
Project IEEE 802.16 Broadband Wireless Access Working Group <<http://ieee802.org/16>>

Title Some concerns to be clarified on unitary precoding

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Re: Call for comments on DL MIMO SDD text (IEEE C80216m-08_657r2)

Purpose For discussion by TGm

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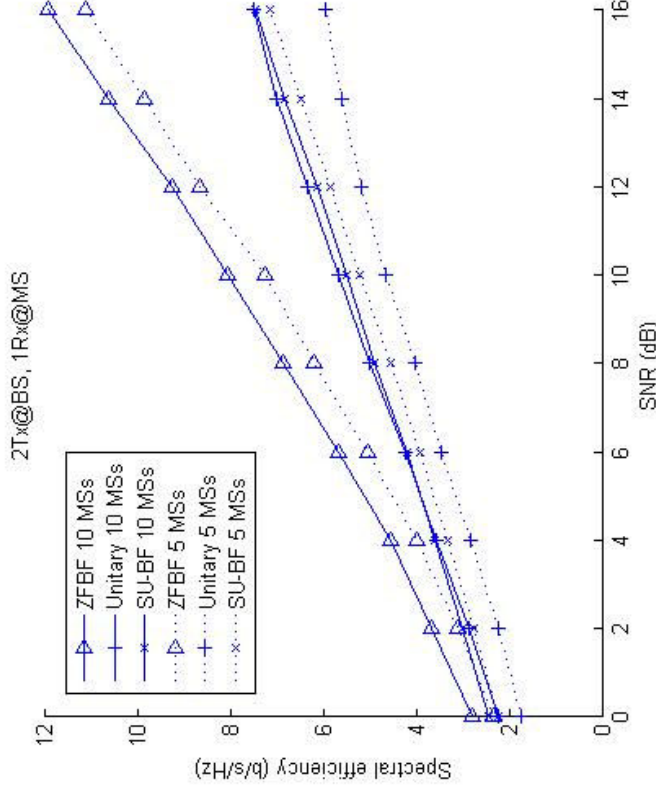
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Summary

- Limitation by number of receive antenna(s) at MS
- Limitation of codebook size
- CQI uncertainty with rank deficiency
- Unification of MSs with UL sounding, Codebook and Analog feedback

Limitation of Rx at MS

- Number of streams are limited by number of Rx at MS
- Example 1: Unitary precoding can not efficiently support MS with 1 Rx



- Example 2: With 4 Tx at BS and 2 or 4 Rx at MSSs, the number of stream is limited by 2.
 - In unitary precoding, some high-end MS with 4 Rx has capability to support multiplexing gain of up to 4. However, this capability is limited by low-end 2 Rx MS.

Limitation of codebook size

- Unitary precoding is vulnerable to the large codebook
 - To have good scheduling gain, codebook size has to be balanced with number of MSs.
- Beamforming gain has to be sacrificed by using a small codebook in MU-MIMO
- It is hard of unitary precoding to simultaneously achieve both sound scheduling gain and beamforming gain.

CQI uncertainty

- Only with full rank transmission, the unitary precoding can have good CQI estimation.
- When rank is deficient, CQI mismatch can be significant
 - With small codebook, the inter-stream interference is in a side-lobe level.
 - CQI mismatch might be solved by feeding back multiple CQI and/or PMI associated with all possible rank. This will result in a large feedback overhead.
- For example: Unitary precoding with 4 streams and 2 bits codebook with 4 codewords.
 - No. of bits of PMI is up to $4 \times (2+2) = 16$ bits/MS
 - No. of bits of CQI = $4 \times 5 = 20$ bits/MS

*: It is assume that 5 bits per CQI feedback.

IEEE C802.16-08/852 Unification of MSs with UL sounding, Codebook and Analog feedback

- Practically, user grouping and precoding matrix design should apply to all MSs regardless of the method of CSI feedback.
- Unitary precoding can not efficiently exploit the CSI obtained via UL sounding and analog feedback.
- The multiuser gain can be diminished by separately treating MSs with different CSI feedback.