Microstrip Antenna Array

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Abstract— **The Recent growth of communication has developed large number of antenna for various applications. In various fields we need antenna with high characteristics .Microstrip antenna may be used in various purposes. Compared with other antennas microstrip antenna have more better prospects and advantages in terms of easily fabrication. This paper mainly describes the microstrip antenna with use of DGS, feedback methods and parameters of antenna. DGS is used to improve various parameters of antenna like, return loss, efficiency, directivity, voltage standing wave ratio.etc.**

Keywords— **Microstrip Antenna, DGS, Antenna parameters, Antenna feedback, Power divider**

I. INTRODUCTION

In communications antenna are mostly used in various applications due to there advantage in terms of low cost, high speed performance and reduced size. Microstrip antenna meets these requirements. But sometime they may give low gain and narrow bandwidth.These can be removed by using more microstrip patch antenna in array configuration From various previous papers has been studied for microstrip antenna without DGS may involve some problems like larger size, high cost and mutual coupling effects But we know in present world antenna size and less cost is main problem. This can be achieved by DGS technique. Also to improve the various parameters of antenna like vswr,gain,directivity,efficiency,s-parameters we may think about the use of DGS technology .Defected ground structure also remove the mutal coupling between various antenna elements.[1] The most common form of Microstrtip antenna is patch antenna. Patch antenna is generally a widebeam; naroow antenna fabricated by etched the antenna metal to a insulated substrate known as circuit board, with layers apposite to substrate which makes a ground plane. Microstrip patch antenna shapes may be elliptical,circular,rectangular &square.Some advantages of micro strip antennas which are useful in wireless applications are(i) Low fabrication cost (ii)It support both linear &circular polarization (iii)Easily integrated with microwave integrated circuits.(iv)capable of double triple frequency operations. But depending on these advantages they have some disadvantages They radiate into half plane.& low power handling capacity [2]DGS is generally a periodic and non-periodic configuration defect mainly in the ground plane. This defect also suppress the mutual coupling between antennas.DGS have been used a microwave filters such as low passfilter,bandpass&bandstop.It comes in numbers of geometry and sizes depend upon the mode of application (a) U-shaped (b) Arrowhead dumbbell-shaped (c) v-shaped (d) E-shaped (e) F-shaped In comparison with periodic EBGs (Electronic Band Gap).DGS is mostly used because it use fewer slots to modify the current distribution on the ground plane It also require less area and have more precision. As we know radiation pattern of single antenna is wide which gives low directivity. So it is necessary to design antenna with high directive characteristics for long distance communication This is accomplished by increase the size of antenna. Antenna array is one of main method to combine radiation from a group of similar antenna to achieve phenomenon of wave interference. The radiation pattern of antenna mainly depends on amplitude distance between elements. [3-5]

DGS Shapes

U-shaped   V-shaped

Arrowhead-dumbbell
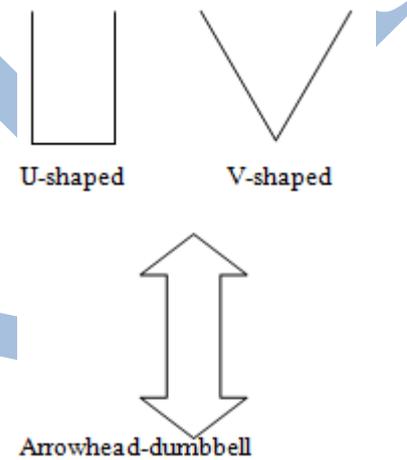
II MICROSTRIP ANTENNA STRUCTURE
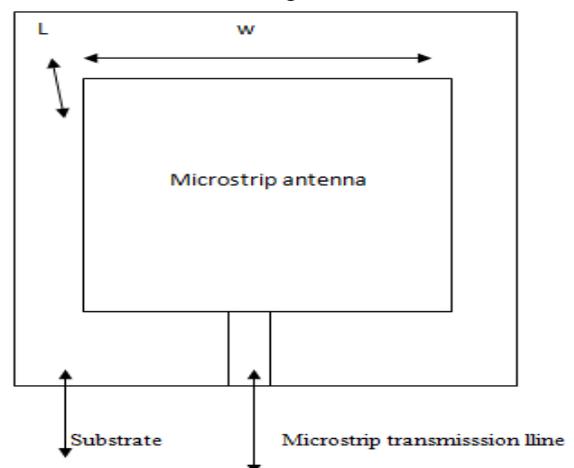
The basic antenna is shown in figure1

Fig: 1(a) Top view of micro strip antenna
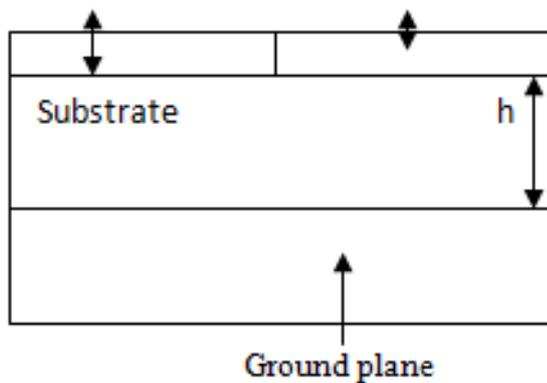
Microstrip transmission line Patch antenna

Fig: 1 (b) Side view of micro strip antenna

The frequency of micro strip antenna is find out by length L shown in figure 1a

The centre frequency is given by

$$f_c \approx \frac{c}{2L\sqrt{\varepsilon_r}} = \frac{1}{2L\sqrt{\varepsilon_0 \varepsilon_r \mu_0}}$$

Width W of micro strip antenna controls the impedance Larger value of w also increase the bandwidth of antenna

III ANTENNA PARAMETERS

In order to describe the performance of micro strip antenna we defined some parameters

(i)Bandwidth
It generally defines the frequency range over which antenna meets the certain set of   performance crititeria.Two methods are defined for antenna bandwidth. An antenna is considered broadband if $f_H / f_L \geq 2$

Narrowband ratio is given by,

$$BW_p = \frac{f_H - f_L}{f_0}$$

Broadband ratio is given by,

$$BW_b = \frac{f_H}{f_L}$$

Here f_0 = operating frequency

f_H = higher cut- off frequency

f_L = lower cut- off frequency

(ii) S-parameters
It describes the the input-output relationship between terminals in a system. In a communication if we use two radio then radio terminal will be two ports (S11 & S22) S11 is mostly used in antenna .it tells how much power is reflected from antenna and known as reflection coefficient.
(iii) Gain
It is mainly a dimensionless quantity which cant be defined in terms of watt or ohm.It is described by the ratio of intensity in a given direction to radiation intensity if power accepted by antenna isotropically.
Antenna gain is close related to directivity and is given by

$$G = e_{rad}\, D$$

Where e_{rad} =radiation intensity of antenna
(iv)Directivity - It is defined as the ability of antenna to focus   the energy in a given direction.
Directivity is given by

$$D_{max} = \frac{4\pi\, U_{max}}{P_{rad}}$$

(v)Efficiency of Antenna
The efficiency of an antenna relates the power delivered to the antenna and the power radiated or dissipated within the antenna. It may be written as ratio of radiated power to the input power of antenna

IV ANTENNA FEEDBACK

Antenna is mainly feed by numbers of methods   given below
1. Microstrip line
2. Coaxial probe
3. Proximity coupling
4. Aperture coupling

In case of Microstrip antenna array we use only Microstrip line but in case of patch antennas we use   All feeding methods
Microstrip line: This feedback is generally used in all applications because it is simple to design and easy to manufacture
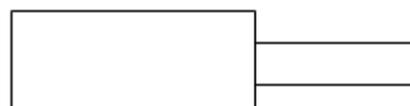
In micro strip feedback a conducting strip is connected to the edge of patch as shown in figure.
The strip is smaller to the patch
Coaxial probe: In this feedback the inner conductor of coaxial connector mainly connects to the dielectric and is soldered to the radiation patch while outer conductor is attached to the ground plane. The main advantage of this feedback is that it can be placed anywhere inside the patch in order to match through its input impedance. Coaxial feedback has low spurious radiation as compared to microstrip.But its provides narrow bandwidth and difficult to model.

Proximity coupling feedback: It is also named as electromagnetic coupling feedback. In this two dielectric substrate are used and feline is between the substrate and radiating patch is mostly on the upper substrate. This feedback provides high bandwidth with respect to others

Aperture coupled feed: In this type of feedback patch and the micro strip feed line are separated by ground plane & coupling between patch and feed is made by a slot in the ground plane

V POWER DIVIDER

Power divider is a network which provides required properties like transmission.islolation &reflection. Various type of power divider has been used in micro strip line feed. The most popular are quadrature, hybrid,ring etc[6]

IV CONCLUSION

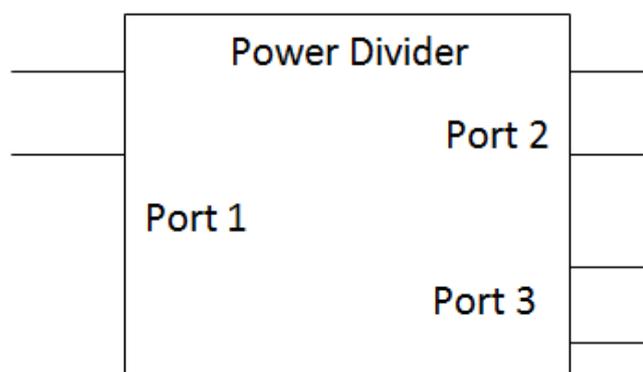Block diagram of a three port power divider

Figure 3

VI CONCLUSION

In This papers Microstrip antenna is defined for DGS which can be used for various wireless and communication purposes The advantages of DGS helps in improving various parameters of antenna which are useful for their operation in network. Even DGS is easily inserted in antenna which reduce the cost of micro strip antenna also

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