## Effect of Copper and Graphene Material on Bow-tie Structured Antenna for 1.2 GHz Application

R. Prasanna<sup>\*</sup> and N. M. Masoodhu Banu<sup>\*\*</sup>

Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai, India \*ORCID: <u>0000-0002-0919-1216</u>, e-mail: <u>prasannaram88@gmail.com</u> \*\*e-mail: <u>drmasoodhubanu@veltech.edu.in</u>

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Abstract—In this paper the effect of copper and graphene conductive ink material on antenna performance is compared. The patch structures are simulated using HFSS software. The designed antenna is resonating around 1.2 GHz giving reflection coefficient below –10 dB. The simulated and fabricated modified bow-tie antenna design have impedance bandwidth of 15 (simulated), 12 (copper), and 13.5 MHz (graphene), respectively, which are suitable for LTE (QUALCOMM), WiMAX, Wi-Fi applications. This modified design consists of various types of slots introduced at various places of bow-tie arm in order to get desired bandwidth and for the improvement in antenna performance parameters. This proposed antenna will work in UHF (Ultra High Frequency) band at 1.2 GHz. Compare to conventional bow-tie antenna this modified design will give better antenna performance parameters. In this work we have compared various performance parameters like return loss, VSWR and bandwidth for each design. These parameters have been validated for proposed model for resonating frequency.

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## INTRODUCTION

Bow-tie antenna is a 2D version of biconical antenna used for UHF (Ultra High Frequency) band applications. Bow-tie antenna is also called as butterfly antenna [1].

Microstrip bow-tie antenna are widely used in recent years for research and engineering applications due to their light weight, thin profile, low cost, good performance, ease of fabrication, compact nature and simple geometry. Bow-tie antenna is a combination of two triangular patches with microstrip feeding fabricated on a suitable substrate [2]. It's better performances makes it suitable for various applications where low weight, less size, low cost, good performance, ease of installation, aerodynamic profiles are considered. These features are useful in satellite communication, television, radiosonde, navigational aids, radar, UWB, Wi-Fi, WLAN, WiMAX, wireless security cameras, wireless video links and transmitters and other communication systems [3].

These microstrip patch antennas are compatible with modular devices (solid state devices such as oscillators, amplifiers, switches, mixers and other electronic devices can be added directly to substrate board) and resonating for various standard frequencies [4].

By introducing slots at various parts of bow-tie antenna, the resonating frequency is tuned according to the application and also various performance factors like return loss, VSWR and bandwidth are improved when compared to conventional bow-tie antenna with no slots.

In this paper a bow-tie antenna with various slots is introduced in order to improve the performance of antenna in terms of return loss and VSWR improvements [5, 6]. This modified design consists of two correlated zigzag vertical and horizontal rectangular slots introduced in half portion of bow-tie arm. This proposed antenna is resonating around 1.2 GHz where  $S_{11} \le -10$  dB and VSWR < 2.

The design was fabricated using copper based patch which resonates at 1.2 GHz. The same design is fabricated using graphene based patch in order to improve the performance parameters and bandwidth. Parameters are improved using by material other than copper or metamaterial [7–9]. Bow-tie slot geometry leads to uniformity in the return loss, achieving a peak response curve and increased bandwidth.

Bandwidth and impedance matching will be effective by introducing the slots successively [10]. Return loss will be based on the length of the feed line [11-13], resonant frequency will be achieved by introducing

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