

Improved Space-Time Codes for the OFDMA PHY with four transmission antennas

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Assist in clarifying C802.16e-04/370r2 contribution document.

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- **Problem statement**

- The existing 4 antenna, rate 1 STC does not fully exploit the available spatial diversity.

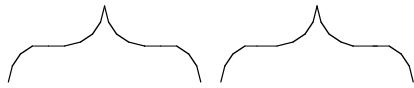
- **Proposed Solution**

- ➔ Use full diversity STC

1. Without changing matrix A
2. No additional encoding complexity
3. Trivial Decoding complexity increase

- **4 Tx, Rate 1 STF-code**

Subcarrier

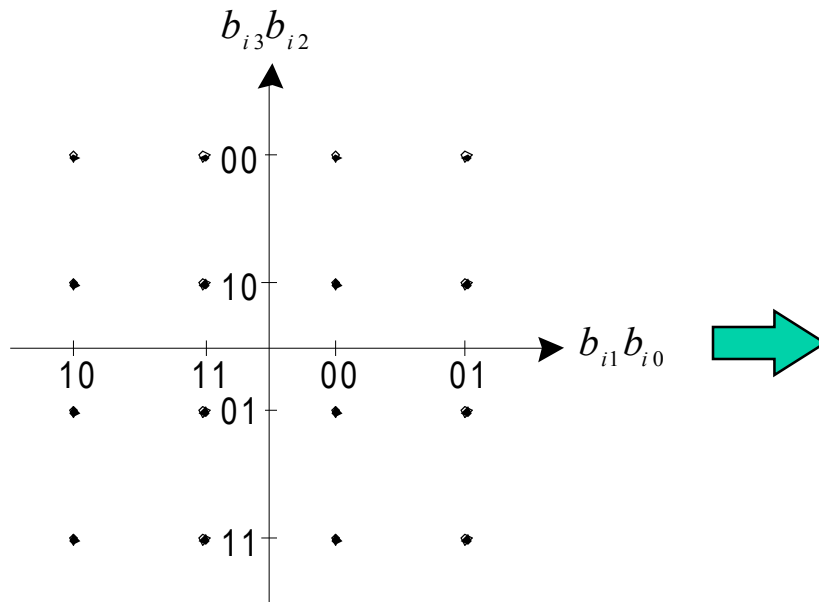
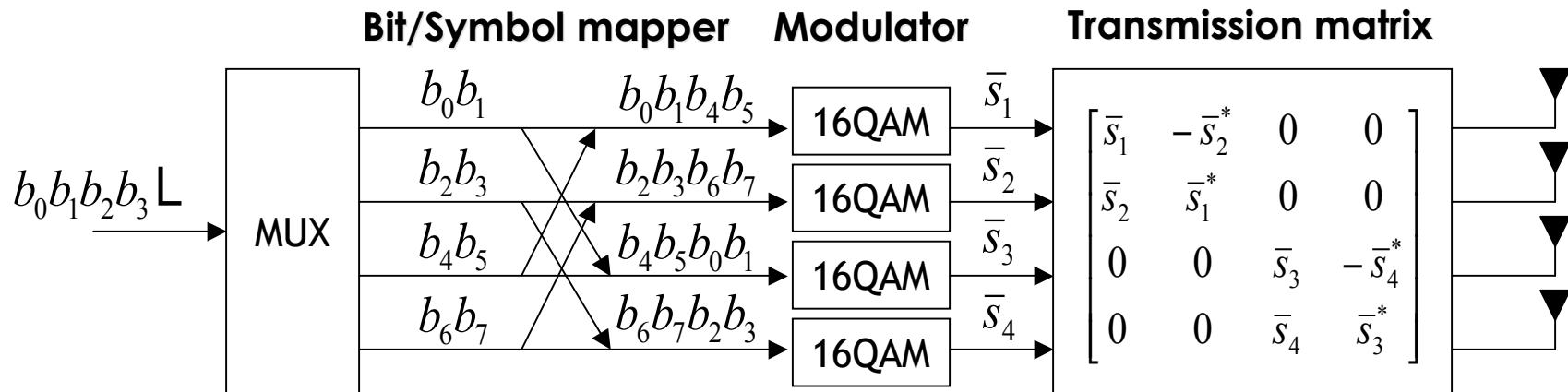


1 2 1 2

OFDM symbol

$$\theta = \tan^{-1}(2), \tan^{-1}(1/4) \text{ and } \tan^{-1}(1/8)$$

- Equivalent representation – QPSK case**



- Simple bit mapping to the matrix A**
- Extension to 16/64QAM is applicable**

- **Decoding procedure**

- **Received signal**

$$\begin{bmatrix} y_1^1 \\ y_2^1 \\ y_1^2 \\ y_2^2 \end{bmatrix} = \begin{bmatrix} \bar{s}_1 & -\bar{s}_2^* & 0 & 0 \\ \bar{s}_2 & \bar{s}_1^* & 0 & 0 \\ 0 & 0 & \bar{s}_3 & -\bar{s}_4^* \\ 0 & 0 & \bar{s}_4 & \bar{s}_3^* \end{bmatrix} \begin{bmatrix} h_1(1) & h_2(1) & h_3(2) & h_4(2) \end{bmatrix} + noise$$

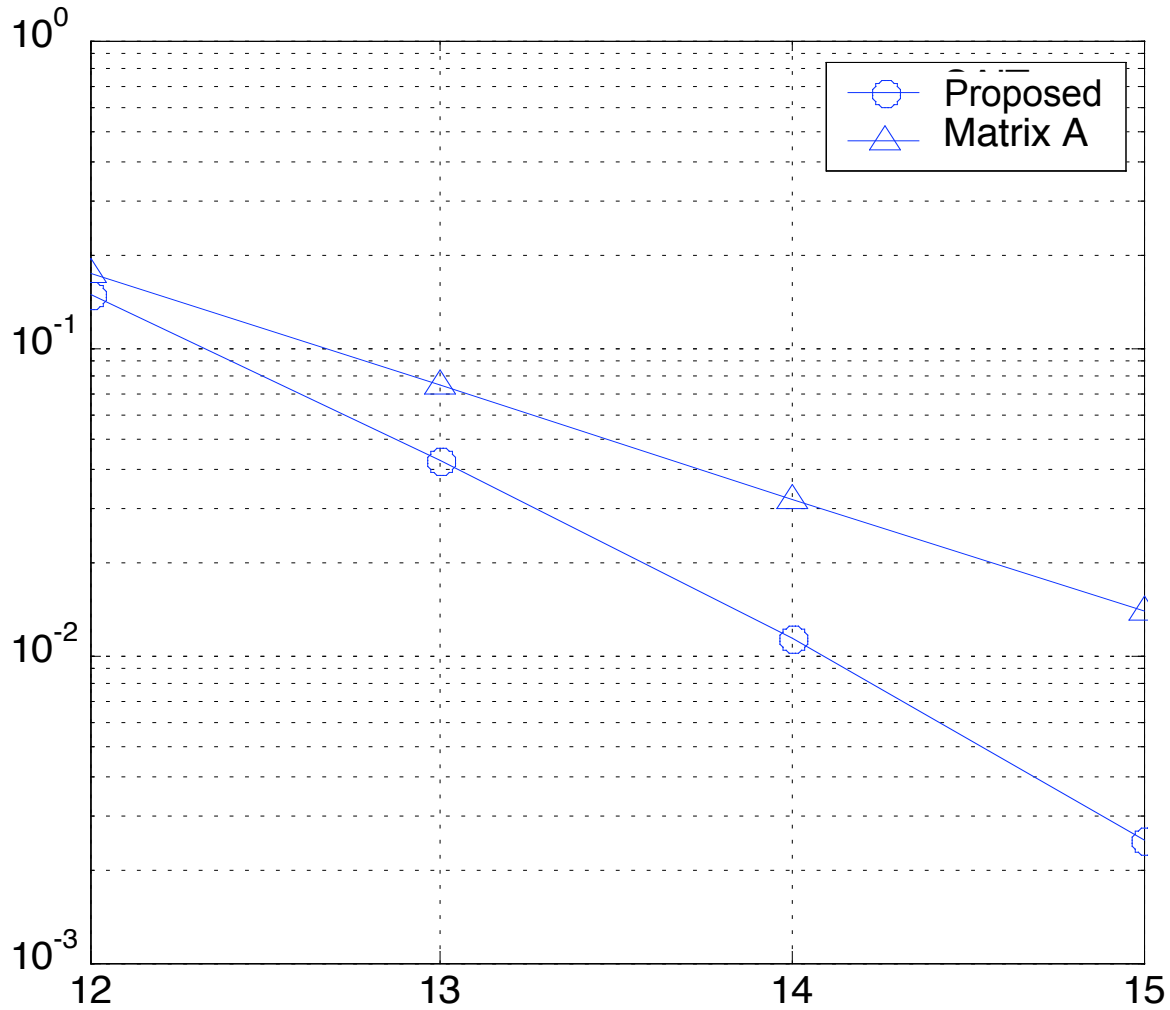
- **Estimate of transmit symbols**

$$\begin{bmatrix} \hat{s}_1 \\ \hat{s}_2 \\ \hat{s}_3 \\ \hat{s}_4 \end{bmatrix} = \begin{bmatrix} \alpha^{-1} & 0 & 0 & 0 \\ 0 & \alpha^{-1} & 0 & 0 \\ 0 & 0 & \beta^{-1} & 0 \\ 0 & 0 & 0 & \beta^{-1} \end{bmatrix} \begin{bmatrix} h_1(1)^* & h_2(1) & 0 & 0 \\ -h_2(1)^* & h_1(1) & 0 & 0 \\ 0 & 0 & h_3(2)^* & h_4(2) \\ 0 & 0 & -h_4(2)^* & h_3(2) \end{bmatrix} \begin{bmatrix} y_1^1 \\ y_2^1 \\ y_1^2 \\ y_2^2 \end{bmatrix}$$

$$\alpha = |h_1(1)|^2 + |h_2(1)|^2, \beta = |h_3(2)|^2 + |h_4(2)|^2$$

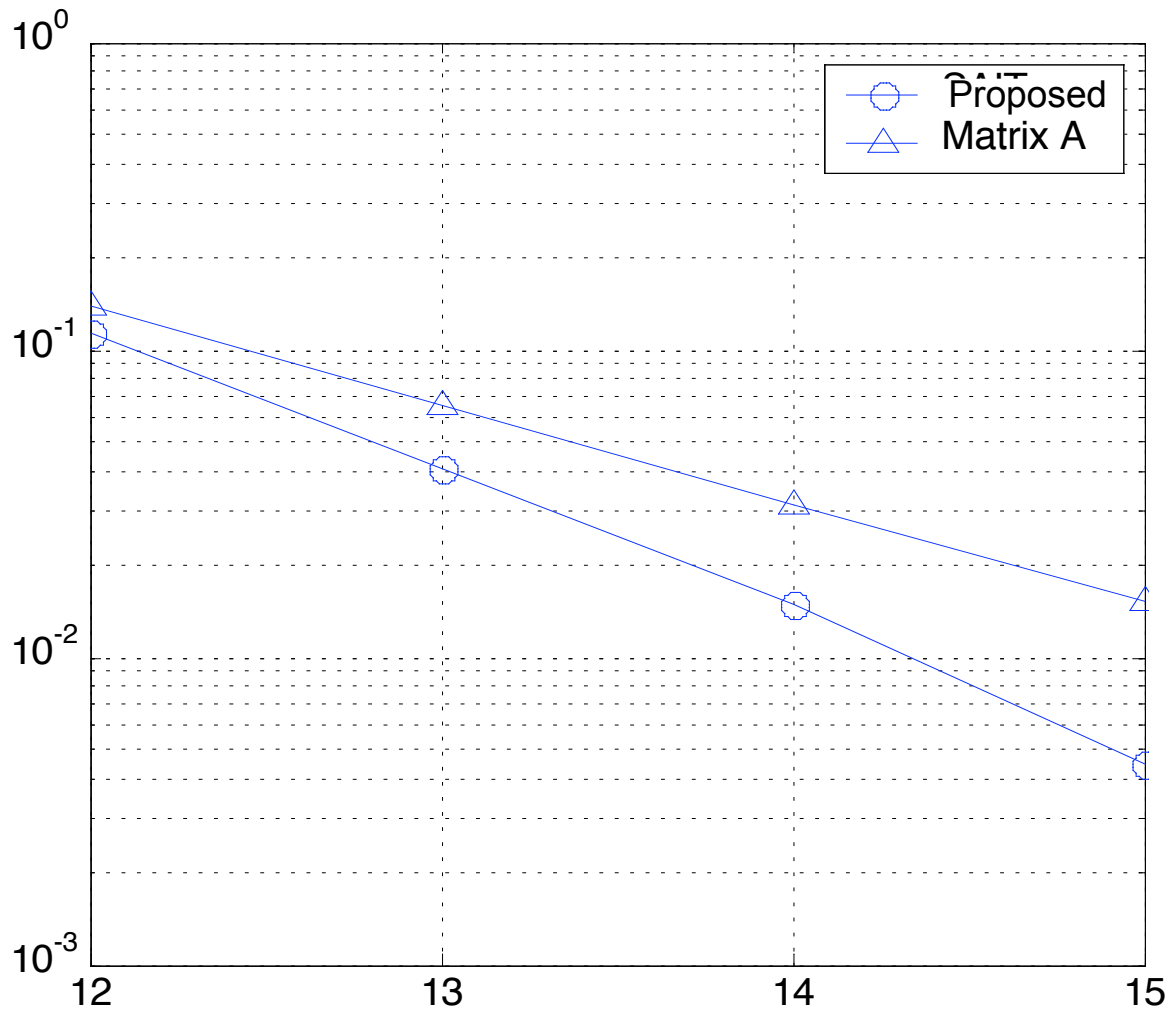
➔ **Simple decoding**

- **Simulation result (1)**



- 16QAM
- CTC 3/4 rate
- Veh. A
- 60 km/h
- Band AMC

- **Simulation result (2)**



- 16QAM
- CTC 3/4 rate
- Ped. A
- 3 km/h
- Band AMC

Proposed Text Changes

**Change text according to contribution
CXXXXXX replacing the existing 4 antenna rate
1 code with the proposed 4 antenna rate code.**

Thank you.