**3GPP TSG-RAN2 #121bis-e R2-230xxxx**

**Electronic meeting, April 17 – April 26, 2023**

**Agenda item:**x.x.x

**Source:** LG Electronics (Rapporteur)

**Title:** Summary of [AT121bis-e][301][R15-17 UP] UP related correction (LG)

**Document for:** Discussion and Decision

# 1. Introduction

This document is a summary of the following documents.

* [AT121bis-e][301][R15-17 UP] UP related correction (LG)

Scope: Treat the following tdocs related to UP corrections

* **5.1.2.1 R15 MAC:**  R2-2303854
* **6.1.2 UP corrections**: R2-2303686, R2-2303916
* **6.3.2 R17 URLCC**: R2-2303920, R2-2303921

Determine agreeable parts/CRs. For Agreeable parts progress CRs

Intended outcome: Report, Agreed CRs.

Deadline: Company comments (Friday, 21st 10:00 UTC), Final report and CRs (Tuesday 25th 10:00 UTC)

Note that R2-2303480 is handled in another e-mail discussion [013], and R2-2303756 is withdrawn.

# 2 Contact Information

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# 3. Discussion

## 3.1 [R15] Handling of DCI for the deactivated configured grant

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| R2-2303854 Clarification on handling of DCI for the deactivated configured grant Samsung CR Rel-15 38.321 15.13.0 1599 - F NR\_newRAT-Core  R2-2303855 Clarification on handling of DCI for the deactivated configured grant Samsung CR Rel-16 38.321 16.11.0 1600 - A NR\_newRAT-Core  R2-2303856 Clarification on handling of DCI for the deactivated configured grant Samsung CR Rel-17 38.321 17.4.0 1601 - A NR\_newRAT-Core |

**Reason for change**

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| The following scenario was observed during IoDT:  1. gNB 🡪 UE: DCI with UL grant with HARQ Process ID (HPID) 2 addressed to C-RNTI/CS-RNTI, and thus UE sends the data and stores the TB for HPID 2.  2. gNB 🡪 UE: *RRCReconfiguration* to configure CG Type 2.  3. gNB 🡪 UE: DCI to activate CG Type 2 but failed, so UE does not send CG confirmation MAC CE. However, gNB misdetected that the UE performs the first CG transmission and but gNB failed to decode it successfully. gNB thinks the retransmission is necessary.  4. gNB 🡪 UE: DCI with HPID 2 and NDI 1 with CS-RNTI (i.e., retransmission) to check whether UE receives the previous activation DCI or network failed to receive the CG confirmation MAC CE.  After step 4 above, some Ues may perform retransmission of the (stored) TB for HPID 2 in step 1 if they strictly follow the current specification. If so, network needs to figure out the case, e.g., according to the presence of CG confirmation MAC CE. Note that if network utilizes certain HPID for the CG, and it was deactivated before, then the stored TB may still contain the CG confirmation MAC CE (for the deactivation before), so from network perspective, it may not be possible to distinguish whether it was UE or network to fail to receive the message in step 3.  On the other hand, some Ues may not perform retransmission for CS-RNTI (i.e., no transmission) since the configured grant has NOT been activated yet in step 3 from UE perspective.  The current specification is unclear which behavior is correct, and it is reasonable that UE ignores the DCI addressed to CS-RNTI for retransmission that are not activated yet. This also helps network to decide whether to re-send the activation DCI for CG Type 2. |

**Question 1: Do companies agree with the intention of the CR? If so, do companies support the changes in the CR?**

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| Company | Agree with intention? (Y/N) | Support the change? (Y/N) | Comments |
| vivo | Maybe not | **N** | We are wondering whether the mentioned case really exists.  In our understanding, the NW should use the activation command again, rather than using the retransmission scheduling in such a case.  [Samsung] The problematic case is that gNB interpreted that UE activated the CG but gNB didn’t successfully decode it. Then, gNB thinks the retransmission is needed.  If the majority of companies think the mentioned case is valid, we are fine to follow the majority view. |
| Apple | Y | **N** | The proposed change seems logical, but we are not sure it resolves the ambiguity. Or perhaps the scenario is not clear.  According to 38.213, the UE must validate the PDCCH for the UL grant type 2.  - If the DCI in step 3 was received, the UE must do DCI validation. If validation is achieved, the UE considers the information in the DCI format as a valid activation. So, if HPID 2 was involved then this could invalidate the earlier TB?  - If the UE did indeed not receive the DCI with the CG activation for HPID 2 in step 3, then the UE would consider the earlier TB to be requested for retransmission in step 4.  In other words, the network must check the CG confirmation MAC CE anyway. Even if the spec change seems logical, it may not fully resolve the ambiguity. In fact we do not think step 4 is the expected network behavior since the purpose of confirmation MAC CE is to help the gNB understand if the CG activation was successful or not.  [Samsung] The main reason of the problematic case is that gNB failed to detect the activation failure at the UE side and interpreted that CG was transmitted but not successfully transmitted to the gNB. Then, step 4 is a natural gNB behaviour. |
| Xiaomi | N | **N** | We are not sure if the mentioned case will exist or not. If the CG is not activated due to some failure, the UE will not initialize this CG and will not use the following CG resources to transmit to the NW and this of course can be recognized by the NW. So we fail to understand why NW continue to schedule a retransmission addressed to CS-RNTI?  [Samsung] UE does not transmit the CG as you mentioned.  But it is possible that gNB misdetected that CG was transmitted but gNB didn’t successfully decode it. Then, gNB thinks the retransmission is needed, so allocation of the retransmission resource is quite natural. |
| Huawei, HiSilicon | N | **N** | Similar view as above companies. From our understanding, the sensible NW should continue to send an activation DCI until a CG confirmation MAC CE is received, rather than sending a DCI for retransmission. In fact, the current spec on this is inherited from LTE and we don’t hear any requirement from the NW side since then. So we don’t see a reason to change the UE behaviour on this.  [Samsung] In case that the UE didn’t transmit the CG but gNB detected that CG was transmitted but decoding of the MAC PDU is failed, the gNB thinks that a MAC PDU is already stored in the HARQ buffer, so gNB has to allocate the retransmission resource to avoid the loss of the MAC PDU.  [HW] It recalled me that we have discussed how to avoid sending an out-of-date MAC PDU in case of gNB DTX in R15, and introduced UL HARQ buffer flushing when skipping an UL grant (R2-1808832). I think it is somehow relevant to your concern, i.e. it is very likely that the previous CG confirmation MAC CE will be discard by HARQ buffer flushing after a CG period. In this case, the UE will ignore the grant with CS-RNTI due to empty HARQ buffer and thus it seems your concern can be removed. If we still consider that the MAC CE might be still kept in the HARQ buffer, i.e. the gNB activate and deactivate CG within a CG period, it is very corner case from our understanding. So we don’t see a big problem with the current spec. |
| LG | N | **N** | We are wondering why the network provides DG for retransmitting CG confirmation MAC CE. We think the network should transmit another DCI (to activate the CG) if the CG confirmation MAC CE is not received.  [Samsung] The problematic case is that gNB misdetected that CG was activated, so gNB assumes a MAC PDU was already transmitted. Then, allocation of retransmission grant is natural gNB behaviours. |
| OPPO | N | **N** | We also doubt whether the case exists in the reality. For the case mentioned, we understand the NW would re-send the activation DCI once the CG confirmation MAC CE is not received.  [Samsung] As we replied to other companies, the problematic case is that gNB misdetected that CG was activated, so gNB assumes a MAC PDU was already transmitted. Then, allocation of retransmission grant is natural gNB behaviours.  [OPPO] Thanks for further clarification. For the clarified scenario, at the time of step 4, we may discuss case by case.  Case 1 (the HARQ buffer is empty): The UE will ignore the grant, as we specified in MAC.  Case 2 (the HARQ buffer is not empty and the MAC PDU is without CG confirmation MAC CE): The NW can know the issue of step 3 if the UE performs the retransmission.  Case 3 (the HARQ buffer is not empty and the MAC PDU is with CG confirmation MAC CE): this CG confirmation MAC CE is associated with the previous (de)activate DCI, which is a corner case especially when different HARQ processes involved in for feedback. |
| MediaTek | N | **N** | This is NBC for Rel-15 and there are Ues already in the field that will not follow this change. This change will only add more confusion as some Ues will follow this change while others will not. We should not change legacy UE behaviour and leave it to NW implementation to resolve this. NW can resolve this by choosing to send the activation DCI again.  [Samsung] As far as we know, Rel-15 Ues in the field did not implement CG, so there will not be an inter-operability issue for them. If Rel-15 is really a concern, we are ok to correct it from Rel-16 or 17.  Also, the problematic case is that gNB already deemed UE had sent initial transmission, such that gNB may avoid to retransmit DCI which would cause the loss of the (misdetected) initial transmission. |
| Samsung | Y | **Y** | Proponent  The problematic case happened due to misdetection of CG transmission (i.e. UE did not activate the CG and did not transmit the CG, but gNB misdetected that UE transmitted the CG but it was not successfully decoded at gNB). This misdetection probability is low but it sometimes happens, considering gNB serves many Ues. |
| Lenovo | N | **N** | Agree with others that in case gNB repeats the activation DCI in order to increase the reliability this should be really a corner case. |
| Qualcomm | N | **N** | In our understanding, the ambiguity described in the CR happens only when the transmission in Step 1 is addressed to CS-RNTI and the TB contains a Confirmation MAC CE (e.g. step 1 is deactivation of the CG and Step 4 is reactivation of the CG).  Our understanding of the current spec is that UE is required to retransmit whatever TB UE has in the HARQ buffer for that HARQ process, regardless of the state of the CG associated with that HARQ process. Then in the scenario described in the CR, gNB should resend the activation DCI instead of a retransmission DCI for the HARQ process. Although in this approach gNB is not be able to determine whether the failure occurs in the reception of first DCI or first transmission of Confirmation MAC CE, nothing is broken and the CG is activated as intended.  The proposed change is clearly an NBC and can cause problem for legacy UEs if network implements the proposed change. |
| ZTE | No, even though having some sympathies.. | **No** | To our understanding, the root reason of such issue is DCI loss (i.e. DCI for activating CG). According to my recollection, we have discussed a lot of times about the issues those are caused by DCI loss, and conclusion is that the DCI loss is inevitable, and in RAN2 , the discussion of the issue caused by DCI loss shall be avoided as much as possible. |
| Intel | N | **N** | In step 3, UE does not transmit the CG but gNB mis-detects the transmission. This is false alarm at gNB (as gNB needs to perform e.g. energy detection). Although this can happen, the probability should be very low.  In addition, the proposed change is NBC and should be avoided for Rel-15 and Rel-16. |
| Ericsson | N | **N** | NBC correction. The gNB would likely resend the activation when no confirmation MAC CE is received for the CS-RNTI (DCI) |
| Nokia | Y | **With comment** | Agree to solve the problem, but the proposed change has side effect that for deactivation case, the UE would not be able to retransmit the confirmation MAC CE after reception of the deactivation command.  Suggested update:  1> else if an uplink grant for this PDCCH occasion has been received for this Serving Cell on the PDCCH for the MAC entity's CS-RNTI:  2> if the NDI in the received HARQ information is 1:  3> if the corresponding configured grant is activated; or  3> if there is a MAC PDU in the HARQ buffer of the corresponding HARQ process which includes a Configured Grant confirmation MAC CE or a Multiple Entry Configured Grant Confirmation MAC CE: |

**Rapporteur summary on Q1**

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## 3.2 [R17 NRDC] HARQ buffer flush at SCG deactivation

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| R2-2303686 Correction on HARQ buffer flush at SCG deactivation Nokia, Nokia Shanghai Bell CR Rel-17 38.321 17.4.0 1592 - F LTE\_NR\_DC\_enh2-Core |

**Reason for change**

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| When the SCG is deactivated and the TATs are maintained at the UE, the UL HARQ buffers are not flushed for the PSCell whilst the NDIs for the HARQ processes are all set to 0. For SCell deactivation, the UL HARQ buffers are flushed explicitly (ie., regardless of the TAT running state), however, for PSCell, this seem to have forgotten to specify unintentionally.  When the SCG is newly activated, this can lead to unsynchronization between the UE and the NW when the potentially very old data is transmitted by the UE to NW.  Hence, the UL HARQ buffers associated with the PSCell should be flushed upon SCG deactivation. Naturally, this needs to be done only in case the TAT(s) are maintained upon SCG deactivation. |

**Question 2: Do companies agree with the intention of the CR? If so, do companies support the changes in the CR?**

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| Company | Agree with intention? (Y/N) | Support the change? (Y/N) | Comments |
| vivo | N | **N** | The current spec is good, nothing is broken. Specifically, as long as setting NDI to 0, then NW can schedule new transmission after SCG activation (i.e. the newly generated MAC PDU overrides the stored one), similarly to the MAC reset case.  This is different from the Scell case (where MAC is shared between activated PCell and Scell, so only flushing HARQ buffer associated with Scell, without setting NDI to 0 works). |
| Apple | Y | **Y** | We assume the network only sends the SN to deactivated state after all the lower layers are in settled state (i.e., no RLC or PDCP outstanding packets), so ideally there should not be any HARQ buffers non-empty. At the same time, the proposed change can eliminate any race condition. We are OK to flush the HARQ buffer if TAT is running upon SCG deactivation. |
| Huawei, HiSilicon | Not sure | **N** | We are not sure if this is needed because the NW can toggle the NDI for a new transmission when the SCG is newly activated. If there is mobility, the TA timer will be anyway stopped so this will be flushed. So we don't see a need to fix this by a change to the spec. |
| LG | N | **N** | If the SCG is activated again long after the deactivation, the TAT would be likely to be already expired, and HARQ buffer may be already flushed.  Else, if the SCG is activated shortly after the deactivation, the network can know the last transmitted NDI of the HARQ process, and the network would send the toggled NDI to discard the old data. Thus, we don’t see any problem with the current behaviour. |
| MediaTek | Y | **Y** | Agree with Apple |
| Samsung | N | **N** | Agree with other companies that NDI was already set to 0 and the NW can trigger a new transmission regardless of UL HARQ buffer. |
| Lenovo | N | **N** | If NDI is set to 0, NW can trigger a new transmission. Therefore there should be no issue. Also TAT may be already quite likely expired. |
| Qualcomm | Yes | Yes | We think the CR is correct and support the change. |
| ZTE | N | N | Agree with other companies that the NDI has been reset to 0, there seems misalignment between UE and NW is a corner case. |
| Intel | N | N | We agree with Huawei and LG that: 1) After SCG is activated again, gNB can toggle NDI for a new transmission; 2) It is likely that TAT will expire when SCG is activated again, therefore UL HARQ buffer will be flushed anyway. |
| Ericsson | N | N | Agree with other companies. |
| Nokia | Y | **Y** | Proponent.  The NDI setting is only done to enable NW to use NDI 1 for the first transmission and there is no ambiguity between UE and NW which NDI setting is at the UE after MAC reset. This does not affect to HARQ buffers by any means.  Hence, it is noted that NDI setting to 0 does not help as the first scheduling by the NW can fail and the NW thinks the UL transmissions by the UE is failing and NW wants to change the NDI to 0 to move to more conservative scheduling. At this point, the issue happens since the HARQ buffer includes the old data. |

**Rapporteur summary on Q2**

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## [R17 MIMO] Interruption of random access procedure for SpCell BFR

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| R2-2303916 Corrections on interruption of random access procedure for SpCell BFR ASUSTeK CR Rel-17 38.321 17.4.0 1603 - F NR\_FeMIMO-Core |

**Reason for change**

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| In Rel-15 and Rel-16, conflit between sharing HARQ process between configured grant and random access procedure is being discussed but not resolved:  RAN2#103bis agreement:  **Agreements**  - No solution to deal with collision of msg3 with configured grant on same HARQ will be specified for Rel-15. These issues can be addressed in Rel-16 WI.  RAN2#110-e agreement:   * Prioritization between non-overlapping uplink grants is NOT supported in Rel-16.   The UE could perform a random access procedure for SpCell BFR and HARQ process 0 would be used for Msg3 transmission with BFR MAC CE. If a configured grant using HARQ process 0 is activated/configured, Msg3 transmission would be interrupted because Msg3 in HARQ buffer for HARQ process 0 is replaced by a new MAC PDU:    It would lead to unsuccess or delay of the random access procedure for SpCell BFR. |

**Question 3: Do companies agree with the intention of the CR? If so, do companies support the changes in the CR?**

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| Company | Agree with intention? (Y/N) | Support the change? (Y/N) | Comments |
| vivo | N | **N** | Anyway, the UE can acquire the BFR MAC CE from Msg3/MsgA buffer again in the next RA attempt. Nothing is broken. It is an optimization rather than a correction. Maybe we can discuss this in Rel-18 TEI rather than changing the R17 CR after a year of release freeze. |
| Apple | Y | **N** | We tend to think the case can be handled by proper UE implementation. No need to change the specification. |
| Xiaomi | Y | **N** | We share the intention but we don’t think we need to have any change considering this issue has been discussed in previous releases and with nothing introduced, we still survive. |
| Huawei, HiSilicon | Yes but | **N** | For R16 and 17, we think the issue mentioned by this contribution can be resolved by proper NW implementation given that it has a choice to configure CG offset to avoid usge of HPID#0. For R15, we share the intention, however, it is too late to fix this considering this issue has been discussed over multiple times, so we can live without any change to the spec. |
| LG | Y | **N** | We think smart UE implementation would prevent use of HARQ process for new transmission if BFR MAC CE is transmitted on the HARQ processs. It’s not sensible that UE transmits a new data on CG while BFR procedure is ongoing.  We think sensible UE behaviour can be left up to UE implementation without any spec changes. |
| OPPO | N | **N** | It could be up to UE’s implementation |
| MediaTek | N | **N** | We have discussed this issue every release now. NW vendors have always indicated that this can be resolved by proper NW configuration. We do not need to reopen this discussion just because a new MAC CE is introduced in R17. |
| Lenovo | N | **N** | Agree with others that the issue can be avoided. |
| Samsung | N | **N** | This is Rel-17 correction. Since Rel-16 CG is allowed not to use HPI=0 by RRC reconfiguration, such a problematic case can be avoided by NW. |
| Qualcomm | N | **N** | We have the same comment as MediaTek |
| ASUSTeK | Y | **Y** | We don’t think NW configuration can completely negate this issue as the NW does not know when and which UE initiates the random access procedure for BFR, and UE implementation may not be able to mitigate this issue either since there’s no restriction on whether to use a UL grant if BFR is triggered on a Cell. |
| ZTE | N | **N** | Conner case and this can be avoided. |
| Intel | N | **N** | Agree with other companies that the issue can be avoided by network and/or UE implementation. |
| Nokia | Y | **N** | Agree with the issue but a NOTE would not help as the UE might not follow. |

**Rapporteur summary on Q3**

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## 3.4 [R17 IIOT] DRX for one shot HARQ feedback

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| R2-2303920 Discussion on one-shot HARQ feedback ASUSTeK discussion Rel-17 38.321 NR\_IIOT\_URLLC\_enh-Core  R2-2303921 Corrections on DRX for one shot HARQ feedback ASUSTeK, Nokia, Nokia Shanghai Bell CR Rel-17 38.321 17.4.0 1604 - F NR\_IIOT\_URLLC\_enh-Core |

**Reason for change**

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| It has been agreed and introduced in Rel-17 (NR\_IIOT\_URLLC\_enh) that UE would start or restart drx-HARQ-RTT-TimerDL for the HARQ process(es) whose HARQ-ACK information is reported to extend Active Time after receiving PDCCH indicating one-shot HARQ feedback or retransmission of HARQ feedback.  However, when UE receive PDCCH indicating one-shot HARQ feedback or retransmission of HARQ feedback, its corresponding HARQ feedbacks (for all HARQ processes) may be transmitted during a running *drx-RetransmissionTimerDL*. It means that *drx-RetransmissionTimerDL* could be still running when *drx-HARQ-RTT-TimerDL* expires. In this case, *drx-RetransmissionTimerDL* would not be re-started as expected by network. |

**Question 4: Do companies agree with the intention of the CR? If so, do companies support the changes in the CR?**

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| Company | Agree with intention? (Y/N) | Support the change? (Y/N) | Comments |
| vivo | N | **N** | We fail to see the motivation. Currently, nothing is broken. Once (re)starting the RTT timer, the MAC will stop the DRX ReTX timer and start the DRX ReTX timer after the expiry of the RTT timer, as shown in the following figure, |
| Apple | N | **N** | HARQ RTT and Retransmission timers are defined per HARQ process. If a HARQ RTT timer gets restarted for a HARQ process following a one-short HARQ feedback at an earlier instance in time, the retransmission timer would have been stopped for the same HARQ process. Moreover, the spec also has a condition to start the Retransmission timer when the HARQ RTT DL timer expires, which is not bound to the UE receiving the PDCCH. Therefore, in our understanding the change is not needed. |
| Xiaomi | N | **N** | We fail to understand the issue because the RTT/retransmission timer is maintained per process and at t5, RTT timer for these process(es) whose HARQ feedback is reported should be started and retransmission timer for these process(es) should be stopped. And at t6, when RTT timer for these process(es) is expired, retransmission timer for for these process(es) should be started. So we think option 2 is what we already have in the current specification. |
| Huawei, HiSilicon | N | **N** | Agree with above comments. Option 2 mentioned in the contribution is exactly the current behaviour and we fail to see a reason to change the spec. |
| LG | N | **N** | We also think Option 2 in the document is current behaviour as per greent text. Why do we need another stop behaviour (yellow text)?  4> start or restart the *drx-HARQ-RTT-TimerDL* **and stop the *drx-RetransmissionTimerDL*** for the corresponding HARQ process(es) whose HARQ feedback is reported in the first symbol after the end of the corresponding transmission carrying the DL HARQ feedback. **(Option 2)**  3> stop the *drx-RetransmissionTimerDL* for the corresponding HARQ process(es) whose HARQ feedback is reported; |
| OPPO | N | **N** | Same view as the above companies, we see no issue based on the current spec. |
| MediaTek | N | **N** | Agree with companies above, we don’t see an issue with the current spec. |
| Samsung | N | **N** | Option 2 is the current UE behaviour as other companies indicated. No additional spec change is necessary. |
| Lenovo | N | **N** | Agree with others, that the current UE behaviour is option 2. |
| Qualcomm | N | **N** | Agree with others that Option 2 actually is the current UE behavior. |
| ASUSTeK | Y | **Option 1 is preferred.**  **Option 2 is acceptable.** | We may not describe the issue very clearly in the discussion paper so it seems to cause some confusion and we are sorry for that.  According to the current spec (from Rel-15), the timings of (re)-starting HARQ RTT Timer and stopping Retx Timer are **different**. Retx Timer is stopped immediately upon detection of PDCCH since UE was just scheduled by network. And HARQ RTT Timer is (re)-started after sending HARQ feedback.  \*\*\*    \*\*\*  Considering the example/issue shown in Figure 3 of the discussion paper, Retx timer is **not** stopped at t6 according to the current spec and active time is not extended as network expected.  So two options are proposed. Option 1 is restarting HARQ RTT Timer at t7 and Option 2 is stopping Retx Timer at t6.  Actually this issue was partially solved when multiple ACK/NACKs fall within a running HARQ RTT timer as introduced in Figure 1/2a/2b of the discussion paper. And we think option 1 seems more aligned to the operation of **re**-starting HARQ RTT timer as introduced so Option 1 is preferred. If most companies are fine with option 2, we can also provide the corresponding CR based on TP in Annex of discussion paper. |
| ZTE | N | **N** | Agree with others. |
| Intel | N | **N** | Agree with others that option 2 is current UE behavior. |
| Ericsson | N | **N** | We agree with others that the current behaviour is as Option2 as described by e.g. LG. |
| Nokia | Y | **Y** | Support option 1 in the discussion paper and the corresponding CR.  Disagree with companies’ comments that the retx timer is already stopped at the point of NACK transmission according to current specification, as it is only stopped at the time of the PDCCH reception. We had the same misunderstanding also last meeting when we thought nothing was needed.  For this concerned case in figure 3 in the discussion paper, retx timer is not be even started yet at the point of PDCCH reception for one-shot feedback (at T3) so nothing to be stopped there, it is only started at T5. |

**Rapporteur summary on Q4**

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# 3. Conclusions

**To be filled later**