

Final Exam 15.05.2013

Calculator allowed!

TLT6407 Radio network planning (5 cp)

1. Calculate a cable loss reduction when LNA of $NF_{LNA} = 4$ dB and $GAIN_{LNA} = 10$ dB is used. Cable loss is 2 dB and BTS noise figure is $NF_{BTS} = 2$ dB. What is the maximum gain provided by LNA if $GAIN_{LNA} = \infty$ (infinity).

Friis formula: $F = F1 + (F2-1)/G1 + (F3-1)/G1G2 + \dots$

2. Explain shortly the following items:

- Frequency hopping
- Angular spread
- Trunking gain
- Coherence bandwidth
- Cell breathing

3. Make a final dimensioning for a GSM network that has fifteen (15) 3-sector base stations for coverage, and 10 frequencies (minimum reuse to be used = 10). Number of users is 1000, and capacity requirement per user is 1.2 Erl.

4. Explain main functional steps what happens during the time when the UE is switched on and fist call starts in UMTS system.

5. Compare the downlink cell ranges of two different UMTS services:

- Service 1: 12.2 Mbit/s and $E_b/N_0 = 2$ dB
- Service 2: 12.2 kbit/s (speech) and $E_b/N_0 = 6$ dB

Assume mobile noise figure $NF = 8$ dB and thermal noise power $N_0 = -108.15$ dBm. The base station peak EIRP is 43 dBm for both services. Assume path loss model $L = 138.5 + 35.7 \log_{10}(d)$ [dB], where d is the distance in km.

Erlang-B table.

CHs	1%	2%	3%	5%
1	0.01	0.02	0.03	0.05
2	0.15	0.22	0.28	0.38
3	0.46	0.60	0.72	0.90
4	0.87	1.09	1.26	1.52
5	1.36	1.66	1.88	2.22
6	1.91	2.28	2.54	2.96
7	2.50	2.94	3.25	3.75
8	3.13	3.63	3.99	4.54
9	3.78	4.34	4.75	5.37
10	4.46	5.08	5.53	6.22
11	5.16	5.84	6.33	7.08
12	5.88	6.61	7.14	7.95
13	6.61	7.40	7.97	8.83
14	7.35	8.20	8.80	9.73
15	8.11	9.01	9.65	10.60
16	8.88	9.83	10.50	11.50
17	9.65	10.70	11.40	12.50
18	10.40	11.50	12.20	13.40
19	11.20	12.30	13.10	14.30
20	12.00	13.20	14.00	15.20

CHs	1%	2%	3%	5%
21	12.80	14.00	14.90	16.20
22	13.70	14.90	15.80	17.10
23	14.50	15.80	16.70	18.10
24	15.30	16.60	17.60	19.00
25	16.10	17.50	18.50	20.00
26	17.00	18.40	19.40	20.90
27	17.80	19.30	20.30	21.90
28	18.60	20.20	21.20	22.90
29	19.50	21.00	22.10	23.80
30	20.30	21.90	23.10	24.80
31	21.20	22.80	24.00	25.80
32	22.00	23.70	24.90	26.70
33	22.90	24.60	25.80	27.70
34	23.80	25.50	26.80	28.70
35	24.60	26.40	27.70	29.70
36	25.50	27.30	28.60	30.70
37	26.40	28.30	29.60	31.60
38	27.30	29.20	30.50	32.60
39	28.10	30.10	31.50	33.60
40	29.00	31.00	32.40	34.60