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

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Purpose:

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**

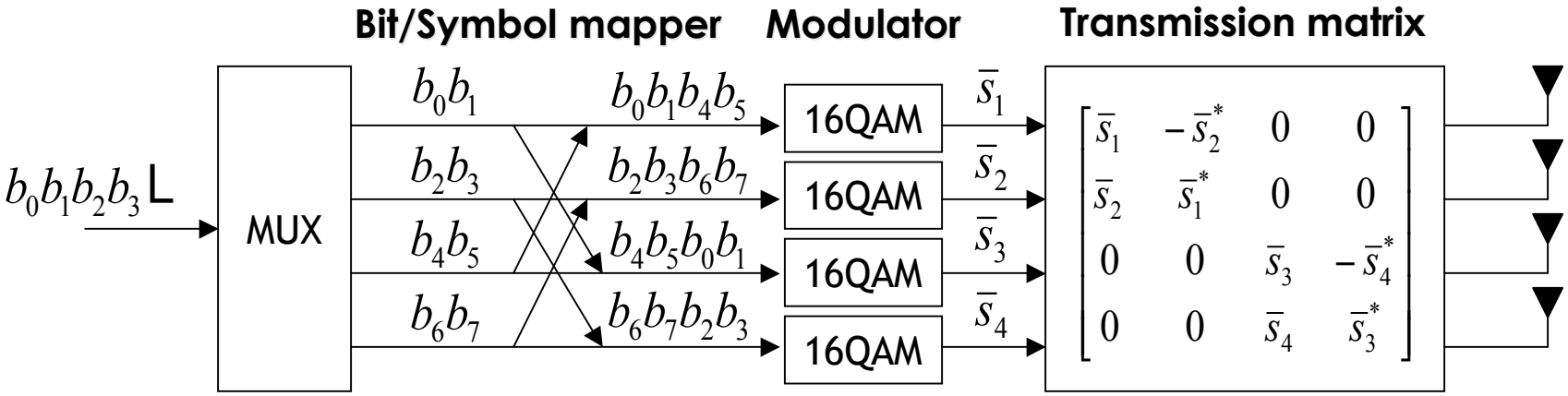
Subcarrier

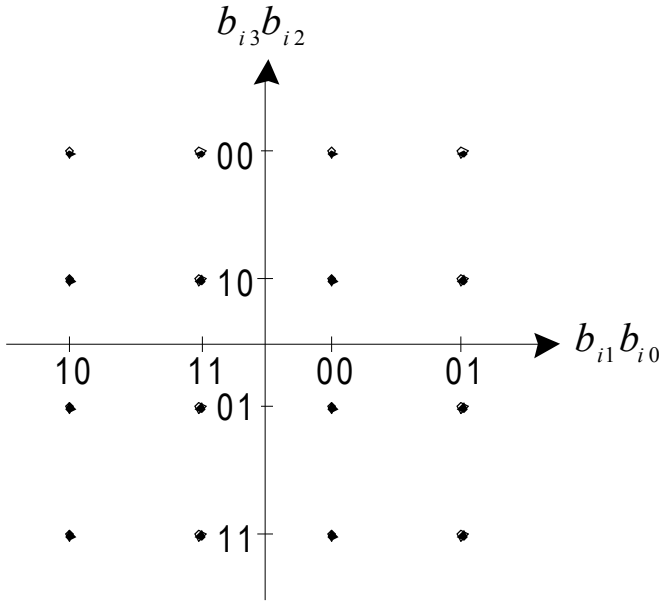
1 2 1 2

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**

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

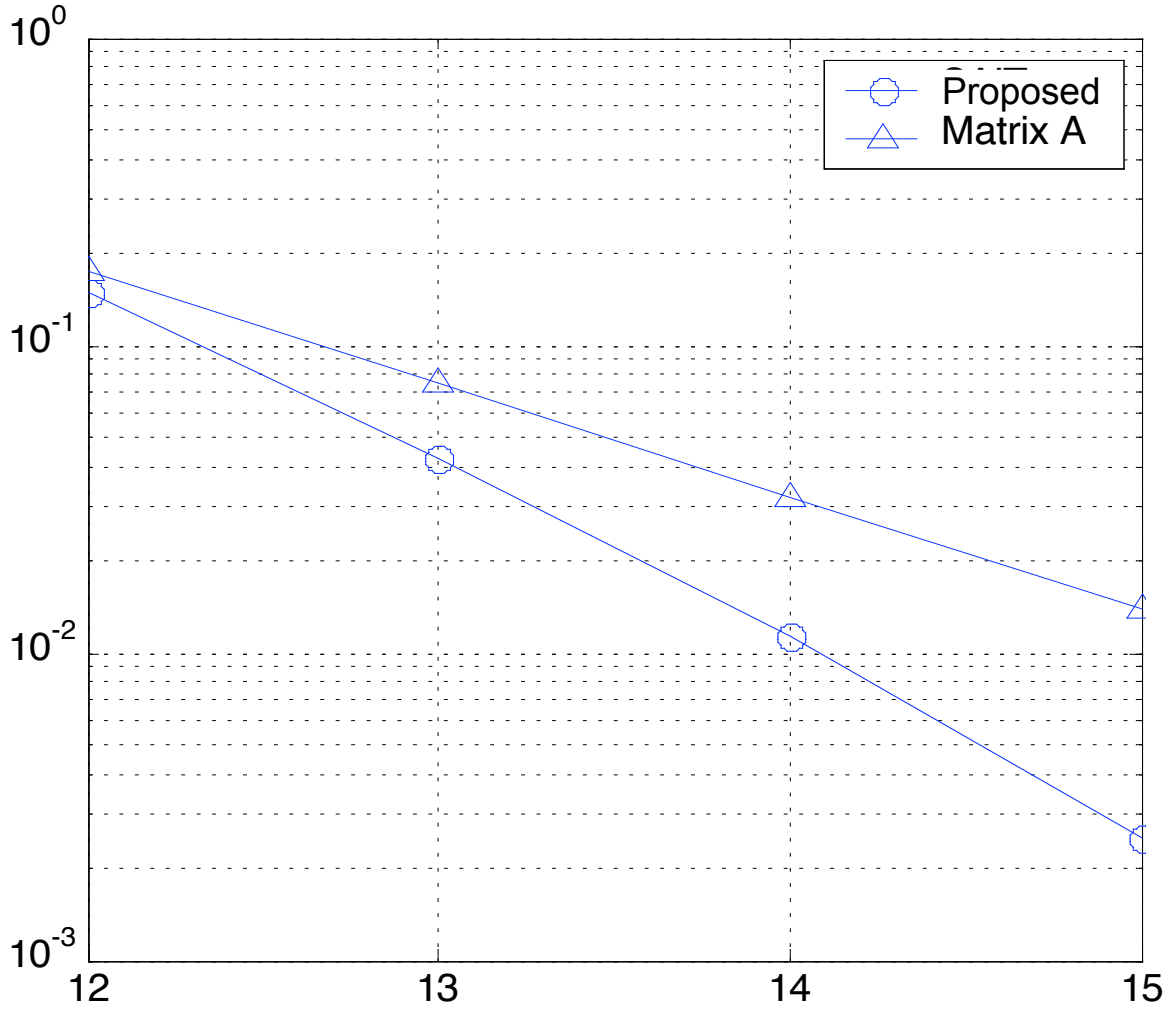
  - **Estimate of transmit symbols**

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

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

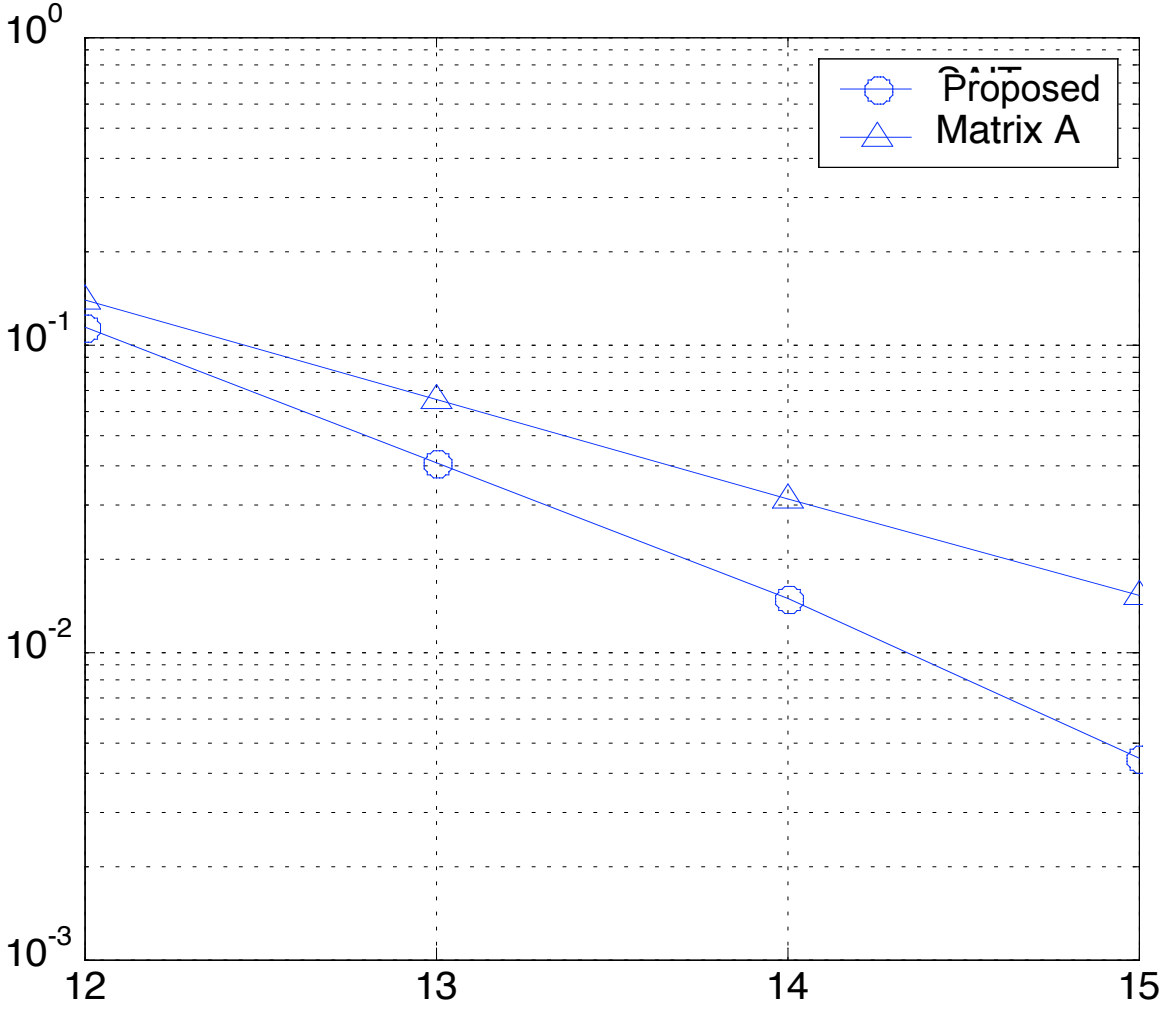
    ➔ **Simple decoding**

- **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.