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Title: HSDPA MIMO system performance results

Document for: Discussion

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1. INTRODUCTION

In this document, we provide system simulation results for HSDPA MIMO for evaluating the impact of receiver selection to system performance. The considered HSDPA MIMO scheme is 2x2 PARC, and performance impacts have been studied in the micro urban scenario defined in [1] using the total cell throughput as the performance criteria.

2. SIMULATIONS ASSUMPTIONS

The simulation parameters are in line with the scenario presented in [1] including

- 6 dB isolation to non-serving sites
- Proportional fair scheduling
- Full buffer traffic model
- 50% and 75% HSDPA transmit power allocation
- LMMSE or SIC receiver
- 10 code category UEs

The system simulation model for SIC receiver assumes that the SIC receiver operates only on HS-DSCH signal ignoring other own cell signals, e.g., DPCH signals. The SIC receiver removes *completely* the interference caused by the better quality MIMO stream from the weaker stream. In that respect, the used SIC receiver model is a model for an ideal SIC receiver. The non-MIMO signals were transmitted from both antennas using STTD diversity mode. The considered PARC scheme is 2x2 PARC with forced dual-stream transmission, which ignores the effect of fallback modes. In theory, this PARC modification should benefit most from SIC type of receiver.

Note, that SIC receiver is not devoted to PARC type of MIMO only, but it can be also used with D-TxAA MIMO.

3. SIMULATION RESULTS

Average cell throughputs are presented in the following figure 1.

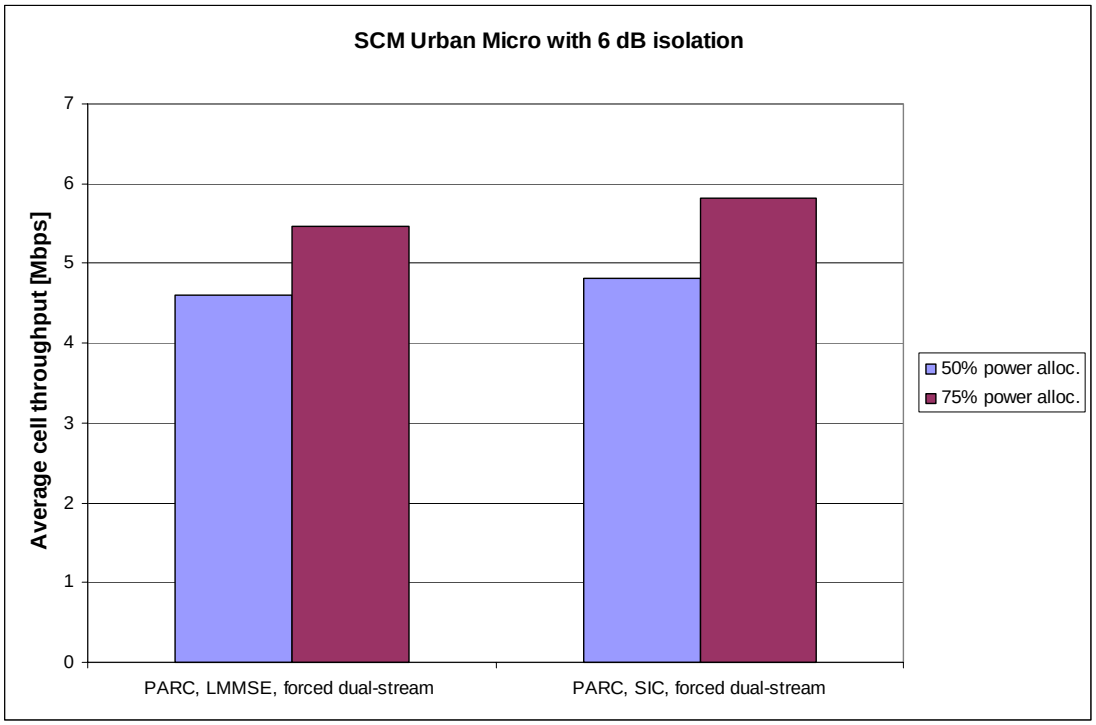

Figure 1. Average cell throughputs with 50% and 75 % HSDPA power allocation

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

Table 1. Average cell throughput and relative SIC gain

Scheme	Transmit power	Average cell throughput [Mbps]	Relative gain (LMMSE vs SIC)
PARC, LMMSE, forced dual-stream	50 %	4.60	NA
PARC, SIC, forced dual-stream	50 %	4.82	4.8 %
PARC, LMMSE, forced dual-stream	75 %	5.47	NA
PARC, SIC, forced dual-stream	75 %	5.82	6.4 %

4. CONCLUSION

The simulation results indicate that SIC performance gain over linear LMMSE receiver is sensitive to assumptions on portion of the cell power allocated for HSDPA MIMO, and implicitly to assumption on which portion of own cell signals cannot be used for interference cancellation process. According the simulation results, SIC performance gain is less than 7% assuming an ideal SIC model for system simulations. It is expected that SIC performance gains in cell throughputs would be further reduced if rank adaptation would be assumed. Furthermore in practise, non-idealities in the receiver (channel estimation inaccuracy etc.) will reduce SIC gain further.

REFERENCES

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

[2] 3GPP TR 25.996 (V6.1.0), “Spatial channel model for Multiple Input Multiple Output (MIMO) simulations”

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 [2])
Site to site distance	1000 m
Propagation model	$L = 34.5 + 38\log_{10}(d)$, according SCM Urban Micro in [2]
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 [2])
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 [2]
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
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 [2]
Speed	3 km/h
Packet scheduler	Proportional fair
Traffic model	Full buffer