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

Submission Title: Text for Adaptive MIMO High Rate PD Com. Proposal

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Abstract: This contribution presents an Input for IEEE 802.15.7r1 Draft D0 on MIMO High-rate PD Communication

Purpose: Text for MIMO High-rate PD communication in IEEE802.15.7r1 Draft D0 .

6.4 MIMO Communication

The use of adaptive multiple input multiple output (MIMO) communication for High rate PD is optional. **Figure 1** illustrates the general overview of the MIMO communication.

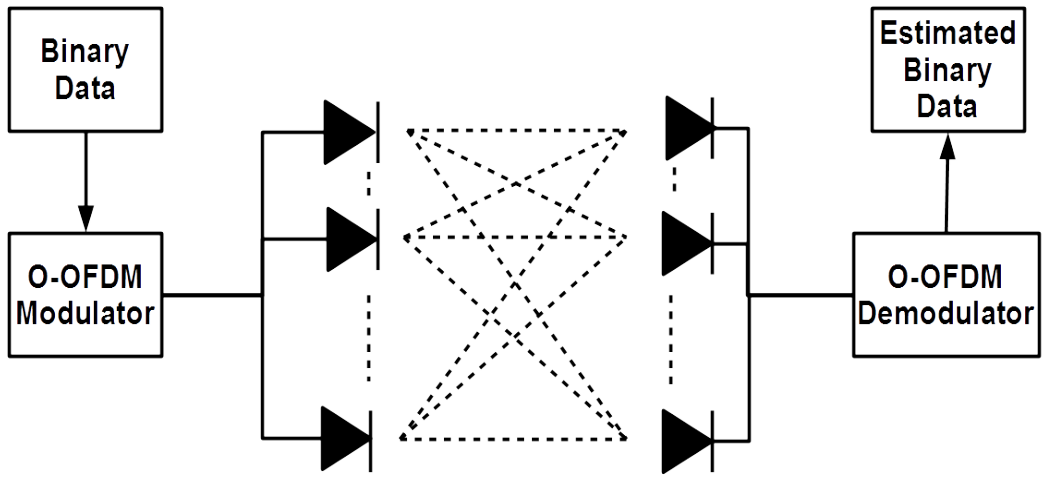


Figure 1 General Overview of High-Rate PD MIMO Communication

The information is transmitted from multiple LEDs to multiple PDs through optical wireless channels. The maximum number of LED arrays and PD arrays, which can be supported by the High rate PD is set to 16.

6.4.1 MIMO Communication Setup

To setup the MIMO communication, it is assumed that the association is realized in SISO mode. Afterwards VLC receiver sends MIMO info request the start the setup. Transmitter provides the number of Transmit elements and its MIMO capabilities. The receiver sends channel info request to start the channel estimation process. The transmitter sends in SISO mode information elements, which include the channel estimation sequence. The channel state information (i.e., channel coefficients, channel correlation, signal-to-noise ratio etc.) is estimated by the receiver. Based on channel conditions, the receiver selects the optimal transmission mode, which includes modulation type, modulation order, MIMO configuration and MIMO type. The selected transmission mode is provided to the transmitter via a feedback channel**.**

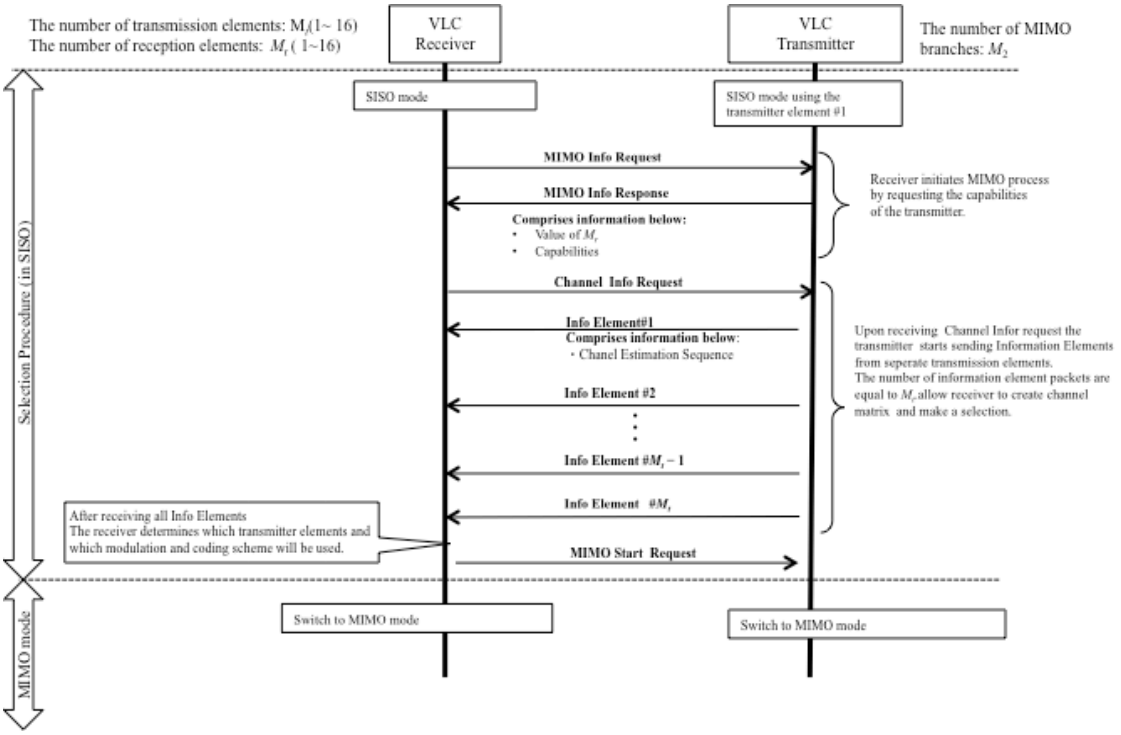


Figure 2 MIMO Communication Setup

All possible communication modes should be set on a lookup table for selection. (Note to editor: This table should be finalized when all SISO modes are set.) A sample for the lookup table is shown in Table 1.

Table 1 MIMO Communication Modes

Transmission Mode (TM)	MIMO Configuration	MIMO Type	Modulation Type	Modulation Order
1	1x1	RC	PSK	2
2	1x2	...	...	...
.	...	SMUX	QAM	4
.	N_TxN_R			8
.				16
				32
				64
				128

				256 512 1024 2048 4096

The selection algorithm is provided below. The performance metric is pre-determined values according to the quality-of-service (QoS) requirements for targeted applications, such as highest date rate under a specific BER threshold.

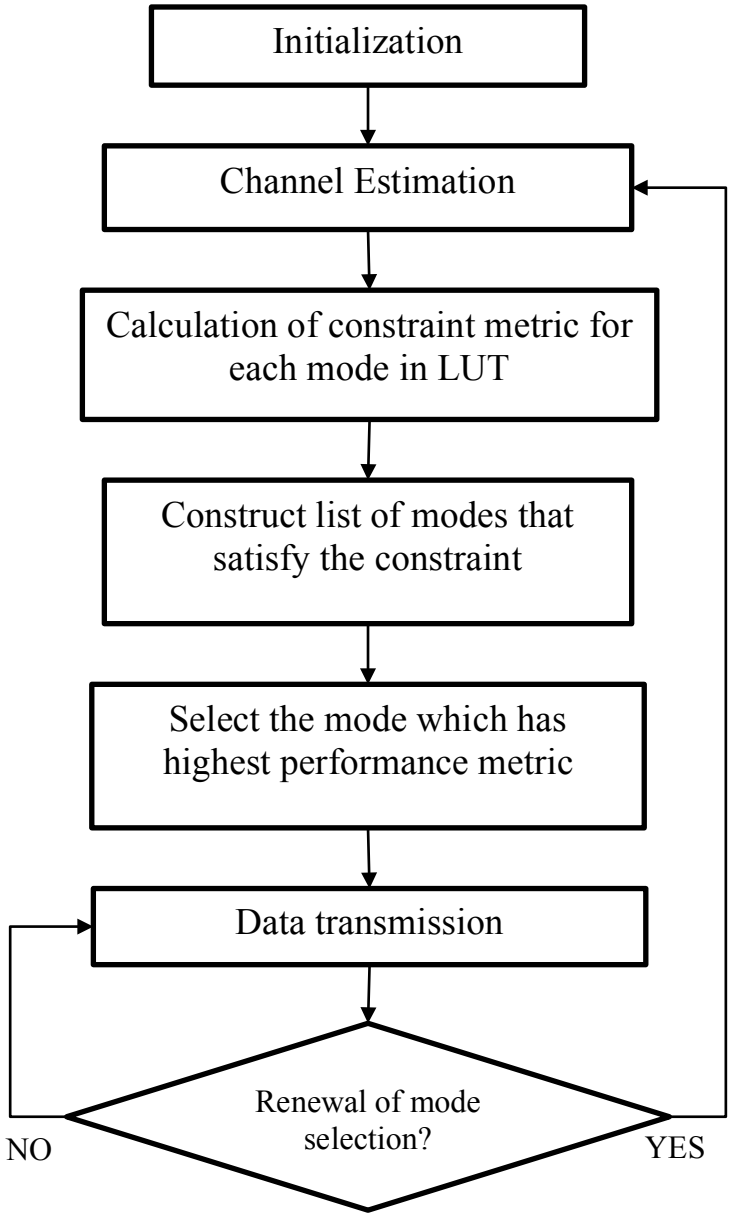


Figure 3 MIMO Mode Selection Algorithm

Two main MIMO schemes can be supported.

Repetition Coding:

In the repetition coding, the same information is transmitted from all transmit elements.

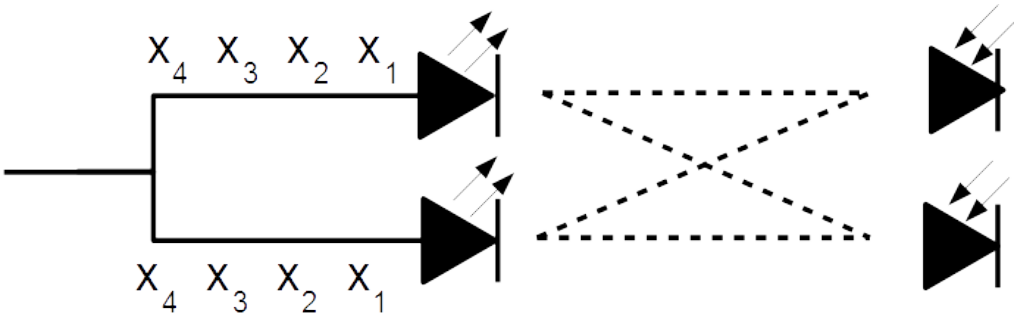
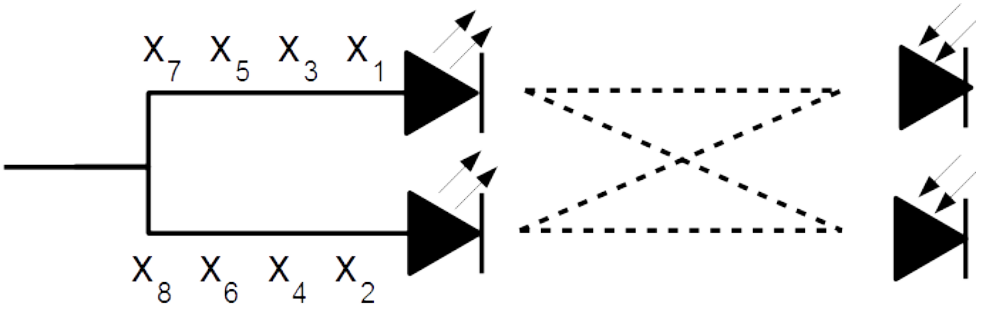


Figure 4 Repetition Coding for MIMO Communication

Spatial Multiplexing

In the spatial multipexing case every transmit element sends independent information.



6.4.2 MIMO Communication Frame Structure

The frame structure for MIMO communication is shown in Figure 4.

- Synchronization (SYNC) part is used for frame detection, frame synchronization, frequency recovery and timing acquisition. Start Frame Delimiter (SFD) is to show that SYNC part finished.
- Channel Estimation Sequence (CES) should provide channel estimation of each transmitter.
- In all those parts, SISO CES sequences will be used.
- The Header contains essential information such as payload size, modulation, and coding (if used) in the payload.

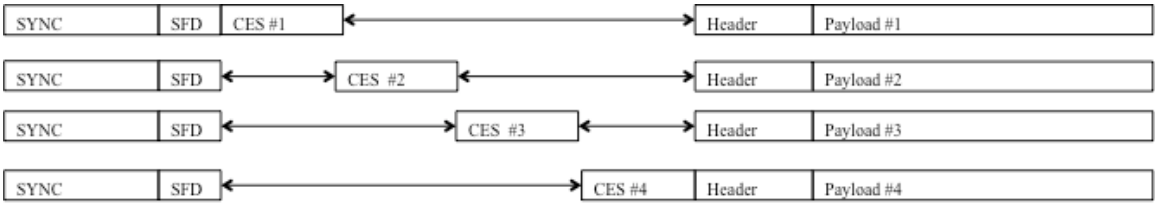


Figure 5 MIMO Frame Structure

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