TSG-RAN Working Group 1 ***TSGR1#15(00) 1010***
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Agenda Item:

Source: Alcatel

Title: Need for synchronization of downlink power balancing starting times

Document for: Decision

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1 Introduction

At the RAN3#14 meeting, Alcatel presented a contribution highlighting some problems related to the non-synchronisation of downlink power balancing, and proposing a solution to solve it. NEC had a similar proposal on the same subject.

Although the issues raised by Alcatel and NEC were agreed as being valid by RAN3, some companies objected to implement a solution to solve it, arguing that the effect on performance was probably not noticeable. A Liaison statement has thus been sent to RAN1, requesting the opinion of RAN1 experts on the need to synchronise downlink power balancing.

This contribution recalls the problems raised in RAN3 and the simple solution proposed by Alcatel and NEC to solve it. It finally recommends RAN1 to reply to RAN3 that the synchronisation is worth being implemented for an efficient power balancing scheme.

2 Discussion

The power balancing procedures aims at correcting the drifts of Tx Power between the different Node B of a UE active set, these drifts being due to different errors on TPC commands on each radio link. With the DL power control messages, the SRNC may provide the same reference power to each Node B, or a different one if a permanent shift in Tx power is desired.

When each Node B evaluates the power difference to be applied with using a P_{init} measured at a different time, it was shown in Tdoc R3-001723 that a residual drift remains at the end of the convergence loop. This drift corresponds to the difference of P_{init}, which are measured at different times in each Node B. If the DL power control messages are received within a time window of 10 to 20 ms, starting times for power balancing are shifted by the same time. Within a typical rayleigh profile and UE speed of 30 km/h for instance, the inner loop power control may have moved with a maximum value of 30 dB (+1 or –1 dB at each slot), and often with a value above 5 dB. Such a drift between transmitter powers has a significant impact on power control. Indeed, the cells involved in the active set of a UE are usually received with an Ec/Io range of 3 dB or less, and having a difference of 5 dB between the transmitter powers will lead to the situation where one of the cell of the active set (and maybe the best received one) may no longer be received by the UE, and does not participate to the power control loop.

The period of power balancing needs to be quite short at high network load (around 5 to 10 frames), and with a typical TPC error rate of 5%, the drift due to TPC commands errors will be less than 5 dB in most cases (the drift is less than 5 dB in 90% or so according to our simulation results). This means that the drift due to the non-synchronisation of power balancing may be in the same order of the drift due to power control errors. This simple analysis shows that performing downlink power balancing without synchronisation may lead to a worse performance than not doing any power balancing at all.

Furthermore, we would like to highlight that the solution proposed by Alcatel and NEC to align starting times between the different Node B for power balancing is rather simple to implement. Each Node B simply needs to start its adjustment period, and thus to take the initial power value in slot 0 of frame CFN 0 modulo the ‘adjustment period’.

3 Conclusion

In this paper, we have recalled a problem related to the non-synchronisation of power balancing and the quite simple solution that had been proposed by Alcatel and NEC to solve it. Implementing the synchronisation of power balancing in the network can be done at low cost and solves a recognised issue.

Based on this, Alcatel recommends RAN1 to reply to RAN3 that the synchronisation of power balancing is worth being done and shall be implemented in RAN3 specifications for Release 99.