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# Miniaturized Dual-band V-Shaped Monopole Antenna fed by V-Stub

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## Abstract

A miniaturized dual-band v-shaped monopole antenna fed by v-stub is presented. The proposed antenna performs two resonant modes covering dual-band of wireless standards, for operating in the IEEE 802.11 a,g,n WLAN (5.15-5.35 GHz and 5.725-5.825 GHz) and IEEE 802.16e WiMAX (3.3-3.69 GHz and 5.25-5.85 GHz) bands. The antenna is printed on a 1.6-mm thick FR-4 substrate and the relative permittivity of 4.4, is fed by cross v-strip line a  $50\Omega$  with SMA connector. The antenna size is  $18\text{ mm} \times 26\text{ mm} \times 1.6\text{ mm}$  in dimensions. The measured results show that the miniaturized size antenna achieves a broad operating bandwidth of 3.24–3.71 GHz and 4.85-5.87 GHz for  $|S_{11}| < -10\text{ dB}$  and omnidirectional beam. The measured gains of the antenna at 3.5 GHz and 5.5 GHz frequencies are 1.51 dBi and 2.34 dBi, respectively.

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*Keywords:* Dual-band antenna; Miniaturized antenna, Omnidirectional beam, WiMAX, WLAN

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## 1. Introduction

Recently, in order to satisfy the development requirements of small size, multiband, and omnidirectional pattern antenna for multisystem, especially for the Wireless Local Area Network (WLAN: 2.4–2.48 GHz, 5.15–5.35 GHz, and 5.72–5.85 GHz) and the Worldwide Interoperability for Microwave Access (WiMAX: 2.5–2.69 GHz,

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3.4–3.69 GHz, and 5.25–5.85 GHz) frequency bands into a single wireless device. The development of dual-band and multiband antennas with simple structure, miniaturized size, low profile, light weight and low cost. A great quantities of monopole printed antennas for dual-band or multi-bands operations have been reported in the literature [1–4]. However, they usually have complicated structures or the antenna larger space in dimensions horizontal and vertical directions. For the perspective operation, present a miniaturized dual-band v-shaped monopole antenna fed by v-stub for providing multiband operation covering all the operating bands of WLAN/WiMAX systems. The performance features of the proposed antenna are property in term of impedance bandwidth, gain and radiation patterns.

Details about the contents described by the divided as following: Part 1, presents the introduction of dual-band and multi-band antenna while Part 2, show the geometry of the proposed antenna. Simulation and measurement results are presented in Part 3. Finally, Part 4 concludes the paper.

## 2. Antenna Design

The antenna design of the proposed miniaturized dual-band v-shaped monopole antenna fed by v-stub is depicted in Fig. 1.

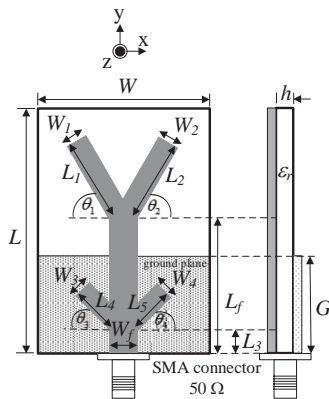


Fig 1. Geometry of the proposed antenna.

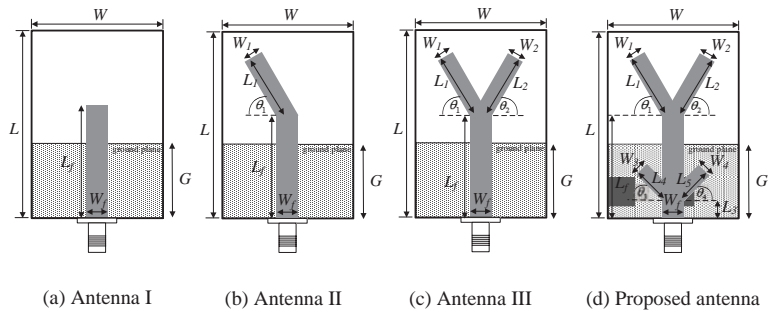


Fig 2. Investigated designs of the proposed antenna.

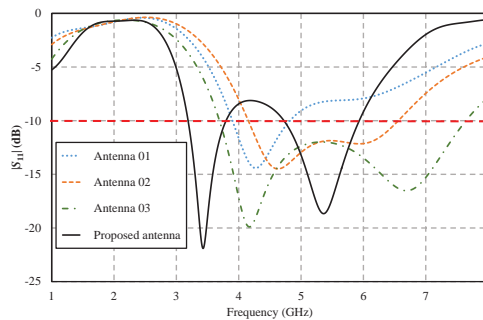


Fig 3. Compared  $|S_{11}|$  of the designs antenna.

The proposed antenna is fabricated on a low-cost FR-4 substrate with relative permittivity ( $\epsilon_r$ ) of 4.4 and thickness ( $h$ ) of 1.6 mm. The total size of the antenna are 18 mm  $\times$  26 mm  $\times$  1.6 mm. This antenna compose of V-shaped monopole of length ( $L_1 = L_2$ ) 10 mm and width ( $W_1 = W_2$ ) 1.5 mm with the angle ( $\theta_1 = \theta_2$ ) of 50 degree. A 50 $\Omega$  microstrip line of width ( $W_f$ ) 3 mm and length ( $L_f$ ) 16 mm is used for feeding the antenna and additional V-stub of length ( $L_4 = L_5$ ) 5 mm and width ( $W_3 = W_4$ ) of 1.5 mm with the angle ( $\theta_3 = \theta_4$ ) of 30 degree with gap the length ( $L_6$ ) of 1.5 mm. The ground plane with the length ( $G$ ) of 13.5 mm are placed on the opposite side of the V-shaped monopole.

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