3GPP TSG RAN WG1 ***TSGR1#16(00)1223***
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Agenda item:

Source: **Philips**

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

Document for: **Discussion**

1 Introduction

Algorithm 2 power control uses blocks of 5 consecutive TPC commands when the UE is not in soft handover, but blocks of 3 when in soft handover.

The observation has been made on the email reflector that the ability of a UE at any particular time to make effective use of the soft-handover mode of algorithm 2 may depend on implementation-specific issues such as the assignment of rake fingers. A UE might therefore find itself in the position of needing to switch between the soft-handover and non-soft-handover modes during a frame.

As it is not obvious how a UE should switch between processing blocks of 3 TPC commands and processing blocks of 5 TPC commands during a radio frame, it is worth reconsidering the relative merits of using 3 or 5 TPC commands when in soft handover.

The following simulation results provide a comparison.

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

In the following results, N is the number of consecutive TPC commands processed in a block. 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 2, N=3	3.9	4.7	19.2
	Algorithm 2, N=5	3.8	4.5	18.2
300	Algorithm 2, N=3	3.8	4.6	18.3
	Algorithm 2, N=5	3.7	4.5	17.4

Figure 1: Comparison of power control algorithms in soft handover

4 Conclusions

The results in Figure 1 suggest that N = 5 gives slightly better results in soft handover than N = 3. However, previous results in [1] suggested that there could be advantages to using N = 3 in soft handover. Either way, the performance is very similar, and there is little to choose betweeen N = 3 and N = 5 in soft handover.

A key factor is therefore to avoid unnecessary complexity in the UE, and for this reason it is proposed in [2] that the number of consecutive TPC commands should be the same whether in soft handover or not.

5 References

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

[2] TSGR1#16(00)1214 *"Correction of uplink power control algorithm 2"*, Panasonic, Philips, October 2000