3GPP TSG-RAN WG2 #115e R2-210xxxx

Electronic Meeting, 16 – 27 August 2021

Agenda Item: 8.2.2.1

Source: Samsung

Title: [AT115-e][220][R17 DCCA] Bearer handling of 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:

* [AT115-e][220][R17 DCCA] Bearer handling of SCG deactivation (Samsung)

Scope:

* + - Discuss the Bearer handling of SCG (de)activation based on online discussion

Intended outcome: Report

* + - Discussion summary in [R2-2108862](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2108862.zip) (by email rapporteur).

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

* + - Initial deadline (for company feedback): 1st week Fri, UTC 0900
    - Initial deadline (for rapporteur summary): 2nd week Mon, UTC 1000

The following document is to be treated in this email discussion:

Web Conf (Tuesday 1st week), Bearer handling (1)

UP details: Bearer handling for SCG deactivation

[R2-2107669](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107669.zip) Bearer handling for SCG deactivation Samsung discussion Rel-17 LTE\_NR\_DC\_enh2-Core

* Discuss bearer handling in deactivated SCG (e.g. proposals in [R2-2107669](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107669.zip)) in offline [220] (Samsung)

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 SRB3 handling for deactivated SCG

For deactivated SCG, it is straightforward to maintain SRB1 for MCG link. However, we may need to discuss whether to keep SRB3 or not, if configured. Considering the previous agreements, keeping SRB3 alive would not have any benefit. In this regard, it would be reasonable to suspend SRB3 upon SCG deactivation.

**Proposal 1. SRB3 is suspended upon SCG deactivation, if configured.**

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| --- | --- | --- |
| Company | Agree/Disagree | Comments |
| LG | Disagree | We don’t see the need to suspend RBs (including SRBs and DRBs) at SCG deactivation, because the UE anyway cannot transmit the data to SCG. It does not give any harm to keep the SRB3 alive. |
| MediaTek | Agree | We don’t why keeping SRB3 active while actually it cannot transmit/receive. There should be no case that UE has to trigger SCG activation due to data arrival from SRB3? |
| Ericsson | Disagree | It is not clear what it means here: PDCP entity associated with SRB3 is suspended or the SCG transmission is suspended as in SCG failure information procedure. Since PDCP entity suspend (which initializes the counter) would lead to keystream re-use issue (see questions related with from P6 to P9 below), we prefer to have a precise wording. In this case, it should be  suspend SCG transmission for all DRBs/SRBs as in SCG failure information procedure. |
| OPPO | Agree | If SCG is deactivated, no reason and no necessary to keep SRB3 alive. Anyway, the SRB3 will be resumed or removed when SCG is activated. |
| Nokia | Agree | Alternative cumbersome solution would be to never have SRB3 for deactivated SCG. But we prefer suspension. Maybe formulation of proposal could be more like suspend SCG transmission for DRBS/SRBs as in SCG failure information procedure – This to ensure we do not need re-specify something that is already in the specs (or at least we can just copy-paste procedure) |
| Samsung | Agree | Based on previous agreements, the signaling for SCG activation and deactivation would be transmitted via MCG. Keeping SRB3 alive would not be beneficial.  The intention of this proposal is not about “PDCP suspend”. After agreeing to suspend all DRBs and SRBs for SCG, we can say “SCG transmission is suspended”. |
| Apple | Yes and see comments | If SRB3 is kept active, RRC layer would not prevent RRC messages (measurement report, UAI message, etc) passing to PDCP layer, leading to unnecessary SCG activation request.  Else if SRB3 is suspended upon SCG deactivation, it means that UE can only resume by itself in order to transmit MCGFailureInformation message in SCG deactivated state.  Thus, we feel it’s better to keep SRB3 suspended, rather than active. |
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One thing is to be noted 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. The network may release SRB3 upon SCG deactivation. However, mandating the network to release it would not be a good way. This issue is about the case that SRB3 is suspended.

**Proposal 2. For SRB3, the old RRC message is discarded upon SCG deactivation, if any.**

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| Company | Agree/Disagree | Comments |
| LG | Agree | Agree, however, we think this issue is not related to SRB suspension. The PDCP SDUs/PDUs of SRBs can be discarded by discard timer or request by RRC, even if the PDCP entity is not suspended. |
| MediaTek | Agree |  |
| Ericsson | Disagree | The principle looks okay for UE-initiated RRC message, like measurement report.  Question is whether this is needed to be agreed and if so, how to capture in the spec. There can be many corner cases due to race conditions. Our view is that there is no need to specify and can be left for UE implementations to discard. |
| OPPO | Agree | For my understanding, it is corner case that there is RRC signaling generated in SCG because the MN and SN will decide to deactivate the SCG together. Anyway, if the RRC message is generated in SCG side, it is better to discarded. |
| Nokia | Disagree | This seems something that does not need to be specified. We see regular suspension as specified currently is sufficient |
| Samsung | Agree | We already have similar behavior to discard old RRC messages in 38.331, e.g. DAPS fallback case. |
| Apple | Agree |  |
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## 3.2 DRB handling for deactivated SCG

For split DRB and duplication DRB, SCG RLC bearer would not be used for data transmission and reception when SCG is deactivated and thus it seems straightforward to suspend SCG RLC bearers of split DRB and duplication DRB, if configured, while the PDCP entities associated to such DRBs continue to perform transmit/receive operation to maintain MCG RLC bearers. Other than spilt DRB and duplication DRB, the normal SCG DRBs would be suspended upon SCG deactivation. The network may release the SCG RLC bearers and SCG DRBs upon SCG deactivation. However, mandating the network to release them would not be a good way.

**Proposal 3. The SCG RLC bearer of split DRB and duplication DRB is suspended upon SCG deactivation, if configured.**

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| Company | Agree/Disagree | Comments |
| LG | Disagree | Same comment as in our response for P1.  Suspension/resumption is not needed since RAN2 already agreed that the UE can initiate SCG activation if needed. In addition, if we agree to suspend split DRB/ duplication DRB, the UE may need to perform autonomous bearer relocations whenever there is UL data to transmit via the split DRB/ duplication DRB until SCG is activated. However, this isn’t needed since RAN2 already agreed that the UE can initiate SCG activation if needed.  We don’t see the need to suspend RBs (including SRBs and DRBs) at SCG deactivation, because the UE anyway cannot transmit the data to SCG. It does not give any harm to keep the SRB3 alive. |
| MediaTek | Agree | We assume suspend here only imply that no data transmission to SCG RLC bearer for split/duplication DRB. UE initiated SCG activation is still under discussion. We think that data arrival in duplication DRB does not trigger the UE initiated SCG activation procedure. |
| Ericsson | Disagree | We can use the same formulation as during SCG failure, i.e., SCG transmission of split DRBs is suspended.  The intention is to re-use the existing procedure and minimize spec impacts. Additionally, it is not clear what it means by RLC bearer suspension and there is no need to consider the duplication DRB which is a subcase of split DRB. |
| OPPO | Disagree | For my understanding, there is no data reception and transmission in RLC bearer of split DRB or DRB with DC based PDCP duplication and it may result in SCG deactivation. The SCG deactivation will not force to suspend RLC bearer of split DRB or DRB with DC based PDCP duplication. The SCG deactivation will not impact the QOS of the DRBs.  **The SCG can be deactivated only when all SCG RLC bearers are not used and SCG should be activated if at least one SCG RLC bearer is used.**  However, if primary leg is not in SCG side and if data volume is lower than the configured threshold, i.e *ul-DataSplitThreshold*, the SCG RLC bearer will not be used.   |  | | --- | | - if the total amount of PDCP data volume and RLC data volume pending for initial transmission (as specified in TS 38.322 [5]) in the primary RLC entity and the split secondary RLC entity is equal to or larger than *ul-DataSplitThreshold*:  - submit the PDCP PDU to either the primary RLC entity or the split secondary RLC entity;  **====omit some text**  - else:  - submit the PDCP PDU to the primary RLC entity. |   However，the data volume changes will results in ping-pong SCG activation/deactivation request.  So we propose here:  **For each split bearer, if data volume is lower than the configured threshold, i.e *ul-DataSplitThreshold* and the primary leg is not in SCG side, the SCG RLC bearer will not be used, but SCG cannot be suspended in this case.** |
| Nokia | Maybe | We assume similar suspension can be done as specified already now for SCG failure - maybe this is also the intention of proposal? |
| Samsung | Agree | Suspension means no data transmission and reception as we have in RRC spec. UE initiated SCG activation would be triggered by data volume indication.  In my understanding, we would use the sentence like “transmission is suspend” for cell group level. |
| Apple | Agree | We think it’s straightforward to stop transmission over SCG RLC bearer upon SCG deactivation. SCG RLC bearer can be only resumed once SCG is activated. |
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**Proposal 4. The normal SCG DRB is suspended upon SCG deactivation, if configured.**

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| Company | Agree/Disagree | Comments |
| LG | Disagree | Same comment as in our response for P1 |
| MediaTek | To Discuss | If SCG DRB is still configured after SCG deactivation, we need discuss how to handle this while there is UL data arrival. |
| Ericsson | Disagree | Whether the SCG DRB would be supported or not is still under discussion. If it were supported, then the principle makes sense, but we have the comments as above that it is the transmission on SCG that is suspended not the bearer itself. |
| OPPO | Agree | It is obvious action due to SCG deactivation. |
| Nokia | Disagree | If there would be data to be sent on SCG DRB then UE initiates SCG activation procedure. Isn’t this already agreed or is the intention to revert this decision? And argument that there would be data on deactivated SCG at point of deactivation would be just showing that this is bad NW implementation. No need to cover cases when NW deactivates SCG with data on normal SCG DRBs. |
| Samsung | Agree | We think that UE initiated SCG activation is not related to suspension of DRB. If there would be data to be sent on SCG DRB, then the PDCP entity will indicate the data volume to lower layer, which is the same as that of RRC INACTIVE state.  Our understanding is that one of the benefit of SCG deactivation is to keep SCG configuration. So, there would be a case to maintain normal SCG DRB configuration unless we do mandate the network to always release them upon SCG deactivation.  In the similar reason, we think that UE suspends configured DRBs when going to INACTIVE state in legacy. |
| Apple | Disagree | First, we don’t see too many differences between keeping SCG bearer active and suspended.  Then, regarding suspended SCG bearer, as illustrated in R2-2107605, our concern is if we allow SCG DRB to maintain after SCG is deactivated, how should UE behave once UL data is generated. For example, if UE can trigger SCG activation request for every UL data packet, it could lead to frequent unnecessary SCG activation. On the other hand, if UE needs to accumulate the UL data volume to a threshold, latency for data transmission may get very long.  Thus, our preference is to remap the SCG bearer to split bearer or MCG bearer upon SCG deactivation, to make our life easier. |
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## 3.3 PDCP operation for deactivated SCG

If the network always updates the security key upon SCG activation from deactivation, i.e. sk-counter, there would be no security issue and RLC/PDCP re-establishment would be triggered accordingly, which makes PDCP operation simple. However, there seems no reason to mandate the security key update for SCG activation case, given that the security key update is optional in NR handover unlike LTE handover.

**Proposal 5. The security key update is up to network implementation upon SCG activation from deactivation.**

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| Company | Agree/Disagree | Comments |
| LG | Agree |  |
| MediaTek | Agree |  |
| Ericsson | Agree |  |
| OPPO | Disagree with comments | For RRC\_INACTIVE state, after each activation from RRC suspend, the key will be update based on Horizontal derivation or vertical derivation based on availability of new NCC.  We are not sure if there is security risk if the SCG key is not update after SCG reactivation.  **Send LS to SA3 whether the S-KgNB should be update when the SCG is activated.** |
| Nokia | Agree |  |
| Samsung | Agree | As in legacy, the security key should be updated if SCG is activated after SCG change. If SCG is activated for the same SCG, it would be the same as intra-gNB handover without security key update, which is up to network decision. |
| Apple | Agree | During the deactivation interval, if there is no key update on MN, we don’t see the need to update the SN key upon SCG activation from deactivation. |
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If we apply the same principle as that of legacy handover to SCG deactivation/activation, it seems straightforward to handle DRB based on the security key update as follows:

**Proposal 6. The normal SCG DRB is resumed after RLC/PDCP re-establishment upon SCG activation, if security key is updated.**

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| Company | Agree/Disagree | Comments |
| LG | Disagree | As explained in P1, we don’t see the need to suspend RBs (including SRBs and DRBs) at SCG deactivation. Then, there is no need to resume DRBs. |
| MediaTek | To Discuss | We would like to clarify that whether the NW will set the re-establishment flag (*reestablishPDCP* and *reestablishRLC*) in this case (Assuming YES). Or the UE has to perform the re-establishment no matter the flag is set or not? |
| Ericsson | Disagree | We believe that there is no need to suspend DRB/SRBs and so there is no need to agree on the resume part.  In addition, it is already agreed that key refresh requires PDCP/RLC re-establishment and valid for all DRBs. |
| OPPO | To Discuss | If the SCG activation is sent via RRC signaling, the RRC signaling may set he reestablished indication of PDCP and RLC respectively and UE will follow the indication from network.  If the SCG activation command is sent via L2, the UE will perform RLC/PDCP re-establishment self.  PDCP re-establishment is FFS. |
| Nokia | Maybe | Wouldn’t this be part of the existing configuration? So up to network to ensure re-establishment is done if required. |
| Samsung | Agree | The intention is to have the common understanding for UE and network behavior as that of legacy. |
| Apple | See comments | If RAN2 ever agrees the suspension on SCG DRB, we suppose this proposal is true. |
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**Proposal 7. The normal SCG DRB is resumed without RLC/PDCP re-establishment upon SCG activation, if security key is not updated.**

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| Company | Agree/Disagree | Comments |
| LG | Disagree | As explained in P1, we don’t see the need to suspend RBs (including SRBs and DRBs) at SCG deactivation. Then, there is no need to resume DRBs. |
| MediaTek | To Discuss | We would like to clarify that whether the NW will set the re-establishment flag (*reestablishPDCP* and *reestablishRLC*) in this case (Assuming NO). |
| Ericsson | Disagree | See above, even though we agree that RLC/PDCP re-establishment is not needed if security key is not updated (which is already agreed before). |
| OPPO | To Discuss | If the SCG activation is sent via RRC signaling, the RRC signaling may set he reestablished indication of PDCP and RLC respectively and UE will follow the indication from network.  If the SCG activation command is sent via L2, the UE will perform RLC/PDCP re-establishment self. Anyway, the UE will also initialize the PDCP/RLC state variables when SCG is activated even if there is no security key update.  PDCP re-establishment is FFS. |
| Nokia | Maybe | Wouldn’t this be part of existing configuration? So up to network to ensure re-establishment is done if required. |
| Samsung | Agree | The intention is to have the common understanding for UE and network behavior as that of legacy. |
| Apple | See comments | If RAN2 ever agrees the suspension on SCG DRB, we suppose this proposal is true. |
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When UE receives the indication of SCG deactivation, the transmitting PDCP entity with PDCP discard timer configured with infinity may still have PDCP PDUs which have not been acknowledged by lower layers. In this case, such old PDCP PDUs may not be discarded until released and retransmitted later upon SCG activation.

In the early stage of NR, RAN2 had similar discussion for the case that UE goes to RRC INACTIVE state and finally specified the corresponding behavior in 38.323 as follows:

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| 5.1.4 PDCP entity suspend  When upper layers request a PDCP entity suspend, the transmitting PDCP entity shall:  - set TX\_NEXT to the initial value;  - discard all stored PDCP PDUs; |

**Proposal 8. The transmitting PDCP entity of the normal SCG DRB discards PDCP PDUs upon SCG deactivation.**

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| Company | Agree/Disagree | Comments |
| LG | Disagree | We think PDCP operation should not be affected by SCG deactivation. There is no harm to keep the PDCP entity alive. |
| MediaTek | To Discuss | It seems that a little bit strange to put SCG to deactivated state while there data ongoing on SCG DRB. But if yes, we think this is correct behavior. |
| Ericsson | Disagree | We consider this as a corner case and no need to discuss.  This is for SCG DRBs, and so the network would not de-activate the SCG unless it is certain that there is no ongoing data transmission from the SCG. In other words, there won’t be any PDCP PDUs which have not been acknowledged by lower layer.  Also, it is not clear for us if the proposal also means that the TX counter is reset. If so, then there is the key stream re-use issue. The proposal seems to be related with RRC\_INACTIVE which, upon resume, requires key update and so no key stream re-use issue. |
| OPPO | To Discuss | For SCG deactivation case, only SCG RLC bearer is suspended and the PDCP will not be suspended. E,g, for SN terminated MCG bearer, the PDCP in SCG side cannot be suspended. We can use the uniform rules for all PDCP in SN side. |
| Nokia | - | No need to discuss until we have decided whether we suspend |
| Samsung | Agree | We have the same issue when the network sends UE to RRC INACTIVE state. Even if there is no on-going data on SCG DRB, the transmitting PDCP entity can have PDCP PDUs not acknowledged by the lower layer after final transmission. Note that PDCP discard timer can be configured with infinity. In PDCP point of view, PDCP PDU is discarded only when discard timer is expired or PDCP status report is received.  In this proposal, nothing is to say about COUNT reset. As described in this contribution, we mentioned that COUNT value should not be reset due to key-stream issue.  We wonder how the PDCP operation is not affected by SCG deactivation. The intention of this proposal is to clarify UE behavior, not to suspend PDCP entity. Whether to suspend PDCP entity or keep the PDCP entity alive would be the next step. |
| Apple | See comments | If RAN2 ever agrees the suspension on SCG DRB, we suppose this proposal is true. |
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When UE receives SCG deactivation indication, the receiving PDCP entity may have stored PDCP SDUs (i.e. out-of-order PDCP SDUs) and t-Reordering may be still running. In this case, it should wait for the expiry of t-Reordering to deliver them to upper layer, which can cause unnecessary delay. To resolve this, we can stop t-Reordering and deliver the stored PDCP SDUs to upper layer, if any.

In the early stage of NR, RAN2 had similar discussion for the case that UE goes to RRC INACTIVE state and finally specified the corresponding behavior in 38.323 as follows:

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| 5.1.4 PDCP entity suspend  …  When upper layers request a PDCP entity suspend, the receiving PDCP entity shall:  - if t-*Reordering* is running:  - stop and reset *t-Reordering*;  - deliver all stored PDCP SDUs to the upper layers in ascending order of associated COUNT values after performing header decompression;  - set RX\_NEXT and RX\_DELIV to the initial value. |

**Proposal 9. The receiving PDCP entity of the normal SCG DRB stops t-Reordering if running and deliver the stored PDCP SDUs to upper layer upon SCG deactivation.**

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| Company | Agree/Disagree | Comments |
| LG | Disagree | We think PDCP operation should not be affected by SCG deactivation. There is no harm to keep the PDCP entity alive. |
| MediaTek | To Discuss | It seems that a little bit strange to put SCG to deactivated state while there data ongoing on SCG DRB. But if yes, we think this is correct behavior. |
| Ericsson | Disagree | See above for proposal 8. |
| OPPO | To Discuss | For SCG deactivation case, only SCG RLC bearer is suspended and the PDCP will not be suspended. E,g, for SN terminated MCG bearer, the PDCP in SCG side cannot be suspended. We can use the uniform rules for all PDCP in SN side. |
| Nokia | - | Let’s first discuss whether we even suspend |
| Samsung | Agree | We have the same issue when the network sends UE to RRC INACTIVE state. Even if there is no on-going data on SCG DRB, the receiving PDCP entity can keep t-Reordering running after final reception. For example, this can happen for UM DRB.  We wonder how the PDCP operation is not affected by SCG deactivation. The intention of this proposal is to clarify UE behavior, not to suspend PDCP entity. Whether to suspend PDCP entity or keep the PDCP entity alive would be the next step. |
| Apple | See comments | If RAN2 ever agrees the suspension on SCG DRB, we suppose this proposal is true. |
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# Conclusion

**TBD**