

Radio Communication Systems II, Examination, 12.1.2011

Problem 1. Explain the following concepts/functions

- a) Name WCDMA QoS classes (4) and give an example application for each class.
- b) What are main differences between spreading and scrambling code usage in WCDMA uplink and downlink?
- c) Why it is important that user terminals can receive well P-CPICH (primary common pilot channel) everywhere in the WCDMA network? What is Admission Control in WCDMA and how does it work?

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 20 active 12.2kbps speech users in the cell. How many 64kbps data users can be supported (in addition to those 20 speech users)? System chip rate is 3.84Mcps, activity factor is 0.67 for speech and 1 for data, and required E_b/N_0 for speech is 5dB and for data 2dB.

Problem 3. Multi-antenna methods in WCDMA/HSDPA:

- a) Describe the principles of different multi-antenna methods that can be used in WCDMA/HSDPA (4 different methods).
- b) Describe the difference between diversity gain and coherent combining gain. Why some transmit diversity method may provide coherent combining gain and why some transmit diversity method may provide diversity gain?

Problems 4 and 5 in 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-F 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		
A	Transmitter power on HS_DSCH	12,00 W
	Transmitter power on HS_DSCH	dBm
	TX antenna gain	17,40 dBi
	TX cable loss	2,00 dB
B	Transmitter EIRP	dBm
Receiver characteristics		
	Thermal noise density	-173,98 dBm/Hz
	Receiver noise figure	8,00 dB
	Receiver noise density	-165,98 dBm/Hz
	Receiver noise power	-100,13 dBm
C	Spreading gain	dB
	SINR	5,00 dB
	Receiver sensitivity	dB
D	Load factor	0,50
E	Interference margin	dB
	RX antenna gain	0,00 dBi
	RX Body loss	0,00 dB
	Diversity gain	0,00 dB
	Fast fading margin	0,00 dB
	Soft handover gain	0,00 dB
	Indoor penetration loss	10,00 dB
	Coverage probability (cell edge)	0,90
	Shadow fading std deviation	6,00 dB
	Shadow Fading Margin	7,50 dB
F	Allowed propagation loss	dB

Problem 5. LTE

- Describe main functions of LTE Mobility Management Entity (MME).
- Why SC-FDMA receiver is usually more complex than OFDMA receiver?
- Name and briefly explain three advantages of Orthogonal Frequency Division Multiple Access (OFDMA).