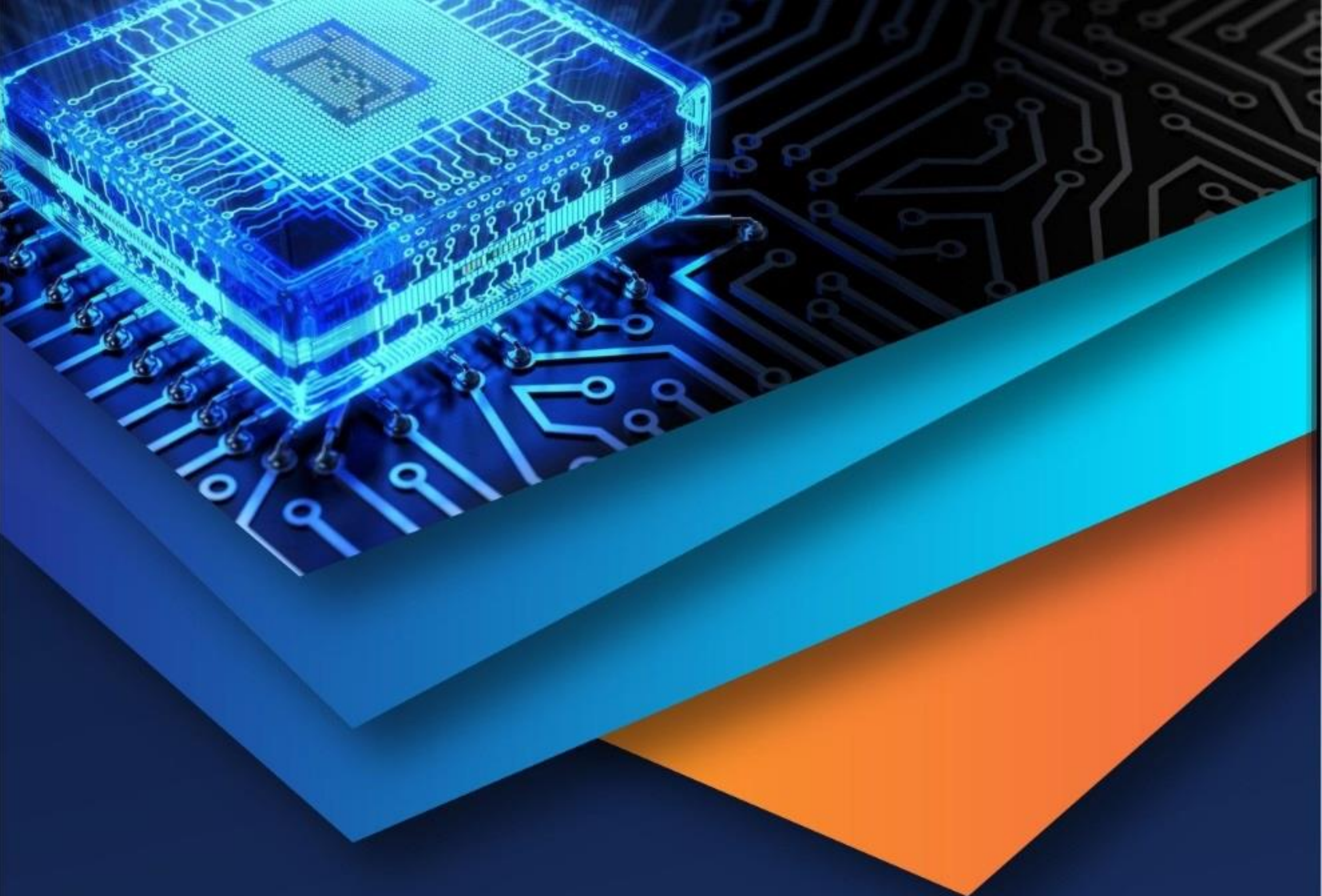

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