TSG RAN WG 4 # 2
15 - 19 February 1999
Turin, Italy
Source: System simulation ad-hoc

Revised Minutes of the ad-hoc group on parameters and system scenarios for inter-operator interference and ACIR definition

Participants agreed on the simulation methodology outlined in a revised version of document WG4 038, Annex A and Annex B from Nokia.
For the purpose of this document, the ACIR definition is taken from document WG4 048, source Ericsson.
Simulations are based on snapshots were users are randomly placed in a predefined deployment scenario; in each snapshot a power control loop is simulated until Eb/N0 target is reached.
For the purpose of this document, an **outage occurs** when, due to a limitation on the maximum TX power, the measured Eb/N0 of a connection at the end of a PC loop is lower than the Eb/N0 target.
Please note that the measured Eb/N0 is obtained by the measured C/I multiplied by the Processing gain.
Soft handover is modeled allowing a maximum of 2 BTS in the active set; the window size of the candidate set is equal to 3 dB; selection combining is used in the Uplink and Maximum Ratio Combining in DL.
Two scenarios were discussed:
1. FDD Macro to FDD Macro cell interference
2. FDD Macro to FDD Micro cell interference

The following modeling assumptions were agreed:
- Minimum Coupling Loss (MCL) was defined as the minimum distance loss including antenna gain measured between antenna connectors.
  The following values were assumed:
  70 dB for the Macrocellular environment, 53 for the Microcell
- Macro and microcell path loss are defined as in Doc RANWG4 (99)038, Annex A and B; antenna gain and cable losses are included in the pathloss formula.
- Power Control:
  - Perfect power control modeling (0 % TPC error, no delay, no step size) in the power control loop; Eb/N0 target is precisely reached by traffic channels requiring TX power lower than the maximum allowed.
  - Initial TX power for the PC loop of each Traffic Channel:
    UL: based on path loss, Thermal noise and 6 dB noise rise.
    DL: randomly chosen
    Many delegates felt that the initial TX power choice doesn't effect the convergence process (PC loop) to the target Eb/N0
  - PC Dynamic range: 65 dB UL, 25 in DL
- Bandwidth assumed in processing gain calculation: To be defined, a proposal exists

- DL orthogonality factor: 0.4 was assumed in the Macrocellular environment, while 0.06 in the micro.
  A concern was expressed regarding the orthogonality factor assumed in the Microcellular environment for the NLOS part of the path loss model.
- No Multi User Detection in UL
- Deployment scenario for Macrocell
  - Omnidirectional hexagonal Macrocell with BTS placed at the center of the cell;
  - Cell radius: 500 m for Macrocell.
  - Intersite distance for each operator: 1000 m
  - Intersite distance between operators: 500 m and 250 m
- Deployment scenario for Microcell
  - Manhattan like grid
  - Cell radius and inter-site distance to be defined via e-mail reflector
- Simulated services: 8 kbps speech and 144 kbps data services assumed, with 100 % activity factor
- In a first phase, no mix of speech and data services is considered
- Maximum DL TX power per each traffic channel: 30 dBm in Macrocell, 20 dBm in the Microcell case
- Maximum BS TX power: 43 dBm Macrocell, 33 dBm microcell.
- Common channel TX power: 30 dBm Macrocell, 20 dBm microcell
- Statistical data: percentage and distance distribution of outage, variation of the outage with ACIR

- Eb/N0 values: taken from the RTT proposal, vehicular environment Macrocell, pedestrian for Microcell, no Turbo codes for data
- C/I target values: derived from Noise value, processing gain and Eb/N0 requirement
- Simulations are run independently for the UL and DL
- number of snapshots per simulation: at least 10000 in the speech case, higher in the data case (20000 proposed)
- Loading of the system for the UL:
    - The number of users in the uplink (N_UL) is derived from the single operator case
    - It is defined according to a 6 dB noise rise in the UL (6 dB noise rise is equivalent to 75 % of the Pole capacity of a CDMA system):
      A simulation is run with a predefined number of users, and at the end the average noise rise is measured; if lower than 6 dB, the number of users is increased until the 6 dB noise rise is reached.
      The number of users corresponding to a 6 dB noise rise is here defined as *N_UL*.
      The percentage of outage in correspondence of N_UL users is defined as *GOS_single_UL*
      Note: an alternative approach has been proposed where N_UL is derived by choosing a target GOS_single_UL instead than deriving it from the 6 dB noise rise.
    - N_UL users are then considered to load each operator in the multi-operator case
    - For a given value of ACIR, the obtained percentage of outage is observed and compared to the GOS_single_UL
- Loading of the system for the DL:
    - The number of users in the downlink (N_DL) is derived from the single operator case
    - It is defined according the *GOS_single_UL* derived from the Uplink simulations.
      A simulation is run with a predefined number of users, and at the end the percentage of outage is measured; if lower than *GOS_single_UL*, the number of users is increased until the percentage of *outage in DL* is equal to *GOS_single_UL*
      The number of users corresponding to an outage equal to GOS_single_UL is defined as *N_DL*; a comparison of N_UL and N_DL can then show the difference in capacity between UL and DL.
    - N_DL users are then considered to load each operator in the multi-operator case
    - For a given value of ACIR, the obtained percentage of outage is observed and compared to the GOS_single_UL
    - If in the PC loop of each snapshot the overall TX power of each BS is higher than the Maximum Power allowed, at a minimum for each simulation statistical data related to this event have to be collected to validate the results; based on these results, in the future a different approach could be used for DL.

Open Issues
The following issues have to be agreed at the plenary or over the reflector:
- microcell cell size and microcell inter-operator intersite distance
- exact Eb/N0 values to be used for this simulation to be chosen from link level RTT proposal.
- Common channel power orthogonality; a first proposal is to assume this power orthogonal
- Bandwidth value to be used for Processing gain calculation; it has been proposed to use 4.096 MHz
- number of cells in the deployment scenario
- statistical significance level of results
- traffic distribution

- Additional data on ACIR and power amplifier implementation will be provided in the future by some manufacturer, and the consequences on the current model assumption will be discussed

It is proposed to allow comments and refinements on the reflector until March the 2nd (Tuesday)

Summary of System Assumptions:

Parameter	UL value	DL value
MCL macro	70 dB	70 dB
MCL micro	53 dB	53 dB
Antenna gain (including losses)	11 dBi	0 dBi
	0 dBi	11 dBi
Log Normal fade margin	10 dB	10 dB
# of snapshots	> 10000 for speech, higher for data	> 10000 for speech, higher for data
#PC steps per snapshot	> 150	> 150
step size PC	perfect PC	perfect PC
PC error	0 %	0 %
margin in respect with target C/I	0 dB	0 dB
Initial TX power	path loss and noise, 6 dB noise rise	random initial
Outage condition	C/I target not reached due to lack of TX power	C/I target not reached due to lack of TX power
Handover threshold for candidate set	3 dB	
active set	2	
Combining	selection	Maximum ratio combining
noise figure	5 dB	9 dB
Receiving bandwidth	4.096 MHz proposed	4.096 MHz proposed
noise power	-103 dBm proposed	- 99 dBm proposed
Maximum BTS power		43 dBm macro 33 dBm micro
Common channel power		30 dBm macro 20 dBm micro
Maximum TX power speech	21 dBm	30 dBm macro 20 dBm micro
Maximum TX power data	21 dBm	30dBm macro 20dBm micro
Power control range	65 dB	25 dB
MUD	Off	N/A
non orthogonality factor macrocell	N/A	0.4
non orthogonality microcell	N/A	0.06
Cell radius		500 m macro TBD micro
Inter-site single operator		1000 m macro TBD micro
BTS type		omnidirectional
Intersite shifting macro		500 and 250 m
Intersite shifting micro		TBD
bit-rate speech	8 kbps	8 kbps
Multipath environment	Vehicular macro Outdoor micro	Vehicular macro Outdoor micro
Data	144 kbps	144 kbps
Multipath environment	Vehicular macro Outdoor micro (No Turbo codes)	Vehicular macro Outdoor micro (No Turbo codes)
Activity factor speech and data	100 %	100 %