TSG-RAN Working Group 1 Meeting #19 ***TSGR1#19(01)0207***

Las Vegas, USA
February 27- March 2, 2001

Source:	**Panasonic**
Title:	**System Level simulation results of HSDPA estimating downlink channel quality from the transmit power of DPCH**
Agenda Item:	**AH24 (HSDPA)**
Document for:	**Discussion**

1. Introduction

This contribution follows up on Tdoc R1-01-0004 [5] regarding the use of DPCH transmit power information to estimate downlink channel quality. This contribution also presents more elaborate simulation results responding to comments made in the previous meeting. Those comments are described in Tdoc R1-01-0188 [6], chapter 7.1.2 Reviewal of T-docs related HSDPA, pp.13, note (*5).

The simulation results of this contribution show that the proposed scheme works well and that the reliability of the proposed method is good.

2. Description of method

2.1 Discussion about downlink channel quality estimation

For downlink channel estimation, several schemes have been discussed. [1][2]

- UE reports CIR information explicitly
- NodeB estimates down link channel quality from the transmit power of DPCH

Another option is the combination of them.

The first scheme can reflect the downlink channel quality explicitly. This scheme requires uplink resource for the transmission of CIR information and transmission errors may cause the degradation of throughput .

In this contribution we present the comparative simulation results of two methods. In the proposed scheme NodeB estimates downlink channel quality from the transmit power of the associated DPCH for each applies MCS selection and scheduling accordingly.

2.2 Proposed downlink channel quality estimation method

Downlink channel quality is estimated from the transmit power of the associated DPCH without any explicit information from UE. [5] The procedure, incorporating scheduling, is described by the future steps.

1. TPC command for downlink associated DPCH for HS-DSCH is sent from UE.
2. NodeB decides transmit power of associated DPCH according to the TPC command.
3. NodeB selects the UE that requires the lowest power of DPCH.
4. NodeB selects MCS for the UE according to the transmission power of the UE.
5. NodeB transmits HS-DSCH packet to UE until packet has been sent.

3. Simulation assumptions

The following assumptions are added in order to respond to the comments made in the previous meeting. [6] Other detailed simulation assumptions are identical to the common assumptions and are shown in Table. 4 through Table. 6.

-UE velocity of 40km/h and 120km/h are considered.
-TPC error ratio is set to 4%.
-CIR measurement error in UE is introduced as a statistical variable with 1dB sigma.
-CIR reporting erasure is set to 1%.

4. Simulation results

Annex A shows simulation results of throughput. Annex. B shows the probability of soft handover. Annex C shows distribution of MCS levels. Annex D shows simulation assumptions according to the common assumptions.

The following considerations can be noted from the simulation results.

- Slight incensement in the throughput

  Service throughput and packet call throughput increase a little when transmit power of DPCH is used for estimation of the downlink channel quality. The simulation results are shown in Table. 1 and Table. 2.

- Soft handover on DPCH doesn't affect

  The probability distribution of number of active set of Node B is shown in Table. 3. When the estimation is performed using the DPCH transmit power, the effect of soft handover of DPCH must be considered.

  However the effect of soft handover for downlink channel estimation using transmit power of DSCH is not high.

  The reason is that the diversity gain between DPCH and DSCH is not so big, which is estimated as the diversity gain difference between antenna selection diversity and maximum ratio combining diversity. DPCH can achieve diversity gain with soft handover which is achieved by maximum ratio combining diversity, while DSCH can achieve diversity gain with Fast Cell Selection which is achieved by antenna selection diversity.

  Moreover the soft handover of DPCH doesn't affect the throughput drastically especially when Max C/I scheduler is used. It is because Node B doesn't allocate high MCS to UE's that are in SHO, and those UE's are not selected by Max C/I scheduler. The reason is that DPCH Tx power in SHO is relatively higher than that for the UE's which are in the centre of the cell.

- Use of the proposed scheme will have benefit from reduction of MCS

  When the number of MCS is reduced, difference in the throughput between proposed scheme and explicit CIR report scheme will decrease. The reduction of the number of MCS set has been discussed e.g. from seven MCS to four MCS. When the number of MCS is reduced the throughput difference between proposed scheme and explicit CIR reporting scheme will decrease, because more coarse MCS selection can be allowed for Node B when the number of MCS set is reduced.

5. Conclusion

We propose that as long as there is an associated DPCH for each DSCH user CIR reporting is not used but rather the DPCH transmit power level is used to estimate channel quality and determine MCS level. The throughput achieved with this method has been shown to be at least as good as with CIR reporting and potentially significant savings are achieved in terms of uplink capacity by not having to report the CIR.

6. References

[1] R1-00-1399, Motorola "Comments on Lucent's proposal on HSDPA" Stockholm, Sweden, November 21-24, 2000

[2] R1-00-1434, Ericsson "Comments and discussion on HSDPA proposals" Stockholm, Sweden, November 21-24, 2000

[3] R1-00-1094, Nokia, Ericsson, Motorola "Common HSDPA system simulation assumptions" Berlin, Germany, August 22-25, 2000

[4] R1-00-0909, Motorola "Evaluation Methods for High Speed Downlink Packet Access (HSDPA) " Oulu, Finland, July 4 -7, 2000

[5] R1-01-0004, Panasonic "System Level simulation results of HSDPA estimating downlink channel quality from the transmit power of DPCH" Boston, USA, January 15-18, 2001

[6] R1-01-0188, Secretary "Draft minutes of WG1 #18 meeting" Las Vegas, USA, Feburary27-March2, 2001

Annex A. Throughput results

Table. 1 Throughput Performance (37users in each sector) in 40km/h

Downlink channel quality estimation	Average Throughput			
	OTA (bps)	Service (bps)	Packet call (bps)	Utilization (%)
Explicit CIR report from UE	951,035	950,955	254,909	100
DPCH transmit power at NodeB	1,038,284	1,038,198	348,860	100

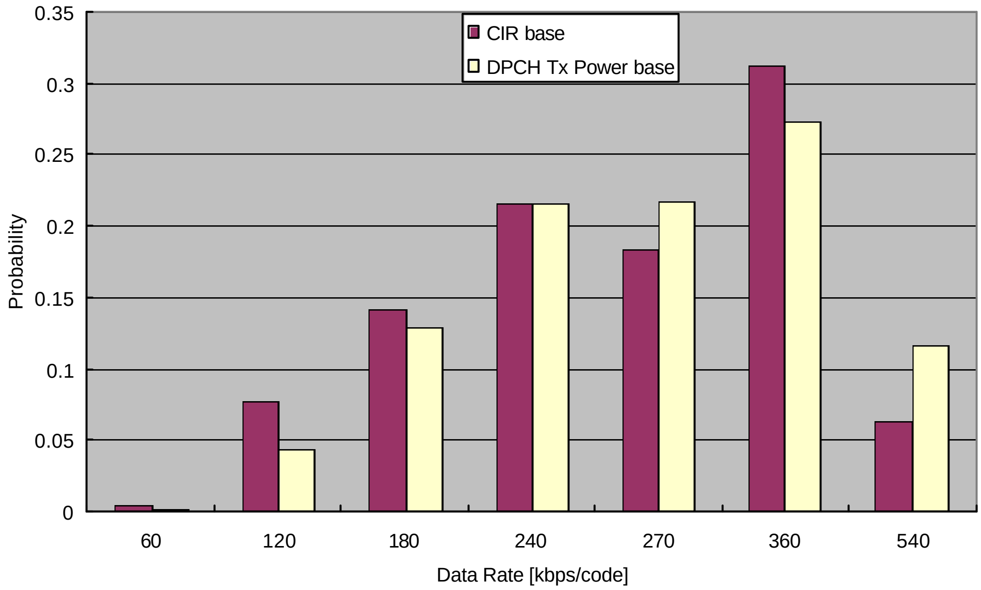
Table. 2 Throughput Performance (37users in each sector) in 120km/h

Downlink channel quality estimation	Average Throughput			
	OTA (bps)	Service (bps)	Packet call (bps)	Utilization (%)
Explicit CIR report from UE	993,902	993,799	242,759	100
DPCH transmit power at NodeB	1,026,301	1,026,215	338,094	100

Annex B. SHO probabilities

Table. 3 Probabilities of Number of active NodeB

UE's speed		40km/h	120km/h
Number of active NodeB	1	69%	69%
	2	21%	21%
	3	10%	10%



Annex C. Distribution of MCS levels

Fig. 1 Distribution of MCS level in 40km/h

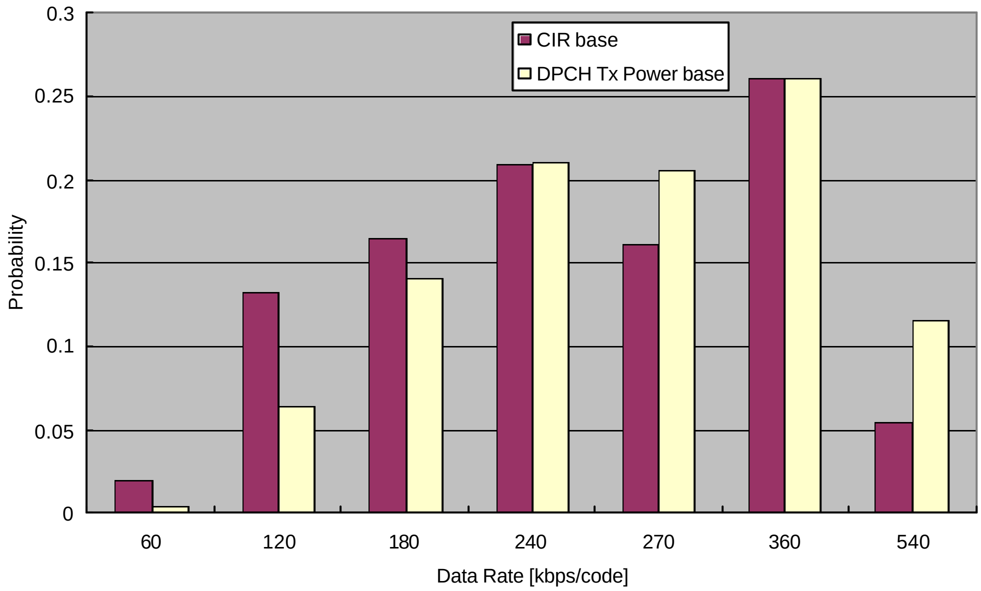


Fig. 2 Distribution of MCS level in 120km/h

Annex D. Detailed simulation assumptions

The highlighted points are considered responding to the comments in the last meeting.

Table. 4 Simulation parameters

Parameter	**Explanation/Assumption**	**Comments**
Cellular layout	Hexagonal grid, 3-sector sites	7 cell with wrapping
Site to Site distance	2800 m	
Antenna pattern	As proposed in [4]	Only horizontal pattern specified
Propagation model	$L = 128.1 + 37.6\ Log_{10}(R)$	R in kilometres
CPICH power	-10 dB	
Other common channels	- 10 dB	
Power allocated to HSDPA transmission, including associated signaling	Max. 80% of total cell power HS-DSCH max 20ch (-14dB per code)	
Slow fading	Similar to UMTS 30.03, B 1.4.1.4	
Std. deviation of slow fading	8.0 dB	
Specify Fast Fading model	Jakes spectrum	Generated by Filter approach
Correlation between sectors	1.0	
Correlation between sites	0.5	
Correlation distance of slow fading	50 m	See D,4 in UMTS 30.03.
Carrier frequency	2000 MHz	
BS antenna gain UE antenna gain	14 dB 0 dBi	
UE noise figure	9 dB	
BS total Tx power	44 dBm	
Active set size	3	Maximum size
STTD	Disabled	
Fast HARQ scheme	Chase combining	Dual stop-and-wait
Frame length of HARQ	3.33ms	
HARQ feedback erasure rate	0%	
Max. # of retransmissions	5	Retransmissions by fast HARQ
FCSS feedback erasure rate	1%	
HS-DSCH frame length	3.33ms	5slots
Scheduler	Maximum C/I scheduler Minimum DPCH power scheduler	See [3]
Call model	Modified ETSI	See [3]
Number of users	37 in each sector	

Channel Model	1) 40km/h, single path Rayleigh ray 2) 120km/h, single path Rayleigh ray	

Table. 5 shows the simulation parameters when Node B estimates channel from DPCH transmit power without explicit CIR report from UE.

Table. 5 Simulation parameters when Node B estimates channel from DPCH transmit power

TPC command error	4% error	
CIR measurement error at UE	1dB standard deviation	

Table. 6 shows the simulation parameters when UE reports CIR information explicitly to NodeB. CIR is calculated using CPICH.

Table. 6 Simulation parameters when UE reports CIR information

CPICH measurement transmission delay	1frame	
CPICH measurement rate	Once per 3.33 ms	
CPICH measurement report erasure rate	1%	
CPICH measurement error	1dB standard deviation	