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

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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.

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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

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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.


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.
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