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1. INTRODUCTION

In this document, we provide system simulation results for HSDPA MIMO evaluation according to the procedures agreed in TSG-RAN#30 [1] and TSG-RAN#31 [2]. Both 2x2 PARC and 2x2 D-TxAA has been studied in the micro urban scenario defined in [3] using the total cell throughput as the performance criteria. The system performance is an important factor when deciding how to apply MIMO (and what kind of MIMO) as an enhancement method for HSDPA.

2. SIMULATIONS ASSUMPTIONS

The simulation parameters are in line with the scenario presented in [3] including

- 6 dB isolation to non-serving sites
- Site to site distance 1000 m
- Proportional fair scheduling
- Full buffer traffic model
- 50% and 75% HSDPA transmit power allocation
- LMMSE receiver for each scheme
- 0% and 4% feedback errors for D-TxAA
- 10 code category UEs

While neighbor sites might be lightly loaded (producing the 6 dB isolation), the case of interest is when the serving site is to be operated at high load. Hence, in the simulated scenarios we have assumed 60 mobiles per site. The main simulation parameters are described in Annex A.

In previous discussions it has been raised that in the case that the dual stream transmission is not feasible the system should revert back to R'99 transmit diversity modes [5]. Thus when a MIMO transmission method finds out that single-stream transmission is better than dual-stream transmission, a fall back mode is activated. A logical choice for PARC fallback mode is STTD, because transmit power can be balanced between two transmit antennas. D-TxAA employs CL1 as a fallback mode, because same feedback bits are needed for antenna weight adjustment.

The PARC was simulated also with forced dual-stream transmission, which ignores the effect of fallback mode.

3. SIMULATION RESULTS

Average cell throughputs are presented in the following figure 1.

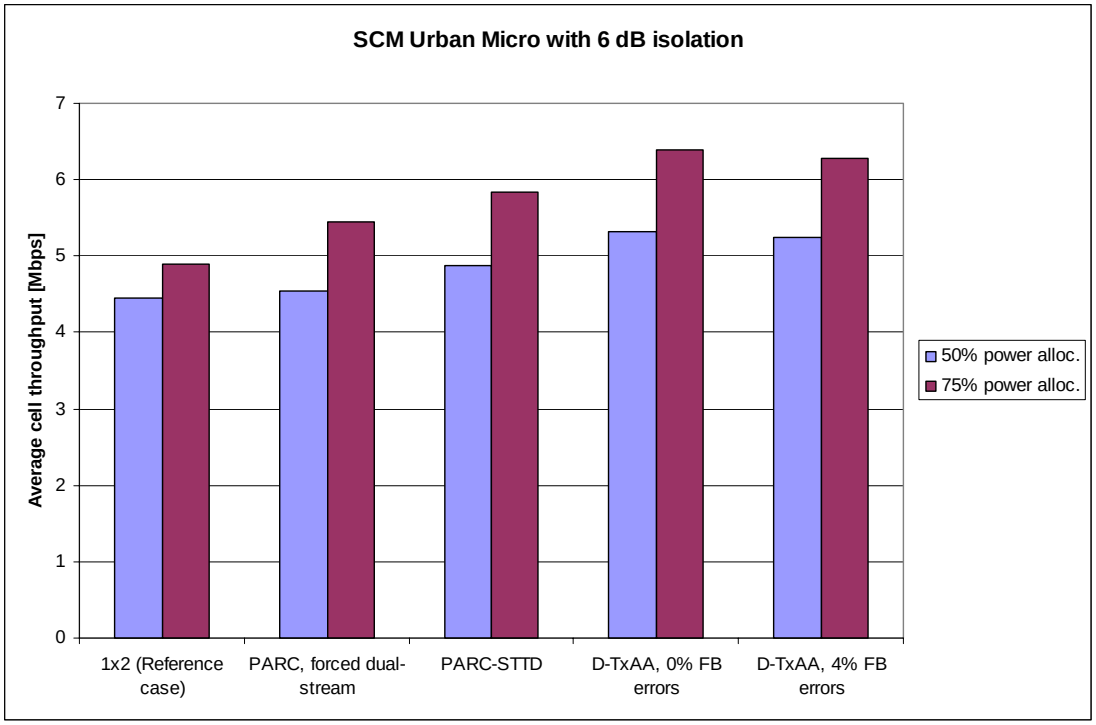

Figure 1. Average cell throughputs with 50% and 75% HSDPA power allocation.

The table 1 presents the system level gains for HSDPA with MIMO.

Table 1. Average cell throughput and relative MIMO gain

Scheme	Transmit power	Average cell throughput [Mbps]	Relative gain
1x2 (Reference case)	50 %	4.45	NA
PARC, forced dual-stream	50 %	4.54	2.0 %
PARC-STTD	50 %	4.87	9.4 %
D-TxAA, 0% FB errors	50 %	5.32	19.6 %
D-TxAA, 4% FB errors	50 %	5.25	18.0 %
1x2 (Reference case)	75 %	4.89	NA
PARC, forced dual-stream	75 %	5.45	11.5 %
PARC-STTD	75 %	5.83	19.2 %
D-TxAA, 0% FB errors	75 %	6.39	30.7 %
D-TxAA, 4% FB errors	75 %	6.28	28.4 %

4. CONCLUSION

When logical choice of R99 fallback modes is included in the simulations, the D-TxAA clearly outperforms the PARC. The D-TxAA gain is still significant with realistic amount of feedback errors. Also, retaining the uplink control channel enables further evolution of the HSDPA MIMO. Therefore, we propose that D-TxAA will be selected as the HSDPA MIMO scheme.

REFERENCES

[1] RP-060002, Report of the 30th 3GPP TSG-RAN meeting (St Julian, Malta, 29 November – 2 December 2005)

[2] Report of the 31st 3GPP TSG-RAN meeting (Sanya, China 8 – 10 March 2006)

[3] R1-051626, "Reference scenario for the selection of the UTRA MIMO scheme", Soul, Korea, November 2005.

[4] 3GPP TR 25.996 (V6.1.0), "Spatial channel model for Multiple Input Multiple Output (MIMO) simulations"

[5] R1-060708, "Selection of a Rel-7 MIMO scheme for the upcoming evaluation phase", Denver, US, February 2006

Annex A:

Table 2. System level simulation parameters

Parameter	Value
Cellular layout	19 Node-B, 3-sector cell sites
Antenna horizontal pattern	70 deg (-3 dB) with 20 dB FBR (3-cell sites) (as defined in SCM [4])
Site to site distance	1000 m
Propagation model	$L = 34.5 + 38\log_{10}(d)$, according SCM Urban Micro in [4]
Power allocated to HS-PDSCH transmission, excluding associated HS-SCCH signaling	Max. 50 % of total cell power Max. 75 % of total cell power
CPICH power	Pilot power is 10% of total Node B transmission power
Slow fading	Log normal distribution (as defined in SCM [4])
Standard deviation of slow fading	10 dB
Correlation between sectors	1.0
Correlation between sites	0.5
Carrier frequency	1900 MHz
BS antenna gain	as defined in SCM [4]
UE antenna gain	0 dBi
UE noise figure	9 dB
Thermal noise density	-174 dBm/Hz
Fast HARQ scheme	Chase Combining, 6 HARQ processes
Number of retransmissions	3 (in addition to initial transmission)
BS total Tx power	38 dBm
HSDPA slot length	2 msec
HS-SCCH Decoding	Ideal
CQI feedback delay	3 TTIs
FBI errors	0 %, 4 %
MCS selection	Default criterion:10% initial transmission BLER, can be selected as appropriate for the investigated transmission scheme
ACK/NACK feedback	Error-free
Antenna correlation	Implicitly covered by Urban Micro models as given in Table 5.1 in [4]
Speed	3 km/h
Packet scheduler	Proportional fair
Traffic model	Full buffer