Modeling of Ultra Wideband Antennas for Wireless Indoor Applications

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Abstract

Since the approval of the Federal Communications Commission (FCC) for the use of the unlicensed Ultra Wideband (UWB) spectrum (3.1–10.6 GHz) in 2002, UWB wireless systems have achieved unprecedented high data rates surpassing those of legacy short range wireless systems such as Bluetooth and Wi-Fi. There are many challenges associated in UWB antenna design. Antennas targeted for UWB applications must provide satisfactory radiation properties over UWB spectrum and simultaneously achieve good time domain performance. UWB antennas are also required to be compact and easy to fabricate in order to be suitable for consumer products.

In this thesis, several antennas were modeled and simulated to understand their suitability for UWB applications. Two state of the art simulation packages namely CST Microwave Studio based on Finite Difference Time Domain (FDTD) and HFSS based on Finite Element Method (FEM) were deployed to model various antennas. Extensive studies were carried out on a particular family of UWB antennas which is the family of Printed Planar Monopole Antennas from which two antennas were successfully modeled and analyzed.

The first antenna is the Coplanar Waveguide (CPW) Fed Disc Monopole antenna. The design of this antenna was based on tuning its physical parameters to optimize its performance. One prototype was fabricated and there were great agreements between simulated and measured results. The fabricated antenna is compact in size (47×47 mm) and implement on a relatively cheap FR4 substrate. The antenna achieved UWB impedance matching with satisfactory radiation properties and time domain performance. The second antenna was designed based on the Genetic Algorithm by means of MATLAB and CST Microwave Studio.

The designed antenna was miniaturized to (47×47 mm) and simulated on FR4 substrate. The simulated results reveal impedance matching across the whole UWB spectrum with acceptable time domain performance.