Radio Communication Systems II, Examination, 17.12.2009

Problem 1. . Explain the following concepts/functions

a) What is Admission control in WCDMA and how does it work?

b) What is the near-far problem? Is it a problem in WCDMA uplink or downlink?

c) Describe WCDMA uplink soft handover and explain the difference between soft handover and softer handover in WCDMA.

Problem 2. Consider uplink of an isolated WCDMA cell. Give the formula for uplink load and solve the following problem: Assume that target noise rise of the cell is 3dB and there are two active 128kbps users in the cell. How many 12.2kbps speech users can be supported (in addition to those two 128kbps data users)? System chip rate is 3.84Mcps, activity factor is 0.67 for speech and 1 for data, and required Eb/No for speech is 5dB and for data 2.5dB.

Problem 3.

a) Name and describe the three main HSPA downlink scheduling approaches.

b) Explain the principle of Hybrid Automatic Repeat Request (HARQ) protocol and describe how Incremental Redundancy and Chase Combining algorithms work.

c) Briefly explain in what way HSPA two-antenna transmission methods (Closed-loop transmit diversity, open-loop transmit diversity and Multiple-Input Multiple-Output (MIMO) improve downlink performance.

Problems 4 and 5 on the next page

Problem 4. Calculate the allowed propagation loss in High-Speed Downlink Shared Channel (HS-DSCH). Give the missing figures related to A-G in your answer and explain how the values were calculated. Are all the parameters in the link budget really needed?

		HS-DSCH 512kbps	
	Transmitter characteristics		
	Transmitter power on HS_DSCH	16	W
	Transmitter power on HS_DSCH	42.0412	dBm
	TX antenna gain	17.4	dBi
	TX cable loss	2	dB
A	**Transmitter EIRP**		**dBm**
	Receiver characteristics		
	Thermal noise density	-173.975	dBm/Hz
	Receiver noise figure	8	dB
B	Receiver noise density		dB
C	Receiver noise power		dBm
D	Spreading gain		dB
	SINR	6	dB
E	Receiver sensitivity		dB
	Load factor	0.75	
F	Interference margin		dB
	RX antenna gain	0	dBi
	RX Body loss	0	dB
	Diversity gain	0	dB
	Fast fading margin	0	dB
	Soft handover gain	0	dB
	Indoor penetration loss	20	dB
	Coverage probability (cell edge)	0.9	
	Shadow fading std deviation	6	dB
	Shadow Fading Margin	0	dB
G	**Allowed propagation loss**		**dB**

Problem 5. LTE concepts/functions

a) Briefly describe the purpose of X2 interface. Why it is important for E-UTRAN?

b) What is the cyclic prefix and why is it used?

c) Name and briefly explain two disadvantages of Orthogonal Frequency Division Multiple Access (OFDMA).

d) Why was Single Carrier Frequency Division Multiple Access (SC-FDMA) selected for LTE uplink instead of OFDMA?

e) Why is LTE scheduling usually more efficient than HSDPA scheduling?