3GPP TSG-RAN WG1#83 **R1-157211**
Anaheim, US, 16th - 20th November 2015

On CSI feedback without PMI

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Agenda Item: 6.2.4.3.2

Document for: Discussion and Decision

Background

- RAN1#82bis proposal (here denoted as “Class C” CSI reporting):
  - A CSI process can be configured without PMI reporting, where the CSI process is associated with one CSI-RS resource configuration with L={1,2,4} CSI-RS ports.
  - UE reports CQI/RI for the CSI process and CQI/RI calculation is based on the assumption in the following table

	L=1	**L=2**		**L=4**			
CSI-RS	15	{15,16}		{15,16,17,18}			
RI	-	1	2	1	2	3	4
Assumed precoding matrix	-	$\begin{bmatrix}1\\0\end{bmatrix}$	$\frac{1}{\sqrt{2}}\begin{bmatrix}1 & 0\\0 & 1\end{bmatrix}$	$\begin{bmatrix}1\\0\\0\\0\end{bmatrix}$	$\frac{1}{\sqrt{2}}\begin{bmatrix}1 & 0\\0 & 1\\0 & 0\\0 & 0\end{bmatrix}$	$\frac{1}{\sqrt{3}}\begin{bmatrix}1 & 0 & 0\\0 & 1 & 0\\0 & 0 & 1\\0 & 0 & 0\end{bmatrix}$	$\frac{1}{2}\begin{bmatrix}1 & 0 & 0 & 0\\0 & 1 & 0 & 0\\0 & 0 & 1 & 0\\0 & 0 & 0 & 1\end{bmatrix}$

“Class C” interpretation

- PMI reporting is made redundant by specifying a fixed precoding matrix per rank
  - This can already be achieved with legacy codebook subset restriction (CSR) to a single matrix W_0 per rank

- An antenna selection precoding matrix is specified
  - This can already be achieved by L port CSI-RS virtualization precoding with a virtualization matrix T and applying W_0
    - For example, L=2, $T = \frac{1}{2}\begin{pmatrix} 1 & 1 \\ 1 & -1 \end{pmatrix}$ gives with legacy 2TX codebook + appropriate CSR these Class C matrices $TW_0 = \frac{1}{\sqrt{2}}\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}, \begin{pmatrix} 1 \\ 0 \end{pmatrix}$
    - Another 4x4 matrix T and CSR can be identified for L=4 using legacy 4 TX codebooks and obtain the desired Class C matrices

UCI overhead

- If CSI-RS virtualization T and CSR is applied, the same functionality can be achieved using legacy operation with wideband PMI, subband CQI, as in the RAN1#82bis proposal
  - PUSCH mode 3-1 can be used
- PMI overhead for legacy
  - PUSCH mode 3-1 PMI –> 1 or 2 bits for 2TX, 4 bits for 4 TX
    - Total UCI payload is 61 bits (2TX), 64 bits (4TX) in 20 MHz BW
- UCI overhead saving of introducing Class C is 3-6%
  - No other benefit identified

Conclusion

- No need to specify an additional CSI feedback class/mode without PMI