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Agenda Item: AH24: High Speed Downlink Packet Access
Source: **Wiscom Technologies**
Title: Link Level Simulation Results of HSDPA in TDD Mode
Document for: Discussion

1 Introduction

Previous studies of HSDPA focus mainly on FDD mode [1-4,6]. Recently, HSDPA in TDD mode has been proposed and included in the HSDPA TR [1]. This contribution presents the link level simulation results of HSDPA in TDD mode.

2 Simulation parameters

2.1 General simulation parameters

General simulation parameters are listed in Table 1. In this contribution, the simulations are run in AWGN channel and ideal channel estimation is assumed. Based on the studies of optimum number of MCS levels in FDD, simulations of 5 MCS levels are conducted, as shown in the table. Considering the trade off between fast adaptive MCS and overhead, the 4-time-slot HSDPA frame length is selected for TDD mode. The details of frame structure and frame bit size are shown in Figure 1 and Table 2.

Table 1. General simulation parameters

Parameter	Value	Comments
Propagation conditions	AWGN	
CPICH power	10%(-10dB)	
Ec/Ior	-1.55dB	70% of total transmission power
Closed loop Power Control	Off	
HSDPA frame Length	2.67 ms (4 slots)	In a radio frame, total 12 slots are used for downlink
Ior/Ioc	Variable	
Channel Estimation	Ideal	
Channel coding	Turbo code (PCCC)	Rate Matching from 1/3 to 1/2 and 3/4
MCS levels	QPSK 1/2 & 3/4, 16QAM1/2 & 3/4, 64QAM 3/4	
Tail bits	6	
Max no. of iterations for Turbo Coder	8	
Metric for Turbo Coder	Max-Log-MAP	
Input to Turbo Decoder	Soft	
Turbo Interleaver	per Release-99	
Number of Rake fingers	1	
HARQ	None	
Information Bit Rates (Kbps)	As defined	
Number of Multicodes Simulated	1	Simulate only 1 code
TFCI model	None	
STTD	Off	
Information Bit Rates (Kbps)	As defined	
Chip Rate	3.84 Mcps	high chip rate TDD mode
SF	16	
Burst Type	Type 2	3GPP TS 25.221
Other L1 Parameters	per Release-99	

2.2 Frame structure and information bit rate

In 3GPP TDD mode, the radio frame has duration of 10 ms. One radio frame consists of 15 time slots, each allocated to either the uplink or the downlink. With such flexibility, more time slots can be allocated for downlink for asymmetric traffic in HSDPA. Considering total 12 time slots in a radio frame used for HSDPA, 12 time slots can form a single HSDPA frame. But it will prevent the fast adaptive MCS selection. Thus we select a 4-time-slot HSDPA frame with a structure [5] shown in Figure 1. The HSDPA frame duration is 2.67ms. The uplink slots between HSDPA frames can be used for channel quality measurement, ARQ feedback from UE and any other uplink. Such frame structure allows fast adaptive MCS selection with reasonable overhead. It is comparable to the commonly used 5-time-slot HSDPA frame in FDD mode. Table 2 shows the information bit per frame and the information date rate for different MCS schemes.

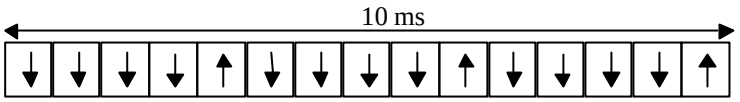

Figure 1. HSDPA frame configuration in TDD mode.

Table 2. Information bit rate for HSDPA frame length of 2.67 msec

Chip Rate=3.84 Mcps, SF=16, Frame length=2.67ms		12 Codes		1 Code	
Modulation	Code Rate	Info Rate (Mbps)	Info bits/frame	Info Rate (kbps)	Info bits/frame
64	3/4	8.9424	29808	745.2	2484
16	3/4	5.9616	19872	496.8	1656
16	1/2	3.9744	13248	331.2	1104
4	3/4	2.9808	9936	248.4	828
4	1/2	1.9872	6624	165.6	552

4 Simulation Results

Figure 2 shows the frame error rate versus Ec/Ioc in AWGN channel for different MCS schemes. More detailed plots of different MCS are shown in Figure3-5 for easy reference.

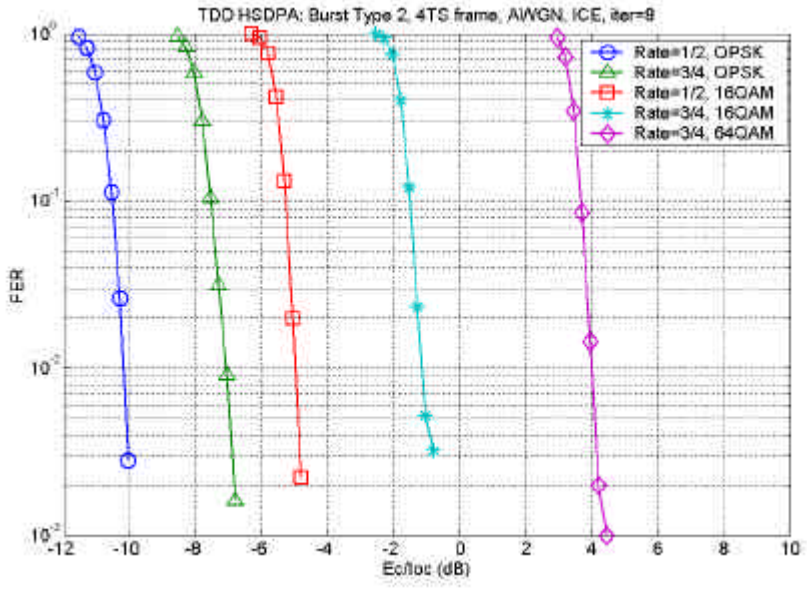

Figure 2. FER versus Ec/Ioc in AWGN channel for different MCS schemes.

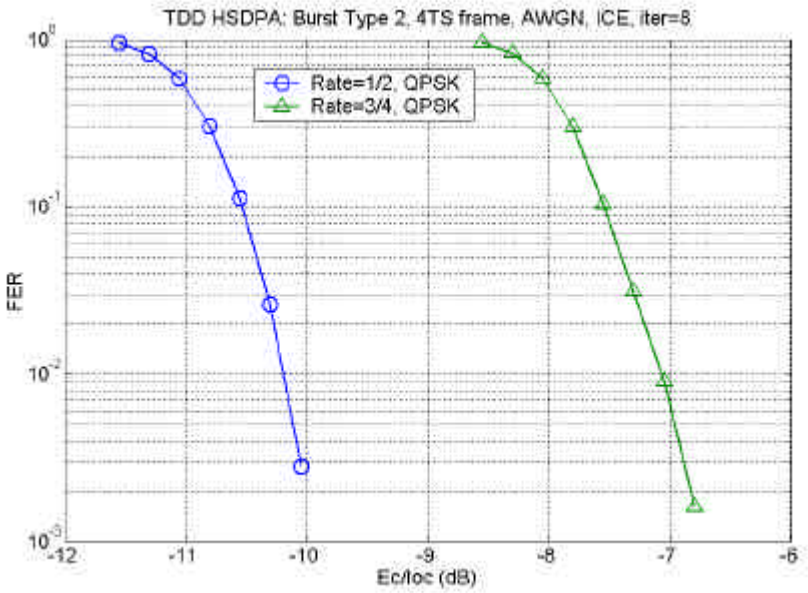

Figure 3. FER versus Ec/Ioc. AWGN channel, QPSK.

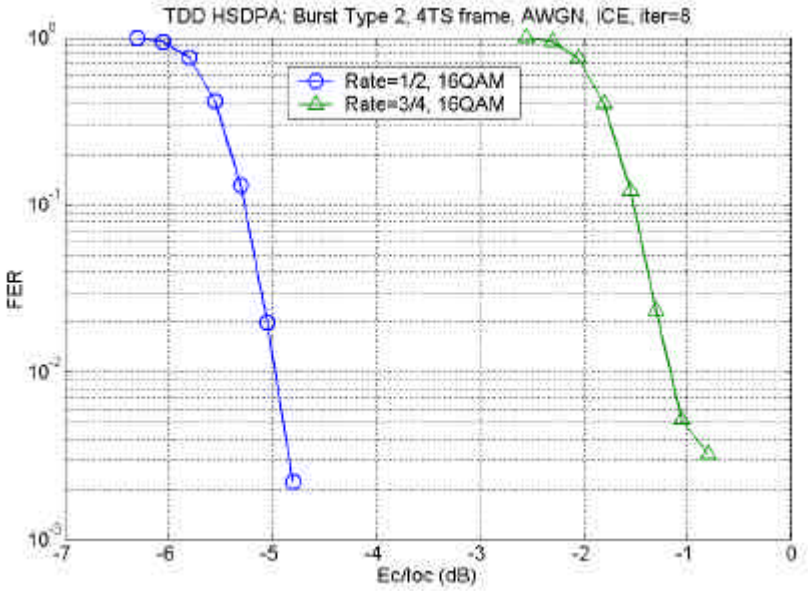

Figure 4. FER versus Ec/Ioc. AWGN channel, 16QAM.

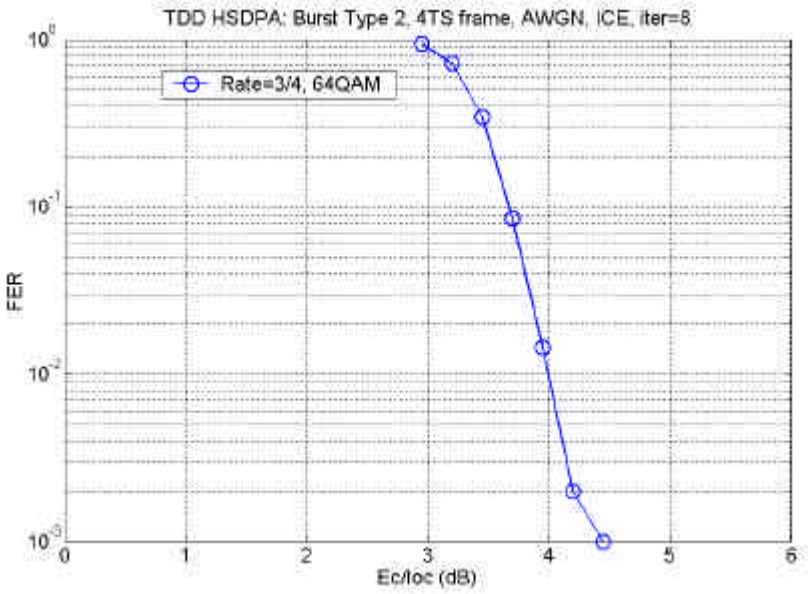

Figure 4. FER versus Ec/Ioc. AWGN channel, 64QAM.

3 Conclusion

We presented the link level simulation results of different MCS schems for HSDPA in TDD mode in AWGN channel. It can be used a baseline reference for further study and system level simulations. A frame structure of HSDPA in TDD mode is proposed.

4 References

[1] 3GPP TR V0.5.0 (2000-05), Physical Layer Aspects of UTRA High Speed Downlink Packet Access, 3GPP Release 2000, TSG-RAN Working Group1 meeting#18, TSGR1#18, R1-01-0186, 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 R1-01-0025, Wiscom Technologies, **“**On the Need of Long-Range Prediction of Channel Estimation in HSDPA and Text Proposal,” TSGR1#18, Boston, MA, USA, January 15-18, 2001.
[4] TSG RAN R1-01-0136,Wiscom Technologies, "Simulation results for Section 13.3.7.1 of TR 25.848", TSGR1#18, Boston, MA, USA, January 15-18, 2001.
[5] TSG RAN R1-01-0250, Wiscom Technologies, "Proposal of a HSDPA Frame Structure in TDD Mode", TSGR1#19, Las Vegas, U.S.A. February 27- March 2, 2001
[6] TSG RAN R1-01-0249, Wiscom Technologies, “Long-Range Prediction (LRP) of Faded Signals in HSDPA for FDD and TDD,” TSGR1#18, Boston, Massachusetts, USA, Jan. 15-18, 2001.