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A Broadband circularly polarized antenna of square-ring patch for UHF RFID reader applications

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Abstract

A circularly polarized, broad bandwidth, square-ring patch antenna for radio-frequency identification (RFID) is proposed. The antenna has a dimension of $100 \times 100 \times 22.9 \text{ mm}^3$. By using a Wilkinson power divider and a patch-antenna structure, a measured 3-dB axial-ratio bandwidth of approximately 140 MHz (16.47%), an impedance bandwidth of 136 MHz (15.81%), and a measured peak gain of approximately 6.8 dBic are being achieved. The operating band of the proposed antenna is suitable for China (840–846 MHz), Europe (865–868 MHz) and the United States (902–928 MHz) ultra-high frequency (UHF) RFID applications.

Keywords: RFID, axial ratio, Wilkinson power divider, UHF

1. Introduction

Radio-frequency identification (RFID)—the automatic identification of objects by using RF signals—is a rapidly developing technology. An RFID system typically contains four components: a tag, a reader or interrogator, an antenna, and a host computer. The antenna, a crucial component, facilitates signal transmission from the tag to the reader [1]. Several frequency bands, for example, 125 KHz, 13.56 MHz, 869 MHz, 902–928 MHz, 2.450 (2.400–2.483) GHz, and 5.800 (5.725–5.875) GHz, have been used for RFID signal transmission. The design of RFID antennas becomes increasingly complicated as the operating frequency enters the microwave region. RFID antennas with varying structures, such as meander line, aperture-coupled patch, and single-patch structures, have recently been proposed [2-3]. Examples of RFID-reader antennas include the patch antenna fed by a Wilkinson power divider [4] and the annular-ring slot antenna with a slot-line feed [5]. However, these antennas are too large, and some single-feed single-element patch antennas usually have a narrow circular-polarized (CP) bandwidth [6-9].

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