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Agenda Item:
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1 Introduction

Cell synchronization is planned for UTRA TDD in order to fully exploit the system capacity.
The accuracy that is required was already discussed in previous WG1 and WG4 meetings. Tdocs R4-00-413 and R1-00-0382 contain the various effects that could have an influence on the required accuracy. Although, setting this requirements is mainly a WG4 matter, it is seen as beneficial to start the discussions also in WG1 as the leading WG for this WI.

2 Proposal for the Introduction of Accuracy Classes

The following proposal is based on the idea, that a minimum requirement for the synchronisation could be quite loose and should be set in order not to impact the system capacity and the performance. However, it is seen beneficial to allow optionally a better accuracy that could have an advantage for handover and for LCS. In order for the system – especially – the UE to make use of this enhanced accuray we propose to establish three classes for the accuray of Node B synchronization and provide information to the UE either about the accuracy class or the synchronisation accuracy itself of the target cell for handover.

Class 1 : ± 100 ns

Class 2 : ± 500 ns

Class 3 : ± 2.5 s

Class 1: The high accuracy supports LCS methods and allows synchronized handover with autonomous timing advance calculations by the UE.

Class 2: The medium accuracy does not require a high sync effort but allows the UE to autonomously calculate the TA for the new cell during handover. However, the UE is informed, that there could be a sync error of up to 1 s. In order to avoid the catastrophic case, that its transmissions arrive too early at the new cell's receiver, the UE applies 2 s less than the calculated TA (with clipping at zero TA). The maximum timing error of the UE's transmission at the cell's receiver is 4 s.

Class 3: The sync error is so large, that it does not make sense for the UE to calculate the TA autonomously and correct it with the maximum sync error. The better solution for the UE is to use no TA at all at least immediately after handover, i. e. to adapt itself to the timing in the new cell similar to the initial access case. The maximum timing error of the UE's transmission at the cell's receiver is two times the propagation delay.

We propose the following usage of TA during handover:

1. In large cells and low sync accuracy (± 2.5 us), HO will be done without TA, so that the maximum timing error would be twice the propagation delay, e. g. 6 us or 24 chips for 1 km radius. TA would only be useful for a cell larger than 1.5 km in radius. It might be advantageous to transmit a special burst format.

2. In large cells with medium sync accuracy (e. g. ± 0.5 us) HO will be performed with TA. However, the UE will correct the calculated TA value for the sync inaccuracy. The maximum timing error would be 4 s or 16 chips. For an estimation window of 57 chips this is be tolerable. Even the TA step size is 4 chips. The correction value is calculated in the RNC and signalled to the UE before handover execution.

3. In large cells with high sync accuracy (+- 100 ns) TA will be used after HO. The maximum timing inaccuracy will be 400 ns.

4. In small cells no TA will be used. The maximum timing inaccuracy will be twice the propagation delay.