TSG-RAN Working Group 1 meeting #9 ***TSGR1#~~9~~(99)k03***
Dresden, Germany
Nov. 30 - Dec.3, 1999

Source: Nortel Networks

Title: Synchronization of NodeBs and UE for DPC_mode

Document for: Discussion

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1. Introduction

An LS statement was received from WG3 asking WG1 if they think that the start of the DPC_mode should be synchronized between the NodeBs and the UE [1].
In this contribution we present some simulation results that show the impact on the NodeBs transmitted powers if the UE applies the rate reduction algorithm (repeats the same TPC command over three slots) while NodeBs interpret these commands as three different commands.

2. Simulation Assumptions

Assuming the UE to be communicating with two NodeBs simultaneously and the transmitted power of NodeB1 to be *P1* (dB) and of NodeB2 to be *P2 (dB)*, we define Z to be

$$z = |P1 - P2|$$

We look into the average and variance of the serving NodeBs transmitted powers to compare the different cases.

The simulation assumptions are:

- The UE is in soft handover with two cells. The paths loss difference (not including the multipath fading) between the two cells and the UE is 2dB.
- The multipath fading channel is two Raleigh paths fading channel.
- The signal is received using a four fingers RAKE receiver.
- Power control is employed on both uplink and downlink links. This includes both the inner loop and the outer loop algorithms.
- The change in the transmitted power due to the closed loop is limited to ±15dB.
- The error rate on the power control commands is not fixed but rather function of the link quality.
- The FER on both the downlink and the uplink is 1%.
- The Transmitted powers are assumed to be equal at the beginning of the simulations.
- The NodeBs transmitted powers are synchronized every *S* frames
- The power control step size in both links is 1dB.

The performance is investigated for three cases:

Case 1: The UE repeats the same TPC command over three slots and both NodeBs know that.
Case 2: The UE repeats the same TPC command over three slots and both NodeBs don't know that.
Case 3: The UE repeats the same TPC command over three slots, NodeB1 knows that while

NodeB2 doesn't know.

When a NodeB does not know that the UE is repeating the commands, it will adjust its power three times over three slots instead of adjusting its power once every three slots.

3. Results

The following table shows the average and variance of the NodeBs transmitted powers.

Velocity Km/h	**case**	Synchronization period (*S*)	E(P1)	E(P2)	Var(P1)	Var(P2)
5	**1**	200	3.27	3.65	7.06	9.34
5	**2**	200	3.90	3.66	17.66	17.92
5	**3**	200	3.95	4.53	31.64	13.32
50	**1**	200	4.97	4.99	6.14	7.53
50	**2**	200	5.61	5.17	22.15	24.45
50	**3**	200	5.86	5.62	33.63	11.47
5	**1**	20	3.28	3.33	5.87	6.12
5	**2**	20	3.56	3.76	10.60	13.26
5	**3**	20	4.11	3.22	26.91	4.35
50	**1**	20	4.87	4.87	5.02	5.01
50	**2**	20	5.27	5.48	16.28	18.71
50	**3**	20	6.04	5.22	33.04	7.36

4. Conclusion

When the UE repeats the same TPC command three times while NodeB interprets these as three different commands, the average and the variance of NodeB transmitted power are increased. The degradation in the system performance will depend on the duration of the unsynchronized operation. If the unsynchronized operation is expected to be long enough to affect the system performance, then having a synchronized operation will be the better choice.

5. Reference

[1] TSGR1#9(99)h93: Liaison statement on DPC Mode Support for Release '99