

A Dual band Triangular shaped DRA Array for WLAN/WiMAX Applications

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Abstract— In this paper, a dual-band triangular dielectric resonator antenna (DRA) array is presented for wireless local area network (WLAN) and worldwide interoperability for microwave access (WiMAX) applications. Here, two triangular dielectric resonators are used as an array. The DRA array is excited by conformal strip connected to microstrip line which is an effective feed mechanism to obtain dual-band operation. Simulation process was done by using a CST microwave studio. The result shows that the proposed antenna achieves an impedance bandwidth from 3.55 to 3.70 GHz and 4.52 to 5.34 GHz covering 3.5 GHz WiMAX band and 5.2 GHz WLAN band. Parametric studies are carried out by varying the heights of the triangular shaped dielectric resonators and conformal strips. Simulated results show that DRA array has a better resonant frequency for DR height, $h_1 = 11.5$ mm and conformal strip height $h_2 = 10.4$ mm. The average peak gain achieved is 7.02 dBi and 8.9 dBi at 3.5 GHz and 5.2 GHz respectively and directivity varies from 6.06 dBi to 9.26 dBi for overall frequency range. The proposed design can also be used for HIPERLAN (high-performance radio LAN) applications which operate at 5.15 GHz to 5.30 GHz. With these features, this design of triangular DRA array is suitable for dual-band wireless communication systems.

Keywords— DRA array, Conformal patch feed, wireless local area network (WLAN), worldwide interoperability for Microwave access (WiMAX).

I. INTRODUCTION

In recent years, the dielectric resonator antenna (DRA) has been widely studied due to its several advantages such as high radiation efficiency, light weight, low profile, various DR shapes (rectangular, cylindrical, spherical etc.) and different feed mechanisms (probe, microstrip line, slot, coplanar line etc.) [1-4]. DRA's size and bandwidth can be easily controlled by varying the dielectric constant of materials in a wide range [1]. In many cases with a single element DRA, desired specifications cannot be achieved. For example high gain, high efficiency, directional radiation pattern cannot be synthesized with a single DRA of any shape. In these applications, a DRA array with appropriate element arrangement and feed configurations can be used to provide desired specifications [5-7].

Dielectric Resonator Antenna is widely used in today's electronic warfare, missile, radar and communication

systems. They find use both in military and commercial applications. The dual-wide band technology has become one of the most fascinating technologies in in-door communication due to its great advantages including large capacity of data, high speed data rate and small size. However, WLAN (5.15 to 5.825 GHz) and WiMAX (3.3 to 3.7GHz), which are limited by IEEE 802.11a, HIPERLAN/2 and IEEE 802.16, overlap each other [8, 9].

In this paper, we proposed a triangular dielectric resonator antenna array fed by microstrip line for WLAN and WiMAX applications. The CST microwave studio software has been used to analyze the performance of the designed antenna array such as S parameter, input impedance, radiation patterns, gain and directivity. The obtained results show significant performance improvement in terms of impedance bandwidth and radiation pattern.

II. ANTENNA DESIGN

Fig 1 (a) shows the geometry of the proposed DRA array, where triangular-shaped dielectric resonators having dielectric constant 9.2, are placed above a substrate with a dielectric constant 4.4. Below the substrate is a ground plane. The dimension of the ground plane is 58×56 mm². The same dimension is used for substrate also. The DRA array consists of two equilateral triangles where the resonators having height $h_1 = 11.5$ mm and sides $L_1 = 20$ mm. The excitation mechanism adopts as conformal strips, attached on one side of the dielectric resonator and connected to a microstrip feed line [10, 11]. The conformal strip has height $h_2 = 10.4$ mm and width $W_1 = 3$ mm. The microstrip feed line is etched on FR4 substrate with width $W_2 = 3$ mm, $W_0 = 28$ mm, length $L_2 = L_0 = 14$ mm and is connected to a SMA connector. Fig 1(b) shows the schematic view of the triangular DRA array.

The dual-band design of the proposed triangular DRA array adopts different methods [12-15]. The coupling between the DR and the feed mechanism can be easily adjusted by changing the size of the conformal patch, thus a dual-band impedance matching has been obtained. The desired frequencies for WLAN/WiMAX are obtained by changing the heights of dielectric resonators.

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