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High K Dielectric Resonator Antenna for High Speed Applications

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Abstract

This paper presents a simulation study on cylindrical Dielectric Resonator Antenna (DRA) suitable for wireless communication applications the crucial component of a wireless network is antenna as it is used to radiate electromagnetic energy. The proposed antenna is fed with a 50Ω microstrip transmission line, the substrate is GaAs and DRA used is silicon dioxide, GaAs offers high speed applications and SiO_2 is widely available, economical and mostly used in IC applications. The return loss, gain and radiation pattern has been studied. In the proposed design we also select a list of microwave dielectric resonator materials with different dielectric constants and its antenna parameters has been keenly studied at about 5GHz on the GaAs substrate and the resulting gain versus dielectric constant has been analyzed. From the analyzis it follows that as the dielectric constant varies the gain shows variation for a particular solution frequency and the gain curve shows its maximum peak in the range of 30-70 (dielectric constant). The design and simulation has been done in Ansoft HFSS 13

Keywords: Dielectric resonator antenna (DRA), antenna parameters, microstrip transmission line, radiation pattern, return loss.

Introduction

In the resent past dielectric resonators have been used extensively in microwave circuits as oscillators and filters [1]. The use of dielectric resonator as a resonant antenna was proposed by S. A LONG in early nineteen eighties [2]. Dielectric resonator antennas offer advantages like small size, low cost and most importantly freedom from metallic loss [3]. Therefore dielectric resonator antenna have a lot of applications in millimeter band where the conductor loss of a metallic antenna becomes severe. As compared to the microstrip antenna, the DRA has a much wider

impedance bandwidth. This is because the microstrip antenna radiates only through two narrow radiation slots, whereas the DRA radiates through the whole DRA surface except the grounded part. Owing to their wide applicability in wireless communication techniques cylindrical DRA has attracted much more attension [4].

Antenna Configuration

The configuration of proposed cylindrical DRA is shown in Fig. 1. It comprises a DR of diameter D=11mm fabricated using Silicon dioxide material with relative permittivity 4. The DR is fed energy by a 50Ω microstrip line of width 1. 2mm and lenght 50mm by putting on the top of substrate. The substrate is GaAs with dielectric constant 12. 9. The return loss, gain and radiation pattern are obtained through simulation using Ansoft HFSS13

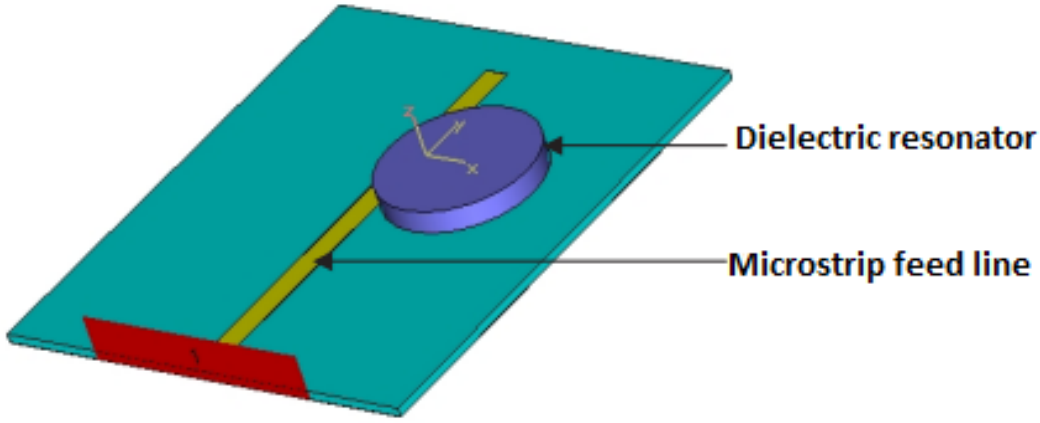
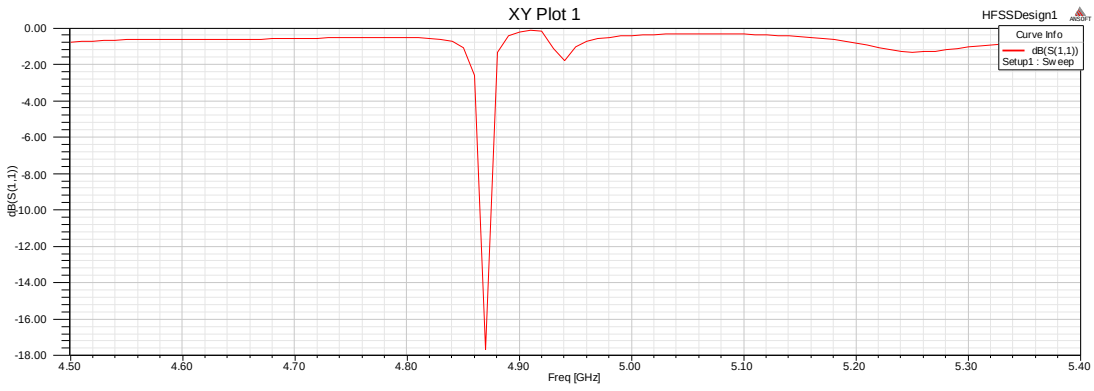


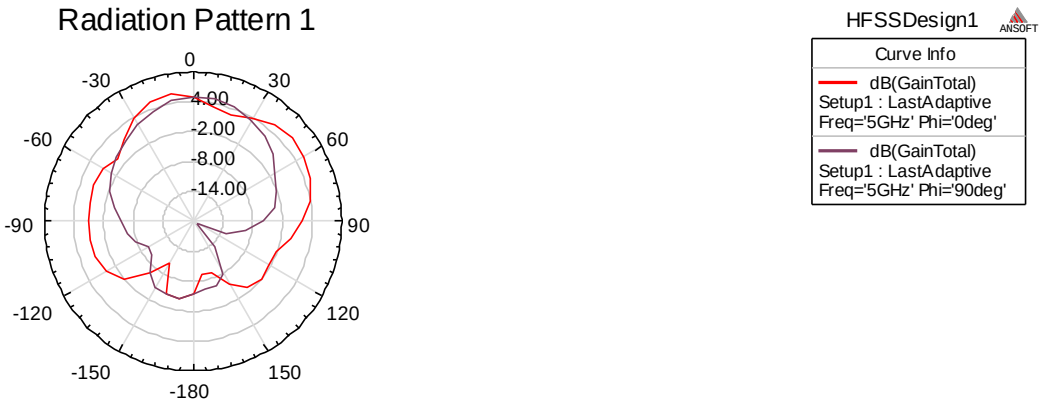
Fig 1.

Return loss.



3D Polar Plot.

Radiation Pattern.



Comparison Table

Srl. No	Resonator Material	Dielectric constant	Gain at 5GHz
1	CaO-4Co3O4-Nb2O5-TiO2	12	4. 940
2	Ca (La1/2Ta1/2) O3	23	5. 338
3	SrZrO3	30	6. 992
4	Ba5Nb4O15	39	7. 206
5	Sr2La4Ti5O18	48	6. 961
6	NdTiNbO6	52	6. 450
7	ZrTe3O8	67. 5	6. 237
8	Ca2Ba3Nb2TiO12	75	6. 201
9	BaPr2Ti5O14	84	5. 312
10	Pb0. 6Ca0. 4ZrO3	94	5. 305

Result and Conclusion:
From the above table it is clear that the graph of dielectric constant versus gain shows its maximum peak at dielectric constant of 30 and the range is maximum from dielctric constant 30-70 and then it decreases. The return loss and radiation pattern of dielectric resonator antenna using silicon dioxide material on the top of GaAs substrate has also been analyzed at 5 GHz.

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