Chapter 3
High-Gain Broadband Antennas for 60-GHz Short-Range Wireless Communications

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ABSTRACT

This chapter introduces design and implementation of high-gain broadband antennas for 60-GHz short-range communications. It presents different antenna configurations and architectures that can be good candidates for the 60-GHz industrial, scientific and medical (ISM) band. Printed dipole array (PDA) antennas and especially the Printed log-periodic dipole array (PLPDA) antennas will be discussed in this chapter. Loading these kind of antennas with low-cost spherical or hemispherical dielectric lenses will also be presented and demonstrated to increase the gain of the antenna. Another type of antennas called electromagnetically coupled (EMC) elliptical patch antenna arrays will be investigated. Antipodal Vivaldi antenna and corrugated antipodal Vivaldi antenna are also introduced as good candidates for 60-GHz short-range communication applications.
INTRODUCTION

Recently, the worldwide opening of a massive amount of unlicensed spectra around 60 GHz has triggered great interest in developing affordable 60-GHz radios for a number of applications such as high-quality high-definition (HD) video streaming, distributed mobile and grid computing, real-time gaming, Internet access, and fast large file transfer. This is because there is a great opportunity for ultra-high speed short-range wireless communications by using the unlicensed band 57-66 GHz millimeter-wave (mmWave) industrial, scientific and medical (ISM) band by Fisher (2007). Recently, a 60 GHz frequency region has been selected for short-distance radars and indoor communications. This is because of the high levels of atmospheric attenuation, 60 GHz signals can be easily confined to Pico-cell zones. However, researchers suggested outdoor, underground, and large hall types of environmental applications.

Significant progress has been made in regulations, standards, and solutions as shown in Figure 1. In the year 2000, Japan first issued 60-GHz regulations for unlicensed utilization in the 59–66 GHz band with maximum transmit power limited to 10 mW for maximum transmission bandwidth of 2.5 GHz. In 2004, United States and Canada utilized the frequency band 57–64 GHz (bandwidth of 7 GHz) for unlicensed use with maximum transmit power of 500 mW for an emission bandwidth greater than 100 MHz. Australia has allocated only 3.5 GHz bandwidth from

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**Figure 1. Spectra available for unlicensed 60-GHz band.**
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