3GPP TSG-RAN WG1#86 **R1-167634**

Gothenburg, Sweden, August 22 – 26, 2016

SOURCE: ERICSSON

TITLE: PERFORMANCE OF CDM-8 FOR NON-PRECODED CSI-RS

AGENDA ITEM: 7.2.4.1.1

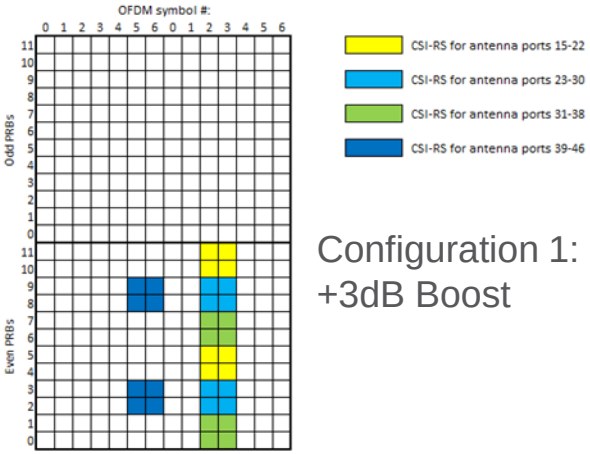
DOCUMENT FOR: DISCUSSION AND DECISION

BACKGROUND

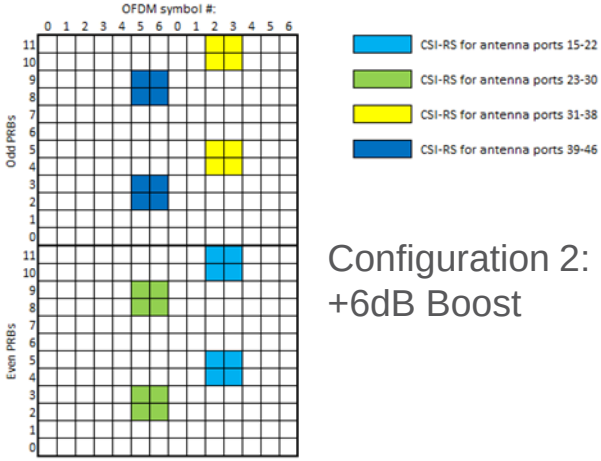
- In RAN1#85, the following conclusion was made with regards to CDM-8 for Class A CSI-RS design
  - Conclusion: Further discussion till RAN1#86, especially regarding evaluating different alternatives, e.g., using OCC 2/4/8, high reuse of CSI-RS, etc.
- In this contribution, we present simulation results comparing a CDM-8 proposal with a CDM-4 scheme
  - Simulations with CSI-RS reuse factors 1 and 3 are presented

CDM4, CDM8 ASSUMPTIONS

- CDM4 Scheme
  - 4x4 layout
  - 0.5 CSI-RS REs/RB/port
  - 32 ports with 8-port CSI-RS configurations
  - For reuse 3, configuration 1 shown below is used with +3dB power boosting
  - For reuse 1, configuration 2 shown below is used with +6dB power boosting
- CDM8 Scheme
  - 4x4 layout
  - 0.5 CSI-RS REs/RB/port
  - Design proposed in R1-164214
  - +6dB power boosting is assumed



Configuration 1: +3dB Boost



Configuration 2: +6dB Boost

- Note: Choice of which configuration (shown to the left) to use for reuse 1 and reuse 3 cases are motivated by our results in R1-167633
- Remaining simulation assumptions are given in the appendix

COMPARISON WITH REUSE-1

UE Speed: 3 km/hr

Reference RU [%]	20		50	
Reference offered traffic [bps/Hz/cell]	0.6222		1.0637	
	CDM4	**CDM8**	**CDM4**	**CDM8**
Cell edge throughput [bps/Hz/user]	1.1451		0.4516	
Mean throughput [bps/Hz/user]	3.5485		2.3439	
Cell edge gain [%]	0	6	0	20
Mean throughput gain [%]	0	0	0	8

UE Speed: 30 km/hr

Reference RU [%]	20		50	
Reference offered traffic [bps/Hz/cell]	0.5593		0.9297	
	CDM4	**CDM8**	**CDM4**	**CDM8**
Cell edge throughput [bps/Hz/user]	0.9950		0.3751	
Mean throughput [bps/Hz/user]	3.3569		2.1824	
Cell edge gain [%]	0	4	0	21
Mean throughput gain [%]	0	1	0	7

UE Speed: 60 km/hr

Reference RU [%]	20		50	
Reference offered traffic [bps/Hz/cell]	0.5399		0.8708	
	CDM4	**CDM8**	**CDM4**	**CDM8**
Cell edge throughput [bps/Hz/user]	0.9423		0.3644	
Mean throughput [bps/Hz/user]	3.3127		2.1505	
Cell edge gain [%]	0	5	0	24
Mean throughput gain [%]	0	1	0	8

COMPARISON WITH REUSE-3

UE Speed: 3 km/hr

Reference RU [%]	20		50	
Reference offered traffic [bps/Hz/cell]	0.6212		1.1337	
	CDM4	**CDM8**	**CDM4**	**CDM8**
Cell edge throughput [bps/Hz/user]	1.1850		0.4715	
Mean throughput [bps/Hz/user]	3.3749		2.2114	
Cell edge gain [%]	0	7	0	20
Mean throughput gain [%]	0	1	0	7

UE Speed: 30 km/hr

Reference RU [%]	20		50	
Reference offered traffic [bps/Hz/cell]	0.5415		0.9361	
	CDM4	**CDM8**	**CDM4**	**CDM8**
Cell edge throughput [bps/Hz/user]	0.9826		0.3884	
Mean throughput [bps/Hz/user]	3.1651		2.0596	
Cell edge gain [%]	0	4	0	16
Mean throughput gain [%]	0	1	0	6

UE Speed: 60 km/hr

Reference RU [%]	20		50	
Reference offered traffic [bps/Hz/cell]	0.5141		0.8797	
	CDM4	**CDM8**	**CDM4**	**CDM8**
Cell edge throughput [bps/Hz/user]	0.9100		0.3607	
Mean throughput [bps/Hz/user]	3.0996		2.0082	
Cell edge gain [%]	0	6	0	14
Mean throughput gain [%]	0	1	0	5

OBSERVATION:

- With CSI-RS overhead reduction, the CDM-8 scheme of R1-164214 provides some marginal gains over the existing CDM-4 design @ 50% reference RU
  - For Reuse 1 case, cell edge throughput gains of 20-24% and mean throughput gains of only 7-8% are observed
  - For Reuse 3 case, cell edge throughput gains of 14-20% and mean throughput gains of only 5-7% are observed

PROPOSAL:

- It should be noted that the CDM-8 design in R1-164214 requires the specification of new CSI-RS configurations.
- We should carefully consider whether the performance benefits of any given CDM-8 design justifies the specification impact. Hence, we make the following proposal:

- **Proposal: Support of CDM-8 schemes in Rel-14 eFD-MIMO should be justified with performance benefits while taking into account the specification impact.**

APPENDIX: SIMULATION PARAMETERS

Carrier frequency	2 GHz
Bandwidth	10 MHz
Scenarios	3D UMa 500m ISD
Antenna Configuration	8x4 with 2x1 virtualization (121 degree tilt)
Cell layout	57 homogeneous cells
Wrapping	Radio distance based
UE receiver	MMSE-IRC
CSI periodicity	5 ms
CSI delay	5 ms
CSI mode	Aperiodic mode 3-2
Outer loop LA	Yes, 10% BLER target
eNB Tx power	46dBm
Traffic model	FTP Model 1, 500 kB packet size
UE speed	3 km/h, 30 km/h, 60 km/h
UE noise figure	9dB
Scheduling	Proportional fair in time and frequency
Transmission Mode	TM10 with non-shifted CRS
DMRS overhead	2 antenna ports
CSI-RS	Overhead accounted for; channel estimation error modeled
Codebook	2D Grid of Beams based on DFT
HARQ	Max 5 retransmissions
Antenna spacing	0.8 lambda in vertical, 0.5 lambda in horizontal
Handover margin	3 dB

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