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Design Of Microstrip Line-Fed Compact Low Profile Rectangular Dielectric Resonator Antenna For Wireless Applications

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Abstract

The purpose of this paper is to propose the design and investigations done on microstrip line feed rectangular DRA with copper plate covering. The work presents the compact small size DRA with bandwidth in range of 3GHz-4GHz and operational frequency of 3.5GHz and the techniques to control the bandwidth and voltage standing wave ratio in these types of DRA.

Keywords

Dielectric resonator antenna (DRA), microstrip line feed, wi-max antenna

Introduction

Increase in demand of high performance networks with increase in number of users of mobile communications has led the foundation for innovation and research of new types of antenna which is small in size and efficient enough to give the desired result.

DRA antenna has been of interest due to their low loss, high permittivity, light weight, ease of excitation and high bandwidth. Rectangular DRA has more advantage over the hemispherical and cylindrical structures because they are easier to fabricate and possess design flexibility.

A design of compact rectangular DRA is presented in this paper using HFSS for wireless application in 3.5 GHz band.

Antenna configuration:

Figure 1 and 2 shows the geometric configuration of antenna with hfss design.

DRA is designed on a substrate Roger RT /duroid 6010 TM with ε_r =10.2. The rectangular DRA is also designed using the same substrate with top covering of metallic plate(copper) and feed by a microstrip line of copper. The length of patch covering the lower face of DRA is 2/3rd of the length of DRA.

Substrate dimension= 30x40x1.27 mm
DRA dimension = 20x21x2 mm
Feed line dimension = 2x5 mm
Patch dimension =10x6 mm

Color index:

Brown: substrate
Yellow: DRA
Orange: feed line and patch

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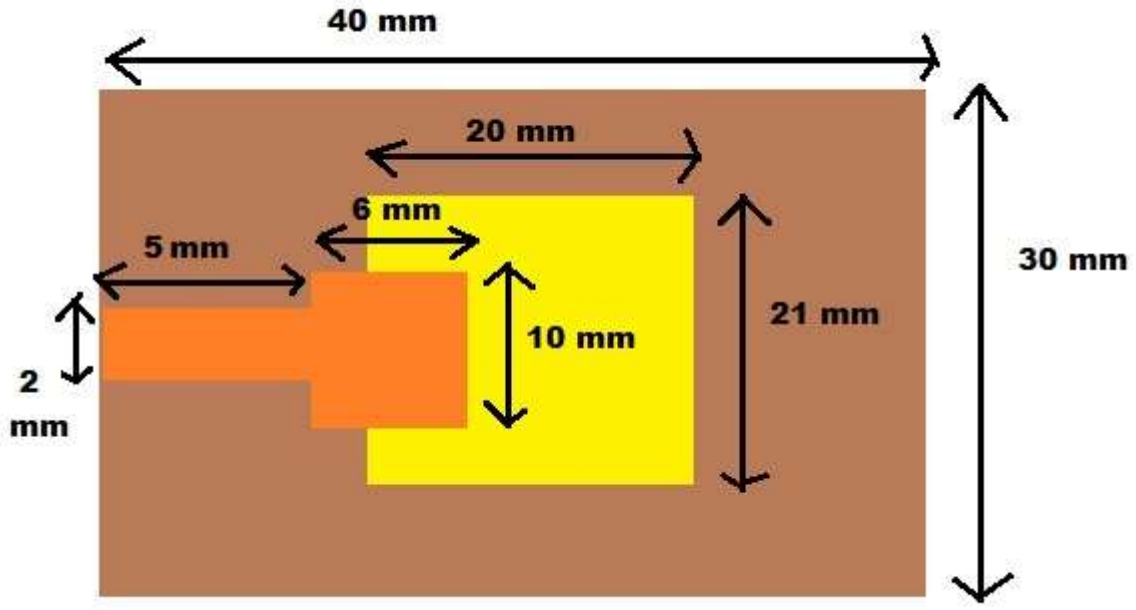


Figure 1: rectangular DRA structure

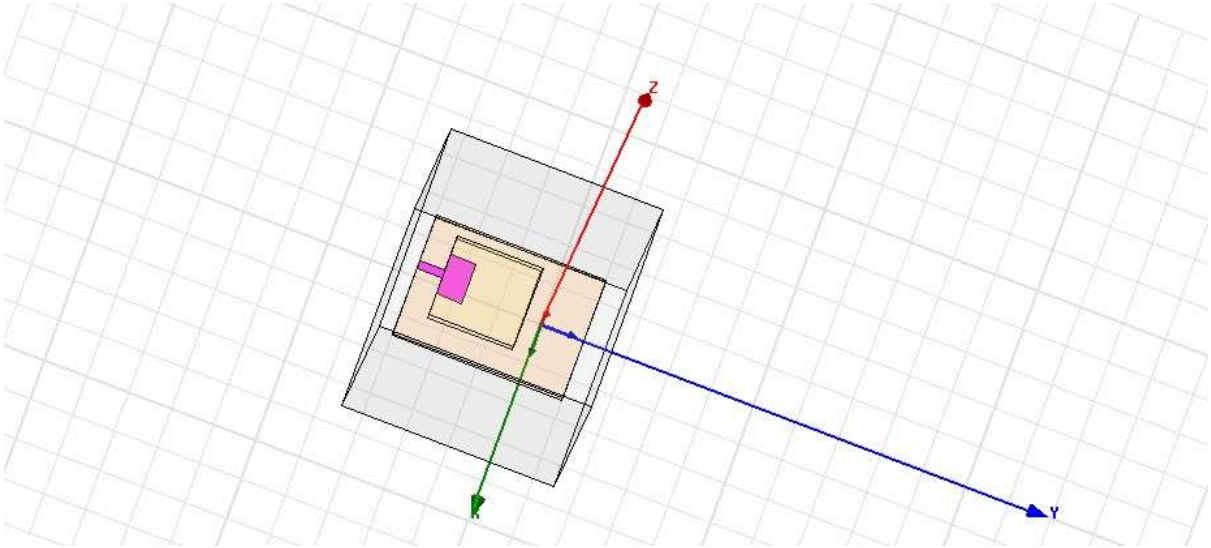


Figure 2: rectangular DRA hfss design

Investigation

As proposed structure given in [1] proves that metallic plate on top of rectangular structure enhances bandwidth and the same is realised by us and further investigation is carried on which proves that increase in width of DRA and decrease of feed length reduces

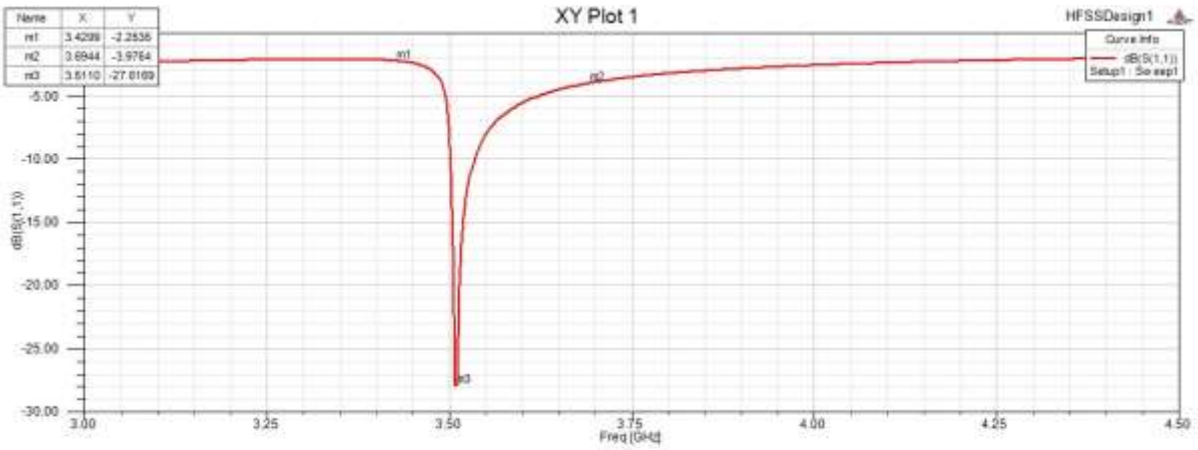
bandwidth and VSWR and significant increase in patch length increases bandwidth and increases VSWR.

The structure in [1] which proposes that feed length truncated at half length in DRA provides enhanced bandwidth is further investigated and found that the feed length at 2/3rd inside DRA provides the best VSWR.

Simulation results

Simulation done at centre frequency of 6ghz

1) S(1,1) vs frequency graph



at 6ghz

from the figure of simulation it is cleared that the resonant frequency is 3.5GHz which is desirable for wireless application and a operation band of 3.2Ghz to 3.9GHz.

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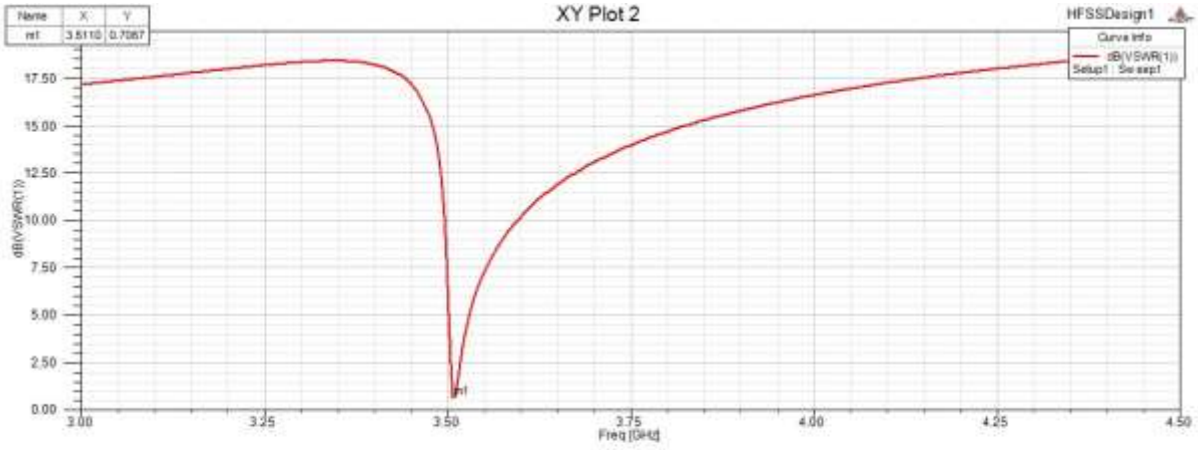
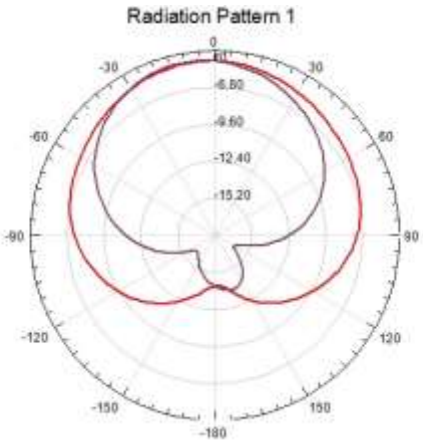
2) V.S.W.R vs frequency plot



at 6ghz

Voltage standing wave ratio (V.S.W.R) is found to be 0.706, in antenna a V.S.W.R less than 2 is desired.

3) Radiation patterns:



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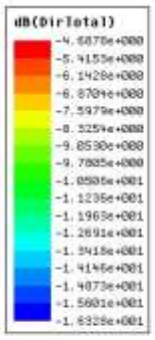

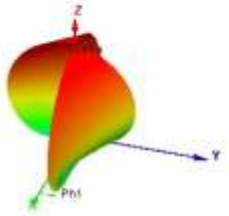

Conclusion

A compact dielectric microstrip line fed DRA has been designed and measured. The designed prototype is small in size and made on easily available substrate with 3.5ghz resonance frequency and covering the 3ghz band with a directivity of 4.6dbi and specially suitable for wi-max application. It fulfils the demands of new communication system requirements.

References

[1] M.saed and R.yadla "Microstrip fed low profile and compact dielectric resonator antenna", Progress in electromagnetics research, PIER 56, 151-162, 2006

[2] Achraf Jaoujal, Noura Aknin, and Ahmed El Moussaoui "Wide-Band Rectangular Dielectric Resonator Antenna for Wireless Applications", PIERS Proceedings, Marrakesh, MOROCCO, March 20-23, 2011

[3] Balanis, C. A., Antenna Theory: Analysis and Design, John Wiley & Sons, Inc., USA, 2005.

[4] H. Raggad, M. Latrach, A. Gharsallah and T. Razban "A Compact Dual Band Dielectric Resonator Antenna For Wireless Applications"

[5] Garg, R., P. Bhartia, I. Bahl, and A. Ittipiboon, Microstrip Antenna Design Handbo*ok*, Artech House, Norwood, MA, 2001

[6] Long, S. A., M. W. McAllister, and G. L. Conway, "Rectangular dielectric resonator antenna", Electronics Letters, Vol. 19, No. 6,218–219, March 1983.

[7] Luk, K. M. and K. W. Leung (eds.), Dielectric Resonator Antennas, Research Studies Press Ltd., Hertfordshire, England,UK, 2002.

[8] Kranenburg, R. A. and S. A. Long, "Microstrip transmission line excitation of dielectric resonator antennas," Electronics Letters, Vol. 24, No. 18, 1156–1157, Sept. 1988.

[9] M.G. Keller, M. Cuhaci, J. Shaker, A. Petosa, A. Ittipiboon, Y.M.M. Antar, "A Ka-Band Dielectric Resonator Antenna Reflectarray", European Microwave Conference EMC 2000, Paris, France, Oct. 2000, pp. 272-275.

[10] A. Ittipiboon, R.K. Mongia, Y.M.M. Antar, P. Bhartia, M. Cuhaci, "Aperture Fed Rectangular and Triangular Dielectric Resonators for Use as Magnetic Dipole Antennas," IEE Electronics Letters, Vol. 29, No. 3, 1993, pp. 2001-2002.

[11] A.A. Kishk, A. Ittipiboon, Y.M.M. Antar, M. Cuhaci, "Dielectric Resonator Antenna Fed by a Slot in the Ground Plane of a Microstrip Line," Proc. Eight Int. Conf. on Antennas and Propagation, *ICAP'93*, Apr. 1993, Part 1, pp. 540-543.

[12] K.W. Leung, K.Y.A. Lai, K.M. Luk, D. Lin, "Input Impedance of Aperture Coupled Hemispherical Dielectric Resonator Antenna," IEE Electronics Letters, Vol. 29, 1993, pp. 1165-1167.