TSG-RAN Working Group 1 Meeting #18 TSGR1#18(01) 0050

Boston, Massachusetts, USA
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Agenda Item: AH24: High Speed Downlink Packet Access
Source: Wiscom Technologies
Title: Performance of AMCS and HARQ for HSDPA in the non-ideal measurement and feedback situations
Document for: Discussion

1 Introduction

In order to evaluate the performance of the basic features proposed for HSDPA (AMCS, fast HARQ and FCSS), the simulation cases are defined in the latest HSDPA TR [1]. According to the simulation case 1 listed in Section 13.3.7.1 of [1], we evaluate the performance of adaptive modulation and coding schemes (AMCS) and fast HARQ. In this contribution, we present the simulation results in the non-ideal measurement and feedback situations for HSDPA and compare them with the performance in the ideal case.

2 Simulation parameters

Simulation parameters are set according to the simulation case 1 in Section 13.3.7.1 of [1] and listed below.

Parameter	Explanation/Assumption	Comments
CPICH power	-10 dB	10% of total cell power
Other channels	- 7 dB	20% of total cell power
Ec/Ior for HSDPA transmission	-1.55 dB	70% of total cell power
MCS selection rule	CPICH measurement	
MCS update rate	once per 3.33ms (5-slot frame)	
CPICH measurement transmission delay	1 frame	
MCS selection delay	1 frame after receiving measurement report	
Std. dev. of CPICH measurement error	0dB, 3dB	
CPICH measurement rate	once per 3.33ms	
CPICH measurement report error rate	0%, 1%	Independent errors. The report error is treated as unknown value.
Fast HARQ feedback error rate	0%, 4%	Independent errors. The feedback error is treated as NACK.
Max. # of retransmissions	15	Retransmissions by fast HARQ
MCS levels	QPSK 1/2 & 3/4, 16QAM1/2 & 3/4, 64QAM 3/4.	
Fast HARQ scheme	2-channel stop-and-wait with Chase combining	The effective SIR is the sum of SIR's of all combining packets.
STTD	On	
Carrier frequency	2 GHz	
Specify Fast Fading model	1-path Rayleigh with speed 3 kmph	Jakes model

3 Simulation Results

Figure 1 shows the throughput versus Ec/Ioc with a single code for HSDPA in the situations of ideal and non-ideal measurement and feedback. In the ideal case, the standard deviation of CPICH measurement error is 0dB, the CPICH measurement report and HARQ feedback are both error free. In the non-ideal case, the standard deviation of CPICH measurement error is 3dB, the error rate of CPICH measurement report and HARQ feedback are 1% and 4% respectively. When the CPICH measurement report error occurs, it is treated as an unknown value and ignored. Thus the MCS selection will be based on the previous CPICH measurement report. Assuming the CRC prediction on HARQ ACK/NACK feedback, the HARQ feedback error is treated the same as NACK. It is observed that at slow vehicle speed the performance between the ideal and non-ideal case is about 1 to 2 dB for most Ec/Ioc except very low values (less than –15dB). To further understand this performance difference, we evaluate the effect of different error separately. Figure 2-4 shows the throughput losses due to CPICH measurement error, HARQ feedback error and CPICH measurement report error respectively. Comparing with the ideal case, in the typical range Ec/Ioc (-15dB to 5dB), the performance loss is mainly due to CPICH measurement error and therefore possible unsuitable MCS level. For high Ec/Ioc, the HARQ feedback error will cause unnecessary retransmission and reduces the throughput. The simulated 1% CPICH measurement report error does not cause any throughput loss due to slow changing channel in this case. In Figure 4, the two curves overlap each other.

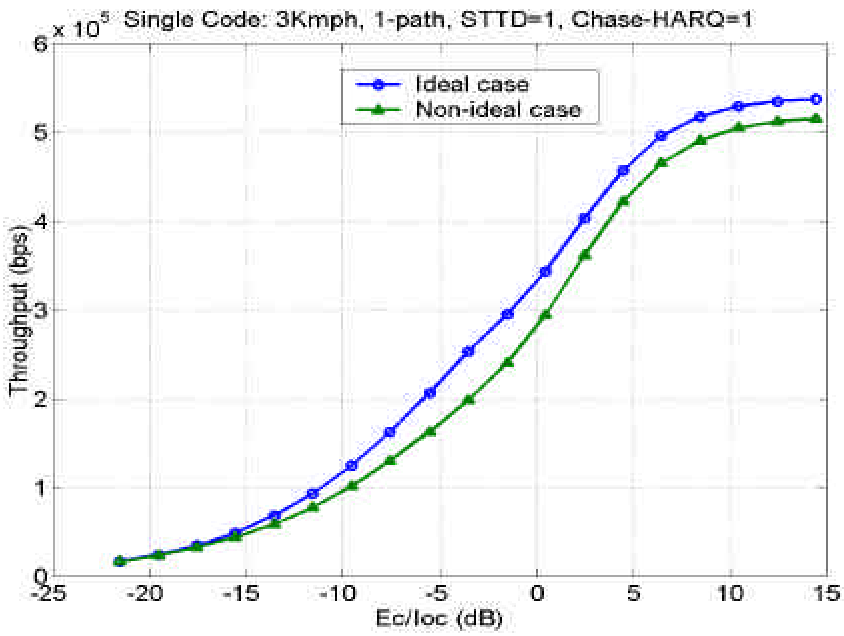

Figure 1. Throughput versus Ec/Ioc for ideal and non-ideal measurement and feedback cases. 1-path Rayleigh channel, speed = 3kmph, STTD on, HARQ with Chase Combining.

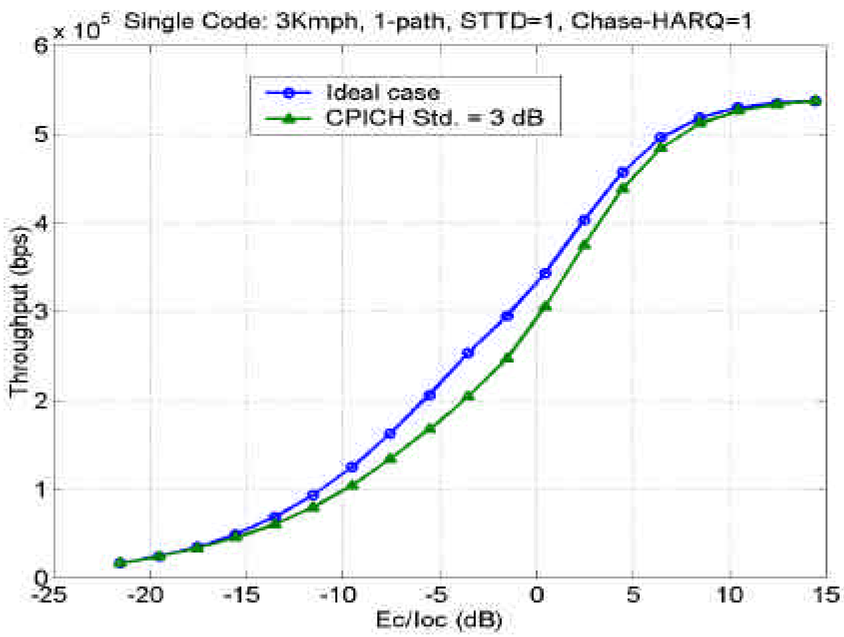

Figure 2. Throughput versus Ec/Ioc for ideal case and measurement error only case. 1-path Rayleigh channel, speed = 3kmph, STTD on, HARQ with Chase Combining.

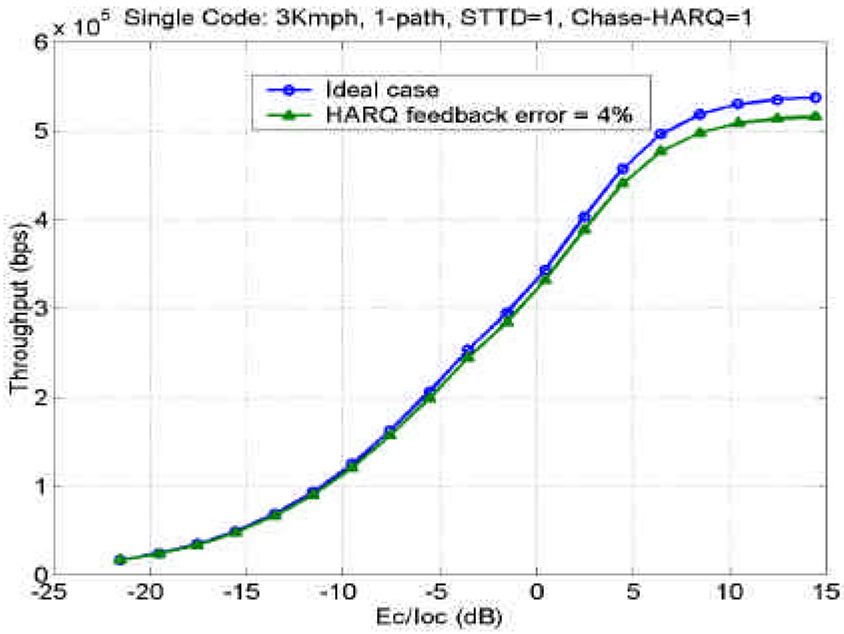

Figure 3. Throughput versus Ec/Ioc for ideal case and HARQ feedback error only (4%) case. 1-path Rayleigh channel, speed = 3kmph, STTD on, HARQ with Chase Combining.

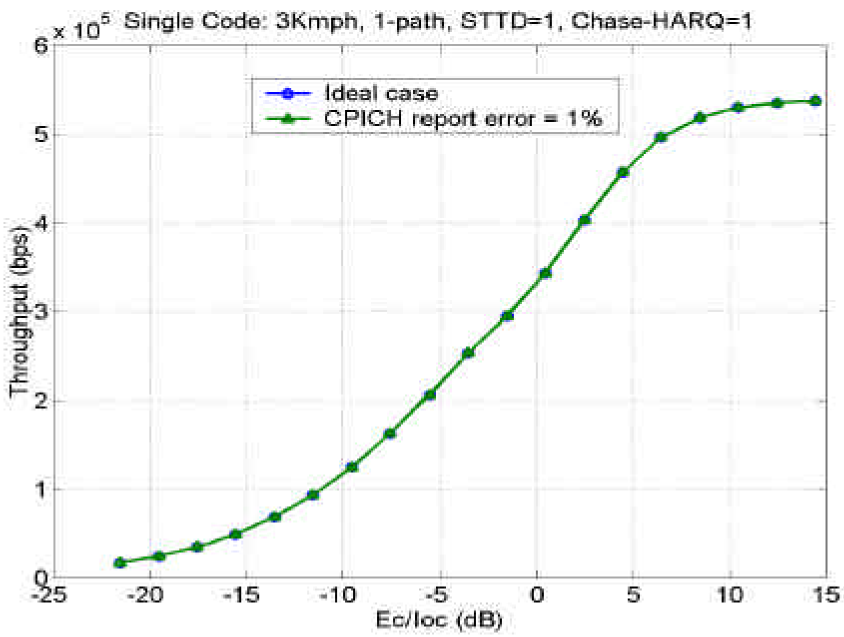

Figure 4. Throughput versus Ec/Ioc for ideal case and measurement report error (1%) only case. 1-path Rayleigh channel, speed = 3kmph, STTD on, HARQ with Chase Combining.

4 Conclusion

We presented the simulation results of AMCS and HARQ for HSDPA in the non-ideal measurement and feedback situations. For the typical value of Ec/Ioc, the channel measurement accuracy has large impact on the throughput. It is observed that at slow vehicle speed the performance between the ideal and non-ideal case is about 1 to 2 dB for most Ec/Ioc except very low values (less than –15dB). It thus suggests that at slow vehicle speed, longer time CPICH average might be necessary for more accurate measurement to improve the throughput. However, at fast vehicle speed, the long time average might fail to track the channel condition closely. Thus, more advanced MCS selection rule [4] might include both long term and short term channel average as well as Doppler frequency estimation to improve the AMCS and HARQ performance. Further investigation is needed in this topic.

5 References

[1] 3GPP TR V0.2.0 (2000-05), Physical Layer Aspects of UTRA High Speed Downlink Packet, 3GPP Release 2000, TSG-RAN Working Group1 meeting#18, TSGR1#18(01)xxxx, Boston, Massachusetts, USA, 15th-18th Jan. 2001.

[2] R1-00-1326, Wiscom Technologies, "Link level simulation results for HSDPA", TSGR1#17, Stockholm, Sweden, November 21-24, 2000.

[3] R1-00-0051, Wiscom Technologies, "Effect of feedback delay on the performance of AMCS and HARQ for HSDPA", TSGR1#18, Boston, MA, USA, January 15-19, 2001.

[4] TSG RAN R1-01-0025, **"**On the Need of Long-Range Prediction of Channel Estimation in HSDPA and Text Proposal," TSGR1#18, Boston, MA, USA, January 15-19, 2001.