TSG-RAN Working Group 1 Meeting #18 TSGR1#18 (01)0051

Boston, Massachusetts, USA
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Agenda Item: AH24: High Speed Downlink Packet Access
Source: Wiscom Technologies
Title: Effect of MCS selection delay on the performance of AMCS and HARQ for HSDPA
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 of the effect of MCS selection delay on the performance of AMCS and HARQ for HSDPA.

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 pow er
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	0, 1, 2 frame	
MCS selection delay	0, 1, 2 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, 15 kmph	Jakes model

3 Simulation Results

Figure 1 and 2 show the throughput versus Ec/Ioc with a single code for HSDPA for different MCS selection delays in ideal and non-ideal measurement and feedback case respectively. The vehicle speed is 3kmph for Figure 1 and 2. Here the total MCS selection delay means the time difference between the CPICH measurement at UE and MCS selection applied at Node B. The delay may come from the processing time at UE, processing time at Node B, the transmission delay, and the multiplexing and scheduling delay. The zero frame delay is obviously unrealistic and is just used for comparison. Both ideal and non-ideal measurement and feedback cases are considered [3]. 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. Notice that at very low vehicle speed case, limited MCS selection delay does not cause significant performance loss due to slow changing channel. Figure 3 and 4 shows the similar simulation results for higher vehicle speed, 15kmph. Here the throughput loss due to MCS selection delay is about 1 dB or 22% throughput loss. If the delay increases further compared with the channel correlation time, the performance loss is expected to be larger. In that case, the technique to predict the channel condition as proposed in previous contribution [4] will help to reduce the perfomance loss due to MCS selection delay as well as to improve the channel estimation.

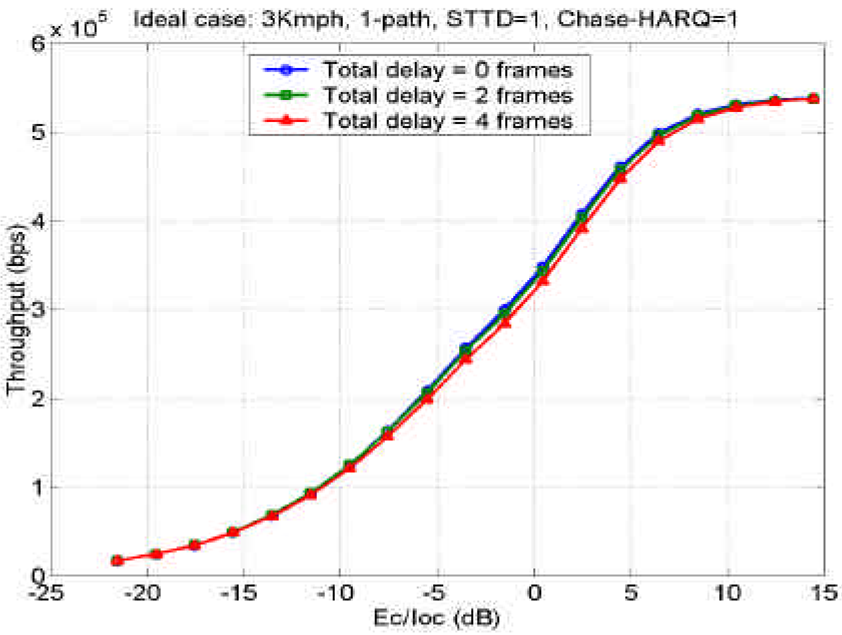

Figure 1. Throughput versus Ec/Ioc for different MCS selection delay in ideal measurement and feedback cases. 1-path Rayleigh channel, speed = 3kmph, STTD on, HARQ with Chase Combining.

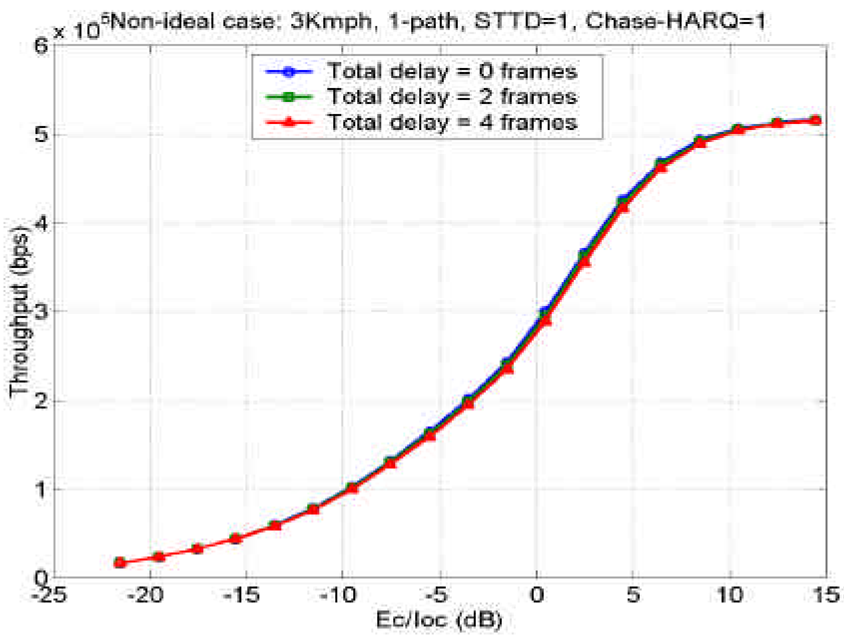

Figure 2. Throughput versus Ec/Ioc for different MCS selection delay in non-ideal measurement and feedback cases. 1-path Rayleigh channel, speed = 3kmph, STTD on, HARQ with Chase Combining.

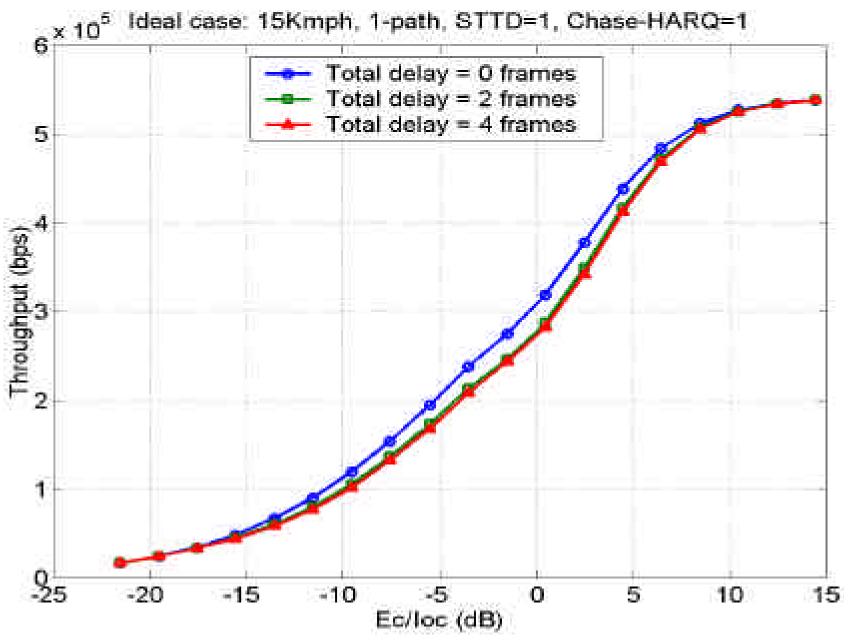

Figure 3. Throughput versus Ec/Ioc for different MCS selection delay in ideal measurement and feedback cases. 1-path Rayleigh channel, speed = 15kmph, STTD on, HARQ with Chase Combining.

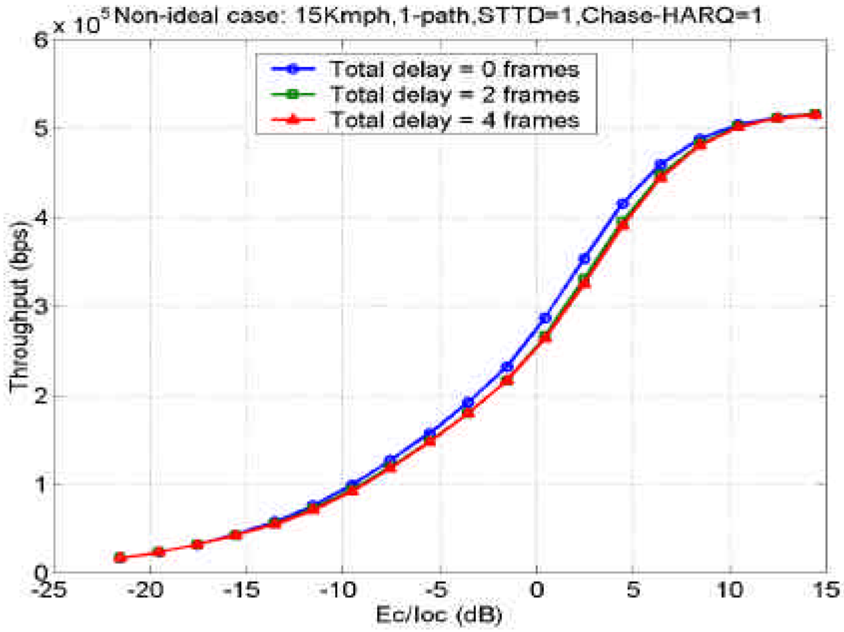

Figure 4. Throughput versus Ec/Ioc for different MCS selection delay in non-ideal measurement and feedback cases. 1-path Rayleigh channel, speed = 15kmph, STTD on, HARQ with Chase Combining.

4 Conclusion

We evaluate the effect of MCS selection delay on the performance of AMCS and HARQ for HSDPA. The perfomance loss due to the MCS delay is not significant at very slow vehicle speed. However it increases at higher vehicle speeds and larger MCS selection delays. The throughput loss due to MCS selection delay is about 1 dB or 22% throughput loss. Thus the technique to predict the channel condition might help to reduce such performance loss. The channel prediction technique [4, 5] can be incorporated with the MCS selection rule to improve the AMCS and HARQ performance in HSDPA.

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

[3] TSG RAN R1-01-0050, Wiscom Technologies, "Performance of AMCS and HARQ for HSDPA in the non-ideal measurement and feedback situations", TSGR1#18, Boston, MA, USA, January 15-19, 2001.

[4] TSG RAN R1-00-1393, Wiscom Technologies, "Use of Long-Range Prediction for channel estimation and its application in HSDPA," TSGR1#17, Stocholm, Sweden, November 21-24, 2000.

[5] 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.