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1. Introduction

In the WG1 #15 meeting in Berlin, Nokia presented a contribution , R1-00-1079, where it was proposed that so called RX gating should be made possible together with TX gating, to allow further increasement of UE battery life.

The RX gating would be possible, if network could signal a parameter K to the UE to be used during gating state. The parameter K would define that after gating state has initiated , transmission of DPDCH / PDSCH can start again only in restricted frames; in every Kth frame. Thus UE receiver would have to be on during the whole frame only in every Kth frame. In the frames between, the UE receiver would have to be on only during every 3rd or 5th slot (1/3 or 1/5 gating), for making SIR estimation and decoding TPC symbols , so that closed loop power control continues working.

The issues below were raised during discussions in WG1 #15, when R1-00-1079 was presented. Further comments are given for these issues in this paper.
- Increasing delay
- Handover measurement requirements

2. Limitation for K parameter values

After having done some further studies on this issue, the new proposal is that we limit maximum K to be Kmax=4. This sounds like a reasonable figure, if we look at the earlier UE battery calculation results, see table 1 and 2 below [1]. The UE battery life improvement with K=8 does not increase any more very much compared to K=4.

Gating rate	K	UE battery life improvement
1/3	1	21 %
	4	**32 %**
	8	34 %
1/5	1	34 %
	4	**56 %**
	8	60 %

Table 1. UE battery life improvement due to gating, with medium range tx power level and DPCCH_gating_%=0.66, which refers to DSCH+DCH case [1].

Gating rate	K	UE battery life improvement
1/3	1	26 %
	4	**35 %**
	8	37 %
1/5	1	44 %
	4	**61 %**
	8	65 %

Table 2. UE battery life improvement due to gating, with high range tx power level. DPCCH_gating_%=0.66 which refers to DSCH+DCH case [1].

3. Existing restrictions on TrCH TTI starting times vs. K parameter

It was commented in WG1 #16, that the proposal of RX gating – usage of K parameter - will increase the delay for any data to be transmitted in downlink. On the other hand, it was also commented that there are already now restrictions in the L1 specifications for the starting frames of transport channels of the CCTrCH with different TTI lengths.

Let's look at these already existing restrictions. TS 25.212, v.3.3.0 definition in section 4.2.14 is copy pasted below.

----------Copy paste from TS 25.212, v3.3.0 (2000-06), section 4.2.14 starts here ----------

After addition or reconfiguration of a transport channel *i* within a CCTrCH, the TTI of transport channel *i* may only start in radio frames with CFN fulfilling the relation:

$CFN_i \bmod F_i = 0$.

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This means that TTI of each transport channel within a CCTrCH, having TTI length of F_i can only start in every F_i th frame.

The most probable TTI lengths to be used in practice will be:

?? TTI = 10, or TTI 20 ms for Packet data
?? TTI = 40 ms for RRC signaling.

This will mean that if the allowed values for K would be K={1,2,3,4} (see the previous chapter, where Kmax is proposed to be K=4), then there would be

✍✍no extra delay for RRC signaling
✍✍10-30 ms delay for packet data with TTI=10 ms service
✍✍20 ms delay for packet data with TTI=20 ms service

So as a conclusion, the effect to delay is very minimal, even with Kmax=4. And of course, it is always possible for the network operator to use K=1, if the service is very delay sensitive.

It should be also understood that there would be even longer delay for packet data , if the connection release would happen in between, and RACH access would have to be used to start a new packet connection.

4. Handover measurements during rx gating

In the previous contribution, R1-00-1079, it was proposed that during gating it would be required to do handover measurements only for those cells in the neighbor list, for which initial search has already been done. The reasoning for this proposal, which was very first draft idea anyway, was that it was first thought that initial search might be difficult to do during gating, if the receiver would not be on long enough period consecutively, often enough.

Since we now, in chapter 2, have proposed to limit the K parameter to be Kmax = 4, this means that the receiver would need to be on during the whole frame quite often; in every 4^{th} frame. So with this kind of K parameter limitation, we have the opinion, that it is possible to do also initial search measurements during the gating state.

Thus our new proposal is that all the normal handover measurements, including initial search, are done during RX gating. Further we propose, that WG4 should define the handover measurement requirements during the RX gating. E.g. there could be slightly different measurement period during RX gating than during non-gating state.

We propose that WG1 sends a Liaison Statement on this issue to WG4.

5. Conclusion

It was already shown in our previous contribution [1], that there are more benefits from DPCCH gating concept, if we can achieve UE battery savings both from rx and tx side. Note: those UE battery figures are repeatedly shown in this contribution, in chapter 2.

In this contribution it has been proposed that K max would be limited to Kmax=4, since the UE battery life will not improve very much beyond that value.

Limiting Kmax to Kmax=4 will mean that there is no additional delay introduced to RRC signaling, since the transport channel carrying RRC signaling will typically use TTI=40 ms. No additional delay is introduced, because there is already a restriction in the current specification that TTI of TrCH having TTI length of F_i, can only start in every F_i th frame. Thus TTI of transport channel carrying RRC signaling would anyway be able to start only in every 4^{th} frame.

For packet data there is 10-30 ms additional delay introduced, but this is quite minimal increase, if we think about the possibility, that the connection release would happen in between, and RACH access would have to be used to start a new packet connection. That would mean much bigger delay for the packets than 10-30 ms.

Limiting Kmax to Kmax=4 will also mean that receiver will have to be on often enough , for long enough period, so that it can be defined that all the normal handover measurements are to performed during gating, including initial search. We propose, that WG4 should define the handover measurement requirements during the RX gating. E.g. there could be slightly different measurement reporting period during gating than during non-gating state. We propose that WG1 sends a Liaison Statement on this issue to WG4.

The proposed TR text on RX gating is given in a separate contribution, R1-00-1339.

REFERENCES

[1] R1-00-1079, Nokia, "Proposal of using both tx and rx gating " , Berlin, Germany , August 22-24, 2000.