Wireless networks of energy efficient dynamically controlled LED sources

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Abstract

The paper presents the results of development and practical implementation of wireless networks of controlled spectrally tunable light emitting diode (LED) light sources using RF transceivers operating in the unlicensed frequency bands of 868 and 2400 MHz. Such sources allow synthesizing either a white light with various color temperatures or a colored light with different tints; they are of significant interest in connection with general lighting and with some special applications. The problems of practical realization of light sources and their optimization with respect to luminous efficiency, dynamic range and the distance of wireless control have been investigated.

Key words:
LED; dynamic control; ISM and ZigBee technologies; PCB antenna

Introduction

Light emitting diodes (LEDs) due to their technical and economic advantages (low power consumption, a long service life and low service costs, a small size, the absence of hazardous IR and UV radiation, ease of disposal) are the leading contenders for future light sources. Currently, when the world-leading manufacturers such as Nichia, Cree, Philips, Lumileds and Osram have all achieved a very high level of luminous efficiency of 150 – 200 lm/W in their mass-produced LEDs, the quality of generated light becomes increasingly important [1, 2]. Lighting systems have to be capable of generating light with a wide range of color temperatures (2700 – 6500 K) and with a high color-rendering index. To satisfy the modern requirements to high-quality lighting, the average color-rendering index R_a must be more than 95, and special color-rendering indexes R_8 – R_{14} must be no less than 85 [3, 4].

Another important property of lighting is its controllability, i.e., the possibility to change its spectral and color parameters. The ability to control the