Chapter 11
Antenna System and Architecture–Circular Polarized UWB Antenna for Indoor Positioning Application

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ABSTRACT

Indoor environment can be characterized as sever attenuating and depolarizing medium for electromagnetic (radio) waves propagation. These signals are radiated from transmitters to space (free-space propagation channel) and received from space to receivers through antennas. These signals are commonly radiated or received with pre-defined signal’s polarization schemes and these schemes are always controlled by the antenna. In this chapter, the two-dimensional antenna designs and its polarization schemes are presented for minimizing the sever effects of an indoor environment. Emphasis is on understanding the special attention required for designing an antenna dedicated to an Indoor Positioning/Localization System. Some recent developments in antenna designs are presented as an example for the better understanding and its future perspective.

DOI: 10.4018/978-1-4666-8645-8.ch011
INTRODUCTION

Indoor localization based applications are poised to grow in coming years as predicted by some leading market research company and consulting firms. For example, MarketsandMarkets (2014), a full-time market research firm, has predicted a robust growth in Indoor Location marketing by publishing that the intended market is expected to grow globally from $0.6 billion in 2014 to $4 billion by 2019. Similar growth prediction has also been reported by another market research firm, PR Newswire (2014), expects that the global indoor location market will reach $2.6 billion in 2018, up from $0.4 billion in 2013. There are a number of different factors driving market growth and some new systems are designed for indoor navigation services. The spurt in localization service is directly reflects the demand and deployment of such system. Such demands will only lead to more advanced and smart antenna designs. The compact and low cost circular polarization will have great demands for indoor localization system. Two-dimensional planar Circular Polarized (CP) antenna designs presented in this chapter have high perspective compared to traditional circular polarized as well as linear polarized (LP) antenna designs. Simple design and low cost, both are achieved with the discussed two-dimensional antenna designs; these are main factors which have not let the use of traditional antennas in common wireless systems.

Indoor environment can be characterized as a sever attenuating and depolarizing medium for electromagnetic (radio) waves propagation. These signals are radiated from transmitters to space (free-space propagation channel) and are received from space by receiver antennas. These radio waves are commonly radiated or received with a pre-defined signal’s polarization scheme. These schemes are always controlled by the antenna polarization characteristics. Therefore, the prospects of signal polarization and diversity are discussed and presented in details.

This chapter gives an insight view of the special attention required for designing an antenna dedicated to Indoor Localization/Navigation/Positioning System because of the harsh indoor conditions (multipath, back-scattering, strong attenuation, etc). These conditions act as an attenuating as well as a depolarizing medium, simultaneously. Antenna designs and their polarization schemes are presented for minimizing the sever effects of an indoor environment. Emphasis is on understanding the special attention required for designing an antenna dedicated to an Indoor Positioning/Localization applications based on Ultra Wideband (UWB) technology. The scheme for dual signal polarizations is mainly presented towards this goal. The most important issue is how an electromagnetic wave interacts with the receiver antenna. The polarized signal is produced by the antenna and hence the physical design of an antenna plays an important role towards it. Usually, a two-dimensional patch antenna is preferred solution for indoor navigation applications because of its
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