

Multiple Antenna Transmission for DL Control Channels

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Source(s):

Seung Joon Lee, Dong Seung Kwon,
Choong Il Yeh, Young Seok Song, Byung-Jae Kwak, Jihyung Kim, Wooram Shin

E-mail: s.j.lee@etri.re.kr; dskwon@etri.re.kr

ETRI

161 Gajeong-dong, Yuseong-gu, Daejeon
305-700, Korea

Re:

IEEE 802.16m-08/005: Call for Contributions on Project 802.16m System Description Document (SDD) (2008-01-24), Downlink Control Structures.

Abstract:

Consideration of using multiple transmit antennas for downlink control channels in IEEE 802.16m systems

Purpose:

Adoption of proposed text into SDD

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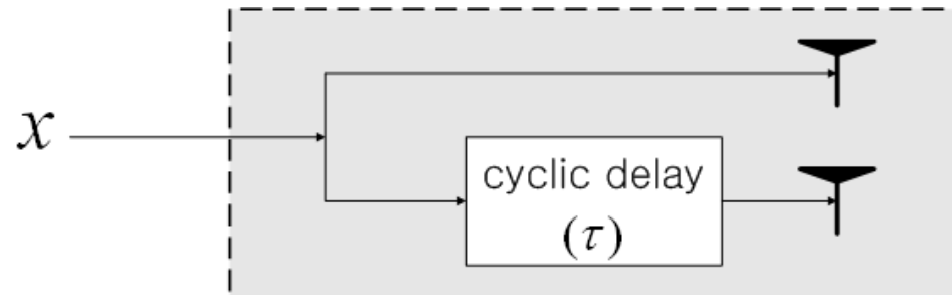
Introduction

- One of the most important issues for DL control channel transmission
 - Coverage extension
- Block error rate performance against SNR is compared for one, two, and four transmit antenna schemes. → Multiple transmit antenna schemes are shown to be effective for coverage extension.
- Proposal: Considering use of multiple (up to 4) antenna transmission schemes for DL control channel.

Two Transmit Antenna Schemes

- STBC (or SFBC):
$$\begin{bmatrix} x_1 & -x_2^* \\ x_2 & x_1^* \end{bmatrix}$$

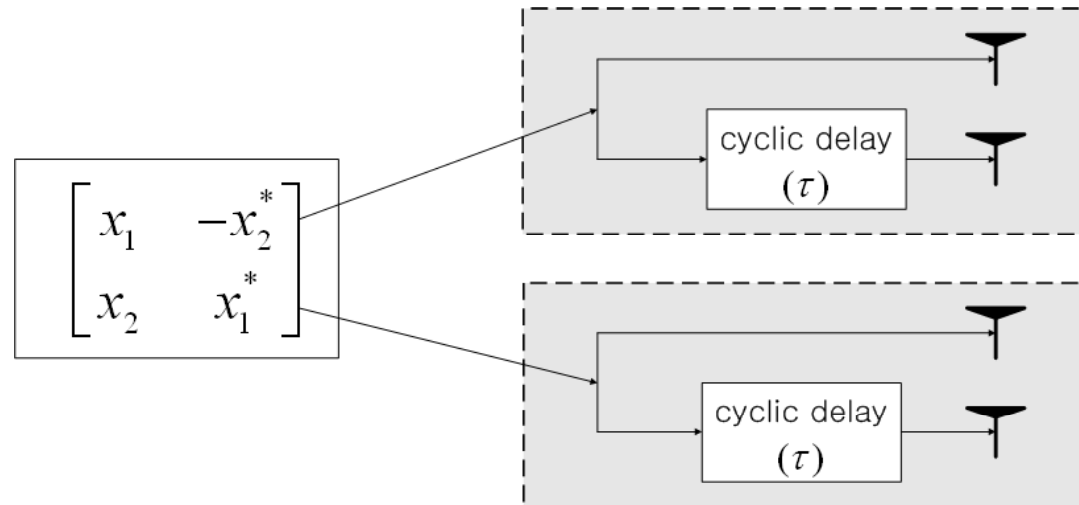
- Cyclic delay diversity (CDD)



- CDD has simpler encoding. However, it has smaller diversity gain than STBC.

Four Transmit Antenna Schemes

- STBC (or SFBC):
$$\begin{bmatrix} x_1 & -x_2^* & 0 & 0 \\ x_2 & x_1^* & 0 & 0 \\ 0 & 0 & x_3 & -x_4^* \\ 0 & 0 & x_4 & x_3^* \end{bmatrix}$$
- CDD
- Combined STBC (or SFBC) and CDD:

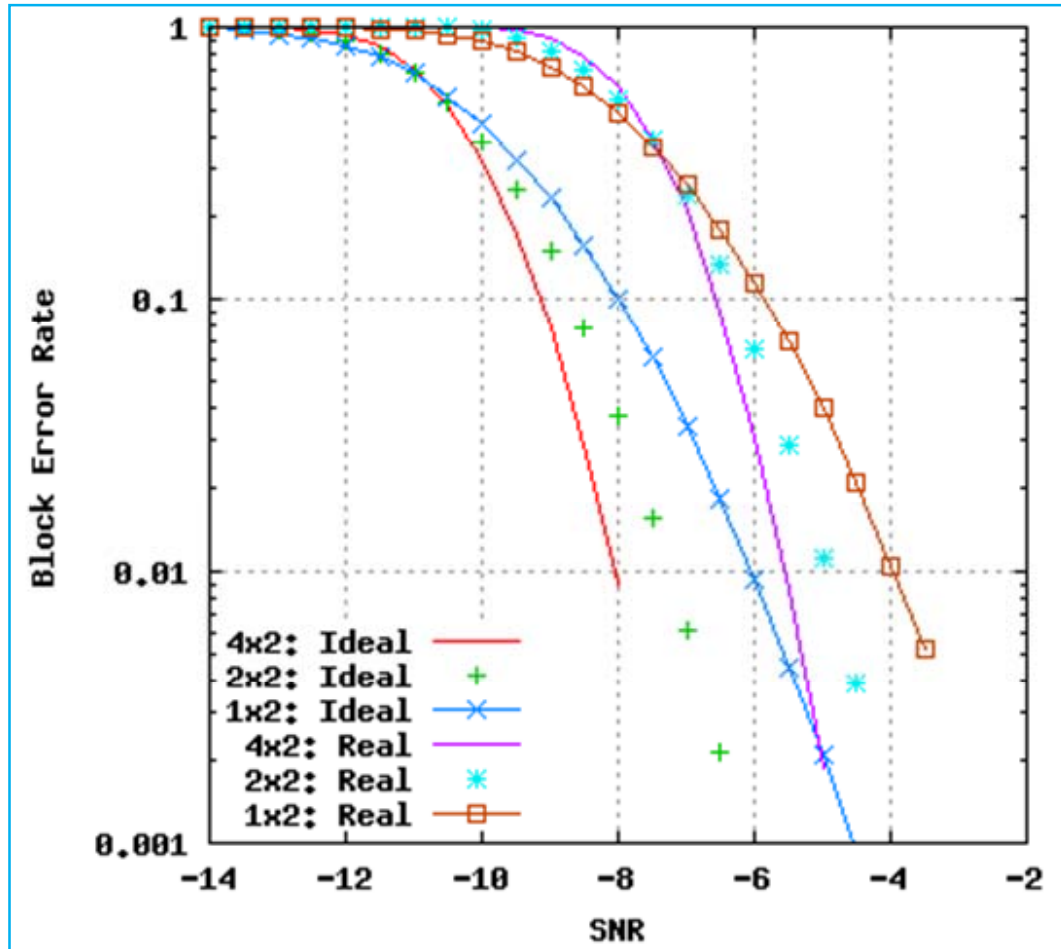


- It has similar performance (diversity gain) to the above STBC.

Performance Comparison for 1, 2, and 4 Transmit Antennas

- Simulation Assumptions
 - Number of receive antennas: 2
 - Modulation & encoding: QPSK, 1/12 Turbo code
 - Bandwidth: 5 MHz
 - Channel model: Typical Urban
 - Channel estimation: linear MMSE
 - Pilot density per Tx antenna: decreasing with the number of Tx antennas
 - 1 Tx antenna: 12.5 % (This value is just an example but not the contributor's specific preference.)
 - 2 Tx antennas: 6.25 %
 - 4 Tx antennas: 3.125 %

Performance Comparison (Cont'd)



1x2: single Tx antenna
2x2: 2 Tx antennas (STBC)
4x2: 4 Tx antennas
(combined STBC and CDD)

Ideal: with perfect knowledge of channel

Real: with linear MMSE channel estimation

- Gain of **2** Tx antennas over **1** Tx antenna: **1.0 dB**
- Gain of **4** Tx antennas over **2** Tx antennas: **0.6 dB**

Proposed Texts into SDD

- X.y. DL control channel structure
 - *Multiple (up to four) transmit antenna schemes should be applied, so as for DL control channel to be reliably delivered to cell edge users.*