XXV Congresso de Iniciação Científica da Unicamp
October 18 to 20 Campinas | Brazil
2017

Dual Band Vivaldi Antenna Design and Electromagnetic Simulation for Drone Spoofing

Lucas A. S. Astini*, Leandro T. Manera, Mauricio M. Donatti

Abstract
A dual band vivaldi antenna was designed to operate at the frequencies of 2.4GHz and 5.8GHz, which are common frequencies used by drones' radiocontrollers. The project idea is to use this simulated antenna as an upgrade for a previously created spoofing module [1], that consists in a system responsible for identifying a drone's radiocontroller signal in range (as well as checking its model) and then emitting its own signal capable of taking control of the drone.

Key words:
Vivaldi, Antenna, Electromagnetic Simulation.

Introduction

Drones are becoming popular nowadays and, although they may serve for worthy purposes, it is important to create a way of countering users willing to take advantage of this technology to break the law.
In order to deal with drone related problems, a system capable of highjacking drones by simulating its radiocontroller's signal was created [1]. To increase the range of drone models as well as improving its spoofing capabilities, a dual band Vivaldi antenna was designed.

Results and Discussion

This Vivaldi antenna (Image 1) was simulated using the CST (Computer Simulation Technology) software. It was shaped on a small rectangular space that ends on exponential curves and is excited by a feeding line on the back of the board.

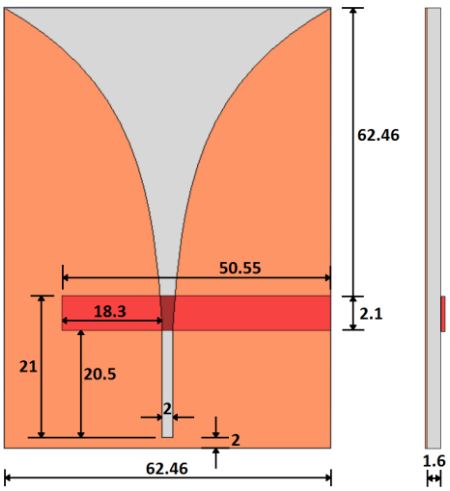

Image 1. Parameters of the antenna in mm, front view (left) and side view(right).

In order to operate at the frequencies of 2.4GHz and 5.8GHz (Image 2), which are standard operating frequencies of drones, the distance between the end of the exponential curves is half the length of the wave of 2.4GHz (62.46 mm). This particular antenna also presented good bandwidth, having a good margin of frequencies below -10 dB (return loss).

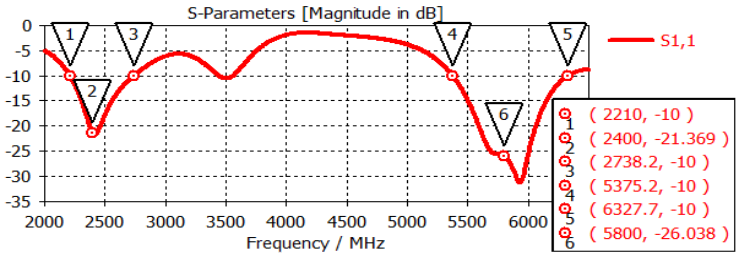

Image 2. Scattering parameter of the antenna.

A Vivaldi antenna is considered a directive antenna (Image 3), presenting high gains on its main direction. The antenna simulated on this project achieved up to 7.45 dB (at 5.8GHz).

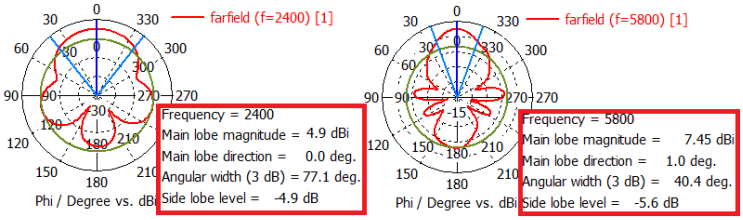

Image 3. Irradiation patterns for 2.4GHz and 5.8GHz, respectively.

Conclusions

The Vivaldi antenna achieved high gains at the frequencies proposed (4.9 dB at 2.4GHz and 7.45 dB at 5.8GHz), which is a characteristic of antennas with directional radiation pattern. It also presented bandwidth (frequencies which this antenna is able to operate with good performance (below -10 dB)) of 21.34% at 2.4GHz and 16.27% at 5.8GHz, fitting perfectly its purpose, making it able to communicate with most of the commercial drones. In a future project, the proposal is to create an antenna array [2] starting from this design, in order to have even greater gains.

---

[1] Donatti, M.; Frazatto, F; Manera, L.; Teramoto, T.; Neger, E. "Radio frequency spoofing system to take over law-breaking drones", 2016 IEEE MTT-S Latin America Microwave Conference (LAMC), 2016
[2] Fontgalland, G; Ferreira, P. I. L. "Combining Antenna Array Elements by Using ICA Method for Remote Sensing of Sources", EEE Antennas and Wireless Propagation Letters, 2017