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Title: **Algorithm 2 power control in soft handover**

Document for: **Discussion**

1 Introduction

Algorithm 2 power control enables the UE to use the minimum 1dB power control step size to emulate the effect of using a smaller step size. The UE accomplishes this by considering blocks of N consecutive TPC commands, and only implementing a power control step if all N commands are the same.

Simulation results demonstrating that Algorithm 2 can give significant benefits at high UE speeds and also some benefit at low speeds, have been presented in [1], [2] and [3]. For normal mode when not in soft handover, a value of N = 5 has been agreed [4].

For algorithm 2 in soft handover, some simulation results addressing the value of N were presented in [5], reaching the conclusion that N=3 is best in this case. In the present paper, we present further simulation results for soft handover, using the metrics of SIR variance and E_b/N_0.

2 Description of Simulations

The basic simulation conditions were as follows:

2GHz carrier frequency
15 slots per frame
Physical channel rate 30kbps
UE in soft handover with 2 cells
Pedestrian A channel in both cells
AWGN interference
Perfect Rake receivers tracking 2 paths in each of the two cells
Ideal channel estimation
Soft combining performed in UTRAN for the 2 cells
SIR estimation error based on UL SIR, using 6 pilot bits
1 slot loop delay for inner loop power control
Inner loop power control step size 1dB
AWGN TPC error on DL in each cell: 4% in normal mode; 7% in recovery period
No control channel overhead in Eb/No
Approx. 4dB coding gain from $^1/_3$-rate K=9 convolutional coder
Target BER after decoding = 10^{-3}
UE uses algorithm set out in [6] for combining TPC commands from different cells.

3 Simulation Results

The metrics used for comparison are:

- UL SIR variance (average of the 2 cells)
- UL received Eb/No (after soft combining in the UTRAN from the 2 cells)
- UL transmitted Eb/No

UE speed / km/h	Power control algorithm	Rx'ed Eb/No / dB	Tx'ed Eb/No / dB	Average SIR variance / dB^2
100	Algorithm 1	4.0	4.9	19.9
	Algorithm 2, N=3	3.9	4.7	19.2
300	Algorithm 1	4.1	4.8	19.7
	Algorithm 2, N=3	3.8	4.6	18.3

Figure 1: Comparison of power control algorithms in soft handover

4 Conclusions

The results shown in Figure 1 confirm that the use of Algorithm 2 power control with N=3 can be beneficial in the soft handover case, as well as in the normal (non-handover) case.

A text proposal is presented in [6].

5 References

[1] TSGR1#5(99)553 *"Implementation of small power control steps"*, Philips, June 1999

[2] TSGR1#6(99)959 *"Further Results on Emulation of Small Power Control Steps* , Philips, July 1999

[3] TSGR1#7(99)b41 *"Algorithm 2 Power Control in Normal Mode"*, Philips, August 1999

[4] TSGR1#7(99)e20 TS25.214 v1.2.2

[5] TSGR1#7(99)c47 *"Emulated small step size during soft handover"*, Nortel, August 1999

[6] TSGR1#7(99)d65 *"Text proposal for power control in soft handover"*, Philips, Nortel, September 1999