

Project: IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs)

Submission Title: Partial PHY proposal in support of Coordinated-Interference Management for IEEE802.15.7r1

Date Submitted: January 10, 2016

Source: Mohamed Kashef¹, Mohamed Abdallah¹, Murat Usyal², Khalid Qaraqe¹

Address: 1) Texas A&M University at Qatar, Doha, Qatar, 2) Ozyegin University, Istanbul, Turkey

Contact info: Mohamed Abdallah, email: mohamed.abdallah@qatar.tamu.edu

Abstract: This contribution presents a partial PHY proposal with interference coordination support for IEEE 802.15.7r1

Purpose: This is a partial PHY proposal to enable interference coordination modes.

Notice: This document has been prepared to assist the IEEE P802.15. It is offered as a basis for discussion and is not binding on the contributing individual(s) or organization(s). The material in this document is subject to change in form and content after further study. The contributor(s) reserve(s) the right to add, amend or withdraw material contained herein.

Release: The contributor acknowledges and accepts that this contribution becomes the property of IEEE and may be made publicly available by P802.15.

Contents

- Introduction
- Coordinated-Interference Management
- Numerical Results
- Summary

Introduction (1/2)

Problem statement for VLC channel

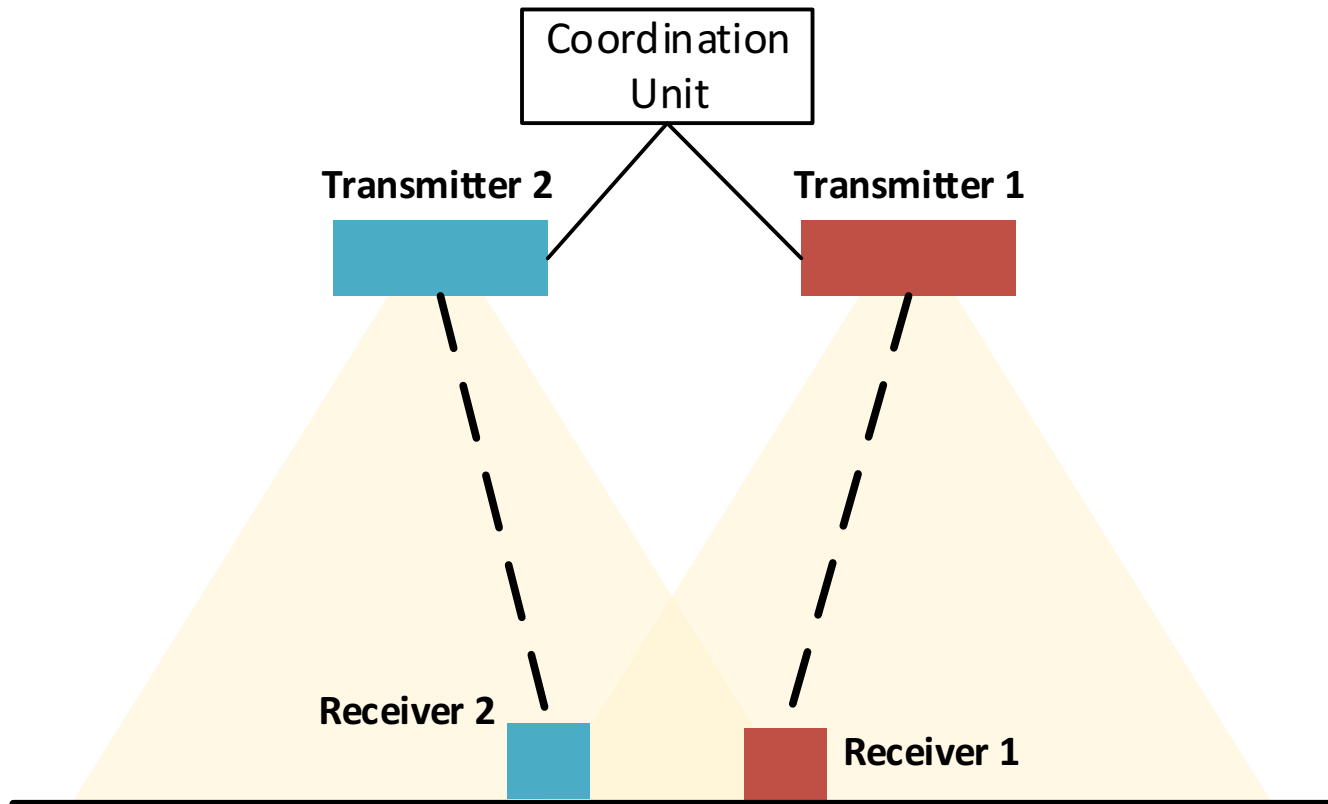
- Overlapped access points coverage regions
 - A required illumination pattern
 - Existence of multiple access points
- Limited optical transmission power
 - Depending on illumination level
 - Depending on safety regulations

Introduction (2/2)

In order to address the problems, we support an interference coordination mechanism in VLC that includes

- Centralized coordination operation
 - Orthogonal Transmissions
 - Power-controlled Transmissions

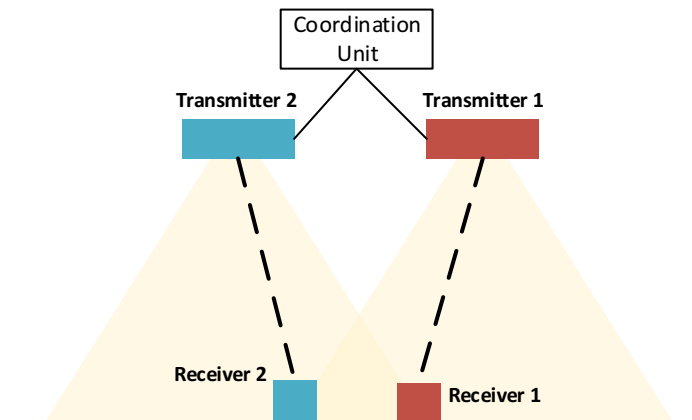
Coordinated-Interference Management (1/2)



Coordinated-Interference Management

(2/2)

- The coordination unit uses the location information of nodes to determine the mode of operation and the used electrical powers of the transmitters
- Two Modes of Operation
 - Orthogonal Transmissions: In this mode, resources are allocated to a transmitter. Examples include time division multiple access (TDMA) and frequency division multiple access (FDMA).
 - Power-Controlled Transmissions: In this modes, resources are shared between transmitters. The electrical power is controlled of each transmitter under a fixed average optical power requirement.



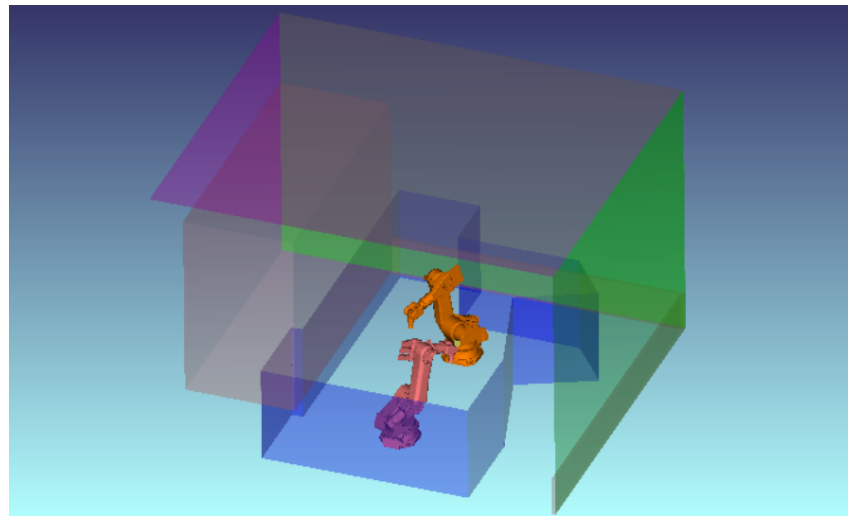
Numerical Results

- DCO-OFDM
- Pulse shaping filter: Root raised cosine
- Number of subcarrier: 64
- Cyclic prefix length: 3
- Noise power spectral density (N_0): 10^{-21} W/Hz

Example: Manufacturing Cell

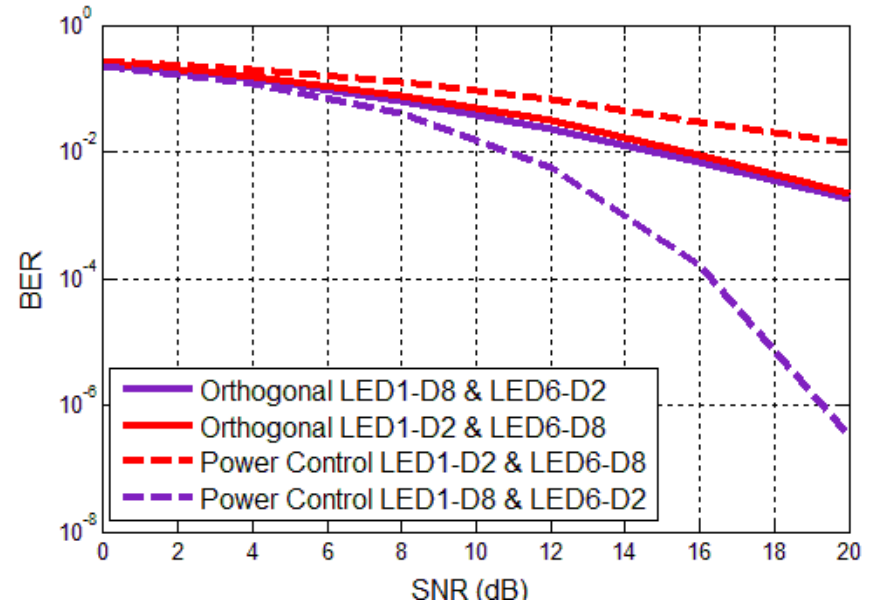
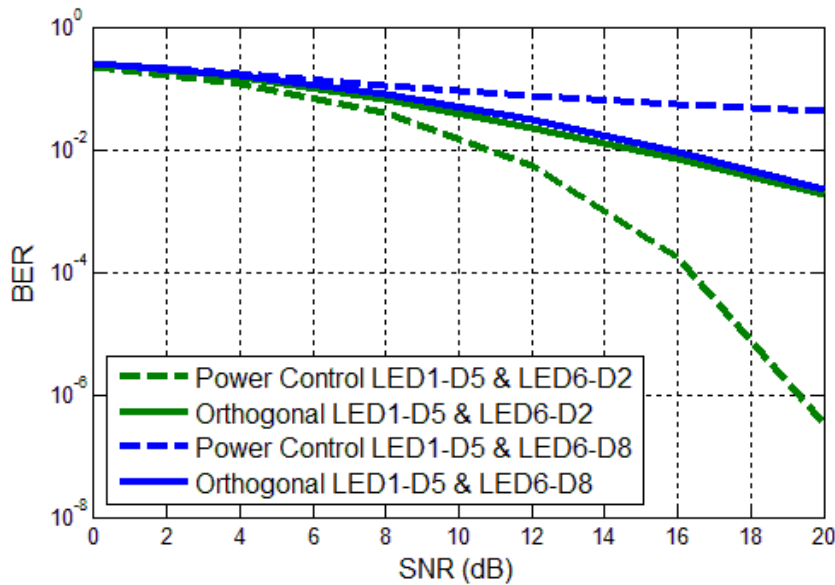
Various destinations have different channel responses for the available LED transmitters.

Scenario 4 from IEEE P802.15-15-0746-01-007a.



manufacturing cell with two robots in a factory environment

The bit error rate (BER) performance of various pairs of LEDs and destinations. In orthogonal transmissions BPSK transmission is used. For power-controlled transmissions, 4-QAM is used. The shown performance is the min-max BER performance of the system.



Based on the transmitter and the associated destination, the transmission mode of either orthogonal or power-controlled transmissions can improve the BER performance significantly.

Summary

- Proposed interference coordination support techniques for IEEE 802.15.7.r1
- Two coordination modes: orthogonal and power-controlled transmissions.
- Examples at the manufacturing cell model have shown gains of at least 3 dB can be obtained by applying interference coordination.

Acknowledgement

This work was made possible by the NPRP award [NPRP 5 - 980-2-411] from the Qatar National Research Fund (a member of The Qatar Foundation). The statements made herein are solely the responsibility of the author[s].