DL MIMO Structure

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Base Contribution:
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Abstract:
Comment for MIMO structure
Purpose:
Discussion and adoption

SCW vs. MCW

- There are discussions on MIMO structure
- The pros and cons for each MIMO structure is as follows;
  - SCW (Vertical Encoding)
    - Pros : Small feedback overhead is required, spatial diversity can be achieved, legacy structure (same receiver/transmit structure can be reused), can use same feedback channel
    - Cons : Per stream link adaptation can’t be applied, layer level SIC receiver can’t be applied
  - Pure MCW (Horizontal Encoding)
    - Pros : Per layer link adaptation can be applied, layer level SIC receiver can be applied
    - Cons : Large feedback overhead is required, spatial diversity can’t be achieved

MCW with limited number of codeword and stream permutation

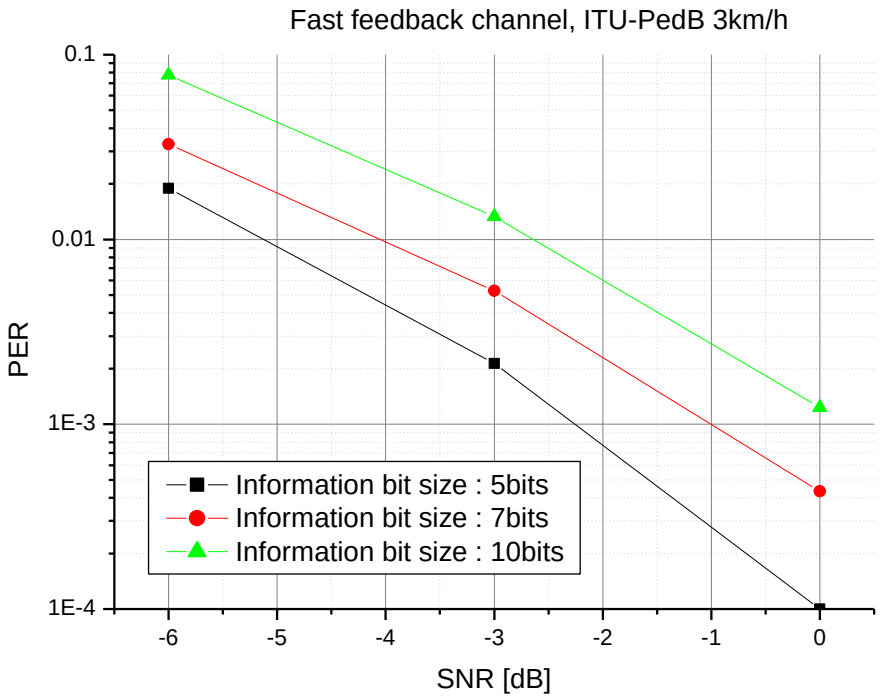
- MCW with limited number of layer is between SCW and pure MCW
  - Pros : Per layer link adaptation can be applied, layer level SIC receiver can be applied, partial spatial diversity can be achieved
  - Cons : Medium feedback overhead is required
- MCW with stream permutation
  - Stream permutation makes averaging all layers
  - Same feedback overhead compare with SCW structure when MS receiver type is MMSE or MLD
  - When SIC type of receiver is applied, feedback overhead is effectively reduced (Compare with MCW without stream permutation)
    - SINR for second layer is always “SINR for first layer + delta” (positive value)
  - Full spatial diversity can be achieved (Same as SCW)
  - Layer level SIC receiver can be applied (Same as MCW)

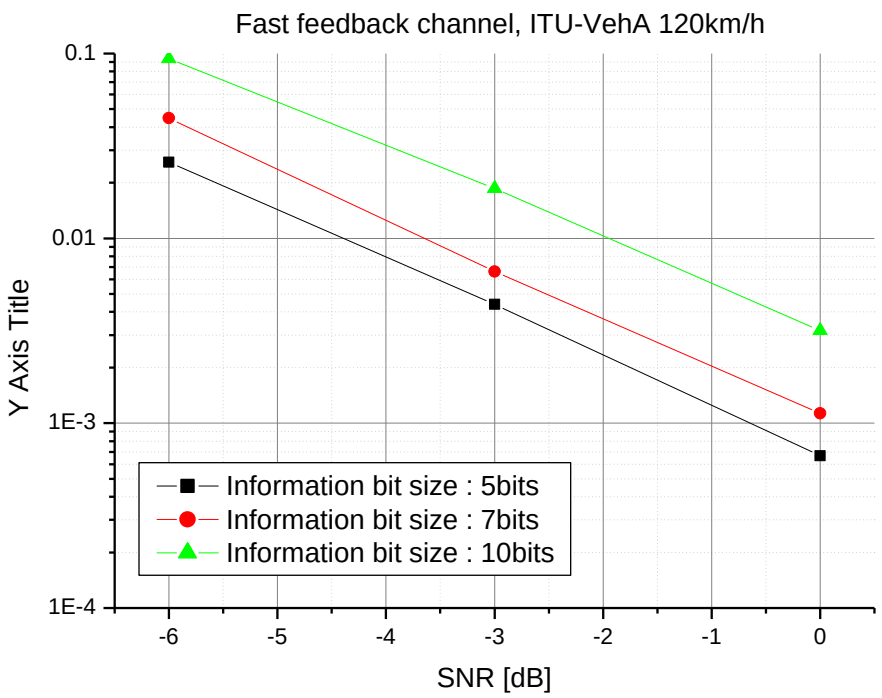
Example of CQI Feedback Overhead

Feedback mode	MIMO Structure	SCW	Pure MCW		Pure MCW with stream permutation		MCW with 2 Max codeword		MCW with 2 Max Codeword and stream permutation	
	Receiver Type	Without SIC	W/O SIC	W/ SIC	W/O SIC	W/ SIC	W/O SIC	W/ SIC	W/O SIC	W/ SIC
Whole Band Feedback	Rank 1	5	5	5	5	5	5	5	5	5
	Rank 2	5	10	10	5	7	10	10	5	7
	Rank 3	5	15	15	5	9	10	10	5	7
	Rank 4	5	20	20	5	11	10	10	5	7
Sub-band Feedback (5 Sub-band repot, Full)	Rank 1	25	25	25	25	25	25	25	25	25
	Rank 2	25	50	50	25	35	50	50	25	35
	Rank 3	25	75	75	25	45	50	50	25	35
	Rank 4	25	100	100	25	55	50	50	25	35
Sub-band Feedback (5 Sub-band report, 1 bit for each Sub-band, Diff.)	Rank 1	5	5	5	5	5	5	5	5	5
	Rank 2	5	10	10	5	10	10	10	5	10
	Rank 3	5	15	15	5	15	10	10	5	10
	Rank 4	5	20	20	5	20	10	10	5	10

Assume 5 bits are required for each CQI value, 2 additional bits are required for delta CQI for SIC receiver with stream permutation

Example of fast feedback channel performance





Performance comparison between different mode

	Normalized Spectral Efficiency	Normalized Cell Edge throughput
SCW with MMSE	1.00	1.0
MCW with MMSE	0.97	0.93
MCW + SP with MMSE	0.98	0.96

	Normalized Spectral Efficiency	Normalized Cell Edge throughput
MCW with MMSE+SIC	1.00	1.00
MCW + SP with MMSE+SIC	1.01	1.00

Simulation assumptions is based on 16m EMD except for mPedB 3km/h, sub-framing and related parameters

Suggestions

- **Choose only one MIMO structure**
  - Decide MIMO structure in this meeting for progress in different RG (e.g. UL Control RG)
  - Multiple MIMO structure results in multiple options for many features such as feedback mechanism, feedback channel, ACK/NACK control, …
  - Different MIMO structure for OL-SU-MIMO and CL-SU-MIMO makes trouble for HARQ processing
- If we decide to use MCW, then
  - **Limit maximum number of layer to 2**
    - How to map layer to stream is FFS
  - **Apply stream permutation type of technique** to further reduce feedback overhead and to enable usage of same feedback channel for different rank
    - How to apply stream permutation is FFS
    - For MU-MIMO, stream permutation is not applied
    - For CL-SU-MIMO, applying stream permutation is FFS (to enable dynamic switching)

Remedy

- *Line 20-21, page 4, Choose only one of the following options;*
  - Option 1 : For SU-MIMO, Vertical encoding (SCW) is employed. ~~[The support of horizontal encoding (MCW) for SU-MIMO is FFS].~~
  - Option 2 : For SU-MIMO, ~~Vertical encoding (SCW) is employed.~~ stream permuted horizontal encoding (MCW) with maximum number of two layer is employed. When SU-MIMO and MU-MIMO are dynamically switched, stream permutation function is disabled. ~~[The support of horizontal encoding (MCW) for SU-MIMO is FFS].~~