3GPP TSG-RAN WG2 #116e R2-21xxxxx

Electronic Meeting, 1 – 12 November 2021

Agenda Item: 8.2.2.1

Source: Samsung

Title: [AT116-e][221][R17 DCCA] UP issues for SCG deactivation (Samsung)

WID/SID: LTE\_NR\_DC\_enh2-Core

Release: Rel-17

Document for: Discussion and Decision

# 1 Introduction

This document is to handle the following email discussion:

* [AT116-e][221][R17 DCCA] UP issues for SCG deactivation (Samsung)

Scope:

* + - Discuss remaining UP issues for SCG (de)activation based on [R2-2109942](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_116-e/Docs/R2-2109942.zip). Discuss also whether we need to do MAC reset at SCG deactivation.

Intended outcome:

* + - Discussion summary in [R2-2111314](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_116-e/Docs/R2-2111314.zip) (by email rapporteur).

Deadline for providing comments, for rapporteur inputs, conclusions and CR finalization:

* + - Initial deadline (for company feedback): 2nd week Mon, UTC 0900
    - Initial deadline (for rapporteur summary): 2nd week Mon, UTC 1300

The following documents are to be treated in this email discussion:

## 8.2.2.1 Deactivation of SCG

**Web Conf (1st week Tuesday) (2)**

*UP details of SCG deactivation:*

[R2-2110870](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_116-e/Docs/R2-2110870.zip) UP handling while SCG is deactivated Huawei, HiSilicon discussion LTE\_NR\_DC\_enh2-Core

**FFS if we need to reset MAC at SCG deactivation. Discuss further offline [221] (Samsung)**

[R2-2109942](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_116-e/Docs/R2-2109942.zip) UP issues for SCG deactivation Samsung discussion Rel-17 LTE\_NR\_DC\_enh2-Core

**Discuss in offline [221] (Samsung) how to handle these.**

2 Contact Information

The rapporteur encourages the delegates who provide input to provide their contact information in the below table:

|  |  |
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# 3 Discussion

## 3.1 R2-2110870: MAC reset for SCG activation/deactivation

In 38.321, UE behaviors for MAC reset are specified as shown below.

----------------------------------------------------------- 38.321 -------------------------------------------------------------------------

5.12 MAC Reset

If a reset of the MAC entity is requested by upper layers, the MAC entity shall:

1> initialize *Bj* for each logical channel to zero;

1> initialize *SBj* for each logical channel to zero if Sidelink resource allocation mode 1 is configured by RRC;

1> stop (if running) all timers;

1> consider all *timeAlignmentTimer*s as expired and perform the corresponding actions in clause 5.2;

1> set the NDIs for all uplink HARQ processes to the value 0;

1> sets the NDIs for all HARQ process IDs to the value 0 for monitoring PDCCH in Sidelink resource allocation mode 1;

1> stop, if any, ongoing Random Access procedure;

1> discard explicitly signalled contention-free Random Access Resources for 4-step RA type and 2-step RA type, if any;

1> flush Msg3 buffer;

1> flush MSGA buffer;

1> cancel, if any, triggered Scheduling Request procedure;

1> cancel, if any, triggered Buffer Status Reporting procedure;

1> cancel, if any, triggered Power Headroom Reporting procedure;

1> cancel, if any, triggered consistent LBT failure;

1> cancel, if any, triggered BFR;

1> cancel, if any, triggered Sidelink Buffer Status Reporting procedure;

1> cancel, if any, triggered Pre-emptive Buffer Status Reporting procedure;

1> cancel, if any, triggered Recommended bit rate query procedure;

1> cancel, if any, triggered Configured uplink grant confirmation;

1> cancel, if any, triggered configured sidelink grant confirmation;

1> cancel, if any, triggered Desired Guard Symbol query;

1> flush the soft buffers for all DL HARQ processes;

1> for each DL HARQ process, consider the next received transmission for a TB as the very first transmission;

1> release, if any, Temporary C-RNTI;

1> reset all *BFI\_COUNTER*s;

1> reset all *LBT\_COUNTERs*.

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*Rapporteur’s comment: If we do not reset MAC at SCG activation or deactivation, it can cause several error cases, e.g. soft combining problem for DL HARQ buffers after SCG activation due to not-flushed one. Before going to the details, it would be better to discuss how to handle MAC reset for SCG activation/deactivation.*

In the last meeting, RAN2 agreed to the following one, which conflicts with one action of legacy MAC reset:

* 1: The TAT associated with the PSCell continues running when the SCG is switched from activated to deactivated state and the UE considers the TA as valid as long as it is still running.

Hence, it seems difficult to keep TAT associated with PTAG running together with the legacy MAC reset at SCG deactivation.

Based on this, Rapporteur think that several options could be on the table:

* **Option 1**: Define a new UE behavior and trigger it upon SCG deactivation (like partial MAC reset in LTE)
  + In this option, the new UE behavior can include necessary actions (FFS) from the legacy MAC reset and the action keeping TAT associated with PTAG running, which can be triggered upon SCG deactivation.
* **Option 2**: Reset MAC upon SCG activation
  + In this option, we can follow the same principle as initiation of RRC Re-establishment, i.e. reset MAC upon SCG activation. We can keep TAT associated with PTAG running upon SCG deactivation.
* **Option 3**: No need for MAC reset upon SCG activation/deactivation
  + Rapporteur doesn’t think that this option would work without any problem. Please correct me if I am wrong.
* **Option 4**: Any other suggestion?

**Q1. Which option do you prefer if you agree that UE should do any actions related to MAC reset for SCG activation/deactivation? or do you have any other suggestion?**

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| Company | Preferred option | Comments |
| OPPO | Option 4 | During SCG deactivation, the UE behavior looks like SCG failure. UE just suspend SCG transmission. So the MAC should be reset.  If MAC reset, the legacy behavior is to stop all MAC timer including TAT timer.  So I think we should not change legacy behavior of MAC reset.  We can choose to stop TAT timer instead and reconsider the agreements we made before, e.g. always RACH after SCG activation. |
| Nokia | No strong view – option 1 or 2 – option 2 seems simpler as no need to discuss Q2 | We would need to define UE behaviour to do basically everything as is done in MAC reset apart from TAT stopping. We could define “if” structure in 5.12 of MAC spec so that if “new MAC reset” is requested by upper layers then UE will not consider *timeAlignmentTimer* as expired. |
| Ericsson | Option 1 + “*partial MAC reset” on SCG activation* | Option 2 does not work, due to race conditions. One example is that there may be an ongoing Buffer Status Reporting procedure. It would be “messy” to capture in the MAC spec so that it does not lead to a random access while the SCG is de-activated, assuming UE-initiated SCG activation via random access on SCG would not be supported.  There are some additional UE actions on the MAC level that are useful to trigger upon SCG activation. See the detailed answer to Q2 below.  With that said, the current MAC running CR models the SCG de-activation as just another instance of SCell de-activation, which is not appropriate when considering that the UE actions at SCG activation/deactivation are more MAC entity related. It is therefore cleaner to list the specific MAC actions at SCG activation and deactivation in the new chapter of the MAC running CR. |
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**Q2. If you prefer Option 1, which actions are UE required to do at SCG deactivation? Please describe the reason why which action should be performed.**

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| Company | Comments |
| Ericsson | 1. Some UE actions in “MAC reset section” are useful to have at SCG deactivation, e.g., those that may not be aware by the network and can happen due to race conditions when the network de-activates the SCG.  1> stop, if any, ongoing Random Access procedure;  1> flush Msg3 buffer;  1> flush MSGA buffer;  1> cancel, if any, triggered Scheduling Request procedure;  1> cancel, if any, triggered Buffer Status Reporting procedure;  2. Some UE actions in “MAC reset section” are not needed, e.g., consider TAT associated with PTAG expired, discard explicitly signalled contention-free Random Access Resources for 4-step RA type and 2-step RA type, if any  3. Some UE actions are needed at SCG activation. For example, the phr-PeriodicTimer should be re-started, and this is to follow the legacy behavior, see below:  1> if it is the first UL resource allocated for a new transmission since the last MAC reset:  2> start phr-PeriodicTimer.  Another example is the Bj, it seems strange to reset it at deactivation, since it would keep increasing even when SCG is deactivated or might be more reasonable to initialize it at SCG activation.  The above are just examples on why such a baseline model is needed, and we are open to hear more views and discuss details.  Lastly, we need to discuss other relevant actions, for example, how about the configured grant/configured downlink assignments in the PSCell? In the MAC running CR, they are cleared, but these are not discussed/agreed. |
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## 3.2 R2-2109942: UP issues for SCG deactivation

### 3.2.1 How to specify TAT timer related behaviour upon SCG deactivation

In the last meeting, RAN2 agreed to keep TAT associated with the PTAG running when SCG is switched from activated state to deactivated state. However, we need to note that there can be several TAT timers, e.g. TAT timers associated with PTAG and STAG. There seems no reason to keep TAT timer associated with STAG running upon SCG deactivation, if configured and running. Therefore, the intention would be to keep TAT timer associated with PTAG running and consider TAT timer associated with STAG as expired.

**Q3. Do you agree to the wording “Upon SCG deactivation, except for timeAlignmentTimer associated with PTAG, if configured, consider all timeAlignmentTimers as expired.”? Please share your views on this.**

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| Company | Agree/Disagree | Comments |
| OPPO | Agree | OPPO once had the same proposal in paper. All SCells will be deactivated state during SCG state. So the STAG timer should stop. |
| Nokia | Disagree | How would this differ from deactivating SCell with UL associated with STAG? If we have issue with that then it is not related to this WI but generally for SCell with UL as anyway all the SCells of deactivated SCG are deactivated. |
| Ericsson | Disagree | Since we keep the TAT associated with PTAG, we don’t see motivations to stop the TAT associated with STAG.  Upon the expiry of the TAT associated with the STAG, the PUCCH/SRS resources are released, see below  2> else if the *timeAlignmentTimer* is associated with an STAG, then for all Serving Cells belonging to this TAG:  3> flush all HARQ buffers;  3> notify RRC to release PUCCH, if configured;  3> notify RRC to release SRS, if configured;  3> clear any configured downlink assignments and configured uplink grants;  3> clear any PUSCH resource for semi-persistent CSI reporting;  3> maintain NTA (defined in TS 38.211 [8]) of this TAG.  Upon SCG activation, if the TAT associated with STAG is expired/stopped, the UE has to perform random access on SCells belonging to STAG. While if the TAT associated with STAG is kept running, then the UE can send the scheduling request on the SCell.  As far as I understand, in legacy, even if all SCells belonging to STAG are de-activated, the TAT for STAG is not considered as expired, and so good to keep this. |
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### 3.2.2 UM DRB handling for deactivated SCG

In the last meeting, RAN2 discussed bearer handling for deactivated SCG and finally made small progress:

* 5. The security key update is up to network implementation upon SCG activation from deactivation.
* PDCP entity is not suspended at SCG deactivation for at least AM DRB. FFS for Stage-3 details
* UL data processing is not prohibited during SCG deactivation for at least AM DRB. FFS for Stage-3 details
* UL data transmission to SCG is prohibited during SCG deactivation. FFS for Stage-3 details
* UE-initiated activation is still FFS.

*Rapporteur’s comments: Rapporteur would like to emphasize that we cannot reuse the legacy PDCP suspend procedure as it is for SCG deactivation since it was designed only for RRC INACTIVE state. That’s why there are several cases to just suspend DRBs without triggering PDCP suspend procedure in 38.331, i.e. “suspend a DRB” does not imply “suspend PDCP entity of that DRB”. Rapporteur suggests to focus on UM DRB handling because it would be easy to handle AM DRB and possibly split bearer after having consensus on UM DRB.*

Regarding UM DRBs, we have two issues as follows:

* **Issue 1**: Data loss can happen inside UE even before transmission
  + Data loss can happen inside UE even before transmission if UM DRB is not suspended (i.e. UL data processing is not prohibited during SCG deactivation). In NR, UE implementation can do uplink data processing before/after the reception of uplink grant. For deactivated SCG, UM DRB can process uplink data if not suspended. If the security key is updated at SCG activation, then PDCP/RLC re-establishment will flush all the processed data, which causes data loss inside UE since there is no re-generation procedure for UM DRB according to legacy PDCP re-establishment.
* **Issue 2**: The reordering delay can happen for UM DRB.
  + The reordering delay in the receiving PDCP entity can happen for UM DRB. For example, upon SCG deactivation, the out-of-order PDUs cannot be immediately delivered to upper layer before the expiry of t-reordering timer, which causes unnecessary delay. The reasonable network implementation would not perform HARQ retransmission after sending SCG deactivation indication, i.e. no need to wait for outstanding PDUs.

**Q4. Do you agree to Issue 1? Please share your views on this.**

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| Company | Agree/Disagree | Comments |
| OPPO | Agree with comments | I assume that the SCG is deactivated when there is no data transmission and reception in SCG side. If there is data arrival, the SCG activation will be triggered. Even if the data is processed, it will be transmitted latter. |
| Nokia | Agree with comments | But this does not seem any different from key change to any UM bearer.  On the other hand, if the UM bearer is a split one, suspending PDCP would also prevent use of MCG transmissions. |
| Ericsson | Disagree | This is not an issue that we should solve in the standard. This issue is not unique to SCG de-activation and can happen, for example, during handover or when the network changes the security key. Possible pre-processing of UL data for the deactivated SCG is left for UE implementation, as long as pre-processed data is not lost. |
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**Q5. If you agree to Issue 1, do you agree to suspend UM DRB upon SCG deactivation to resolve Issue 1? Please share your views on this.**

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| Company | Agree/Disagree | Comments |
| OPPO | Disagree | It is related the model of SCG deactivation. We agree just suspend the SCG transmission, not suspend DRB (like RRC\_INACTIVE). If we agree this, we may reconsider the model of SCG deactivation. |
| Nokia | Disagree | See our comment under Q4. |
| Ericsson | Disagree | It is not clear the relation between “suspend DRB” and “pre-processing”. If DRB is suspended, does it mean that the pre-processing is not allowed? |
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**Q6. Do you agree to Issue 2? Please share your views on this.**

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| Company | Agree/Disagree | Comments |
| OPPO | Agree but no need to address |  |
| Nokia | Agree for SCG bearer, disagree for split bearer. |  |
| Ericsson | Disagree | The t-Reordering timer is for reception and so the DL traffic. The network is aware of the DL traffic and so will not de-activate the SCG if there is any ongoing DL traffic. |
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**Q7. If you agree to Issue 2, do you agree to stop and reset t-Reordering timer, if running, and deliver all the stored PDCP SDUs to upper layers upon SCG deactivation? Please share your views on this.**

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| Company | Agree/Disagree | Comments |
| OPPO | Disagree | No need to impact PDCP legacy behavior. No big issue. |
| Nokia | Agree | If so configured by RRC (i.e. most likely for SCG bearer). |
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### 3.2.3 SRB3 handling for deactivated SCG

For deactivated SCG, it is straightforward to maintain SRB1 for MCG link. However, we need to discuss whether to keep SRB3 or not, if configured. Since keeping SRB3 alive would not have any benefit. In this regard, it would be reasonable to suspend SRB3 or suspend SCG transmission of SRB3 upon SCG deactivation. If we suspend SCG transmission of SRB3 (i.e. UL data processing is not prohibited during SCG deactivation), the UL RRC message may trigger a UE initiated activation request, which would be impacted by another discussion. So we can leave the exact wording as FFS.

**Q9. Do you agree to suspend SRB3 or suspend SCG transmission of SRB3 upon SCG deactivation (FFS for the exact wording)? Please share your views on this.**

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| Company | Agree/Disagree | Comments |
| OPPO | Agree with comments | Suspend SRB3 transmission. |
| Nokia | Disagree | SRB3 may be needed for MCG failure recovery. SN-configured measurement reports can sent via MCG i.e. as if SRB3 was not configured, while the SCG is suspended. |
| Ericsson | Disagree | We agree that PDUs on SRB3 should in general not trigger a UE initiated SCG activation request.  A common modelling instead of a case-by-case discussion is preferred. We don’t think it is necessary to suspend SRB3, as the running RRC CR has shown one way to capture it:  1> else if the UE is in (NG)EN-DC:  2> if SRB3 is configured and the SCG is not deactivated:  3> submit the *MeasurementReport* message via SRB3 to lower layers for transmission, upon which the procedure ends;  2> else:  3> submit the *MeasurementReport* message via E-UTRA embedded in E-UTRA RRC message *ULInformationTransferMRDC* as specified in TS 36.331 [10]. |
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One thing to be noted is that RRC messages may be generated to be transmitted via SRB3 before the reception of SCG deactivation indication. In this case, they may be transmitted later upon SCG activation, which should be avoided.

In Rel-16, the same issue was discussed in DAPS handover and RAN2 finally specified the corresponding behavior as shown below. Hence, the same principle can be applied to the SCG deactivation case.

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| 38.331  3> for each SRB:  4> if the *masterKeyUpdate* was not received:  5> configure the PDCP entity for the source PCell with state variables continuation as specified in TS 38.323 [5];  4> release the PDCP entity for the target PCell;  4> release the RLC entity as specified in TS 38.322 [4], clause 5.1.3, and the associated logical channel for the target PCell;  4> trigger the PDCP entity for the source PCell to perform SDU discard as specified in TS 38.323 [5];  4> re-establish the RLC entity for the source PCell; |

**Q10. Do you agree that the old RRC message for SRB3 is discarded upon SCG deactivation? Please share your views on this.**

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| Company | Agree/Disagree | Comments |
| OPPO | Disagree | We only agree to suspend the SCG transmission during SCG deactivation. In this case, the SCG RRC message can be transmitted via MCG RRC anyway. |
| Nokia | Agree |  |
| Ericsson | Disagree | As currently captured in the RRC running CR, while the SCG is deactivated, the SCG measurement reports are sent via SRB1 and so this becomes a corner case. The corner case happens when the RRC message is generated while UE receives the SCG deactivation message. It is our understanding that these RRC messages are passed to PDCP entity, triggering an SCG activation request. There is no need to optimize for a corner case. |
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# Conclusion

**TBD**