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Analysis of Slot-fed Dielectric Resonator Antenna

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ABSTRACT
A slot-fed dielectric resonator antenna (DRA) with wideband operations in 5.8 GHz frequency band is proposed in this paper. Slot represents coupling mechanism between resonators & the microstrip line. The microstrip feed line is positioned at right angle to the centre of the slot for efficient coupling. The DRA & slot both are resonant structures & with proper design wide bandwidth can be achieved. The rectangular DR placed at the centre of the rectangular ring slot. The return loss & radiation patterns of these are presented.
Key Words: *DRA, Microstrip, Gain.*

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INTRODUCTION:

Satellite communication, direct digital broadcast, GPS, blue tooth like communication application of wireless require wideband to accommodate large data rates. Dielectric resonatorantenna (DRA) is also called microwaveantenna works in microwave ranges from0.3 GHz(1m) to 300 GHz (1mm) &available in wide band width.

Dielectric resonator (DR) of dielectric resonator antenna (DRA) is madeof ceramic material of different shapeand sizes such as cylindrical, hemisphere, conical, rectangular etc. Thisantenna lacks metal parts; metal parts make iron lossat high frequencies & dissipating energy. So it has lower losses & more efficientthan metal antenna at high microwave& millimetre wave frequencies. With these advantages as- low cost, no conductor loss, small size & lightweight, easy of excitation & highradiation efficiency (generally >95%) etc. DRAalsohas a unique feature i.e. couplingbetween DRA & planer transmission line canbe easily controlled by varying the position of DRA wrt. feeding line so performanceof DRA easilyoptimized.

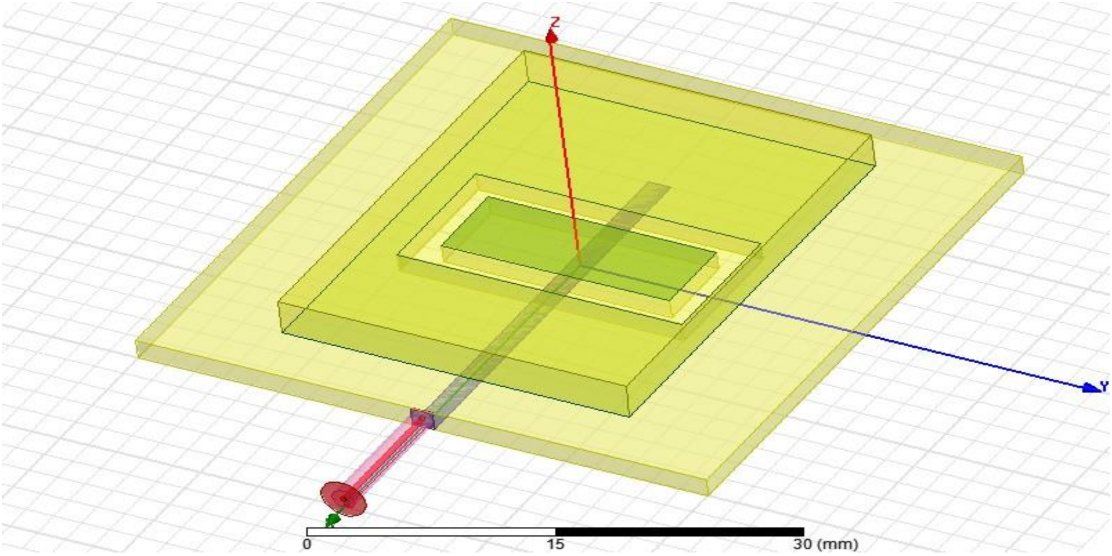


Fig.1 - Configuration of Slot-Fed Dielectric ResonatorAntenna

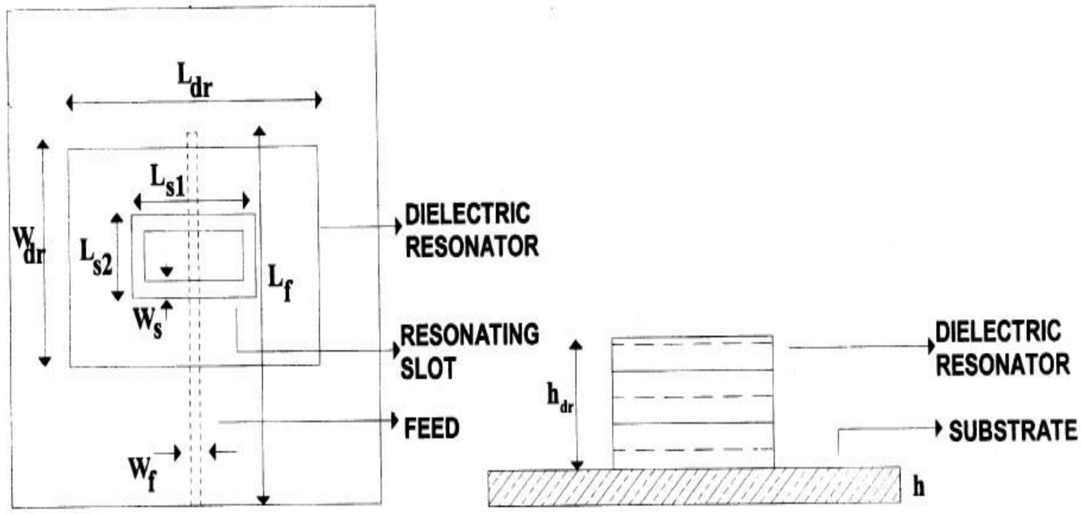


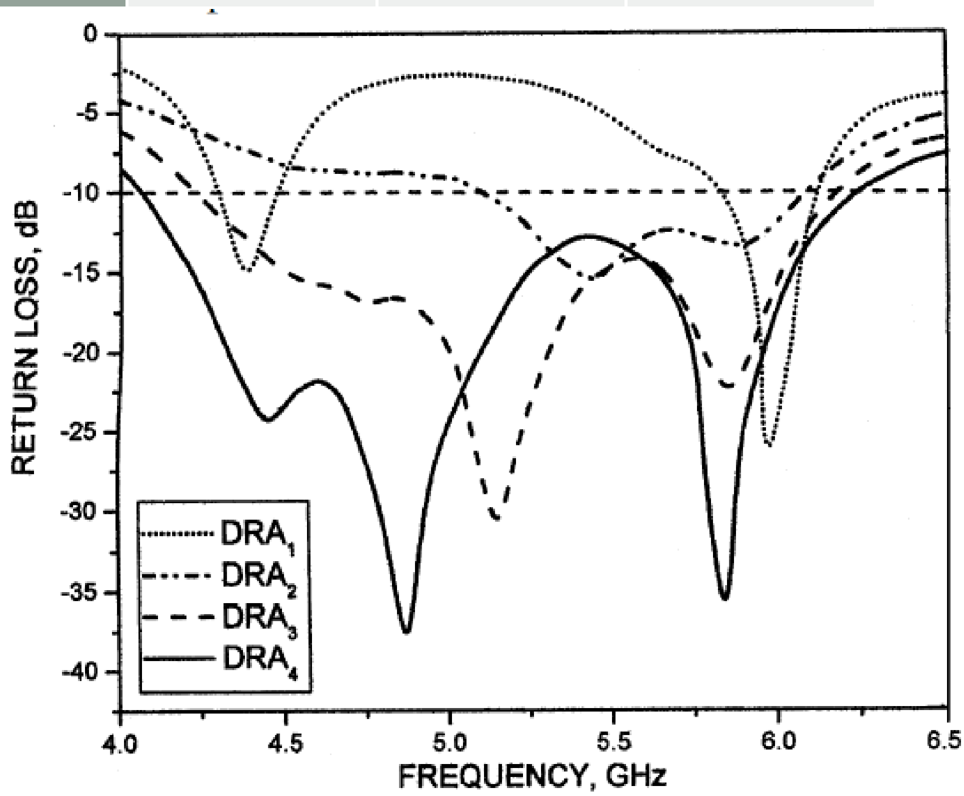
Fig.2 – Top view and side view ofDRA

Configuration:
Geometry of DRA is shown infigure above. Rectangular ring slot of widthW_S and other two lengths L_s1, L_s2 is madeon the substrate. DR of width W_{dr} and length $L_{dr}$is situated on theslot.
Microstrip feed line is situated belowthe substrate due to this radiating slotisisolated from any unwanted couplingfrom the feed. A rectangular DR of dimensions L_{dr}= 3.15 cm, W_{dr}= 2.44 cm, H_{dr}=0.3, 0.9, 1.5, 2 cm is taken with thematerial Roger of dielectric const.11.9.
Dielectric constant of substrate istaken lesser than DR, here is of4.2.
The operating bandwidth of DRA can be varied over wide range by suitable choice of dielectric constant of resonator material
Dimentions of DRA = $\lambda 0$ / $\varepsilon 1/2$, here $\lambda 0$ is free space wave length. A 50 ohm microstrip feed line of L_f = 3cm and W_f=0.157 cm with stub length is of approximate $\lambda 0$ /6 is used for impedance matching.
The bandwidth is calculated by formula:
$BW = [f_h - f_L] / f_c \times 100$ %
Where f_h, $f_L$are the higher and lower frequencies, respectively and fc is central frequency.as shown in figure band width can be increased with the height of DR and by taking suitable dielectric constant.

Results:
Experiment work is done by taking various dimensions of DR, microstrip line, Slot & by taking different values of dielectric constants for both substrate and DR. Different plots for different dimensions are shown in table-1 and figures below.

Table 1: Dimension of DR

	Length	Width	Heigth
DRA_1	3.12 cm	2.44 cm	0.3 cm
DRA_2	3.12 cm	2.44 cm	0.6 cm
DRA_3	3.12 cm	2.44 cm	0.9 cm
DRA_4	3.12 cm	2.44 cm	1.2 cm



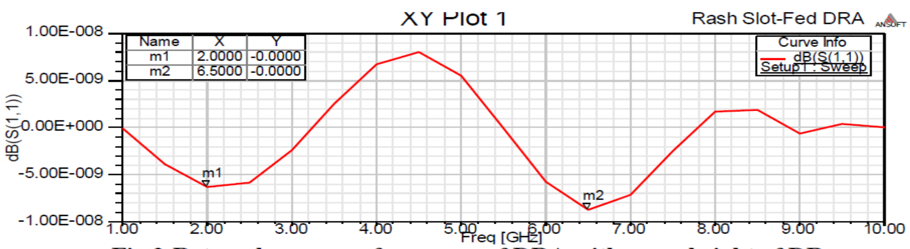


Fig.3-Return loss verses frequency of DRA with more height of DR

Conclusion:

This antenna is very simple to manufacture and we can get very easily large band width with this antenna by taking large difference between dielectric constants of substrate and DR & by taking different dimensions of whole arrangement.

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